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6,012	313	800	154	4547	40	7479	397	10,329	414	13,012	415	15,013	641
6,681	23	929	144	4552	335	7487	343	10,396	622	13,021	154	15,015	472
7,793	16	958	141	4577	340	7535	466	10,412	672	13,023	829	15,021	309
9,214	30	994	617	4597	146	7538	462	10,424	717	13,054	838	15,030	397
9,215	30	1004	618	4701	59	7666	46	10,504	427	13,055	278	15,064	223
0,322	52	1100	143	4796	325	7702	162	10,536	532	13,056	487	15,081	532
2,520	256	1102	325	4981	315	7732	461	10,581	469	13,150	429	15,160	197
2,942	159	1129	19	5013	637	7757	52	10,609	524	13,180	309	15,173	773
3,816	20	1257	143	5015	421	7803	83	10.693	315	13,189	21	15,179	772
3,966	12	1326	217	5030	258	7814	397	10,704	25	13,264	836	15.206	406
4,175	28	1354	223	5031	325	7829	475	10,767	218	13,265	481	15,254	772
4,219	19	1396	156	5032	32	7844	524	10,798	343	13,275	1095	15,285	12
4,224	19	1397	14	5039	32	7892	472	10,814	406	13,301	701	15,292	609
4,238	21	1417	13	5051	309	7901	420	10,866	44	13,355	247	15,297	850
4,318	86	1479	110	5066	343	7917	516	10,900	529	13,401	67	15,304	917
4,319	86	1559	83	5151	318	8037	247	10,960	817	13,480	752	15,311	265
4,618	30	1573	280	5157	335	8039	876	11,004	601	13,523	630	15,326	461
4,622	25	1596	146	5169	407	8066	16	11,052	642	13,561	779	15,338	25
4,647	206	1628	209	5189	395	8067	309	11,066	711	13,579	255	15,388	672
4,739	63	1628A	209	5219	220	8154	519	11,069	154	13,598	815	15,418	979
4,840A	47	1635	160	5223	217	8260	551	11,077	86	13,621	703	15,486	58
4,940	12	1665	11	5244	403	8266	223	11,086	152	13,669	600	15,506	344
5,004	21	1716	620	5245	15	8323	598	11,090	103	13,703	752	15,516	40
5,046	13	1732	58	5246	16	8332	164	11,099	600	13,734	12	15,539	610
5,120	52	1770	206	5256	246	8345	475	11,103	712	13,751	81	15,542	524
5,122	209	1936	190	5264	395	8345A	621	11,126	672	13,752	45	15,553	20
5,291	59	1942	190	5342	317	8356	551	11,154	682	13,764	98	15,590	871
5,313	40	1962	163	5368	323	8356A	551	11,173	403	13,772	146	15,591	688
5,404	63	1969	52	5435	397	8374	672	11,174	88	13,787	191	15,618	45
5,467	27	1980	41	5478	407	8407	551	11,191	696	13,828	823	15,626	52
5,477	48	2045	159	5479	618	8435	315	11,196	679	13,838	162	15,629	682
5,537	46	2083	46	5493	326	8486	519	11,213	248	13.840	958	15,631	610
5,574	83	2154	190	5635	673	8490	44	11,215	424	13,845	762	15,648	883
5,576	39	2230	214	5655	318	8499	519	11,254	46	13,861	815	15,677	824
5,576A	40	2368	191	5749	522	8513	476	11,279	248	13,882	201	15,727	260
5,596	41	2435	189	5775	150	8527	33	11,409	462	13,892	461	15,734	824
5,681	45	2466	93	5776	48	8648	532	11,475	11	13,915	29	15,735	925
5,748	54	2522	209	5824	315	8667	207	11,479	403	13,935	827	15,744	859
5,777	12	2718	39	5836	197	8670	248	11,565	527	13,949	878	15,776	517
5,805	41	2791	212	5841	159	8712	262	11,574	113	13,949A	878	15,786	955
5,859	57	2797	15	5845	315	8727	632	11,621	675	13,965	1145	15,808	825
6,065	39	2826	59	5959	313	8744	516	11,622	700	13,970	150	15,818	55
6,073	68	2859	216	5976	672	8758	600	11,632	634	13,972	622	15,838	625
6,262	143	2870	246	5997	154	8389	154	11,632A	713	13,983	780	15,922	1248
6,264	115	2877	109	6011	64	8913	532	11,652	698	14,001	532	15,947	750
6,409	459	2902	114	6088	398	8913A	696	11,669	197	14,030	824	15,949	979
6,550	106	2906	196	6089	54	8924	158	11,698	414	14,062	154	15,966	708
6,577	52	2927	250	6183	59	9020	42	11,758	316	14,067	337	15,973	760
6,578	98	2939	90	6283	475	9032	459	11,876	406	14,115	758	15,974	1128
6,771	59	2985	167	6329	93	9102	88	11,902	688	14,122	278	16,002	141
6,790	52	2989	101	6333	49	9202	102	11,925	754	14,173	470	16,009	165
6,811	90	2993	261	6373	64	9210	618	11,926	675	14,177	483	16,012	470
6,813	55	3013	65	6379	328	9254	252	11,944	675	14,191	194	16,085	680
6,829	41	3130	154	6385	146	9264	403	11,974	696	14,192	403	16,086	959
6,855	83	3135	255	6389	30	9279	54	11,983	102	14,233	20	16,088	45
6,886	60	3176	551	6432	398	9281	873	11,993	460	14,255	220	16,100	44
6,887	214	3192	145	6498	315	9290	626	12,227	109	14,259	876	16,101	44
6,888	60	3206	272	6529	406	9305	516	12,242	545	14,263	57	16,104	257
6,889	60	3213	248	6574	15	9327	397	12,243	88	14,278	688	16,142	819
6,917	211	3225	144	6581	35	9339	618	12,291	704	14,279	688	16,164	968
6,998	83	3240	30	6635	673	9349	601	12,353	529	14,281	248	16,165	94
7,002	42	3310	258	6654	316	9416	546	12,395	55	14,319	835	16,168	98
7,036	103	3310A	258	6711	157	9426	618	12,431	762	14,323	113	16,181	466
7,218	98	3353	96	6712	211	9435	209	12,452	765	14,339	164	16,248	814
7,222	196	3353A	96	6731	637	9457	524	12,454	539	14,365	1130	16,258	343
7,254	86	3413	159	6814	398	9529	407	12,465	957	14,395	1145	16,269	327
		3449	167		601	9540	280	12,467	861	14,401	696	16,271	989
		3450	274	6820	600	9687	52	12,502	516	14,464	429	16,322	325
1906.		3455	327	6924	157	9695	16	12,523	415	14,489	255	16,340	688
		3458	11	6935	41	9706	417	12,525	330	14,496	815	16,348	540
		3486	159	6937	472	9752	467	12,526	423	14,507	146	16,351	1131
37	29	3506	15	6950	459	9774	15	12,527	701	14,519	278	16,364	1012
87	110	3521	263	6992	606	9785	204	12,538	201	14,567	398	16,368	539
131	100	3542	30	7007	150	9791	640	12,596	45	14,568	402	16,440	765
132	53	3566	252	7029	146	9803	460	12,603	824	14,586	54	16,442	963
146	101	3575	258	7073	57	9808	423	12,615	246	14,601	831	16,443	540
175	102	3583	261	7188	462	9881	606	12,616	246	14,637	859	16,450	540
234	100	3684	248	7189	144	9889	637	12,618	150	14,653	990	16,453	553
310	160	3709	16	7195	472	9893	627	12,621	690	14,674	322	16,460	672
352	88	3809	191	7221	461	9959	765	12,630	67	14,710	874	16,461	524
353	16	3885	163	7277	472	10,008	254	12,700	306	14,779	325	16,471	675
415	154	4001	248	7277A	472	10,050	164	12,729	207	14,784	881	16,498	861
495	86	4081	248	7297	167	10,052	44	12,783	272	14,799	461	16,510	835
503	150	4114	280	7299	467	10,091	611	12,838	29	14,816	861	16,516	264
659	152	4115	280	7318	460	10,097	24	12,842	196	14.818	111	16,519	701
678	167	4274	113	7340	100	10,156	54	12.872	821	14,896	477	16,558	888
715	29	4336	23	7357	461	10,161	621	12,885	831	14,918	820	16,583	63
717	55	4365	337	7357A	519	10,216	60	12,898	480	14,921	605	16,598	265
729	414	4409	318	7380	476	10,284	716	12,915	322	14.922	876	16,600	248
753	43	4473	218	7443	410	10,309	695	12,920	775	14,947	12	16,612	18
788	154	4537	164	7450	154	10,324	88	12,950	425	14,992	691	16,628	337

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16,631	46	18,574	971	20,309	114	22,105	1100	24,229	427	26,311	1283	28,697	889
16,641	696	18,576	189	20,327	1146	22,122	1191	24,234	1205	26,314	461	28,707	835
16,676	717	18,599	23	20,359	956	22,129	1212	24,236	1132	26,416	1273	28,746	968
16,701	55	18,600	971	20,380	1016	22,162	1203	24,240	991	26,501	430	28,765	1235
16,714	824	18,602	1041	20,397	44	22,166	827	24,247	601	26,502	634	28,767	628
16,741	217	18,603	157	20,404	1100	22,167	1039	24,272	1092	26,503	1295	28,886	1213
16,752	921	18,611	835	20,408	407	22,187	599	24,308	988	26,526	1276	28,897	699
16,809	167	18,612	163	20,440	712	22,202	960	24,310	673	26,542	600	28,920	1250
16,827	859	18,622	957	20,445	765	22,264	1202	24,344	312	26,664	1282	28,936	928
16,833	264	18,643	398	20,452	1052	22,317	701	24,348	1001	26,665	1282	28,959	209
16,870	699	18,663	18	20,484	1131	22,319	156	24,349	461	26,698	675	28,960	328
16,882	552	18,680	1067	20,488	980	22,327	1279	24,352	1241	26,732	1200	28,961	328
16,890	481	18,692	114	20,494	867	22,327A	1279	24,405	780	26,755	871	28,963	1279
16,901	956	18,738	957	20,507	48	22,336	716	24,418	815	26,808	1091	28,964	1279
16,905	326	18,741	1029	20,519	45	22,340	428	24,427	751	26,819	1131	28,977	1251
16,907	44	18,742	325	20,526	990	22,387	1023	24,429	1082	26,833	751	28,982	821
16,908	16	18,745	1001	20,545	325	22,390	1139	24,492	1289	26,838	947	28,984	1206
16,910	760	18,748	1042	20,548	1100	22,395	959	24,518	680	26,867	1054	28,995	758
16,910A	967	18,749	1002	20,586	167	22,421	873	24,526	477	26,875	955	29,007	599
16,912	1012	18,769	762	20,638	1103	22,422	524	24,624	1272	26,882	1271	29,093	343
17,001	1012	18,792	1052	20,651	888	22,430	102	24,647	332	26,906	947	29,134	1007
17,002	1013	18,803	696	20,680	223	22,491	328	24,666	956	26,928	318	29,231	675
17,006	968	18,806	481	20,699	956	22,512	311	24,667	1255	26,929	534	29,264	999
17,062	141	18,810	211	20,716	1016	22,519	621	24,677	406	26,934	618	29,371	876
17,069	675	18,812	1042	20,723	691	22,525	524	24,687	1271	26,944	430	29,291	1192
17,081	814	18,828	1041	20,773	712	22,534	1203	24,695	1271	26,946	675	29,368	703
17,129	703	18,835	876	20,802	960	22,571	753	24,742	397	26,954	1046	29,383	967
17,131	258	18,879	398	20,813	750	22,643	750	24,787	1245	26,962	889	29,390	1269
17,154	976	18,910	972	20,832	887	22,658	534	24,806	261	26,981	972	29,404	775
17,163	16	18,925	1057	20,837	756	22,752	766	24,822	1244	27,034	1281	29,408	691
17,164	864	18,927	254	20,894	11	22,766	827	24,823	323	27,036	1030	29,425	985
17,169	343	18,964	691	20,918	978	22,781	830	24,826	838	27,048	1093	29,427	609
17,256	827	18,967	1041	20,955	873	22,783	552	24,830	433	27,059	1050	29,471	816
17,267	632	19,001	859	20,979	415	22,796	1088	24,833	600	27,061	928	29,480	990
17,347	1271	19,033	1009	21,021	467	22,799	1202	24,901	1022	27,064	1189	29,504	1020
17,414	35	19,038	1009	21,022	600	22,810	343	24,905	1052	27,072	963	29,552	546
17,441	1013	19,045	323	21,081	1146	22,850	48	24,942	307	27,092	1099	29,554	673
17,461	823	19,048	461	21,086	537	22,872	1134	24,945	774	27,099	1097	29,599	752
17,480	631	19,107	220	21,144	1045	22,887	340	24,961	817	27,120	1016	29,661	627
17,487	868	19,115	83	21,160	611	22,901	1200	24,969	978	27,124	460	29,728	1203
17,512	883	19,130	1052	21,171	1162	23,019	517	24,970	770	27,125	889	29,750	1135
17,534	968	19,140	1250	21,172	211	23,049	318	24,973	1232	27,126	889	29,764	820
17,539	876	19,146	1041	21,180	1163	23,055	1210	24,985	1205	27,128	1046		
17,554	618	19,146A	1041	21,240	167	23,080	1231	24,986	1243	27,215	1015		
17,558	959	19,186	257	21,250	1105	23,113	707	25,043	410	27,280	1057	**1907.**	
17,559	403	19,193	306	21,258	1078	23,119	1232	25,108	1269	27,290	202		
17,573	777	19,215	991	21,269	1001	23,130	823	25,112	1282	27,316	150	3	489
17,612	460	19,229	1052	21,321	1128	23,165	1139	25,193	1043	27,322	1234	89	963
17,615	418	19,241	529	21,337	1128	23,165A	1139	25,211	428	27,343	707	89A	1087
17,617	931	19,276	605	21,338	1015	23,230	1012	25,248	1237	27,417	834	91	967
17,656	328	19,321	1106	21,342	1164	23,293	1202	25,327	859	27,438	868	121	1129
17,665	630	19,322	522	21,348	534	23,313	460	25,340	980	27,499	621	135	929
17,672	972	19,332	675	21,349	699	23,379	417	25,404	1279	27,527	1004	210	931
17,699	207	19,398	1131	21,416	475	23,381	987	25,416	1281	27,564	1139	342A	1231
17,743	818	19,408	1029	21,440	1144	23,413	930	25,417	1139	27,592	307	387	696
17,758	874	19,411	972	21,444	1062	23,449	1241	25,435	1278	27,616	1021	407	696
17,768	698	19,465	93	21,461	150	23,450	1239	25,445	1275	27,629	1191	414	828
17,773	1207	19,477	464	21,473	547	23,455	1063	25,469	1131	27,691	773	420	1290
17,775	539	19,480	675	21,475	632	23,534	1206	25,489	475	27,700	987	430	968
17,779	469	19,493	1052	21,478	406	23,555	1237	25,494	113	27,701	1206	444	774
17,825	487	19,495	1059	21,486	1078	23,556	1237	25,498	532	27,727	405	530	1204
17,832	395	19,513	1110	21,493	423	23,567	696	25,507	815	27,747	1093	590	828
17,878	540	19,557	979	21,505	1131	23,594	1089	25,512	1290	27,788	1252	591	828
17,909	630	19,624	675	21,509	1131	23,606	1128	25,530	1202	27,828	1008	593	1003
17,935	1012	19,709	1192	21,510	1132	23,648	777	25,547	1133	27,837	424	596	767
17,981	876	19,712	1013	21,511	1042	23,648A	838	25,595	984	27,842	1041	598	1148
17,985	599	19,718	25	21,513	1132	23,664	928	25,605	1009	27,904	1088	628	873
17,996	40	19,723	621	21,576	825	23,678	1250	25,635	332	27,958	751	665	1231
17,997	220	19,727	338	21,583	972	23,681	770	25,637	540	28,014	602	703	1241
17,999	957	19,728	429	21,584	435	23,684	220	25,647	1292	28,021	524	780	964
18,014	1001	19,729	81	21,590	1045	23,687	881	25,691	1105	28,053	1163	791	840
18,045	270	19,780	397	21,591	1088	23,761	1237	25,718	947	28,108	773	816	984
18,080	24	19,791	167	21,592	1136	23,768	1244	25,735	1207	28,139	1235	833	600
18,081	1001	19,848	1100	21,654	1042	23,780	778	25,747	990	28,147	959	929	751
18,127	1004	19,868	551	21,667	1148	23,789	1059	25,750	1106	28,148	861	942	1163
18,131	397	19,870	1020	21,669	1132	23,835	1138	25,847	403	28,182	1143	965	817
18,136	889	19,894	1288	21,672	1144	23,864	194	25,857	1200	28,199	691	974	1091
18,152	83	19,922	1077	21,678	827	23,869	1241	25,864	433	28,199A	925	993	1295
18,217	779	19,944	1013	21,721	528	23,875	1028	25,913	1078	28,225	690	1041	1212
18,256	815	19,960	32	21,770	928	23,875A	838	25,940	836	28,240	1235	1079	836
18,260	246	19,961	67	21,780	1139	23,966	1077	25,966	928	28,261	427	1080	878
18,280	947	19,962	1082	21,787	1150	24,967	967	25,971	1136	28,342	535	1085	699
18,292	835	19,973	410	21,847	83	24,008	1043	25,976	871	28,354	618	1101	772
18,294	968	20,005	1087	21,866	780	24,035	883	25,977	313	28,370	209	1154	752
18,361	12	20,029	406	21,876	1148	24,067	1213	25,978	1015	28,375	1005	1184	895
18,382	409	20,037	112	21,916	270	24,082	984	25,994	676	28,449	760	1193	821
18,405	189	20,057	1095	21,926	756	24,091	959	26,002	546	28,573	1282	1241	469
18,435	829	20,085	1078	21,949	403	24,092	466	26,005	1200	28,575	1052	1290	599
18,485	42	20,119	1007	21,973	980	24,093	835	26,077	934	28,576	752	1314	775
18,447	816	20,124	1003	22,002	1205	24,096	98	26,085	188	28,578	959	1344	929
18,448	1042	20,125	824	22,021	1003	24,101	967	26,144	1243	28,581	1138	1357	1163
18,449	1042	20,132	313	22,023	1151	24,135	1233	26,146	955	28,585	1107	1383	1089
18,499	1022	20,144	270	22,026	1045	24,144	957	26,187	605	28,587	765	1446	918
18,505	957	20,209	861	22,028	1191	24,172	1251	26,190	1003	28,593	698	1448	1039
18,508	197	20,210	676	22,038	967	24,189	627	26,211	1286	28,660	675	1450	1057
18,512	524	20,281	1190	22,039	1008	24,192	402	26,276	429	28,689	1233	1454	779
18,562	526	20,305	1078	22,049	41	24,222	1028	26,306	398	28,695	480	1472	1235

o. of atent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1907.		**1907.**		**1907.**		**1907.**		**1907.**		**1907.**		**1907.**	
1592	1235	3179	1029	4550	868	6106	1194	7838	1296	10,025	947	13,701	1286
1593	1043	3210	1279	4589	1078	6110	1053	7857	1231	10,164	1027	13,715	1270
1594	1044	3276	876	4590	964	6183	918	7879	1041	10,165	889	13,908	1207
1595	524	3279	1082	4605	1100	6193	878	8026	1207	10,226	1078	13,938	1238
1636	610	3294	1282	4613	1215	6229	680	8223	1041	10,230	1054	13,943	1242
1646	1093	3302	1139	4614	1237	6228	680	8232	1091	10,343	1110	13,979	1095
1647	1093	3303	519	4620	980	6316	1067	8242	1144	10,359	1063	13,986	1192
1658	622	3367	1253	4717	1207	6336	605	8245	963	10,362	1291	13,989	1138
1824	1283	3374	1283	4728	1131	6394	887	8359	1204	10,363	1057	14,097	1189
1843	1212	3404	691	4814	519	6405	871	8369	1213	10,532	1239	14,549	1295
1928	1216	3433	883	4861	1198	6502	972	8372	456	10,533	1197	14,550	1162
1946	1135	3435	1238	4911	1078	6522	829	8375	778	10,557	1275	14,587	1199
1948	343	3500	821	4919	1062	6592	1247	8560	1205	10,771	1238	14,762	1146
1959	1105	3507	1144	4927	972	6722	977	8640	1189	10,984	1291	15,087	1283
2065	1235	3533	519	5014	891	6723	523	8708	774	11,060	918	15,352	1275
2111	917	3536	963	5019	999	6724	1136	8800	1156	11,159	1289	15,529	1156
2123	816	3610	1001	5020	963	6726	1244	8924	1156	11,185	863	15,536	1079
2131	1239	3631	1146	5032	1244	6735	1284	9015	1156	11,187	968	16,218	1202
2166	481	3650	1230	5137	1189	6755	1151	9156	893	11,559	1090	16,344	1269
2242	917	3665	947	5189	1189	6814	1003	9157	893	11,609	1192	16,446	958
2286	948	3692	608	5195	1231	6843	1163	9170	1066	11,711	1280	16,448	1286
2314	863	3711	1146	5223	1242	6890	673	9180	1193	11,716	1192	16,504A	1283
2356	1005	3769	1199	5224	1156	6963	868	9285	1270	11,803	1244	17,325	1252
2377	874	3789	712	5226	887	7099	1237	9300	1197	11,821	1095	17,460	1275
2428	1046	3803	766	5273	1049	7116	1272	9444	1156	11,865	1283	17,521	1194
2460	1146	3811	823	5277	1286	7132	1255	9458	1138	11,903	964	17,610	1082
2461	1109	3834	1146	5295	967	7149	1238	9548	960	11,917	1146	18,147	1092
2477	1077	3938	1079	5327	968	7150	1238	9553	1138	11,925	999	18,220	1291
2484	1253	4009	984	5345	535	7217	1109	9575	1092	11,928	1046	18,499	1251
2511	634	4015	1135	5379	1238	7320	1204	9633	1281	12.213	1138	18,597	1296
2519	976	4021	773	5438	1153	7351	1236	9635	1199	12,219	964	18,900	1204
2559	1065	4049	1247	5542	838	7371	1021	9636	1054	12,258	1129	18,901	1243
2565	1109	4051	972	5576	1272	7382	1088	9637	1204	12,355	1025	19,001	1273
2586	487	4124	1230	5640	818	7405	918	9725	1109	12,454	1290	19,002	1194
2596	1106	4159	605	5655	1017	7407	1002	9733	881	12,606	1191	19,003	1194
2766	1135	4174	984	5656	1203	7453	918	9740	1241	12,741	1022	19,005	1251
2770	712	4193	872	5657	1097	7637	1079	9845	1136	12,751	1232	19,288	1212
2775	840	4235	1194	5658	1015	7641	1008	9855	1163	13,042	1206	19,547	1286
2789	1013	4250	1028	5841	1194	7650	861	9857	838	13,062	1164	19,768	1255
2795	814	4254	1090	5842	1163	7709	1129	9931	980	13,382	1099	19,943	1253
2909	1077	4306	1039	5887	830	7749	1088	9939	1238	13,508	958	20,125	1291
3035	986	4336	1055	5891	1107	7775	872	9961	1236	13,510	1189	21,116	1296
3103	889	4366	955	5957	1204	7776	971	9981	928	13,518	1196	22,092	1275
3106	688	4407	859	6048	540	7784	955	9995	1156	13,585	1189		
3174	972	4478	1090	6105	1194	7836	931	10,024	955	13,620	1191		

ERRATA, 1907.

Vol. XXVI	Page.	Column.	Line from Top.	Line from Bottom.	Corrigenda.
No 1—Jan. 15	32	1	..	23	*For* " Methylditannin " *read* " Methyleneditannin."
No. 2—Jan. 31	43	2	1, 4, and 10	..	*For* " Pyrone " *read* " Pyrane."
No. 7—April 15	295	2	..	4	*For* " Bohrmann " *read* " Rohrmann."
,, ,,	309	2	15	..	*For* " 25,310 " *read* " 25,313."
No 8—April 30	380	1	..	28	*For* " T. J. Austin " *read* " F. J. Austin."
,, ,,	386	2	31	..	*For* " commercial " *read* " chemically."
,, ,,	387	1	1 and 2	..	*Formula should read* $C = 115{\cdot}205\left(\sqrt{1 + 0{\cdot}04367\frac{a}{l}} - 1\right)$.
,, ,,	400	2	..	14	*For* " Bought " *read* " Boulit."
No. 10—May 31	536	1	Title in middle of column		*For* " Schchta " *read* " Schacht."
No. 11—June 15	606	1	23	..	*For* " Gontor " *read* " Bontor."
,, ,,	611	1	36	..	*For* " Standt " *read* " Staudt."
,, ,,	634	1	20	..	*For* " Bernberg " *read* " Bemberg."
,, ,,	645	2	..	24 and 23	*For* " barium " *read* " bismuth."
No. 16—Aug 31	928	2	2	..	Insert patentee's name :—" C. Lean. From Maschinenbauanstalt Humboldt."
No 17—Sept 16	986	1	..	18	Insert patentee's name :—" J. Schäfer."
No 24—Dec 31	1266	1	11	..	*For* " 41·19 " *read* " 31·19."

In the first table on page 242 (No. 6, March 30th), the words " calculated to food alone " should be deleted, both in the heading and above the last two columns. The first four columns of figures refer to the whole of the diet, while the last two columns show the percentages digested of protein and carbohydrates respectively on the breakfast foods alone.

Page 294, column 1, lines 3 and 5 and illustration : the picture illustrates the 1000 kilowatt furnace and not the 500 kilowatt furnace, and the reference should be transferred accordingly.

Journal of the Society of Chemical Industry.

No. 1, Vol. XXVI. JANUARY 15, 1907. No. 1, Vol. XXVI.

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Official Notices.

JAMESTOWN EXPOSITION: SPECIAL ALCOHOL EXHIBIT.

An exposition is to be held at Jamestown, Va., U.S.A., from April 26th to Nov. 30th, 1907, to celebrate the 300th anniversary of the first English settlement on North American soil. A special feature will be an exhibit of the various apparatuses, machines, and appliances by which the heat, light, and power which can be obtained from alcohol may be utilised for domestic, agricultural, and manufacturing purposes, and also of the articles of manufacture into which alcohol enters as a component or factor. The exhibit will be under the superintendence of Prof. Charles E. Munroe, of George Washington University, to whom all applications for space should be addressed.

SECRET COMMISSIONS AND BRIBERY PREVENTION LEAGUE.

A league for the prevention of secret commissions and bribery has been formed under the auspices of the London Chamber of Commerce. Among the objects of the League are to expose flagrant cases of bribery, corruption, and blackmail, and, if necessary, to take steps to prosecute; and also to assist its members and subscribers in any action which may be considered by the Council necessary to recover secret commissions paid or received. All communications should be addressed to the Secretary, Mr. A. E. W. Gwyn, 58, Coleman Street, London, E.C.

Manchester Section.

Meeting held at Manchester on Friday, December 7, 1906.

DR. G. H. BAILEY IN THE CHAIR.

THE CONSTANTS OF BOG-BUTTER, FOUND IN THE PEAT IN IRELAND.

BY L. G. RADCLIFFE AND W. H. MADDOCKS.

Bog-butter is mentioned in various dictionaries of science, and samples of it may be seen in many museums, but there is no recent record of its constants. A year or two ago a lump of bog-butter about 20 lb. in weight was found by the Peat Development Co., of Maghery, Moy, Co. Tyrone, and we have to express our thanks to Messrs. Hamilton Robb and Jas. Harper for the sample of which the constants were determined.

The sample was found 4 ft. below the surface, and is considered to be some hundreds of years old. It is a white, crumbly, cheese-like substance, and the outside has become converted into a wax-like substance, similar to the so-called adipocere. Perhaps originally, the butter was put into the peat water to preserve it and to give it a piquant flavour, then it was lost, but the peat water acted so effectually as a preservative that it is still recognisable as having once been butter; this claim is supported by the fact that interspersed throughout the mass are to be found numerous cow hairs.

The following list of constants is interesting, as showing the change that a fat like butter undergoes when immersed in peat water for centuries:—Titer test on the original sample of bog-butter, 45·5° C.; melting point of the original sample in capillary tube: incipient fusion, 46·5° C.; complete fusion, 49·5° C.; total fatty matter soluble in ether, 98 per cent.; residue insoluble in ether, 1·97 per cent.; specific gravity, $\frac{100}{15.5}$, 0·8390; Zeiss butyro-refractometer number, determined at 50° C., 23·5; acid value, 201·9; saponification value, 324·1; acetyl value, 2·2; Reichert-Meissl value (glycerol-soda method), 1·2; Hehner value, 98·5 per cent.; iodine value (Wijs' method), 10 per cent.; salt, nil.

The residue insoluble in ether contained nitrogen, and was most probably the casein.

The following series of unpublished values was obtained on another sample by Mr. W. B. Hart, and kindly communicated to us after reading the above paper:—Water, 46·33; salt, nil; insoluble (curd, &c.), 0·32; fatty matter, 53·35 per cent. The fatty matter consists of neutral fat, 20·44 per cent., and free fatty acids, 79·56 per cent., and the total fatty matter gave the following figures:—Iodine value, 14·06; Reichert-Meissl value, 1·43; Hehner value, 97·83 per cent.; molecular weight of insoluble fatty acids, 278·1; melting point, 44° C.; solidifying point, 40° C.; whilst the neutral fat had an iodine value of 10·38 per cent., and a saponification value of 230·2. The iodine value of the free fatty acids was found by calculation to be 15 per cent.

Scottish Section.

THE RELATION OF SOLUTION PRESSURE TO SURFACE CONDITIONS IN METALS.

BY DR. C. E. FAWSITT.

(This J., Dec. 15, 1906, 1133—1134.)

ERRATUM.

Page 1134, column 1, line 8, for "0·225" read "0.0225."

Yorkshire Section.

Meeting held at Leeds on Monday, December 3, 1906.

F. W. BRANSON, ESQ., IN THE CHAIR.

DETERMINATION OF FORMALDEHYDE IN MILK, &c.

BY F. W. RICHARDSON.

Occasionally a little formalin is added to milk, and the public analyst is required to estimate the amount of such addition. In my opinion the best method hitherto has been that devised by Mr. Otto Hehner ("Analyst," 1896, 94 *et seq.*). When strong sulphuric acid is poured down the side of a test-tube containing milk so as to give a good lower stratum, a violet colour appears at the junction of the two liquids, when the milk contains as little as 1 part of formaldehyde in 200,000. It is advisable to add 0·05 per cent. of ferric sulphate to the strong sulphuric acid to give the maximum amount of colour. I have made a number of attempts to convert this colour reaction into a comparative or quantitative method, but until recently I met with little success. So much depended upon the extent to which the sulphuric acid and milk layers intermingled, and there was always a blend of brown and yellow colours to confuse the comparison. The essential feature of the process I now use is the addition, drop by drop, of 4 c.c. of strong ferruginised sulphuric acid to 5 c.c. of the milk placed in a porcelain dish. After each addition of acid, the solution is vigorously stirred. In this manner one obtains a liquid sufficiently clear for colorimetry. In order to make colour comparisons in glass cells by Lovibond's system, I tried dilution experiments. Water decolorises completely; alcohol gives unsatisfactory results; a mixture of equal parts of sulphuric acid and water allows not only of dilution to any extent, but of retention of colour for long periods. By the use of this diluent, I can estimate colorimetrically as little as 0·002 mgrm. of formaldehyde. In 5 c.c. of milk containing 0·0056 mgrm. of formaldehyde and 50 c.c. of the acid liquid finally obtained, the colour units in a 2-in. glass cell by Lovibond's system were:—Red, 5·0; blue, 2·0; yellow, 0·5; or by composition:—Black, 0·5; violet, 1·5; red, 2·5: total, 4·5. Unfortunately the acid-milk mixture is always somewhat turbid, from the presence of fat globules; on this account milk itself does not seem to be a desirable menstruum for use with aqueous solutions of formaldehyde in order to obtain the requisite violet colour. I therefore attempted to find what constituent in milk gives the reaction. The fat, the sugar, and the caseins were rapidly eliminated, and an albumose was found to be the effective agent. Knowing that the peptic digestion of egg albumin proceeded through the albumose to the peptone stage, I allowed a solution of pepsin containing 0·2 per cent. of hydrochloric acid to act on strained white of egg at 98° F., until the maximum colour result with formalin and sulphuric acid was obtained. The digestion was then stayed and the liquid used for comparative estimations of formaldehyde. White of egg itself does give a violet colour, but its semi-digested product gives much more, while its fully-digested product gives little or no colour. Milk treated by Tolmatscheff's process, using magnesium sulphate, gives: (1) a precipitate, casein, and fat, not colourable by formalin and sulphuric acid; and (2) a filtrate colourable by formalin and sulphuric acid; proving that either albumins, albumoses, or globulins are the cause of the violet colour. Hehner (*loc. cit.*) also found that peptones failed to give the violet reaction, but he seems to have obtained with egg-albumin a much feebler colour than I have found. No doubt the age of the egg may have much to do with the different result.

As a result of digestion of beef fibrin with artificial gastric juice for several hours at 98° F, I obtained a solution giving an intense violet, and, strange to say, after precipitation with excess of salt, the filtrate gave a very deep colour with the formaldehyde test, proving that albumoses are not the only nitrogenous bodies capable of giving the reaction.

The intense colours obtained from 0·2 mgrm. of formaldehyde with albumoses, in 100 c.c. of total solution, were shown, the mixture of equal parts of strong sulphuric acid and water having been used as the diluent—one part of formaldehyde in half a million parts of the solution in one case, and one part in 5 millions in another; the colour in a 2 in. glass cell gave:—Red, 3·5; blue, 1·5 units. That is, violet, 1·5; red, 2·0 units. Even the palest of the colours had remained quite unchanged, although the solutions had been exposed to light, both natural and artificial, for several days.

I am now fixing the conditions necessary to make the method quantitative, and in a further communication I hope to say something definite as to the class of albuminoids giving the deepest colours with the formaldehyde test.

Discussion.

Mr. T. Fairley pointed out that formaldehyde had been found recently in wood smoke, and in air under certain atmospheric conditions. Would Mr. Richardson's methods succeed in these cases? It would be necessary to discriminate between added formalin and that present naturally in substances.

Prof. A. G. Green suggested that the colour obtained might be due to the presence of tyrosine, which was formed by the hydrolysis or peptonisation of most albuminoids. It had recently been shown that caramel contained large quantities of formaldehyde.

Mr. W. P. Bloxam asked whether a blank experiment had been made with the reagents in absence of the proteid material. This precaution was suggested by the experience of the test proposed for albuminous substances by Adamkiewicz. In this case an impurity present in the acetic acid used was ultimately found to be essential to the reaction, and the acetic acid could be omitted from this test.

Mr. O. F. Kirby asked if formalin could be removed from such a substance as milk by boiling, and if the milk would be free from deleterious properties after such treatment.

Mr. F. W. Richardson, in reply, said that the reaction never went far enough to produce tyrosine. Boiling would of course remove the formalin, which was volatile. He had never found a sulphuric acid which would give the formalin reaction in the absence of proteid.

Meeting held at the University, Leeds, on December **14**, 1906.

MR. F. W. BRANSON IN THE CHAIR.

ANALYSIS OF INDIGO.—PART II.

BY I. Q. ORCHARDSON, B.SC., S. H. WOOD, B.SC., AND W. P. BLOXAM, B.SC.

In Part I. of this paper* a new method was described for the analysis of artificial and natural indigos. This "tetrasulphonate method" was built up as a result of a careful study of pure indigotin and of the impurities of cake indigo, and after a critical examination of the best known existing methods. It was clearly seen that any practical and rapid method of analysis must involve sulphonation of the indigo and subsequent complete separation of the sulphonation product from the attendant impurities. This might be achieved by the selective precipitation either of the sulphonated impurities or of the indigotinsulphonic acid, methods involving both these principles having been recommended, but in no case was the result found to be completely satisfactory. The complete precipitation of the impurities seemed improbable in view of the number and variety of the bodies present. Eventually it was found that by sulphonating the indigo under conditions which converted all the indigotin into the tetrasulphonic acid, it was possible to completely and selectively precipitate the indigotin as the potassium salt of indigotin tetrasulphonic acid by means of potassium acetate.

The following work deals with the isolation of these impurities and their behaviour with reagents as a result of which the tetrasulphonate process was devised. Some experiments upon the estimation of indigotin obtainable from the leaf have been made and a new method has been worked out for this purpose.

Indigo-Gluten.—The first impurity to be isolated was the so-called indigo-gluten. This body was first found in crude indigo by Berzelius (Berz. Jahresb., **7**, 26), who extracted it with dilute acid, neutralised the extract with chalk, evaporated to dryness, and dissolved out the gluten with alcohol. For our purposes the indigo-gluten was extracted from Bengal indigo with dilute sulphuric acid; the product was isolated by neutralising the acid with barium carbonate, filtering, passing carbon dioxide through the filtrate, boiling, filtering again, and finally evaporating to dryness on the water-bath. The indigo-gluten thus obtained was a yellow horny mass, which on grinding gave a light, biscuit-coloured powder. 0·2 grm. of this indigo-gluten powder quickly dissolved in 5 c.c. of concentrated sulphuric acid (96 per cent.) at 100° C., and on diluting to 1000 c.c. gave a light yellow solution which was rapidly oxidised by permanganate as seen in the table (Table I. (1) p. 6). During sulphonation of crude indigo, therefore, this product goes into solution, and it is impossible to tell by colour observation whether, during the separation process, it is carried away with the other impurities, or remains associated with the indigotin; for, since its product formed by treatment with sulphuric acid is very slightly coloured, it does not in any way obscure the end point of the indigo titration. This point appears to have escaped the notice of other workers, who have been satisfied that the clearness of the end point on titration with permanganate is necessarily an indication of the purity of the product oxidised. This indigo gluten solution is more easily oxidised than indigotin sulphonic acid, and its presence, therefore, increases the consumption of permanganate, and so gives rise to errors in the estimation of the percentage of indigotin (Table II. (1) p. 6). It is absolutely essential, therefore, to separate this indigo-gluten from the indigotin during the analytical process. The behaviour of this indigo-gluten during the "tetrasulphonate process" was tested by treating 1 grm. of the isolated product with 5 c.c. of 20 per cent. fuming sulphuric acid for 20 minutes in the water oven (just as in the sulphonation of pure indigotin), diluting the solution to 500 c.c., and to 100 c.c. of this adding 100 c.c. of potassium acetate solution (45 grms. in 100 c.c. of solution), warming and cooling in ice for one hour. Careful experiment showed that not a trace of the indigo gluten was precipitated under these conditions. In order to more rigorously test its behaviour, a mixture of pure indigotin and indigo-gluten was sulphonated with 20 per cent. fuming sulphuric acid and analysed by the tetrasulphonate method. The result given in Table III. (1) (p. 6) showed that the indigotin tetrasulphonate was completely separated from the indigo-gluten product, which, even in presence of precipitated matter, thus remained entirely in solution.

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* This J., Aug. 15, 1906, p. 735.

Indigo-brown.—Indigo-brown has long been known as a constituent of natural indigo. Chevreul (Ann. Chim., 1, **16**, 5) and Berzelius (Lehrb. iii., 685; Gm., **13**, 48) both refer to it as the substance extracted from crude indigo (after the removal of indigo-gluten) with caustic alkali. For the purposes of this work it was extracted by means of pyridine, which was found to be the only solvent suitable for the purpose.

Bengal indigo, which had been freed from indigo-gluten as described, was boiled for some time with pyridine, and filtered; the residue was then washed with hot pyridine, the washings being collected separately. When the pyridine filtrate changed from a pure red brown to greenish-brown, the extraction was stopped, the last washing being ignored. The main extract and the first washings were then mixed and evaporated to dryness on the water bath. A dark brown resinous mass was obtained, which when cold was ground to a fine, almost black, powder.

The results of several quantitative extractions of crude Bengal indigo by acid and pyridine were given in Part I. of this paper. It was there shown that from the air-dried cake there was a loss of 21·5 per cent. by extraction with acid, and that from the purified product pyridine extracted a further 18 per cent. of indigo-brown.

This indigo-brown, which has been described as a body of uncertain constitution (Watt's Dict. of Chemistry, 1865, III., 257), is a mixture of several bodies, some of which have been isolated and purified. (An account of the investigations into the nature and properties of these bodies will be communicated to the Chemical Society by A. G. Perkin and W. P. Bloxam.)

0·2 grm. of the indigo-brown was treated with 5 c.c. of 96 per cent. sulphuric acid for one hour in the water oven; during the process a large amount of sulphur dioxide was evolved, showing that oxidation was taking place. Under this treatment sulphonation, or at least solution, was effected. The diluted product was of a dark brown colour, and was attacked by permanganate (Table I. (2) p. 6), though not perhaps so readily as indigo tetra- or di-sulphonic acid. This sulphonated indigo-brown is responsible for the dirty end point obtained when titrating a crude indigo sulphonic acid without purification. It was found impossible to obtain a sharp or consistent end point when indigotin to which this impurity has been added was sulphonated and titrated; so that it is absolutely necessary to remove this impurity in order to obtain accurate results. The relation of this indigo brown to the "tetrasulphonate method" was tested in the way described for the indigo-gluten, *i.e.*, it was subjected to the same treatment as that under which indigotin is completely precipitated, and under such conditions it remained entirely soluble in presence of potassium acetate. A mixture of pure indigotin and this impurity was analysed by the "tetrasulphonate method," and the percentage of indigotin obtained was the same as that taken, showing that the separation had been complete (Table III. (2) p. 6). The end point in every case was almost as bright as that given by pure indigotin sulphonic acid. Mixtures of indigotin with both indigo-gluten and indigo-brown were analysed, and the results (Table III. (4) p. 6) show that when these bodies exist together, as they do in Bengal indigos, the removal by the "tetrasulphonate process" is complete.

Indigo-yellow.—The earliest reference to this body is made by Bolley and Crinsoz (Zeits. f. Chemie, 1866, 573). Rawson (this J., 1899, 251—252) discovered it in Java indigo and showed that its presence prevented accurate indigo analysis. Perkin (Proc. Chem. Soc., 1904, 172) established its identity with kampherol, and later (*loc. cit.* 1906, 130) showed that it was derived from a glucoside resident in the leaves of Natal and Java plants. The glucoside known as kampheritrin has the formula $C_{27}H_{30}O_{14}$; on hydrolysis it yields kampherol and rhamnose. The kampherol itself is a light coloured body which crystallises in yellow needles melting at 276° C. Mr. A. G. Perkin kindly presented us with sufficient of this valuable product to enable us to carry out these investigations. Kampherol is easily sulphonated at the temperature of the water oven with 96 per cent. sulphuric acid; the sulphonic acid so formed is very readily attacked by permanganate (Table I. (3) p. 6). When indigotin and kampherol were sulphonated together and oxidised direct, the kampherol practically reacted as indigotin (Table II. (3) p. 6)—that is to say, when the indigotin had all been oxidised, the kampherol had already been responsible for as much potassium permanganate as an equal weight of indigotin would have consumed. Titanium trichloride has a more selective action; for the disappearance of blue in a reduction titration is almost a true indication of the amount of indigotin present in such a mixture; the reading at the end point is rendered difficult, however, by the presence of the sulphonic acid of kampherol.

To obtain a product which can be subjected to analysis by either the permanganate or titanium method, it is necessary, therefore, to remove kampherol, when present, from the sulphonated product. The removal of kampherol by the "tetrasulphonate method" is not so simple as is the case with the other impurities. The sulphonic acid of kampherol formed under the conditions used in the "tetrasulphonate" process is not precipitated by the addition of the usual amount of potassium acetate; but in presence of indigotin tetrasulphonic acid, and especially in the presence of other sulphonated impurities, it tends to be carried down mechanically. It is, therefore, necessary to wash the precipitated indigotin tetrasulphonate with the isotonic solution of potassium acetate persistently, until the yellow colour of the washing gives place to light blue. The use of an isotonic solution at normal temperature instead of ice-cold is recommended for this washing. When these precautions are taken, the sulphonic acid of kampherol can be completely separated from the indigotin sulphonic acid, which on titration gives the true value (Table III. (3) p. 6).

The presence of kampherol in crude indigo can be detected by extracting with sodium carbonate, which is coloured a deep yellow if this substance is present. The indigo is extracted with boiling alcohol, the extract evaporated to a small volume and poured into boiling water, and any precipitated matter is filtered off. The filtrate is tested for kampherol by dyeing mordanted calico in the usual way with addition of chalk or calcium acetate. The presence of this yellow body causes the aluminium mordant to be dyed a bright yellow.

The larger percentage of indican in the Java and Natal plant (*Indigofera arrecta*) renders it possible that this plant will be entirely employed in India for indigo manufacture. Containing as it does a large amount of the kampheritrin, it is probable that in the future most Indian natural indigo will contain at least traces of kampherol, so that it is necessary to be able, for analytical purposes, to separate its sulphonation product from that of indigotin.

TABLE I.

0·2 grm. of impurity was sulphonated with 5 c.c. of 96 per cent. sulphuric acid for one hour in the water oven, and diluted to 1,000 c.c.; 20 c.c. were diluted to 100 c.c. with distilled water and titrated with potassium permanganate (1 grm. per litre).

Constituent.	c.c. permanganate.
1 Indigo-gluten ..	0·5 c.c. immediate consumption.
2 Indigo-brown ..	0·8 c.c. about, too dark in colour for accurate titration.
3 Kampherol	8·0 c.c. pink colour, disappeared on standing.

TABLE II.

Mixture of indigo and impurity sulphonated, diluted and titrated as in Table I.

Constituents.	Actual per cent. indigotin.	Found per cent. indigotin.
1 0·8 Indigotin .... 0·2 Indigo-gluten	80	83·5
2 0·8 Indigotin .... 0·2 Indigo-brown	80	87
3 0·85 Indigotin ...... 0·15 Kampherol	85	100·5

TABLE III.

Mixture of indigotin and impurity analysed by the tetrasulphonate method; sulphonated with 5 c.c. 20 per cent. fuming sulphuric acid for 20 minutes.

Constituents.	Actual per cent. indigotin.	Found per cent. indigotin.
1 0·8 Indigotin .... 0·2 Indigo-gluten	80	79·5
2 0·8 Indigotin .... 0·2 Indigo-brown	80	79·8
3 0·85 Indigotin ...... 0·15 Kampherol	85	85
4* 0·6 Indigotin .... 0·2 Indigo-gluten .... 0·2 Indigo-brown	60	59·5
5* 0·6 Indigotin .... 0·05 Kampherol ...... 0·18 Indigo brown .. 0·17 Indigo-gluten	60	61·0

*4 and 5 were sulphonated with 25 per cent. fuming sulphuric acid

Bergtheil-Briggs' method of analysis.—A new method of analysis published by Bergtheil and Briggs (this J., 1906, 729) was now examined.

The method of sulphonation recommended was suggested and had been employed by Dr. Schulten of Calcutta, and aims at the sulphonation of indigotin, but not of the accompanying impurities. The procedure is so rapid and easy of accomplishment that it was attractive, and appeared to be an accurate method of analysis. With a view to testing it, pure indigotin, obtained by sublimation under diminished pressure, was treated in the way described. The result was an astounding one, for the consumption of permanganate indicated a percentage of 112—113. This result can only be interpreted on the assumption that the method was standardised on indigotin which was far from pure. This is remarkable, as Bergtheil and Briggs in their paper claim to find no difficulty in preparing such a standard and make light of the precautions insisted on by Bloxam (Chem. Soc. Trans., 1906, **87**, 974). It will be seen that indigo at a concentration of 1 in 1000 is titrated with $N/50$ permanganate, 1 c.c. of the permanganate being taken as equivalent to 0·0015 grm. of indigotin.

This factor as shown above gives an error of from 12—13 per cent.; the error is minimised if the indigo is diluted considerably, though at no dilution whatever is 1 c.c. of $N/50$ permanganate equivalent to 0·0015 grm. of indigotin.

If indigotin sulphonic acid at a concentration of 1 in 5000 be titrated and calculated on this basis, it yields a return of 105—106 per cent., and further dilution has no appreciable effect in diminishing the consumption of permanganate, so that, under the best conditions possible, the standard indigotin of Bergtheil and Briggs, which gave rise to the recommendation of such a factor, could not have reached a purity of more than 95 per cent. indigotin. It is remarkable, too, that such an important point as the effect of dilution of the indigo solution on the consumption of permanganate has received no attention from these authors. No value can, therefore, be attached to the results published by them on the various methods of analysis, which they have professed to critically review (*loc. cit.*).

In order, however, to test the efficiency of the method as regards its removal of impurities, experiments were made, using a correct factor for the conversion of permanganate into indigotin. Twenty c.c. of the 1 in 1000 indigo resulting from the treatment were diluted with distilled water to 100 c.c., and titrated with permanganate containing 1 grm. per litre; the calculation being based on the fact that 9 c.c. of 1/1000 permanganate is equivalent to 0·02 grm. of indigotin at 1/5000. This factor has been proved on a pure indigotin which yielded no impurity to solvents, and which gave 100 per cent. when titrated with titanium trichloride under the improved conditions detailed in Part I. of this paper.* It seemed, however, improbable at the outset that this method would be successful, as it contained no provision for removing the sulphonated indigo-gluten which is so easily soluble.

A crude Bengal indigo was first analysed; by the "tetrasulphonate" process it yielded consistent results between 61 and 61·5 per cent. By the Bergtheil-Briggs method, however, using the corrected permanganate factor, it gave on two occasions 66·8 per cent. and 67·5 per cent. It was obvious that some impurities were in solution, not only because of the high figure obtained, but also because of the lack of clearness in the end point, which was distinctly poor. The colour of the sediment in the flask, however, showed that a considerable amount of impurity had remained insoluble, and had been carried down by the barium sulphate. In order to discover which of the various impurities had been removed and which dissolved, experiments were made on the isolated impurities and upon mixtures of pure indigotin with gluten, brown and kampherol. It was found that the gluten remained in solution, and that the brown was not completely removed and gave rise to errors varying from 2 to 5 per cent., also that the kampherol was unaffected by the process, remaining in solution in the same way as the indigotin product itself.

The following figures (Table IV., p. 7) show the errors involved even when the error of calculation, previously described, is eliminated.

It appears from an examination of Bergtheil and Briggs' paper that the authors endeavoured to isolate the impurities of crude indigo with a view to testing their effect upon the method. Being unsuccessful in separating the actual impurities, they were content with using the bodies obtained by evaporating to dryness the seet water. It is obvious that the seet water contains in solution chiefly those substances which are not associated with the finished cake, seeing that the cake is formed by pressing the precipitated material, whilst the seet water carries away soluble matter. Finally the method of analysis gives irregular results, which is not remarkable when one considers the improbability of an absolutely

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* The same factor holds for both the disulphonic and the tetrasulphonic acids of indigotin. Moreover, this factor we find is identical with that set forward by the B.A.S.F. Co. ("Chemistry of Pure Indigo," B.A.S.F. Brochurse, 1900).

Table IV.—*Mixture of indigotin and impurity analysed by the Bergtheil-Briggs method.*

	Constituent.	Actual per cent. indigotin.	Found per cent. indigotin.
1	0·400 Indigotin ...... 0·103 Indigo-gluten ..	79·8	82
2	0·400 Indigotin ...... 0·107 Indigo-brown ..	78·8	83·4
3	0·400 Indigotin ...... 0·100 Kampherol	80	97·8
4	0·300 Indigotin ...... 0·102 Indigo-brown .. 0·101 Indigo-gluten ..	59·6	62·8
5	0·300 Indigotin ...... 0·100 Indigo-brown .. 0·100 Indigo-gluten ..	60	65·5

selective solution of indigotin from substances, all of which are known to dissolve with more prolonged treatment. The barium sulphate does not appear to have any absorptive properties, for the same effect is obtained by the rather tedious process instead of paper filtration, of carrying down the insoluble products with barium sulphate.

Indigotin from the leaf.—This portion of the work was not carried out with the intention of determining the actual percentage of indigotin obtainable from the fresh leaf, as only dried leaf was available; the object was rather to investigate the stability of indican under the conditions involved in extraction and indigo production. Indican was first obtained by Schunck in 1855 (Phil. Mag., 1855 and 1858) from woad leaves; the product was not crystalline and was probably impure. It was at one time thought that indican was a glucoside of indigo white and a sugar, but Schunck and Romer (Ber., 1879, 2311) showed this was not the case, and Marchlewski and Radcliffe (this J., 1898, 430) suggested that it was a glucoside of indoxyl and glucose, and that on hydrolysis the indoxyl was liberated, and, in presence of oxidising, agents, condensed to form indigotin. In 1900 Hoogewerff and Ter Meulen (Proc. K. Akad. Wetensch., Amsterdam, 1900, **2**, 520) obtained pure indican in a crystalline form. They describe it as crystallising from aqueous solutions in spear-shaped crystals, which contain 3 mols. of water of crystallisation, and which melt at 51° C. When deprived of its water, indican has a composition represented by the formula $C_{14}H_{17}NO_6$. Hydrolysis of indican produces in the first instance indoxyl and glucose; in presence of oxidising agents this indoxyl is oxidised, water and indigotin being formed. Two mols. of indican on hydrolysis and oxidation yield 1 mol. of indigotin. It has yet to be proved, however, whether any of the methods devised for the production of indigotin from the extracts of the leaf furnish a quantitative yield according to the published equations. Hoogewerff and Ter Meulen were only able to obtain from their indican a yield of 91 per cent. of indigotin (*loc. cit.*), the purity of which they could not guarantee. The estimation of "blue" from the leaf depends upon methods whose accuracy has never yet been experimentally demonstrated, so the matter cannot be definitely settled until quantitative experiments have been performed on the absolutely pure glucoside; failing this, it is impossible to say whether the accepted figures are really a true statement of the percentage of indigotin obtainable from the leaf; and whilst that percentage is in doubt, it is useless to speculate as to the efficiency of the manufacturing process.

Persulphate method for estimating indigotin from the leaf.—Rawson's method, involving the use of hydrochloric acid and ammonium persulphate, was investigated, and also that recommended by Bloxam and Leake (Dalsing Serai Report, 1904), in which sulphuric acid is substituted for hydrochloric acid. To study the nature of the reaction, it was necessary to have a stock solution of leaf extract containing indican. This was prepared in the following way:—50 grms. of dry leaf were placed in a dry glass filter funnel provided with a paper, the base of which was fitted with an india-rubber tube and clip. The clip was closed, and the leaf rapidly covered with boiling water, and allowed to remain so immersed for about a minute; the clip was then removed, and when the liquid had filtered through, the leaf was washed several times with water at 60° C. In this way the enzyme is destroyed, filtration is rapid, and, for quantitative determinations on 10 grms. of leaf, extraction of indican is complete after using about 300 c.c. of water. For the stock solution, however, complete extraction was unnecessary, and the combined filtrates from four such experiments on 50 grms. of leaf were mixed and used as a standard solution.

It was now necessary to settle upon those conditions which would give the maximum yield of indigotin consistently, and the following method was finally adopted:—200 c.c. of the solution were warmed to 60° C., 100 c.c. of a mixture of equal parts of 2 per cent. ammonium persulphate and 4 per cent. sulphuric acid were added, and the whole kept at 60° C. for one hour. The liquid was then boiled and filtered hot through asbestos; the precipitated material consisted of indigotin mixed with other brown bodies, &c., and was therefore washed with hot 1 per cent. sodium hydroxide, glacial acetic acid, and finally with water; the indigotin thus freed from its impurities was dried at 110° C. with the asbestos, the asbestos and indigotin were ground up in a small beaker with sand, and sulphonated with 10 c.c. of 96 per cent. sulphuric acid for one hour in the water oven. The sulphonic acid was diluted to 500 c.c., and 100 c.c. of this was titrated with a permanganate solution containing 1 grm. per litre, 9 c.c. of this solution being equivalent to 0·02 grm. indigotin when at a dilution greater than 1 in 5000. The indigotin obtained in this way was so pure that it was not necessary to apply the tetrasulphonate method to it. This procedure, applied to the stock solution, gave three consistent results, showing that 200 c.c. of the solution contained 0·07 grm. of indigotin. The stock solution was standardised in this way every other day, and was found to maintain its strength for the week during which the recorded experiments were made. The effect of varying the conditions was investigated with the following results:—

Persulphate experiments.

	Conditions.	Indigotin obtained.	Difference from standard.
1	Standard:— 200 c.c. extract; 100 c.c. acid oxidising mixture at 60° C. for one hour	0·070	—
2	200 c.c. extract; 100 c.c. acid oxidising mixture left at the laboratory temperature overnight, boiled and filtered	0·063	10 per cent. loss.
3	200 c.c. extract: 50 c.c. acid alone, 15 minutes, then 50 c.c. persulphate for 45 minutes..	0·0585	16 per cent. loss.
4	200 c.c. extract: 50 c.c. persulphate alone, 15 minutes, then 50 c.c. acid for 45 minutes	0·006	91 per cent. loss.
5	200 c.c. extract: 15 c.c. sulphuric acid and 50 c.c. persulphate at laboratory temperature, for 15 minutes, boiled and filtered	0·071	1·4 per cent. gain.
6	200 c.c. extract, 100 c.c. acid oxidising mixture, boiled for 5 minutes	0·0545	22 per cent. loss.

In every case, the filtrate was examined for indican by a further addition of the hydrolysing and oxidising agents, and allowing it to stand.

It will be seen from (2) that the development of the indigo in the cold is not favourable of a good yield; it appears that the rate of hydrolysis is so slow at this temperature that a certain percentage of the indican is oxidised by the persulphate before it is hydrolysed. This instability of indican to persulphate is borne out by (4), in which the addition of the persulphate 15 minutes before the acid has caused a destruction of 91 per cent. of the indican. Under those conditions, in which the best yield of indigo was obtained, the colour of the solution showed that hydrolysis of the indican was not complete at the end of 15 minutes; it therefore seems probable that, even under the most favourable circumstances, oxidation of the glucoside precedes hydrolysis.

From a few experiments made with a stronger acid (5), it would seem possible to so adjust the relation and strength of acid and persulphate, as to give at some temperature a quantitative production of indigo from indican. An objection arises here, however; the use of a strong acid seems to promote the production of some red body, as it was always observed that when strong acids were used, the glacial acetic acid washing was of a bright red colour, whereas when weaker acids were used, it was usually just tinged blue, and was really only necessary to remove the last traces of soda. The soda washing varied considerably: when the oxidation process had not been severe the washing was green coloured, and on standing changed to red; if, however, the treatment with the persulphate had been a more vigorous one then the soda washing was of a brown tint.

These experiments show that the production of indigo from an extract containing indican is a delicate reaction, greatly dependent upon the conditions under which the hydrolysis and oxidation take place. This fact was further emphasised by an examination of methods involving the use of persulphate and hydrochloric acid. With the knowledge gained from the experiments described, it was possible to examine the method recommended by Rawson (Report on Cultivation of Indigo, 1904), as follows:—

"Twenty grms. of leaves are introduced into 250 c.c. of boiling water and the boiling continued for two minutes. The solution is strained off through muslin, the mass of leaves squeezed and well washed with boiling water. The solution is treated with 5 c.c. of hydrochloric acid (20° T.) and 40 c.c. of a 5 per cent. ammonium persulphate solution. The persulphate is not added all at once; at first 2 c.c. only are added, and after half an hour 2 c.c. more, and again 2 c.c. after another half hour. After two hours from the commencement of the operation, the remainder of the ammonium persulphate is added, and on standing for a further period of an hour, the solution is heated and filtered through asbestos. The indigotin thus obtained is washed, dried, and further treated as in the ordinary analysis of indigo."

This method was tested by treating the stock solution in the way described. The solution was warmed to 90° C. in order to imitate the conditions obtained after extracting the leaves with boiling water. The following results were obtained. (1) 200 c.c. extract under the standard treatment yield 0·07 grm. indigotin. (2) 200 c.c. under the conditions involved by Rawson's treatment yielded 0·057 and 0·055 grm. indigotin.

Thus the addition of hydrochloric acid and persulphate in this way when the solution is at such a high temperature results in a loss of 20 per cent. of indigotin. This loss was detected by Bergtheil and Briggs, who have recently, and whilst our experiments were in progress, modified and improved Rawson's process. The main features of this modified process (this J., 1906, 734) are the addition of the acid to the cooled extract, and the determination of the state of oxidation of the indican after the addition of small amounts of persulphate by filtering a portion of the liquid and observing the colour changes on the addition of more oxidising agent. The method is very tedious, and is not applicable to the air-dried Natal plant as received by us, because the extract from this plant is too dark in colour to allow of the distinguishing of such a slight change as that from yellow to green, which is necessary for the efficient working of the process. On the ordinary Indian leaf, however, the three methods give the following results on a stock solution. (1) Rawson's method of adding hydrochloric acid and persulphate to the hot extract gave 0·049 gr. indigotin. (2) Bergtheil's method of adding the acid and persulphate to the cold extract gave 0·058 grm. (3) Heating with sulphuric acid and persulphate at 60° for one hour gave 0·059 grm. of indigotin. The last two methods give practically identical results, but the production of indigotin at 60° C. is recommended as being not only quicker, but applicable to extracts of all indigo plants.

The results obtained under approximately the same conditions with the use of persulphate were sometimes inconsistent enough to lead us to doubt whether the reaction was a quantitative one. The abundant production of brown substances during the oxidation also seemed to suggest that some of the indican was giving rise to products other than indigotin. With a view to corroborating the results obtained by this method, a study was made of the production of indigotin from indican by means of the enzyme resident in the leaves of indigo plants. In these investigations we had the advantage of the experience of Dr. Gaunt, who conducted all the experiments relating to the enzyme.

The enzyme of indigo leaves.—The formation of indigo from the indigo plant has during the past twenty years been submitted to a considerable amount of investigation, which has led to very different views as to the nature of the process.

Alvarez (Compt. rend., 1887, **115**, 286) was led to believe in the existence of a specific micro-organism which brought about the change. Beijerinck (Proc. K. Akad. Wetensch., 1900, 120), however, found that several commonly occurring aerial micro-organisms were also capable of bringing about the formation of indigo from plant extract. Van Lookeren and Van der Veen (Landw. Versuchs. Stat., **43**, 401), on the other hand, believed that fermentation was due to the presence of an enzyme, a view which was also upheld by Beijerinck (Proc. K. Akad. W., 1900, 120), Hazewinkel (*loc. cit.* 1900, **2**, 512), and Van Romburgh (*loc. cit.* 1899, **2**, 344). They state, however, that the enzyme is insoluble in water, and only slightly soluble in glycerin or a 10 per cent. brine solution. Bergtheil (Chem. Soc. Trans., 1904, 870), who appears to have been unaware of the work of the three latter chemists, describes a method of bringing the enzyme into solution with the aid of hide powder, which he suggests fixes the tannin and thus facilitates the extraction of the enzyme. We have made several attempts to prepare a solution of the enzyme according to his method. The solution obtained agreed in physical properties with that described by Bergtheil, but in no case when proper precautions were taken, *viz.*, using sterilised plant extract and enzyme solution filtered through a Berkfeldt filter, could formation of indigo be observed, either when air was bubbled through the mixture of enzyme and plant extract at 40° C. for a few hours, or when the mixture was left in the incubator at 30° C. overnight. The cause of our failure to secure this so-called soluble enzyme is not quite clear; it is true that we operated on dried leaves, whereas Bergtheil presumably worked with fresh leaves. The dried leaves, however, contain a considerable amount of active enzyme, for on fermentation they yield a copious production of indigo; moreover, Beijerinck stated that dry or fresh leaves gave the same result, both giving evidence of an insoluble enzyme. Further, we have succeeded in making an active insoluble enzyme preparation according to the method given by Beijerinck, by extracting the leaves with 90 per cent. alcohol in the cold. The leaves are ground in a mortar with the alcohol, which is removed from time to time. When alcohol about 100—120 times the weight of leaves has been used, the pulp becomes brown in colour, and, on filtering and drying, of yellow tint. It contains no indican and little chlorophyll, yet if placed in plant extract and kept at about 40° C. for a few hours, it gives rise to the production of a considerable amount of indigo. Exact quantitative experiments, however, have not been carried out up to the present, owing to the difficulty of estimating indigotin in the plant in presence of the leaf substance. We have to thank Prof. Beijerinck for sending us an active leaf preparation which exhibited the same activity as that which we had prepared by his method from the air-dried leaf. As no corroboration of the persulphate method was forthcoming as a result of this study of the enzyme, a new method for the estimation of indican in an extract was investigated.

Isatin method for the estimation of indican in leaf extracts.—Baeyer (Ber., **14**, 1745) discovered that by the condensation of indoxyl and isatin, indirubin was formed. Beijerinck (Proc. K. Akad. Wetensch., 1899, 120), in discussing indican, suggests the possibility of estimating indican by warming its solution with hydrochloric acid and isatin, and determining the amount of indirubin produced. The production of indirubin by condensation of indoxyl with indigotin is represented thus:—$C_8H_7NO + C_8H_5NO_2 = C_{16}H_{10}N_2O_2 + H_2O$. This method was further recommended by Beijerinck in a letter to the authors, as to the best method for the analysis of indican in the leaf. As the method does not appear to have been adopted in India, for no published details could be found, qualitative experiments were first made with indoxyl and isatin in order to acquaint ourselves with the nature of the reaction. Three trial experiments were then made on an extract of air-dried leaf, to discover the conditions tending to yield high results. It must be borne in mind that a quantitative production of indirubin by this means would yield twice the weight of indirubin, as compared with the weight of indigotin produced from the same amount of indican by the persulphate method; every molecule of indican thus giving rise to 1 mol. of indirubin.

The conditions of the first experiments were as follows:—(1) 200 c.c. of extract was warmed to 60° C. with 50 c.c. of isatin solution (0·1 grm. in 200 c.c. of water), 5 c.c. of (20° Tw.) hydrochloric acid was added, and the whole kept at 60° for 2 hours, boiled, and filtered through a tared paper. The precipitate was washed with hot 1 per cent. soda, and then with hot water until free from alkali. The filter paper containing the indirubin was then dried and weighed. The yield was 0·033 grms. of indirubin.

(2) 200 c.c. of extract, 50 c.c. of isatin sol., 5 c.c. (20° Tw.) of hydrochloric acid. The mixture left overnight at the laboratory temperature, boiled, filtered, washed, dried and weighed as in (1). 200 c.c. yielded 0·032 grm. of indirubin.

(3) 200 c.c. of extract, 50 c.c. of isatin solution, and 20 c.c. of pure hydrochloric acid were kept at 60° C. for 2 hours, boiled, &c., as in (1). 200 c.c. yielded 0·057 grm. of indirubin.

The products so obtained were tested colorimetrically by solution in glacial acetic acid and comparison with pure indirubin. All the products proved to be contaminated with indigotin, though (3) was the least blue. The higher yield in the case of (3) is explained by the very small amount of indigotin it contained. Experiment (3) was repeated, and gave a result of 0·0565 grm. of indirubin from 200 c.c. of extract; the product, however, still contained indigotin, which, presumably, is formed by air oxidation of the indoxyl. These first experiments show that the stronger acid gives the better results. To preclude the possibility of air oxidation, experiments were conducted in a closed flask through which carbon dioxide was passed during the progress of the reaction.

(4) 200 c.c. of extract was boiled with 150 c.c. of isatin solution for 5 minutes to expel air, carbon dioxide passing through the flask. 20 c.c. of hydrochloric acid was then added by means of a funnel, and the whole boiled for 20 minutes in presence of carbon dioxide. The product was filtered and washed as before, except that in this and in all later experiments dilute acetic acid was substituted for the final water washing, as water tends to bring the indirubin through the paper in a colloidal state. The dried precipitate weighed 0·092 grm. of indirubin.

(5), Duplicate of (4), yielded 0·092 grm. of indirubin. These results were so satisfactory that quantitative experiments were now carried out on weighed quantities of leaf.

(6) 5 grms. of Natal old leaf were extracted as described in the persulphate method, 0·1 grm. of isatin was added to the extract, which was boiled for 10 minutes, arrangement being made for the passing of carbon dioxide. 20 c.c. of hydrochloric acid were then added, and the whole kept boiling for 30 minutes, then filtered, washed, dried, and weighed as described. 0·094 grm. of indirubin resulted from 5 grms. of leaf, *i.e.*, 1·88 grms. from 100 grms. of leaf, equivalent to 0·94 per cent. of indigotin from the leaf.

The product obtained in this way was analysed by sulphonation and reduction with titanium trichloride. The result showed that it contained 95 per cent. of indirubin. The Natal old leaf had given, by the persulphate method, a percentage which on one occasion reached 0·7 per cent., but as a rule was about 0·65 per cent. So that, allowing for the fact that the product obtained by this new method is not quite pure, we have an increase of nearly 40 per cent. over and above that obtained by our improved persulphate method. The use of sulphuric acid instead of hydrochloric acid was tried. The results, however, were practically the same. The three following experiments clearly show the superiority of the "isatin method" over the persulphate.

(7) 5 grms. of Natal leaf were extracted as described, 0·1 grm. of isatin was added, and the solution boiled in presence of carbon dioxide for 10 minutes. 20 c.c. of recently boiled sulphuric acid, containing 10 c.c. of 96 per cent. sulphuric acid were added, and the whole kept just on the boil for one hour, carbon dioxide passing through during the experiment. 0·092 grm. of indirubin were obtained, equivalent to 0·92 per cent. of indigotin.

(8), Duplicate of (7), gave 0·94 per cent. of indigotin.

(9) Persulphate method.—10 grms. of Natal leaf, extracted as previously described; 50 c.c. of acid-oxidising mixture, containing 2 c.c. of sulphuric acid and 1 grm. of ammonium persulphate, were added at 60° C., and the whole kept at 60° C. for one hour; boiled, filtered, washed, and dried as in (7) and (8), and weighed. Result, 0·069 grm. of indigotin from 10 grms. of leaf, equal to 0·69 per cent. of indigotin from leaf.

Similar persulphate experiments, in which the product was sulphonated and titrated with permanganate, gave 0·67 and 0·65 per cent. If we take the highest figure (0·7) given by the persulphate under the best conditions, we have the following relations established from a consideration of the results given above:—

Rawson's well-known method	56
Persulphate as recommended here ..	70
"Isatin method," giving indirubin (of 95 per cent. purity)	88

The last means an increase of nearly 60 per cent. over Rawson's method. We do not claim that these figures, 0·92 per cent. and 0·94 per cent., necessarily show the limit of the possibilities of the process, as further investigation may still increase the yield of indirubin. The conditions of reaction have not yet received sufficient attention to warrant any pronouncement as to the most favourable conditions for the process. These results, however, show that the hitherto accepted methods for the estimation of the indigotin obtainable from the leaf do not by any means indicate the amount of indican present. Moreover, no method can be guaranteed as accurate until, when checked by the use of pure indican, it gives the theoretical amount of indigotin or indirubin.

Experiments on the pure glucoside are now in progress, and it is hoped that as a result of this work a quantitative method for the estimation of indigotin obtainable from the leaf will shortly be obtained.

Discussion.

Prof. A. G. Green said the study of the behaviour of each of these constituents under the conditions of analysis to his mind strongly confirmed the accuracy of the process previously put forward by the authors. The isatin method of determining the percentage of indican in the leaf by the formation of indirubin seemed to be a great improvement on the persulphate method. The persulphate must be very apt to over-oxidise and to act on the impurities in the indigo, which vary constantly in amount. These results so far had been obtained with dry leaf, and it was most desirable that the two methods should be compared, using fresh or wet leaves. Did the authors, using a given quantity of indoxyl, get the theoretical quantity of indirubin by the isatin method, and was there any possibility of the isatin being itself reduced so as to condense with unchanged isatin and give some indirubine on its own account? Was the factor used by the authors in calculating the proportion of indigotin by the permanganate method founded on any equation?

Mr. Orchardson, in reply to Prof. Green's last query, said that the factor used by the authors was found independently by titrating pure indigo. It did not correspond to any equation. The titanium chloride method ran according to an equation, but the permanganate method did not. He believed that the factor latterly used by Rawson and Bergtheil gave an excess of indigo in the ratio of 237 to 222, or about 7 per cent. This might account for the difference between the official statements of the earlier artificial indigo (1900 and later) and those found by Mr. Bloxam and his coadjutors. In this indigo the impurities were colourless or nearly so, and in some cases extraction by solvents gave 94 per cent.

After some remarks by Mr. T. Fairley and Mr. A. B. Steven commending the paper, Dr. R. Gaunt said he had tried the older methods, also that of Bergtheil and the tetrasulphonate method. With the former he had great difficulty in observing the end point, while he had no difficulty with the tetrasulphonate method. He had been, unfortunately, unable to isolate a soluble enzyme from indigo. Enzymes generally had been regarded as soluble in water. They might be in a different state in the fresh leaf from that obtaining in the dry leaf, and further study was necessary to make clear the nature and action of the enzymes in fresh indigo.

Mr. A. G. Perkin referred to the influence of the gluten on the analytical figures. It gave a colourless solution and consumed a good deal of permanganate, showing the need for great watchfulness in the analysis of indigo. Very few firms who used indigo analysed their own, because they could not get satisfactory results, and the analysis was left in the hands of specialists who had much experience in the analysis of indigo. Replying to Prof. Green, as to the possibility of another glucoside being present in the indigo leaf—Mr. Bloxam and himself had been making a study of indican and found that the behaviour of the leaf in the various processes of extraction closely resembled that of solutions of indican. So far there was no evidence of a second glucoside. He believed that the reaction between isatin and indoxyl was known to be quantitative, and considered it very unlikely that during the analytical method suggested, any isatin could be reduced to indoxyl. The author's indirubin, prepared from the leaf extract in the manner described, as it came out was a nicely crystalline substance, and had a pure appearance so that he had considerable hope as to the utility of the process. Mr. Perkin testified to the extreme care taken by Mr. Bloxam and his assistants to secure accuracy. Many of the experiments had been repeated several times. The three gentlemen associated with Mr. Bloxam tested separately and independently the previously published methods, and, in Mr. Perkin's opinion, where four well-trained chemists could not obtain satisfactory results, the average worker was unlikely to succeed.

Mr. W. P. Bloxam expressed his satisfaction with the admirable way in which Mr. Wood had described their work, and his regret that the exponents of the older methods of analysing indigo were not there to support their views. It was unfair to compare the use of permanganate after purification by the tetrasulphonate process with the permanganate methods as formerly applied, which gave end points more or less obscure. It was a great step in advance to isolate from commercial indigo a pure indigotin compound before titration by permanganate, titanium chloride, &c. By the older methods the average Bengal indigo was supposed to contain 75 per cent. of indigotin, whereas the tetrasulphonate process gave 60 to 62 per cent.

A full report of the work done would be submitted to Government which he hoped would lead to good practical results in the indigo industry. He had reason to believe that the brown impurities found in all cake indigo were decomposition products of indican, and if that belief was confirmed on further investigation, there was much room for improvement in the ordinary cake manufacture, for ordinary cake indigo contained up to 20 per cent. of this brown product. They had now obtained pure crystallised indican, and would try to ascertain the best conditions to estimate it accurately without loss. If they succeeded in proving that there was much more indican in the leaf than was previously suspected, they would place an enormous potential advantage in the hands of the Indian Government. They had criticised, but they also fully appreciated the work of those who had laboured in this field before them and enabled them to work greater progress than might otherwise have been possible. They earnestly hoped that the Government would enable them to continue this investigation. In conclusion he wished to earnestly thank Mr. Wood and Mr. Orchardson for their share in the work done during the past fifteen months; to Prof. Green for his great courtesy and the many facilities afforded during the investigation, and, above all, to Mr. A. G. Perkin for his continual, active, and earnest sympathy and kindness in the work done under his "general supervision."

Obituary.

JOSEPH BERNAYS, C.E., M.S.E., M.I.C.E.

Joseph Bernays was born in Mayence, May 26th, 1835. Having from childhood shown a decided talent for engineering, he was apprenticed in a trade wherein he learnt to work in wood and iron. Afterwards he studied under Redtenbacher in the Technische Hochschule at Carlsruhe. Soon after he had completed his course with the highest honours, he became a draughtsman to Sulzer Bros., of Winterthur, with whom he remained for some years. At the age of 25 years, he came to England and obtained a situation as draughtsman, then as engineer, and finally as chief engineer, in a large London firm of hydraulic and general engineers. Here he designed the perfume fountain exhibited in the International Exhibition of 1862 (London). He then entered the services of a large firm of general engineers where he superintended especially the manufacture of centrifugal pumps, a then somewhat neglected branch of engineering. He invented the "Bernays' centrifugal pump," which combined in its construction considerable advantages both in power and economy of steam consumption. This pump secured for its inventor and the firm for which it was constructed an honourable mention at the International Paris Exhibition of 1867. In the year 1872, Bernays commenced business on his own account as a mechanical and consulting engineer. In the same year he was called upon to enter a competition for the best plans for mining the afterwards famous cupreous pyrites deposits of San Domingo in Portugal. Bernays' system was the one selected and was adopted by the owners of the mine, who afterwards appointed him their consulting engineer. Bernays' system, that of sinking vertical shafts, has been ever since maintained both for developing and working these deposits. In 1877, Bernays invented a steam engine, which attained considerable importance; it had two vertical cylinders with the crank shaft placed between them, the crank-pin being connected with the crank ends of both cylinders by means of a triangular connecting rod. This engine was patented and shown in motion as a working model at the Paris Exhibition of 1878, and gained for its inventor the bronze medal. Bernays also won a money prize for designing a lift for the Jungfrau Railway. He was for 40 years a member of the Society of Engineers, being elected in 1866, and he filled the office of President in 1880. On March 3rd, 1879, he read a remarkable paper before that Society entitled "The new Pits and Hauling Machinery for the San Domingo Mines in Portugal." He was an original member of the Society of Chemical Industry, and has been a member of its Publication Committee for the last 23 years. Though failing health had already forced him to retire from business, he nevertheless filled his post as a member of the Publication Committee with unflagging zeal, and was present at the meeting of Friday, December 21st, three days before his death on Monday, December 24th, 1906.

SAMUEL CABOT.

Samuel Cabot was born in Boston, Mass., U.S.A., in 1850, and was the son of one of the most prominent physicians then in that city. He was educated at the Boston Latin School, and the Massachusetts Institute of Technology. He became, in 1870, the chemist of the Merrimac Manufacturing Company and introduced several important improvements, among which were one for the treatment of spent madder, and another in the process of sulphuric acid manufacture. In 1873, he proceeded to Zürich and there studied applied chemistry under the late Emil Kopp. Subsequently returning to the United States, Samuel Cabot, in 1877, went into partnership with Frederick Nourse, for the manufacture of lampblack, roofing-felt, ammonia, &c. From this business, Mr. Nourse retired in the autumn of 1878, and immediately afterwards Cabot commenced with his employés an ingenious system in which he made them partners with him in his rapidly increasing profits. The range of products manufactured, and the profits made, were now greatly increased. In 1882 and 1883, he devised and erected plant at Worthington, Pennsylvania, for the manufacture of carbon black.

He was a member of the Society of Chemical Industry.

In 1889, he became a very active member of the Corporation of the Massachusetts Institute of Technology. From 1889 to 1892, he was a member of the Committee on Chemistry, Physics, and Botany; from 1899 to 1902, of the Committee on Chemical Engineering; from 1892 to 1902, on Chemistry and Biology; from 1902 to 1906, of the Committee on Chemistry and Chemical Engineering, and that on Modern languages and English. In 1901, he presented the Institute with a valuable tract of land in the town of Brookline, for an athletic field, and in 1905, he instituted the Cabot medals, with a fund of $200.00 a year for five years, for the encouragement of athletic competition, &c.

He was also for years a member of the Visiting Committee of the Chemical Department of Harvard College. He had a most versatile mind, and took interest in many subjects, both literary and scientific. Death took place somewhat suddenly, after an attack of pneumonia, on the 26th of November, 1906.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, & MACHINERY.

ENGLISH PATENTS

Drying and cooling air; Apparatus for ——, especially suitable for treating air for use in blast-furnaces and in other places where large volumes are required. Sir A. S. Haslam, Derby. Eng. Pat. 1665, Jan. 22, 1906.

THE claim is for an improvement in apparatus described in Eng. Pat. 436 of 1895, and consists in passing the air through a preliminary cooler. This is formed of a number of nests of pipes placed between tiers of vertical plates which may be plain or corrugated. Ammonia or some other suitable gas is expanded in the pipes, and water is caused to flow over the plates in a thin film. The air, before passing to the cooling apparatus proper, is caused to flow over these plates and pipes cooled by the expansion of the ammoniacal gas, depositing moisture owing to the lowering of the temperature, the deposited water being carried off by the film of water flowing over the plates.—W. H. C.

Drying kilns. G. A. Mower and W. J. Bassett, London. Eng. Pat. 3458, Feb. 12, 1906.

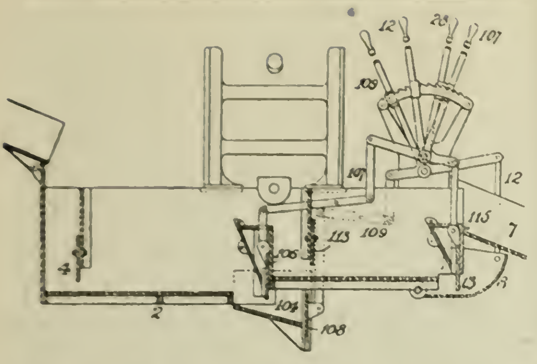
A SERIES of drying chambers, each of which is separately connected to a series of flues by suitable dampers, controlled from above by rods or chains and having indicator boards to show the position of the dampers, are connected together by a common return flue. Air is caused to circulate through the flues and chambers by a fan or blower, and separate flues are provided so that either "cold," "dry," or "wet" air can be circulated as desired.
—W. H. C.

Column stills; Baffle-plates for ——. E. Guillaume, Paris. Eng. Pat. 11,475, May 16, 1906. Under Int. Conv., May 26, 1905.

THE claim is for improvements in the baffle-plates described in Eng. Pat. 3561 of 1903 (see U.S. Pat. 732,548 of 1903; this J., 1903, 859), and consists in forming the overflow openings along the whole length or periphery of the partition. The slope of the plates is directed towards the exterior wall of the column in order to provide a space in which some liquid and any sediment may collect, so that the latter can be drawn off through an opening in the wall of the still.—W. H. C.

Separating substances of different specific gravities; Apparatus for ——. C. A. Allison, London. From J. Christ, Tamaqua, Pa., U.S.A. Eng. Pat. 20,894, Sept. 20, 1906.

THE materials to be separated are fed into the compartment, 4, of the separating box, 2, which has a perforated bottom, and is mounted in a tank filled with water and having a V-shaped bottom to facilitate the collection of any fine particles which may pass through the perforated bottom of the box, 2. The separation of the materials into layers of different specific gravity is effected by imparting an undulating motion to the water in the tank, either by moving the box, 2, vertically up and down, or by using plungers to agitate the water as in an



ordinary "jig." The box, 2, is divided into two compartments; the heaviest material of all collects in the pocket, 104, and passes away over the sill, 108. The lighter material passes over the division plate, 106, and under the partition, 113, and the separation continues in the second compartment. The heavier material passes under the partition, 13, to the adjustable receptacle, 8, over the lip of which it finally flows. The lighter material passes over the sill, 115, on to the shoot, 7. The sills or partitions, 8, 13, 106, and 108, are all adjustable by the levers, 12, 28, 107, and 109.—W. H. C.

Separating substances of different specific gravities; Apparatus for ——. J. M. Draper, Glasgow. From J. Christ, Tamaqua, Pa., U.S.A. Eng. Pat. 15,285, July 5, 1906.

The claim is for the use of conveyors for feeding and discharging the materials treated in the apparatus described in the foregoing abstract. The elevator for the heavier bodies has perforated buckets, so that the water can drain away, whilst the lighter bodies are delivered by an elevator on to a shaking and drying table.—W. H. C.

Centrifugal liquid separators. P. T. Sundberg, Stockholm. Eng. Pat. 18,361, Aug. 15, 1906.

The groove or grooves in which the liquids collect before flowing from the machine are made eccentric with the outlet at the deepest point of the groove.—W. H. C.

French Patents.

Atomising or pulverising liquids by centrifugal turbines; Processes of ——. J. F. P. Kestner. Fr. Pat. 361,839, Oct. 13, 1905.

See Eng. Pat. 20,698 of 1905; this J., 1906, 973.—T. F. B.

Atomising water in a centrifugal turbine; Apparatus for ——. J. F. P. Kestner. Fr. Pat. 361,840, Oct. 13, 1905.

See Eng. Pat. 20,697 of 1905; this J., 1906, 915.—T. F. B.

Drying apparatus; Continuous ——. Aktiebolaget Separator. Fr. Pat. 368,121, July 17, 1906.

See Eng. Pat. 16,003 of 1906; this J., 1906, 1136.—T. F.B.

Sharpening blunted cutting edges or points; Chemical process for ——. E. Vandor. Fr. Pat. 368,397, July 28, 1906.

The blunted surfaces are coated with a resistant varnish in such a manner that, by the aid of heat and centrifugal force or gravitation, this varnish collects on the worn surfaces exclusively. The tools are then subjected to the action of a chemical etching agent, which is allowed to eat away the metal until the coating of varnish is undermined and peels off, leaving a sharp cutting surface exposed.—C. S.

Pyrometer; Liquid ——. E. Gabreau. Fr. Pat. 368,500, July 28, 1906.

The heat rays to be measured are focussed, by means of a reflector or lens, on to a thermometer containing any suitable liquid, and graduated to permit the temperature to be read off direct. The thermometer may also be provided with a magnifying device and a vernier.—C. S.

II.—FUEL, GAS, AND LIGHT.

English Patents.

Gas furnaces and method of working the same. J. H. Ladd, Surbiton. Eng. Pat. 24,940, Dec. 1, 1905.

See Fr. Pat. 367,242 of 1906; this J., 1906, 1084.—T. F. B.

Gas furnaces; Regenerative ——. F. K. Siemens, London. Eng. Pat. 14,947, June 30, 1906.

A regenerative gas furnace, wherein the hearth or bed is hotter at the finishing end than at the charging end (compare this J., 1903, 1197), and which is constructed over two reversible air regenerators, is provided with ports for admitting gas and air at the hotter end and ports for the escape of combustion products at the other. Between the furnace bed and the top of the regenerators are arranged, side by side, two heat-equalising flues, through one of which the air passes on its way from the corresponding regenerator to the furnace, whilst the other equaliser is idle; or through one of which the products of combustion pass, on their way from the furnace to the corresponding regenerator, whilst the other is idle. In another modification there is a single heat-equalising flue, through which pass products of combustion only, and a single valve or set of valves which directs the hot air from one of the regenerators to the furnace, and the combustion products from the equaliser to the other regenerator.—H. B.

Oil; Apparatus for burning —— *for heating purposes.* H. Watson and T. McIlraith, Ardrossan, N.B. Eng. Pat. 13,734, June 15, 1906.

In this apparatus the oil to be burned is allowed to drop on to a horizontal incandescent tube, and the vapour produced is carried by a current of air against a heated plate, where it ignites and is directed through the incandescent tube into the firebox to be heated. The apparatus consists of the incandescent tube or burner of refractory material, surrounded by two concentric casings; the outer end of the tube projects some distance beyond the casings into the firebox. The air current (obtained either by induced draught or from a blower) flows first along the annular space between the outer and inner casings, then returns through the annular space between the latter casing and the tube, and carries along with it the vapour produced by the oil dropping on to the tube. The combustible mixture impinges upon the highly-heated end face of the inner casing, and thence flows back through the tube in a flaming condition into the firebox.—H. B.

Smoke and fumes; Apparatus for treating ——. D. J. Lawton and H. I. Reynolds, Grant's Pass, Oregon, U.S.A. Eng. Pat. 25,777, Dec. 11, 1905. Under Int. Conv., Dec. 30, 1904.

The smoke is caused to enter a vertical drum through an elbow-pipe which enters the side of the drum with a downward inclination. The drum has conical upper and lower ends, water being fed in at the upper end and divided into jets by a perforated plate placed above the smoke inlet. The falling water washes the smoke, and both then pass from the bottom of the drum through two horizontal settling tanks placed in series and provided with a gas connection above, through which the washed smoke can pass to the outlet, and with a liquid connection below.
—W. H. C.

Air gas [Carburetted]; Apparatus for the manufacture of ——. J. S. Walker, Ware, Herts. Eng. Pat. 23,966, Nov. 21, 1905.

An air-pump, driven by a cord and falling weight, delivers air into a floating bell, whence the air is driven, along with the carburetting spirit, through a mixing chamber into the carburetter, and from the latter the carburetted air passes to the point of consumption. An electric bell-push is pressed upon by the falling weight when it has reached the lowest point of its descent, to give warning that the cord needs re-winding. A brake, connected by a lever to the top of the floating bell, stops the air-pump mechanism when the bell is full. A perforated chamber in the upper part of the carburetter is packed with "chalk nuts," which prevent spray from entering the service pipe.—H. B.

Gas generators. J. E. Dowson, London. Eng. Pat. 1417, Jan. 18, 1906.

The generator is constructed, at its lowest part, of an annular vaporiser of inverted truncated-conical shape. The inner wall forms part of the wall of the combustion chamber. The annular space between the inner and outer walls is closed at the bottom, so as to contain the water to be vaporised, but is open at the top, whence the issuing steam is directed downwards, by an outer casing, to the base of the fuel, to be sucked in along with the air supply.—H. B.

Acetylene gas; Manufacture of ——. J. McRae and H. Ingram, London. Eng. Pat. 25,046, Dec. 2, 1905.

To protect the calcium carbide within an acetylene generator from the action of water vapour, a film of oil, made from horse fat, is interposed between the carbide and the water. The layer of oil may be provided as a coating upon the lumps of carbide, or it may be introduced on to the surface of the water in the generator.—H. B.

Furnaces; Electric —— [*for calcium carbide*]. C. Bingham. Eng. Pat. 4336, Feb. 22, 1906. XI*A*., page 23.

French Patents.

Coke-ovens. Solvay et Cie. Fr. Pat. 368,564, Aug. 1, 1906.

The improvement suggested in coke ovens for the recovery of by-products, consists in connecting the coking chamber by means of a system of piping with a distributor, in such a way that the gas produced by the carbonisation of the coal can either be drawn from the coking chamber into an extractor to be freed from by-products and returned to the distributor, or taken directly from the coking chamber to the distributor.—W. C. H.

Coke and anthracite; Process for the agglomeration of powdered ——. A. A. Oullié. Fr. Pat. 368,726, Aug. 9, 1906.

The fuel blocks are made from 1,000 parts of coke or anthracite powder, 60 parts of quite neutral sodium silicate of "35°," 10 parts of precipitated calcium carbonate, and 5 parts of manganese dioxide. The powder is moistened with 5 per cent. of water, and the calcium carbonate and manganese dioxide are intimately mixed with it, the sodium silicate, diluted with its own weight of water, being next added in small quantities, and worked up with the mass for a quarter of an hour. When drawn from the press, the blocks should be taken to a stove heated to about 60° C., and ventilated with hot dry air. —W. C. H.

Alcohol; Process for denaturing and carburetting ——. A. J. Durupt. Fr. Pat. 368,713, Aug. 8, 1906. XVII., page 29.

Hydrogen and carbon monoxide; Process of obtaining —— separately from coal and steam, and their use in the manufacture of illuminating gas. J. E. G. Lahousse. Fr. Pat. 361,866, Oct. 24, 1905.

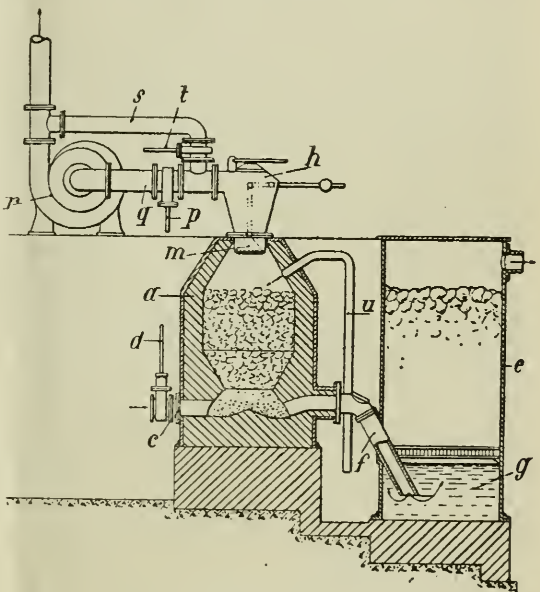
Coal, mixed with barium sulphate, is heated at a red-heat so as to produce carbon monoxide and barium sulphide, according to the equation, $BaSO_4 + 4C = BaS + 4CO$. The sulphide of barium produced is then heated to redness in a current of steam, whereby hydrogen is liberated, with re-formation of barium sulphate:—$BaS + 4H_2O = BaSO_4 + 4H_2$. The regenerated barium sulphate is ready for use *de novo*. The carbon monoxide produced in the first operation may be employed for heating the retorts, the hydrogen being employed, either carburetted or not, for lighting purposes; or one part of the carbon monoxide may be used for heating the retorts, another may be caused to re-act with a portion of the hydrogen to produce methane, according to Sabatier and Senderens' process (this J., 1905, 1164), and the remainder of the hydrogen may be mixed with the methane.—H. B.

Hydrogen and carbon monoxide; Process of obtaining ——, *separately, from coal and steam, and their use in the manufacture of illuminating gas.* J. E. G. Lahousse, First Addition, dated Oct. 28, 1905, to Fr. Pat. 361,866, Oct. 24, 1905 (see preceding abstract).

Sulphate and sulphide of strontium are used in place of the corresponding barium compounds mentioned in the principal patent.—H. B.

Water-gas producer. Soc. pour L'Exploitation des Procédés de Production de Gaz Industriels. Fr. Pat. 368,834, Aug. 13, 1906. Under Int. Conv., Aug. 17, 1905.

The producer, which is designed to operate by suction during the heating period, is illustrated in the accompanying figure, in which *a* is the producer, *c* and *d* the air inlet and valve, and *f* the gas-outlet pipe, which dips under the water, *g*, in the scrubber, *e*; *u*, the steam-supply pipe, *m*, the valve at the bottom of the hopper, *h*; *q* a pipe for leading the hot waste gases through the hopper to the blower, *r*, and *s* a by-pass pipe. The fuel in the producer rests directly upon the ashes at the bottom, there being no fire-grate. During the heating period, air is sucked in at *c*, the valves, *m* and *p*, being open, valve, *t*, closed, and the blower in operation; the pipe, *f*, is sealed by the water and requires no valve. During the run, the valves, *d*, *m*, and *p*, are closed, the blower is stopped, and steam is blown in from the pipe, *u*, the water-gas escaping through *f* and the scrubber. The producer can be charged with fresh fuel through the hopper during the run. The by-pass pipe, *s*, is used when the fire is lit at first, and also when the producer is shut down for the night, the valve, *t*, having a small perforation for gas to escape.—H. B.



Blast-furnace gases; Cooling apparatus for ——. Soc. Anon. des Hauts Fourneaux et Forges de Dudelange. Fr. Pat. 368,731, Aug. 9, 1906. X., page 22.

Filaments of incandescence electric lamps; Manufacture of ——. J. R. Crawford. Fr. Pat. 368,870, Aug. 14, 1906.

See Eng. Pat. 14,898 of 1905; this J., 1906, 918.—T.F.B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Pine wood distillation in the United States. Oil and Col. Tr. J., Dec. 15. [T.R.]

A report of the U.S. Department of Agriculture supplies the following figures showing the quantity of pine distilled and the products. The total amount used by the fifteen operators reporting was 16,969 cords, with a value of $42,805. The average relative amounts of charcoal obtained from pine and hardwood are approximately 350 lb. and 700 lb. per cord. The average price of pine wood per cord is also lower. The number of stills was 15. The products comprised 300,106 bushels of charcoal, 362,500 galls. of tar, 434,780 galls. of oil, and 238,180 galls. of turpentine.

Petroleum deposits of Berekei. K. Charitschkoff. Petroleum, 1906, 2, 185—186.

The Berekei oilfield is on the western shore of the Caspian Sea, to the north of Baku, and about 17 miles from Derbend. The oil springs have long been known to the natives, and the first borehole was put down in 1895 to a depth of 329 ft. The oil (sp. gr. 0·9056) was accompanied by brine and gas, and yielded, on distillation, up to 31·8 per cent. of good petroleum, and a dense residuum (sp. gr. 0·978) unsuited for making lubricating oil. Boring was continued in 1902 to a depth of 640 ft., and the oil from the spouters gave a lamp oil of sp. gr. 0·868. The wells continued to spout for seven months and yielded about 3000 pood per diem. Samples of Berekei oil examined by the author furnished 1·5 per cent. of "light benzine" (b.pt. up to 100° C.), 5·85 per cent. of "heavy benzine" or ligroin (b. pt. 100°—150°), 29·42—34·0 per cent. of petroleum (b. pt. 150°—270° C.), and 56·85 per cent. of residuum. The petroleum burned fairly well, and had the sp. gr. 0·8045, with a flashing point of 28·5° C. (Abel-Pensky). The residuum had the flashing point 127° C. (Pensky-Martens) and the viscosity 4·56 (Engler), but was unsuitable for making lubricating oil. By cold fractionation with 95 per cent. alcohol from solution in amyl alcohol, after refining with sulphuric acid and neutralising, the residuum yielded five fractions with the properties of solar oil and spindle oil. The crude oil was almost entirely free from paraffin, and contained only 0·3 per cent. of solid hydrocarbons. The residuum contained 84·03 per cent. of carbon, 12·10 per cent. of hydrogen, 0·72 per cent. of sulphur, and 3·15 per cent. of oxygen. The petroleum is equal, in point of yield and quality, to Baku oil, and the residuum makes a first-class fuel. The brine contains iodides, bromides, and strontium carbonate, and the gas has the composition: carbon dioxide, 12·82 per cent.; methane, 65·84 per cent.; ethane, 19·92 per cent. A pipe line and storage tanks have been constructed, and the position of the field, in a plain near the sea and railway accommodation, is favourable for its future development, though the district is unhealthy owing to the prevalence of fever, and in a lawless state.—C. S.

English Patent.

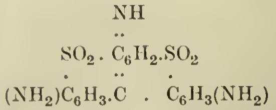
Coking or carbonising peat, wood, or the like; Ovens for ——. E. Stauber, Kongsberg, Germany. Eng. Pat. 1397, Jan. 18, 1906.

See Fr. Pat. 362,497 of 1906; this J., 1906, 685.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

Triphenylmethane dyestuffs, Basic —— containing sulphur. J. Schmidlin. Ber., 1906, 39, 4204—4216.

By the action of fuming sulphuric acid on the leucanilines, blue dyestuffs are obtained, but hitherto only those prepared from the homologues of *p*-leucaniline have been described (Ger. Pat. 160,550). The author finds that the latter also yields a similar dyestuff. Twenty-six grms. of *p*-leucaniline hydrochloride are added to 250 grms. of fuming sulphuric acid containing 60 per cent. of sulphur trioxide, and the mixture kept in a closed vessel for a month at the ordinary temperature. At the end of this time the acid is diluted with 500 grms. of ice and 500 grms. of water, and the solution subjected to anodic oxidation whereby the liquid becomes blue, and blue crystals with metallic lustre (3 grms.) of the sulphate of *p*-rosaniline-disulphone

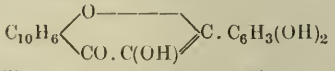


$$\begin{array}{ccc} & NH & \\ & \colon & \\ SO_2 \,. & C_6H_2 & .\,SO_2 \\ \cdot & \colon & \cdot \\ (NH_2)C_6H_3 \,. & C & .\;\; C_6H_3(NH_2) \end{array}$$

separate. The crystals have a violet-red reflex and are very sparingly soluble in water, more soluble in dilute acids, and very soluble in concentrated hydrochloric acid, giving a brown solution. The trisulphonic acid of this compound is obtained by adding 30 grms. of *p*-leucaniline hydrochloride to 200 grms. of fuming sulphuric acid as before, and heating the mixture to gentle boiling. The cooled product is poured on to 200 grms. of ice and diluted with 150 c.c. of water. After standing, a precipitate forms, which, on drying, is a white crystalline powder. This trisulphonic acid crystallises with 4 mols. of water and dissolves in warm water with an intensely blue colour. The hydrated acid is thus colourless and the anhydrous acid blue. Under similar conditions, leucaniline salts yield the corresponding rosaniline-disulphone and the leuco-base of New Magenta (triaminotritolylmethane) also gives a disulphone. When the latter disulphone is heated with hydrochloric acid, two of the amino-groups are replaced by hydroxyl groups, and the same compound is obtained by diazotising the disulphone and heating the solution. The violet diazo-solution is also rapidly decomposed by light with the formation of the dihydroxy-compound.—J. C. C.

3′:4′-Dihydroxy-α-naphthoflavonol. P. Bigler and St. v. Kostanecki. Ber., 1906, 39, 4034—4037.

By heating veratric aldehyde with acetonaphthol in alcoholic solution in presence of caustic soda, 2-veratrylaceto-1-naphthol is obtained in red prisms, m. pt. 134·5° C. When an alcoholic solution of this is treated with hydrochloric acid and boiled for 24 hours, 3′:4′-dimethoxy-*α*-naphthoflavanone results, which crystallises in white needles, m. pt. 135° C. On boiling the acetic acid solution of the isonitroso-derivative with 10 per cent. hydrochloric acid, 3′-4′-dimethoxy-*α*-naphthoflavonol is formed, and this on being treated with strong hydriodic acid yields 3′:4′-dihydroxy-*α*-naphthoflavonol



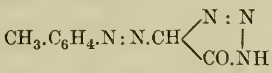
$$C_{10}H_6\left\langle\begin{array}{l} O\text{———}\!\!\diagdown \\ CO\,.\,C(OH)\!\!\diagup\!\!\!\diagup \end{array}\right. C\,.\,C_6H_3(OH)_2$$

which crystallises in shining yellow needles m. pt. 286° C. It has a strong affinity for mordanted fibres, but the shades produced are not very good. On alumina mordant a brownish-yellow shade is obtained. The dyestuff dissolves with an orange colour in dilute caustic soda, and its solution in concentrated sulphuric acid is yellow with a green fluorescence.

In their study of hydroxyflavonol dyestuffs, the authors have arrived at the following conclusions as having importance in the theory of mordant dyestuffs. (1) In the phenolic dyestuffs, four groups act as "colour-giving" groups, namely: OH(1), OH(2), strong; O(1), OH(2), weak; OH(1), OH(peri), fairly strong; O(1), OH(peri), very weak. (2) Groups which are weak in colour-giving properties are considerably strengthened in this direction by the presence of free hydroxyl groups.—J.C.C.

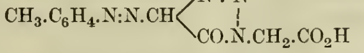
5-Triazolone and 5-triazolone derivatives from diazo-fatty acids; Formation of ——. T. Curtius and J. Thompson. Ber., 1906, 39, 4140—4144.

When diazoacetamide is digested with 2 mols. of 2*N*-caustic potash solution, and a solution of diazotoluene sulphate added in the cold, a deep orange solution is produced from which, by the addition of acetic acid, 4-azotoluene-5-triazolone



$$CH_3.C_6H_4.N:N.CH\left\langle\begin{array}{l}N:N\\ \quad\;\;|\\ CO.NH\end{array}\right.$$

is obtained. This crystallises from hot alcohol in yellow needles, which give a deep yellow solution with alkalis. It may also be prepared by adding diazotoluene sulphate to the 5-triazolone obtained by treating diazoacetamide with baryta water. In a similar manner, 4-azotoluene-5-triazolone-1-acetic acid



$$CH_3.C_6H_4.N:N.CH\left\langle\begin{array}{l}N:N\\ \quad\;\;|\\ CO.N.CH_2.CO_2H\end{array}\right.$$

crystallising in orange-red needles, m. pt. 156° C., and 4-azotoluene-5-triazolone-1-acetamide crystallising in yellow needles, m. pt. 166° C. are obtained.—J. C. C.

Indigo trade of India. Review of the Trade of India in 1905–06. Cd. 3272. [T.R.]

THE following statement shows the exports of indigo in the past four years :—

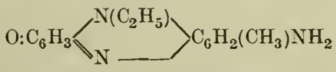
	From Calcutta.	From Madras.	From other ports	Total.	Value.
	cwt.	cwt.	cwt.	cwt.	Rs.
1902–03......	29,403	32,242	3,732	65,377	1,20,56,819
1903–04......	29,858	24,414	6,138	60,410	1,07,62,026
1904–05......	30,029	11,901	7,322	49,252	83,46,073
1905–06......	19,062	7,756	4,368	31,186	58,63,777

The exports from India in 1895–96 amounted to 187,337 cwts., with a value of R. 535·45 lakhs. In 1895–96, the average value was R. 285·8 per cwt. ; in 1905–06 it was R. 188 per cwt. Exports to the United Kingdom fell away 30 per cent., and the Continent also took less than in the previous year, while direct exports to Persia have shrunk by 55·9 per cent. The United States took only 1,530 cwts., compared with 4,334 in the previous year. Only a negligible revival has appeared in the Japan trade, the quantity exported being 242 cwts., with a value of R. 47,506. The area under indigo in Bengal, United Provinces, Punjab, and Madras in December last was 380,663 acres, as against 476,949 in the previous year. In the previous five years the area averaged 833,742 acres, and in the previous ten years 1,112,661. Much of the ground that used to be under indigo has now been turned over to cotton, which offers a fairly constant market, and to sundry experimental cultures like rubber, flax, &c.

ENGLISH PATENTS.

Dyestuffs ; Manufacture of pure Bordeaux-red sulphurised [sulphide] ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 2797, Feb. 5, 1906. (Compare this J., 1906, 260, 880.)

WHEN safraninones containing alkyl radicals are heated with sulphur and alkali sulphides, pure Bordeaux-red sulphur dyestuffs are obtained. Example : 72 parts of sodium nitrosophenol, containing 31 parts of pure nitrosophenol, are dissolved in water and mixed with a solution of 37·5 parts of monoethyl-*m*-toluylenediamine. After oxidising the resulting indophenol with 200 parts of manganese paste (containing about 40 per cent. of MnO_2) the hydrochloride of ethosafraninone



$$O:C_6H_3\left\langle\begin{array}{l}N(C_2H_5)\\ N\end{array}\right\rangle C_6H_2(CH_3)NH_2$$

crystallises out. Ten parts of this are heated with 55 parts of crystallised sodium sulphide and 25 parts of sulphur or 80 parts of sodium sulphide and 40 parts of sulphur, to about 110°—135° C. in a reflux apparatus. The dyestuff is precipitated by adding acids or by a current of air. It dissolves readily in alkali sulphides, and dyes cotton a pure Bordeaux shade. When treated with copper salts on the fibre a pure violet is obtained. Similar dyestuffs are produced from the corresponding methyl or benzyl derivatives, and with other substituted derivatives of *p*-aminophenol such as the colour bases derived from *o*-chloro-*p*-aminophenol, *p*-amino-*o*-cresol, *p*-aminosalicylic acid, *p*-aminophenol-*o*-sulphonic acid on the one hand, and from monoalkylated *m*-toluylenediamines on the other hand.—J. C. C.

Phenylglycine or its homologues ; Manufacture of ——. O. Imray, London. From Farb. vorm. Meister, Lucius, und Brüning, Hoechst-on-Maine, Germany. Eng. Pat. 9774, April 26, 1906. (See Ger. Pat. 167,698 ; this J., 1906, 471.)

IN the usual process for obtaining phenylglycine by the action of chloracetic acid on aniline, poor yields are obtained owing to the formation of by-products by the action of the chloracetic acid on the phenylglycine formed. This is avoided by separating the glycine as it is formed as an insoluble salt of a heavy metal. For example :—Chloracetic acid is allowed to act on aniline in presence of hydrated ferrous oxide, or ferrous carbonate, and a concentrated salt solution. The glycine-iron salt thus formed is insoluble in the salt solution and may be filtered off and decomposed by caustic alkali or an alkali carbonate.—A. B. S.

Colouring matter ; New —— [azo dyestuff] and the production thereof. J. Hirschberger, E. Hoffa, and Levinstein, Ltd., Manchester. Eng. Pat. 3506, Feb. 13, 1906.

THE tetrazo-compound of 20·4 parts of *oo*-diaminophenol-*p*-sulphonic acid is run into a solution of 24·6 parts of sodium *a*-naphthol-*o*-sulphonate, and 30 parts of sodium acetate. The mixture is stirred for several hours and warmed to 35° C. After cooling it is made alkaline with sodium carbonate, and a solution of 14·5 parts of *β*-naphthol in 12 parts of caustic soda (35 per cent.) and 100 parts of water added. After stirring for five hours and warming to 45° C., the mixture is boiled up and the dyestuff isolated by adding salt. The colouring matter dyes wool reddish-brown from an acid bath, and on chroming a bluish-black is obtained which is very fast to milling, washing, and light.—J. C. C.

Polyazo dyestuffs ; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 5245, March 3, 1906. (See U.S. Pat. 807,119 of 1905 ; this J., 1906, 65.)

Azo dyestuffs are obtained by condensing the intermediate bodies produced by combining 1 mol. of an aromatic aldehyde with the 1.2-diamino-5-naphthol-7-sulphonic acid, with 1 mol. of an azo dyestuff containing the aldehyde group in the presence of bisulphite, and subsequently combining with diazo bodies. If *m*-aminobenzaldehyde be taken in the first instance, diazotisable dyestuffs are obtained. For example :—12·1 kilos. of *m*-aminobenzaldehyde are dissolved in water by heating with about the theoretical quantity of bisulphite, and the solution is then mixed with a solution of 25·4 kilos. of 1.2-diamino-5-naphthol-7-sulphonic acid. The mixture is boiled for one hour, and, after acidifying with hydrochloric acid, the precipitate is filtered off after removal of the sulphurous acid by heating. This intermediate body is dissolved in "soda," and a solution of the azo dyestuff obtained in the usual manner from 12·1 kilos. of *m*-aminobenzaldehyde and 24 kilos. of 1.4-naphthol sulphonic acid, is added. The solution is acidified with acetic acid and then boiled until a sample is completely precipitated by hydrochloric acid ; it is then salted out and the dyestuff filtered off. To combine with diazobenzene, the dyestuff is again dissolved in "soda," and the diazo body from 9·3 kilos. of aniline is added at 0° C. The solution becomes bluish-red, and the dyestuff is salted out and filtered off. The dyestuff thus obtained dyes cotton a bright scarlet very fast to acids. By diazotising and developing on the fibre with *β*-naphthol, the intensity and fastness of the dyeings are increased. —A. B. S.

Dyestuffs [Azo] ; Manufacture of new disazo ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6574, March 19, 1906.

SEE Fr. Pat. 364,406 of 1906 ; this J., 1906, 923.—T. F. B.

Dyestuffs; Manufacture of new disazo —— and of a new intermediate compound for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9695, April 25, 1906.

See Fr. Pat. 365,582 of 1906; this J., 1906, 979.—T. F. B.

Dyestuffs compounds; Process for the manufacture of new sulphur [sulphide] ——. Chem. Fabr. vorm. Weiler-ter-Meer, Uerdingen, Germany. Eng. Pat. 8066, April 3, 1906. Under Int. Conv., Feb. 26, 1906.

By treating sulphide dyestuffs with sodium sulphide until the latter is absorbed, an evolution of ammonia takes place, the temperature rises, and new sulphide dyestuffs are produced which contain no free sodium sulphide. Example: 100 parts of "Sulphur Black T extra concentrated" are mixed with a concentrated solution of 30—35 parts of sodium sulphide until a uniform mass is obtained. With the development of ammonia the temperature rises, and the volume of the dysetuff is increased. Later, the free alkali sulphide disappears and the product may be used immediately or after drying for dyeing and printing. The dyestuffs obtained in this way do not blacken copper rollers except when treated with acids or concentrated solutions of caustic alkalis or with dilute solutions of caustic alkalis and alkaline salts at a relatively high temperature.—J. C. C.

French Patents.

Phenyl-1.2-naphthimidazole; Process for making amino-sulphonic acids of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,852, Oct. 16, 1905.

See Eng. Pat. 20,780 of 1905; this J., 1906, 750.—T. F. B.

Phenylnaphthimidazole; Process of making amino-hydroxysulphonic acids of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,863, Oct. 23, 1905.

See Eng. Pat. 21,175 of 1905; this J., 1906, 1142.—T. F. B.

Colouring matter; Tinctorial ——. A. F. Ventre and C. C. T. Porcher. Fr. Pat. 361,865, Oct. 23, 1905.

Ten parts of a freshly-prepared, 20 per cent. solution of ammonium molybdate, 1·5 parts of nitrobenzene, and 1 to 5 parts of sulphuric acid are added to 100 parts of a 1 per cent. solution of a ketonic sugar, *e.g.*, lævulose, saccharose, or cane molasses; the sulphuric acid may be replaced by hydrochloric acid, or by formic or acetic acid. After heating for 5 to 30 minutes, with frequent stirring, the solution becomes deep blue in colour, and, when diluted, is stated to produce fine blue shades on silk; other dyestuffs or compounds (*e.g.*, picric acid) may be added to the solution to vary the shade of the dyeing.
—T. F. B.

Dyestuffs; Production of azo ——. Badische Anilin und Soda Fabrik. Fr. Pat. 368,608, Aug. 3, 1906. Under Int. Conv., March 12, 1906.

The tetrazo-compound of *p*-aminobenzeneazo-2-amino-8-naphthol-6-sulphonic acid is combined either with 2 mols. of a compound containing the group, $-NH.CH_2.COOH$, or with 1 mol. of such a compound, and 1 mol. of another component such as a naphthol- or naphthylamine-sulphonic acid. The same dyestuffs may be produced by combining tetrazotised *p*-phenylene diamine with 1 mol. of 2.8.6-aminonaphtholsulphonic-acid and 1 mol. of another component (which may contain the glycin group), diazotising the product, and combining with a component containing the glycin group, or not, according to whether the azo dyestuff already contains it. The dyestuffs thus obtained are readily soluble in water, and have a great affinity for cotton, on which they produce varying black shades of great purity; it is stated that half-wool fabrics can be dyed with these dyestuffs in the fulling bath, the cotton being fully dyed before the wool has become shaded.—T. F. B.

Dyestuffs; Production of sulphurised vat —— [Thioindigo dyestuffs]. Badische Anilin und Soda Fabrik. Fr. Pat. 368,775, Aug. 10, 1906. Under Int. Conv., July 3, 1906.

Red dyestuffs identical with those already known as "Thioindigo Red," &c., are obtained by heating arylthioglycol-o-carboxylic acids, their salts or esters, with sulphur, with or without a diluent. 100 parts of phenylthioglycol-o-carboxylic acid may be heated with 200 parts of sulphur for one to two hours at 220° C.; the product may be used at once in sodium sulphide solution.
—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

English Patents.

Yarn; Apparatus for testing ——. J. Moscrop, Manchester. Eng. Pat. 353, Jan. 5, 1906.

A machine for yarn testing in which the yarn is wound upon a large flat reel. The stretching arrangement is connected with arms which grip the threads at each end of the reel, and, by suitable mechanism, the extension and strength of the threads is recorded by means of pencils on a sheet of paper.—A. B. S.

Claret shades on cotton goods; Production of easily dischargeable ——. R. B. Ransford, Upper Norwood. From L. Casella und Co., Frankfort on Maine, Germany. Eng. Pat. 5246, March 3, 1906.

The Naphthylamine Claret produced on the fibre by means of β-naphthol and α-diazonaphthalene is difficult to discharge with hydrosulphite. This is made easier if a portion of the naphthol is replaced by one of its monosulphonic acids. For example:—The goods are impregnated with a concentrated solution containing three parts of β-naphthol, one part of 2.7-naphtholsulphonic acid, and 1·2 parts of caustic soda with or without "para soap." The cloth is dried and passed through a solution of diazotised α-naphthylamine, washed, dried, and printed with a hyraldite discharge in the usual way.
—A. B. S.

Transfer printing. J. F. Thorpe and W. Briggs and Co., Ltd., Manchester. Eng. Pat. 17,793, Sept. 2, 1905.

See U.S. Pat. 831,582 of 1906; this J., 1906, 1041.—T. F. B.

Dyeing on fibre; Production of red ——. Kalle und Co. Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 16,908, July 26, 1906. Under Int. Conv., Oct. 27, 1905.

Red dyeings may be obtained on fibres or fabrics by treatment with an oxidising agent and thioindoxyl or thioindoxylcarboxylic acid, either separately or simultaneously. Fifty parts of thioindoxylcarboxylic acid dissolved in 150 parts of water and 150 parts of caustic soda (40° B.), are stirred into a thickening consisting of 40 parts of rice starch and 40 parts of "dragantin" (6 per cent.), in 576 parts of water, and the mixture is printed on the fibre or fabric, which is then dried, and passed, at 70° C., through a solution containing 10 per cent. of concentrated hydrochloric acid and 1·5 per cent. of sodium bichromate, and finally rinsed.—T. F. B.

Dyeing and printing red on textile fibre. Kalle und Co. Akt.-Ges., Biebrich on Rhine, Germany. Eng. Pat. 17,163, July 30, 1906. Under Int. Conv., Nov. 14, 1905.

The products obtained by condensing thioindoxyl or its carboxylic acid with isatin (see Eng. Pat 17,162 of 1906; this J., 1906, 1038), may be applied in dyeing and printing red shades on textile fibres in the manner described in Eng. Pat. 14,261 of 1906 (see Fr. Pat. 359,400 of 1905; this J., 1906, 426).—T. F. B.

Printing textile fabrics. W. E. Kay, Manchester, and G. McGregor, Alexandria, N.B. Eng. Pat. 3709, Feb. 15, 1906.

Textile fabric is impregnated by padding or otherwise with an alkaline solution of naphthol, dried, and printed with a diazo mixture (*e.g.*, of *p*-nitraniline) by a suitable printing machine; an acid or resist, appropriate to the colours to follow, is now printed on the fabric in the same machine and operation, this resist falling wholly or partially upon the azo colours produced, followed by a printing or padding with an acid or basic dyestuff, with its mordant, or a sulphide dyestuff, or by a colour capable of development by the naphthol. The process may be varied by printing or padding with a mordant only, after the acid or resist, and then dyeing after the usual ageing process.—T. F. B.

French Patents.

Silk, artificial; Revolving spinneret for ——. Soc. Française de la Viscose. Fr. Pat. 361,877, Oct. 30, 1905.

The viscose is delivered into a tube carrying the spinneret. This tube is mounted on two sets of ball bearings and can be revolved by a pulley.—A. B. S.

Silk, artificial; Production of brilliant fibres of ——. G. Boucquey. Fr. Pat. 368,706, Aug. 8, 1906.

The solution of cellulose in ammoniacal copper hydroxide is forced through the spinnerets into a dilute solution of an acid which contains a certain quantity of sugar, molasses, or glucose. These additions are said to prevent any injurious action of the acid on the fibre.—A. B. S.

Cellulose; Preparation of mixed esters of ——, *and their application for artificial silk.* L. Lederer. Fr. Pat. 368,766, Aug. 10, 1906. XIX., page 30.

Ramie or China grass; Retting of —— *by means of putrid fermentation with a view of obtaining decortication of the plant, and degumming of the fibres.* C. Guerry and C. Ponthus. Fr. Pat. 361,854, Oct. 16, 1905.

The incrusting pectic matters in the raw ramie fibre contain substances which prevent fermentation taking place, and so interfere with any retting process such as is employed for hemp and flax. These "anti-ferment" substances are rendered insoluble and inert by the addition of various proteid matters, such as egg or blood albumin, soluble casein, gelatin, &c. The stalks of fresh or dry ramie are placed in a tank of water containing some of the above-mentioned substances. The quantity used depends on the dryness of the stalks and on the temperature. Fermentation starts naturally or by addition of a small quantity of an old bath, and loosens the fibrous layer from the wood. The wood is then removed by scutching and heckling as with flax. The filaments thus obtained are treated in another similar retting bath, rinsed, and finally carded, combed, spun, and bleached.—A. B. S.

Fats; Extraction of —— *from waste washings, and in particular from wool-washings.* M. Roullet. Fr. Pat. 368,654, Aug. 6, 1906. XII., page 25.

Mercerising of fabrics; Frame for ——. J. P. Bemberg Akt.-Ges. Fr. Pat. 368,709, Aug. 8, 1906.

The fabric, previously impregnated with the mercerising liquid, is passed along a tenter frame until it has reached the desired width. It then passes over a short portion of the frame having parallel sides, and then, by inclination of the guides, into a washing vat, which is about one metre long, filled with warm water or with a warm weak lye. The caustic soda is sufficiently diluted to prevent shrinking when the cloth is released from the tenter. The pieces are now removed from the tenter, squeezed, and washed.

Drying threads and other products of the textile industry; Machine for ——. A. N. Marr. Fr. Pat. 368,753, Aug. 9, 1906.

See Eng. Pat. 19,508 of 1905; this J., 1906, 924.—T. F. B.

Fabrics in the open width; Machine for the wet treatment of ——. Stephanus and Richter. Fr. Pat. 368 596, Aug. 3, 1906.

See Eng. Pat. 19,182 of 1906; this J., 1906, 1216.—A. B. S.

Designs on fabrics; Production of transparent ——. J. Giehler. Fr. Pat. 368,662, Aug. 6, 1906.

The process consists in printing on the fabric with chemicals capable of altering the volume of the various fibres so that the printed places appear lighter when viewed by transmitted light. A suitable chemical for this purpose is a paste consisting of chromium oxide and acetic acid. —A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Nitrate of soda statistics. W. Montgomery and Co. Dec. 31, 1906. [T.R.]

Shipments, consumption, stocks, and prices, from 1904 *to* 1906.

					1904.	1905.	1906.
Shipments from South American Ports to all parts for the six months ending 31st Dec.	Tons				898,000	934,000	1,009,000
Ditto do. for the twelve months ending 31st Dec.	,,				1,476,000	1,623,000	1,719,000
Afloat for Europe on 31st Dec.	,,				510,000	491,000	559,000
Stocks in U.K. Ports :—							
		1904.	1905.	1906.			
Liverpool	Tons	6,000	8,400	7,500	21,000	18,000	17,000
London	,,	2,100	1,400	2,400			
Out Ports	,,	12,900	8,200	7,100			
Stocks in Continental Ports on 31st Dec.	Tons				141,000	165,000	173,000
Consumption in U.K. for the six months ending 31st Dec.	,,				43,000	34,000	37,000
Do. in Continent do. do.	,,				261,000	269,000	283,000
Do. in U.K. for the twelve months do.	,,				121,000	101,000	108,000
Do. in Continent do. do.	,,				1,010,000	1,089,000	1,135,000
Do. in United States do. do.	,,				275,000	308,000	358,000
Do. in other Countries do. do.	,,				41,000	49,000	40,000
Do. in the World do. do.	,,				1,447,000	1,547,000	1,641,000
Visible supply on 31st Dec. (including the quantity afloat for Europe and Stocks in U.K. and Continent)	,,				672,000	674,000	749,000
Price on 31st Dec.	per cwt.				10/10½	10/9	11/1½

Iron sulphide; Soluble ——. A. Konschegg and H. Malfatti. Z. anal. Chem., 1906, **45**, 747—751.

If the precipitate of ferrous sulphide and sulphur obtained by the action of ammonium sulphide on ferric chloride solution be washed free from ammonium salts, and then triturated with water and not too much potassium hydroxide or sodium hydroxide, it dissolves to a deep green solution, slowly on standing, or immediately on warming. Ferrous sulphide is not dissolved when subjected to similar treatment, but dissolves if flowers of sulphur be added, and is also soluble in alkali sulphide solution provided not too large a proportion of polysulphide-sulphur be present. A similar deep green solution is obtained by treating basic iron compounds, *e.g.*, the hydroxide, with ammonium sulphide. If the green solution containing excess of alkali be boiled, it becomes paler, and finally decomposes, ferric hydroxide being precipitated. An intermediate stage is frequently observed in which the liquid becomes light yellow in colour, without separation of hydroxide. From the yellow solution alcohol precipitates a black sulphide soluble in water. If the original green solution be precipitated with alcohol, the precipitates are frequently no longer soluble in water; sometimes they dissolve with a brown or black colour, but only rarely with a green colour. Of the precipitates which dissolved with a green colour, the one poorest in alkali contained 14 per cent. of potassium, whilst other products obtained by the treatment of iron sulphide ($FeS+S$) or hydroxide with alcoholic potash or potassium sulphide, had compositions approximating the formula, FeS_2K.—A. S.

Hydrogen peroxide; Decomposition of —— by copper salts in alkaline solution. F. Claessens. Ann. pharm., 1906, **12**, 285. Chem.-Zeit., 1906, **30**, Rep., 433.

Hydrogen peroxide, when brought in contact with alkaline copper solutions, is immediately decomposed with evolution of oxygen. On this fact the author bases a method of assay which is not of the highest accuracy, but is rapid, and shows "volumes" of available oxygen directly. A measured volume of hydrogen peroxide is decomposed in an ordinary nitrometer by means of an excess of ammoniacal copper sulphate solution, and the volume of the evolved oxygen is read off.—W. A. C.

Lead persulphate and lead peroxide; Solubility and oxidation-potential of ——. F. Dolezalek and K. Finckh. XIA., page **22**.

English Patent.

Hydrogen peroxide; Process for preparing a stable solution of ——. W. Heinrici, Halle an der Saale, Germany. Eng. Pat. 16,612, July 23, 1906. Under Int. Conv., Aug. 28, 1905.

See Addition of July 4, 1906, to Fr. Pat. 356,880 of 1905; this J., 1906, 1219.—T. F. B.

French Patents.

Nitric acid; Electrolytic process for the concentration of —— Saltpetersäure Ind.-Ges. G. m. b. H. Fr. Pat. 368,716, Aug. 8, 1906. XIA., page 24.

Ammonia, ammonium sulphate, and other ammoniacal salts; Synthetic process of manufacturing ——, as well as the nitrates of sodium, potassium, and other metals. A. Gorainoff. Fr. Pat. 368,585, Aug. 2, 1906. XIA., page 23.

Arsenic ores and other arsenical products; Application of shaft furnaces to the treatment of —— for the obtainment of arsenious acid. G. Estradère and C. Gibello. Fr. Pat. 361,846, Oct. 14, 1905.

The ore or other material is heated in a shaft furnace, from which the flames and arsenical vapours pass through one or more adjacent sublimation chambers, and finally to a condensing chamber wherein the arsenious oxide is stated to be deposited in a pure and white condition.
—A. S.

Flowers of sulphur or sublimed sulphur; Process and apparatus for the continuous manufacture of ——. A. Boude et Fils. Fr. Pat. 361,874, Oct. 28, 1905.

The retort in which the crude sulphur to be distilled is heated, is furnished with two diverging exit channels, from the same end, each leading to a separate condensing chamber. A plate, attached to a horizontal stem traversing the channel and terminating in a hand-wheel outside, is actuated by a screw movement to close or open the valve as desired, the same arrangement being made also with the opposite branch channel. Thus, the two condensing chambers being independent of one another, one can be cut off from the retort while being emptied, without affecting the continuity of the sublimation, which continues into the other condenser. Or, if required, both condensers may be open to the retort simultaneously.
—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

English Patent.

Sheet glass; Production of ——. E. C. R. Marks, London. From J. W. Colburn, Franklin, U.S.A. Eng. Pat. 18,663, Aug. 20, 1906.

Sheet glass is drawn from a molten mass, the intermediate surface portion of which mass, from which the sheet is drawn, being maintained at the requisite temperature for passing into sheet, whilst the outer surface portions are superheated, and a flow of glass away from the two surfaces of the sheet, and towards the outer portions, is caused by two rotating rollers partially immersed in the mass. Means are provided for superheating the outer portions of the surface of the molten mass, and for protecting the sheet itself from the heat. The sheet is drawn over a bending roller, driven partly by external means, partly by the friction of the glass sheet itself, and then passes on to a sheet-receiving carrier moving in a plane below the top of this roller.—A. G. L.

French Patent.

Glass-house pot. H. C. Fry. Fr. Pat. 368,771, Aug. 10, 1906.

The glass-house pot described is in the form of a long oval, and entirely covered. The raw materials are fed into an opening in the upper part of the front of the pot, and pass partly by the aid of gravitation along a curved floor or platform, which extends from the front to the back of the inside of the pot. At the lower end of this platform, at the back of the pot, the fused materials fall through holes into the main melting and fining chamber of the pot, and from this the fined glass passes, at the bottom, through a hole into the third compartment of the pot, which forms the drawing chamber, the mouth of which is below the opening into which the raw materials are fed. Between the dome of the drawing chamber and the lower side of the sloping platform is a channel for the escape of gases, at the front of the pot, from the main melting chamber. By means of this arrangement of the three compartments the molten glass during the process of fining is not subjected to the disturbance caused by the evolution of gases from the raw materials, as this takes place chiefly in the upper or feeding compartment of the pot, and the pot being entirely closed, the glass is not affected by any injurious furnace gases.
—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Marble; Action of —— on kaolin. R. Rieke. Sprechsaal, 1906, **39**, 1295. Chem.-Zeit., 1906, **30**, Rep., **444**.

The author examined a series of mixtures of Zettlitz kaolin with from 1 to 70 per cent. of marble with respect to the contraction and porosity after burning at different temperatures. It was found that marble acts differently from magnesite, causing less contraction. Whilst a mixture of kaolin with 20 per cent. of magnesite shows a maximum with respect to contraction, a mixture of kaolin with 20 per cent. of marble shows between wide limits of temperature (from Seger cone 05 to cone 12) a very small, nearly constant contraction of about 3·3 per cent., and a porosity of 21—24 per cent. The most fusible mixture is one of the composition, $Al_2O_3,2SiO_2,3CaO$, corresponding to 53·8 per cent. of calcium carbonate; its melting point is that of Seger cone 9.—A. S.

Portland cement; Action of aqueous solutions of calcium chloride and magnesium chloride on ——. O. von Blaese. Tonind.-Zeit., 1906, **30**, 1734. Chem.-Zeit., 1906, **30**, Rep., 444—445.

Calcium chloride and magnesium chloride have a similar but not identical influence on the time of setting of Portland cement. With the cement used in the experiments, the time of setting attained its highest value with a 2 per cent. solution of calcium chloride and with a 6 per cent. solution of magnesium chloride. With a 10 per cent. solution of calcium chloride or a 15 per cent. solution of magnesium chloride, the cement began suddenly to set very rapidly; the magnesium chloride caused a considerably stronger evolution of heat during the setting than did the calcium chloride. Test pats of cement prepared with concentrated magnesium chloride solution, especially when stored under water, proved weaker than similar pats prepared with calcium chloride solution. From the results of his experiments, the author concludes that solutions containing up to 10 per. cent of calcium chloride may be used for preparing mortar to be employed in structures exposed to air and water, but stronger solutions should be used only when water has no access to the finished mortar, and in no case should solutions of a strength greater than 25 per cent. be used. In most cases a 20 per cent. solution will be sufficiently concentrated. In dilute solutions up to 5 per cent. strength, calcium chloride may be replaced by magnesium chloride, but solutions containing more than 10 per cent. of magnesium chloride should never be used.—A. S.

Portland cement; Action of acid, alkaline, and fermenting liquors on ——. Rohland. Z. ges. Brauw., 1906, **29**, 704—707.

The surface layer of hardened Portland cement consists chiefly of calcium hydroxide, coagulated silicic acid and aluminium hydroxide, crystallised calcium hydroxide, and calcium carbonate formed from the last. It is to be expected that the rapidity with which solutions attack Portland cement should vary according to the concentration of hydrogen ions in such solutions. Strong mineral acids which form soluble calcium salts readily act on Portland cement; in the case of acids which form insoluble calcium salts, such as sulphuric, sulphurous (which readily oxidises), and hydrofluoric acids, the cement becomes covered with a protecting coat. Contrary to expectation, acetic acid, which is comparatively slightly dissociated in aqueous solution, attacks Portland cement considerably; this abnormal action may be due to some catalytic process not hitherto investigated. The presence of organic substances retards the action of strong acids on Portland cement very considerably. Solutions containing hydroxyl ions have no effect on hardened cement, and exert a favourable effect on cement which is in process of setting. In the presence of water, the calcium silicate and aluminate in the cement are hydrolysed to calcium hydroxide, and colloidal silicic acid and alumina; owing probably to increase of hydroxyl ions, the silicic acid and alumina become coagulated, thereby protecting the cement from further action. By addition of alkali (potash, soda, lime), the concentration of the hydroxyl ions is increased, the hydrolysis of the calcium compounds in the cement being thus diminished. Salts that are hydrolysed by water, have an unfavourable action on cement if they consist of a strong acid and a weak base; if they consist of a weak acid and a strong base, they exert a favourable influence at the beginning of the setting process and subsequently have no effect. Alkali carbonates belong to the latter class, and present a special advantage, in that they form a protecting layer of calcium carbonate. Non-hydrolysable salts, provided that they do not react with the ingredients of the cement, have no effect on hardened cement (*e.g.*, chlorides and sulphates of sodium and potassium). Organic liquids which contain neither hydrogen- nor hydroxyl-ions, such as shale and mineral oils, have no action on hardened cement; it must be remembered, however, that such liquids may become acid by oxidation. Oils containing fatty acids are, of course, injurious, although it has been observed that rich cement mortar (1:1), especially when it becomes covered with calcium carbonate through hardening in the air, is very resistant to these liquids. With regard to wine musts, the organic acids present are so slightly dissociated, that these liquids have practically no effect on Portland cement; the same is true of the phosphoric acid, and the sulphuric acid forms a protecting coat. Owing to the presence of various acids, beer attacks Portland cement; moreover, the carbon dioxide forms bicarbonate with the calcium hydroxide. Hence, unless great care is exercised, cement cannot be recommended as a material for vessels for storing beer. Water from hot springs containing sulphur, should not be conducted through tubes made of cement, since these are liable to be attacked by the sulphur. Some metals (*e.g.*, lead), when placed in contact with cement, exert an injurious action on the latter. Cement surfaces may be rendered less porous by saturating them with water-glass solution, hydrofluosilicic acid, fluosilicates, stearic acid, or paraffin wax dissolved in petroleum ether.—L. E.

English Patents.

Sandstone, artificial; Manufacture of ——. A. Gardeur, Brussels. Eng. Pat. 24,219, Nov. 23, 1905.

Sand, lime, and slag cement are intimately mixed and pugged with water; the paste so obtained is moulded into bricks. When they begin to set, the contents of the moulds are taken out and introduced into a digester apparatus. In this they are submitted, under pressure, to the action of water at a high temperature for at least twelve hours. After the water has been discharged, drying is effected by means of steam. It is claimed that the chemical combinations, formed during the cold setting of the cement, are transformed by the subsequent processes into other combinations of complex basic silicates, thereby strengthening the material and at the same time imparting to it the structure, appearance, and normal properties of natural sandstone. Reference is directed to Eng. Pats. 8142 of 1893, 20,770 and 23,018 of 1895, 12,368 of 1896, 8226 of 1898, 18,787 of 1899, and 23,680 of 1902 (this J., 1897, 45, 613; 1898, 926; 1900, 147).—O. R.

Stones, artificial, and similar building materials; Manufacture of ——. A. Klinge and C. Schourup, Viborg, Denmark. Eng. Pat. 24,224, Nov. 23, 1905.

This invention relates to a method of producing artificial stones with a mixture of cement, clay, and sand, in which the usual firing of the stones is omitted. The proportions of the ingredients are variable. An average composition is 1 part of cement, 2 parts of clay, and 3 parts of sand. The clay is first mixed with water, allowed to settle, and thoroughly kneaded. To it is added a dry mixture of cement and sand, and the whole kneaded again with a further suitable quantity of water. The stones, after moulding, are dried in the air. Reference is directed to Eng. Pats. 1195 of 1877, and 2629 of 1881.—O. R.

Bricks, tiles, and other articles; Materials or composition for making red ——. W. Smith, Dublin. Eng. Pat. 1129, Jan. 16, 1906.

Materials, which would not yield red products when fired alone, are mixed with iron sulphate and a clay which would give a red product when fired by itself. As a preliminary treatment, clays may be separated from the greater part of the limestone contained therein by sifting or washing. Sand may be freed from shells by sifting or washing through a 60-mesh sieve, after which the sand is ground so as to pass at least a 100-mesh sieve.
—A. G. L.

Marble, artificial ; Manufacture of ——. S. Schougaard. Copenhagen. Eng. Pat. 15,553, July 9, 1906.

To the mixtures usually employed in this manufacture—alum-gypsum or Keen's cement and flour of Carrara marble—the inventor adds equal parts of boiled milk and water, mixed with a small quantity of a suitable binding medium such as dextrin. After stirring, pigments are added as required. The mass is formed on a plate of glass or the like in the usual manner. A suitable mixture is obtained by mixing 3 kilos. of dextrin with 50 kilos. of water and 50 kilos. of boiled milk, and adding 75 per cent. of alum-gypsum or Keen's cement and 25 per cent. of flour of Carrara marble.—O. R.

Portland cement ; Manufacture of ——, *and apparatus therefor.* H. Peters, Rochester, Kent. Eng. Pat. 23,816, Nov. 18, 1905.

The invention relates to apparatus for effecting, by mechanical means, the removal of the dried mixtures of slurry and fuel from the drying chambers to the kilns. The operation is effected by means of rakes, mounted on suitable carriages, these carriages being drawn to and fro along guides secured to the walls and extending from end to end of the chamber and into the kiln. Each rake consists of a number of chisel-shaped tines, which can turn freely at their non-acting ends on a shaft ; these tines may be raised or lowered according to requirements. During the passage of the carriage towards the kiln the tines penetrate and break up the dried mixture, and then carry forward detached portions and cause them to descend into the kiln. During the passage from the kiln the tines turn back on the shaft automatically. —C. A. W.

Cement ; Manufacture of ——. R. Liebold, Berlin, F. E. Wittig and C. Grimm, Meissen, Saxony. Eng. Pat. 14,233, June 21, 1906. Under Int. Conv., June 22, 1905.

See Addition of Oct. 5, 1905, to Fr. Pat. 345,421 of 1904 ; this J., 1906, 267.—T. F. B.

French Patent.

Stone ; Artificial ——. M. W. Marsden. Fr. Pat. 368,599, Aug. 3, 1906.

This invention refers to the production of artificial building materials, which are comparatively light in weight, and resistant to crushing strain, changes of temperature, and to fire. Some pliant material, such as cement or gypsum, is used as the basis of the product, and is mixed with inert material such as furnace waste (cinders, slag, &c.) ; special substances are incorporated with the mass, such as salt, asbestos, &c., with the object of accelerating or retarding the setting, or of forming a glaze on exposure to the fire. To manufacture the product, the inert material is crushed, sifted, and intimately mixed with water and with other constituents, salts, gypsum, &c., and the mass is either moulded into blocks, or applied at once to walls, &c.—W. C. H.

X.—METALLURGY.

Antimonial gold ores ; Assay of ——. G. T. Holloway. Inst. Min. and Metall. Bull., No. 27, 1906, 13—14.

The author's experiments were made mainly on ordinary commercial stibnite ores containing from 0·5 to 2 oz. of gold and a few dwts. of silver, about 70 per cent. of antimony sulphide, 20 per cent. of silica, and also "shaley" and earthy matter, with 2 or 3 per cent. of iron oxide. The best results were obtained by the method of partial oxidation with nitre, with addition of excess of lead oxide, the charge consisting of : Ore, 20 ; sodium carbonate, 60 ; borax, 20 ; red lead, 80 ; and nitre, 14 grms. To hinder corrosion of the crucible 10 or 12 grms. of fire-clay or any common clay may be added to the charge. The charge fuses rapidly, and yields a clean yellow slag. The lead button is scorified and cupelled. With low-grade ores it is best to fuse several charges of the composition given, and scorify and cupel the resulting lead buttons. The slag must be worked up if the silver is to be determined, but need not be for the gold determination, except where extreme accuracy is desired. The slag is treated, when necessary, by grinding, and fusing with 20 grms. of red lead and 3 grms. of flour.—A. S.

Cyanide works' clean-up practice. J. E. Thomas. J. Chem. Metall. and Min. Soc. S. Africa, 1906, **7**, 109—111.

The operations should be carried out in a separate room or floor, provided with separate drainage, so that washings may be run directly into a sump and any residue collected and included in the next clean-up. The gold-bearing zinc, &c., from the extractor-boxes should be conveyed by an overhead "crawl" with tipping buckets. For the acid treatment, it is better to have two tubs of a certain capacity than one of the same total capacity, as much less time is lost through "boiling over." For filter-pressing, the gold slimes should be removed from the bottom of the vat, not sucked up by a hose hung over the side. The charges from the acid-treatment tubs should also have been put through a 64-mesh sieve, and the contents of the washing vats kept agitated whilst the filter-press is being filled, to avoid choking of the connecting pipe. The cloths should be protected by filter-paper, and the washing be done with hot water. Whether sodium bisulphate or sulphuric acid is used for the washing, all the washings should be run into a large vat and treated for dissolved gold by sprinkling zinc fume on the surface of the slightly acid liquid. The zinc fume used is produced by distilling zinc *in vacuo*, 5 to 7 lb. being needed to treat washings amounting to 100 tons. The treated washings should be drawn off, after settling, by means of a siphon. If the immersed arm is painted white, it can easily be seen whether the liquid is clear enough to draw off. The vat may have a sloping false bottom of cement painted over with "P. and B. acid-proof paint" to facilitate cleaning. The acid-dissolving tubs should be provided with reversible stirring gear.—A. G. L.

Clark's gold refining process. H. T. Brett. J. Chem. Metall. and Min. Soc. S. Africa, 1906, **7**, 124—125.

The slimes may first be freed from calcium hydroxide and carbonate by treatment with dilute hydrochloric acid. Zinc is next removed by means of sulphuric acid. The slimes, which need not be thoroughly washed, and which should not be dried, are then moistened with a solution of nitre cake in sulphuric acid ; thus, to 5 grms. of slimes containing 50 per cent. of water should be added 1 grm. of 50 per cent. sulphuric acid, to which a little nitre cake has been added. The whole is then heated to a visible red heat to destroy cyanogen compounds, convert most of the metals into sulphates, and expel mercury and selenium. The material when cold should be reddish or brownish without any black patches. To the still hot mass, nitre cake is added, preferably in portions, in quantity depending on preliminary tests, and varying from 0·5 to 3 parts of nitre cake to 1 of slime. The whole mass is again heated to a visible red heat, and the melt obtained is poured on to a clean iron plate and broken up into lumps, which should be white to bluish- or greenish-white with patches of spongy gold. The lumps are then systematically extracted with hot water so as to obtain a saturated solution of silver sulphate (containing 0·5 to 1 oz. of silver per litre). The spongy gold and impurities left are next washed quite free from silver, and either smelted to gold, or, preferably, amalgamated, using a very small amount of potassium cyanide solution to aid the process. The gold left after heating the amalgam may be refined by heating with a little potassium chlorate and common salt, and adding, after these have melted and run through the porous cake of gold, a little nitre cake and finally some borax. Even silver can be eliminated in this way. White cast iron should be used for the heating vessels, as wrought iron and grey iron are much more readily attacked. —A. G. L.

Sulphides in ores; A process for oxidising metallic ——. N. Lebedeff and B. Pomeranzoff. Eng. and Mining J., 1906, **82**, 1061—1062.

The process described by the authors consists in mixing the ground ore with clay in suitable proportions (generally 1:1 by volume), and submitting the mass to the gradual action of a current of hot air at 300°—400° C. The mass may be treated loose, or in briquetted form, in a special form of apparatus, or in a reverberatory furnace. It is stated that the oxidation of the sulphur proceeds energetically, especially if the clay contain much iron; in the latter case the oxidation is probably effected to a considerable extent by oxide of iron. The time required is much less than that occupied in the ordinary roasting process, and the temperature is not sufficient to decompose the sulphides if they have not been mixed with clay. The following experiment is cited. A piece of copper matte and a briquette made of the same matte crushed and mixed with clay were treated with a current of air heated to about 400° C. After about 24 hours the piece of matte showed only traces of superficial oxidation; the briquette, on the other hand, was almost completely oxidised, with the exception of a small core in the centre.—A. S.

Palladium; Alloys of —— with silver. R. Ruer. Z. anorg. Chem., 1906, **51**, 315—319.

The author has studied the alloys of palladium and silver by means of heating and cooling curves. The results show that, just as in the case of palladium-copper alloys (this J., 1906, 1150), no chemical compound is formed. The two metals form an uninterrupted series of mixed crystals. Micrographic examination of the alloys confirmed these results. The hardness of the alloys increases with rising amounts of palladium from that of silver (somewhat below 3 on Mohs's scale) to that of palladium (about 3). —A. S.

Palladium; Alloys of —— with gold. R. Ruer. Z. anorg. Chem. 1906, **51**, 391—396.

Heating and cooling curves of palladium-gold alloys show that, just as in the case of palladium-copper (this J., 1906, 1150) and palladium-silver alloys (see preceding abstract), no chemical compound is formed, the alloys consisting of an uninterrupted series of mixed crystals. There are, however, certain differences in the form of the curves corresponding to the three series of alloys mentioned. For example, the melting point of palladium is lowered 94° C. by 10 per cent. of copper, 26° C. by 10 per cent. of silver, and 7° C. by 10 per cent. of gold. On the other hand, 10 per cent. of palladium raises the melting point of copper by 7° C., of silver by 98·5° C., and of gold by 207° C. The hardness of the palladium-gold alloys increases with the content of palladium from that of gold (about 2½ on Mohs's scale) to a maximum (3½, for the alloy containing about 70 per cent. of palladium), and then falls gradually to that of palladium (about 3).—A. S.

Bismuth-thallium alloys. M. Chikashige. Z. anorg. Chem., 1906, **51**, 328—335.

The author's experiments comprised determinations of the cooling curves of bismuth-thallium alloys and micrographic examination of the cold alloys. With from 0 to 20 per cent. of thallium, the alloys consist of crystals of bismuth together with an eutectic (20 per cent. of thallium, m.pt. about 195·5° C.). The alloys containing from 20 to 35·5 per cent. of thallium consist of the eutectic mentioned and crystals of the compound, Bi_5Tl_3 (37 per cent. of thallium, m.pt. 211·7° C.); the alloys with from 35·5 to 38·5 per cent. of thallium consist of a series of mixed crystals of bismuth on the one hand, and thallium on the other, with the compound, Bi_5Tl_3. With from 38·5 to 53 per cent. of thallium, the alloys consist of crystals of the compound, Bi_5Tl_3, and a second eutectic (53 per cent. of thallium, about 186° C.), and with from 53 to 66·3 per cent. of thallium, of the eutectic and a second series of mixed crystals. The alloys containing 66·3 to 74·6 per cent. of thallium solidify as mixed crystals, but at 90° C. the latter appear to be transformed into metallic bismuth and the compound, $BiTl_3$. There are also two maxima on the portion of the cooling curve relating to alloys with more than 74·6 per cent. of thallium, but the existence of compounds of the two metals corresponding to these two points could not be detected. The compound, Bi_5Tl_3, is soft and tolerably difficult to polish. The freshly polished surface is light grey, but rapidly acquires a yellow colour. On exposure to the air, the compound oxidises and becomes covered with a white powder.—A. S.

English Patents.

Ores [Sulphides] containing copper, zinc, and lead; Method of treating complex ——. N. M. Ogle, London. Eng. Pat. 24,238, Nov. 23, 1905.

The granular ore is roasted at a dull red heat so as to convert as much as possible of the zinc sulphide into sulphate; to this end, a small quantity of sodium nitrate may be added to the ore. If from 25 to 30 per cent. of sulphur is present in the ore, no external heat is needed for this calcination; otherwise, sulphur must be added to the ore. In either case, the gases produced are utilised for the manufacture of sulphuric acid. The roasted ore is ground and systematically extracted with boiling water, which dissolves out zinc sulphate; the residue is then extracted with dilute sulphuric acid, which dissolves the zinc oxide formed, together with oxides of copper and iron, leaving lead sulphate, gold, silver, &c., with the gangue. This residue is smelted as usual. The impure zinc sulphate solution is freed from copper either electrolytically or by adding metallic zinc, and from iron by oxidising the solution by air or bleaching-powder and adding zinc oxide or carbonate, and is then evaporated to dryness, together with the pure zinc sulphate solution first obtained. The resulting zinc sulphate is mixed with 4 per cent. of charcoal and heated to redness in a retort, when zinc oxide is formed according to the equation: $2ZnSO_4+C=CO_2+2SO_2+2ZnO$. The sulphur dioxide produced is utilised for making sulphuric acid. The percentage of carbon used must not be too great, otherwise the following reaction takes place: $ZnSO_4+4C=4CO+ZnS$. The zinc oxide obtained is purified from zinc sulphate by extraction with hot water, dried, made into briquettes with coal or pitch, and smelted for zinc.—A. G. L.

Steel; Process of hardening carbon ——. S. N. Brayshaw, Manchester. Eng. Pat. 25,004, Dec. 2, 1905.

Ordinary carbon steel with a hardening-point of about 740° C. is heated for a short time to a temperature considerably above this (860° to 900° C.) so as to reach a certain "higher-change-point." Without allowing it to cool, the steel is transferred to a bath at a temperature somewhat below the hardening-point (705° to 730° C.), kept at this temperature for some time, and quenched in an ordinary cold bath. The heated baths are preferably composed of fused salts, but molten lead or alloy may be used.—A. G. L.

Iron; Manufacture of decarburised cast ——. Soc. Electrométallurgique Française, Froges, France. Eng. Pat. 13,189, June 7, 1906. Under Int. Conv., Aug. 5, 1905.

See Fr. Pat. 356,714 of 1905; this J., 1906, 29.—T. F. B.

Drying and cooling air; Apparatus for ——, especially suitable for treating air for use in blast furnaces, and in other places where large volumes are required. Sir A. S. Haslam. Eng. Pat. 1665, Jan. 22, 1906. I., page 11.

French Patents.

Ores of lead, zinc, arsenic, and bismuth containing precious metals; Process for the treatment of ——. Soc. Savigny Père et Fils. Fr. Pat. 361,833, Oct. 11, 1905.

The ore is heated in a cupola furnace or "water-jacket" with a hot or cold blast of such force that the lead, zinc, arsenic, &c., are practically completely volatilised, whilst the residual slag containing the gold and most of the silver is almost free from those metals. The lead, zinc, &c.,

are recovered in the form of oxides by condensation, and the precious metals are separated from the slag by the usual methods.—A. S.

Copper; Metallurgical and electro-metallurgical process for obtaining pure ——. L. Jumau. First Addition, dated July 11, 1906, to Fr. Pat. 364,430, March 20, 1906 (this J., 1906, 892)

The roasted ore is lixiviated with a solution of ammonium sulphate, and after removal of the free ammonia, the solution is treated with sulphur dioxide, thus producing a precipitate of cuprous and cupric sulphites. These sulphites are treated either with sulphuric acid or ammonium bisulphate, which cause the separation of a portion of the copper in the metallic condition. Another modification consists in heating the mixed sulphites in an autoclave in presence of water to a temperature between 140° and 170° C., when the following reaction is said to occur: $CuSO_3.Cu_2SO_3 + 2H_2O = 3Cu + 2H_2SO_4$.—R. S. H.

Tin-plate scrap; Process for the chlorination of —— in a closed vessel. T. Goldschmidt. Fr. Pat. 368,618, Aug. 3, 1906.

The patent relates to the process of de-tinning tin-plate scrap by treatment with gaseous chlorine under pressure in a closed vessel. In order to avoid attack of the iron by the chlorine, a vigorous movement of the chlorine is produced in the interior of the apparatus in order to render the temperature uniform in all parts of the chamber, and to prevent the temperature rising too high. An anhydrous liquid, *e.g.*, stannic chloride, may advantageously be introduced into the apparatus, in order to accelerate the cooling. The vigorous movement of the chlorine is effected either by dividing the chamber into two compartments, and circulating the gas, by means of fans, from one to the other, or by providing a circulating pipe, outside the chamber, leading from the top to the bottom.—A. S.

Blast-furnace gases; Cooling apparatus for ——. Soc. Anon des Hauts Fourneaux et Forges de Dudelange. Fr. Pat. 368,731, Aug. 9, 1906.

The apparatus consists of a horizontal cylindrical casing, fitted centrally with a horizontal rotary shaft, which carries a series of transverse, sieve-like discs. In the usual form of such scrubbers, the casing is half-filled with water, so that the dust and dirt, collected from the gas by the exposed upper portion of each disc, is removed from the latter as it plunges into the water; after some time, however, a dirty scum collects on the water, neither subsiding nor flowing away, but fouling the discs as they emerge from the water. According to the present invention, the water level in the casing is kept so low that no part of the discs is submerged; no partitions for regulating the flow of water are provided between the discs; and the latter are kept irrigated by water supplied under pressure on to their surfaces from sprinkling pipes directed radially inwards to near the rotary shaft. The discs are thus always flushed with clean water, and the available cross-sectional area of the apparatus is twice that provided by the customary arrangement.—H. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Lead; On the electro-chemistry of ——. A. C. Cumming. Trans. Faraday Soc., Nov. 13, 1906. [Advance Proof.]

Although the existence of plumbic salts, in which lead functions as a tetrad, has been known for some time, no measurements have been made of the E.M.F. due to the tendency of plumbic ions to be transformed into plumbous ions. The knowledge of this E.M.F. and its dependence upon the relative concentration of the plumbous and plumbic ions in solutions is of great importance in the study of the lead accumulator, the electromotive force of which has been ascribed to the tendency of plumbic ions formed from lead peroxide and sulphuric acid to be transformed into plumbous ions with liberation of the extra electric charges.

The author has found that lead peroxide is measurably soluble in strong solutions of nitric acid. The measurement of the oxidation potential was carried out with platinised platinum electrodes, coated with lead peroxide, and suspended in a nitric acid solution saturated with lead peroxide and containing a known amount of plumbous nitrate; concordant results were obtained. Having analytically determined the solubility of lead peroxide in nitric acid solutions varying from 5·3 N to 11·5 N, and taking the total concentration of plumbous nitrate from the quantity of this added to the cell, the author calculates the value of P (the E.M.F. due to the tendency of plumbic ions to change to plumbous ions) with different concentrations of nitric acid and plumbous nitrate and obtains results which show a close agreement and average 1·826 volts. This seems to prove that in these nitric acid solutions, the ratio of the ionic concentrations of $Pb^{\cdot\cdot\cdot\cdot}$ and $Pb^{\cdot\cdot}$ closely agrees with the ratio of the total concentrations of plumbic and plumbous salts.

Measurements were also made of the plumbous ion concentrations in different solutions. An interesting result from these measurements is the support for the formula $NaPb(OH)_3$ for the compound formed when lead oxide (PbO) dissolves in caustic soda.—R. S. H.

Lead persulphate and lead peroxide; Solubility and oxidation potential of ——. F. Dolezalek and K. Finckh. Z. anorg. Chem., 1906, 51, 320—327.

The lead persulphate, $Pb(SO_4)_2$, was prepared according to the process of Elbs (this J., 1901, 132), and the pasty mass obtained was kept for a long time under sulphuric acid of sp. gr. 1·7, until it became crystalline. Excess of the crystalline salt was shaken with sulphuric acid of different concentrations until the clear solution showed no further increase in oxidising power as determined by titration with potassium iodide and thiosulphate, and from the data obtained, the solubility of the persulphate was calculated. The solubility curve shows a distinct maximum and minimum. The persulphate is not perceptibly soluble in acid containing less than 0·32 mol. of sulphuric acid per mol. of water, but is hydrolysed with separation of lead peroxide. With acid containing from 0·32 to 0·59 mol. of sulphuric acid per mol. of water, the yellowish persulphate becomes white owing to the formation of a basic persulphate, $PbOSO_4,H_2O$, the solubility of which increases with the concentration of the acid. The conversion of the basic into the normal persulphate occurs at 22° C. with acid containing 0·59 mol. of sulphuric acid per mol. of water, and afterwards as the concentration of the acid is increased, the solubility of the normal persulphate falls to a minimum (with an acid containing about 1 mol. of sulphuric acid per mol. of water) and then again rises, owing to the formation of complex compounds.

With respect to the solubility of lead peroxide, the crystalline product obtained by the electrolysis or chemical oxidation of lead salts is much less soluble and chemically active than the freshly-prepared amorphous peroxide obtained by the hydrolysis of lead per-salts. In sulphuric acid containing 1720 grms. of acid per litre the solubility of the amorphous peroxide amounts to 99·5 mgrm.-mols. per litre at 22° C., which agrees well with that of lead persulphate, showing that the peroxide is slowly converted into the persulphate. With acid containing 1097 grms. of sulphuric acid per litre, also, the solubility of the peroxide corresponds to that of the persulphate. In three other experiments, however, too small values were obtained owing to conversion of the amorphous peroxide into the less soluble crystalline modification. In acid containing less than 950 grms. of sulphuric acid per litre, the peroxide is not perceptibly soluble. Lead persulphate is one of the most powerful oxidising agents, and possesses the advantage that it yields as reaction-product, an almost insoluble salt (lead sulphate). Measurements of the oxidation potential of the salt in sulphuric acid solutions of different concentration gave the following results :—

v = Strength of acid in mols. H_2SO_4 per mol. H_2O ..	0·5	0·6	0·7	0·8	1·2
E.M.F. at 11·5° C.	1·87	1·90	1·89	1·88	1·85

The oxidation potential attains a maximum of 1·90 volts with acid of the same strength as that in which the salt is most soluble, namely, at 11·5° C., acid containing 0·57 mol. of sulphuric acid per mol. of water. For a temperature of $t°$ C. the strongest oxidising action will be obtained with a solution of lead persulphate in acid of strength calculated from the equation: $v_0=(0\cdot55+0\cdot0019t)$ mols. $\frac{H_2SO_4}{H_2O}$. It follows from this, also, that to protect lead persulphate from decomposition, it is best to keep it under sulphuric acid of the highest concentration.—A. S.

Chromium oxide; Reduction of —— by boron. B. du Jassoneix. Compt. rend., 1906, **143**, 897—899.

When chromium oxide is heated with boron in magnesia crucibles in the electric furnace, products are obtained containing from 5 to 17 per cent. of boron. Fusions with more boron than this contain the excess as boron carbide. The limiting percentage corresponds with the formula CrB. The fusion products are all attacked by hydrofluoric, hydrochloric, and sulphuric acids.—J. T. D.

English Patents.

Ozone from oxygen or atmospheric air; Apparatus for the production of ——, and its application for ventilation, &c. J. R. Craig, Glasgow. Eng. Pat. 16,681, Aug. 17, 1905.

This invention relates to apparatus for the production of ozone from oxygen or atmospheric air by the silent discharge of high tension currents, and further to increase the efficiency of systems of ventilation by the ozone so obtained. The inventor claims a greater proportion of ozone for energy expended than that hitherto obtainable, and this he obtains mainly by imparting a vibratory motion to the electrodes, thereby bringing them into contact with a number of planes of air, which is equivalent to increasing the active surface of the plates. The apparatus, which is made entirely of metal, comprises a cylindrical casing in which are placed a number of pairs of electrodes, circular in shape and preferably connected in parallel. One form of electrode consists of a sheet of roughened glass, as a di-electric, having on each side a sheet of metal gauze held on the face of the glass by screw clips; provision is made for keeping the surface of the gauze at a uniform distance from the surface of the glass; by this means reduction of efficiency, due to a "streaky" discharge, is prevented. Each sheet of gauze is fastened to the screw clip by small springs and so caused to vibrate evenly in front of the glass plate with the periods of the alternating current. Furthermore, each pair of electrodes, as a whole, is caused to vibrate in the direction of the length of the cylinder by some suitable contrivance. Between each pair is fixed a baffle-plate having a central orifice, so that the air, drawn through the apparatus by a fan, after passing over the face of the first electrode, concentrates, passes through the orifice, and spreads over the surface of the succeeding plate.—C. A. W.

Furnaces; Electric —— [for calcium carbide]. C. Bingham, London. Eng. Pat. 4336, Feb. 22, 1906.

The invention relates to "tapping" or "continuous" carbide furnaces, and consists in the provision, outside the furnace, in the vicinity of the tapping hole, of an additional electrode from which a current may pass through the mass of solidified carbide in the tapping hole to the interior of the furnace. The solid mass is thereby liquefied, and the molten carbide can flow freely out of the furnace. The additional electrode may be within the tapping hole itself, or just outside.—C. A. W.

Arcs for the electrical treatment of gases; Production of ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 18,599, Aug. 20, 1906.

See Fr. Pat. 368,717 of 1906; following these.—T. F. B.

Elastic material or plastic compound suitable for electrical and mechanical purposes, varnishes, or the like. H. E. Kershaw. Eng. Pat. 24,622, Nov. 28, 1905. XIIIC., page 25.

French Patents.

Furnaces; Electric ——. F. Morani. Fr. Pat. 368,409, April 17, 1906. Under Int. Conv., Feb. 1, 1906.

For the purpose of reducing the loss of energy and overcoming the difficulties of making connections for the current with long electrodes suspended vertically, it is proposed to construct the furnaces with suspended conductors which are not themselves connected to the source of current. The electric current is led to the furnace to fixed electrodes, an arc being struck between one or more of these electrodes and one or more movable conductors of minimum length, the latter not necessarily connected to the source of current. The resistance of the furnace is regulated by changing the relative position of the furnace and the movable conductors. Various arrangements are described for grouping a number of furnaces in parallel or series, and for two-phase and three-phase currents.—R. S. H.

Chemical reactions in gases at the temperature of the electric arc; Production of ——. A. A. Naville, C. E. Guye, and P. A. Guye. Fr. Pat. 361,827, Oct. 7, 1905.

A direct current electric arc is caused to take a rapid rotating motion by being subjected to an alternating magnetic field. A furnace is described for carrying out this process in which one electrode is tubular and serves to conduct the gases to the furnace chamber, whilst the other is in the form of a disc with a down-turned rim, or in the form of a cone.—R. S. H.

Electric arcs; Production of stable ——, of great size. Badische Anilin und Soda Fabrik. Third Addition, dated July 4, 1906 (Under Int. Conv., June 8, 1906). to Fr. Pat. 357,358, Aug. 30, 1905.

In place of a single tube with a central insulated electrode, the present addition provides for the use of two tubes each with its axial electrode, both tubes leading into the same common chamber. (See also this J., 1906, 79, 1053.)
—R. S. H.

Gases; Treatment of —— in the electric arc by the passage of a conducting solid body between fixed electrodes. Salpetersäure Ind. Ges. G. m. b. H. Fr. Pat. 368,715, Aug. 8, 1906. Under Int. Conv., Aug. 18, 1905.

Solid conductors, for example rods supported in the periphery of a rotating disc, are caused to pass at regular intervals between fixed electrodes. In order to prevent the continuation of the discharge between the fixed electrodes and the moving conductor, a jet of the gas to be treated is injected between the electrodes with sufficient force to break the arc.—R. S. H.

High tension flame arcs; Production of ——, for the treatment of air or gases. Salpetersäure Ind. Ges. G.m.b.H. Fr. Pat. 368,717, Aug. 8, 1906.

For obtaining long arc flames for the treatment of gases, particularly with horn-shaped electrodes, two or more opposing tuyères are arranged which inject the gas between the electrodes and form in the plane of the electrodes a sheath which carries the lengthening of the arc to its maximum. An auxiliary device such as an electromagnet is employed for changing the nature of the discharge and causing the formation of an arc flame rather than an ordinary luminous arc.—R. S. H.

Ammonia, ammonium sulphate, and other ammoniacal salts; Synthetic process of manufacturing —— as well as the nitrates of sodium, potassium, and other metals. A. Goriainoff. Fr. Pat. 368,585, Aug. 2, 1906.

The process is based on the use of electrolytic hydrogen and oxygen. The hydrogen is supplied to a burner disposed in a water-jacketed closed vessel, with just sufficient air to give complete combustion. The flame plays within a channel lined with refractory material and provided with baffles of the same, which become highly heated. The gases issuing from the combustion chamber consist essentially of nitrogen and water vapour. The latter is condensed by suitable apparatus, and the nitrogen, purified, if necessary, from any traces of oxygen present (by, for instance, ammoniacal copper solution), is stored in a gasometer for use in two parallel operations; one, the production of ammonia by the combination of hydrogen and nitrogen, and the other, of nitrogen oxides (ultimately of nitric acid) by the direct combination of the nitrogen with the oxygen obtained previously by electrolysis of water, both under the influence of electric sparks acting on the previously heated gases. Apparatus for carrying out these processes is shown, including devices for effecting the rapid cooling of the heated gases in which nitrogen oxides have been formed, to avoid reverse action. Means for absorbing the ammoniacal or nitric acid vapours thus synthetically produced, by suitable liquids to form any desired ammonium salts, or nitrates, as the case may be, are described.—E. S.

Nitric acid; Electrolytic process for the concentration of ——. Salpetersäure Ind. Ges. G.m.b.H. Fr. Pat. 368,716, Aug. 8, 1906.

Dilute solutions of nitric acid are electrolysed in order to cause a concentration of the acid in the anode chamber of the cell. Since at the cathode, oxides of nitrogen are set free, it is proposed in the present invention to lead them back, preferably after refrigeration, to condense the peroxide of nitrogen, to the anode chamber. In contact with the nascent oxygen at the anode these oxides are transformed into nitric acid.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

English Patents.

Ores; Furnace plant for reduction of —— by electric transformer-furnaces. O. Frick, Saltsjöbaden, Sweden. Eng. Pat. 10,097, April 30, 1906.

This invention relates to a method of treating ores and metals by means of transformer-furnaces. The melting proper of the principal part of the charge is accomplished in a transformer-furnace for a comparatively small charge, the furnace having a small melting space, and the primary winding and iron core are dimensioned for a great consumption of energy. The treatment of the material is completed in a transformer-furnace having a comparatively large melting space, the primary winding and iron core being dimensioned for a small consumption of energy.—B. N.

Metals; Precipitating —— electrolytically. A. Ramén, Helsingborg, Sweden. Eng. Pat. 18,080, Aug. 11, 1906.

The solution, from which the metals are to be obtained electrolytically, is divided into two parts, and from one portion the copper or other metal is precipitated by means of iron. The waste lye thus obtained consists essentially of a solution of a ferrous salt, and this is introduced into the anode chamber as a "depolarising medium," the second portion of the solution being introduced into the cathode chamber and electrolysed. Instead of using the liquid to be electrolysed for precipitation of the metals with iron, any waste lye with an analogous composition may be used. The "depolarising medium" may be concentrated to a suitable degree and may be of any desired composition; a constant reduction in the difference of potentials is thus effected, and consequently a reduction in the consumption of energy.—B. N.

French Patents.

Copper. Electro-metallurgical process for the extraction of —— from its minerals. L. Jumau. First Addition, dated July 11, 1906, to Fr. Pat. 359,913, Nov. 29, 1905 (this J., 1906, 185).

An ammoniacal solution of cuprous sulphite or cuprous and cupric sulphites is electrolysed, and in order to prevent local action, due to the solubility of copper in an ammoniacal solution of cupric hydroxide, carbon dioxide is passed through the electrolyte during the deposition. The carbon dioxide serves also to agitate the solutions. —R. S. H.

Electrode for electric furnaces. Röchling'sche Eisen- und Stahlwerke G.m.b.H. and W. Rodenhauser. Fr. Pat. 368,480, July 28, 1906.

The electrode or other object for transmitting an electric current to the furnace is constituted of substances which conduct at high temperatures, as for example the alkaline-earths or rare earths; these compounds being bound together by some carbonaceous agent. The advantages claimed for these electrodes are that they can be shaped with great ease, they are highly refractory, and, moreover, on account of the presence of carbon, even the cooler portions of the electrode satisfactorily conduct the current. In contact with the charge in the furnace the lower surface of the electrode becomes decarburised, but on account of the high temperature continues to conduct the current.—R. S. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Saponification; Theory of ——. J. Lewkowitsch. Ber., 1906, 39, 4095—4097.

In reply to Marcusson (this J., 1906, 1106), the author points out that Marcusson has confused partial saponification with saponification by stages. In the first seven experiments described, his method was liable to cause further decomposition of the intermediate mono- and diglycerides. Yet in one experiment Marcusson actually obtained higher acetyl values, which he attributed to alterations of the fatty acids, though without offering any proof of such alterations. In the author's opinion these higher values are striking proofs in support of his theory of saponification by stages. Again, in the experiments on enzymatic hydrolysis, Marcusson obtained higher acetyl values notwithstanding the fact that the samples were taken in such a way that the unstable intermediate lower glycerides might easily be overlooked. As regards rancid fats Marcusson will not admit the occurrence of dierucin, and quotes Muspratt (Chem. Technol. I., 41) to the effect that dierucin can only be regarded as a decomposition product formed by the action of sulphuric acid on trierucin. To this the author replies that he could desire no stronger support for his view that glycerides are hydrolysed by stages.

Two of Marcusson's rancid fats gave acetyl values of 8·1 and 6·0 respectively, and these were attributed to errors in the method of determination; but the author points out that the errors in working should be by no means so high. In conclusion, he contends that so long as no evidence is given that the appearance and disappearance of the acetyl values are not due to lower glycerides, Marcusson's suggestion of alterations in the fatty acids through formation of anhydrides, &c., during saponification must be regarded as absolutely non-proven. (See also this J., 1898, 1107; 1899, 1031; 1904, 905; 1906, 856.)—C. A. M.

Chrysalis oil. J. Lewkowitsch. Z. Unters. Nahr. u. Genussm., 1906, 12, 659—660.

A sample of oil obtained from chrysalides of the silk-worm was of a dark brown colour and possessed smell slightly resembling that of fish oil. The oil was clarified to a considerable extent by filtration through fullers' earth; after standing, a quantity of flocculent, amorphous matter was deposited. The following chemical and physical values were obtained on the examination of the oil:—Sp. gr. at 40°/40° C., 0·9105; saponification value, 190·0; iodine value, 116·3; unsaponifiable matter, 2·61 per cent.; acid value, 27·51; mean molecular weight of the fatty acids, 281·7; solidifying point of the fatty acids, 34·5° C. A specimen of the oil, extracted by means of ether from the chrysalides, had a higher acid value than the above, namely, 62·8, this being due to the decomposed condition of the chrysalides. The yield of oil was about 27 per cent. and, as considerable quantities are available, the author sees no reason why it should not be manufactured into a low quality soap.—W. P. S.

French Patents.

Fatty acids; Manufacture of oxygenated ——. G. Imbert Fr. Pat. 368,543, July 31, 1906.

The addition compounds of hypochlorous acid or chlorine with the fatty acids of animal or vegetable oils are heated under pressure with a caustic alkali, alkali carbonate, or alkaline-earth. For instance, 1 kilo. of dichloro-stearic acid is heated with 350 grms. of caustic soda and 5 litres of water for three hours at 120° C., or 1 kilo. of oleic acid is dissolved in 5 litres of water with 500 grms. of caustic soda, and chlorine is added in quantity equivalent to the iodine value of the fatty acid; the product is then heated at 150° C. for six hours.—J. F. B.

Fats; Extraction of —— *from waste washings and in particular from wool-washings.* M. Roullet. Fr. Pat. 368,654, Aug. 6, 1906.

The waste liquors are treated in an apparatus acting continuously with a substance that will produce an emulsion by chemical or physical action. Suitable substances mentioned are petroleum spirit, carbon tetrachloride, ether, hydrochloric acid, &c., and bases such as soda, magnesia, and lime. Centrifugal force or distillation can be used subsequently in the separation of these agents.—C. A. M.

Fats; Method of extracting ——. H. Breda. Fr. Pat. 368,697, Aug. 7, 1906.

In separating fats from soaps, salts, oxides, or other inorganic substances, acetone can be advantageously replaced by its homologues boiling between 67° and 170° C., a temperature being chosen at which the soaps do not dissolve with the fat, or if they dissolve separate out as the solution cools. Claim is also made for the addition of ketones of a lower boiling point, with the object of preventing gelatinisation on cooling the solution. Or a mixture of ketones with hydrocarbons boiling at 85° C. may be used as the solvent, the addition of the hydrocarbons increasing the solvent power of the mixture.
—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Paints and colours containing lead; Regulations for the manufacture of ——. Home Office Circular, Dec. 27, 1906. [T.R.]

An amended draft of the regulations relating to the above manufactures has been issued by the Home Office, to replace the draft published on July 9 last (see this J., 1906, 702), embodying certain slight alterations and modifications.

English Patent.

Lead, basic sulphate of; Process of producing ——. E. Toelle, "Mulheim," Germany. Eng. Pat. 19,718, Sept. 4, 1906.

Basic lead sulphate, $2PbSO_4, Pb(OH)_2$, is produced by adding the calculated quantity of sulphuric acid to lead oxide with continuous stirring.—A. G. L.

French Patent.

Zinc soaps [Paint]; Industrial manufacture of ——. N. Lecesne. Fr. Pat. 368,755, Aug. 9, 1906.

A suitable quantity (from 0·25 per cent.) of oleic acid or other fatty acids is mixed and thoroughly incorporated with zinc oxide and a little water, the fatty acids being used either pure or diluted with boiled oil. The resulting zinc soap can be mixed into an emulsion with raw or boiled oil, and the emulsified oil will then form a thick paste with zinc oxide or other pigment, and the constituents will not separate even on prolonging standing. It is claimed that in this way the covering power and qualities of resistance looked for in lead pigments are imparted to zinc oxide.—C. A. M.

(*B.*)—RESINS, VARNISHES.

English Patents.

Turpentine and other products from wood; Method of and apparatus for extracting ——. P. M. Justice, London. From M. McKenzie, Plainfield, U.S.A. Eng. Pat. 15,338, July 5, 1906.

See Fr. Pat. 367,926 of 1906; this J., 1906, 1226.—T. F. B.

Elastic material or plastic compound suitable for electrical and mechanical purposes, varnishes, or the like. H. E. Kershaw. Eng. Pat. 24,622, Nov. 28, 1905. XIII*C*., see below.

(*C.*)—INDIA-RUBBER, &c.

Assam rubber and its commercial prospects. H. H. Mann. Agricult. J. of India, 1906, I., 390—398.

The only rubber-bearing tree lending itself to cultivation in North-East India is *Ficus elastica*, which is in every way inferior to *Hevea* and *Castilloa*, but has been successful in Java and the Malay States. The author, after discussing the results of private and Government experimental plantations, arrives at the conclusion that the culture of *Ficus* in Assam is not likely to be a profitable speculation in itself, but may advantageously be resorted to as a by-culture in connection with tea-planting. For details as to the knowledge so far available with regard to *Ficus*, the original should be consulted.—W. A. C.

India-rubber; Effect of powdered glass on the vulcanisation and oxidation of ——. R. Ditmar and O. Dinglinger. Gummi-Zeit., 1906, 21, 234—235.

Peruvian rubber was mixed with 4 per cent. of sulphur and rising percentages of finely powdered and sifted glass, and vulcanised for two hours under a pressure of six atmospheres. The products were subjected to the usual mechanical and oxidising tests. It was found that the breaking strain increases uniformly, up to 20 per cent. of added glass, whilst the elongation is not definitely affected in either sense. The tendency to oxidation diminishes with increased admixtures. The more highly loaded, and therefore porous, specimens have the combined oxygen relatively more evenly distributed throughout the mass.—W. A. C.

English Patents.

Elastic material or plastic compound suitable for electrical and mechanical purposes, varnishes, or the like. H. E. Kershaw, Kenley, Surrey. Eng. Pat. 24,622, Nov. 28, 1905.

The gum of the *sapota mullerii* tree is digested with carbon bisulphide, or similar solvent, together with an alkaline phosphate and some thickening agent, such as tar and, if desired, shellac, resin, or gum. After evaporation of the solvent an elastic material is obtained, suitable for electrical and other varnishes, or it may be amalgamated with pyroxylin to produce a preparation similar to celluloid but less liable to crease. It is also capable of vulcanisation by any well-known method.—S. R. T.

Elastic substance similar to india-rubber and its method of manufacture. L. Roland, Paris. Eng. Pat. 10,704, May 7, 1906.

See Fr. Pat. 364,075 of 1906; this J., 1906, 875.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Liming; Mode of action of —— *[in leather manufacture].* E. Stiasny. Gerber., 1906, 32, 200—202, 214—216, 228—231, 242—243, 258—260, 272—274, 288—290.

The object of liming is to loosen hair and at same time to swell the hide. Simple liming is conducted with milk of lime, but alkalis, sodium and arsenic sulphides, &c., are frequently added to intensify or modify the action. The "swelling" of the hide is characterised by absorption of water and increase of weight, but at the same time an action takes place which may be described as "plumping" by which the soft and flaccid hide becomes firm and elastic. This plumping is also produced by acids, and is not a necessary accompaniment of swelling, but, as will be seen, an independent effect of certain liming materials. Besides these visible changes, the absorption and change of the liming substances, and the solution and change of hide-substance must be considered. Bacterial action also plays some part when old limes are employed, but cannot be here considered, since chemical changes alone are sufficient to produce the required effects. Since lime only exists in very dilute solution, and hence almost completely ionised, whilst undissolved lime can have no direct action, it would appear that either hydroxyl or calcium ions must be the active agents; and as a similar effect is not produced by calcium salts, while it is common to other caustic alkaline solutions, it is obvious that hydroxyl ions play an important part. Experiments however (on carefully salted and well washed calf-skin), led to the following results:—Solutions of various bases of *N*/20 strength (approximately that of lime-water) produced very unequal effects in swelling, plumping, and loosening the hair. In six days, sodium hydrate produced the greatest swelling and plumping effect, whilst no loosening of hair occurred; ammonia gave less increase of weight, and the skin remained quite soft, but hair was fully loosened; baryta and lime were intermediate in effect. *N*/10 solutions gave analogous results. Sodium and ammonium hydroxides vary much in dissociation, and consequently in concentration of free hydroxyl ions, but solutions equivalent in this respect still behaved differently. Further experiments with sodium hydrate of *N*/1 and lower concentrations showed that the plumping and swelling effects increased with concentration, though not in direct ratio; and that the loosening of hair only occurred in the higher concentration, *N*/1 solution actually attacking the hair itself. In all cases the increase of weight by absorption of water rapidly increased during the first 24 hours, and then considerably diminished during the continuance of the experiments, which, in the case of the weaker dilutions, reached 10 days. The plumping or stiffening effect was considerable even in the *N*/20 solution. It might be suggested that the retention of the hair was due to the compression of the hair-pores due to swelling, but this is negatived by the fact that even after the plumping was considerably reduced by washing in tepid water, the hair remained perfectly tight. A similar series of experiments was carried out with ammonia with markedly different results. Swelling increased with concentration, reaching in the *N*/1 solution nearly the same degree as with sodium hydrate, but even in the weaker solutions, loosening of the hair occurred on the first day, and all the pieces remained quite soft and unplumped, showing the independence of swelling and plumping. The dependence of swelling on the concentration of the hydroxyl ions was again very marked, and this point was further confirmed by an experiment in which the ionic dissociation of ammonia was repressed by addition of ammonium chloride, with a corresponding diminution of swelling and also some lessened loosening of the hair. So far, the observations have been confined to physical changes in the hide, but the chemical changes in the liming liquors must now be considered. For this purpose, dilution of the solutions by the water of the wet hide was taken into account, the water determinations being made either by actual drying of a portion of the sample, or by immersing for 24 hours in 100 c.c. of strong alcohol, of which the gravity was determined before and after the experiment by Mohr's balance, and the water calculated by ordinary tables. The methods showed good agreement. It is shown that the amount of alkali absorbed by hide increases largely with the concentration of the solution, and that lime and baryta are absorbed much more largely than sodium hydrate, as measured in c.c. of *N*/10 HCl, whilst ammonia shows a still less absorption than sodium hydrate. The titrations thus show that hydroxyl ions are largely removed by the hide either by absorption of the dissolved base, or by neutralisation of the latter by dissolved hide substance. Both these actions appear to take place; the total base in the solution diminishes, and a portion of it becomes neutral to phenolphthalein, though not to methyl orange, by combination with weak organic acids. The dissolved hide substance increases with the concentration of the alkaline solution, and is much greater with potassium and sodium hydrates and ammonia, than with calcium or barium hydrates. With shredded gelatin, the solution of organic matter is least with ammonia. The action of milk of lime is frequently "sharpened" or increased by additions which either increase the concentration of the OH ions or introduce SH ions. Among the former are not only the alkalis, but alkaline salts of acids which form difficultly soluble and consequently little ionised compounds with lime. In simple lime-milk, the saturated solution is in equilibrium with the undissolved lime on the one hand and with the Ca and OH ions on the other. If sodium sulphate be added, calcium sulphate is formed and thus calcium ions are withdrawn from solution and replaced by the more soluble sodium ions, and this proceeds till the concentration of calcium ions of hydrate and sulphate is such that no more lime can go into solution, but as the OH ions are equivalent to the combined valency of the calcium and sodium ions existing as hydrates, the total concentration of OH ions is greatly increased. With the still less soluble carbonates, oxalates, and phosphates, a still greater concentration is attained before equilibrium is reached. A similar result is produced by the addition of ammonium salts, the less ionised ammonium hydrate being formed which forms a reservoir of potential hydroxyl ions, whilst the actual concentration of OH ions is increased by the continued solution of lime. The effect is thus similar to the direct addition of the alkalis except that the equilibrium concentration is limited; and in most cases the effect on the hide is what would be expected from a combination of those of the different alkalis already described, ammonia forming, however, a remarkable exception, producing, as was to be expected, less plumpness in proportion to the swelling, but scarcely increasing the unhairing effect which is so marked in ammonia alone. This is attributed to the tendency of ammonia to produce complex calcium-ammonium compounds such as the well-known $Ca(NH_3)_8.Cl_2$. Similar effects occur in presence of zinc and barium salts, but not with sodium or potassium hydrate, and the observation is of practical importance in judging of the effect of the ammonia present in limes from their action on the hide substance. In recent times, the use of agents, which produce SH ions, such as alkaline sulphydrates, and, indirectly, arsenic sulphides, has become of great importance. The author shows that SH ions alone as in calcium, barium, or sodium sulphydrate solutions fully saturated with hydrogen sulphide, produce neither swelling nor unhairing effects. It is, therefore, necessary for advantageous action that hydroxides also be present, and it is shown that to produce the most satisfactory unhairing and swelling effect, equal parts of hydroxide and sulphydrate should be used, excess of the latter being very disadvantageous. It is pointed out that this condition results from the use of sodium sulphide alone, which hydrolyses into sodium sulphydrate and sodium hydrate. With temporary hard waters, this equilibrium is upset by the conversion of hydrate into carbonate, and to get good results, it is necessary to restore this equilibrium by the addition of lime or sodium hydrate. Red arsenic sulphide is employed as a "sharpening" agent for limes for glove kid and some other fine leathers, although the yellow sulphide will also produce an unhairing mixture. It is usually added to considerable excess of hot slaking lime. It has been shown by von Schroeder and Schmidtz-Dumont (Ding. Polyt. J., 1896) that nearly all the sulphur under these conditions, forms calcium sulphydrate, most of the arsenic remaining undissolved (in part as metallic As), though traces of soluble calcium sulpharsenite or oxysulpharsenite are formed, which are shown to have no unhairing effect, and a portion of hydrogen sulphide is evolved. The hydroxyl concentration in presence of excess of lime, is that of an ordinary lime-liquor. If arsenic sulphide is mixed with an insufficient proportion of lime, considerable quantities of calcium sulpharsenite are formed. Some observations on old and used limes showed that the ammonia and amines present had no appreciable effect on the unhairing, and that the specific effects of such liquors are almost entirely due to bacterial action, and are prevented by the addition of agents such as chloroform which suspend or destroy bacterial activity.—H. Br.

Leather; Determination of the specific gravity of ——. R. A. Earp. Collegium, 1906, 422—424.

The "apparent" specific gravity of the sample is determined by weighing the mercury displaced (M) by a weighed piece of the leather (W) pushed into a full stoppered bottle of the liquid. The bottle used has a wide curved rim, and is filled with mercury. The stopper is carefully inserted, after which it is removed and the leather put in end ways, the stopper being again pushed down, and the mercury which collects on the rim poured off and weighed. Then sp. gr. $= W.\frac{M.}{13{\cdot}56}$ To determine the "real" specific gravity of leathers, samples must be dried at 100° C. until constant in weight. Weighed portions (2 to 3 grms.) are immersed in a bottle of paraffin oil of known specific gravity. After soaking for a night to expel air, the samples are taken out, wiped, and again weighed, and their volumes determined by the mercury method. From the original weight, the final weight, and the volume, specific gravities can be calculated. Let W=original weight, w=increase in weight (*i.e.*, difference between first and second weighings); S=specific gravity of leather, s=specific gravity of oil; V=volume of leather as determined, and v_1 and v_2=volumes of leather substance and oil absorbed respectively, then: (1) $v_1+v_2=V$; (2) $Sv_1=W$; (3) $sv_2=w$. Substituting for v_1 and v_2 in (1), we have $\frac{W}{S}+\frac{w}{s}=V$. Whence $S=\frac{Ws}{Vs-w}$.—S. R. T.

English Patent.

Leather; Treatment of waste ——. A. G. Inrig, London. Eng. Pat. 25,467, Dec. 7, 1905.

Waste leather is heated with an alkaline solution, consisting of milk of lime containing caustic soda and acetic acid, till a pulp is produced, when the mass is removed to a bath of dilute sulphuric acid. The acid mixture is heated, and the matter which rises to the surface is skimmed off and dried, and may be moulded under the influence of heat or rolled into sheets suitable for electrical purposes. It may also be mixed with sawdust, stannate of soda, and hide glue, after which the mass is ground, thoroughly mixed and used hot for coating surfaces, or moulded as desired. Sawdust may be replaced by such waste materials as rags, paper waste, or straw (which are introduced with the alkali), whilst the addition of bichromate of potash or rubber renders the preparation suitable for the production of fireproof floor covering or golf balls.—S. R. T.

French Patents.

Leather; Patent ——, and method of preparing same. The Patent Leather Co. of America. Fr. Pat. 368,383, July 26, 1906.

The leather is coated with a liquid containing pyroxylin dissolved in amyl acetate, and diluted with alcohol and a non-drying oil, the last-named in sufficient quantity to form a viscous mass. This treatment is followed by successive coatings with a liquid containing a soluble nitrocellulose and a smaller proportion of oil.—C. S.

Casein; Manufacture of plastic masses from ——. J. Kathe. Fr. Pat. 368,704, Aug. 8, 1906.

The casein is heated with water before being moulded and compressed, or it is treated with steam at the ordinary pressure or *in vacuo.*—C. A. M.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot; Colloidal water in ——. *Non-influence of fibre in the analysis of beetroot by hot or cold aqueous digestion.* H. and L. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 615—627.

Sucrose is not uniformly distributed throughout the beetroot; in some cells, the juice is rich, in others it is poor, in sucrose, whilst some cells contain only water and salts. To this sucrose-free water in beetroot, Scheibler gave the name of colloidal water. When the beetroot is grated, some of the cells are completely broken, and others are more or less damaged, the remainder being left intact. When the pulp is expressed, the broken cells yield their juice most readily; with increased pressure, the partially damaged cells yield their juice. Hence, an analysis of the juice will only give an accurate result if the cells, from which the juice has proceeded, are representative of the whole root. Increase of temperature, fine grinding of the pulp (*e.g.*, with the Sans Pareille press), and dilution of the latter, facilitate the complete diffusion of all the juices in the beetroot. The authors show that complete diffusion occurs when the finely ground pulp is digested with cold water or hot alcohol. Diffusion is also complete when coarser pulp is digested with hot water. In beetroot analysis by the hot or cold aqueous digestion methods, the volume occupied by the fibre is equal to its true volume (*i.e.*, as dry matter).—L. E.

Beetroot juice; Defecation of crude —— with phosphotungstic acid. Non-influence of the precipitate on the sugar content of the juice. H. and L. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 613—615.

Scheibler has stated that the precipitate formed on defecating beetroot juice with phosphotungstic acid, absorbs water from the juice, the sucrose content of the filtrate amounting to three times that of the original juice. The authors have determined the sucrose contents of the pulp and juice of old beetroots and of the juice of new beetroots, using phosphotungstic acid and basic lead acetate in parallel experiments. The results did not confirm Scheibler's observation; there was no practical difference between the solutions defecated with phosphotungstic acid and basic lead acetate respectively. Phosphotungstic acid is a bad defecating agent; the solutions filter slowly, and it is often difficult or impossible to take the polarisation reading of the filtrate, owing to the formation of a violet or black coloration.—L. E.

Viscosities; Comparative —— of sucrose and invert sugar solutions. H. Pellet and C. Fribourg. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 666—668. (See also this J., 1906, 1059.)

The authors have determined the viscosities of a series of solutions containing varying proportions of sucrose and invert sugar, the total amounts of both sugars in solution being 65 per cent. in each case. The results show that the viscosity diminishes as the proportion of invert sugar increases, and that the ratio of the viscosities of solutions containing sucrose and invert sugar respectively (65 per cent. solutions in each case), is about 2 : 1, this ratio not being affected by temperature. The lower viscosity of invert sugar solutions explains the greater fluidity of cane-sugar products as compared with beet-sugar products of the same dry substance content, and explains also the readiness with which the former crystallise.—L.E.

Sugars; Colour reaction for reducing ——. Chavassieu and Morel. Compt. rend., 1906, **143**, 966—967.

The reagent is prepared by dissolving 1 grm. of *m*-dinitrobenzene in 100 c.c. of alcohol, and adding 35 c.c. of 33 per cent. caustic soda; the mixture is rose-coloured (caused by the action of alcohol on dinitrothiophene present in the dinitrobenzene), but the tint is not deep enough to interfere with the colour reaction. By treating 20 c.c.

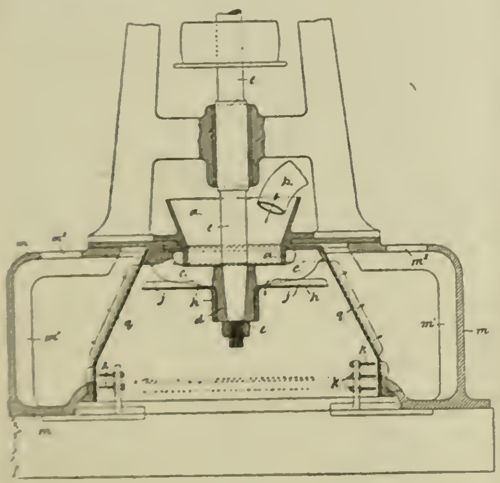
of a 1 per cent. solution of the substance under examination with 10 c.c. of the reagent, the following results are obtained:—With sucrose, no colour; with maltose, lactose, dextrose, galactose, and arabinose, a violet colour within 15 minutes; with lævulose, a violet colour within two to three minutes (lævulose may thus be distinguished in the presence of aldoses). Similar results are obtained when 0·1 per cent. solutions of the carbohydrates are used; the colours are, however, produced more slowly. Aldehydes and ketones containing no hydroxyl groups, give a red colour, uric acid, a violet colour with the reagent; hence substances under examination must be free from these compounds. Albumins, albumoses, acid amides, urea, and creatine give no colour, and do not interfere with the reaction. This reaction possesses the advantage of being very readily executed.—L. E.

Cane molasses; Reducing sugars in ——; their influence on the quality and quantity of the molasses obtained. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 669—672.

It has been suggested that, since sucrose is less soluble in invert sugar solution than in water, addition of invert sugar to molasses should facilitate crystallisation of the sucrose. The author shows that such is not the case; addition of invert sugar causes the retention of a larger quantity of water which more than counterbalances the lower solubility of the sucrose.—L. E.

English Patent.

Centrifugal machines [for massecuite, &c.]. W. Hulme and C. J. Crosfield, Liverpool. Eng. Pat. 24,175, Nov. 23, 1905.



The mixtures to be separated, massecuite, for example, is fed from the pipe, *b*, into the funnel, *a*, from which it falls on to the distributing plate, *h*, which as well as the conical cage, *q*, is carried and rotated by the shaft, *e*. The plate, *h*, has a slight upward inclination, and is provided with blades, *j*, which together with the arms, *c*, impart a centrifugal motion to the mixture, which is thrown, mixed with a large quantity of air, against the inner surface of the basket, *q*. The air and liquid pass through the perforated drum, and the dried sugar or other solid matter slides down the inner surface of the drum and is continuously removed by the scrapers, *k*. The whirling mass of air and liquid in the casing, *m*, is separated by the blades, m^1, the air escaping through the opening, m^2. Reference is made to Eng. Pat. 2597 of 1897; and any claim mentioned therein is exempted from claim in the present patent.—W. H. C.

XVII.—BREWING, WINES, SPIRITS, &c.

Yeast; Influence of the chemical constitution of the nitrogenous nutrient on the fermentative capacity of ——. H. Pringsheim. Ber., 1906, **39**, 4048—4055.

The author has observed that the fermentative functions of yeast are influenced by the nature of the nitrogenous nutrition which is presented to it, and that in many cases, although there is a distinct growth and reproduction of the yeast, the latter is incapable of fermenting sugar, *i.e.*, it apparently secretes no zymase. This condition depends on the chemical constitution of the nitrogenous nutrient, and the substances which are capable of contributing to the building up of protoplasm endowed with fermentative properties are mainly those which contain the grouping .NH.CH.CO in their molecule. This classification includes all the amino-acids, the degradation products of albumin. Guanine and uric acid, which contain the closely allied group .NH.C.CO, also serve for the nutrition of a fermentative yeast. Ammonium salts, of course, are an exception to this rule, and are active nutrients. On the other hand, a limited reproduction but no fermentation was observed in media containing, in addition to sugar and mineral salts, nitrogenous compounds not poisonous to yeast but not containing the critical group formulated above. Of such compounds, acetamide, aniline, benzamide, acetanilide, benzylamine, pyridine, and several others were tested. The author, therefore, proposes this biological property as a test for the presence of the group .NH.CH.CO in nitrogenous compounds of unknown constitution.—J. F. B.

Yeast; Production of fusel oil by ——. F. Ehrlich. Ber., 1906, **39**, 4072—4075.

The author comes to the same conclusion as Pringsheim (this J., 1906, 1167) that no fusel oil is produced in the fermentation of sugar by sterile "Acetondauerhefe," even if leucine be present. This was proved not only directly but indirectly, by the observation that the leucine was unchanged during the fermentation. The fermentation of *r*-leucine by living yeast, with the production of fusel oil, takes place preferentially at the expense of the *l*-leucine, and the residue consists chiefly of *d*-leucine, but in the case of "Acetondauerhefe" the *r*-leucine was recovered still optically inactive. From this it follows that the fermentation of leucine depends on a process quite distinct from the ordinary fermentation by zymase. If it is the result of enzyme action at all, the enzyme in question must be destroyed by the treatment employed for killing the yeast cells. The author believes that the production of fusel oil is closely connected with the process of albumin synthesis in the yeast cell.—J. F. B.

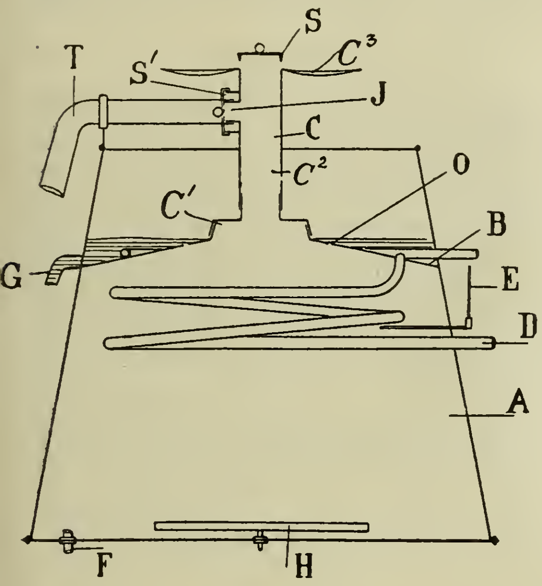
Borates; Coagulation phenomena caused by ——. [Agglutination of yeast]. II. H. van Laer. Bull Soc. Chim. Belg., 1906, **20**, 277—288. (See also this J., 1905, 555.)

When yeast is killed by heating, the critical quantity of borax required for coagulation is increased; as the amount of borax is increased beyond the critical quantity, the flocks become larger and settle more rapidly. During the preservation of dead yeast (protected from bacterial attack), anti-coagulating acids are formed which augment considerably the amount of borax requisite for coagulation; these inhibiting substances are found chiefly in the liquid surrounding the dead cells. Alkalinity of the medium favours the coagulating action of borax on dead yeast cells considerably, but only slightly in the case of living yeast, probably because living yeast reacts against an excess of alkali, with the production of acids. Dead yeast cells are not coagulated by boric acid; if, however, the liquid is rendered sufficiently alkaline with caustic soda, coagulation is effected by boric acid. With increasing alkalinity, this coagulation becomes complete, and is effected by very small quantities of boric acid; by increasing the amount of the latter beyond that required for complete coagulation, the yeast flocks become larger and the deposit firmer. On adding the first drop of boric acid solution to the alkaline dead yeast suspension, the yeast cells are distinctly affected, although visible flocculation has not occurred; the dead cells adhere for a longer or shorter time to the bottom of the flask when the latter is inverted. Hence the critical quantity only represents that quantity of boric acid which produces flocks large enough to be visible. Ammonia, like caustic soda, enables boric acid to agglutinate yeast, but its action is less powerful.—L. E.

Portland cement; Action of acid, alkaline, and fermenting liquors on ——. Rohland. IX., page 19.

English Patents.

Beer; Fermenting vats for use in the manufacture of ——. [*Froth condensation*]. J. Tonnaer and J. J. de Keersmaecker et Fils, Brussels. Eng. Pat. 37, Jan. 1, 1906.



The fermentation vessel, A, (see figure) is provided with a lid, B, at a suitable height. This lid has perforations, O, and a central opening at C^1, to which is fitted the froth condenser, C. The vessel is filled with wort up to the level, C^1, at the top of the lid, and the froth rises up the pipe, C^2, until it overflows into the perforated annular basin, C^3, where it is condensed and thoroughly oxygenated before it falls back into the tun. By placing the lid, S, upon the top of the pipe, C^2, barm can be drawn off through the branch, J, and pipe, T; at other times the lid, S, closes the branch, J, at the position, S^1. At the end of the fermentation the beer is drawn off at F, and the barm at G. D is an attemperator, E a thermometer, and H is an inlet for sterilised air.—J. F. B.

Beer; Process of manufacturing ——. J. F. Bergo and D. Kainscop, Lens, France. Eng. Pat. 12,838, June 1, 1906. Under Int. Conv., June 6, 1905.

See Fr. Pat. 355,612 of 1905; this J., 1905, 1248.—T. F. B.

Fermenting wort; Process and apparatus for ——. H. A. Schalk, New York City. Eng. Pat. 13,915, June 18, 1906.

See U.S. Pat. 831,748 of 1906; this J., 1906, 1062.—T.F.B.

French Patents.

Sugar juices; Process for the sulphitation and desulphitation of ——, *and its application to different fermentation industries.* E. A. Barbet. Fr. Pat. 361,869, Oct. 27, 1905.

See Eng. Pat. 13,217 of 1906; this J., 1906, 1229.—T. F. B.

Brewing from malt, raw grain, or their derivatives in the form of grits, meal, and husks. R. Kubessa. Addition, dated July 13, 1906, to Fr. Pat. 333,939, July 9, 1903. Under Int. Conv., July 15, 1905. (See Eng. Pat. 15,935 of 1903; this J., 1904, 32.)

The husks, either dry or as a plain or filtered mash, are added to the boiling or boiled grits wort, before adding the meal, in order to cool the grits wort down to the saccharification temperature and lessen the volume of brewing liquor required. The meal may be added in a dry state after the grits wort has been cooled as above. —C. S.

Alcohol; Process for denaturing and carburetting ——. A. J. Durupt. Fr. Pat. 368,713, Aug. 8, 1906.

About 2 per cent. of methyl alcohol and 36 per cent. of liquid hydrocarbon, such as coal-tar oil or petroleum, having a boiling-point near that of alcohol, are added to alcohol. The mixture is submitted to distillation, and is afterwards cooled to about 10° C. to remove highly volatile solid substances, so that the resulting spirit contains 20 per cent. of denaturing and carburetting constituents. The addition of 10 per cent. of this spirit to neutral alcohol denatures the latter. The denatured alcohol when mixed with 36 per cent. of volatile hydrocarbon furnishes a spirit for motors, and the solid portion separated during the cooling process may be used for heating purposes.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Phosphorus in foods; Distribution of ——. M. Balland. Compt. rend., 1906, **143**, 969—970. (See also this J., 1903, 313.)

The amount of phosphorus in a number of foodstuffs was determined directly (in the material itself, not in the ash) with the following results:—

Foodstuff.	Percentage of Phosphoric acid.
Wheat (of various origins except Australian, which is lower in P_2O_5)	0·65—0·11
Maize, millet, barley, buckwheat, rye, sorghum, crude rice	maximum about 0·80
Carrots, cabbages, turnips, onions	about 0·10
Asparagus ends, chicory, cauliflowers, lettuces, leeks	maximum 0·18
Potatoes, sweet potatoes	maximum 0·2
Truffles	maximum 0·50
Lupins, peas	0·61—1·00
Haricot beans, lentils	up to 1·35
Beans	up to 1·45
Cherries, strawberries, currants, oranges, pears, apples, grapes	generally below 0·10
Dried figs, dates, bananas	up to 0·30
Almonds, dried nuts	up to 0·90
Beef, veal, mutton, fowl's flesh	seldom above 0·45
Flesh of Fish	0·60
Snails, oysters, mussels	0·26—0·35
Various cheeses	0·68—1·81
Roasted coffee	up to 0·40
Cocoa	maximum 1·30
Hen's eggs	0·26
Fatty substances of wheat extracted by ether	0·32
Fatty substances of oats, meat, and cheese, extracted by ether	0·20
Butter from Isigny	0·13
Commercial lard	0·02

—L. E.

English Patents.

Fat contained in milk and other dairy produces; Alkalibutyrometric process for determining the percentage of ——. A. Sichler, Leipzig, Germany. Eng. Pat. 715, Jan. 10, 1906.

See Fr. Pat. 362,444 of 1906; this J., 1906, 716.—T. F. B.

Centrifugal separators; Cream and other ——. R. Hoddinott, Battle. Eng. Pat. 3542, Feb. 13, 1906.

The interior of the supply tube has rifled grooves cut in it, the inclination being in the same direction as that in which the bowl revolves. The object is to give the liquid entering the machine a rotary motion in the same direction as that in which the bowl is revolving.—W. H. C.

Flour or other ground cereal; Method of bleaching and conditioning ——. L. F. Little, London. Eng. Pat. 6389, March 16, 1906.

Nitrogen peroxide, stored under pressure in bottles or receptacles provided with outlet valves through which the gas may be supplied in controlled quantities, is claimed for bleaching flour, &c.—J. F. B.

French Patent.

Tea free from theine; Preparation of ——. Kaffee-Handels Akt.-Ges. Fr. Pat. 368,804, Aug. 11, 1906.

Tea leaves are first extracted with a volatile solvent, such as ether, petroleum spirit, benzene, or chloroform, in order to remove the aromatic substances present. The leaves are next subjected to the action of gaseous ammonia, sulphur dioxide, or hydrochloric acid, and the liberated theine is removed by further extraction with chloroform. After drying, the extracted leaves are mixed with the extract containing the aromatic substances, and the solvent distilled off, with constant agitation.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Exhaust ventilation in factories and workshops. Home Office Memorandum, Nov., 1906.

Exhaust ventilation, for the removal of injurious dust and fumes, is expressly required by Regulations and Special Rules in several dangerous trades, and H.M. Inspectors are further empowered by s. 74 of the Factory and Workshop Act to require it whenever any process is carried on by which dust, gas, vapour, or other impurity is generated and inhaled by the workers to an injurious extent. For this purpose it is essential to apply the exhaust so that the dust or fumes shall be carried away at or near to the point of origin, and not allowed to diffuse in the air of the room; and further that the installation shall be carefully planned with regard to the particular circumstances of each case. While great advances have been made in this direction in recent years, it is often found that owing to misapprehension of the conditions of the problem, ineffective installations have been provided at considerable cost; and in view of this it has been thought advisable to bring together, for the information of manufacturers, a number of examples of well-planned installations, which in practice have secured the desired results. Such examples, selected by Commander Sir H. P. Freer Smith, have now been published in book form. (See page 1236 of Journal for Dec. 31st, 1906.)

English Patents.

Ozone from oxygen or atmospheric air; Apparatus for the production of ——, *and its application to ventilation, &c.* J. R. Craig. Eng. Pat. 16,681, Aug. 17, 1905. XI*A*., page 23.

Water, Process and system of purifying ——. J. F. Wixford, St. Louis. Eng. Pat. 19,214, Sept. 22, 1905. Under Int. Conv., June 26, 1905.

See U.S. Pat. 807,008 of 1905; this J., 1906, 86. Reference is directed under Section I., Subsection 6, of the Patents Act, 1902, to Eng. Pats. 3550 of 1869; 2659 of 1871; 3593 of 1884; 6459 of 1885; 22,546 of 1891; and 12,861 and 18,266 of 1900.—T. F. B.

Water, Process of purifying ——. J. F. Wixford, St. Louis. Eng. Pat. 19,215, Sept. 22, 1905. Under Int. Conv., Sept. 23, 1904.

See U.S. Pat. 807,412 of 1905; this J., 1906, 87. Reference is directed under Section I., Subsection 6, of the Patents Act, 1902, to Eng. Pats. 1893 of 1876; 60 of 1877; 3593 of 1884; 6459 of 1885; 8883 of 1889; 22,546 of 1891; 9646 of 1896; 12,861 of 1900; 11,354 of 1901; and 17,690 of 1904.—T. F. B.

Filtering media [for sewage] from slag; Manufacture of ——. F. W. Stoddart, Bristol. Eng. Pat. 3240, Feb. 9, 1906.

Comparatively large lumps of slag, suitable for the treatment of sewage, are formed by supplying the molten slag under some pressure to the upper end of an inclined pipe. Near the lower end of this pipe there is a lateral opening communicating with a chamber to which air under pressure can be supplied intermittently. Each time that air is supplied from this opening to the pipe, all the slag between the opening and the exit end is cut off and ejected in one lump, whilst the slag in the upper part of the pipe, being under greater pressure, will not be driven back.—A. G. L.

French Patents.

Water; Method and apparatus for purifying and sterilising —— *by means of ozonised air.* J. H. Bridge. Fr. Pat. 368,620, Aug. 3, 1906.

The water is passed through a U-shaped pipe, the right limb of which is shorter than the left, and at its top is connected with a closed rectangular chamber. The flow of the water aspirates a current of ozonised air into the pipe, the supply-pipe for the air entering the left limb of the U-pipe. Baffle-plates are provided in the rectangular chamber to aid in mixing the ozonised air with the water, and any unabsorbed air is collected at the top of the chamber and conducted back to the ozonising apparatus. Several modifications of the plant are described.—W. P. S.

Sterilising, softening, and heating water and other liquids; Process and apparatus for ——. G. W. Westrope. Fr. Pat. 368,756, Aug. 9, 1906.

See Eng. Pat. 26,527 of 1905; this J., 1906, 1063.—T. F.B.

(*C.*)—DISINFECTANTS.

English Patent.

Antiseptic or disinfecting compounds. J. W. England, Philadelphia. Eng. Pat. 24,618, Nov. 28, 1905.

See U.S. Pat. 817,166 of 1906; this J., 1906, 493.—T.F.B.

XIX.—PAPER, PASTEBOARD, &c.

French Patents.

Cellulose; Manufacture of fatty acid esters of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 368,738, June 20, 1906.

Esters of cellulose are prepared by the action on cellulose of the anhydride of an acid of the fatty series in presence of mono-, di- or tri-chloracetic acid, with or without a diluting agent. For the preparation of cellulose acetate, 3 parts of cellulose are heated at 50°—55° C. with a mixture of 8 parts of mono-chloracetic acid and 16 parts of acetic anhydride until a homogeneous solution is obtained. Propionates and butyrates of cellulose are obtained in an analogous manner by the action of the corresponding anhydride in presence of chloracetic acid.—J. F. B.

Cellulose; Preparation of mixed esters of ——, *and their application for artificial silk.* L. Lederer. Fr. Pat. 368,766, Aug. 10, 1906.

Mixed esters of cellulose are produced by treating nitrocellulose with acid-chlorides or anhydrides, with or without the assistance of a condensing agent (compare this J., 1905, 1251). Suitable mixtures are:—Nitrocellulose, 1 part; acetyl chloride, 2—3 parts; or nitrocellulose, 1 part; acetic anhydride containing 0·5 per cent. of its weight of sulphuric acid, 4 parts. The mixture is allowed to remain for some hours at a temperature of 20°—30° C., and the product is purified by precipitation in water or other suitable medium (benzene, &c.). The mixed esters are soluble in acetone, and the solutions may be used for the manufacture of artificial silk.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Bromine and iodine; Temporary duty-free admission of —— into France. Bd. of Trade J., Dec. 27. [T.R.]

A law, dated 12th December, extends the *régime* of temporary duty-free admission to bromine destined for the manufacture of sodium and ammonium bromides, and also to iodine destined for the manufacture of dry sodium iodide. The conditions governing the temporary free admission of these products are to be determined by decree.

Bismuth tannates; Preparation of ——. Schweiz. Woch. Chem. Pharm., 1906, **44**, 805.

When bismuth hydroxide is heated with a solution of tannin, bismuth sub-tannate or mono-tannate is obtained; the same compound is formed by the interaction, with heat, of bismuth nitrate and three molecular proportions of sodium tannate. If the application of heat be avoided, compounds richer in tannin, approaching bismuth ditannate, are obtained. A solution of 322 grms. of bismuth nitrate in 52 grms. of 43·3 per cent. nitric acid and 300 grms. of water, is poured into a solution of 854 grms. of tannin, and 340 grms. of caustic soda in 4 litres of water, with constant agitation. The mixture is allowed to stand for five or six hours with occasional stirring at the normal temperature: the supernatant liquid is then decanted, and the precipitate washed with water. It is then collected and dried at 40° C. The product is a light, bright yellow powder, with a slightly acid taste. From the high proportion of tannin which it contains, it is better adapted for medicinal use than the mono-tannate usually prescribed.—J. O. B.

Calcium chloride; Some molecular compounds of ——. B. Menschutkin. Iswiestja d. Petersburger polytechn. Inst., 1906, **5**, 355—388. Chem. Centr., 1906, **2**, 1715—1716.

The author determined chiefly the solidification points of mixtures of calcium chloride with different organic compounds, and succeeded in isolating the following compounds, some of which are already known. With methyl alcohol: $CaCl_2, 4CH_3OH$; $CaCl_2,3CH_3OH$, m. pt. 178° C.; and another of unknown composition, but containing less methyl alcohol. With ethyl alcohol, $CaCl_2,3C_2H_5OH$, m. pt. 97° C.; with propyl alcohol, $CaCl_2,3C_3H_7OH$, m. pt. 87°—88° C.; with isopropyl alcohol, $CaCl_2,3(CH_3)_2CHOH$; with isobutyl alcohol, $CaCl_2, 3(CH_3)_2CH.CH_2OH$, m. pt. about 105° C.; with isoamyl alcohol, $CaCl_2, 3(CH_3)_2CH.CH_2CH_2.OH$. With tertiary alcohols, calcium chloride appears to yield compounds containing only 1 mol. of the alcohol. With acetic acid, $CaCl_2,4CH_3CO_2H$, m. pt. 73° C.; with propionic acid, $CaCl_2, 4C_2H_5CO_2H$; with butyric acid, $CaCl_2,2C_3H_7CO_2H$. With ethyl acetate, $CaCl_2,2CH_3CO_2C_2H_5$; with methyl acetate, $CaCl_2,2CH_3CO_2CH_3$; with ethyl formate, $CaCl_2,2HCO_2C_2H_5$. With methylal, $CaCl_2,CH_2(OCH_3)_2$; with ethylal, $CaCl_2,CH_2(OC_2H_5)_2$.—A. S.

Glucosides of the Jasminiaceæ: syringin and jasmiflorin. J. Vintilesco. J. Pharm. Chim., 1906, **24**, 529—536.

Jasminium nudiflorum.—From the behaviour of the aqueous extracts of the branches of the plant, gathered in January, with the ferments invertin and emulsin, it is concluded that the product at first regarded as a new glucoside, and provisionally named jasmiflorin, is a mixture of syringin, the crystalline glucoside isolated by the author from lilacs and privets, and an amorphous glucoside. The name jasmiflorin has therefore been retained for the latter. It is accompanied by a yellow bitter principle, also amorphous, which is not a glucoside. The roots of the plant, in February, are found to yield no jasmiflorin, but only syringin. Syringin is separated from jasmiflorin by treating the residue left on evaporating the ethyl acetate extract containing the two glucosides with 95 per cent. alcohol, in which the crystals of the former are much less soluble. Pure syringin has the m. pt. 190°—192° C., and $\alpha_D = -170° 38'$, and contains 4·61 per cent. of water of crystallisation. Jasmiflorin is separated with difficulty from syringin by solvents; it is isolated from the above alcoholic mother liquor, which is first treated with neutral lead acetate to remove jasmipicrin, and then precipitated with basic lead acetate by which reagent syringin is not thrown down. When liberated from the lead compound, it has the $\alpha_D = -145°$ C., and affords a yellow solution which does not reduce Fehling's reagent before hydrolysis, but which is hydrolysed by emulsin. It gives a reddish-brown colour with strong sulphuric acid; on dilution with water a brown flocculent precipitate is formed. Under similar conditions syringin gives a blue flocculence.

Jasminium fruticans.—Schlagdenhaufen and Reeb have isolated a glucoside which they have named jasminin, in the preparation of which they employ basic lead acetate to remove impurities, yet subsequently state that their glucoside is precipitated by that reagent. The author finds that leaf-bearing branches of the plant, gathered in May, contain syringin, but in less quantity than that found in the same parts of *J. nudiflorum.*

Jasminium officinale.—So far, syringin has not been isolated from this plant. It gives, with emulsin, indication of the presence of glucosidal bodies, and a small quantity of a crystalline glucoside, other than syringin, has been obtained from it.—J. O. B.

Vanillin; Occurrence of ——. E. O. von Lippmann. Ber., 1906, **39**, 4147.

Whilst examining dahlia tubers for fructose and inulin, large quantities of ether-alcohol extracts were evaporated and the residue extracted with light petroleum, which was afterwards evaporated. After ten years' standing, star-like clusters of needles were deposited, which on recrystallisation proved to be pure vanilin.—F. Shdn.

Orange oil. Schimmel's Report, 1906 (Oct.-Nov.), 35.

The values given are based on the results of the last few years' observations, and are more accurate than any previously reported:—

Bitter orange oil: d_{15° 0·854 to 0·857; $\alpha_{D_{20^\circ}} +90°$ to +93°; α_D of the first 10 per cent. of the distillate higher than α_D of the original oil. Residue on evaporation 3 to 5 per cent.

Sweet orange oil: d_{15° 0·848 to 0·853; $\alpha_{D_{20^\circ}} +95°$ to +98°; α_D of the first 10 per cent. of the distillate, not, or but little lower than α_D of the original oil; residue on evaporation 2 to 4 per cent. The altered behaviour of the oil as compared with that formerly observed is possibly due to the fact that the selection of the fruit and the expression of the oil used to take place with less care than at present.

Heracleum oil. Schimmel's Report, 1906 (Oct.-Nov.), 41.

This oil is obtained from the fruit, or the entire umbellate heads of *Heracleum sphondylium* L. The distillate obtained from the dry umbels from which the fruit had been removed presented the following characteristics: the yield of oil amounted to 0·08 per cent.; the odour of the brownish-yellow oil differs distinctly from that of the fruit. $d_{15^\circ} = 0·9273$; $\alpha_D = -0° 48'$; acid number, 16·2; ester number, 148·6: ester number after acetylation, 195·9; soluble in 1·1 vol. of 80 per cent. alcohol; when more solvent is added, opalescence and separation of paraffin occur. Two oils distilled from the fruit only, furnished the following data:—

1. Yield (compared with dry material), 0·9 per cent.; $d_{15^\circ} = 0·8744$; $\alpha_D = +0° 38'$; acid number, 15·[illegible]; ester number, 215·4; ester number after acetylation, 285·3; soluble in 0·8 and more vol. of 80 per cent. alcohol; not entirely soluble in 70 per cent. alcohol.

2. Yield (compared with dry material), 1·21 per cent.; $d_{15^\circ} = 0·8798$; $\alpha_D = +1° 6'$; acid number, 7·3; ester number, 242·4; ester number after acetylation, 276·3; soluble in 1 vol. and more of 80 per cent. alcohol.

A distillate from the dry, ripe fruit of *Heracleum giganteum* L. (yield 3·6 per cent.) behaved as follows: $d_{15^\circ} = 0{\cdot}8722$; $\alpha_D = +1^\circ\ 14'$; acid number, 1·6; ester number, 288·3; ester number after acetylation, 314·2; soluble in 1 vol. and more of 80 per cent. alcohol.

Parsnip oil. Schimmel's Report, 1906 (Oct.–Nov.), 51—52.

FOR the first time this oil has now been distilled from cultivated plants (*Pastinaca sativa* L.) from the irrigated fields at Miltitz. The ripe dried seeds, the umbels, and the roots of the plants were separately distilled with steam.

1. *Oil from dry seed of Pastinaca sativa* L.: The bright yellow oil obtained, represented a yield of 1·47 per cent., and had the following properties: $d_{15^\circ} = 0{\cdot}8736$; $\alpha_D = -0^\circ\ 9'$; $n_{D20^\circ} = 1{\cdot}43007$; acid number, 4·4; ester number, 240·6; ester number after acetylation, 276; it was soluble in 2½ vols. of 80 per cent. alcohol.

2. *Oil from the dry umbels*: This had a dark-brown colour, and its yield was 0·3 per cent.; $d_{15^\circ} = 1{\cdot}0168$; $\alpha_D = -0^\circ\ 50'$; $n_{D20^\circ} = 1{\cdot}50049$; acid number, 4·2; ester number, 62·9; ester number after acetylation, 86·2; it was soluble in 6·5 vols. of 80 per cent. alcohol, with separation of paraffin.

3. *Oil from the dry roots:* The bright yellowish oil, which in odour resembled vetiver oil, was obtained in a yield of 0·35 per cent., and had the following properties: $d_{15^\circ} = 1{\cdot}0765$; $\alpha_D = -0^\circ\ 10'$; $n_{D20^\circ} = 1{\cdot}52502$; acid number, 3·9; ester number, 12·6; ester number after acetylation, 33·7; not completely soluble in 10 vols. of 80 per cent. alcohol; soluble in 0·6 vol. of 90 per cent. alcohol.

Oil of Persea gratissima Gaertn. Schimmel's Report, 1906 (Oct.—Nov.), 59—61.

THIS oil is shown to consist for the most part of methylchavicol, with smaller quantities of *d*-pinene and paraffinoid substances.

Oil of Pinus Sabiniana Douglas. Schimmel's Report, 1906 (Oct.—Nov.), 64—65.

The balsam which served as raw material for this investigation, is a viscid, brownish-yellow mass with a greenish reflection, and an odour resembling that of the sweet orange. It is soluble in alcohol, ether, benzene, and partly soluble in light petroleum spirit. Acid number, cold, 156; saponification number, hot, 179·05. From the balsam by distillation with steam 8·44 per cent. of almost colourless essential oil was obtained, and 91·3 per cent. of a yellow brittle resin. The oil had the following properties: $\alpha_D = -0^\circ\ 9'$; $d_{15^\circ} = 0{\cdot}6962$; behaviour on distilling: 97° C. to 98·5° = 5 per cent.; 98·5° to 99° = 87 per cent.; above 99° = 8 per cent. The principal portion of the fraction of the b.pt. 98·5° to 99° was optically inactive had $d_{15^\circ} = 0{\cdot}6880$, and corresponded in its properties with those given by Thorpe for heptane.

Tannisol [Methylditannin]; Preparation and reactions of ——. Apoth.-Zeit., 1906, **21**, 997.

TANNIN is heated with 35 per cent. formaldehyde solution on the steam bath, when a strong reaction takes place. The resulting mass is evaporated to dryness, powdered, and again heated to 40°—50° C. to drive off excess of formaldehyde. Tannisol thus obtained is a reddish-brown, odourless and tasteless powder, insoluble in water and in petroleum spirit, soluble in alcohol, dilute alkalis, in alkali carbonates and in ammonia, from which solutions it is precipitated by acids as a reddish-white powder. When heated for a prolonged period at 100° C. it loses 12 per cent. of water. A trace of tannisol dissolved in strong sulphuric acid gives a brown solution, which turns green on heating, ultimately becoming blue. The sulphuric acid solution develops a fine blue colour, afterwards changing to wine red, when diluted with alcohol. It also gives a grass-green precipitate when treated with excess of caustic soda solution. Tannisol is employed in medicine as an astringent antiseptic.—J. O. B.

Guaiacolsulphonic acid; Notice concerning Rising's 3- or 6- ——. L. Paul. Ber., 1906, **39**, 4093—4095.

ACCORDING to Barell, *p*-guaiacolsulphonic acid is produced by the sulphonation of guaiacol at 140°—150° C. (Pharm.-Zeit., 1899, [13]). Rising regards this compound as 3- or 6-guaiacolsulphonic acid, and finds that the 4- as well as the 5-guaiacolsulphonic acids when heated to 125° C. give rise to the same *v*-guaiacolsulphonic acid (Ber., 1906, **39**, 3685). The author considers that *v*-guaiacolsulphonic acid and Barell's *p*-guaiacolsulphonic acid are identical with catecholsulphonic acid. The change produced by heating is merely due to the splitting off of a methyl group. On methylation *v*, 4-, and 5-guaiacolsulphonic acids yield the same veratrolsulphonic acid.—F. SHDN.

5-Nitro-guaiacol; Notice concerning ——. F. Reverdin and P. Crépieux. Ber., 1906, **39**, 4232.

BY using a method devised by Meldola and Cousin, the authors obtained a substance they believed to be 4-nitroguaiacol (Ber., 1903, **36**, 2257). But on comparison with the results of Paul (Ber., 1906, **39**, 2773), it appears that this substance is identical with 5-nitro-guaiacol ($OH:OCH_3:NO_2 = 1:2:5$).—F. SHDN.

"Absolute" alcohols; Determination of the densities of —— by means of their critical temperatures of solution. L. Crismer. Bull. Soc. Chim. Belg., 1906, **20**, 294—305.

As shown in a previous paper (this J., 1904, 451), the determination of the critical temperature of solution of petroleum in alcohol affords a very simple and rapid method for determining the percentage of water in commercial absolute alcohol, and hence its density, Mendelejeff's tables being used. An error of 0·1° C. in the observation of the critical temperature corresponds to an error of 0·005 per cent. of water, or 1·5 units in the fifth decimal place of the density. On the other hand, using a pyknometer of 500 c.c., the same error corresponds to 8 units in the fifth decimal. But when the Westphal balance or even a large pyknometer is employed it is impossible to adjust the temperature closer than ±0·5° C. without using a delicate thermostat and unless that is available the variation may amount to 8 units in the fourth decimal place, corresponding to 4·8° C. in the critical temperature of solution. In standardising a sample of petroleum it is easier to prepare perfectly anhydrous alcohol as a standard than to take the precautions necessary for an accurate determination of the density. It is merely necessary to boil absolute alcohol with lime for two or three days and to test the fractions of the distillate as described *loc. cit.* A curve can then be drawn parallel to the curves given by the author in his previous paper for mixtures of alcohol and water. Since, however, it has been stated that different petroleums do not always give parallel curves, it is safer to establish a second point on the curve by adding a known weight of water to the anhydrous alcohol. These curves are very nearly straight lines. Standardised petroleum can be preserved for years in stoppered bottles protected from the light without undergoing changes which affect the fourth decimal in the density of the alcohol.—J. F. B.

ENGLISH PATENTS.

Camphene; Manufacture of ——. C. Weizmann and the Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 5,032, March 1, 1906.

CLAIM is made for the manufacture of camphene by boiling pinene hydrochloride with a tertiary base of the class to which pyridine and quinoline belong.—F. SHDN.

Camphene; Manufacture of ——. Basler Chem. Fabr., Switzerland. Eng. Pat. 19,960, Sept. 7, 1906. Under Int. Conv., May 3, 1906.

CAMPHENE can be produced by heating pinene hydrochloride with an easily fusible metal salt of a higher fatty acid. In the examples cited, lead stearate, palmitate, and oleate, a mixture of copper oleate and stearate, and manganese oleate were used.—F. SHDN.

Hexamethylenamine; New salts of ——, and manufacture thereof. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 5039, March 1, 1906.

SEE Fr. Pat. 363,764 of 1906; this J., 1906, 867.—T.F.B.

Quinine oxy-magnesium haloid compounds; Manufacture of —— and of quinine esters therefrom. G. W. Johnson, London. From Verein. Chininfabrik. Zimmer und Co., Frankfort-on-Maine, Germany. Eng. Pat. 8527, April 9, 1906.

Quinine oxy-magnesium compounds are obtained by the action of organomagnesium halides on quinine at the ordinary or at higher temperatures; they may be precipitated from their solutions in benzene, &c., by means of ether. By acting on these compounds, or their solutions, with organic acid chlorides or anhydrides, esters of quinine are produced. 324 parts of dry quinine are allowed to stand with the ethyl magnesium chloride prepared from 24·4 parts of magnesium, until evolution of ethane ceases, 78·5 parts of acetyl chloride are added, and the mixture boiled for two hours under a reflux condenser. The product is extracted by hydrochloric acid, and the acetylquinine precipitated by ammonia and crystallised from petroleum spirit.—T. F. B.

French Patent.

Catechutannic acid; Process for converting catechin into ——. L. Sensburg. Fr. Pat. 368,777, Aug. 10, 1906. Under Int. Conv., Aug. 14, 1905.

See Eng. Pat. 18,004 of 1906; this J., 1906, 1231.—T. F. B.

German Patents.

Pulegone; Process for preparing a base $C_{10}H_{17}NO$ from ——. F. W. Semmler. Ger. Pat. 173,775, Feb. 20, 1904.

By heating the oxime of pulegone with hydrochloric acid, water is split off, and the -NH group becomes attached to a carbon atom, a base, $C_{10}H_{17}NO$, being formed. When purified, it has a b. pt. of 91° C. (8 mm. pressure).—T. F. B.

Phenyldimethylpyrazolone; Process for preparing soap-like compounds of ——. F. Eschbaum. Ger. Pat. 171,421, June 29, 1904.

The salts produced by the combination of 1 mol. of phenyldimethylpyrazolone with 2 mols. of one of the higher fatty acids (oleic, palmitic, or stearic acid), or a mixture of these, is dissolved in a neutral fat.—T. F. B.

Iron preparation [albuminate] readily soluble in water and in alcohol; Process for preparing a ——. E. Laves. Ger. Pat. 173,013, Nov. 4, 1904.

Preparations containing iron, readily soluble in water and alcohol, are obtained by mixing ferric albuminate with ferric saccharate (or a mixture of ferric hydroxide and sugar). They are suitable for producing clear, stable, and palatable solutions of ferric albuminate.—T. F. B.

Barbituric acids and their C-alkyl derivatives; Method of preparing ——. Chem. Fabr. auf Aktien, vorm. E. Schering. Ger. Pat. 171,294, Dec. 3, 1904.

Urethanes may be condensed with malonaminic esters or their alkyl substitution products, in presence of alkaline condensing agents, to form dialkylbarbituric acids or their alkyl derivatives; in this instance, a closed chain compound is formed by the interaction of two unsymmetrical compounds.—T. F. B.

C.C-Dialkyl-2-aryliminobarbituric acids; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 172,979, Dec. 9, 1904.

Arylguanidines may be condensed with dialkylmalonic esters in presence of alkali compounds of methyl alcohol, to form *C.C*-dialkyl-2-aryliminobarbituric acids; these may be decomposed by heating with acids into arylamines and the corresponding dialkylbarbituric acids.—T. F. B.

C.C-Dialkylbarbituric acids: Process for preparing ——. A. Einhorn. Ger. Pat. 172,404, Feb. 4, 1905. Addition to Ger. Pat. 165,649, Nov. 24, 1904. (See this J., 1906, 336).

Dialkylthiobarbituric acids are converted into dialkylbarbituric acids by heating with organic acids (acetic acid, oxalic acid, toluenesulphonic acid, &c.), or with acid salts (*e.g.*, bisulphites); the heating may be carried out in ethereal solution or under pressure without a solvent. —T. F. B.

Salicylic acid and its compounds; Process for rendering —— completely soluble in fats. E. Lonner. Ger. Pat. 173,789, April 13, 1905.

When mixed with the anilide of stearic acid, American vaseline, and *Lanolinum anhydricum*, salicylic acid and its various compounds are stated to be completely soluble in fats.—T. F. B.

Aminobenzoic acid alkamine esters; Process for preparing N-alkylated o- and m- ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 172,447, Nov. 16, 1905. Addition to Ger. Pat. 170,587, April 16, 1905.

N-alkyl-*o*- or *m*-aminobenzoic acid alkamine esters are obtained by heating N-alkyl-aminobenzoic esters with alkylamines, or by the action of primary or secondary amines on the esters of the alkylaminobenzoic acid with halogenated alcohols. The products are of value as narcotics. (See Eng. Pat. 17,162 of 1905; this J., 1906, 607).—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Developing bases and sulphurous acid; Use of compounds of —— as developers. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1906, 22, 433—437.

Addition compounds of sulphurous acid with *p*-aminophenol, methyl-*p*-aminophenol, and *p*-phenylenediamine were prepared by the action of sulphur dioxide on the free bases suspended in water at 80° C., or by crystallising hot solutions of the bases in 40 per cent. sodium bisulphite solution. They are sufficiently stable to be employed practically, and possess similar developing properties to the bases, which are liberated on addition of alkali, with formation of alkali sulphite. The insolubility of the sulphurous acid compound of *p*-aminophenol (0·05 per cent. at 15° C.) hinders its extensive use, but the other two compounds, having solubilities of 3·5 and 19·5 per cent. at 15° C. respectively, can well be used in photography.—T. F. B.

Persulphate and ferricyanide reducers; Effect of ——, and re-development of bleached negatives with alcoholic developers. W. Scheffer. Brit. J. Phot., 1906, **53**, 964—965.

By a microscopic examination of vertical sections through films of exposed plates which had been reduced with ammonium persulphate and with potassium ferricyanide, it was found that the former had penetrated the whole thickness of the film, whilst the action of the latter was confined to the silver grains on the surface; this accounts for the different appearances of the negatives. The action of an alcoholic solution of catechol on a negative bleached by an acid bichromate solution, was to so harden the upper layer of the film as to prevent the developing action penetrating beyond these; the result of this is that the negative is softer in contrast than the original. —T. F. B.

German Patents.

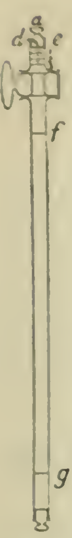
m-Amino-o-hydroxybenzylamine [Photographic developer]; Process for preparing ——. A. Einhorn. Ger. Pat. 167,572, Jan. 5, 1905.

m-Amino-*o*-hydroxybenzylamine, which is an energetic photographic developer, is prepared by reducing *m*-nitro-*o*-hydroxybenzylamine, or by reducing the acidyl derivatives of the latter, and then hydrolysing the amino-compounds thus formed.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Collodion-cotton. G. Lunge. Z. angew. Chem., 1906, **19**, 2051—2058.

The author has made an investigation of the conditions which govern the production of collodion-cotton. Special attention has been paid to the influence of the percentage of water in the mixed acids, the temperature and time



of nitration, and the viscosity and solubility in ether alcohol of the resulting nitrocellulose. Surgical cottonwool was used in the experiments. It was purified further by boiling in a 2 per cent. sodium carbonate solution, and extracting with alcohol and ether. The content of ash was found to be only 0·06 per cent. Nitration and purification were carried out in the ordinary way. The solutions used for determining viscosity, were in general of 3 per cent. strength, and the measurements were made in a Cochius viscometer. The long tube and upper cup are filled with the solution up to one of the marks shown on the cup, depending on the size of the air bubble required. (See figure). The tap, *b*, is then closed, and the stopper, *a*, inserted, turned momentarily so that the bore, *d*, is opposite the opening, *e*, in order to equalise the pressure, and then again turned so as to close the tube. The apparatus is then inverted and clamped in a vertical position. On opening the tap, *b*, the air-bubble rises through the liquid, and the time, in seconds, taken by the bubble in passing from *f* to *g*, is an index of the viscosity. The following conclusions have been drawn. Collodion-cottons completely, or almost completely, soluble in ether-alcohol are produced on nitrating dry cotton-wool with mixed acids containing equal proportions of sulphuric and nitric acids and a content of water lying between 15·5 and 19 per cent. The best results are obtained between 17 and 18 per cent. The nitrogen content of the nitrocellulose lies between 11 and 12·5 per cent. and decreases with increasing percentage of water in the mixed acid. Similar percentages of nitrogen in the nitrocellulose are obtained with the same mixed acid on nitrating for eight hours at 20° C., two hours at 40° C., and 20 minutes at 60° C. The viscosity of the ether-alcohol solution is a direct function of the concentration of the solution. It does not stand in any direct ratio to the percentage of nitrogen, but at the same time reaches its maximum at the higher percentages of nitrogen. The viscosity decreases with increasing temperature of nitration, with increased time of nitration, and increased percentage of water in the nitrating acids. The highest viscosities are therefore obtained by using strong acids and nitrating for only a short period of time. The following tables show some of the results obtained with a collodion cotton obtained by nitrating one part of cotton-wool with 73 parts of a mixed acid containing: sulphuric acid, 40·11; nitric acid, 41·05; nitrogen peroxide, 0·70, and water, 18·05 per cent.

Temp. of Nitration.	Yield.	Nitrogen.	Solubility.	Viscosity at 18° C.	
				Percentage strength of solution.	Seconds.
°C.		per cent.	per cent.		
20	155·0	11·26	95·0	2	14·2
40	154·6	11·20	98·7	3	18·1
				2½	9·5
60	153·6	11·31	100·0	3	5·15
				4	10·9
				5	27·4

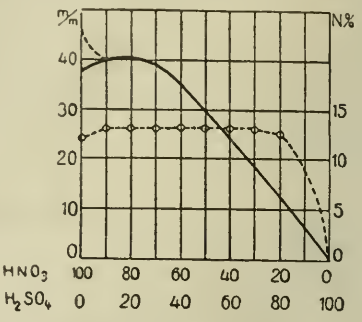
Another specimen obtained by nitrating one part of cotton-wool with 73 parts of a mixed acid containing: sulphuric acid, 42·36 per cent.; nitric acid, 41·10 per cent.; nitrogen peroxide, 1·03 per cent., and water, 15·5 per cent., gave the following results:—

Temp.	Time.	Yield.	Nitrogen.	Solubility.	Viscosity at 18° C.	
					Percentage strength of solution.	Secs.
° C.			per cent.	per cent.		
20	8 hrs.	165·4	12·39	100	2	108·0
40	2 hrs.	166·3	12·42	100	3	278·0
50	1 hr.	165·1	12·43	100	3	77·5
60	20 min.	165·2	12·47	100	3	36·8
	2½ hrs.	163·5	—	100	3	4·55
				100	5	9·8
				100	7	44·9

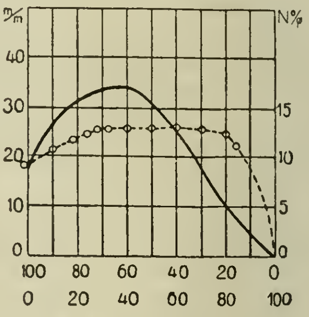
—G. W. McD.

Cellulose; Theory of the nitration of ——. A. Saposchnikoff. Z. ges. Schiess.- u. Sprengstoffwesen, 1906, 1, 453—456.

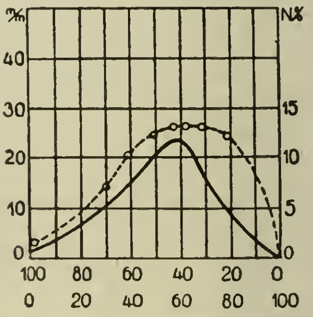
The author shows that there is a close relation between the vapour pressure of nitric acid, in mixtures of nitric acid, sulphuric acid, and water, and the percentage of nitrogen in the nitrocelluloses obtained when cellulose is nitrated in these mixtures. In the subjoined diagrams the vapour pressure curve is represented by a black line, whilst the percentage of nitrogen is given by a dotted curve. The results indicate that the highest nitrogen content is obtained when the nitric acid is in the state of monohydrate, HNO_3, whilst the lowest nitration products correspond to the nitric acid hydrate, $HNO_3.H_2O$. Thus, addition of 20—25 per cent. of water to nitric acid of sp. gr. 1·52 causes a rapid fall in the vapour pressure from 46 mm. to 9·4 mm., and it is pointed out that nitric acid of this concentration gives rise to Vieille's tetranitro cellulose, $C_{24}H_{36}(NO_3)_4O_{16}$. On the other hand, addition of a large excess of sulphuric acid to nitric acid of sp. gr. 1·52 causes dehydration, and consequently a lowering in the percentage of nitrogen in the resulting nitration product. Experiments carried out with a nitrating acid containing 34 per cent. of nitric acid, 61 per cent. of sulphuric acid, and 5 per cent. of water show that at temperatures varying from 0° to 40° C. there is little variation in the products of nitration.—B. J. S



Nitric acid of sp. gr. 1·52.



Nitric acid of sp. gr. 1·48.



Nitric acid of sp. gr. 1·40.

"Nitrocellulose" and "nitroglycerine"; Hydrolysis of ——. O. Silberrad and R. C. Farmer. Chem. Soc. Trans., 1906, **89**, 1759—1773.

Experiments on the hydrolysis of nitrocellulose and nitroglycerin in alkaline solution showed that the reaction is complicated by the simultaneous reduction of the nitric acid as shown by the formation of large amounts of nitrites, and by the degradation of cellulose and glycerol to hydroxy-acids, &c. (see this J., 1906, 868). The velocity of hydrolysis did not show the normal decrease as the quantities of the reagents diminished, but remained almost constant until a large proportion of the alkali was used up. These results indicate that intermediate products are formed which are gradually acted on by alkali. These intermediate products are insoluble in water, for it was found that when the alkaline liquid was separated, the saponification ceased almost entirely in the filtrate. Much more alkali was consumed in the saponification than could be accounted for by the nitroxyl groups present. For example a nitrocellulose containing nitrogen equivalent to 5·04 nitroxyl groups, neutralised 9·2—9·5 instead of 5·04 equivalents of baryta, whilst nitroglycerin gave a saponification equivalent of 4·85 instead of 3. Apparently the nitric acid primarily set free on hydrolysis, is in a more active condition than ordinary nitric acid, and decomposes the cellulose and glycerol, since these latter could not be detected among the products, although ordinary nitric acid does not oxidise cellulose or glycerol in concentrations such as were employed in the experiments. Some quantitative results obtained with respect to the hydrolysis of varying quantities of gun-cotton in barium hydroxide solution and in nitric acid respectively, are shown in the following table:—

Grms. of gun-cotton.	Concentration of H or OH ions.	Velocity (grm.-equiv. of acid liberated per hour).	
		Calculated.	Found.
	(1) *Hydrolysis by barium hydroxide solution.*		
3·10	0·197	0·0035	0·0033
4·97	0·191	0·0051	0·0053
20·42	0·096	0·0070	0·0071
22·10	0·189	0·0144	0·0142
∞	1·000	0·168	—
	(2) *Hydrolysis by nitric acid.*		
5·10	0·821	0·00018	0·00018
10·00	0·821	0·00022	0·00021
20·35	0·821	0·00025	0·00024
∞	1·000	0·000347	—

Taking into consideration that in the comparatively rapid hydrolysis in presence of acid or alkali, the diffusion of the nitrocellulose into the aqueous solution is imperfect, whilst in the slow decomposition which occurs in presence of water alone, the solution remains saturated with nitrocellulose throughout the reaction, the concentrations of hydrogen- and hydroxyl-ions respectively necessary to produce the minimum velocity of hydrolysis were calculated from the experimental results, by the aid of the formula, $v=\frac{cqs}{k+q}$, where c is the concentration of alkali or acid, q is the weight of nitrocellulose (grms. per 400 c.c. in the present experiments), s is the limiting velocity for a solution saturated with gun-cotton, v is the observed velocity, and k is a constant. At 37·8° C. the hydrolysis will take place with its minimum velocity when the concentration of the hydrogen ions is $3{\cdot}7\times10^{-6}$, and that of the hydroxyl ions is $7{\cdot}8\times10^{-9}$; under these conditions $5{\cdot}6\times10^{-5}$ grm.-equivalents of acid per litre of water per year will be liberated from the nitrocellulose. In practice the decomposition will be accelerated by the acid set free. Since a solution containing $3{\cdot}7\times10^{-6}$ grm.-equivalents of hydrogen ions per litre reacts appreciably acid to litmus, it would appear that if gun-cotton be allowed to remain in water, no acceleration of the hydrolysis takes place so long as the solution is neutral to litmus. It follows, therefore, that storage under water forms the safest method of keeping gun-cotton, since under these conditions the impurities will decompose without any appreciable effect on the nitrocellulose itself. The hydrolysis of gelatinised nitrocellulose in presence of alkali follows an almost exactly similar course to that of gun-cotton. Two specimens of cordite and one of ballistite were found to undergo rapid hydrolysis in alkaline solution, but the decomposition appears to be confined almost entirely to the nitroglycerin which passes into the aqueous solution. For instance, it was found that 70 per cent. of the nitroglycerin of a cordite had been decomposed, whilst the nitrocellulose was almost unaltered.—A. S.

ENGLISH PATENTS.

Nitroglycerine; Manufacture of ——. F. L. Nathan, J. M. Thomson, W. Rintoul, and A. Scott, Waltham Abbey. Eng. Pat. 6581, March 19, 1906.

See Fr. Pat. 366,593 of 1906; this J., 1906, 1068.—T.F.B.

Safety explosives; Manufacture of ——. B. G. Reschke, Hamburg, Germany. Eng. Pat. 17,414, Aug. 2, 1906.

In the manufacture of ammonium nitrate explosives as described in Eng. Pat. 12,716 of 1906 (this J., 1906, 953), claim is made for the replacement of fennel by other suitable specimens of umbelliferous plants, with or without the addition of wood-meal. Several examples are given. —F. Shdn.

FRENCH PATENTS.

Explosive. R. Imperiali. Addition, dated May 23, 1906, to Fr. Pat. 364,948, Feb. 22, 1906. (See Eng. Pat. 14,545 of 1905; this J., 1906, 953.)

The ammonium nitrate or potassium nitrate specified in the main patent is to be used in association with antimony sulphide, according to the explosive power desired.—C. S.

Explosives; Process for preparing safety ——. B. G. Reschke. First Addition, dated Aug. 2, 1906, to Fr. Pat. 366,729, May 31, 1906.

See Eng. Pat. 17,414 of 1906; preceding these.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

INORGANIC—QUANTITATIVE.

Zinc; Delicate method of precipitating ——. G. Bertrand and M. Javillier. Compt. rend., 1906, **143**, 900—902.

To the liquid (say half a litre, containing 1 mgrm. or less of zinc) are added a few c.c. of milk of lime, or 50 c.c. of lime water, then 10—15 per cent. of its volume of concentrated ammonia. The liquid is filtered if need be, and then boiled till alkaline vapours cease to be evolved. After cooling, the precipitate of calcium zincate and carbonate is collected on a filter. It is then dissolved in a little hydrochloric acid, the liquid evaporated to dryness, the residue taken up with water, rendered strongly ammoniacal, the calcium precipitated by ammonium oxalate and filtered off, the filtrate evaporated to dryness with sulphuric acid, and the residue ignited and weighed. After weighing, it is identified as zinc sulphate by dissolving in water, and testing one half with hydrogen sulphide and the other with potassium ferrocyanide. Blank experiments must of course be carried out with all the reagents, and the result deducted from the weight of the zinc precipitate obtained.—J. T. D.

Hydrogen peroxide; Decomposition of —— by copper salts in alkaline solution. F. Claessens. VII., page 18.

Antimonial gold ores; Assay of ——. G. T. Holloway. X., page 20.

ORGANIC—QUALITATIVE.

Sugars; Colour reaction for reducing —— with m-dinitrobenzene in alkaline solution. Chavassieu and Morel. XVI., page 27.

ORGANIC—QUANTITATIVE.

Halogens; Determination of —— in organic compounds by means of metallic sodium and ethyl alcohol. A. Stepanow. Ber., 1906, **39**, 4056—4057.

The weighed substance (0·2 to 0·5 grm.), contained in a bulb tube, is introduced into an Erlenmeyer flask containing 20 to 40 c.c. of 98 per cent. ethyl alcohol. The flask, fitted with a long condenser, is placed on a water-bath, and sodium is added through the condenser tube. The quantity of the metal used is 25 times the theoretical amount called for by the equation:

$$RX + C_2H_5OH + Na_2 = RH + NaX + C_2H_5ONa.$$

After complete solution of the sodium, the contents of the flask are diluted with 20 to 40 c.c. of water, and the alcohol distilled off. After cooling, the liquid is strongly acidified with dilute nitric acid, and the halogen contained in the residue determined by Volhard's method. Figures quoted by the author for 26 determinations show errors varying between +0·03 per cent. and —0·24 per cent. The reaction is easily and rapidly carried out, and is stated to be of universal applicability.—O. R.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

o-Nitrotoluene: The two modifications of ——. I. von Ostromisslensky. Z. physik. Chem., 1906, **57**, 341—348.

When *o*-nitrotoluene is freshly distilled and the distillate cooled quickly to —20° C., the portion which passes over at 218°—221° C. always crystallises in the *α*-form, whilst that distilling at 221°—224° C. (obtained by heating small quantities above the b. pt., 218° C., with a large flame) yields the *β*-form. A more convenient method of obtaining the latter is to immerse the fused substance in solid carbon dioxide at from —50° C. to —60° C. The labile *α*-modification is first obtained, which, however, after standing a short time, changes to the more stable *β*-modification. By nucleating the supercooled liquid with a crystal of either the *α*- or *β*-form, the corresponding modification is always produced. The *α*-modification is obtained in long, stellate, transparent needles, and the *β*-modification in snowy, opaque aggregates. The change from the *α*- to the *β*-form proceeds fairly quickly at —20° C., and the limit point is near the melting point of the *α*-modification (—10·56° C.). The *β*-variety melts at —4·14° C. Similar *α*- and *β*-modifications were also noticed in the case of the following substances, the difference between the melting points being noted in brackets, *o*-chlorotoluene (5·8°), *o*-toluidine (5°), *o*-chlorophenol (7°), *o*-bromotoluene (5·1°).—J. C. C.

Oleates of certain heavy metals; Specific conductivity of solutions of ——. L. Kahlenberg and R. B. Anthony. J. Chim. Phys., 1906, **4**, 358—364.

Oleates of magnesium, zinc, aluminium, nickel, cobalt, iron, and cadmium were prepared by adding the respective sulphates to a solution of sodium oleate. The precipitates were washed, dried at a temperature slightly below the decomposition point, and dissolved in various solvents. The dielectric constants were determined by a modification of Drude's method, the temperature being that of the room. The results given in tabular form show that the dielectric constant of benzene, carbon tetrachloride, chloroform, carbon bisulphide, and cotton-seed oil are only slightly modified by the presence of these oleates, though in general there is a slight reduction. A similar reduction is seen in the case of pyridine, though it is insignificant with some of the oleates. With nitrobenzene the lowering is more marked. In general, the presence of oleates of these heavy metals in the solvents tested, tends to lower the dielectric constant; and the results show clearly that this value is not additive in character. In fact, the solutions behave as though the special electric properties of the different metals were practically masked.
—C. A. M.

Membranes; Precipitate —— in jellies, and the constitution of gelatin jellies. H. Bechhold and J. Ziegler. Z. Chem. und Ind. der Kolloide, 1906, **1**, 157.

The authors have studied the formation of membranes by salts dissolved in pure gelatin diffusing through an intermediate layer of gelatin. A test-tube was filled first with a layer of gelatin containing dissolved silver or lead nitrate, which was allowed to set hard before a layer of pure dialysed gelatin was introduced, following which came a gelatin layer containing sodium or barium chloride. The tubes were set aside in the dark for a period, and the formation of the membranes investigated either, as in the case of silver membranes, by exposure to light or by cutting the tube of gelatin into thin slips and detection of the salt present by spot tests. The results may be summarised as follows:—A thin precipitate membrane in gelatin allows solutions of the salts, by the action of which it is formed, to pass through as long as there is a difference of osmotic pressure on the two sides of the membrane. The membrane grows from the direction of higher pressure towards that of lower. With no difference of osmotic pressure such a visible permeable membrane is sufficient to stop diffusion. A fused silver chloride or barium sulphate membrane in gelatin does not hinder the diffusion of salt solutions, whereas a copper or zinc ferrocyanide precipitate in gelatin is non-permeable for potassium ferrocyanide. The results are explained by assuming with Quincke that a gelatin jelly consists of a network of gelatin masses of low water content, surrounded by channels of a medium rich in water, of low gelatin content, so that the electrolytes which make use of these latter as diffusion passages are prevented from passing when these are stopped by membranes. In the gelatin network, diffusion of electrolytes does not take place.—E. F. A.

Patent List.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

28,767. Bévenot. Extraction and desiccation of the solids in natural fluids or solutions. [Belg. Appl., Dec. 16, 1905.]* Dec. 17.

28,792. Stead and Palmer. Continuously acting apparatus for separating a gas from a mixture of gases. Dec. 17.

28,932. Fawcett, Ltd., and Bottomley. Compound rotary drier and cooler for mineral substances, &c. Dec. 19,

28,977. Whitham. Separation of liquids from solids or matter held in suspension. Dec. 19.

29,007. Jury. Apparatus for producing extracts by diffusion and concentration. [Fr. Appl., Dec. 19, 1905.]* Dec, 19.

29,126. Manbré. Packing for absorbing towers or columns. Dec. 21.

29,356. Andrews. Furnaces. Dec. 24.

29,390. Scard. Multiple evaporators. Dec. 24.

29,496. Precht. Dehydrating air and other gases. Dec. 27.

29,520. MacDonald and Duncan. Machinery for extracting moisture from sludges, slimes, and the like. Dec. 28.

29,565. Wyllie. Liquid feed regulators for evaporating and crystallising apparatus.* Dec. 28.

29,733. Soc. l'Air Liquide. *See under* VII.

Complete Specifications Accepted.

26,065 (1905). Prache and Bouillon. Apparatus for evaporating or concentrating liquids. Dec. 28.

26,578 (1905). Frith. Highly heated muffles or furnaces. Dec. 28.

26,998 (1905). Clark. *See under* II.

87 (1906). Cooke and Kelly. Apparatus for dehydrating animal and vegetable substances. Dec. 28.

1479 (1906). Mecredy and Hawes. Apparatus for obtaining dry products from liquids or semi-liquids. Dec. 31.

19,729 (1906). Haddan (Aktiebolaget Separator). Centrifugal machines for separating solids from liquids. Dec. 31.

II.—FUEL, GAS, AND LIGHT.

Applications.

28,775. Deuts. Gasglühlicht A.-G. Production of metallic incandescence bodies for electric glow lamps. [Ger. Appl., March 27, 1906.]* Dec. 17.

28,834. Crossley and Rigby. Producer gas generators. Dec. 18.

29,155. Norden (Bartel). Manufacture of mantles for incandescent gas lighting. Dec. 21.

29,291. Duncan and Hardie. Manufacture and purification of illuminating gas. Dec. 22.

29,314. Bourcoud. Manufacture of producer or kindred gas. Dec. 22.

29,396. Barker and White. Production of gas for power purposes. [U.S. Appl., Sept. 12, 1906.]* Dec. 24.

29,416. Gebr. Siemens und Co. Electrodes for arc lamps. [Ger. Appl., May 17, 1906.]* Dec. 24.

29,599. Drinkwater and O'Connor. Reducing the arsenic in gas and other cokes. Dec. 29.

29,752. Feld. Treatment of coal gases, &c., in recovering tar and ammonia therefrom. Dec. 31.

Complete Specifications Accepted.

26,855 (1905). Bourdos, Rothschild, and Sutcliffe. Filaments of incandescent electric lamps. Dec. 31.

26,998 (1905). Clark. Condensing apparatus for use in purifying coal and other gas. Dec. 31.

6935 (1906). Sepulchre. Gas generators. Dec. 28.

7803 (1906). Bloxam (Lux). Manufacture of tungsten filaments for incandescence electric lamps. Dec. 28.

9307 (1906). Hoseason. Manufacture of incandescent mantles. Dec. 31.

13,764 (1906). Büchel. Binding thermite into solid briquettes. Dec. 28.

17,996 (1906). Wise (Solvay et Cie.). Coke ovens. Dec. 28.

19,115 (1906). Sellers, Capel, and Wallis. Generating steam for conversion into water gas. Dec. 28.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

29,752. Feld. *See under* II.

Complete Specifications Accepted.

24,318 (1905). Oppenheimer, Boatman, and Kent. Lubricating oil and process for obtaining same. Dec. 31.

24,319 (1905). Oppenheimer, Boatman, and Kent. Lubricating oil and process for obtaining same. Dec. 31.

27,254 (1905). Klever. Manufacture of emulsifiable compositions from hydrocarbon oils. Dec. 31.

22,430 (1906). Harris. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

28,765. Newton (Bayer und Co.). Manufacture of new anthracene derivatives. Dec. 17.

28,867. Newton (Unger). *See under* XIV.

29,750. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. Dec. 31.

29,765. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. Dec. 31.

Complete Specifications Accepted.

352 (1906). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Dec. 31.

9102 (1906). Newton (Bayer und Co.). Manufacture of anthracene dyestuffs. Dec. 31.

10,052 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the thiazine group. Dec. 28.

11,174 (1906). Johnson (Kalle und Co.). Manufacture of *o*-carboxyphenylthioglycollic acid. Dec. 31.

12,243 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of indoxylic compounds. Dec. 31.

20,397 (1906). Imray (Durand, Huguenin, et Cie.). Manufacture of condensation products from gallic acid or a derivative thereof and an alkyldiaminoarylthiosulphonic acid, and of gallothionines therefrom. Dec. 28.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

28,828. Jamieson and Govan. Method of printing fabrics. Dec. 18.

28,982. Simon. Process of weighting silk.* Dec. 19.

29,134. Calico Printers' Association, and Fourneaux. Printing textiles. Dec. 21.

29,135. Calico Printers' Association, and Hadfield. Dunging and mordanting cotton piece goods. Dec. 21.

29,183. Wohle. Treatment of vegetable fibres. Dec. 21.

29,365. Ritchie and Scott. Treating flax, hemp, jute, rhea, and the like. Dec. 24.

29,514. Burgoyne. Treatment of wool or like fabrics by drying, scouring, and kindred processes. Dec. 28.

Complete Specifications Accepted.

26,811 (1905). Malard. Apparatus for extracting the yolk from wool. Dec. 31.

2939 (1906). Wilson. Reproducing designs or the like on textile or other fabrics. Dec. 28.

12,718 (1906). Minck, and Bremer Baumwollwerke. Obtaining fibres from cottonseed hulls and similar waste products. Dec. 31.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

28,963. Woltereck. Production of ammonia. Dec. 19.

28,964. Woltereck. Production of ammonia. Dec. 19.

29,092. Parsons. Preparation of carbon, its compounds and alloys. Dec. 20.

29,223. Grossmann. Treatment of ammonia liquors before and after distillation. Dec. 22.

29,383. Johnson (Chem. Fabr. Schlempe). Manufacture of cyanides in a condition fit for storing and transport. Dec. 24.

29,660. Marley. Manufacture of graphite and plumbago. Dec. 29.

29,733. Soc. l'Air Liquide. Liquefaction of atmospheric and other gases. [Fr. Appl., Jan. 4, 1906.]* Dec. 31.

29,752. Feld. *See under* II.

Complete Specifications Accepted.

2466 (1906). Hermite. Method and apparatus for obtaining saturated solutions of salts. Dec. 28.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

29,427. Mayer. Furnaces for burning glass, porcelain, majolica, &c. [Ger. Appl., Dec. 29, 1905.]* Dec. 24.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

29,395. Sankey. Plastic cement or plaster. Dec. 24.

29,408. Morgan. Cement kilns.* Dec. 24.

29,760. Cowper - Coles. Manufacture of cement. Dec. 31.

Complete Specifications Accepted.

27,082 (1905). De Angelis. Heat resisting composition. Dec. 31.

3353 (1906). Sankey. Manufacture of silica fireproof non-conducting tiles, lumps, bricks, &c. Dec. 28.

3353A (1906). Sankey. Manufacture of silica cement, crucibles, and other articles. Dec. 28.

X.—METALLURGY.

Applications.

28,756. Angel. Treatment and reduction of complex sulphide and other ores. Dec. 17.

28,757. Angel. Furnace for treating sulphide and other ores. Dec. 17.

29,057. Simm and Simm. Extraction of tin from tin ores. Dec. 20.

29,156. Oettinger. Method of obtaining metallic vapours from ores and furnace products. [Ger. Appl., Jan. 3, 1906.]* Dec. 21.

29,315. Westgarth. Tilting furnaces. Dec. 22.

29,385. Templer. Treatment of crushed ores previous to cyaniding or the like. Dec. 24.

29,728. Schwarz. Method and apparatus for concentrating ores.* Dec. 31.

Complete Specifications Accepted.

27,218 (1905). Blackman (Emett). Hardening cast iron and the like. Dec. 31.

9687 (1906). King. Nodules of metalliferous material. Dec. 28.

12,395 (1906). Wallin. Producing metals from ores and heating substances in electric furnaces. Dec. 28.

15,818 (1906). Kaiser. Production of metals from ores or furnace products in the electric furnace. Dec. 28.

16,168 (1906). McAdams. Casting aluminium alloy. Dec. 31.

24,096 (1906). Rhein.-Nassauische Bergwerks u. Hutten A.-G. Direct production of zinc from zinc sulphide, and utilisation of the sulphur. Dec 28.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Application.

28,897. Cowper-Coles. Electrodeposition of iron.* Dec. 18.

28,959. Hiorth. Operating electrical smelting furnaces. [Appl. in Norway, May 5, 1906.]* Dec. 19.

28,960. Hiorth. Electric induction furnace. [Appl. in Norway June 2, 1906.]* Dec. 19.

28,961. Hiorth. Operating electrical smelting furnaces. Appl. in Norway. Nov. 6, 1906.]* Dec. 19.

29,019. Gröndal Kjellin Co., and Härden. Electric induction furnaces.* Dec. 19.

29,122. Moir. *See under* XVIII*B*.

29,271. Frick. Electric furnaces. [Swed. Appl., Dec. 27, 1905.]* Dec. 22.

29,300. Cowper-Coles. Electrodeposition of iron. Dec. 22.

29,367. Bijur. Treatment of negative pole plates.* Dec. 24.

29,655. Ruthenburg. Electrolytic apparatus. Dec. 29.

Complete Specifications Accepted.

146 (1906). Ashcroft. Electrolysis of alloys, fused salts, solutions, ores, or compounds. Dec. 31.

234 (1906). Fermerling and Pörschke. Galvanic cells. Dec. 31.

7240 (1906). Bingham. Electric furnaces. Dec. 31.

9279 (1906). Johnson (Badische Anilin und Soda Fabrik). Production of long stable electric arcs. Dec. 28.

10,156 (1906). Hartenstein. Electric furnaces. Dec. 28.

12,205 (1906). Möllenbruck and Dielmann. Carbon electrodes for primary batteries. Dec. 31.

12,395 (1906). Wallin. *See under* X.

15,818 (1906). Kaiser. *See under* X.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

29,331. Webb and Webb. Soaps. Dec. 24.

Complete Specification Accepted.

22,430 (1906). Harris. Treating vegetable and animal oils. Dec. 28.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

28,984. Bloxam (Act. Ges. f. Anilinfabr.). Manufacture of red colour lakes and intermediate products. Dec. 19.

29,504. Garcia. Paints for buildings. Dec. 27.

Complete Specification Accepted.

27,036 (1905). Mills. Converting sulphate of lead into a basic pigment and preparing paint therefrom. Dec. 31.

(C.)—India-Rubber.

Complete Specification Accepted.

4701 (1906). Gratz. Processes for obtaining caoutchouc. Dec. 28.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

28,806. Boult (Sylvestre). Manufacture of artificial leather.* Dec. 17.

28,867. Newton (Unger). Production of black solid tannin, black dye, and black cutch. Dec. 18.

28,886. Bacon. *See under* XIX.

29,368. Roach and Roach. Process of tanning hides,* Dec. 24.

29,661. Norris. Process of treating hides or skins.* Dec. 29.

Complete Specifications Accepted.

26,550 (1905). Bakau Co., and Meikle. Process of obtaining soluble extracts from bark and other vegetable matters. Dec. 28.

26,771 (1905). Nowak. Substance for treating hides. Dec. 28.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

29,211. Newlands and Eastick. Manufacture and purification of invert sugar. Dec. 22.

Complete Specification Accepted.

26,264 (1905). Noffke. Saccharometers. Dec. 28.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

28,920. Maardt. Manufacture of beer wort. Dec. 18.

28,981. Frestadius. Method of distilling fermented peat juice. Dec. 19.

29,484. Coomans. Mash tun.* Dec. 27.

Complete Specifications Accepted.

4274 (1906). Whitehouse and Beetlestone. Alcohol separation process. Dec. 28.

12,227 (1906). Takamine. Diastatic substance. Dec. 31

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

29,425. Emmerich. Improving the palatability and digestive qualities of sterilised milk. Dec. 24.

29,552. Ozonair, Ltd., Rogerson, and Briant. Beverage. Dec. 28.

(*B.*)—Sanitation; Water Purification.

Applications.

29,122. Moir. Treating sewage by electrolysis. Dec. 21.

29,596. Howard. Purification of water. Dec. 29.

Complete Specification Accepted.

14,339 (1906). Reisert. Purification of water. Dec. 28.

(*C.*)—Disinfectants.

Complete Specification Accepted.

14,818 (1906). Hume. Composition for dipping sheep, goats, &c. Dec. 28.

XIX.—PAPER, PASTEBOARD, &c.

Application.

28,886. Bacon. Manufacture of resin size for paper making. Dec. 18.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Application.

29,093. Bergell and Wülfing. Manufacture of hexamethylenetetramine derivatives.* Dec. 20.

Complete Specifications Accepted.

11,574 (1906). Johnson (Verein. Chininfabriken Zimmer und Co.). Manufacture of boracic acid esters. Dec. 31.

13,401 (1906). Newton (Bayer und Co.). Manufacture of new pharmaceutical compounds. Dec. 28.

25,494 (1906). Meister, Lucius, und Brüning. Manufacture of dialkylbarbituric acids. Dec. 28.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

29,480. Bloxam (Neue Photographische Ges.). Converting silver pictures into platinum pictures having catalytic power.* Dec. 27.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

29,021. Himalaya. Safe and non-poisonous high explosives.* Dec. 19.

29,289. Soc. de Prod. Chim. et d'Explosifs Bergès, Corbin et Cie. Manufacture of explosives. [Fr. Appl., Jan. 3, 1906.]* Dec. 22.

Complete Specifications Accepted.

18,692 (1905). Silberrad. Explosives.

20,309 [(1906). Reschke. Explosive compounds. Dec. 31.

Journal of the Society of Chemical Industry.

No. 2, Vol. XXVI. JANUARY 31, 1907. No. 2, Vol. XXVI.

Official Notices.

JAMESTOWN EXPOSITION: SPECIAL ALCOHOL EXHIBIT.

An exposition is to be held at Jamestown, Va., U.S.A., from April 26th to Nov. 30th, 1907, to celebrate the 300th anniversary of the first English settlement on North American soil. A special feature will be an exhibit of the various apparatus, machines, and appliances by which the heat, light, and power which can be obtained from alcohol may be utilised for domestic, agricultural, and manufacturing purposes, and also of the articles of manufacture into which alcohol enters as a component or factor. The exhibit will be under the superintendence of Prof. Charles E. Munroe, of George Washington University, Washington, D.C., to whom all applications for space should be addressed.

SECRET COMMISSIONS AND BRIBERY PREVENTION LEAGUE.

A league for the prevention of secret commissions and bribery has been formed under the auspices of the London Chamber of Commerce. Among the objects of the League are to expose flagrant cases of bribery, corruption, and blackmail, and, if necessary, to take steps to prosecute; and also to assist its members and subscribers in any action which may be considered by the Council necessary to recover secret commissions paid or received. All communications should be addressed to the Secretary, Mr. A. E. W. Gwyn, 58, Coleman Street, London, E.C.

Obituary.

THE REV. CANON WM. HAIG-BROWN, LL.D.

The death is announced of the Rev. Canon William Haig-Brown, LL.D., who had been Master of Charterhouse for the last nine years, and headmaster of the Charterhouse School for a period of 34 years.

Born at Bromley, Kent, in 1823, Dr. Haig-Brown received his schooling at Christ's Hospital, going from there to Pembroke College, Cambridge, where he graduated in 1846. After being elected to a fellowship in 1848, Dr. Haig-Brown took holy orders, and was elected tutor of Pembroke. After a short period as an assistant master at Harrow, he was elected headmaster of Kensington Proprietary School in 1857, and six years later was chosen to be headmaster of Charterhouse.

Thus began his association with the famous foundation at a critical moment in its history. Its numbers had been declining for some years, and the report of the Public Schools Commission, which appeared in 1864, recommended the removal of the school to Godalming, some particulars of which will be found in the Guide Book prepared for the visit of American and Colonial members in 1905. The kindness of Dr. and Mrs. Haig-Brown to those members who visited the Charterhouse on that occasion will long be remembered.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows.—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 12.)

English Patents.

Evaporation or concentration of liquids; Apparatus for the ——. C. L. Prache and C. G. V. Bouillon, Paris. Eng. Pat. 26,065, Dec. 14, 1905. Under Int. Conv., March 24, 1905.

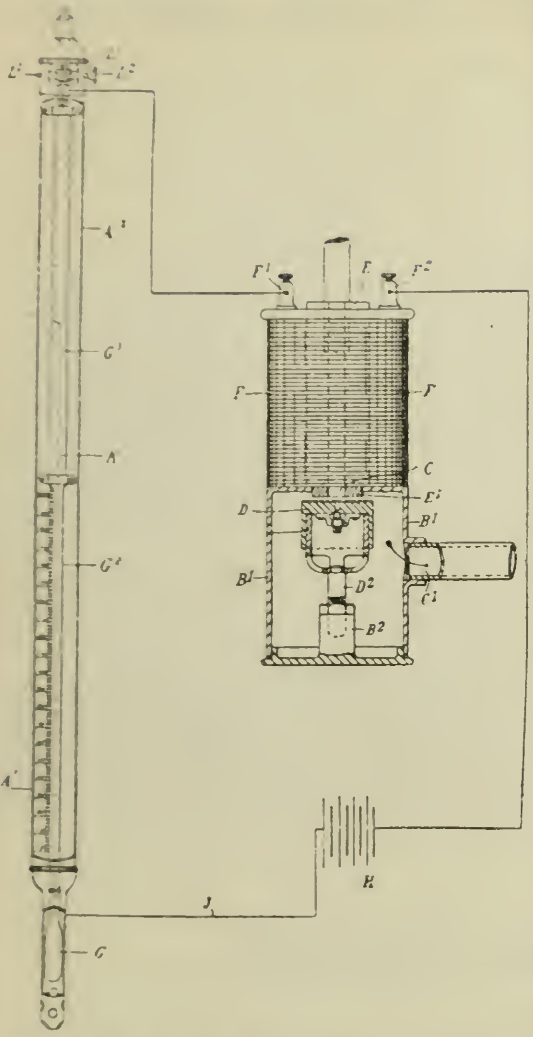
See Fr. Pat. 364,408 of 1906; this J., 1906, 874.—T. F. B.

Furnaces [; Gas-fired ——]. E. Brook, Huddersfield. Eng. Pat. 2718, Feb. 3, 1906.

The claim is for improvements in the gas-fired reverberatory furnaces described in Eng. Pat. 2657 of 1893, and consists in supplying the air to effect the combustion of the gaseous fuel through several valve-controlled openings in the furnace crown. In order to prevent any air being drawn into the furnace when the side working-doors are opened, a passage is formed in the bottom of each doorway, and connected to a flue passing under the bottom of the furnace. This flue is in connection with the chimney, and any air which enters the doors is drawn away at once to the chimney and does not pass into the furnace and cause a lowering of the temperature by diluting the gases.—W. H. C.

Regulating the temperature of ovens, dyeing vats, or the like, and for controlling the supply of fuel to a steam generator or the like, or the supply of steam therefrom; Apparatus for automatically ——. S. R. Trotman and J. E. Hackford, Nottingham. Eng. Pat. 25,576, Dec. 8, 1905.

A non-magnetic valve-casing, B^1, has an inlet, C, and an outlet, C^1. The gas or steam enters through a pipe which passes through the hollow soft iron core, E, the lower end of which forms the valve-seat, E^1. The valve, D, is also of iron, and is supported in a vertical position by the rod, D^2, and the stand, B^2. A coil of wire, F, F, is wound round the core, E, one end, F^2, being connected to one pole of the battery, H, the other pole of which is connected to the mercury in the bulb, G, of the contact



thermometer, A^1. The other end, F^1, of the coil, F, F, is connected to the rackwork, L, L^1, L^2, by which the platinum contact wire, K, is adjusted. The upper enlarged portion, G^2, and G^3, of the stem of the thermometer is filled with a non-conducting liquid, such as toluene, to prevent access of air to the mercury. The upper contact is adjusted, and the bulb, G, inserted into the space, the temperature of which is to be controlled. So long as the temperature remains below the desired point, the circuit is open, and the gas or steam enters the valve casing. When the temperature rises above the desired point, the circuit is closed, and the iron core, E, becomes an electro-magnet which closes the inlet by attracting the iron valve, D, to the seating, E^1.—W. H. C.

Controlling the supply of fuel to a steam generator, or the steam supply therefrom; Apparatus for automatically ——. S. R. Trotman and J. E. Hackford, Nottingham. Eng. Pat. 25,576A, Dec. 8, 1905.

The valve is similar to that described in the preceding abstract, but the contact is made by the pointer of a steam-pressure gauge attached to the boiler or steam main.—W. H. C.

Condensing, evaporating, or the like; Surface apparatus for ——. E. L. Cartwright, Hull. Eng. Pat. 4547, Feb. 21, 1906.

The tubes through which the heating or cooling medium is circulated are of flattened or elliptical cross-section. Each tube is formed into a coil, or is bent in the form of a series of a corrugations or waves, so as to obtain a maximum of expansion and contraction. The object is to prevent any loss in heat transmission due to the accumulation of scale, which is cracked off by the expansion and contraction of the pipes.—W. H. C.

French Patents.

Dryer; Continuous, centrifugal ——. Aktiebolaget Separator. Fr. Pat. 368,120, July 17, 1906.

A perforated cylinder provided with scrapers is interposed between the outer drum and the conical or curved plates of a centrifugal machine.—W. H. C.

Filters; Process and apparatus for washing ——. H. Reisert. Fr. Pat. 369,056, Aug. 20, 1906.

The filtering material is supported on a perforated plate situated at about half the height of a closed vessel; the liquid to be filtered is introduced through a pipe on to the surface of the filter, and the filtrate collects in the space below the perforated plate, whence it is drawn off through a siphon, so that this lower space is always filled with liquid. When it is desired to wash the filter, the inlet and outlet pipes are closed; air under pressure is passed into the lower space, and the contents of the latter are forced upwards through the filter. A wide central pipe extends through both compartments of the vessel, and serves as an outlet for the liquid forced through the filter. In order that the liquid may be emptied from the lower part by the pressure of air, a plate is fitted under the perforated partition and is bent downwards so as to form a circular pipe round the central overflow pipe. Instead of air-pressure being employed, water from a high tower may be admitted to the space below the filtering material.
—W. P. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 13.)

Benzene in illuminating gas; Technical determination of ——. D. A. Morton. J. Amer. Chem. Soc., 1906, **28**, 1728—1734.

The author finds that ammonium nickel nitrate solution (see Dennis and O'Neill, this J., 1903, 763) is but an indifferent absorbent for benzene, and that its absorbing power is due, not to the nickel compound, but to the water present. Its use leads to inaccurate results, the extent of the error varying widely according to the amount of benzene in the gas. Concentrated sulphuric acid readily absorbs benzene vapour and gives accurate results for a large number of tests without renewal. Whilst the defect due to the absorption of ethylene is insignificant, traces of the higher olefines may cause slightly too high a value.—E. F. A.

English Patents.

Furnace; Smoke-consuming ——. A. Sichert, Karlsbad, Austria Hungary. Eng. Pat. 15,516, July 9, 1906.

See Fr. Pat. 367,785 of 1906; this J., 1906, 1139.—T.F.B.

Coke ovens. W. L. Wise, London. From Solvay et Cie., Brussels. Eng. Pat. 17,996, Aug. 10, 1906.

See Fr. Pat. 368,564 of 1906; this J., 1907, 13.—T. F. B.

Suction gas producers. C. J. Atkinson, Manchester. Eng. Pat. 25,313, Dec. 6, 1905.

In order that the water-supply to the vaporiser may vary automatically in accordance with the demand for gas, there is connected to the air-supply pipe a vessel in which is a series of vertical tubes of different heights, open at the upper ends, and communicating at the lower with a water supply of constant level. When the producer is not working, no water overflows from these tubes, but when working, the suction causes the water to rise and overflow from one, two, or more of the tubes, according to the partial vacuum produced, and the overflowing water is led to the vaporiser. Instead of several tubes, there may be only one, which is provided with a vertical slit down the upper part of its length; as the water-level rises with increased suction, so does the rate of outflow through the slit increase.—H. B.

Gas and air; Process for the manufacture of a mixture of ——, for illuminating purposes, and an apparatus therefor. H. H. Lake, London. From Selas G.m.b.H., Berlin. Eng. Pat. 25,596, Dec. 8, 1905.

A mixture of gas and air, having a constant composition however the consumption may vary, is obtained by bringing the gas and air together under a constant relative pressure and velocity; the gas and air are mixed before entering the motor apparatus which delivers the mixture to the service pipes. In one apparatus described, the gas supply, which is kept at a constant pressure by means of a governor, is led through one of two meter-drums, fixed upon the same shaft, the other meter-drum serving to draw in air, and both drums deliver into a common pipe leading to a motor-driven blower, from which the mixture is delivered to the service-pipe. Since both meter-drums are actuated by the gas pressure, and revolve simultaneously, the resulting mixture is of constant composition, whatever variations occur in the demand. In another apparatus claimed, the gas supply is reduced to atmospheric pressure, and is drawn through an opening of predetermined area into a mixing chamber along with a corresponding supply of air. Since both gas and air are at the same pressure, the proportions drawn into the mixing chamber are invariable, whatever the demand. In this case the motor apparatus consists of a double-acting pump, which delivers the gases from the mixing chamber to the service pipe, the latter being fitted with a return pipe and relief valve in the usual manner.—H. B.

Carburetters. F. C. Lynde, Manchester. Eng. Pat. 25,805, Dec. 12, 1905.

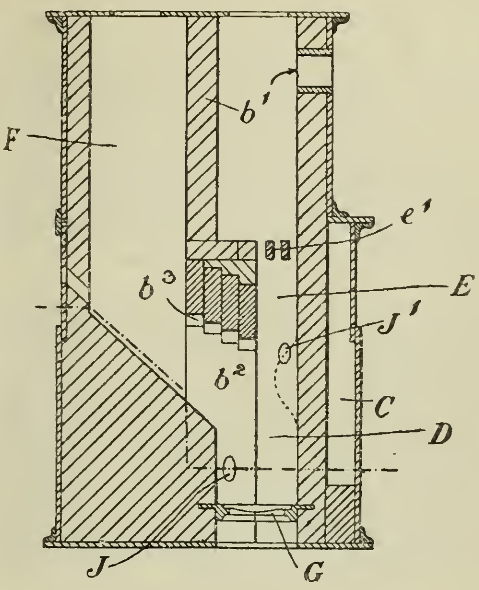
An automatic air-escape valve is fixed upon the air-supply pipe of the carburetter, and is actuated by the varying pressure of the current of air. A by-pass pipe from the air-supply pipe, by means of which a portion of the air-current is let off and mixed with the carburetted air issuing from the carburetter, is provided with an automatic valve, likewise actuated by the pressure within the air-supply pipe, for the purpose of regulating the strength of the gaseous mixture.—H. B.

Suction gas generators. J. Fielding, Gloucester. Eng. Pat. 26,829, Dec. 23, 1905.

The air, together with a regulated amount of water in the form of spray, is caused to pass radially through a hollow, circular plate, upon which the incandescent fuel rests, the mixture of air and steam issuing at the periphery of the plate and passing upwards into the fuel uniformly all round the base of the fire. A number of bars or fins within the plate break up the current of air and spray, and offer to it a large heating surface. The current of air and spray is admitted at the under side of the hollow plate, through a central pipe, which permits of the plate being either stationary or rotatable.—H. B.

Producer gas plants. G. L. Morton, Gedling, Notts. Eng. Pat. 1980, Jan. 26, 1906.

The producer is designed for use with bituminous fuel, the object being to insure a high temperature and the presence of carbon dioxide at the point where the raw fuel enters the generator, so that tarry matters may be decomposed, and the liberated carbon converted into monoxide by the carbon dioxide. In the illustration, which shows a sectional elevation of the producer, the fuel-container, F (which is fed through a suitable hopper), has a sloping bed, which causes the fuel to fall into the combustion zone, D, as required, the container, F, communicating with the combustion zone, D, through an arched opening, b^2, having a stepped roof, b^3, in the dividing wall, b^1. To ensure the presence of sufficient carbon dioxide in the gases at this point, tuyères, J and J^1, are provided for admitting hot air from the space, C, between the refractory lining and the outer casing. G is the fire-grate; intense heat is therefore radiated upon the incoming fuel. The hot gases, on their way to the condenser and scrubber, pass up the "conversion space," E, and through iron slag, coke, or the like, which rests on the bars, e^1, and serves to entrap any unattacked carbon in the gas.—H. B.



Gas generators. V. Sepulchre, Paris. Eng. Pat. 6935. March 22, 1906. Under Int. Conv., March 25, 1905.

See Fr. Pat. 361,127 of 1905; this J., 1906, 583.—T. F. B.

Steam and gas generators; [Electrical ——]. F. A. Weigel and I. Wolf, Johnetta, Pa., U.S.A. Eng. Pat. 22,049, Oct. 5, 1906. Under Int. Conv., Oct. 5, 1905.

The steam and gas generator, which is designed to operate a steam engine of ordinary construction and is connected to the steam-chest thereof by means of a pipe, consists of a strong cylinder, connected to a water supply and provided internally with two carbon electrodes, one of the electrodes being mounted loosely so that it may be capable of reciprocating rapidly, thereby causing sparks to pass from the end of the one electrode to the adjacent end of the other, in presence of the water. On passing an electric current of high amperage and voltage through the generator, a mixture of steam, hydrogen, and oxygen is produced, and is led into the steam-chest of the engine. The rapid reciprocation of the loose carbon electrode is effected by a rocking beam, to one end of which the carbon is connected, whilst the other end rests upon the periphery of a wheel, provided with a number of lugs or cam-surfaces, and driven by the steam engine. As the wheel revolves, the cam-surfaces cause the end of the beam to rise and fall rapidly, imparting a corresponding movement to the electrode at the other end.—H. B.

Filaments from tungsten or molybdenum, or an alloy thereof; Manufacture of electric incandescence lamp ——. A. G. Bloxam, London. From J. Lux, Vienna. Eng. Pat. 27,002, Dec. 27 1905.

FILAMENTS are made of tungsten, molybdenum, or alloys thereof, by triturating the trioxides or acid hydroxides of these metals (with or without admixture of the metals themselves, or of other compounds thereof, free from carbon), together with excess of ammonia solution, or solutions of mono- or polyamines (especially nitrogen bases of alcohol radicals, such as butylamine), the tough plastic mass produced being then converted into incandescence filaments by heating to redness with exclusion of air, as usual.—H. B.

Filaments of tungsten or molybdenum for electric incandescence lamps; Manufacture of ——. A. G. Bloxam, London. From J. Lux, Vienna. Eng. Pat. 9020, April 14, 1906.

TUNGSTEN dioxide, or molybdenum sesquioxide, is mixed with an ammoniacal solution of casein or an aqueous solution of isinglass, lævulose, or the like, in such proportion that the carbon thus introduced may afterwards be completely burnt to carbon monoxide or dioxide by the oxygen of the metallic oxide; the mixture is worked to a plastic mass, fashioned into threads, carbonised to decompose the agglutinant, and finally heated in a vacuum, in a reducing gas, or in an indifferent atmosphere, by means of the electric current.—H. B.

Incandescing bodies for electric lighting and heating purposes. Allgemeine Elektricitäts-Ges., Berlin. Eng. Pat. 18,485, Aug. 17, 1906. Under Int. Conv., Aug. 29, 1905.

A COMPOUND of a metal of high melting-point, with an element of the silicon or boron group, is mixed with not less than 10 per cent. of a second-class conductor, and the mixture is formed into filaments. For example, an intimate mixture of tantalum silicide and the oxides of yttrium and erbium is rendered plastic by means of a suitable organic binder, and formed into filaments, which are ignited in the open air until the binding material has been eliminated, and are then heated to incandescence *in vacuo* or in an inert atmosphere until uniform. The efficiency of the filaments so prepared can be increased by incorporating with them a certain proportion of carbon; for example, by admitting gasolene vapour into the bulb after the above incandescing operation, continuing the incandescence for the desired period, and finally heating the filament to a white heat *in vacuo*. The metallic oxide and carbon are stated to exist side by side.—H. B.

UNITED STATES PATENT.

Retort; Gas ——. M. J. Keough, St. Louis, Mo. U.S. Pat. 832,131, Oct. 2, 1906.

THE claim is for a retort for gasifying petroleum or other liquid hydrocarbons, and consists of a series of outer fire-clay semi-circular retorts, set in a furnace and heated in the usual manner. A tube, closed at the rear end and of smaller diameter, is inserted into the clay retort so as to leave an air space between the two. The open end of the inner retort projects beyond the front of the outer one into a metal heating and gas-collecting chamber placed in front, and common to several retorts. Oil is passed through a coil in the heating chamber and delivered in a thin stream into the inner retort by a pipe which lies along the bottom of the latter, and owing to the even temperature maintained by the air-jacket is continuously and completely gasified, without the formation of deposits of carbon, and gas passes through the open front of the metal retort into the heating chamber, from which it is conducted away through a pipe at the top.—W. H. C.

FRENCH PATENTS.

Gas for all purposes; Process and apparatus for the production of mixed and low grade ——. G. Laquai. Fr. Pat. 369,045, Aug. 20, 1906.

THE apparatus described has a fuel chamber provided with a feed-hopper and step grates and necessary stirring and cleaning openings. The lower end of the lower step-grate is extended into a flat grate, beneath which is a water ash-pit. Above the middle of the flat grate is a hanging partition, which divides the producer into two compartments, one being the fuel chamber above mentioned, and the other a gas reducing compartment, filled with incandescent material. A steam generator is arranged in the upper part of the hanging partition, and in the lower part of this are passages for the gas to pass from the first to the second chamber. Gas can also pass from one to the other compartment at a lower level, namely at the point of contact on the flat grate. The gas, after passing up through the second or reducing compartment, is withdrawn from the top by a pipe, by which it is carried down to a hydraulic main, from which it is withdrawn for use. The down gas-pipe to the hydraulic main is surrounded by a cylinder in which is a spiral partition, which forms a closure between the down gas-pipe and the cylinder. Air is introduced at the bottom of the cylinder, and in ascending this it becomes heated by the gas passing down the exit-pipe to the hydraulic main. Means are provided for charging the heated air in the spiral channel with steam. The heated air charged with steam is admitted by a pipe, provided with a regulating valve, into the reducing compartment of the producer, at the same level, but on the opposite side, as the upper gas passages which connect the two compartments. By a suitable arrangement of pipes, heated air from the cylinder and steam from the steam generator in the partition between the compartments of the producer, can be introduced beneath the step-grate into the fuel combustion compartment.—W. C. H.

Zinc ores and ammoniacal gas liquor; Reciprocal treatment of ——. F. Chevalet. Fr. Pat. 369,046, Aug. 20, 1906. X., page 53.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 14.)

Reduction [of nitrobenzene]; A new method of ——. T. Weyl. Ber., 1906, **39**, 4340—4343.

THE hydrogen phosphide which is produced when red phosphorus is boiled with water, acts as a reducing agent. The reduction of nitrobenzene by this means was studied, and in one experiment in which 25 grms. of nitrobenzene were heated with 25 grms. of red phosphorus and 100 grms. of water in a closed vessel for 35 hours at 100° C., a yield of 86·2 per cent. of the theoretical quantity of aniline was obtained. At 110°—115° C. only a small quantity of aniline was formed, and ammonia was detected in the products. The reaction proceeds according to the equation: $3C_6H_5.NO_2 + 4PH_3 = 3C_6H_5.NH_2 + 2H_3PO_3 + 2P$ the phosphorus reacting with water as follows:—$4P + 6H_2O = 3H_3PO_2 + PH_3$.
—J. C. C.

Petroleum; Synthesis of —— *from calcium carbide.* K. Charitschkow. Westnik shirow. prom. 1906, **7**, 180; Chem.-Zeit., 1906, **30**, Rep., 465.

A SAMPLE of petroleum prepared by the synthetic method of Sabatier and Senderens (reaction of acetylene and hydrogen in presence of nickel; see this J., 1902, 853) furnished 5·0 per cent. of distillate up to 150° C., 14·5 per cent. boiling between 150° and 200° C., 29·25 per cent. between 200° and 270° C., and 50·75 per cent. of residuum, the latter being very thick and with the characteristic smell of masut. The residue contained: Hydrogen, 9·25 per cent.; carbon, 88·47 per cent.; and oxygen, 0·42 per cent., indicating the presence of a higher proportion of unsaturated hydrocarbons than in natural Russian oil. Sulphuric acid extracts 80 per cent. from this artificial residuum, or about 20 per cent. more than from the natural residuum; and the substance exhibits in a marked degree the "oil tar" properties of Grosny residuum. The fractions resemble those from the destructive distillation of masut, in their high content of unsaturated hydrocarbons.—C. S.

Kerosine and benzine [Petroleum spirit]; Theory of the chemical purification of ——. K. Charitschkow. Westnik shirow. prom., 1906, **7**, 124. Chem.-Zeit., 1906, **30**, Rep., 476.

The chemical processes occurring in the purification of petroleum distillates by oxidising agents and the like, have not hitherto been clearly explained. The change of colour is due to oxidation and to the presence of unstable sulphuric esters. These are decomposed in secondary reactions, forming dark resinous bodies which dissolve in the hydrocarbons. Sulphur compounds may partly account for the smell in crude benzine. The author found thiophene in benzine from Grosny, and Girard has found both thiophene and dimethylthiophene in other kinds of petroleum. The odour may also be attributable to ethylene and acetylene compounds of saturated or unsaturated alcohols, or to nitrogenous bodies, especially in the case of lamp oil and benzine from lignite tar or bituminous shale. Most of the impurities can be removed with sulphuric acid; others, *e.g.*, benzine from Grosny and Bibi-Eibat petroleum, require treatment with chromic acid or fuming sulphuric acid. Crude petroleum contains, in general, about 0·2 per cent. of nitrogen, but that from the Ferghana field contains as much as 0·57 per cent. in the form of pyridine, pyrrol, and similar bodies, of b. pt. 110°—120° C.—R. L.

ENGLISH PATENT.

Distilling coals and other hydrocarbonaceous substances; Process and apparatus for ——. W. P. Thompson, London. From H. Wurts, jun., Newark, N.J., U.S.A. Eng Pat 753, Jan. 11, 1906.

The apparatus is designed for the distillation, at a temperature just below red-heat, of the heavy oils, waxes, phenols, &c., from cannel and bituminous coals, lignites, &c., with production of the minimum quantities of products of destructive distillation, the method consisting in heating the material, placed in shallow superposed trays within a gas-tight chamber, in a current of the "deoxidised" gaseous products of combustion derived from the contiguous furnace which heats the chamber. The trays within the chamber are arranged inside a casing, which is open at top, front, and bottom, and can be withdrawn on opening the front of the chamber, for convenience of access to the trays. The trays are spaced and "staggered" relative to each other, so that the hot flue-gases on entering the chamber first pass along the surface of the material in the top tray, then pass below the tray in the opposite direction, and so zig-zag downwards to the bottom of the chamber, and thence through an exhauster to the condenser.—H. B.

FRENCH PATENTS.

Acetone; Manufacture of ——. Pagès, Camus et Cie. First Addition, dated July 27, 1906, to Fr. Pat. 361,379, April 14, 1905.

The process described in the main patent (see Eng. Pat. 8757 of 1906, this J., 1906, 634), is, according to the present Addition, carried out under reduced pressure.—W. H. C.

Zinc ores and ammoniacal gas-liquor; Reciprocal treatment of ——. F. Chevalet. Fr. Pat. 369,046, Aug. 20, 1906. X., page 53.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 16.)

Sodium β-naphthalenesulphonate; Solubility of —— in water and hydrochloric acid. E. Fischer. Ber., 1906, **39**, 4144—4145.

The following table gives the amount of sodium salt taken up by 100 parts of solvent at 23·9° C. :—

	H_2O.	*N*-HCl.	2*N*-HCl.	3*N*-HCl.	5*N*-HCl.
	5·93	6·49	5·35	4·12	2·40
	6·12	6·36	5·34	4·13	2·43
	6·08	6·55	—	—	—
Average :	6·04	6·47	5·35	4·13	2·42

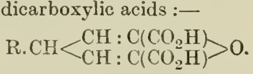
—D. B.

Pyrone series; Researches in the ——. E. E. Blaise and H. Gault. Bull. Soc. Chim., 1906, **35**, 1261—1264.

With the object of obtaining derivatives containing the pyrone nucleus, the authors prepared 1:5-diketonic acids by condensing oxalacetic ester with acyl aldehydes and saponifying the product with acids, thus :—

$$(C_2H_5.CO_2)_2:CH.CHR.CH:(CO_2.C_2H_5) \rightarrow$$
$$CO_2H.CO.CH_2.CHR.CH_2.CO.CO_2H.$$

These diketonic acids are easily dehydrated with formation of γ-pyrone-*aa*′-dicarboxylic acids :—

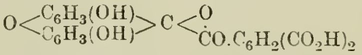


$$R.CH<\begin{matrix}CH:C(CO_2H)\\CH:C(CO_2H)\end{matrix}>O.$$

—J. C. C.

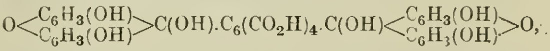
Colour and fluorescence; Relationship of —— to constitution. I. Condensation products of mellitic and pyromellitic acids with resorcinol. O. Silberrad. Chem. Soc. Trans., 1906, **89**, 1787—1811.

On heating together resorcinol and mellitic acid, $C_6(CO_2H)_6$, or pyromellitic acid, $C_6H_2(CO_2H)_4$, at about 150°—160° C., condensation occurs, dyestuffs analogous to the phthaleins, and which may be regarded as xanthyl derivatives, being produced. The following compounds were prepared :—(1) From pyromellitic acid and resorcinol-3.6.9-trihydroxyxanthylbenzene-2-carboxylactone-4.5-dicarboxylic acid :—



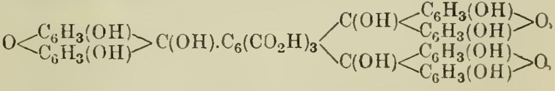
$$O<\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}>C<\begin{matrix}O\\CO.C_6H_2(CO_2H)_2\end{matrix}$$

which melts above 300° C., and dyes silk and wool a brilliant yellow. The 2.4.5.7-tetrabromo-derivative dyes wool and silk a brilliant crimson. (2) From mellitic acid and resorcinol, 3.3′.6.6′.9.9′-hexahydroxy-*m*-dixanthylbenzene-2.4.5.6-tetracarboxylic acid :—



$$O<\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}>C(OH).C_6(CO_2H)_4.C(OH)<\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}>O,$$

which decomposes above 300° C. without melting, and dyes silk and wool a brownish-yellow. The 2.2′.4.4′.5.5′.7.7′-octabromo-derivative dyes wool and silk pink. (3) The dixanthyl derivatives may exist in two modifications, according as the xanthyl groups are meta or para to one another. By using the 1.4-diethyl ester of mellitic acid instead of the free acid, and afterwards saponifying the condensation product, the corresponding *p*-dixanthyl-derivative is obtained. This also decomposes above 300° C. without melting; it dyes wool and silk yellow, and its solutions exhibit a more intense fluorescence than those of the meta compound. The octabromo-derivative dyes silk and wool brownish-pink. (4) From mellitic acid and resorcinol, 3.3′.3″.6.6′.6″.9.9′.9″-nonahydroxy-*sym*-trixanthylbenzene-2.4.6.tri-carboxylic acid :—

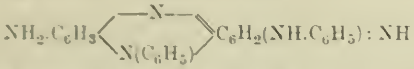


This compound dyes silk and wool brownish-yellow. The dodecabromo-derivative dyes silk and wool red with a tinge of violet, and the corresponding iodo-derivative gives pink shades.

It will be seen that the mellitic derivatives are hydrated, and contain the full complement of carboxyl groups, whereas the pyromellitic derivatives are anhydrides or lactones. The author points out that the view currently accepted that the colour of the phthaleins is due to a quinonoid structure (compare this J., 1904, 319; 1906, 749), and their fluorescence to the oscillatory tautomeric relationship of the carbinol form with the corresponding lactone (compare this J., 1903, 127) is open to considerable doubt, since many of the analogous melliteins and pyromelliteins, although intensely coloured and strongly fluorescent, and capable of dyeing wool and silk, cannot be reasonably formulated as quinone derivatives, and admit of no possibility of tautomerism. The results point rather to the correctness of Baeyer's view, that the colour of phthaleins and other dyestuffs is due to a peculiar form of carbon linking (this J., 1905, 326, 432). In the present case the 9-carbon atom of the xanthyl-derivatives, corresponding to the carbinol carbon atom of triphenylcarbinol derivatives, appears to possess latent chromophoric properties, the development of which depends on the substituents in the xanthyl or other groups attached thereto. In these xanthyl-derivatives, also, the change from the lactonic to the carbinol form and *vice versa* does not take place with the ease which is generally assumed in the case of the phthaleins.—A. S.

Safranines; Method of preparing symmetrical ——. P. Barbier and P. Sisley. Bull. Soc. Chim., 1906, **35**, 1278—1282. (Compare this J., 1906, 1037.)

Sym-Anilidophenosafranine is prepared as follows:—20 grms. of aminoazobenzene are mixed with 23 grms. of aminoazobenzene hydrochloride and 100 grms. of phenol, and the mixture heated at between 140° and 150° C. The mass becomes at first violet-red, and finally violet. After heating for 1 hour the phenol is removed by a current of steam, and the violet solution filtered. On adding salt, the dyestuff of formula:—



$$\mathrm{NH_2.C_6H_3}\genfrac{<}{>}{0pt}{}{\mathrm{—N=}}{\mathrm{N(C_6H_5)}}\mathrm{C_6H_2(NH.C_6H_5):NH}$$

is precipitated. It dyes silk and mordanted cotton violet-blue. Similarly, when 22 grms. of *p*-aminoazotoluene (prepared from *o*-toluidine) are heated with 26 grms. of the hydrochloride and 100 grms. of phenol for 2 hours to 200° C., *sym*-tolusafranine is obtained. On heating 23 grms. of *p*-aminoazobenzene hydrochloride with 25 grms. of benzeneazo-*α*-naphthylamine and 100 grms. of phenol gradually to 180° C., an operation which should take about 2 hours, slender, brown needles with a light bronze reflex are produced, which dissolve in water to a Magenta-red solution. These consist of naphthophenosafranine, which dyes silk and mordanted cotton in bluer shades than do pheno- or tolu-safranine.—J. C. C.

English Patents.

Dyestuffs; Manufacture of new monoazo ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8490, April 9, 1906.

See Fr. Pat. 365,040 of 1906; this J., 1906, 922.—T. F. B.

Colouring matters of the thiazine group; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,052, April 30, 1906.

Thiazine dyestuffs containing an alkylamino group are converted into dyestuffs giving different shades in dyeing, by treatment, in acid solution, with an oxidising agent. The dyestuff obtained from Methylene Blue, for example, yields shades which are redder than those produced by Methylene Blue itself, when dyed on tannin-mordanted cotton.—T. F. B.

Anthracene series; Manufacture of new derivatives of the ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 10,866, May 9, 1906.

See Fr. Pat. 365,005 of 1906; this J., 1906, 979.—T. F. B.

Colouring matter [Thio Indigo Red]; Manufacture of sulphur-containing red ——. Kalle und Co. Akt.-Ges., Biebrich on the Rhine, Germany. Eng. Pat. 16,100, July 16, 1906. Under Int. Conv., July 28, 1905. (Compare this J., 1906, 424.)

Instead of heating the glycine of thiosalicylic acid (*o*-carboxyphenylthioglycollic acid) with aqueous caustic soda, and converting the thioindoxylcarboxylic acid into thioindoxyl, the latter may be obtained by heating *o*-carboxyphenylthioglycollic acid to its melting point, water and carbon dioxide being evolved. The thioindoxyl may be obtained from the fused mass by dry distillation or by distillation in a current of steam, or it may be oxidised to the red dyestuff. Example: 20 kilos. of *o*-carboxyphenylthioglycollic acid are gradually heated to 230° C., and the mass maintained at that temperature until no more gas is evolved. A little thioindoxyl distils over with the gases. After cooling, the melt is mixed with the distillate and dissolved in aqueous caustic soda. The solution is mixed with a solution of potassium ferricyanide until no more precipitate is formed, and the dyestuff is filtered off, washed, and dried.—J. C. C.

Colouring matter [Thio Indigo Red]; Manufacture of sulphur-containing red ——. Kalle und Co. Akt.-Ges., Biebrich on the Rhine, Germany. Eng. Pat. 16,101, July 16, 1906. Under Int. Conv., Aug. 9, 1905.

In the preparation of thioindoxylcarboxylic acid (this J., 1906, 444) by heating *o*-carboxythioglycollic acid with acetic anhydride with or without the addition of sodium acetate, it is now found that it is sufficient to stir the substances together and to heat the mixture to a moderate temperature for a short time. Example: 10 kilos. of *o*-carboxyphenylthioglycollic acid are mixed with about 50 kilos. of acetic anhydride and 2 kilos. of sodium acetate, and the mixture is heated for a short time to from 50° to 80° C. If the temperature be raised, or the mixture heated for a long time, thioindoxyl is formed.—J. C. C.

Thioindoxylcarboxylic acid; Manufacture of ——. Kalle und Co. Akt.-Ges., Biebrich on the Rhine, Germany. Eng. Pat. 16,907, July 26, 1906. Under Int. Conv., Oct. 18, 1905. (Compare this J., 1906, 424.)

Thioindoxylcarboxylic acid is obtained in good yield by heating *o*-carboxyphenylthioglycollic acid or its alkali salts with caustic soda. Example: A mixture of 20 parts of disodium-*o*-carboxyphenylthioglycollate and 16 parts of caustic soda is heated for one hour to 250° C. The product is dissolved in water and acidified by a mineral acid, when the thioindoxylcarboxylic acid separates as a white powder. If the temperature be allowed to rise in the latter operation, carbon dioxide is eliminated, and some thioindoxyl is formed.—J. C. C.

Gallic acid or a derivative thereof and an alkyldiamidoarylthiosulphonic acid; Manufacture of condensation products from ——, *and of gallothionines therefrom.* [*Thiazine dyestuffs.*] O. Imray, London. From Dyeworks, formerly Durand, Huguenin, et Cie., Basle, Switzerland. Eng. Pat. 20,397, Sept. 13, 1906.

Leucogallothionine dyestuffs may be obtained by condensing gallic acid or one of its derivatives with a dialkyldiaminoarylthiosulphonic acid (*e.g.*, that of dimethyl-*p*-phenylenediamine), in presence of alkali, and with exclusion of air; the resulting alkaline product is added to excess of acid, when a stable salt of the leucodyestuff is obtained. This may be utilised at once in dyeing and printing, or it may be converted into the gallothionine dyestuff by oxidation after addition of alkali. These dyestuffs dye chrome-mordanted wool in blue to violet shades.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 17.)

Cellulose "peroxide," a new combination of cellulose with oxygen. C. F. Cross and E. J. Bevan. Z. angew. Chem., 1906, **19**, 2101—2102.

It is well known that certain cellulose fabrics, *e.g.*, linen damasks, which have been bleached without the subsequent use of an "antichlor," retain the property, characteristic of "active oxygen," of liberating iodine from potassium iodide for a much longer time than is consistent with the survival of traces of residual hypochlorites. The authors record a case in which a cotton cloth, bleached, soured, and washed under normal conditions, retained an acid reaction and oxidising properties (towards potassium iodide) even after exhaustive washing with distilled water. The acidity was removed, or rather neutralised, by short washing with hard water, but the iodide reaction persisted. On the other hand, the oxidising property was rapidly destroyed by boiling with water or by treatment with "antichlor." Dry heating, at 100° C., also destroyed the "active oxygen" in the cloth, but the fabric was distinctly "tendered." Having regard to all these circumstances the authors postulate the possibility of the formation of a peroxidised derivative of cellulose under certain conditions of the industrial textile bleaching process.—J. F. B.

Chromic oxide ; Process for fixing —— on cotton. M. Richard and D. Santarini. Bull. Soc. Ind. Mulhouse, 1906, **76**, 296—302.

A solution of an alkali bichromate is only reduced by formaldehyde-bisulphite or formaldehyde-hydrosulphite on prolonged boiling. This property may be utilised for mordanting cotton with considerable quantities of chromic oxide. 160 grms. of formaldehyde are added to 400 grms. of sodium bisulphite solution (36° B.), and allowed to stand for some time, when a solution of 200 grms. of sodium bichromate in 200 c.c. of water is added ; the fabric is impregnated twice with this solution, dried, treated for three or four minutes in a Mather-Platt apparatus, and then scoured with caustic soda solution (3° B.) at 80° C. Formaldehyde-hydrosulphite is used in a similar manner. A number of examples are given of the application of the above process in dyeing and printing.—T. F. B.

Fabrics, such as jute, linen, or plush ; Process of fixing an oxidised fatty mordant on thick ——. Caux. Chem.-Zeit., 1906, **30**, 1252.

The fabric is printed with a solution of soft soap, and then, without drying, is impregnated with a solution of bleaching powder ; an insoluble calcium soap is thus formed, which is oxidised by the hypochlorite. The treated fabric is washed, dried, and dyed in the usual way.—W. P. S.

β-Naphthol preparation for p-Nitraniline Red ; Stable ——, and the application of p-Nitraniline Red to animal fibres. C. Schwalbe. Bull. Soc. Ind. Mulhouse, 1906, **76**, 303—304.

A solution of β-naphthol or 2.7-naphtholsulphonic acid in a solution of a ricinoleate, can be preserved for several weeks without losing its power of combining with diazotised *p*-nitraniline. A solution may be made, for instance, of 25 grms. of β-naphthol and 65 to 70 grms. of sodium ricinoleate in 1 litre of water. Cotton impregnated with this solution has been kept for five days without becoming discoloured. Ammonium ricinoleate may replace the sodium soap, in which case bluer shades are produced. Since these solutions contain no free alkali, they can be used for the production of *p*-Nitraniline Red on animal fibres, or mixtures of animal and vegetable fibres. —T. F. B.

Aniline Black ; Formation of —— on the stable β-naphthol preparation. C. Schwalbe. Bull. Soc. Ind. Mulhouse, 1906, **76**, 304—305.

Aniline Black may be printed on cotton or other fibre prepared with a solution of β-naphthol and a ricinoleate soap (see preceding abstract). If the fabric be steamed for three minutes, and developed with a solution of diazotised *p*-nitraniline, a black on a red ground is obtained. Good blacks are said to be obtained, and the shades are improved by chroming, without injuring the red.—T. F. B.

Report on the two preceding processes. T. Stricker. Bull. Soc. Ind. Mulhouse, 1906, **76**, 305—307.

The reds produced with Schwalbe's naphthol solution are less brilliant than those obtained with the ordinary alkaline naphthol solution, or with the latter mixed with tartar emetic, which gives a stable solution. The method, however, is of value in its application to delicate animal fibres, and in cases where it is desired to print Aniline Black on the prepared fabric. Silk impregnated with Schwalbe's solution remains white, like cotton, the reds produced being, however, more brilliant than those obtained on cotton ; on cotton fabrics with silk stripes, the silk is more yellowish-red after dyeing than the cotton. Addition of glycerin to the naphthol preparations increases the depth of shade, and has the advantage of preventing Schwalbe's solution from becoming turbid. Bleached wool is dyed more intensely by using Schwalbe's preparation than by using the ordinary mixture of naphthol, caustic soda, and oil ; further addition of caustic soda to the latter gives deeper shades, but wool cannot be previously prepared with it, owing to rapid discoloration ; addition of tartar emetic, however, removes this objection, and the reds obtained are more intense than those produced by Schwalbe's method.—T. F. B.

English Patents.

Silk, artificial ; Method of producing ——. E. Thiele and R. Linkmeyer, Brussels. Eng. Pat. 16,088, July 16, 1906. Under Int. Conv., Aug. 25, 1905.

Threads produced from solutions of cellulose cuprammonium can only be stretched to any considerable extent during the acid treatment, *i.e.*, whilst the copper is being removed. The threads are washed with water, or a solution of a salt such as sodium sulphate, and then stretched, in the acid bath, to more than their original length, after which the tension may be released, and the threads finished without returning to their original length.—T. F. B.

Wool ; Treatment of raw ——. J. M. Baudot, Tourcoing, France. Eng. Pat. 25,681, Dec. 9, 1905. Under Int. Conv., Dec. 13, 1904.

See Fr. Pat. 349,042 of 1904 ; this J., 1905, 617.—T. F. B.

Wool fibre ; Cleaning of ——. R. and M. Puchert, Werdau, Germany. Eng. Pat. 13,752, June 15, 1906.

The improvement has reference to apparatus of the kind, in which beaters disposed spirally on a rotary shaft in a drum, operate in conjunction with a current of air blown in a longitudinal direction, and consists in the production of a whirling current by the combined action of a longitudinal forced current and several transverse suction currents through divided shafts, for the purpose of keeping the fibres afloat along the entire length of the drum, and effecting the cleaning operation more thoroughly. —D. B.

Cocoa-nut fibres ; Treatment of ——. F. Gaebelé, Paris. Eng. Pat. 12,596, May 30, 1906.

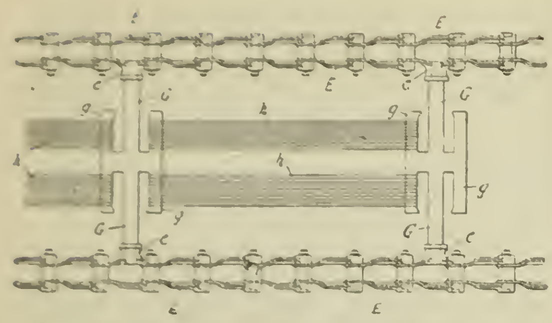
The process is for the production from cocoa-nut fibres of a material having the appearance and elasticity of animal hair, and consists in treating the raw fibre in a concentrated solution of caustic alkali of from 33° to 36° B. and at a temperature of from 25° to 30° C. for six to ten days, and then removing the liquor after maceration. The material is afterwards thoroughly washed and decorticated by passing it between rollers with wide grooves, between which a jet of water is allowed to play to completely cleanse the fibres.—D. B.

Vegetable fibres ; Preparing [degumming] ——. H. R. Bonny, Brooklyn, and R. L. Pritchard, Manhattan, U.S.A. Eng. Pat. 15.618, July 10, 1906.

The degumming process consists in placing the fibres in a horizontal position and in separate layers in a series of cages composed of open wire netting, and moving them sidewise through water containing an alkali borate (1 or 2 grains per oz.), and having a slightly elevated temperature (70°—100° F.). The removal of the colouring matter is effected by subjecting the cages containing the degummed fibres to sidewise reciprocating movement in a soap bath at a temperature of about 95° F.—D. B.

Mercerising apparatus. A. R. Miller, Bothwell, N.B. Eng. Pat. 20,519, Sept. 15, 1906.

Instead of the detachable rods or holders described in Eng. Pat. 9452 of 1899 (this J., 1900, 344), the hanks of yarn to be mercerised are stretched on fixed holders, which are composed of cross-bars permanently attached to the links of endless chains, and are formed with parallel bracket arms so that the hanks can be slipped over their ends while the machine is in motion. The links, E,



are formed with sockets, c, to which are secured the ends of cross-bars or rods, G, each fitted with bracket arms, g, preferably in the form of the letter H, so as to permit of the ends of the hanks of yarn, h, being slipped over them. —J. C. C.

Textile fibrous materials; Method and apparatus for treating —— with the products of electrolysis of water solutions of acids, oxides, and salts. H. Hey, Dewsbury. Eng. Pat. 2083, Jan. 27, 1906.

The textile material to be bleached or otherwise treated is supported on a grid, coated on one or more surfaces with metal, which is placed close to the bottom of a tank or vat containing a suitable solution. The grid forms one electrode, whilst the other, which is also perforated, is kept in position near the top of the tank, and can be removed from it at will. This is lowered on to the material in the vat, and the current is turned on, so that the products disengaged at the lower electrode diffuse through the material, whilst the gaseous products from the upper electrode pass into the air. The electrical connections are so arranged that the current can be reversed, whereby the products from each electrode may be utilised in turn. Cooling pipes and a steam coil may be added to the apparatus when necessary.—T. F. B.

Fabrics; Apparatus for treating —— with liquids. R. Hausdorf, Berlin. Eng. Pat. 11,254, May 14, 1906.

See Fr. Pat. 366,250 of 1906; this J., 1906, 981.—T. F. B

Dyeing and weaving; Spindle for use in ——. O. Bauer, Crimmitschau, and K. Suttner, Neukirchen, Germany. Eng. Pat. 16,631, July 23, 1906.

See Fr. Pat. 368,355 of 1906; this J., 1906, 1218.—T. F. B.

Dyeing and bleaching apparatus. J. Schmitt and E. Handschin, Paris. Eng. Pat. 17,660, Aug. 4, 1906.

See Fr. Pat. 368,485 of 1906; this J., 1906, 1218.—T. F. B.

Textiles, paper, leather, and other absorbent materials; Treatment of —— with compounds of alginic acid. The British Algin Co., Ltd., and T. Ingham, Holywell, and H. Bunzl, Manchester. Eng. Pat. 25,537, Dec. 8, 1905.

Solutions of the double salts of "alginic acid" (see Eng. Pat. 25,187 of 1905; this J., 1906, 908) are incorporated with water-repellant substances, such as waxes, resins, oils, &c., with which they can be readily emulsified when hot, and the products are applied to textiles, paper, leather, and the like, to produce a waterproof finish; colouring matter or filling material may be added to the mixture when desired. For the production of heavily finished fabrics such as bookbinders' cloth, it is advantageous to add glycerin, linseed oil, or a salt of a higher fatty acid. The tendency of the finish to become detached from the material may be counteracted by treating the latter with a dilute solution of the double alginate, and wholly or partially drying, before applying the concentrated finishing mixture.—T. F. B.

Warp sizing and drying machines. T. Martin and E. Bamford, Huddersfield. Eng. Pat. 7666, March 30, 1906.

The invention relates to sizing and drying machines, in which air is heated by passing through cylinders containing steam tubes. The improvement consists in connecting a pipe to the outlet, and leading the heated air back into an expansion chamber, where, under the influence of a suction fan, it is again passed through the machine, which is sealed as well as possible to restrict the entrance of cold air.—D. B.

French Patents.

Wool, horsehair, cotton, and other fibrous or textile material; Apparatus for scouring, dyeing, and treating ——. T. A. S. Wood. Fr. Pat. 368,946, July 31, 1906.

See Eng. Pat. 14,344 of 1906; this J., 1906, 1090.—T. F. B.

Degreasing apparatus; Automatic —— for raw wool. F. Bernhardt. First Addition, dated Aug. 2, 1906, to Fr. Pat. 345,718 of June 9, 1904 (this J., 1905, 85).

In the automatic degreasing apparatus described in the main patent, the level of the liquid in the different compartments of the tank becomes altered, owing to the capillary action of the wool. In order to prevent this a float is placed in the reservoir containing the most concentrated solution, and it is connected with the water valve in such a way that when the level of the liquid falls, water is admitted to the other end of the apparatus, so that the dilution is gradual. The flow of liquid from one compartment to another is automatically stopped by an arrangement which closes the overflow pipes when the machine stops; these are opened again when the apparatus is set in motion.—J. C. C.

Sizing thread and other textile material; Preparation for ——. L. Paechtner. Fr. Pat. 368,991, Aug. 17, 1906. Under Int. Conv., July 5, 1906.

See Eng. Pat. 15,300 of 1906; this J., 1906, 1144.—T. F. B.

Fibres; Method of preparing vegetable ——. H. R. Bonny and R. L. Pritchard. Fr. Pat. 369,033, Aug. 20, 1906.

See Eng. Pat. 15,618 of 1906; preceding these.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 18.)

Ammonium sulphate statistics. Bradbury and Hirsch. Jan., 1907. [T.R.]

The production of ammonia, calculated into sulphate (including that used in the manufacture of ammonia-soda and for other chemical processes) from all sources in the United Kingdom during 1906 is estimated at 283,500 tons, made up as shown in the following table, in which figures for 1904 and 1905 are added for comparison:—

	1904.	1905.	1906.
	tons.	tons.	tons.
Gas works	150,000	156,000	162,000
Iron works	19,500	20,000	20,000
Shale works	42,500	46,000	46,000
Coke and carbonising and producer gas works	33,500	46,500	55,500
	245,500	268,500	283,500

Of the 1906 production it is estimated that England contributed 186,000 tons, Scotland, 95,000 tons, and Ireland, 2,500 tons.

Magnesium chloride; Action of oxygen and steam on ——. W. Moldenhauer. Z. anorg. Chem., 1906, **51**, 369—390.

Action of oxygen on magnesium chloride.—The author has studied the equilibrium of the reaction: $MgCl_2 + \frac{1}{2}O_2 \rightleftharpoons MgO + Cl_2$, at different temperatures, and working in both directions, namely, by the action of oxygen on magnesium chloride, and of chlorine on magnesium oxide.

The lowest temperature at which oxygen acts appreciably on magnesium chloride is 350° C., but up to 500° C. the velocity of the reaction is too low for equilibrium to be attained from both sides in the course of 10 hours. At 550° C. equilibrium is attained in about 36 hours, with oxygen and magnesium chloride, and in about 5 hours with chlorine and magnesium oxide. The value of the equilibrium constant $k = C_{Cl_2} / \sqrt{C_{O_2}}$ was found to be 17·4 at 550° 25·3 at 650°, and 29·5 at 700° C. In the conversion of magnesia into magnesium chloride by the action of chlorine, the reaction is prevented at 750° C. so soon as the chlorine contains 7 per cent. of oxygen. In the reverse action of oxygen on magnesium chloride, the reaction velocity and attainment of equilibrium are both favoured by rise of temperature. The author's results indicate that the temperature of 450° C., given by Lunge as the most favourable for the Solvay process (action of air on anhydrous magnesium chloride), is much too low. Solvay's statements, however, according to which decomposition occurs to the extent of 50 per cent. at about 750° C., appear quite probable. The exceedingly high temperature required in the Weldon-Péchiney process is due to causes of a purely mechanical nature. Theoretically, the Solvay process appears to be the best, but in practice the difficulty of preparing anhydrous magnesium chloride cheaply is a great disadvautage.

Action of steam on magnesium chloride.—Ordinary hydrated magnesium chloride, $MgCl_2,6H_2O$, is stable at temperatures between −3·4° and +116·67° C.; and the tetrahydrate, $MgCl_2,4H_2O$, is stable between 116·67° and 181°—182° C., being transformed at the latter temperature into the dihydrate, $MgCl_2,2H_2O$. If a current of dry hydrochloric acid gas be passed over the tetrahydrate at 140° C., the evolution of water slackens, according to van't Hoff, when the composition, $MgCl_2,2H_2O$, is attained. The author continued the test, and, when no further evolution of water took place, found that the composition of the residue corresponded to $MgCl_2,H_2O$. There is thus another hitherto unknown hydrate of magnesium chloride—the monohydrate. Experiments at different temperatures for different periods of time, together with analyses of the residues, showed that the first step in the action of steam on magnesium chloride (at temperatures between 350° and 505° C.) is represented by the equation: $MgCl_2 + H_2O \rightleftharpoons Mg(OH)Cl + HCl$. The hydroxychloride decomposes between 500° and 510° C. The reaction at temperatures from 505° C. upwards may be represented by the equation: $MgCl_2 + H_2O \rightleftharpoons MgO + 2HCl$. With excess of steam, the decomposition can be driven further than the formation of the hydroxychloride even below 505° C., but only very slowly at 300° C. The second stage of the reaction is not simply that represented by the equation: $Mg(OH)Cl = MgO + HCl$, for if a residue of the composition of the hydroxychloride be heated further in a current of an inert gas instead of steam, water is produced as well as hydrochloric acid. Probably 2 mols. of the hydroxychloride react with formation of magnesia, magnesium chloride, and water, and then a part of the water acts on the magnesium chloride with formation of hydrochloric acid and a further quantity of hydroxychloride, and so on, until finally a mixture of magnesia and magnesium chloride is left. Experiments as to the equilibrium at different temperatures in the action of steam on magnesium chloride gave the following results, the figures representing the percentage of hydrochloric acid gas by volume in the resulting gas: at 350° C., 69·4; 400°, 62·15; 500°, 50·2; 530°, 53·7; 600°, 75·1; and 700° C., 90·2. Between 350° and 505° C., corresponding to the equation: $MgCl_2 + H_2O = Mg(OH)Cl + HCl$, the percentage of hydrochloric acid decreases with rise of temperature, the reaction being exothermic, but above 505° C. the reaction is endothermic. The recognition of this first stage of the reaction affords an explanation of the evolution of hydrochloric acid at relatively low temperatures. In practice, *e g*, in the Weldon-Péchiney process, the addition of magnesia to the magnesium chloride hinders the first exothermic reaction, and the result is that apart from solid oxychloride being easier to handle, the mixture can be dehydrated to a considerable extent without any large loss of hydrochloric acid, and then, at a higher temperature, concentrated hydrochloric acid can be obtained. If technically practicable, the best method of working would be to start with a mixture containing rather more than 1 mol. of magnesia per mol. of magnesium chloride, dehydrate at 300° C., heat the ground residue in a muffle as rapidly as possible to about 700° C. without passing in steam and finally, at the same temperature, decompose the last portions of magnesium chloride by steam. (See also this J., 1889, 190, 391; 1899, 40.)
—A. S.

Alkali metals: Anhydrous monoxides of the ——. E. Rengade. Compt. rend., 1906, **143**, 1152—1153.

By allowing an amount of dry oxygen to react on the alkali metals insufficient to convert the whole of them into monoxide, and then distilling off the excess of the metal *in vacuo*, the monoxide is left behind in a pure state. Cæsium oxide is thus obtained in good crystals, the oxides of rubidium and potassium as confused crystalline masses, and sodium oxide as a quite amorphous body. Certain of the phenomena presented during the reaction suggest that a sub-oxide may be first formed, which at a higher temperature dissociates, forming metal and monoxide. Such a sub-oxide of sodium has already been described (this J., 1899, 870). These sub-oxides might be obtained by the slow distillation of the excess of metal *in vacuo* at a low temperature.—J. T. D.

Iron alum: Cause of the amethyst colour of ——, and mixed crystals of iron alum and manganese alum. O. T. Christensen. Kgl. Danske Vidsk. Selsk. Förh., 1906, [4], 173—195. Chem. Centr., 1906, 2, 1807.

The view that the colour of iron alum is due to the presence of traces of manganese has not hitherto been confirmed analytically. By repeated fractionation of a large quantity (6 kilos.) of violet iron alum, the author, however, succeeded in obtaining finally a mother-liquor, in which manganese could be detected. An iron alum with a distinct amethyst colour contains about 0·00077 per cent. of manganese. Attempts to prepare iron alum free from manganese failed; crystals which were apparently quite colourless yielded, on repeated fractionation, crystals with a faint amethyst colour. When the iron alum contains larger quantities of manganese (*i.e.*, mixed crystals of iron and manganese alums), the colour becomes redder with increase of the amount of manganese. In this case the colouring agent is manganese alum (red), but in the ordinary violet iron alum, the colouring matter is probably a green double sulphate of iron and manganese.—A. S.

Boron sulphide; Preparation of —— from manganese boride. J. Hoffmann. Z. angew. Chem., 1906, **19**, 2133—2134.

The employment of manganous instead of iron boride for the preparation of boron sulphide is recommended as being about 33 per cent. cheaper. The process is similar to that used in the preparation from the iron compound. The reaction commences at a temperature which will melt zinc but not antimony, whilst temperatures high enough to melt the latter cause it to become very marked. The boron sulphide forms both a crystalline and an amorphous deposit in the tube, and a vitreous modification may be obtained by heating in a stream of sulphuretted hydrogen. The latter modification is more resistant than either the amorphous or crystalline varieties.—S. R. T.

Alkali chlorides; Electrolysis of —— with alternating current. II. A. Coppadoro. XIA., page 53.

Ferrous salts; Titration of —— with alkali hypoiodite. E. Rupp and M. Horn. XXIII., page 63.

English Patents.

Ammonia; Absorbers for ——. Clarke, Chapman, and Co., Ltd., Gateshead. and J. Robson, Wallsend. Eng. Pat. 24,840A, Nov. 30. 1905.

The absorber consists of a box, which contains water, and is divided into compartments by horizontal plates having apertures at alternate opposite ends. The lower compartment is separated, by a vertical perforated plate, into two parts, into one of which the gas-inlet pipe extends. Cooling coils pass longitudinally through the compartments and through the apertures in the partition plates. —D. B.

Aluminium oxide from bauxite; Production of ——. G. Muth, Duisburg a/Rhein, Germany. Eng. Pat. 25,477, Dec. 7, 1905.

See Fr. Pat. 360,086 of 1905: this J., 1906, 478.—T. F. B.

Nitrate of ammonia; Production of ——. W. Feld, Hönningen on Rhine, Germany. Eng. Pat. 5776, March 9, 1906.

See Fr. Pat. 365,409 of 1906: this J., 1906, 928.—T. F. B.

French Patents.

Sulphitometer or tube for measuring [liquid] sulphur dioxide. P. V. Pacottet. First Addition, dated Aug. 2, 1906, to Fr. Pat. 365,224, April 13, 1906 (this J., 1906, 928).

The present Addition relates chiefly to improvements in the fittings of the device described in the main patent. The three-way cock at the bottom of the graduated glass tube is replaced by two separate cocks closed by ebonite screws, and the inlet and outlet channels for the liquid sulphur dioxide are hollowed out of the base-plate supporting the glass tube. The pointed screw to close the hole in the upper end of the glass tube is made of ebonite. Modifications in the joints between the glass tube and the upper and lower plates between which it is supported, and also in the device by which the tube is held in position between these plates, are also described.—A. S.

Oven for calcining alumina at a high temperature, and generally applicable for calcining light pulverulent materials. Soc. Electro-Métall. Franç. First Addition, dated Aug. 3, 1906, to Fr. Pat. 364,736, March 29, 1906 (this J., 1906, 984).

A single main gas flue is arranged over the ovens, and the connection to the combustion chambers is made by a movable bent pipe which fits into openings in the flue. The whole or part of the secondary air is preheated, before its admission to the ovens, by causing it to circulate through flues formed in the walls of the gas producer and in the lower part of the oven itself.—W. H. C.

Sulphur sublimation chambers. A. Boude et Fils. Fr. Pat. 369,089, Aug. 21, 1906.

This invention is for an arrangement to use those parts of sulphur sublimation chambers that are most favourable for proper condensation, and consists in the use of arches of any geometrical form and of any material. The arches are ranged along a diameter perpendicular to the breadth of the chamber, and rise to the right and the left from the inlet opening for the sulphur vapour.—W. C. H.

German Patent.

Mercury cathode for the electrolysis of salt solutions. A. Sinding-Larsen. Ger. Pat. 172,682, July 31, 1904. XIA., page 54.

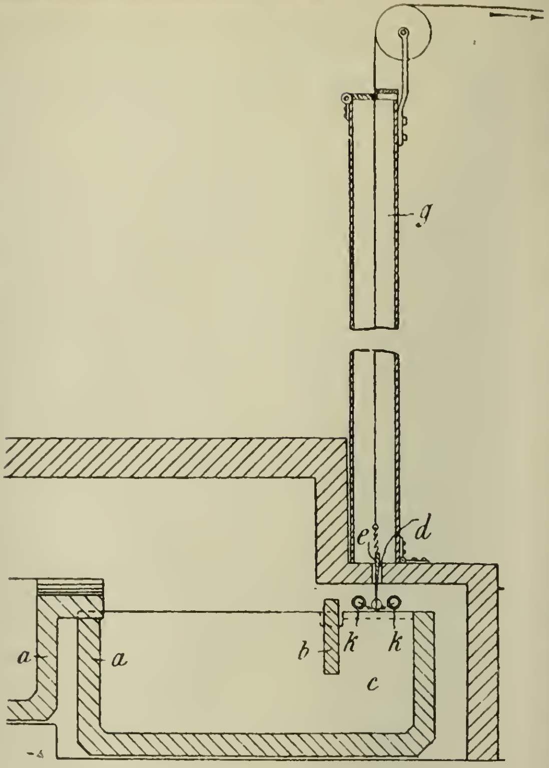
VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 18.)

English Patents.

Glass; Process of drawing window or plate ——. C. Menzel, Lommatzsch, Germany. Eng. Pat. 20,507, Sept. 15, 1906.

This invention relates to a process for the manufacture of window or plate glass by dipping a bar-shaped adhesion device into a glass bath in a melting furnace, and drawing it out again with a uniform motion, air being simultaneously blown against the glass at its egress from the bath. The molten glass is transferred from the melting pots into the working vessel, *a*. The latter is divided into two compartments by means of a partition, *b*. The partition extends about halfway into the bath, so that the glass can pass underneath, a small space, *c*, being thus provided for the drawing of the glass plates. The vault, which closes the drawing compartment at the top, is provided with a narrow slit, *d*, which permits of the introduction and withdrawal of an adhesion bar, *e*. The box, *g*, forms, above the slit, *d*, an air-tight space for the reception of the freshly-drawn glass plates. Opposite to the place where the adhesion bar leaves the glass bath, there are arranged on both sides, blowpipes, *k*, provided with a large number of small holes, so that an air current, introduced into the pipes on both sides, will be directed to the point where the glass leaves the bath. The box, *g*, which encloses the drawing device, also serves for cooling the plates. As soon as the glass plate has been drawn to the required length, the current of air through *k* is discontinued, and the lower end of the plate is melted off. —O. R.



Glass ware; Manufacture of ——. R. Redl, Bischofswerda, Germany. Eng. Pat. 22,850, Oct. 16, 1906.

This is a process of coating glass articles with one or more films of coloured glass. Glass dust is melted with the required pigment and a suitable flux. The homogeneous mass is finely powdered, made into a paste with turpentine, and applied, cold, over the glass foundation, in the form of a jet from a bellows or suitable blowing apparatus. After the film has been deposited, the article is burnt in a muffle or burning oven.—O. R.

German Patent.

Ceramic articles; Process for the manufacture of —— by pressing. E. Conrad. Ger. Pat. 166,207, Oct. 11, 1904.

The material in the moulds, before being compressed, is heated in a vacuum until the whole of the moisture is evolved. It is stated that the occurrence of cracks in the finished articles is prevented by this process.—A. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 20.)

Cement trade; London ——. Ch. of Comm. J. Supp., Jan., 1907. [T.R.]

This trade has been slightly better on the whole than in 1905, but prices have been still much lower than they need have been in view of the great demand. There is an increased demand for cement for ferro-concrete buildings and works of similar descriptions. The importation of foreign cement is again falling off. For the eleven months ended November, 1906, the imports amounted to 161,269 tons, as compared with 221,132 tons in the similar period of 1905, and 258,467 tons in the eleven months of 1904. The export figures show a satisfactory increase, the figures for the eleven months being 607,976 tons in 1906, as against 415,974 tons in 1905, and 352,094 tons in 1904. Steps continue to be taken to put a stop to the piracy of English brands.

English Patent.

Brick kilns and the like; Continuous ——. S. Barnett, Tipton, and R. J. Hadlington and S. Hinton, West Bromwich, Staffs. Eng. Pat. 6333, March 16, 1906.

This invention relates to continuous kilns of the Hoffmann type, and consists essentially of an arrangement of two or more separate grates or furnaces, which is interposed between each pair of successive chambers. The grates run parallel to the sides of the kilns, are fired from the top or ends, and are connected by suitable apertures or flues. A main flue runs under each pair of grates, parallel to the sides of the kiln. Into the main flue, cross connecting flues pass from the centre of the bottom of the adjoining kiln, with dampers, which enable the waste heat to be utilised in the ordinary way. Steam flues are provided, one running centrally, and two running one on each side, for the whole length of the series. These flues are in communication with a stack, which provides the required draught. After the first kiln has been fired from the grates on either side, and when such fires are being drawn, the next kiln is fired from its own grates, and so on, each kiln being finally heated by the gases generated in the grates on either side.—O. R.

French Patents.

Paving, &c.; New material of construction for —— [*from cellulose and caoutchouc*]. V. de Reversat-Marsac. Fr. Pat. 368,542, July 31, 1906.

The new paving material consists of cellulose, obtained by powdering the shells of cocoa-nuts, mixed with caoutchouc. The mixture is compressed and vulcanised.

—A. G. L.

Sawdust; Agglomerate of —— *for making light bricks and other light building materials.* J. Augros and L. Girard. Fr. Pat. 368,624, Aug. 4, 1906.

Sawdust is mixed with sufficient water, preferably boiling, to form a thick paste, and boiling tar or pitch is then added. The mixture is allowed to cool, moulded into bricks, &c., under pressure, after which the bricks are burnt at a regulated temperature. They may be made fireproof by dipping them into a bath of milk of lime, and allowing them to dry in the air.—A. G. L.

Slates designed for covering roofs, &c.; Process for the manufacture of artificial ——. R. Heusch. Fr. Pat. 369,029, Aug. 20, 1906.

In this process for the manufacture of artificial slates, cellulose (woody or plant fibres) is used in place of fibrous asbestos. A suitable quantity of plaster of Paris and a colouring material is added to cement or hydraulic lime, and the mass is mixed with cellulose. The slates produced by this process are light in weight, cheap, and easily made.

—W. C. H.

Marble; Process for the manufacture of artificial ——. G. B. Numann. Fr. Pat. 369,037, Aug. 20, 1906.

The first part of this process for the manufacture of artificial marble consists in subjecting to a very considerable pressure a mixture of plaster of Paris, sand, and colouring materials, to form a stone block. These blocks are then impregnated with an aqueous solution of glue, and polished with suitable chemical products, for example, with a block composed of resins and inert material, such as amaryllis. The blocks are then dried, rubbed with oil, and finally treated with a fatty or waxy body until they are polished.

—W. C. H.

Sorel cement; Process of manufacture of ——. B. Neuburger. Fr. Pat. 368,434, July 19, 1906.

Magnesite, free from sodium salts, is dissolved in hydrochloric acid, and the liberated carbon dioxide is led through a solution of magnesium chloride obtained in a previous operation. On mixing the magnesium chloride solution with magnesium oxide, magnesium carbonate is formed, which greatly augments the strength of the cement.

—A. G. L.

German Patents.

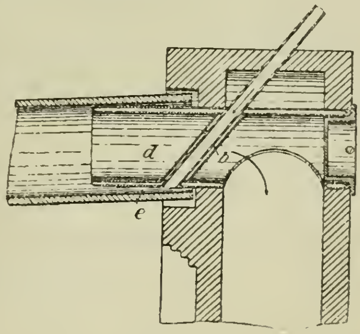
Plaster of Paris moulds; Process for the manufacture of strongly water-absorbent——. Deutscher Gips-Verein, E. V. Ger. Pat. 167,518, Oct. 13, 1904.

The plaster of Paris, before use, is mixed with a small quantity (about 0·25 per cent.) of sodium carbonate, or water containing a small proportion of this salt is used for mixing the plaster.—A. S.

Stone, artificial; Process for the manufacture of —— *by fusing and moulding a mixture of sand and lime.* C. Frerichs. Ger. Pat. 163,502, Dec. 25, 1904.

The mixture of sand and lime, before being fused in a cupola or other furnace, is subjected to a hardening process by the action of steam, whereby it is converted into lumps which are easy to handle.—A. S.

Portland cement kilns; Process for preventing the formation of dust in rotary ——. P. Jochum and C. Gaab. Ger. Pat. 166,886, Jan. 21, 1905.



The finely-ground raw material is mixed with an oily liquid of high boiling point (petroleum residue or the like), and is then introduced into a relatively cool part of the kiln, not traversed by the heating gases, so that on its way to the hotter part of the kiln it is gradually dried, and formed into solid lumps or balls. A device for carrying out the process is shown (see figure). A short pipe, *d*, fixed to the end-support of the kiln, passes a short distance into the kiln, *e*, and serves for leading off the heating gases. The supply-tube, *b*, for the raw material passes through the pipe, *d*, and discharges into the annular space between the pipe, *d*, and the kiln, which space is not only not traversed by the heating gases, but is also cooled by air drawn in through the passage between the kiln, *e*, and its fixed support. The pipe, *d*, and the supply-tube, *b*, may be provided with cold-water jackets.—A. S.

Cement plates; Process for the manufacture of thin, strong ——. J. Kossler. Ger. Pat. 167,516, April 20, 1905.

The cement is mixed with water and placed in moulds surrounded by moist loam, wherein it is kept for a considerable time (1—2 weeks) in a moist condition and under pressure. The strong, but light slabs thus obtained are suitable as a roofing material and for other purposes.

—A. S.

X.—METALLURGY.

(*Continued from page* 22.)

Iron ores; Determination of iron in ——, *by the permanganate method.* A. Müller. Stahl u. Eisen, 1906, **26**, 1477—1484.

The first part of this paper is taken up with an account of the work of Skrabal (Z. anal. Chem., 1903), who investigated the effect of varying quantities of hydrochloric acid, the effect of manganous salts, of stannous chloride, and mercurous chloride on the reaction with permanganate. From Skrabal's conclusions and his own experience, the author proposes the following method of work:—

Titration of the permanganate solution.—For this purpose iron wire is used, of which the composition has been carefully determined. An accurately weighed quantity (about 0·6 grm.) is dissolved in 25 c.c. of hydrochloric acid (sp. gr. 1·12) in a 450 c.c. conical flask at 90° C. It is oxidised to the ferric state by 1 grm. of potassium chlorate gradually added, and 20 c.c. of sulphuric acid (1:1) are added, the whole being kept at 90° C. for two hours, when all hydrochloric acid is expelled. After cooling a little, 50 c.c. of hydrochloric acid (1:3) are added, and the liquid is warmed till any separated ferric sulphate is dissolved. The solution is heated to boiling, and stannous chloride solution added till its colour is faint yellow; it is then boiled again, and the further addition of stannous chloride made, drop by drop, the liquid being finally heated to boiling again before adding the last one or two drops needed to remove the last trace of colour. (The stannous chloride solution contains 50 grms. of the crystallised salt, 500 c.c. of hydrochloric acid of sp. gr. 1·19, and 1500 c.c. of water.) The liquid is cooled by immersion in cold water, 25 c.c. of saturated mercuric chloride solution are added, and the mixture gently stirred or shaken for one minute. It is now diluted by the addition of a litre of water to which 60 c.c. of manganous solution were added, and to which again has been added a drop or two of permanganate, so as to colour it faintly, and the titration is carried out. (The manganous solution is made by dissolving 200 grms. of crystallised manganous sulphate in 600 c.c. of water acidulated with sulphuric acid, filtering, adding 500 c.c. of 1:3 phosphoric acid and 400 c.c. of sulphuric acid, allowing to cool, and adding a second 500 c.c. of the phosphoric acid.) The titration is ended when a pink tint is struck which persists for a few seconds. The author does not read his burette till 15 minutes after the titration is ended.

Treatment of ores.—The weighed portion of the finely-ground dry ore is digested at 90°—95° C. with 50 c.c. of hydrochloric acid of sp. gr. 1·19 for 24 hours, oxidised by means of chlorate, heated with sulphuric acid, and dissolved in 50 c.c. of 1:3 hydrochloric acid as described above. Ores containing organic matter are gently ignited in a porcelain crucible after weighing, and before dissolving. In the case of ores which leave a residue insoluble in hydrochloric acid, about 5 grms. are taken, fused with sodium carbonate, the product dissolved in hydrochloric acid, the solution precipitated with hydrogen sulphide, the precipitate filtered off and washed, incinerated, dissolved in hydrochloric acid and chlorate, reprecipitated with hydrogen sulphide, filtered and washed. The united filtrates are made up to 500 c.c., 100 c.c. are taken for analysis, evaporated to 50 c.c., oxidised with chlorate, and further treated as above.

—J. T. D.

Iron; Nitrogen in ——. H. Braune. Stahl u. Eisen, 1906, **26**, 1496—1499.

The effect of increasing nitrogen-content in iron is to convert the amorphous iron into a crystalline form. The proportion necessary to effect this conversion depends on the amount of carbon, the amount of slag, and the treatment of the metal. The higher the carbon, the less the proportion of nitrogen necessary to effect the change, and the lower the temperature at which the change occurs. The effect of slag particles is to hinder the change. In general, treatment of the metal at a high temperature, and during cooling, such as hammering, rolling, &c., lessens or hinders the effect of the nitrogen. The author suggests the existence for each variety of iron of a "critical" nitrogen-content (hard steel 0·030—0·035; mild steel, 0·040—0·045; soft iron, 0·050—0·060 per cent.), below which the metal is workable, but above which it becomes less so as the nitrogen-content increases. A number of photo-micrographs illustrate the effect of nitrogen on the minute structure of the metal. The authors give the following as the observed percentages of nitrogen in irons and steels of different origin:—

Grey pig iron, 0·007—0·015; ditto (Swedish), 0·002—0·020; white pig iron, 0·021—0·040; ditto, for Thomas process, 0·020—0·030; ditto, for basic Siemens-Martin process, 0·025—0·035; ditto, for puddling, 0·030—0·035; ditto (Swedish), 0·003—0·020; "washed pig iron," 0·035—0·050; puddled iron, for wire, 0·025—0·030; best Swedish iron, 0·006—0·008; acid Siemens or Bessemer steel, 0·006—0·018; basic Siemens steel, 0·020—0·025; Swedish crucible steel, 0·006; other crucible steel, 0·015—0·020.—J. T. D.

Special steels; Employment of —— *for riveting.* G Charpy. Compt. rend., 1906, **143**, 1156—1158.

In view of the results of his examination of the effects of riveting on steel, the author suggests that rivets should be made of that steel in which the most advantageous results follow a treatment similar to that of riveting, that is to say a more or less sudden cooling, not followed by a reheating. Certain chrome-nickel steels have been found to possess this quality, and rivets made from them have been found to stand stresses 2½ times as great as would have caused ordinary mild steel rivets to give way.

—J. T. D.

[Silver] Ores from the Cobalt district [Canada]; Sampling and assaying of ——. F. F. Colcord. Eng. and Mining J., 1906, **82**, 1164.

Some analyses of ores from different parts of the Cobalt district (see this J., 1904, 81; 1905, 357; 1906, 220) are shown in the following table.

Silver.	Silica.	Iron.	Lime.	Arsenic.	Nickel and Cobalt.
oz. per ton.	per cent.	per cent.	per cent.	per cent.	per cent.
300	4·0	4·0	5·0	55·0	14·1
350	53·0	12·4	2·2	5·7	4·1
400	46·1	5·8	4·0	6·2	—
3000	10·0	6·0	5·0	41·0	—
3000	28·3	—	21·7	2·4	—
5600	8·3	—	10·3	27·8	—

The ores are extremely varied both in content of metals and in the character of the gangue, but all of them when ground and sifted leave "metallics" on the sieve, and this makes it difficult to obtain good average samples. Full details of the mode of sampling are given, a combination of the methods of halving by taking alternate shovelsful, and of coning and quartering being employed to obtain a 5-lb. sample from the stock of ore. The rejected portions are treated in a similar manner to obtain a second 5-lb. sample, and, afterwards, two other 5-lb. samples. Each of the 5-lb. samples is accurately weighed, and separated into oversize ("metallics") and fines by means of an 80-mesh sieve, and the separate portions are weighed and divided into the required samples.

In assaying, the fines and "metallics" are treated separately. If the fines contain less than 400 oz. of silver per ton, 0·5 assay-ton is fused with 200 grms. of a flux composed of sodium bicarbonate (10), litharge (20), potassium carbonate (3), silica (3), and borax glass (4), with sufficient reducing agent for a 30—40 grm. lead button. The lead button is scorified once, and cupelled. If the fines contain over 400 oz. of silver per ton, 0·5 assay ton is heated with 100 c.c. of nitric acid to boiling, until decomposition is complete, 300 c.c. of water are added, and the solution filtered. From the filtrate the silver is precipitated as chloride, and the precipitate and the residue insoluble in nitric acid are separately scorified and cupelled as usual. The "metallics" are assayed by scorifying 0·1 assay-ton with 15 grms. of test lead. and 1 grm. each of borax glass and silica, with a covering of 10 grms. of test lead, and cupelling the resulting lead button.—A. S.

Cuprosilicons; Industrial ——. E. Vigouroux. Bull. Soc. Chim., 1906, **35**, 1233—1237.

In view of a paper by Lebeau (this J., 1905, 1308) the author points out that as long ago as 1901 he had shown that the maximum amount of silicon found in any compound of silicon with copper was about 10 per cent., corresponding to the formula, $SiCu_4$. In the present paper he gives the results of an examination of a number of industrial cuprosilicons containing from 10 to 20 per cent. of silicon, and shows that they contain silicides of iron and of manganese, and that iron in other forms of combination, calcium, and sometimes aluminium, are also contained in them. No conclusions can be safely drawn from the analysis of these complex mixtures as to the formula of copper silicide.—J. T. D.

Copper and silicon; Definite compound of ——. E. Vigouroux. Bull. Soc. Chim., 1906, **35**, 1237—1240.

By fusing together copper and very carefully purified silicon, mixed in the proportions of 90 to 10, and further mixed with an additional 7 or 8 of silicon, dissolving out uncombined silicon by means of boiling 5 per cent. solution of sodium hydroxide, a cuprous silicide was obtained, the analysis of which agreed almost exactly with the formula, $SiCu_4$. This, when fused in hydrogen, is a silver-white, brilliant, crystalline, metallic-looking substance, of sp. gr. 7·58. It is readily attacked by chlorine below a red heat, forming chlorides of copper and silicon; is but slightly affected by acids, except nitric acid, which even when very dilute readily and completely decomposes it; and is but slightly attacked by solutions of alkalis. —J. T. D.

Blendes with calcareous gangue; Working-up of ——. L. Bisschopinck. Metallurgie, 1906, 3, 726. Chem.-Zeit., 1906, **30**. Rep., 472.

The difficulty of distilling off the whole of the zinc from blendes with calcareous gangue has been attributed to the formation of zinc sulphide by the action on zinc oxide of calcium sulphide derived from calcium sulphate. The formation of zinc sulphide in this manner is, however, at variance with thermochemical data, and experiment showed that zinc sulphide when heated in a muffle with lime in presence of charcoal is decomposed, metallic zinc and calcium sulphide being formed. The reduction of calcium sulphate to sulphide requires a considerable amount of heat, and this consumption of heat appears to be the cause of the injurious effect of lime compounds in zinc ores. The author calculates that 1 part of calcium sulphate requires for its reduction about 60 per cent. more heat than 1 part of zinc oxide. If, therefore, bad yields of zinc are obtained in the working-up of calcareous blendes, the temperature should be raised or the time of reduction prolonged to compensate for the heat consumed in the formation of calcium sulphide.—A. S.

Chinese tin. F. Browne. Chem. News, 1906, **95**, 3—4.

From 4000 to 6000 tons of tin in the form of flat, rectangular plates, 2 ft. by 1 ft. by 1 in., arrive annually at Hong Kong from the mines of Yunnan. It is refined at the native refineries, three qualities being produced of the following composition:—

	1.	2.	3.
Tin	99·5—99·8	98·6—99·3	95·0
Lead	0·1— 0·4	0·1— 0·7	4·0
Antimony	0—0·1	0·02— 0·3	0·02—0·3
Price per picul of 133⅓ lb. in 1906	$98—99	$95—96	$93—94

About 70 per cent. of the tin exported from Hong Kong is stated to be of No. 2 quality. In the refining process the crude metal is first melted and skimmed, and the separated tin poured into moulds. The dross is cast into bars of about 10 lb. in weight, and heated with charcoal in a wind furnace, the resulting metal being melted and skimmed as before. The residue from the furnace consists chiefly of metallic iron, together with some tin, lead, silica, sulphur, and charcoal, and small quantities of arsenic and antimony. It is sold at 10 dols. per picul. For the analysis of the tin, the method found most satisfactory consists in evaporating 5 grms. of drillings with nitric acid of sp. gr. 1·3, dissolving lead from the residue by means of water, and antimony by means of a 5 per cent. solution of tartaric acid, then washing with boiling water, drying, incinerating the filter and residue, and determining tin as oxide in the usual manner. The lead is determined as sulphate or colorimetrically as sulphide, and the antimony also colorimetrically as sulphide.—A. S.

Chromium and boron; Compounds of ——. B. du Jassoneix. Compt. rend., 1906, **143**, 1149—1151.

Those of the substances produced by fusing together chromium and boron which contain less than 11·6 per cent. of boron are not homogeneous, and when heated in a stream of hydrochloric acid gas leave a residue richer in boron—containing always 11·9—12·6 per cent. This is a definite compound, of formula, Cr_3B_2. Similar treatment of the alloys containing more than 12 per cent. of boron yields a second homogeneous substance containing 16·9—17·3 per cent. of boron—the compound, CrB. The compound, Cr_3B_2, has a sp. gr. of 6·7, is attacked with incandescence by fluorine slightly above the ordinary temperature, and by chlorine at a red heat, superficially oxidised by oxygen at a red heat, soluble in hydrofluoric, hydrochloric, or concentrated sulphuric acid, and decomposed by fused alkali hydroxides or carbonates. The compound, CrB, has a sp. gr. of 6·1, and in its chemical properties is very similar to the other compound, being, however, more readily attacked by reagents.—J. T. D.

Tantalum ores in West Australia. Times Fin. Supp., Jan., 1907. [T.R.]

Tantalum was first discovered in this State in 1894, when stibiotantalite (tantalate and niobate of antimony) was identified in the tin washes of the Greenbushes tinfield, near Bunbury. In 1900 tantalite (tantalate of iron) was discovered in the concentrates at the same place, and shortly afterwards large deposits of manganotantalite (niobate and tantalate of manganese) were found on the Wodgina tinfield. Wodgina is situated on the Pilbara goldfield, about 160 miles inland from Port Headland. The introduction of the tantalum lamp furnished a market for the mineral, and in 1905 over 70 tons, valued at £8,925, were exported. The ore contains from 68 per cent. to 70 per cent. of tantalum. The bulk of these shipments were obtained by "dry-blowing," the alluvial consisting of decomposed pegmatite from the tantalum lodes. The market fell away towards the end of the year, and at present there is no official market obtainable for tantalum ores.

Alloys; Electrical conductivity of ——. W. Guertler. Z. anorg. Chem., 1906, **51**, 397—433.

In the light of our present knowledge of the constitution of metallic alloys as derived from thermal and micrographical analyses, the author has made an exhaustive study of the numerous available data on the electrical conductivity of alloys. He has calculated all these results to show the relation between the volume percentage and the conductivity, expressed in C.G.S. units. The following laws have been found to hold:—(1) Those alloys whose electrical conductivity is a linear function of the volume concentration of the two components, show no measurable (0·05 per cent.) miscibility in the solid condition; that is, no formation of mixed crystals, and *vice versa*. (2) The curve of electrical conductivity of such alloys as form a continuous series of mixed crystals, exhibits a low minimum, and attains the values of the pure components on each side with a steep rise of the curve.

Consequently, with a low concentration of one component in the mixed crystal, further additions cause a much more marked decrease in conductivity than in those cases where the concentration of the component is higher. (3) In the cases of limited miscibility, the law (1) holds between the concentrations of the saturated mixed crystals, and the law (2) between the pure metals and the saturated mixed crystals. (4) If in the series of alloys formed by two metals there exist m compounds, the diagram giving the relation between constitution and conductivity can be divided into $m+1$ separate binary diagrams. In each single system the conductivity follows the laws 1 to 3 as with pure metals. (5) As found by Matthiessen, the electrical conductivity in a series of alloys can never be higher than the value given by the straight line between the single values of the two components. From the results of this study of the question it is clear that the conductivity curves for alloys can serve as a certain criterion for determining the constitution. With regard to the characterisation of chemical compounds, the author points out that from the absence of a summit on the curve one cannot conclude that a compound is non-existent; but on the other hand, the presence of a summit can be safely used as a proof of the existence of a compound.—R. S. H.

English Patents.

Metals; Separation of —— from their ores. J. D. Wolf, London. Eng. Pat. 20,322, Oct. 7, 1905.

In the present patent a device is claimed for supplying water evenly to the travelling endless band on which concentrates and gangue are separated by treatment with an "oil" and water, as described in Eng. Pat. 17,407 of 1904 (this J., 1905, 1309). A distributing chamber extends right across the belt, and close to it at its upper part: the water escapes from this chamber through a long, narrow slit, or through a number of holes close together, and flows on to a plate or lip placed just above and preferably parallel to the belt. This plate or lip is provided with a number of parallel longitudinal ridges, so that the water flows from it on to the belt in a thin, even sheet, without disturbing the ore on the belt. If desired, a similar water supply may also be placed at the lower part of the belt.—A. G. L.

Concentrating table; Ore sectional —— for extracting the minerals from pulverised ores. J. Rodda, Camborne, and S. and P. Rodda, Redruth, Cornwall. Eng. Pat. 25,120, Dec. 4, 1905.

The table is made in two or more sections, and is furnished with a series of riffles in the direction in which it reciprocates. Its inclination can be altered according to the material under treatment. On the first section, the concentrates are separated from the light sand, which is washed into the tailings launder, the concentrates being then further treated on the second section, where they are divided into purer concentrates and middlings, each of which passes into a separate launder.—A. G. L.

Steel and steel alloys; Treatment of metals such as ——. W. F. L. Frith and C. J. Grist, London. Eng. Pat. 26,577, Dec. 20, 1905.

The steel or steel alloy to be heated is enclosed within a hermetically sealed vessel containing mercury or mercury-vapour; the vessel is heated in a bath of a heat-conducting substance of lower melting point than the temperature to which the metal is to be heated. This bath is heated by a furnace or some other source of heat, and it is claimed that its use ensures a more uniform heating of the metal.
—A. G. L.

Steel; Method of demonstrating by colours the heats for forging, hardening, tempering, and annealing ——. F. and H. F. Huntsman, trading as B. Huntsman, Sheffield. Eng. Pat. 1969, Jan. 26, 1906.

The glow of the heated steel is compared in a subdued light with the sheen of a number of differently coloured pieces of silk, placed in glass tubes in a case. The tubes should be placed as close to the steel as practicable.
—A. G. L.

Protective coating upon iron and steel; Process for the production of a ——. C. S. A. Tatlock, Glasgow. Eng. Pat. 7757, March 31, 1906.

A protective coating of magnetic oxide is given to iron and steel by heating the articles in a bath of potassium or sodium nitrate, or of both together, at a temperature only just above the melting point of the nitrate, for a period depending on the thickness of the coating desired (1 minute to 1 hour). Or else, the articles are heated to the same temperature, and the nitrate is sprinkled on them. Finally, the articles are washed and dried.—A. G. L.

Iron or steel; Manufacture or treatment of ——. E. F. Colborn, Salt Lake City, U.S.A. Eng. Pat. 15,626, July 10, 1906.

See Fr. Pat. 367,999 of 1906; this J., 1906, 1224.—T. F. B.

Sulphide ores; Treatment of complex —— H. Baker, Weston Point, Cheshire. Eng. Pat. 26,790, Dec. 22, 1905.

Complex sulphide ores are decomposed by chlorine in aqueous solution to which hydrochloric acid is continually added, so as to keep the solution acid throughout, and to prevent the precipitation of basic compounds of the metals by the basic constituents of the ore. Thus, with certain Broken Hill slimes, good results are obtained when using 4½ cwt. of commercial hydrochloric acid per ton of ore, starting with an initial acidity of 0·05 per cent. (towards methyl orange), and finishing with an acidity of 0·10 per cent., the maximum acidity at any time being about 0·30 per cent.—A. G. L.

Metalliferous material; Nodules of ——. T. C. King, New York. Eng. Pat. 9687, April 25, 1906. Under Int. Conv., May 4, 1905.

See Fr. Pat. 365,432 of 1906; this J., 1906, 991.—T. F. B.

Cupels; Construction of —— for assay purposes, and trays employed therewith. W. S. Rawson. Eng. Pat. 26,073, Dec. 14, 1905. XXIII., page 68.

French Patents.

Alloy; Metallic ——, and method of manufacturing the same. P. I. Juppont and J. Teil. Fr. Pat. 368,370, July 16, 1906.

The alloy, which is claimed to possess great powers of resisting abrasion, consists of German silver, 50 per cent. (40 to 70); zinc, 40 (20 to 55); antimony, 5 (2 to 15); and tin, 5 (2 to 20), the figures in the brackets representing the extreme variations in the composition. The alloy is made by first melting the German silver, and then adding the zinc, antimony, and tin in the order named, the whole being meanwhile well stirred with an iron tool, and protected from oxidation. Finally, the alloy is stirred with a wooden pole, preferably of willow or alder wood.
—A. G. L.

Alloy; Metallic ——, and method of manufacturing the same. P. I. Juppont and J. Teil. Fr. Pat. 368,371, July 16, 1906.

The alloy, which is called "grey metal" from its colour, and is used for bearings, &c., consists of copper, 1·20 per cent. (0·40 to 1·25); tin, 12·00 (10·00 to 15·00); lead, 0·80 (0·60 to 0·85); antimony, 14·00 (6·00 to 20·00) aluminium, 35·00 (15·00 to 35·00); and zinc, 37·00 (30·00 to 55·00), the extreme variations in composition being given by the figures in the brackets. In making the alloy, the copper is first melted, after which the aluminium, antimony, zinc, lead, and tin are added in the order named, the whole being meanwhile well stirred with an iron tool. Finally, the alloy is stirred with a wooden pole, preferably of alder or willow wood.—A. G. L.

Phosphor-bronze not cracking at high temperatures. C. Claessen. Fr. Pat. 368,368, July 25, 1906. Under Int. Conv., Aug. 21, 1905.

Phosphorus is added to ordinary brass in such quantity that the final product obtained contains 0·03 to 0·10 per cent. of phosphorus. The alloy may be heated to temperatures of from 300° to 550° C. without cracking, and is thus suitable for tubes for conveying superheated steam, &c.—A. G. L.

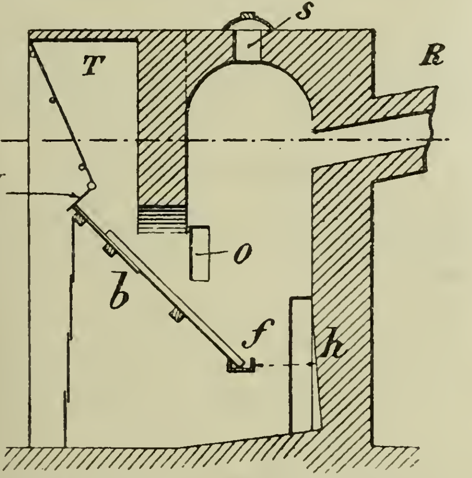
Copper and lead ; Process for obtaining —— from minerals. J. Gathy. Fr. Pat. 368,467, July 28, 1906. Under Int. Conv., Aug. 21, 1905.

A solution of cupric chloride is obtained from the ore by any usual method, and this solution is saturated with sulphur dioxide. The insoluble cuprous chloride precipitated is washed and partly dried, excluding air, and is then mixed with a combustible (charcoal, coke, oil, wood, &c.) and heated to dull redness in a current of steam. Metallic copper, carbon monoxide (and dioxide), and hydrogen chloride are formed, the gases being collected and utilised in the process. Similarly, lead is obtained by heating lead chloride with a combustible in a current of steam at a dull red heat.—A. G. L.

Iron and steel ; Direct manufacture of ——. M. Moore and T. J. Heskett. Fr. Pat. 368,598, Aug. 3, 1906.

In making iron and steel directly by reducing the mineral in a reverberatory furnace, loss of iron occurs through oxidation by the ferric compounds present in the slag covering the reduced metal. To avoid this loss, the patentee proposes to maintain the iron in the slag in the ferrous state by the addition of carbon or other reducing agent from time to time. It is stated that ferrous compounds, at the temperature of the furnace, do not act on, and reoxidise, the reduced metal. In making steel, carbon in regulated quantity is added to the reduced metal, in the form of bricks of pitch sufficiently strong to allow of their being forced through the slag.—A. G. L.

Furnace for the roasting of ores of antimony, arsenic, zinc, lead, and other volatile metals. E. Basse. Fr. Pat. 368,745, Aug. 9, 1906.



The ores are roasted in the continuous closed furnace shown, on the inclined fire-bars, *b f*, on to which they are charged from the hoppers, T and V. The fumes escape through the passage, R. The opening, S, serves for the introduction of fuel at the commencement of the operation. The gangue from the roasted ore falls through the opening, *f h*, into the space below the fire-bars, whence it is removed periodically. Air is supplied through O, and through other openings below the fire-bars.—A. G. L.

Zinc ores and ammoniacal gas-liquor ; Reciprocal treatment of ——. F. Chevalet. Fr. Pat. 369,046, Aug. 20, 1906.

In the treatment of zinc ores containing copper and iron by the wet method, the roasted ore is treated with commercial ammonia or ammonium carbonate solution in order to dissolve the oxides. The inventor proposes to use the roasted ore as a purifying material for coal-gas in place of the iron oxide usually employed. The ore is used several times in succession after revivification each time by exposure to air. It is claimed that in this way the metallic oxides become more amenable to the subsequent treatment. The ore is next lixiviated with ammoniacal liquor in a closed vessel, and the solution is distilled for recovery of the ammonia. The distillation residue on allowing to stand deposits practically the whole of the zinc in the form of oxide, whilst the copper remains in solution, and is subsequently recovered by precipitation with scrap iron.—A. S.

Alloys having pyrophoric action ; Manufacture of —— and their application to ignition and illumination. C. F. Auer von Welsbach.

The patentee seeks leave to amend the specification of Eng. Pat. 16,853 of 1903 (see Fr. Pat. 337,320 of 1903 ; this J., 1904, 484), alleging that he has found that alloys of rare earth metals are practically useless for the purposes of the invention unless they contain cerium, and he desires to amend his claims accordingly. The amendments are printed in full in the "Illustrated Official Journal" for Jan. 23, 1907, and persons intending to oppose the same must leave notice of their objections before Feb. 23, 1907, at the Patent Office, London.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 24.)

(A.)—ELECTRO-CHEMISTRY.

Alkali chlorides ; Electrolysis of —— with alternating current. II. A. Coppadoro. Gaz. chim. ital., 1906, **36** [2], 321—328. (See this J., 1906, 482.)

A solution of sodium chloride electrolysed with platinum electrodes until the maximum yield of hypochlorite was obtained, was filtered and dialysed. The dialysed solution on evaporation gave a residue of colloidal platinum. At temperatures above that of the atmosphere (50°—70° C.) chlorate is not produced until the current-density rises above about 100 ampères per 100 sq. cm. If, in the course of the electrolysis, the electrodes become platinised, the amount of chlorate produced diminishes, owing to a decrease in the current-density and consequent increased reducing power of the hydrogen. The current-yield of chlorate is never greater than 15 per cent. ; it is at its maximum soon after the commencement of the electrolysis, and then continually diminishes, but never becomes *nil* as in the case of the hypochlorite. As in working with continuous current, the current-yield of chlorate is increased if some chromate or bichromate be added to the bath ; the yield then remains above 10 per cent. for a long time. The electrodes become corroded and partially covered with platinum black, but the solution remains free from suspended matter.—A. S.

Gutta-percha ; Temperature coefficients of ——. K. Winnertz. XIIIC., page 59.

English Patents.

Filaments from tungsten or molybdenum, or an alloy thereof ; Manufacture of electric incandescence lamp ——. A. G. Bloxam. From J. Lux. Eng. Pat. 27,002, Dec. 27, 1905. II., page 42.

Filaments of tungsten or molybdenum for electric incandescence lamps ; Manufacture of ——. A. G. Bloxam. From J. Lux. Eng. Pat. 9020, April 14, 1906. II., page 42.

Incandescing bodies for electric lighting and heating purposes. Allgemeine Elektricitäts-Ges. Eng. Pat. 18,485, Aug. 17, 1906. II., page 42.

Furnaces ; Electric ——. C. E. Pettit, London. Eng. Pat. 132, Jan. 2, 1906.

This invention relates to a holder for the lower electrode of an electric furnace. The holder is formed of a solid metal socket, shaped to receive the lower end of the electrode, and having its upper surface formed in steps, so that the masonry of the furnace may be built upon it.

The under surface of the holder is provided with grooves for the reception of a number of independent metal bars or wires connected with the furnace supply circuit.—B. N.

Furnaces ; Electric ——. H. L. Hartenstein, Constantine, U.S.A. Eng. Pat. 10,156, May 1, 1906.

See U.S. Pat. 819,224 of 1906 ; this J., 1906, 544.—T. F. B.

Resistance material ; Electrical ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 6089, March 13, 1906.

This invention relates to a resistance material, composed of a conducting substance, such as graphite, magnetite, or the like, in a powdered or comminuted form, mixed with suitable quantities of calcium or magnesium hydroxide, and silica or flint. The mixture is compressed into a dense mass, which is then subjected to steam under pressure ; a hydrous silicate of calcium or magnesium is thus obtained, which forms a strong binding agent for the conducting material.—B. N.

Electric arcs ; Production of long stable ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 9279, April 19, 1906.

See Addition of April 26, 1906, to Fr. Pat. 357,358 of 1905 ; this J., 1906, 1053.—T. F. B.

Ozone producers ; [Electrical] ——. S. M. Kintner, Pittsburg, Pa. Eng. Pat. 14,586, June 26, 1906. Under Int. Conv., June 28, 1905.

This invention relates to an electrical ozone producer, in which a source of electrical energy, a condenser, a silent discharge gap, and a spark gap are connected in series. —B. N.

Textile fibrous materials ; Method and apparatus for treating —— *with the products of electrolysis of water solutions of acids, oxides, and salts.* H. Hey. Eng. Pat. 2083, Jan. 27, 1906. V., page 46.

Steam and gas generators ; [Electrical ——]. F. A. Weigel and J. Wolf. Eng. Pat. 22,049, Oct. 5, 1906. II., page 41.

French Patents.

Furnace ; Electric ——. C. O. Wingren. Fr. Pat. 369,082, Aug. 21, 1906. Under Int. Conv., Aug. 21, 1905.

See U.S. Pat. 817,212 of 1906 ; this J., 1906, 484.—T.F.B.

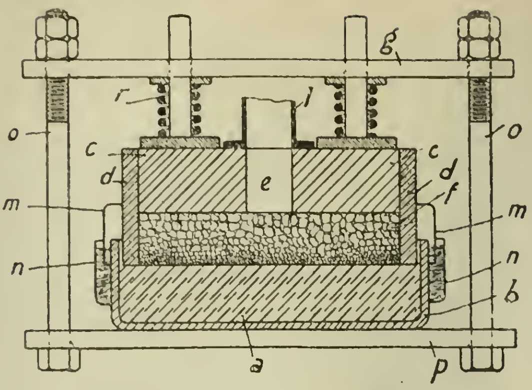
German Patents.

Mercury cathode for the electrolysis of salt solutions. A. Sinding-Larsen. Ger. Pat. 172,682, July 31, 1904.

In the electrolysis of sodium chloride solutions with a mercury cathode, it has been proposed previously to allow the amalgam to form on the under-side of the cathode, the amalgam, in consequence of its lower specific gravity, then rising through the mercury. In this way the mercury becomes continually richer in amalgam, whereas when the amalgam is produced on the upper side of the cathode, it forms a coating on the mercury, and hinders the further production of amalgam. Up to the present the manner of carrying out the process has been to place the mercury on perforated or porous plates of non-conductive material, but this suffers from the disadvantages, that the active surface of the mercury is diminished, whilst gas-bubbles can collect between the mercury and its support, and lessen the current efficiency. The patentee proposes to place the mercury on a support of amalgamated wire gauze (preferably copper gauze), so that the meshes and the individual wires are completely covered with mercury on the under-side. The electrolyte is kept circulating, and the pressure on the two sides of the mercury is, as far as possible, equalised.—A. S.

Viscous substances, especially pasty masses ; Process for the electrolysis of ——. W. Wunder. Ger. Pat. 173,520, Nov. 22, 1904.

In the electrolysis of viscous substances, any gases evolved are not able to escape readily, and therefore remain adhering to the electrodes and lessen the efficiency of the current. The patentee proposes to use an electrode provided with perforations or constructed of porous material, and to keep the electrolyte under pressure. The pores or perforations of the electrode must be so small that, notwithstanding the pressure, the viscous electrolyte cannot penetrate into them. The effect is said to be that the gases evolved tend to pass from the places at higher pressure, *i.e.*, from the electrolyte, to those at lower pressure, that is, through the pores of the electrode. A method of carrying out the invention is illustrated in the figure. The electrolyte, *a*, is contained in a receptacle, *b*, which serves as one electrode. The other electrode, *f*, consists of fragments of carbon becoming gradually larger from below upwards. Above this electrode is a slab, *c*, of conductive material, separated from the first electrode, *b*, by the insulating layer, *d*. The slab, *c*, is pressed down on to the electrode, *f*, by means of the bars, *p*, *g*, and the bolts, *o*, and springs, *r*. The gases escape through the opening, *e*, and the pipe, *l*, and air is excluded from the apparatus by the seal, *m,n*. Instead of the electrode, *f*, a solid one provided with channels or passages for the gases may be employed.—A. S.



(*B.*)—ELECTRO-METALLURGY.

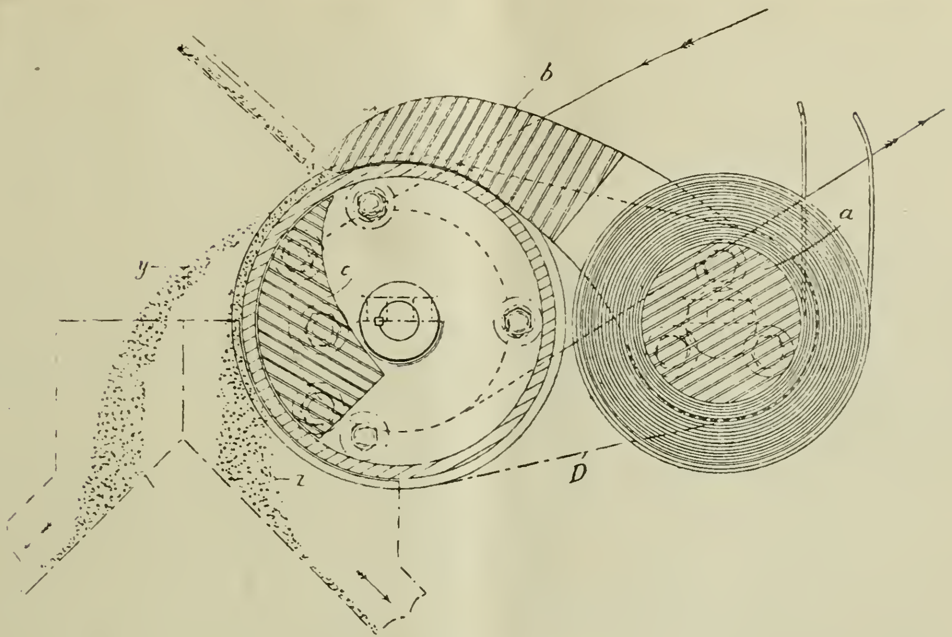
Copper sulphate and sulphuric acid ; Method for the rapid determination of —— *in galvanoplastic baths.* A. Wogrinz and J. Kittel. Chem.-Zeit., 1906, **30**, 1300—1301.

A measured quantity of the well stirred bath-liquor is put into a measuring flask, and hydrogen sulphide passed through it in the cold. After completing the precipitation of cupric sulphide, the excess of hydrogen sulphide is blown out, and the flask filled to the mark. The precipitate settles quickly, and part of the solution is filtered through dry paper ; an aliquot part is titrated with sodium hydroxide, using methyl orange as indicator. The result gives the total free and combined acid. The free acid is determined by direct titration of the solution with sodium hydroxide and Congo paper. The difference between free and total acid is equivalent to the copper salt present. The authors prove the accuracy of the method by a number of test analyses.—R. L.

English Patents.

Magnetic separator. W. Simpkin, London, and J. B. Ballantine, Twickenham, Middlesex. Eng. Pat. 25,748, Dec. 11, 1905.

The separator, shown in cross-section in the figure, consists essentially of an electro-magnet, *a*, one pole, *b*, of which is placed close to and outside a drum of non-magnetic material, on to which the ore falls, whilst the other pole, *c*, is placed similarly close inside the drum, which thus cuts all the lines of force between the two poles, and prevents short-circuiting between the two by the building up of a bridge of magnetic material. The drum is revolved at a high speed, the non-magnetic material being at once



thrown off at *y*, whilst the magnetic material only leaves the drum as it is carried into a weaker magnetic field at *z*. —A. G. L.

Metallic compounds or ores; Electrolysis of ——. E. A. Ashcroft, New York. Eng. Pat. 26,813, Dec. 22, 1905.

This invention relates to improvements on Eng. Pats. 12,377 and 12,083 of 1903 (this J., 1904, 25 and 67). The two cells, containing fused material at different temperatures, are joined by a "heat regenerative pipe," the latter having two adjacent passages arranged to conduct fused material to and fro between the cells. One conduit is provided with vertical openings and the other with lateral openings, the inlets and outlets in each cell being separated by baffle-plates. The second cell, for the collection of the extracted metal, is provided with a globular cathode, the latter having a tubular support and means for cooling the cathode.—B. N.

Metal plating or coating; Removal of —— from metallic or other surfaces. W. R. Hodgkinson, Blackheath; J. H. Hardcastle, Lee; and A. H. Coote, Westcombe Park, Kent. Eng. Pat. 717, Jan. 10, 1906.

Metallic plating or fouling is removed from steel surfaces (*e.g.*, guns or rifles) by immersing the surface in a liquid containing an amide or an ammonium salt of an organic acid, placing in this a piece of metal (iron) and passing an electric current, the steel surface forming the anode and the piece of metal the cathode, until the plating is removed. A suitable liquid consists of a solution of ammonium acetate or formate with an excess of ammonium hydroxide. The process is applicable to the removal of copper, cupronickel, or nickel from iron or steel without affecting the latter.—A. G. L.

Metals; Method of obtaining —— from their ores, or for heating substances, and electric furnaces for use therewith. N. A. Wallin, Charlottenburg, Germany. Eng. Pat. 12,395, May 28, 1906.

See Fr. Pat. 368,013 of 1906; following these.—T. F. B.

Metals from ores or furnace products; Process for obtaining —— in the electric furnace. K. Kaiser, Berlin. Eng. Pat. 15,818, July 12, 1906. Under Int. Conv., July 19, 1905.

See Fr. Pat. 367,969 of 1906; following these.—T. F. B.

Metallic flakes or films; [Electrolytic] process of making ——. T. A. Edison, Llewellyn Park, U.S.A. Eng. Pat. 16,701, July 24, 1906. Under Int. Conv., Dec. 5, 1905.

See Fr. Pat. 367,863 of 1906; this J., 1906, 1225.—T. F. B.

French Patents.

Extraction of metals and heating of materials; Process and electric furnace for ——. N. Wallin. Fr. Pat. 368,013, June 8, 1906.

The secondary circuit of an electric induction furnace is formed by the material under treatment. This material, although non-conducting at ordinary temperatures, becomes conducting upon heating. The resulting metal or other product, either in a fused or solid condition, has a greater electrical conductivity, and serves to close the secondary circuit. Means are provided for feeding in fresh raw material either intermittently or continuously. The electric induction furnace consists of a hearth with annular cavities joined by a bridge, around and through which the core of the primary of the transformer is arranged. The upper portion of the annular cavities is then filled with the material to be treated, which is a poor electrical conductor, whilst the lower portions are occupied by the product of considerably greater conductivity. The heating chamber and transformer may, in special cases, be constructed so as to be separable from the shaft for feeding in raw material and from the recipient for the finished product.—R. S. H.

Metals; Recovery of —— from minerals and from foundry products in the electric furnace. K. Kaiser. Fr. Pat. 367,969, July 11, 1906. Under Int. Conv., July 19, 1905.

Instead of mixing the mineral or other material with a reducing agent, and submitting the mixture to heating in an electric furnace, the inventor proposes to fuse the mineral, if necessary with addition of a flux, and then submit the fused mass to the action of reducing gases. The special case of the recovery of zinc is mentioned. —R. S. H.

Electro-metallurgical furnaces; Arrangement of —— so as to obtain well-fused slags. Röchling 'sche Eisen-und Stahlwerke, G.m.b.H. and W. Rodenhauser. Fr. Pat. 368,631, Aug. 4, 1906.

By raising a portion of the hearth of the furnace at the centre to a point just below the level of the slag, the current is forced to leave the metal and to traverse the slag for a distance corresponding with the raised portion of the hearth. By so doing it heats the slag intensely, and well-fused slags are obtained.—A. G. L.

XII.--FATTY OILS, FATS, WAXES, AND SOAPS.

(Continued from page 25.)

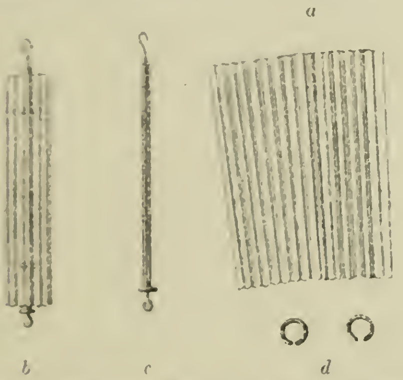
Olive oil from Majorca. P. Pollatschek. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 4—5.

Olive oil from Majorca contains usually from 30 to 40 per cent. of free fatty acids, owing to the methods adopted for harvesting the olives, and the primitive presses used in obtaining the oil from them. In the hill country the fruits are usually left for at least 24 hours before being pressed. To ascertain the effect of the different methods of treatment on the olives, the percentage of free fatty acids was determined in the oil obtained from:—(1) Freshly-plucked fruit, (2) freshly knocked-off fruit, (3) plucked fruit after being kept 24 hours, (4) knocked-off fruit after 24 hours. The following results were obtained:—

		per cent.		per cent.
1	Olives from the plains	0·80	Mountain olives	0·85
2	„ „ „	1·40	„ „	1·80
3	„ „ „	0·85	„ „	0·85
4	„ „ „	5·40	„ „	6·65

Two processes seem to be followed for obtaining the oil from the olives; these are described.—J. A.

Linseed oil; Investigation of the process of drying of ——. A. Genthe. Z. angew. Chem., 1906, **19**, 2087—2099.



The drying apparatus used by the author consisted of a flask holding about 1200 c.c. and closed by a ground-in stopper with a central opening connected with a manometer charged with paraffin oil. The linseed oil (about 300 mgrms.) was distributed in small drops over strips of pure cellulose paper, *a* (30 cm. × 10 cm.), folded as shown at *b*, *a*, and bent round within small glass rings, *c* and *d*, and suspended by the hooks shewn, within the flask. A "correction" flask was used simultaneously to eliminate errors due to variations in the temperature and barometrical pressure. Volatile products (chiefly lower fatty acids) formed in the drying process were absorbed by means of potassium hydroxide. The accuracy of the measurements expressed in c.c. of paraffin oil in the manometer was found to be about ± 1 per cent. In the first experiments, in which flasks of brown glass were used, there was no appreciable absorption of oxygen by raw linseed oil in less than 10 days, and similar results were obtained with commercial boiled oil. When all light was excluded, the reaction was not complete until after about 50 days. In experiments continued from day to day, a marked difference could be observed between the absorption that took place in diffused light by day and in darkness by night.

Influence of light.—In measuring the influence of light, Schott's mercury "Uviol" lamp was employed, with small flasks of "Uviol" glass, so as to obtain the full effect of the rays. The temperature within the flasks was not more than 2° or 3° C. higher than that of the room. The results of these experiments are shown by curves in which the pressure is represented by mm. of mercury in the manometer, and the time by hours. With raw linseed oil the absorption was very slow during the first two hours, and rapidly increased in the third hour. Similarly in the case of boiled oil, the absorption was considerable after three hours, and practically complete in one day. In parallel experiments in daylight, from 8 to 10 days were required, whilst 50 days were necessary in the dark. The addition of siccatives caused no increase in the speed of the reaction in the "Uviol" light.

Influence of catalysers.—Lead and manganese driers (resinates, oleates, linoleates), dissolved in linseed oil in the proportion of 1 per cent., accelerated the drying process in the dark, though not to the same extent as commonly accepted. Thus, in a typical case, drying was not complete until after 14 days. In diffused daylight there was naturally acceleration, the linoleate preparations producing more effect (10 per cent. to 15 per cent.) than the other driers.

Influence of products of the reaction.—The addition of 1 per cent. of various fatty acids, aldehydes, ketones, and of glycerol produced no great acceleration—at most 10 per cent. Exposure of the oil to the rays of the "Uviol" lamp was found to produce a non-volatile catalyser. Thus, raw oil that had been exposed to the rays for 40 hours and then tested was found to become practically dry in 10 days; whereas oil that had been exposed to the air for 2 hours at a temperature of 130° C., took 20 days. The oil exposed to the violet rays as regards drying properties, gave practically the same results as a sample of boiled linseed oil. The "induction" period (*i.e.*, the initial stage before perceptible absorption) was also less, and the curves showed a more pronounced rise at the beginning.

Application of Engler and Weissberg's autoxidation theory.—According to this theory the presence of peroxides should be indicated in the drying process. It was found that raw linseed oil gave peroxide reactions (*e.g.*, separation of iodine from potassium iodide solution). On adding 1 per cent. of typical peroxides, such as benzoyl peroxide to linseed oil, there was marked acceleration of the drying process, the oil becoming practically dry within 10 days. Ethyl peroxide had also some stimulating effect, but hydrogen peroxide had no such influence. The addition of 5 per cent. of fresh turpentine oil had very little effect, whereas the same amount of old turpentine oil had a remarkable accelerating influence. Within the limits of the experiments, the drying reaction was practically independent of the concentration of oxygen—a fact often noted in peroxide reactions. Unoxidised turpentine oil loses its peroxide activity on long-continued heating, and so does linseed oil. Thus, a sample heated for a long time at 350° C. completely lost its drying properties. The author concludes from these and other facts that linseed oil first forms a primary catalyser, and then acts as an acceptor, whilst siccatives are to be regarded as pseudo-catalysers, having only a stimulative effect upon the formation of the primary auto-catalyser.

Enzymic acceleration.—The commercial drier "rhusolin oleate" (obtained from the Japanese tree *Rhus vernicifera*) contains an enzyme which causes an intense acceleration in the drying process of linseed oil. Yet here again the S-form of the absorption curves leads the author to conclude that the enzyme is only a pseudo-catalyser.

Ostwald's formula for auto-catalysis.—It was found that the results obtained could be expressed by means of Ostwald's equation:—

$$\frac{dx}{dt} = k.(m + x).(a - x),$$

which becomes:—

$$k = \frac{l}{(a + m)t} \cdot ln\left(\frac{m + x}{m} \cdot \frac{a}{a - x}\right)$$

where a represents the total amount of oxygen absorbed, expressed in c.c. of reduced pressure; x the atmospheric pressure; and t the time.

Oxygen absorption.—The amount of oxygen absorbed by linseed oil in drying was found to average 23 per cent. at the ordinary temperature, and 26·5 per cent. at 95° C. in the dark, whilst the corresponding amounts in the rays of the "Uviol" lamp were 25·8 and 34·7 per cent. respectively. A secondary reaction, consisting in the main of a slow oxidation of organic substance, accompanies the chief reaction, and part of the oxygen consumed under the influence of light and higher temperature is accounted for by this by-reaction. A polymerisation process runs parallel with the oxidation. The amount of volatile products formed in the drying process was found to be about 15 per cent. of the weight of the oil.—C. A. M.

Ricinoleic acid; Investigation of ——. A. Grün. Ber., 1906, **39**, 4400—4408.

The author regards Juillard's dihydroxy acid, $C_{18}H_{36}O_4$, (Bull. Soc. Chim., 1895, 238) as not a chemical individual, but a mixture of several isomeric compounds. He finds that ricinoleo-sulphuric acid, $C_{17}H_{32}(O.SO_3H).COOH$ is also formed when the acetyl derivative of ricinoleic acid is treated with sulphuric acid. By the action of sulphuric acid on the chloro-oleic acid, $CH_3(CH_2)_5CHCl.CH_2.CH.CH(CH_2)_7.COOH$, obtained by replacing the alcoholic hydroxyl by chlorine, the chief change was the evolution of hydrochloric acid even when the temperature was kept below 0° C. By treating 20 grms. of ricinoleic acid with concentrated sulphuric acid at a temperature below – 5° to – 10° C., leaving the mixture for 24 hours at 0° C., pouring it in small portions into water at 0° C. and separating the acid water, a residue was obtained consisting of the sulphonated compounds of "dihydroxystearic acid," its "anhydride" and unaltered ricinoleic acid. The "dihydroxystearic" acid was found to consist of several isomerides, which were separated by fractional crystallisation into two optically inactive acids melting respectively at 69·5° and 108° C., a dextro-rotatory acid melting at 90° C., and a small amount of an acid of m. pt. 120° C., which was not further examined. The active acid, of the m. pt. 90°, could be converted into a racemate melting at 69° C. The racemate (m. pt. 69·5° C.) gave the reaction of a 1.4-dihydroxy compound, and it is pointed out that 9.12-dihydroxystearic acid is such an acid. It has not yet been determined whether the fraction melting at 120° C. is optically active, or whether the second possible racemate is the acid of m. pt. 108° C. The formation of 9.12-dihydroxystearic acid would agree with the fact that the action of sulphuric acid on ricinstearolic acid produces 12-hydroxy-9-ketostearic acid or its sulphuric ester. In both cases the O or OH group falls in the 9-position. In the author's opinion the mode of the double linking, which is the same in the four acids, oleic, stearolic, ricinoleic, and ricinstearolic acids, has less influence on the course of the reaction than has the position of the OH group.—C. A. M.

Fat in butter; Determination of ——. A. Froehner. XVIIIA., page 63.

English Patent.

Lubricating compounds. E. A. Emery, Cripple Creek, Col., U.S.A. Eng. Pat. 14,263, June 21, 1906.

A hygroscopic solid lubricant for pneumatic machinery is prepared from soap, or other saponaceous material, plumbago, and fluid extract of slippery elm bark, together with water as a solvent, and salt to act as a non-refrigerant. It is applied by introducing it into the compressed-air pipe leading to the machine, and, being "dissolved" in the moisture present in the air, is carried in mechanical suspension to the parts to be lubricated.—C. S.

French Patents.

Olive oil; Crushing and pressing apparatus for the production of ——. C. Torino. Fr. Pat. 368,969, Aug. 11, 1906.

The olives fall from a hopper, between three pairs of revolving rollers by means of which they are crushed to a paste. This paste is received in sacks placed in a chamber mounted on wheels. When the sacks are full, the action of the rollers is stopped, and the chamber containing the sacks is run into the space below the pressing part of the apparatus. The small wheels of the vessel rest in hollows so that they do not have to support the pressure of the piston. The piston is then brought into action, and the expressed oil collected in a channel and run off. When the mass has been sufficiently pressed, the piston is raised, the sacks are emptied, and the process is repeated on a further quantity of olives. The movement of the rollers, and the lowering and raising of the piston, are regulated by levers actuating loose pulleys and geared wheels, so that the working of the apparatus is practically automatic.—W. P. S.

Oil; Apparatus for clarifying waste ——. A. Kock. Fr. Pat. 369,038, Aug. 20, 1906.

The apparatus consists of five or six cylindrical vessels placed one above the other. The oil to be clarified, freed from water, &c., is led into the uppermost vessel, which contains a false bottom formed by a conical sieve. A pipe, reaching to the apex of this sieve, conducts the oil through the bottom of the vessel to the bottom of the next lower one. The oil rises in this vessel and then passes down a pipe into the next vessel, and so on to the last one, which forms a reservoir for the clarified oil. The whole operation consists in the successive settlement of the water as the oil passes through the vessels, solid matters present being removed by screens placed at the top of the first two vessels. Instead of being placed one above the other, the vessels may be concentric, or arranged in steps, the system of clarification being the same as described above.—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(Continued from page 25.)

(A.)—PIGMENTS, PAINTS.

English Patents

Pigments; Manufacture of printing ink ——. P. Fireman, Braddock Heights, Va., U.S.A. Eng. Pat. 25,859, Dec. 12, 1905.

In previous specifications (this J., 1905, 1180; 1906, 129, 1056) the use of artificial ferroso-ferric oxide, obtained by the atmospheric oxidation of ferrous hydroxide, until the ratio of ferrous to ferric iron was 1:2, was claimed. It is now found that it is unnecessary to carry the oxidation so far, and that the oxide in which the ratio is between 1:1·3 and 1:1·6 is the best adapted for a printing-ink pigment, and that even with a ratio as high as 1:0·5 a stable product is obtained. The method of production is the same as before, except that the liquid containing the suspended ferrous hydroxide is heated during the oxidation, and that the oxidised precipitate, after filter-pressing, is dried with exclusion of air. The precipitation of a mixture of a ferrous and ferric salt is also claimed, but the product is less stable.—M. J. S.

Paints; Non-corrosive and antifouling ——. A. M. Flack, Twickenham, Middlesex, and Humidine, Ltd., London. Eng. Pat. 2826, Feb. 25, 1906.

To produce an antifouling paint of the non-desiccant type, a neutral, non-drying oil, such as castor oil, is incorporated with heavy mineral oil, resin, paraffin wax, zinc oxide, and copper arsenite.—M. J. S.

Paint; Manufacture of ——. W. Clark, London. From Standard Paint Co., New York. Eng. Pat. 7073, March 23, 1906.

See Fr. Pat. 364,752 of 1906; this J., 1906, 939.—T. F. B.

GERMAN PATENT.

Pasty substances [Pigments]; Apparatus for grinding and drying ——. R. Haack and Gebr. Burberg. Ger. Pat. 168,716, Nov. 3, 1903.

THE pasty material is first passed between grinding rollers which convey it through the apparatus and finally on to a heated drum which further grinds and, at the same time, dries it. The apparatus is intended especially for white lead and other pigments which are ground whilst wet, and then dried.—A. S.

(*B.*)—RESINS, VARNISHES.

Rosin in varnishes; Determination of ——. A. H. Gill. J. Amer. Chem Soc., 1906, 28, 1723—1728.

To obtain the pure gum-resins the turpentine was removed by distillation with steam, and the oil by Twitchell's process (this J., 1891, 804). Methods of identifying the gum-resin were then examined. Hübl's iodine method showed practically no difference in the figures for kauri and rosin or mixtures of these. The determination of the bromine value by McIlhiney's method gave better results, the method being modified as follows: 20 c.c. of $N/3$ bromine were allowed to act for about three minutes on 10 c.c. of a solution of 0·4 to 0·5 grm. of resin in 50 c.c. of carbon tetrachloride, when about half the bromine remained unaltered. The best results were obtained from the ester value, which varied from 23·1 for pure rosin to 84 for gum kauri.—E. F. A.

Linseed oil; Investigation of the process of drying of ——. A. Genthe. XII., page 56.

ENGLISH PATENTS.

Copying inks and paper for use therewith; Manufacture of ——. E. R. Morris and R. T. Smith, London, and A. E. Bawtree, Wallington, Surrey. Eng. Pat. 1732, Jan. 23, 1906.

FOR the preparation of an ink which will give a copy without damping the copying paper, the employment of perchloride of iron presents advantages which are not found in the hygroscopic substances used hitherto. The following formula gives good results:—

Saturated solution of perchloride of iron, 10 c.c.; logwood extract, 2 grms.; Indigo Carmine, 1 grm.; Methyl Violet, 1 grm.; water, 50 c.c.; glycerin, 5 c.c.; and "syrup," 25 c.c.

The copying paper for use with this ink should be prepared with a substance which gives a deep colour with ferric chloride, such as gallic acid or potassium ferrocyanide. The claim includes the tinting of the copying paper to conceal a discoloration which is liable to occur in course of time.—M. J. S.

Polishing medium; Process for producing a ——. R. Rathmann, Berlin-Schœneberg, Germany. Eng. Pat. 15,486, July 9, 1906.

THE want of success in the attempts hitherto made to replace shellac in polishes by cheaper resins is attributable to the absence of wax from these materials. The present claim is for the addition of a (bees) wax soap to an alkaline solution of a resin or phenol, and the precipitation of the mixture by a mineral acid, producing thereby an intimate blend of the resin and wax acids which can be used as a shellac substitute.—M. J. S.

FRENCH PATENT.

Ink; Copying ——. E. R. Morris, R. T. Smith, and A. E. Bawtree. Fr. Pat. 369,021, Aug. 18, 1906. Under Int. Conv., Jan. 23., 1906.

SEE Eng. Pat. 1732 of 1906; preceding these.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Rubber statistics for 1906. S. Figgis and Co., Jan. 2, 1907. [T.R.]

THE imports of rubber into England in 1906 were 21,269 tons, compared with 21,700 and 19,883 in 1905 and 1904. Stocks on Dec. 31 in the same years were 1669, 1562, and 1272 tons respectively. The imports in 1906 came from Para (8728 tons), Peru (3435 tons), and other countries (9106 tons); of this last amount, the West Coast of Africa was responsible for 4880 tons. The total production of the world in 1906 is estimated at 65,000 tons, practically all of which was consumed. Brazil output showed no decrease, amounting to about 38,000 tons.

Congo rubbers; Chemical examination of ——. J. Liebschütz. Gummi-Zeit., 1907, 21, 336—338.

THE author has examined nineteen varieties of Congo rubbers for loss on washing, resin (by acetone extraction), and ash, with the results tabulated below:—

	Washing loss.	Resin.	Ash.	Character of the resin.
	per cent.	per cent.	per cent.	
(Upper Congo) Mongala strips	2·68	4·44	0·47	Tough, honey-coloured
„ Mongala lumps and balls	7·35	5·95	0·52	Tough, honey-coloured
„ Lac Léopold II.	4·66	4·94	0·39	Tough, yellowish-brown
„ Equateur	2·67	9·28	0·50	Transparent, hard, yellowish-brown
Ordinary Upper Congo	7·00	6·00	1·02	Oily, greenish-yellow
(Upper Congo) Uelé	4·34	4·01	0·62	Waxy, yellowish-brown
„ Aruwimi	4·68	4·52	0·39	Very tough, brownish-yellow, partially crystalline
„ black Kasai	7·34	8·74	1·12	Soft, brown
„ red Kasai	6·67	4·47	0·19	Semi-hard, yellowish-brown
„ Loanda Sankuru sticks	17·00	4·95	1·64	Semi-hard, brownish-yellow
„ Loanda Sankuru balls	12·00	2·01	0·63	Semi-hard, brown
„ ordinary Loanda	12·35	5·63	1·41	Fat-like, yellowish-brown, partially crystalline
„ Yakoma	8·67	6·12	0·60	Tough, yellowish-brown
„ Lopori	5·84	5·51	0·41	Transparent, hard, yellowish-brown
„ Katanga	7·66	8·18	1·19	Fatty, yellowish-green, partially crystalline
„ Isangi	12·00	17·86	0·99	Brittle, transparent, brown, partially crystalline
(Congo) red Djuma	30·33	4·36	1·50	Semi-hard, brown, partially crystalline
(Lower Congo) black thimbles	4·33	5·75	0·40	Tough, yellowish-brown, partially crystalline
„ red thimbles	33·00	4·67	1·40	Tough, brownish-yellow, partially crystalline

The market prices of these rubbers are mostly in agreement with their properties as expressed by the above data. Red Djuma rubber, however, is an exception, being disproportionately high in price; but the author is of the opinion that the specimen examined was not a typical one, as with this kind of rubber, the loss on washing, in general, is seldom more than 20—22 per cent.—W. A. C.

Rubber substitute; Oxidation of ——, and its influence on rubber. R. Ditmar and O. Dinglinger. Gummi-Zeit, 1906, **21**, 285—286.

The authors have subjected four widely different varieties of chlorosulphide and sulphide substitutes to the oxidation test devised by R. Ditmar, and find them all very resistant: in 2½ days, 0·56 per cent. of oxygen absorbed was the highest observed. In examining the effect of substitute when compounded with rubber, washed Peruvian rubber was mixed with 4 per cent. of sulphur and rising proportions of a brown substitute of German make. The samples were vulcanised for two hours at six atmospheres pressure, and tested mechanically. The figures given seem to indicate that both strength and extensibility are increased by admixtures of substitute up to 25 per cent. Oxidation tests were also carried out on these test pieces, and it was found that the oxygen absorbed in 2½ days decreased uniformly from 2·73 per cent. when no substitute was present to 0·94 with 10 per cent. of the same. It is therefore considered that fatty substitute tends to protect rubber from oxidation.—W. A. C.

Gutta-percha; Temperature coefficients of ——. K. Winnertz. Elektrotechn. Zeits., Nov., 1906; Electrician, 1907, **58**, 453.

The temperature coefficients of the insulation resistance of gutta-percha, as applied to submarine cables, have not hitherto been determined in the immediate neighbourhood of 32° F., the values for these temperatures being obtained by extrapolation. From recent experiments down to 35° F., however, it appears that below about 50° F. the curve of coefficients departs from its asymptotic form. Thus a coefficient for 40° F. was found to be 8·7, whereas by extrapolation it would be from 13·0 to 15·7. For temperatures above normal the curve pursues a regular asymptotic course as far as 95° F.—W. A. C.

English Patents.

India-rubber; Manufacture of ——. A. G. Bloxam, London. From M. K. Bamber, Colombo, Ceylon. Eng. Pat. 25,291, Dec. 5, 1905.

Substances which it is intended to incorporate with the rubber, such as vulcanising agents, colouring matters, &c., are added to the original latex, which, if necessary, has been prevented from coagulating by the addition of an alkali or an antiseptic. The mixture is then slightly acidified, and the rubber allowed to coagulate, when a homogeneous mass, containing the added matter, is obtained.—M. J. S.

Caoutchouc; Processes for obtaining ——. B. Grätz, Berlin. Eng. Pat. 4701, Feb. 26, 1906. Under Int. Conv., Feb. 2, 1906.

See Fr. Pat. 363,340 of 1906; this J., 1906, 895.—T. F. B.

Caoutchouc and other organic substances; A compound for coating —— to preserve the natural properties thereof. E. Granier, Paris, and E. L. Froger-Delapierre, Grasse, France. Eng. Pat. 6183, March 14, 1906.

The compound is prepared by mixing albumino-gelatinous substances, or gelatin and albumin, with glycerol and glycerol triacetic ester.—C. S.

French Patents.

Caoutchouc; Process for the preparation of pure ——. A. Foelsing. Fr. Pat. 368,958, Aug. 6, 1906.

The process consists in first eliminating impurities, such as colouring and tanning matters, albuminoids, glucosides, inorganic compounds, oils, waxes, and resins, by the aid of reagents not capable of attacking the rubber and then "decomposing by a chemical process" the residue, consisting essentially of cellulose and india-rubber. The raw material in a finely-divided condition is boiled with a solution of sulphites (preferably calcium sulphite or magnesium sulphite) in sulphurous acid, then dried, and extracted with acetone, or methyl or ethyl alcohol, for the removal of oils, wax, and resin. The residual mixture of cellulose and india-rubber is finally extracted with a rubber-solvent, and the rubber from the solution recovered by evaporation or other suitable method.—A. S.

Pavings, &c.; New material of construction for —— [from cellulose and india-rubber. V. de Reversat-Marsac. Fr. Pat. 368,542, July 31, 1906. IX., page 49.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 27.)

Tannic acid; Determination of —— in tanning materials. W. Vaubel and O. Scheuer. Z. angew. Chem., 1906, **19**, 2130—2133.

The absorption of oxygen in alkaline solution for the estimation of tannic acid in tanning materials has been proposed by Vaubel (Z. angew. Chem., 1903, 389) and Thompson (this J., 1902, 1416); but, according to the authors, the methods fail because no concentration for the alkali is specified. They show that the absorption depends directly upon the concentration of the sodium hydroxide solution used, and have measured it under constant conditions, both by volumetric and gravimetric methods. For the former, a jointless wash-bottle is used, both tubes being provided with stop-cocks and the shorter carrying a small separating funnel. The volume of the flask when filled to the two taps is known. A measured volume of a solution of pure tannic acid is then introduced into the flask, which has previously been filled with oxygen, and 100 c.c. of sodium hydroxide solution are added, the reagents and apparatus being kept at a constant temperature. The apparatus is now frequently shaken, and measured quantities of sodium hydroxide solution run in through the funnel, as required, to replace the absorbed oxygen, the volume of which is finally corrected for temperature and pressure. For the gravimetric method, which is preferable, sodium hydroxide solution is placed in a flask, to the neck of which is attached, by means of a glass stopper, a drying apparatus containing sulphuric acid, whilst through the side passes a tube through which oxygen can be introduced. The weight of the flask, alkali, and acid having been ascertained, the stopper is removed, and 0·5 grm. of pure tannic acid is added. The flask is then closed, and oxygen passed through until no further increase in weight is observed. The experiment is carried out at a constant temperature (12° to 18° C.), and in the absence of direct sunlight. The average oxygen values of tannic acid given by the volumetric and gravimetric methods are 0·3280 and 0·3092 respectively for 1 grm. of dry gallotannic acid. The volumetric method has been employed in the analysis of certain tanning materials, and the results obtained show fair agreement with those from hide powder, but further experiments are still necessary to finally establish the details of the process and the factors for the different tanning materials.—S. R. T.

English Patents.

Hides; Substance for treating ——, and process of making same. O. H. Nowak, Chicago. Eng. Pat. 26,771, Dec. 22, 1905.

See Fr. Pat. 360,854 of 1905; this J., 1906, 647.—T. F. B.

Textiles, paper, leather, and other absorbent materials; Treatment of —— with compounds of alginic acid. The British Algin Co., Ltd., T. Ingham, and H. Bunzl. Eng. Pat. 25,537, Dec. 8, 1905. V., page 46.

XV.—MANURES, &c.

Plant food; Ammoniacal nitrogen as ——. M. Gerlach and Vogel. Centrbl. Bakt. und Par., 1905, 2te Abt. **12**, 124—128; Biedermann's Centrbl., 1906, **35**, 859.

Experiments were made with maize under conditions precluding nitrification of the ammoniacal salts throughout the test: and the results showed that this plant is capable of absorbing and utilising un-nitrified ammonium sulphate in the production of albumin, though the increased weight of plant obtained is less than when nitrates are used.—C. S.

English Patents.

Manurial purposes; Material rich in nitrogen and phosphorus, and application of the same for ——. W. P. Thompson, London. From J. Schlutius, Karow, Germany. Eng. Pat. 26,886, Dec. 23, 1905.

Natural phosphates, rich in iron and alumina, are treated with oxidation products of atmospheric nitrogen, especially nitric acid, in order to produce a fertiliser rich in nitrogen and phosphorus, and free from the gypsum formed in the ordinary superphosphate process.—C. S.

Manure, artificial; Process of manufacturing ——. W. P. Thompson, London. From J. Schlutius, Karow, Germany. Eng. Pat. 26,888, Dec. 23, 1905.

Nitrogenous manures containing potassium or lime, together or separately, are prepared by forming oxides of nitrogen by direct combination from the air, and allowing these products, with or without admixture of steam, to act on crude potash salts, potash lyes, or lime salts, or on a mixture of the same, by contact in absorption columns or in absorption vessels.—C. S.

Manure, artificial; Process of manufacturing —— *from waste material [town refuse].* W. P. Thompson, London. From J. Schlutius, Karow, Germany. Eng. Pat. 26,889, Dec. 23, 1905.

Compounds of nitrogen and oxygen (especially nitric acid), obtained from atmospheric nitrogen, are employed, in a gaseous or partly condensed state, to act on town refuse, all the insoluble matter being separated afterwards by suitable means.—C. S.

XVI.—SUGAR, STARCH, GUM, &c.

(Continued from page 28.)

Pyknometric method; Application of —— *to the determination of weights and volumes of precipitates suspended in liquids. II. Case of precipitates formed in beetroot juice.* H. Gillot and A. Grosjean. Bull. Soc. Chim. Belg., 1906, **20**, 253—277.

The authors have previously shown that the weight of a suspended precipitate, which does not absorb other dissolved substances, may be found from the equation $p = (D - d^1)V \times k$ (1), in which p = weight of precipitate, D and d^1 are the densities of the suspension and of the filtrate therefrom, respectively, V is the volume of the suspension, and k is a coefficient whose value depends on the case under consideration. The authors also represented their results by a curve which was found to be a portion of a hyperbola represented by the following equation:—

$$19{\cdot}187x^2 + 685{\cdot}992xy + 584{\cdot}892y^2 - 924{\cdot}887x \\ - 2954{\cdot}980y + 2625{\cdot}569 = 0 \quad (2)$$

x represents the density of the precipitate; by determining this density, and substituting for x, the value of the constant y may be obtained. If the precipitate is one which does not absorb other substances, the value of k obtained from equation (1) is identical with that of y obtained from equation (2): if $y < k$, water has been absorbed; if $y > k$, dissolved substance has been absorbed. In other words, since x represents the true density of the precipitate (*i.e.*, the density of the precipitate freed from any dissolved substance), the value of y obtained by substituting for x in equation (2), is independent of any absorption, and a comparison of y with k will serve to show if any absorption has taken place. In this investigation the authors have determined the value of k experimentally in the cases of expressed and diffusion beetroot juices precipitated with basic lead acetate. The density of the lead precipitate was also determined, and the value of y obtained from equation (2). The value of k was found to be less than that of y in every case, *i.e.*, the lead precipitate had absorbed dissolved substance; moreover, as the density of the precipitate increased, $y - k$ diminished, the amount of absorption appearing to be inversely proportional to the increase in density of the precipitate. The authors proved that sucrose was absorbed by the lead precipitate, as follows:—Artificial juices, containing inorganic salts, pectin, egg albumin, and known quantities of sucrose, were treated with basic lead acetate, filtered, and polarised, the values of y and k being also determined. Owing to the high density of the precipitate, the difference between y and k was smaller than that obtained with any of the natural beetroot juices. Hence the amount of absorption was correspondingly small; the polarimetric reading showed, however, that the absorption of sucrose was sufficient to counteract the error introduced by the volume of the lead precipitate; in some cases, even, the analysis of the filtrate from the precipitate gave a slightly low result.
—L. E.

Reducing sugars; Determination of ——. G. Bertrand. Bull. Soc. Chim., 1906, **35**, 1285—1299.

The author proposes the following modification of the cupric-reduction method for the determination of reducing sugars:—20 c.c. of the sugar solution (containing not more than 100 mgrms. of reducing sugar; 10—90 mgrms. give most accurate results), 20 c.c. of a solution containing 40 grms. of pure copper sulphate per litre, and 20 c.c. of a solution containing 200 grms. of Rochelle salt, and 150 grms. of caustic soda per litre, are mixed together, heated to boiling, and kept in ebullition for exactly three minutes. The cuprous oxide is allowed to settle, the supernatant liquor then being filtered off through a Soxhlet tube. The precipitate is washed once, by decantation, with hot water, and is then dissolved in a solution containing 50 grms. of ferric sulphate and 200 grms. of sulphuric acid per litre. This solution is then filtered through the Soxhlet tube (in order to dissolve the small quantity of cuprous oxide which was carried over during decantation), the latter being finally rinsed out with water. The amount of ferrous salt in the solution (1 Cu = 1 Fe) is determined with a 0·5 per cent. solution of potassium permanganate. The whole process requires 15—20 minutes. The author gives tables for dextrose, invert sugar, mannose, galactose, sorbose, xylose, arabinose, dihydroxyacetone, maltose, and lactose, from which the weight of the sugar, corresponding to a given weight of copper, may be found.—L. E.

English Patent.

Starch; Manufacture of ——. J. Kantorowicz, Breslau, Germany. Eng. Pat. 10,216, May 1, 1906. Under Int. Conv., May 2, 1905.

See Fr. Pat. 365,834 of 1906; this J., 1906, 998.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(Continued from page 29.)

Cell; The physiological condition of the ——, *and its importance for the technology of fermentation industries.* M. Delbrück. J. Inst. Brewing, 1906, **12**, 642—655.

By the physiological condition of the cell the author means the relative capacity for the secretion of enzymes, the relative activity of those enzymes, and the direction in which their activities are tending. The theory was first developed in the case of barley to explain the variations in the behaviour of the grain during the processes of ripening and malting, the barleys being classed as "hot" (active), or "gentle" (sluggish), according to the phenomena observed during their germination. It was then extended to explain the variations in the fermentative power of yeast according to its race and the general conditions of nutrition and cultivation. Lastly, the idea has been applied to account for the different behaviour of different varieties or crops of potatoes, beets, and grain during storage. The capacity of secreting enzymes appears in most cases to be proportional to the percentage content of nitrogen, although it doubtless depends rather on the nature of the nitrogenous constituents. The nitrogen-content has always played an important part in the determination of the malting value of barley and the fermentative power of yeast. But whilst the physiological activity is fixed by the nitrogenous composition, the physiological condition at any given time differs according to the nature of the enzymes which are active, *i.e.*, according to whether their tendency is constructive (synthetic) or destructive (hydrolytic), and the predominance of one or the other of these tendencies is the resultant of all the inherent and external factors which are operative. The zymase and the proteolytic enzyme of yeast are in a sense antipodes, and yet the formation of the former may be dependent on the constructive activity of the latter. An elevation of temperature above a certain point causes the rapid destruction of the zymase by the proteolase, but the balance thus upset may be restored by stimulating the other vital activities of the yeast by introducing it into a nutrient sugar solution. Thus "life" depends on an auto-regulation of a complicated equilibrium. The physiological utility of all enzymes may perhaps be regarded as protection of the vital equilibrium against external attacks. The combative function of the zymase by the excretion of poisonous alcohol and carbon dioxide has long been recognised, and the author now suggests that a similar function may be ascribed to the proteolytic enzyme. It has been observed that foreign albuminoid matters, *e.g.*, the meals of certain raw cereals, are distinctly poisonous to yeast which is in a particularly sensitive condition, and just as this poisonous property is protective to the grain, so the proteolytic enzyme, by attacking the albuminoid poison, may be protective to the yeast. (See following abstract.)—J. F. B.

Beer yeast ; Toxic action of cereals on low-fermentation ——. H. Lange, Henneberg, F. Hayduck and Wendel. J. Inst. Brewing, 1906, 12, 666—668.

In the course of investigations on yeast stimulants, the authors observed that certain cereals did not stimulate the yeast, but actually exerted a powerfully poisonous influence. This influence was exhibited in the case of the bottom-fermentation beer yeasts, but not in that of top-fermentation distillery yeasts, the top-fermentation beer yeasts occupying an intermediate position. The action is only observed when yeast and cereals are present together in saccharine solutions prepared with distilled water. Rye, wheat, and barley, in the form of grits or flour, when placed with bottom-fermentation beer yeast in a solution of saccharose, will kill up to 99 per cent. of the yeast in a few minutes ; maize and oats do not possess this toxic action. The toxic substance can be obtained in the form of aqueous or glycerol extracts. In the case of rye, the toxic matter is confined to the corn, and is absent from the chaff, husk, and other portions of the plant. It is most concentrated in the nitrogenous fractions of the meals. Its action may be destroyed by heating the cereal for several hours at 100° C. or, in the case of extracts, by boiling. The toxic properties are weakened by malting the cereals, but whether they can be totally destroyed in this manner is undecided. The toxic substance cannot be extracted by ether or alcohol, nor by steam-distillation. It does not appear to be an alkaloid, but observations point to the probability of its being a proteid or a product of the proteids. The toxic action may be entirely eliminated by the addition of inorganic salts, especially salts of calcium and magnesium ; in fact, the salts of ordinary hard water are sufficient to prevent the toxic action. This observation is consistent with the possibility of the substance in question being oxalic acid. Other substances exerting a strongly poisonous influence on bottom-fermentation beer yeast are : egg-albumin, Witte's peptone, and papayotin. The power of resistance of the yeast against the cereal poison is dependent on its physiological condition.—J. F. B.

Analysis from the maltster's standpoint. O. J. Ruh. Amer. Brewer, 1906, 513 ; Woch. f. Brau., 1906, **23**, 743—744.

Although a standard method of malt analysis has been proposed in the United States, it has not been generally adopted, and, owing to the various methods of procedure, the analytical results obtained are not strictly comparable. The determination of moisture, extract, and colour of the wort should be executed with standard apparatus under standard conditions. The extract determination should be made both on the fine and coarse grist. Owing to the small quantity of the malt sample generally available, the determination of the bushel weight is of doubtful value ; moreover, in this connection, both the brewers' corn-weight and the U.S. normal corn-weight (which differ by 1—1·5 lb.) are in use. The methods of determination of the number of mouldy corns, of the acrospire length, and of the quality of the grain, also require to be standardised. In conclusion, the author recommends the nomination of a committee, consisting of an equal number of brewers, analysts, and maltsters (not brewers who do their own malting), for the purpose of standardising malt analysis.—L. E.

Anti-diastase and anti-amylocoagulase. A. Fernbach. Ann. Brass. et Dist., 1906, 512 ; Woch. f. Brau, 1906, **23**, 743.

When bacteria are introduced into a living organism, the latter secretes a class of substances, known as antitoxins, which arrest the action of the toxins excreted by the bacteria. The properties of many toxins permit of the classification of these substances amongst the enzymes. By subcutaneously injecting an enzyme solution into an animal, a serum may be subsequently obtained which possesses an inhibiting effect on the action of the enzyme. If the injected solution contain a number of enzymes, the organism responds with the formation of an equal number of these inhibiting or anti-bodies, each of which is endowed with a specific retarding action. C. Gessard has applied the term "polyvalent" to a serum containing a number of these anti-bodies. By a subcutaneous injection of malt extract into a rabbit, the same investigator has obtained a serum containing an anti-peroxydase which is capable of preventing malt extract peroxydase from producing a blue colour with guaiacol-hydrogen peroxide ; moreover, this serum has the power of inhibiting the saccharification of starch by malt extract, *i.e.*, it contains a substance which opposes the action of diastase. The author and J. Wolff have also shown that this serum contains an anti-amylocoagulase. (See succeeding abstract.)—L. E.

Anti-amylocoagulase. A. Fernbach and J. Wolff. Ann. Brass. et Dist., 1906, 513 ; Woch. f. Brau., 1906, **23**, 743.

The authors employed serum from a rabbit which had been treated with a subcutaneous injection of malt extract. This serum was found to possess anti-coagulating power, thus indicating the presence of amylocoagulase in malt extract, just as the anti-peroxydase and anti-diastatic actions of the serum indicate the presence of peroxydase and diastase in the same extract. If 6 drops of 1 per cent. malt extract be added to 5 c.c. of 2 per cent. starch paste, previously heated for ten minutes to 110° C., coagulation begins after the mixture has stood for 3½—4 hours at 10° C. ; the same result is obtained when 18 drops of normal serum are added ; if, however, serum, obtained from a rabbit treated as above described, be employed, either no coagulation occurs, or only to a very slight extent, and much later than under normal conditions. Further experiments showed that the anti-coagulating serum arrests the action of the coagulase present in barley extract ; the authors have shown, moreover, that the anti-coagulating serum does not prevent the liquefaction of starch by malt extract. The discovery of an anti-coagulase furnishes a fresh proof of the presence of an amylocoagulase in malt extract. The authors had previously shown that by heating malt extract (to 65° C.) the coagulating power of the extract was destroyed, whilst the liquefying, dextrinising, and saccharifying powers were not affected. The action of an anti-body furnishes another, more delicate method whereby the coagulating action may be arrested.—L. E.

Ferments and living cells; Action of alkali phosphates on ——. T. Bokorny. Chem.-Zeit., 1906, **30**, 1249—1250.

EXPERIMENTS are recorded which show that yeast cells are destroyed in five days when placed in a solution containing 10 per cent. each of dipotassium phosphate and disodium phosphate, whilst decomposition does not set in until the tenth day when a 15 per cent. solution of disodium phosphate is employed. Further experiments, showing that invertase, zymase, and maltase are destroyed by 1 per cent. sodium hydroxide solution, but not by a 0·5 per cent. solution, lead to the conclusion that at least 1 per cent. of sodium hydroxide is formed by dissociation in the 15 per cent. disodium phosphate solution.

Infusoria do not appear to be injured by a 1 per cent. disodium phosphate solution, but are killed by a 2·5 per cent. solution. The potassium salt appears to be more injurious in this case than the sodium salt.—W. P. S.

Fermentation of glucose [dextrose]; Influence of sodium arsenate on the —— by yeast juice. A. Harden and W. J. Young. Chem. Soc. Proc., 1906, 22, 283—284.

ALTHOUGH sodium arsenate produces an acceleration of the rate of fermentation of dextrose by yeast juice in a similar manner to sodium phosphate (this J., 1906, 490), the phenomena are somewhat different. With sodium arsenate, the rate is increased 8—12 times, and this high rate continues without change for a considerable time, until many times the quantity of carbon dioxide equivalent to the added arsenate (mol. per mol.) has been evolved. The rate then falls gradually, and the total duration of fermentation is less than in the case of yeast juice to which no arsenate has been added. The arsenate, after the fermentation ceases, is still precipitable by magnesia mixture, differing in this respect from the phosphate.—A. S.

Wine; Influence of the method of obtaining the must and the fermentation and treatment of the new —— upon the nature of the same. W. Seifert. Mitt. Ver. zum Schutze des oesterr. Weinbaues, 1905 [112].

IF, in the preparation of must from the crushed grapes, the latter be placed on the straining-floor, or introduced directly into the press-cage, but without applying pressure, the must obtained is called strainer-must ("*Seihmost*") or first runnings. The latter term is, however, not sufficiently precise, as it is also applied to must obtained from the wine-press by the use of very slight pressure. By applying a gradually increasing pressure to the grapes after the separation of the strainer-must, the so-called press-must or after-runnings is obtained. If only a relatively small quantity of must is obtained on pressing, the mass of grapes is taken out of the wine-press, broken up, replaced in the press, and strong pressure applied, whereby a third must, after-press must ("*Scheitermost oder Nachdruck*"), is obtained. If the pressed mass be taken out and broken up a second time, a second after-press must is obtained, and so on. The strainer-must comes principally from the fleshy part of the grapes between the skin and the core; the press-must comes chiefly from the core or portion surrounding the kernels, and is sometimes called "core-must"; whilst the after-press must comes mainly from the skins, and is sometimes called skin-must. After dealing with the effects on the composition of the must if it be allowed to remain too long in contact with the crushed grapes, the author describes the differences in the composition of the three kinds of musts, and of the wines made therefrom (see following abstract). For the fermentation of the must, the author strongly recommends using pure cultures of yeast. A quantity of perfectly sound and ripe grapes should be collected a few days before the main quantity of the fruit is gathered, and the must obtained from them by pressing caused to ferment by means of a pure culture of yeast. Then 0·5 to 1 litre of this fermenting must is added to each hectolitre of ordinary must. The author also discusses the question of the best time for drawing off the new wine after the main fermentation, and the influence of the time of contact of the new wine with the lees after the main fermentation on the production of various diseases in the wine. Remedies for the diseases are discussed. In general, the new wine should be drawn off about Christmas or New Year, but the exact time must in every case depend upon the condition of the wine.—A. S.

Must; Chemical composition of the different portions of —— obtained on pressing, and of the wines yielded by them. R. Reisch and J. Trummer. Mitt. Chem. Vers.- und Hefereinzuchtlab. k. k. höh Lehranst. für Wein- und Obstbau in Klosterneuburg. 1906.

THE authors' experiments were made with six different kinds of grapes, the object being to ascertain the differences in the chemical composition of the different portions of must, *viz.*, strainer-must, press-must, and after-press must (see preceding abstract), and the average must obtained by mixing together the three portions. The wines made from the four different kinds of musts were also examined. The detailed results are set out in tabular form. It was found that with few exceptions the sugar-content and amount of free acid are greatest in strainer-must and smallest in after-press must, press-must occupying an intermediate position. The reverse is the case with respect to the amounts of sugar-free extract, nitrogen, ash, and phosphoric acid—that is, the strainer-must is poorest and the after-press must is richest in these substances. Analogous differences are observed in the wines prepared from the different musts, those from the press- and after-press musts being poorer in free acid and richer in nitrogen, ash, and phosphoric acid than the wine from the strainer-must, and, moreover, having greater palatefulness and richer bouquet than the latter. The wine obtained from the average must *i.e.*, the strainer-, press-, and after-press musts mixed together, differs little from that obtained from press- and after-press musts. The authors conclude from their results that the belief that a better wine is obtained by fermenting separately the first runnings or strainer-must is quite erroneous. In practice, the best results will be obtained by fermenting the whole of the must in one operation.—A. S.

Wine; Action of free sulphurous acid and acetaldehyde-sulphurous acid on the organisms of ——. W. Seifert. Z. landw. Vers. Oesterr., 1906.

WHEN an excess of sulphur is burnt in air in a closed vessel until the flame is extinguished, only one-third of the total oxygen, at the most, is converted into sulphurous acid. The quantity of sulphurous acid absorbed by a liquid poured into the vessel then depends on the nature of the vessel (glass or wood), the wetness or dryness of the walls during the fumigation, the nature of the liquid which is poured in, and the rapidity with which the vessel is filled. The author has studied all these factors, and found that an alcoholic liquid like wine, when filled into a moist cask fumigated with excess of sulphur, absorbed 160 mgrms. of sulphurous acid per litre, or four-fifths of the total acid produced, whilst water or grape-must absorbed only 100 mgrms. per litre under the same conditions. In the fumigation of casks and filling up with wine under ordinary industrial conditions, when 3 grms. of sulphur were burnt per hectolitre of cask capacity, the wine took up on an average 29·7 mgrms. per litre, but the single observations showed considerable variations. The quantity of free sulphurous acid in wine thus treated diminishes very rapidly owing to its conversion into aldehyde-sulphurous acid; the rapidity of this conversion depends on the age of the wine, or rather on the proportion of aldehyde present. When all the free sulphurous acid has combined, the wine still absorbs iodine equivalent to 2—4 mgrms. of sulphurous acid per litre, but this absorption is due to normal constituents of the wine, and occurs even with untreated wines. It is doubtful whether any dissociation of the aldehyde-sulphurous acid occurs at all in wine at ordinary temperatures. Different races of yeast show different degrees of sensitiveness to the inhibitive action of sulphurous acid. When sulphured grape-musts were pitched with 1 per cent. of pure, vigorous yeast culture, no retardation of the commencement of fermentation was noticed until the proportion of free sulphurous acid was raised to 80—100 mgrms. per litre, whilst an equivalent quantity of aldehyde-sulphurous acid had no effect whatever. The delay at the beginning, caused by the free sulphurous acid, was soon made up, owing to the fixation of the sulphurous acid in the form of the aldehyde compound, and the final results were practically identical. When wines were purposely infected with *Mycoderma vini*, an addition of 170 mgrms. of free sulphurous acid per litre was required to prevent the development of the fungus, whilst even 220 mgrms. of the aldehyde-sulphurous acid afforded no protection. The relatively high resistance of this fungus even towards free sulphurous acid is partly due to the rapid conversion of the acid into the inactive aldehyde compound. Acetifying bacteria are far more sensitive to free sulphurous acid than yeast or mycoderma, and they are affected even by aldehyde-sulphurous acid. Under the conditions chosen, the presence of 50 mgrms. per litre of free sulphurous acid was sufficient to kill the infection, whilst 100 mgrms. per litre of aldehyde-sulphurous acid only delayed the development of the disease.—J. F. B.

Vinegar generator; A new ——. W. J. Lenze. Chem.-Zeit., 1906, **30**, 1299.

The apparatus consists of an oblong chamber 400—600 cm. long, 200 cm. wide, and 225—250 cm. high, standing in a tray which receives the vinegar. A wooden grating a little above the level of the liquid carries wood chips, which are packed up to the cover, allowing the air to circulate freely through the apparatus. The mash is supplied from vats at a higher level, and is evenly distributed over the chips through pots on top of the chamber. The vinegar overflows from the tray into the storage vessels. A plant consisting of four such chambers produces 2000 litres of vinegar *per diem*, containing 10 per cent. of acetic acid. If a stronger product be required, the vinegar is pumped through more than one chamber. This plant requires a floor space of about 60 sq. m., whilst an equivalent plant of 60 Schuetzenbach generators occupies about 110 sq. m. The chambers are constructed entirely of wood, and have earthenware or glass fittings.—R. L.

Lees-of-wine brandy; The improvement of ——. W. Seifert. Mitt. Chem. Vers. Hefereinz. Lab. Wein u. Obstbau, Klosterneuburg, 1906.

The lees remaining after the clarification of fresh wine consist chiefly of yeast, micro-organisms, grape residues, and precipitated matters, together with a considerable proportion of wine. The lees are collected in a separate tun, and a second draught of inferior wine is obtained after the deposit has become more consolidated. Owing to the impure nature of the deposit, the wine is very liable to "turn" during this further process of clarification, and the tun should be fumigated frequently with sulphur dioxide. The lees now retain 50—60 per cent. of wine, and they can either be distilled direct for brandy, or a third fraction of wine can be drawn by pressing the deposit before distillation. In the former case, 100 litres of lees will yield 12—20 litres of brandy containing about 50 per cent. (by vol.) of alcohol; in the latter case, they will yield only one half of that quantity. Distillation is effected, with or without the addition of water, in a pot-still provided with a stirrer and heated by direct fire. The distillate contains only 25—35 per cent. of alcohol, and has a turbid appearance due to the presence of large proportions of œnanthic ether and fusel oil. After a second distillation of the distillate in the same still, a clear brandy is obtained at an alcoholic strength of about 50 per cent. (by vol.). This lees-of-wine brandy is scarcely fit for consumption, and it becomes turbid when diluted with 10—15 per cent. of water. The author proposes a simple treatment for refining these impure brandies so as to bring them into a condition comparable with that of ordinary wine brandies. For that purpose, the brandy is diluted with water until it contains 20—22 per cent. of alcohol. At this dilution, the oils are precipitated and can be removed by filtration through a layer of magnesium carbonate and asbestos. The filtrate comes through perfectly clear, and is then re-distilled in the pot still. About one-fourth is distilled off as brandy of fair quality, which can be diluted to 50 per cent. alcoholic strength for sale, whilst the remainder of the distillate, which is poorer in alcohol and less pure, is collected separately. The same process, with a slight modification, can be used for refining grape-marc brandies.—J. F. B.

Spirits; Re-test of foreign —— *for obscuration prior to delivery for home use.* Bd. of Tr. J., Jan. 10. 1907. [T.R.]

The Commissioners of Customs have issued a General Order (No. 82 of 1906), stating that "attention having been drawn to a number of cases in which a considerable increase in the percentage of obscuration has been found on the re-test of spirits which have remained in warehouse for a lengthened period, the Board desire to notify that, in future, before delivery upon payment of duty, a re-test will be applied to foreign spirits which have remained in bond for more than five years from the date of first warehousing on importation, unless they shall, in the meanwhile, have been re-tested within five years of such delivery."

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 30.)

(*A.*)—FOODS.

Fat in butter; Determination of ——. A. Froehner. Chem.-Zeit., 1906, 30, 1250—1251.

The method proposed is an adaptation of Gottlieb's process for the determination of fat in milk.—W. P. S.

English Patents.

Ferments and fermented materials for use in baking and for pharmaceutical and other purposes; Production of ——. A. Pollak, Allach, Germany. Eng. Pat. 24,739, Nov. 29, 1905.

Highly concentrated extracts of malt, yeast, &c., are mixed (if desired) with suitable nutritive substances (vegetable albumin, "dissolved flour," malt, meal, salts, &c.), and subjected to the action of a pure lactic ferment at 50°—55° C., and the resulting product is mixed with pure pressed yeast that has undergone partial auto-digestion, the mixture being maintained at a high temperature (50°—60° C.) that is insufficient to retard enzyme action. The lactic ferment may be replaced by one obtained from sour dough by cultivation at 40°—50° C. in a rich nutrient medium, to ensure preponderance of the lactic ferment.—C. S.

Homogeneous products [artificial butter] from liquid or liquefied substances; Method of manufacturing ——, *and apparatus therefor.* W. G. Schroeder, Luebeck, Germany. Eng. Pat. 25,404, Dec. 6, 1905.

This invention relates to an apparatus for mixing the materials used in the manufacture of homogeneous products from liquids and liquefied substances, and has special reference to the manufacture of artificial butter. The liquids (milk and fats) are introduced from the top into a preliminary mixing vessel, and are agitated by blades rotating at great speed. The scum is gradually condensed into a cohesive and homogeneous emulsion, which, by virtue of the special construction and arrangement of the mixing blades, is gradually forced down and discharged from the bottom, in the same proportion as the milk and fats are introduced through the top.—O. R.

Centrifugal drums or apparatus [for milk]. B. A. O. Prollius, Copenhagen. Eng. Pat. 16,583, July 23, 1906.

A star-shaped distributing casing provided with holes or slots at the extremities of the projecting parts of the star is fitted over the central supply tube of a centrifugal milk separator. The apparatus can be easily cleaned by unscrewing the top cap of the machine, and lifting out the distributing casing.—W. H. C.

(*B.*)—SANITATION; WATER PURIFICATION.

Water filtration; Use of copper sulphate in ——. A. Kemna. J. Gas Lighting, 1906, **96**, 813—814.

The addition of copper sulphate to water in order to destroy algæ, &c., was tried during August last at the Waelham works of the Antwerp Water Company. It was found that there was a rapid destruction of organisms, and especially of *Eudorina;* the latter were killed by the presence of one part of copper sulphate per million. Another result was the disappearance of most crustacea, *Daphnia*, although very numerous, being effectively dealt with. A noteworthy fact is what may be called the after-effect of the copper sulphate. When the filter, through which the treated water had been passed, was re-started after being cleaned, the loss of head remained *nil* for 10 days, although no copper sulphate was added to the fresh supply of water. After the second, third, and fourth cleanings, the same effect was noticeable. The copper salt does not remain in solution; there are various causes for its precipitation; and it is possible that the grains of sand get coated with a layer of the precipitate. There appears to be a greater difficulty in starting growth on such a filter, although the biological examination of the surface layer when cleaned shows no difference from that of other filters. It cannot be denied, however, that the first effect of the copper sulphate was to make things worse; the filter was unsatisfactory during at least six days, and though the organisms had diminished in number, the filtered water had a marked taste besides containing an increased quantity of free ammonia. (See also this J., 1906, 207.)—W. P. S.

ENGLISH PATENTS.

Manure, artificial; Process of manufacturing —— from waste material [town refuse]. W. P. Thompson. From J. Schlutius. Eng. Pat. 26,889, Dec. 23, 1905. XV., page 60.

Water; Apparatus for purifying ——. H. Breda, Charlottenburg, Germany. Eng. Pat. 6011, March 12, 1906.

This invention relates to an apparatus for use in freeing water from iron compounds contained in solution. Oxidation is effected by forcing compressed air into the water to be purified, which flows continuously through the apparatus under pressure. The mixture of water and air first passes through a mixing pot and thence into one or more purifying receptacles. In the latter, the water is mechanically divided into a great number of thin jets, and these pass through the purifying mass, which consists of some porous inorganic substance having sharp edges. A mud containing ferric hydroxide gradually deposits, which, by virtue of its catalytic powers, accelerates the further oxidation of the ferruginous matter in solution. After the mixture of water and air has passed the "contact" mass, it flows through a filtering mass, which retains any precipitate still in suspension.—O. R.

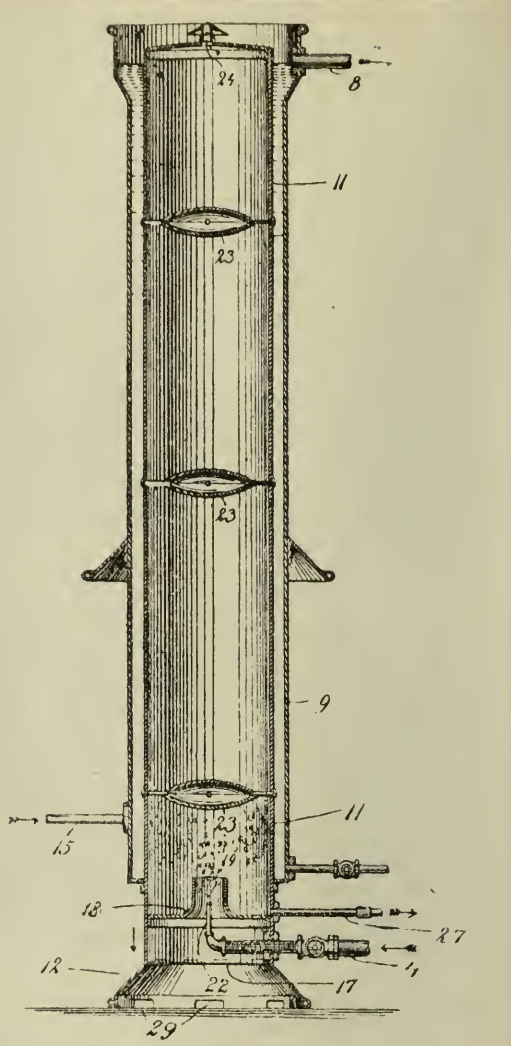
Drinking-water; Process and apparatus for preparing —— from sea water. G. Liebl, Haarlem, Holland. Eng. Pat. 6373, March 16, 1906.

This invention relates to an apparatus for distilling sea water by means of exhaust steam, at less than atmospheric pressure.—O. R.

UNITED STATES PATENTS.

[*Water*] *Distilling apparatus.* W. H. Bartholomew, East Orange, N.J., Assignor to C. B. Hill, Montgomery, N.Y. U.S. Pat. 831,593, Sept. 25, 1906.

The claim is for a condenser described as forming part of U.S. Pat. 829,756 of 1906 (this J., 1906, 950). The condenser consists of a tall cylindrical vessel, 11, surrounded by a cooling-jacket, 9, provided with a water inlet, 15, and an outlet, 8. The steam arrives by the pipe, 4, which terminates in the jet, 22, and enters the condenser through the upturned flange, 19, of the bottom plate, 18, which serves to collect the condensed liquid, the latter being drawn off by the pipe, 27. The steam acts as an injector and draws air through the openings, 29, in the base, 12, and a gauze filter, 17. The air mixes with the vapour and aërates the condensed liquid, and the excess escapes along with any gases which accompany the steam, through the capped pipe, 24, at the top of the condenser. Hollow disc deflectors, 23, are placed at intervals within the condenser to direct the vapours upon the cooled surface.—W. H. C.



(*C.*)—DISINFECTANTS.

FRENCH PATENTS.

Insecticide for plants; Process for making an ——. Soc. Anon. de la Thyoléine. Fr. Pat. 368,968, Aug. 13, 1906. Under Int. Conv., Aug. 14, 1905.

The composition claimed is prepared by mixing from 5 to 15 parts of ichthyolsulphonic acid, 3 parts of glycerin, and 10 parts of soft soap, the mixture being stirred for 30 minutes in a vessel surrounded by boiling water. The paste obtained is soluble in water in all proportions. If desired, the ichthyolsulphonic acid may be neutralised before making the mixture.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 31.)

Celluloid; Analysis of ——. H. Dubovitz. Chem.-Zeit., 1906, **30**, 936—937.

About 2 grms. of the finely-divided celluloid are treated in a 150 c.c. stoppered flask with about 100 c.c. of acetone, the stopper is inserted, and the flask shaken until the whole of the celluloid with the exception of mineral matter has dissolved. The contents of the flask are now made up to 150 c.c., well mixed, and 100 c.c. of the solution withdrawn for the determination of the soluble nitrocellulose. The remaining 50 c.c. of solution is shaken vigorously with about 25 c.c. of an 8 per cent. solution of ammonium chloride. As heat is developed on mixing the acetone with the aqueous solution, the flask is cooled for 1—2 minutes in running water. The precipitate (nitrocellulose and mineral matter) is collected in a Gooch crucible or on a dry filter, freed from camphor by washing with a mixture of one part of acetone and one part of an 8 per cent. solution of ammonium chloride, and afterwards washed with absolute alcohol, and dried at 60° C. until of constant weight. If the weight of the precipitate be a grms. and that of the celluloid taken be A grms., then the percentage of camphor is $100(A-3a)/A$. The precipitate is next mixed with a small quantity of paraffin wax, the mixture melted at a temperature below 100° C. and then burnt, and the residue ignited to obtain the weight of mineral matter. If the weight of mineral matter be c grms., then the percentage of nitrocellulose is $300(a-c)/A$. The 100 c.c. of solution set aside in the first place is treated with ammonium chloride solution as described above, and the precipitate is moistened with absolute alcohol, and introduced into a 150 c.c. graduated, stoppered glass cylinder, wherein it is shaken with 50 c.c. of absolute alcohol, and allowed to stand for half an hour. 100 c.c. of ether are then added, and the whole allowed to stand for 12 hours with frequent agitation. 50 c.c. of the clear solution are evaporated in a platinum crucible, and the residual soluble nitrocellulose weighed. The nitrogen-content of the soluble nitrocellulose is determined in the usual manner with Lunge's nitrometer. The decomposition-temperature of the celluloid is ascertained by heating a sample, cut into small pieces, in a test-tube in an oil-bath until inflammation occurs. The relation between the composition and decomposition-temperature is shown in the following table:—

Camphor	Total Nitro-cellulose.	Soluble nitro-cellulose.	NO_3.	NO_3 in the nitro-cellulose.	Ash.	Decom-position temp. ° C.
21·98	68·1	63·77	24·0	35·26	9·86	136
35·0	64·9	59·1	23·96	36·78	0·0	103
19·6	66·7	—	—	—	13·63	161
18·3	71·3	—	—	—	10·46	131
32·2	67·7	—	—	—	0·0	115

(See also this J., 1890, 1159.)—A. S.

Cellulose "peroxide," a new combination of cellulose with oxygen. C. F. Cross and E. J. Bevan. V., page 44.

English Patents.

Textiles, paper, leather, and other absorbent materials; Treatment of —— with compounds of alginic acid. The British Algin Co., Ltd., T. Ingham, and H. Bunzl. Eng. Pat. 25,537, Dec. 8, 1905. V., page 46.

Cork, artificial; Manufacture of —— from cellulose. G. C. de Briailles, Paris. Eng. Pat. 3013, Feb. 7, 1906.

See Fr. Pat. 364,641 of 1906; this J., 1906, 950.—T. F. B

French Patents.

Pavings, &c.; New material of construction for —— [from cellulose and caoutchouc]. V. de Reversat-Marsac. Fr. Pat. 368,542, July 31, 1906. IX., page 49.

Waters; Purification of industrial —— [from cellulose and paper factories]. Oesterreichischer Verein für Cellulose-Fabrikation. Fr. Pat. 368,868, Aug. 14, 1906.

This invention relates to the mechanical purification of works effluents, with special reference to the recovery of waste fibre in cellulose and paper manufacture. A number of screens, placed one behind the other, successively remove the coarser and the finer impurities contained in the effluent. The coarser matter is first separated by means of elevator screens which communicate with a set of rotary filtering drums. Inside the latter there are drains by way of which the sediment finds egress. The water, still charged with finer particles and fibrous matter, is conducted to a second series of filtering drums. These contain screens of the finest mesh, through which the water issues free from all suspended impurities. Inside the drums are fixed a number of narrow radial partitions, between which the fibres collect. As the drums rotate, a jet of water carries the fibres, after passing through suitably disposed channels, to a well. From this well the fibres are either pumped back to where they are utilised, or else the well is itself fitted with a filtering apparatus. From this, the fibres, partly freed from water, may be collected when required.—O. R.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 33.)

Strychnine; Determination of —— in Nux vomica, by the nitric acid process. [Modification of Gordin's method.] M. H. Webster and R. C. Pursel. Amer. Drug., 1906, **50**, 362—363.

It is found that more definite and complete elimination of the brucine from the mixed alkaloids of *Nux vomica* is obtained when they are treated with nitric acid and a little sodium nitrite, in the presence of sulphuric acid, than when the pure acids alone are employed. The separated total alkaloids from 10 c.c. of fluid extract of *Nux vomica* (or from an equivalent quantity of *Nux vomica* seeds) are dissolved in 15 c.c. of 3 per cent. sulphuric acid; to this solution 3 c.c. of a mixture of equal volumes of nitric acid of sp. gr. 1·4 and distilled water, followed by 1 c.c. of a 5 per cent. aqueous solution of sodium nitrite, are added; after mixing, the liquid is allowed to stand for exactly 30 minutes, with occasional agitation. It is then made alkaline, and the liberated strychnine is shaken out with chloroform in the usual manner.—J. O. B.

Morphine; Determination of —— in opium [by a modification of Léger's method]. L. Picard. Bull. Soc. Pharm. de Bordeaux, 1906, **46**, 241—253.

Six grms. of powdered opium and 48 c.c. of lime water are taken; the opium is first triturated and well mixed with a very small quantity of the lime water, and the rest is then added so as to obtain a homogeneous mixture, which is set aside for two hours, being kept well covered, and occasionally stirred. 0·5 grm. of sodium salicylate is then stirred in, and 10 minutes after, the mixture is filtered and pressed through a cloth. Thirty-six c.c. of the filtrate are transferred to a graduated flask, 4 c.c. of ether are added, and the liquid is made exactly neutral to litmus by the cautious addition of a few drops of very dilute solution of ammonia; six drops of ammonia in excess are then added, the flask is stoppered, agitated for 10 minutes, and set aside for 24 hours. The precipitated morphine is then collected on two counterpoised filters, one inside the other, the morphine adhering to the flask being washed off with 8 c.c. of distilled water. The beak of the funnel is then closed with a piece of rubber tubing carrying a pinch-cock. The funnel is filled with distilled water to which a few drops of ether have previously been added; after five minutes' contact, this liquid is allowed to drain off. This washing is repeated a second time; the drained morphine is then dried on the filter paper at 100° C. and weighed. The dry morphine may, if desired, be again washed with 20 c.c. of benzene, to remove traces of narcotine, but as a rule, the amount of this impurity present is so small as to be negligible. The above method is stated to give better results than the lime method of Petit.—J. O. B.

Chlorocodide ; Conversion of —— into pseudocodeine. L. Knorr and H. Hörlein. Ber., 1906, **39**, 4409—4411.

Pseudocodeine, $C_{18}H_{21}NO_3$, m. pt. 180° C., was obtained by boiling a solution of chlorocodide in water and acetic acid. It crystallises with 1 mol. of water, and has $\alpha_D^{15°} = -94°$. The hydriodide melts at 260°—265° C. The methiodide crystallises from methyl alcohol or water in fine glistening leaflets melting at 270° C. The acetyl derivative of pseudocodeine is an oily base, but its hydriodide crystallises from water in short, anhydrous crystals decomposing at 285° C.—F. Shdn.

Methylmorphimethine ; A fifth ——. L. Knorr and H. Hörlein. Ber., 1906, **39**, 4412—4414.

When pseudocodeine methiodide (see preceding abstract) is boiled with sodium hydroxide, ε-methylmorphimethine separates out as a colourless oil, which cannot be crystallised. The hydrochloride, $C_{19}H_{23}NO_3,HCl$, crystallises from acetone in large glistening cubes, which contain 1 mol. of water and decompose at 150° C. The methiodide of ε-methylmorphimethine crystallises from acetone in needles melting at about 195°—200° C. The acetyl derivative of ε-methylmorphimethine is an uncrystallisable oil: its methiodide crystallises from water in needles, melting at 205°—210° C. ε-Methylmorphimethine is lævo-rotatory.—F. Shdn.

Hordenine ; Constitution of ——. E. Léger. J. Pharm. Chim., 1907, **25**, 5—9.

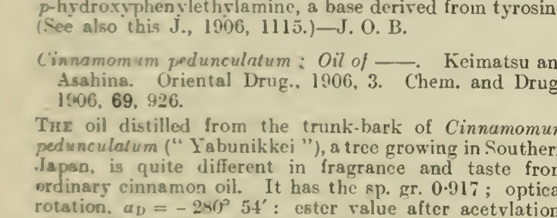
From the facts that acetylhordenine when oxidised with permanganate at 60° C. furnishes acetyl-*p*-hydroxybenzoic acid, m.p. 184·9° C. ; that hordenine itself when heated with nitric acid, yields some picric acid ; that hordenine methyl-hydrate when heated to 170° C. gives trimethylamine among its decomposition products, it is considered hordenine must be *p*-hydroxyphenylethyldimethylamine $C_6H_4(OH)CH_2.CH_2.N(CH_3)_2$. It is closely related to *p*-hydroxyphenylethylamine, a base derived from tyrosine. (See also this J., 1906, 1115.)—J. O. B.

Cinnamomum pedunculatum ; Oil of ——. Keimatsu and Asahina. Oriental Drug., 1906, 3. Chem. and Drug., 1906, **69**, 926.

The oil distilled from the trunk-bark of *Cinnamomum pedunculatum* (" Yabunikkei "), a tree growing in Southern Japan, is quite different in fragrance and taste from ordinary cinnamon oil. It has the sp. gr. 0·917 ; optical rotation, $\alpha_D = -28°\ 54'$: ester value after acetylation, 84·6. When distilled under reduced pressure, the oil yielded a large quantity of phellandrene and a small quantity of eugenol. The fraction distilling between 244° and 249° C. at atmospheric pressure contains methyleugenol.—A. S.

Essential oils ; Constituents of ——. 1. Fission of the bicyclic tricecan system into sabinene and tanacetone. 2. A new series of terpenes (cyclopentadiënes). F. W. Semmler. Ber., 1906, **39**, 4414—4428.

By mixing equal quantities of sabinene and formic acid at below 0° C., and saponifying the resulting formate, an alcohol is obtained which is identical with the alcohol occurring together with α-terpineol in marjoram oil (*Origanum majorana* L.), and to which the name " originol " is given. In the same reaction there is formed, in equal amount, a cyclopentadiëne derivative, which is a member of a new class of terpenes. The following scheme shows the constitution of these substances :—



—J. C. C.

Thephorine [Theobromine-sodium sodium-formate]. F. Zernik. Apoth.-Zeit., 1906, 21, 898—899.

Thephorine (Theobromine-sodium sodium-formate), $C_7H_8N_4O_2NaOH,HCO_2Na$, has been introduced as a diuretic medicinal product. It is obtained by direct combination of sodium-theobromine with sodium formate. The former is obtained by precipitating a solution of the base in a slight excess of aqueous caustic soda with six times its volume of alcohol. The precipitate is washed with alcohol and dried. 70·1 parts of this are dissolved in 200 parts of water, and a solution of 13·5 parts of pure sodium formate in 50 parts of water is added. The mixture is then evaporated to dryness on the water-bath, and the dry residue is powdered. Thus prepared, thephorine is a white powder with a sweetish, faintly alkaline taste, readily soluble in water ; the 1:4 aqueous solution is colourless, has an alkaline reaction with litmus, and gives a precipitate of theobromine, when acidified with sulphuric acid. It should yield not less than 59 per cent. of theobromine (the theoretical quantity being 62·48 per cent.) when treated with acid. The alkaline aqueous solution of 1 grm. of thephorine, when shaken out with chloroform, should not give more than 0·005 grm. of residue when the chloroform solution is evaporated, indicating absence of free theobromine.—J. O. B.

Saiodin [Calcium monoiodobehenate] ; Characters of and tests for ——. F. Zernik. Apoth.-Zeit., 1906, **21**, 1071—1072.

Saiodin is a white, unctuous, odourless, and tasteless powder, insoluble in water, very sparingly soluble in cold alcohol and ether, soluble in chloroform. If 0·25 grm. of saiodin be dissolved with gentle warming in 5 c.c. of chloroform, and 1 or 2 drops of absolute alcohol added, the solution should not show more than the faintest opalescence, and on standing for 24 hours, should throw down no appreciable deposit. When a little of the substance is burned, it gives off violet vapours of iodine. 1 grm. of saiodin is saponified by boiling for 30 minutes with 50 c.c. of *N*/2 alcoholic potash solution, the alcohol is then driven off, and the cold residual soap treated with 40 parts of a mixture of 2 parts of nitric acid and 4 parts of water, to which a few grains of sodium sulphite have been previously added. The whole is then transferred to a separator, and the liberated fatty acid is shaken out with two successive 20 c.c. of ether. The aqueous layer is filtered, and the bulked ether extract is washed twice with water, the aqueous washings being added to the aqueous solution first obtained. After washing the filter with hot water, the bulked aqueous solution is warmed for a short time to dissipate the dissolved ether, cooled, and treated with 25 c.c. of *N*/10 silver nitrate solution and 1 c.c. of ferrous-ammonium sulphate indicator. The uncombined silver is then titrated back with *N*/10 ammonium thiocyanate solution. At the most, not more than 6 c.c. of the latter should be necessary, equivalent to a content of 24·13 per cent. of iodine in the dry saiodin taken. Saiodin is introduced as a drug for the medicinal administration of iodine. —J. O. B.

Benzosalin [Methyl benzoylsalicylate] ; Tests for the purity and identity of ——. F. Zernik. Apoth.-Zeit., 1906, 21. 962—964.

Benzosalin melts at 84°—85° C. The solution (1:49) in alcohol should not give a violet colour reaction with one drop of ferric chloride reagent ; nor, after the addition of a few drops of nitric acid, give more than the faintest opalescence with silver nitrate solution. If 0·5 grm. of the ester be boiled for three minutes with 10 c.c. of *N*/1 sodium hydroxide solution, filtered when cold, and the filtrate be acidified with dilute sulphuric acid, a crystalline mass soon separates. If this be collected on a filter, washed with water, then treated with 5 c.c. of *N*/10 sodium hydroxide solution, a filtrate is obtained which gives a rusty brown colour and precipitate with one or two drops of ferric chloride solution, and a deep violet colour on the addition of more of the reagent.—J. O. B.

Glycocoll; Characteristic reaction for ——. G. Denigès. Bull. Soc. Pharm., Bordeaux, 1906; Rép. Pharm. 1906, **18**, 533.

If a mixture of 0·10 grm. of benzamide and 0·05 grm. of glycocoll be heated, it first reddens, then turns brown. and gives off odorous decomposition products; first ammonia. then benzoic acid, then hydrocyanic acid, and finally benzonitrile, the odour of which resembles that of Tonka beans. Hippuric acid gives similar products when heated alone, so probably that acid is first formed, with elimination of ammonia, when glycocoll and benzamide are heated together.—J. O. B.

Chloroform; Preservation of ——, and indicator of accidental change in it. P. Breteau and P. Woog. Compt. rend., 1906, **143**, 1193—1195.

Alcohol has hitherto been the substance almost exclusively used to prevent or hinder the spontaneous decomposition of chloroform. The authors find that a few tenths per cent. of any of the following substances can be used for the same purpose:—Spirit of turpentine, purified spermaceti, menthol, terpineol, citronellol, geraniol, methyl or amyl salicylate, guaiacol, thymol, safrol, ionone, or methyl-protocatechuic aldehyde. A little sphere of elder pith painted with Congo red forms a most delicate test for the chlorinated acid substances which are the first products of decomposition of chloroform; it turns blue even with the minute amount formed by sealing the capillary end of a tube containing chloroform, if no precautions are taken, by cooling the liquid, to keep the capillary clear of vapour during the sealing. Chloroform, then, may be kept for long periods in white glass bottles with one of the preservative substances mentioned, and will be fit for use as an anæsthetic as long as the Congo-red indicator also contained in the bottle retains its colour. —J. T. D.

Oxalates of the rare earths; Carrying down of ammonium oxalate by ——. G. P. Baxter and R. C. Griffin. J. Amer. Chem. Soc., 1905, **28**, 1684—1693.

The insoluble oxalates of neodymium, praseodymium, yttrium, and certain other of the rare earths, when precipitated in neutral or nearly neutral solution, carry down a considerable quantity of ammonium oxalate. In the case of neodymium, the amount of ammonium oxalate carried down is shown to depend on the concentration of the oxalate at the moment of precipitation. Oxalic acid is not precipitated along with neodymium oxalate, so that the precipitation of ammonium oxalate can be prevented by adding a strong acid to diminish its concentration. The phenomenon is attributed to the formation of unstable double salts, rather than to true occlusion.—E. F. A.

English Patents.

Isobornyl esters; Manufacture of ——. R. E. Ellis, London. From Chem. Fabr. von Heyden, A.-G., Radebeul, Saxony. Eng. Pat. 12,630, May 30, 1906.

See Addition of June 5, 1906, to Fr. Pat. 365,814 of 1906; this J., 1906, 1116.—T. F. B.

Isobornyl oxalates; Manufacture of ——. Basler Chemischer Fabr., Basle, Switzerland. Eng. Pat. 19,961, Sept. 7, 1906. Under Int. Conv., May 5, 1906.

A mixture of camphene, oxalic acid, a condensing agent, and a solvent, is allowed to stand at the ordinary temperature for two or three days, or is heated for a shorter time; the solvent is distilled off. the excess of oxalic acid removed by means of hot water, and the acid isobornyl oxalate separated from the normal ester by means of sodium carbonate, the latter being subsequently purified by distillation with steam. Sulphuric or phosphoric acid may be used as the condensing agent, whilst acetone is a suitable solvent in this process.—T. F. B.

Pharmaceutical compounds; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 13,401, June 11, 1906.

See Fr. Pat. 367,057 of 1906; this J., 1906, 1117.—T. F. B.

Ferments and fermented materials for use in baking and for pharmaceutical and other purposes; Production of ——. A. Pollak. Eng. Pat. 24,739, Nov. 29, 1905. XVIIIA., page 63.

French Patent.

Product that checks the action of the toxin of exhaustion; Process for the preparation of a ——. Kalle und Co., A.-G. Fr. Pat. 368,982, Aug. 17, 1906. Under Int. Conv., Jan. 25, 1906.

Products resembling the toxin of exhaustion produced in the animal system by excessive muscular fatigue, are obtained when albuminoids are decomposed in the cold or at a relatively low temperature by various reagents (caustic soda, nitric or sulphurous acid, or hydrogen peroxide) or by electrolysis. If the reaction products be then heated for a relatively long time, the toxin undergoes decomposition, with formation of an anti-toxin, which can be separated by dialysis, and isolated by evaporating the solution obtained by dialysis, or by extraction with acetone, toluene. or other suitable solvent. For example, albumin is heated for 48 hours at 40° C. with 10 parts of a 5 per cent. solution of caustic soda, the mixture is then heated slowly to boiling, and boiled for five minutes. After cooling and neutralising with hydrochloric acid, the solution is evaporated in a vacuum to a syrupy consistence at a temperature not above 50° C., and then dialysed with distilled water. The resulting solution containing the anti-toxin and saline matter is evaporated to dryness, and the anti-toxin extracted from the residue by toluene or acetone.—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 33.)

French Patent.

Photographic film. L. Smith. Fr. Pat. 369,043, Aug. 20, 1906. Under Int. Conv., Aug. 22, 1905.

See Eng. Pat. 16,999 of 1905; this J., 1906, 654.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 35.)

Trinitrotoluene; Application of —— in the manufacture of explosives. J. Rudeloff. Z. ges. Schiess. u. Sprengstoffwesen, 1907, 2, 4—6.

By direct nitration of dinitrotoluene with a mixture of sulphuric acid and nitric acid, and dependent on the care used in nitration, and the purity of the materials, two varieties of trinitrotoluene are obtained—the one having a melting-point of 72° C.—74° C., the other 77° C.—79° C. By recrystallisation of the latter from alcohol, a third variety is obtained, with a melting-point of 81° C.—82° C. During the past few years trinitrotoluene of a melting-point of 72° C.—74° C. has been increasingly used in the manufacture of explosive compounds. Picric acid, at the present time, occupies an important place in the explosive industry for filling shells and many other purposes, but the author considers that trinitrotoluene will eventually replace it for these purposes. A comparison is drawn between the two compounds. Picric acid has the advantage of a high density (1·65) in the molten state, and, by itself, is safe in handling. It has, however, the disadvantage that it very readily forms explosive compounds with alkalis and many metallic oxides. During the course of manufacture the fine dust of picric acid is unpleasant, and injurious to health, and this is equally the case with the vapour produced during the process of melting the picric acid to cast it into shells. Its acid nature is also a drawback as regards its use in cap and detonating compositions, owing to its tendency, during storage, to attack the copper walls of the capsules. Trinitrotoluene is safe to handle, perfectly neutral, has no deleterious effect upon the health of workpeople, and does not form explosive compounds with alkalis and metallic oxides. As an ingredient of cap and detonating compositions, it has been found to stand variable atmospheric conditions without deterioration. In a No. 8 detonator the 1·5 grms. of fulminate in the composition can be advantageously replaced by a mixture of 0·7 grm. of trinitrotoluene and 0·5 grm. of fulminate. The density of trinitrotoluene when melted and cast into shells is 1·5. A plastic explosive of a density of 1·85—1·90 can be formed by the use of collodion-cotton, dinitrotoluene, potassium chlorate, and trinitrotoluene. If lead nitrate is used in place of potassium chlorate, a density of 2·0 can be obtained, and advantages are claimed for the use of such a composition in shells, as a substitute for picric acid.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

(Continued from page 36.)

APPARATUS, &c.

English Patent.

Cupels; Construction of —— for assay purposes, and trays employed therewith. W. S. Rawson, London. Eng. Pat. 26,073, Dec. 14, 1905.

The cupel is placed on a small recessed tray, instead of on the floor of the muffle. Either the cupel or the tray is provided with three projecting ribs, so that contact between the cupel and tray is made at three points only, whereby lead oxide does not penetrate into the tray until the cupel is saturated.—A. G. L.

INORGANIC—QUALITATIVE.

Copper; Sensitive reaction for ——, and a microchemical test for zinc. H. C. Bradley. Amer. J. Science, 1906 [4], **22**, 326—328. Chem. Centr., 1906, **2**, 1873.

The blue coloration of the hæmatoxylin of logwood by copper salts is a very delicate reaction, capable of detecting the presence of copper at a dilution of 1:1000,000,000, being 1000 times as sensitive as the potassium-iodide-starch reaction, and 10,000 times as sensitive as the ferrocyanide reaction.

Zinc nitroprusside is a crystalline substance which can be easily identified under the microscope in the presence of the insoluble, amorphous nitroprussides of other heavy metals. The solution in which the zinc is to be detected should not be too dilute, and it is well to remove copper by means of hydrogen sulphide.—A. S.

INORGANIC—QUANTITATIVE.

Indicators; Studies on ——. E. Salm. Z. physik. Chem., 1906, **57**, 471—501.

The author's work is treated under the following headings:—Part I. Application of indicators to measurement of affinity—Methods for the determination of the dissociation constant; indicator-method; standard solutions; gas-cell measurement; experimental arrangements and apparatus; measurements; examination of indicators; colorimetric measurement of reactions. Part II. Application of indicators in volumetric analysis—Earlier investigations; principle of the method; preparation of solutions; the colorimeter; results of measurements; theoretical results.—A. S.

Ferrous salts; Titration of —— with alkali hypoiodite. E. Rupp and M. Horn. Arch. Pharm., 1906, **244**. 571—575.

It is found that the oxidation of ferrous salts by iodine proceeds more rapidly in presence of caustic alkali than when Rochelle salt is used, as in the process previously described (this J., 1903, 230). A measured quantity of the neutral or moderately acid solution of the ferrous salt is added to a measured excess of $N/10$ iodine solution, and the whole is rendered distinctly alkaline with $N/1$ or 5 per cent. alkali hydroxide solution. After a few minutes, the mixture is rendered acid by the addition of glacial acetic acid (a volume equal to that of the alkali used) or oxalic acid (a weight in grms. equal to half the number of c.c. of alkali), and then, after 5—10 minutes, the solution is made up to 100 c.c., and the excess of iodine titrated with thiosulphate and starch solution. 1 c.c. of $N/10$ iodine solution = 0·005588 grm. of iron. Ammonium salts interfere with the reaction, but manganese salts have no influence.—A. S.

Cadmium; Determination of —— as oxide. C. P. Flora. Amer. J. Science, **20**, 456. Chem. News, 1906, **94**, 305—306.

Muspratt (this J., 1894, 211; compare also Miller and Page, this J., 1901, 1029) has pointed that the method of determining cadmium by precipitating as carbonate, and igniting the latter to oxide, gives inaccurate results owing to the reducing action of the charred filter-paper on the oxide. The author has found, in agreement with Browning and Jones (Amer. J. Science, 1893 [3], **46**, 280; 1896, [4], **2**, 269), that if the precipitated carbonate be collected on an asbestos filter in a Gooch crucible, the method gives excellent results. In the ignition of the precipitate, care must be taken to avoid the reducing action of any unburned gas from the burner.—A. S.

Free sulphur; Determination of ——. E. Berger. Compt. rend., 1906, **143**, 1160—1161.

A quantity of the substance containing 0·1—0·2 grm. of free sulphur is taken. It is covered by 10 c.c. of fuming nitric acid, and 0·5—1·0 grm. of potassium bromide is added. After a few minutes, the sulphur is completely oxidised and dissolved, the liquid is then evaporated to dryness, and two or three times taken up with a little hydrochloric acid and re-evaporated, so as to expel nitric acid. The precipitation by barium chloride is then carried out in the usual way. The method can be applied to pellets of sulphur formed during the attack of natural sulphides by nitric acid, or to carbon bisulphide extracts, which contain other substances (tarry matters for example) in addition to sulphur.—J. T. D.

Iron ores; Determination of iron in —— by the permanganate method. A. Müller. X., page 50.

[Silver] Ores from the Cobalt district [Canada]; Sampling and assaying of ——. F. F. Colcord. X., page 50.

Chinese tin. F. Brown. X., page 51.

Copper sulphate and sulphuric acid; Method for the rapid determination of —— in galvanoplastic baths A. Wogrinz and J. Kittel. XI*B*., page 54.

ORGANIC—QUALITATIVE.

Benzosalin [Methyl benzoylsalicylate]; Tests for the purity and identity of ——. F. Zerink. XX., page 66.

Glycocoll; Characteristic reaction for ——. G. Denigès. XX., page 67.

Chloroform; Preservation of ——, and indicator of accidental change in it. XX., page 67.

ORGANIC—QUANTITATIVE.

Nitriles and carbamines; Determination of ——. H. Guillemard. Compt. rend., 1906, **143**, 1158—1160.

The most usual occasion on which nitriles and carbamines have to be separated and determined is when they have been produced together by the reaction of an alkyl iodide on a metallic cyanide. The mixture, to which has been added strong solution of potassium cyanide and enough potassium hydroxide to render it alkaline, is distilled. The distillate contains, besides any nitrile and carbamine present, the excess of alkyl iodide, ammonia, and a trace of hydrocyanic acid. It is rendered strongly alkaline by potassium hydroxide and redistilled, when the hydrocyanic acid is completely retained. To the distillate is added a known volume of standard sulphuric acid, and after complete hydrolysis of the carbamine (which is known by the disappearance of its smell), the excess of acid is titrated; this gives the ammonia

The liquid is now distilled, when the nitrile passes over completely. The liquid remaining in the retort is boiled with concentrated sulphuric acid till hydrolysis is complete, then rendered alkaline, and the ammonia distilled off and determined. Deducting from the total amount of ammonia that originally present as such, there remains that derived from the hydrolysis of the carbamine. The distillate from the hydrolysis of the carbamine. The distillate containing the nitrile is heated in sealed tubes at 150° C. for some hours, and the ammonium salt produced by hydrolysis of the nitrile determined.—J. T. D.

Benzene in illuminating gas ; Technical determination of ——. D. A. Morton. II., page 40.

Rosin in varnishes ; Determination of ——. A. H. Gill. XIII*B*., page 58.

Tannic acid ; Determination of —— *in tanning materials.* W. Vaubel and O. Scheuer. XIV., page 59.

Reducing sugars ; Determination of ——. G. Bertrand. XVI., page 60.

Fat in butter ; Determination of ——. A. Froehner. XVIII*A*., page 63.

Celluloid ; Analysis of ——. H. Dubovitz. XIX., page 65.

Strychnine ; Determination of —— *in Nux vomica, by the nitric acid process.* [*Modification of Gordin's method.*] M. H. Webster and R. C. Pursel. XX., page 65.

Morphine ; Determination of —— *in opium* [*by a modification of Léger's method*]. L. Picard. XX., page 65.

Saiodin [*Calcium monoiodobehenate*] *; Characters of and tests for* ——. F. Zernik. XX., page 66.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 36.)

Thorium and uranium ; Colloidal compound of ——. B. Szilard. Compt. rend., 1906, **143**, 1145—1147.

By adding freshly precipitated thorium hydroxide to a boiling 2 per cent. solution of uranium nitrate, a deep red solution is obtained, which contains a colloidal compound of thorium and uranium. Uranium chloride gives a similar solution, having, however, a tint inclining to yellow. The solution decomposes readily above 25° C., but if it be evaporated to dryness at the ordinary temperature, the solid remaining is very stable when heated, darkening considerably in colour, and forming a dense vitreous mass. The substance, dried at the ordinary temperature *in vacuo*, contains thorium, 72—74 ; uranium, 4—5·5 ; oxygen, 10—11 ; water, 12—13 per cent.—J.T.D.

Electrolytic conductivity ; Relation of chemical activity to ——. J. L. Sammis. J. of Phys. Chem., 1906, **10**, 593—625.

By the substitution of benzene for some of the water in aqueous acid solutions, the author has found that the activity of acids in inverting sugar, catalysing esters, and dissolving magnesium can be made to vary independently of the electrolytic conductivity of the solutions. A large proportion of the experimental work is devoted to a study of the replacement of one metal by another in non-conducting solutions of metallic salts. For instance, the author has found that some metals, notably lead, can replace copper from copper oleate dissolved in various organic solvents, although the solutions behave as fairly good insulators. In this replacement lead was found to be more active than sodium, magnesium, iron, and other more electro-positive metals. Solutions of the palmitate and capronate of copper exhibit similar properties, and fused copper oleate at 100° C. is decomposed by metallic lead. Further the author contends that even in these non-conducting solutions the solvents are not indifferent, since in 69 solutions in different solvents lead decomposes copper oleate, whilst in a further 14 solutions no replacement occurs. The author considers that these and similar experiments show conclusively that no constant relation exists between electrolytic conductivity and chemical activity, or in other words, that these do not stand to each other in the relation of cause and effect.—R. S. H.

Nitrobenzene ; Reduction of —— *by fatty alcohols in the light.* G. Ciamician and P. Silber. Ber., 1906, **39**, 4343—4344.

The authors have shown that nitrobenzene is reduced by certain fatty alcohols according to the scheme :—

$$C_6H_5.NO_2 \longrightarrow C_6H_5.NH.OH \longrightarrow C_6H_5.NH_2,$$

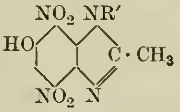
where, however, instead of phenylhydroxylamine, its isomeric transformation-product (*p*-aminophenol) is obtained. No aldehyde was detected in the products, and it was considered that this condensed with the aniline to form the corresponding quinoline base which was actually isolated. It was possible that this base had been formed by the action of light on aniline, and in order to test this point, 70 grms. of aniline were mixed with 70 grms. of paraldehyde and exposed to light for a year, but after this time no change had occurred. It was to be expected, therefore, that by avoiding the presence of acid in the above reaction the formation of quinoline bases might be prevented, and when this precaution was taken in the case of nitrobenzene and ethyl alcohol, only a slight trace of quinaldine was detected.
—J. C. C.

New trinitroacetaminophenol and its use as a synthetical agent. Raphael Meldola. Chem. Soc. Trans., 1906, **89** and **90**, 1935—1943.

When diacetyl-*p*-aminophenol is nitrated by dissolving it in cold fuming nitric acid, the first product is the mononitro-derivative, $C_6H_3(OCO.CH_3)(NO_2).NHCO.CH_3 = 1{:}3{:}4$, corresponding to the *m*-nitro-*p*-aminophenol of Hähle (J. prakt. Chem., 1891, [ii.], **43**, 63 ; Reverdin and Bucky, Ber., 1906, **39**, 2687). This mononitrodiacetyl compound can be further nitrated by dissolving it in a mixture of fuming nitric and strong sulphuric acids, when a *trinitroacetaminophenol* is produced. This new trinitro-derivative is remarkably active as a synthetical agent, owing to the extreme mobility of one of the nitro-groups. It crystallises in yellow needles melting with decomposition at 178°—179° C. The constitution is shown to be

$$C_6H,OH(1),NO_2(2),NO_2{}^*(3)NHCO.CH_3(4),NO_2(5)H,$$

the nitro-group in the meta position and marked *, being the mobile group. The action of various amines on the trinitro-compound has been studied and the final products shown to be substituted benziminazoles of the type



where R′ is the radicle present in the amine used. The trinitro-compound reacts also with hydrazines with the formation of hydrazo-compounds, which pass by oxidation into azo-compounds. Thus, by the action of phenylhydrazine a derivative of hydroxyazobenzene is formed, which is interesting because of its instability.

Stigmasterol, a new phytosterol from Calabar beans. A. Windaus and A. Hauth. Ber., 1906, **39**, 4378—4384.

Phytosterol prepared from Calabar beans and melting at 133° C. was acetylated, and the bromine addition product of the acetate formed. On crystallisation this was readily resolved into two fractions, which were reduced to the corresponding alcohols. The alcohol from the easily soluble bromide melts at 136°—137° C., and is identical with sitosterol, the phytosterol of wheat germs. The alcohol, $C_{30}H_{48}O$, or $C_{30}H_{50}O$, obtained from the difficultly soluble bromine addition compound melts at 170° C., and the name *stigmasterol* has been given to it. The phytosterol of wheat germs is a single substance. The phytosterol of rape-seed oil gives a soluble dibromo-acetate and a difficultly soluble tetrabromo-acetate. The tetrabromide of stigmasteryl acetate crystallises from chloroform and alcohol in four- or six-sided leaflets and decomposes at 211°—212° C. Stigmasteryl acetate crystallises from alcohol in rectangular leaflets melting at

141° C. Stigmasterol closely resembles phytosterol in colour reactions and crystalline form. It crystallises with one molecule of water, and has $[\alpha]_D^{21°} = -45{\cdot}01°$ in chloroform, and $[\alpha]_D^{21°}, = -44{\cdot}67°$ in ether. Several other esters and the chloride are described.—F. SHDN.

New Acts of Parliament.

THE following Acts of Parliament were passed during the last Session:—Workmen's Compensation Act, Notice of Accidents Act, Trades Disputes Act, Census of Production Act, The Alkali, &c., Works Act, Fertilisers and Feeding Stuffs Act. These Acts may be purchased from Messrs. Wyman and Sons, Ltd., Fetter Lane, London, E.C.

FOUNDATION OF A NEW SCHOOL OF DYEING AND BLEACHING, IN THE GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

THE trustees of the late Mr. T. Graham Young have presented to the Governors of the Glasgow and West of Scotland Technical College a sum of £10,000 to assist in making provision for the teaching of dyeing and bleaching in connection with the Chair of Technical Chemistry in the College. Mr. Young's trustees have also voted a sum of £850 for the equipment of the laboratory for the chair. Mr. T. Graham Young was the youngest son of the late Dr. James Young, F.R.S., the founder of the petroleum and paraffin industries.

Trade Report.

CHEMICAL TRADE STATISTICS FOR 1906.

THE following table shows the imports and exports of chemicals, &c., to and from the United Kingdom for the twelve months ended December, 1905, and 1906, as given in the Board of Trade returns:—

Imports.

		1905.	1906.
Bleaching materials	cwt.	236,396	238,123
Boron compounds	,,	254,553	373,867
Brimstone	,,	400,313	500,650
Coal products, not dyes	,,	92,303	91,264
Cream of tartar	,,	66,840	64,173
Glycerin	,,	75,924	49,058
Ammonium chloride	,,	4,569	9,410
Saltpetre	,,	182,052	223,262
Soda compounds	,,	365,703	310,267
Sulphuric acid	,,	92,691	89,904
Tartaric acid	,,	36,443	36,779
Unenumerated chemicals	£	1,942,998	2,103,437
Cinchona	cwt.	31,251	24,602
Quinine and salts	oz.	708,866	1,973,039
Unenumerated drugs and medicines	£	1,137,891	1,028,629
Alizarin and alizarin dyes	cwt.	57,703	57,291
Aniline	,,	174,363	188,061
Synthetic indigo	,,	32,246	39,042
Other coal-tar dyes	,,	1,331	676
Indigo	,,	8,201	7,641
Mercury	lb.	2,552,586	2,911,742
Gum arabic	cwt.	73,222	77,131
Shellac, &c	,,	99,862	82,290
Turpentine	,,	526,679	512,836
Soaps, household	,,	274,238	309,975
Toilet-soap	,,	19,631	18,554
Fish oils	tuns	25,508	27,808
Palm oil, unrefined	cwt.	1,144,368	1,223,787
Seed oils	tons	41,467	47,008
Olive oil	tuns	12,042	14,386
Other fatty oils	cwt	740,405	600,719
Petroleum oils	galls.	300,110,335	299,251,714
Tallow and stearine	cwt.	1,742,819	1,933,837
Rosin	cwt.	1,610,629	1,650,727
Guano	tons	29,223	24,906
Sodium nitrate	,,	104,436	108,486
Phosphates	,,	420,988	442,970
Bark for tanning	cwt	563,604	336,479
Cutch	tons	3,247	5,217
Gambier	,,	7,078	7,318
Myrabolans	cwt	576,924	676,419
Valonia	tons	25,652	18,099
White lead	cwt	306,113	283,371
Nickel oxide	,,	17,406	16,148
Zinc oxide	,,	288,384	278,441
Paraffin wax	,,	908,082	985,080
Starch, including dextrin	,,	1,432,214	1,540,485

Exports.

		1905.	1906.
Bleaching materials	cwt.	937,000	1,003,537
Coal products, not dyes—			
Aniline and coal-tar oils	,,	896,910	1,330,000
Carbolic acid	,,	135,832	114,371
Naphthalene and anthracene	,,	101,517	89,951
Other sorts	,,	9,185,285	10,144,835
Copper sulphate	tons	55,881	42,982
Cream of tartar	cwt.	1,194	1,247
Dyestuffs—			
Products of coal-tar	,,	60,247	42,723
Other sorts	,,	185,781	200,523
Glycerin	,,	147,173	157,725
Chemical manures	tons	561,790	583,564
Quinine and salts	oz.	891,501	1,058,829
Unenumerated drugs and medicines	£	1,415,932	1,498,498
Ammonium chloride	cwt.	99,269	130,585
Painters' colours	,,	1,786,985	1,947,112
Soda, ash	,,	1,491,646	1,901,488
Bicarb.	,,	426,481	404,740
Caustic	,,	1,508,955	1,592,465
Crystals	,,	201,129	189,970
Sulphate	,,	742,332	980,099
Other sorts	,,	347,185	373,748
Sulphuric acid	,,	85,866	98,029
Tartaric acid	,,	1,583	1,510
Unenumerated chemicals	£	2,478,085	2,774,535
Soap, household	cwt.	1,167,976	1,131,294
Toilet-soap	,,	43,837	46,364

Re-Exports.

		1905.	1906.
Gum arabic	cwt.	23,920	17,982
Shellac and other lacs	,,	91,391	64,870
Mercury	lb.	1,599,826	2,078,449
Boron compounds	cwt.	21,774	42,655
Coal products, not dyes	,,	1,990	9,216
Cream of tartar	,,	10,619	6,783
Glycerin	,,	41,283	12,481
Ammonium chloride	,,	2,703	620
Saltpetre	,,	10,520	11,196
Sulphuric acid	,,	46	4
Tartaric acid	,,	4,429	3,382
Unenumerated chemicals	£	203,922	188,464
Cinchona	cwt.	10,700	8,590
Quinine and salts	oz.	103,939	109,742

New Books.

H. W. VOGEL. PHOTOCHEMIE UND BESCHREIBUNG DER PHOTOGRAPHISCHEN CHEMIKALIEN. Fünfte veränderte und vermehrte Auflage, bearbeitet von Dr. ERNST KÖNIG. Gustav Schmidt's Verlag (vorm. Robt. Oppenheim), Berlin. 1906. Price Mk. 11.

8vo volume, containing 363 pages of subject matter and the alphabetical index, followed by nine illustrative plates. The text contains seventeen illustrations. The subject matter is subdivided as follows: I. Physical Action of Light. II. Photochemistry, or the Doctrine of the Chemical Action of Light—(i.) Action of Light on Inorganic Substances. (ii.) On Organic Substances. (iii.) Influence of Light on the Living Processes in Plants and Animals. III. Compounds of the Lighter Metals. IV. Compounds of the Heavier Metals. Compounds of Mercury, Copper, Lead, Tin, Bismuth, Vanadium, Molybdenum, and Tungsten. The Metals of the Iron Group. V. Description of the Photographic Chemicals—(i.) Metalloids. (ii.) Solvents. (iii.) Acids. (iv.) Bases and Salts. (v.) Organic Bases. (vi.) Reducing Agents and Developers. (vii.) Dyestuffs (Colouring Matters). (viii.) Picture Bases, such as Cellulose, Starch Flour, Albumin, Nitrocellulose, Casein, Gelatin, &c. (ix.) Paper.

Patent List.

Where a complete Specification accompanies an Application, asterisk is affixed. The dates given are (i) in the case of Appli tions for Patents, the dates of Application, and (ii) in the case Complete Specifications Accepted, those of the Official Journ in which acceptances of the Complete Specifications are advertis

Complete Specifications thus advertised as accepted are open .nspection at the Patent Office immediately, and to oppositi within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

111. Wheeler. Gas stoves for blast furnaces. Jan. 2.

353. Clarke. Apparatus for pumping electrolytic corrosive solutions. Jan. 7.

420. Baker. Means for treating substances und pressure.* Jan. 7.

443. Shiner. Rotary kilns.* Jan. 7.

528. Maschinenfabr. Oerlikon, Wüthrich, and Stirnima Distilling apparatus. Jan. 8.

529. Maschinenfabr. Oerlikon, Allen, Wüthrich, a Stirniman. Utilising the steam arising from the conce tration or evaporation of solutions, extracts, and otl aqueous liquids. Jan. 8.

Complete Specifications Accepted.

958 (1906). Hargreaves. Appliances for mixi liquids in proportional quantities. Jan. 16.

7007 (1906). Hunt (Love). *See under* VII.

7450 (1906). King and Burnett. Gas-heated furnac Jan. 16.

10,561 (1906). Porteus. Machines for mixing p verulent and granular materials. Jan. 9.

13,751 (1906). Gewecke. Regenerative furnaces. Jan.

17,062 (1906). Chenot and Van Genechten. Appar tus for impregnating liquids with gases. Jan. 16.

II.—FUEL, GAS, AND LIGHT.

Applications.

200. McMullen. Gas producers. Jan. 3.

438. Lavezzari. Burner for gaseous or liquid [Fr. Appl., Jan. 12, 1906.]* Jan. 7.

566. Farnsworth. Production of carburetted air. Jan.

585. Rubert. Production of incandescent filaments f electric lamps, and arc light electrodes.* Jan. 9.

666. Kröner. Determining the intensity of gases means of manometers.* Jan. 10.

800. Collins. Manufacture of retorts for gas and otl furnaces. Jan. 11.

805. Mieville. Apparatus for the production of c buretted air.* Jan. 11.

Complete Specifications Accepted.

26,262 (1905). Feld. *See under* VII.

3225 (1906). Just, Hanaman, Landesberger, a Verein. Elektricitäts A.-G. Manufacture of inca descing bodies for electric incandescent lamps. Jan. 16.

18,152 (1906). Van Vriesland. Incandescent g mantle. Jan. 9.

21,847 (1906). Act.-Ges. f. Selasbeleuchtung. P duction of a constant mixture of gas and air. Jan. 9.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

723. Malden & Malden. Treatment of tars and pitc to render them more suitable for industrial purpos Jan. 10.

8. Van der Toorn. Reduction of ore.* Jan. 9.

3. Fletcher. Crucible furnaces. Jan. 9.

4. Fletcher. Metallurgical furnaces. Jan 9.

3. Jumau. Process for obtaining pure copper.* 10.

2. Raschen, Taylor, Kynaston, and The United Alkali Recovery of zinc from liquors containing zinc and or other metals. Jan. 10.

Complete Specifications Accepted.

8 (1906). Goldschmidt. Thermic mixtures for use in alumino-thermic process. Jan. 16.

89 (1906). Lafontaine. *See under* XI.

,069 (1906). Machlet. Case hardening steel and iron les. Jan. 16.

,021 (1906). Borbeck. Crucible furnaces. Jan. 16.

,062 (1906). Siemens und Halske A.-G. Production chnically pure tantalum. Jan. 16.

I.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

Cowper-Coles. Electrodeposition of metals. Jan. 1.

4. Jumau. Metallurgical and electrometallurgical ess for producing pure copper. [Fr. Appl., March 20, .]* Jan. 7.

6. Cowper-Coles. Electric furnaces.* Jan. 9.

Complete Specifications Accepted.

1 (1906). Pettit. Electric furnaces. Jan. 9.

89 (1906). Lafontaine. Electrolytic process for treat- copper ores and copper waste for the recovery of pure per. Jan. 9.

24 (1906). Cowper-Coles. Electrodeposition of copper other metals. Jan. 16.

.—FATTY OILS, FATS, WAXES, AND SOAPS.

Complete Specifications Accepted.

2,942 (1905). Macherski and Koperski. Preparation decolorising fats, oils, resins, syrups, varnishes, &c. 16.

5 (1906). Harvey and Simpson. Decomposition of and other organic bodies. Jan. 9.

41 (1906). Fullerton, Hodgart, and Barclay, Ltd., and rsedge. Fat melting pans and oil-boiling and distilling aratus. Jan. 16.

,983 (1906). Metz and Clarkson. Process of bleaching and fats. Jan. 9.

I.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Complete Specification Accepted.

45 (1906). Smith. Drying pulp white-lead. Jan. 16.

(*B.*)—Resins, Varnishes.

Complete Specifications Accepted.

2,942 (1905). Macherski and Koperski. *See under* XII.

86 (1906). Laurie and Baily. Apparatus for measur- the resistance to scratching of varnishes, lacquers, and like. Jan. 16.

73 (1906). Linoleum Manufacturing Co., and Vincent. aratus for making linoleum and the like. Jan. 16.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

COMPLETE SPECIFICATION ACCEPTED.

310 (1906). Pim. Drying leather. Jan. 16.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATION.

553. Newlands and Eastick. Improving the quality of caramels. Jan. 9.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATION.

816. Sauer. Production of vinaceous beverages from pure hemoglobin free from serum. [Ger. Appl., Jan. 11, 1906.]* Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

7702 (1906). Faulkner. Apparatus for producing malt extract or wort. Jan. 16.

13,828 (1906). Lean (Mühlenbauanstalt und Maschinenfabr. vorm. Gebr. Seck). Processes for obtaining a high return of extract from malt. Jan. 16.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

APPLICATION.

53. Hooker and Thew. Baking powder. Jan. 1.

COMPLETE SPECIFICATIONS ACCEPTED.

10,004 (1906). Hansen and Sehilbred. Preservation of food. Jan. 9.

18,612 (1906). Wetter (Kaffee-Handels A.-G.). Preparation or treatment of tea. Jan. 16.

(*B.*)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

25. Parsons. Sewage purification, and destruction of pathogenic organisms. Jan. 1.

670. Ellis. Tanks for treating and purifying sewage and other foul substances. Jan. 10.

COMPLETE SPECIFICATION ACCEPTED.

4537 (1906). Broadbent and Broadbent. Combined means for treating trade effluents. Jan. 16.

XIX.—PAPER, PASTEBOARD, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

2902 (1906). De Briailles. *See under* XXII.

20,037 (1906). Claessen. Manufacture of celluloid. Jan. 9.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

COMPLETE SPECIFICATIONS ACCEPTED.

14,323 (1906). Newton (Bayer und Co.). Manufacture of brominated fatty acid derivatives. Jan. 9.

20,586 (1906). Daege, Knoll and Knoll. Manufacture of santalol carbonate. Jan. 16.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

716. Brasseur. Production of multi-colour photographs by means of one negative. [Ger. Appl., Jan. 10, 1906.]* Jan. 10.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

3. Castiglioni. Igniting composition for tipping matches.* Jan. 1.

791. Duttenhofer. Manufacture of explosives.* Jan. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

2902 (1906). De Briailles. Nitration of cellulose. Jan. 9.

21,240 (1906). Weyel. Explosive. Jan. 16.

Journal of the Society of Chemical Industry.

No. 3, Vol. XXVI. FEBRUARY 15, 1907. No. 3, Vol. XXVI

London Section.

Meeting held at Burlington House, on Monday, January 7, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY AT ROME.

BY WALTER F. REID, F.I.C.

The tendency towards specialisation, which is so marked a feature of modern science, is no doubt absolutely necessary in the interests of progress; but it brings with it difficulties of its own. As the path of each specialist diverges more and more from the starting-point, so do the obstacles increase when all are required to work together on matters of common interest. The printing press, which at one time seemed destined to unite all science into a common fabric, renders but little help now, because the mass of material published is becoming so great that even to follow one branch of science is a serious task. Technical journals render valuable assistance by summarising scientific papers as they appear; but in many cases the chief value of such papers lies in the detail, so that abbreviation is not possible. Analytical processes, for instance, depend for their success upon the observation of minute details, and, unless analysts can agree upon these details, their results may differ materially. At the same time, important pecuniary interests may be affected by even slight divergencies in analytical results, and in some industries this has led to the retention of methods that are known to be inaccurate and obsolete. In the sugar industry the need for uniformity in analytical methods led the Association Belge des Chimistes, in 1894, to arrange for a conference with their colleagues from other countries. The idea was a happy one, because points of difference may be easily arranged at a personal interview, especially between colleagues who have learned to know each other personally and have enjoyed each other's hospitality. The meeting at Brussels in 1894 proved a success, and the International Congress of Applied Chemistry had started on its career. The next meeting of the Congress took place in Paris in 1896, and was even more successful than that at Brussels. The third Congress met at Vienna, in 1898, where much useful work was done. Until now British chemists had held aloof, and few had attended the meetings; but when the next Congress met at Paris, in 1900, a considerable number of chemists from this side of the Channel were present, and some contributed important papers. At the fifth Congress, at Berlin, in 1903, British chemists were even better represented, and those present issued an invitation to the Congress to meet in London in 1906. As Italy had, however, on two former occasions invited the Congress to meet in Rome, a third invitation by that country was accepted, and Rome was adopted as the place of meeting in 1906. Appended are a few particulars of some of the recent Congresses, as regards cost and attendance. Members are those who send in their subscriptions, they are not necessarily present at the meeting. A number of ladies also attend each Congress; in Rome there were 385. They are not included in the figures given.

Date.	Place of meeting.	Total cost.	Government grant.	Members.
		£		
1897....	Vienna	782	—	—
1900....	Paris	1200	—	1751
1903....	Berlin	15,000	750	2533
1906....	Rome	8160	2800	2375

The dates finally adopted for the Rome meeting were from April 26th to May 3rd. As the International Exhibition at Milan was to be opened at the beginning of May, those leaving Italy by the Northern lines would be able to visit this on their return journey. A strong Italian Committee was formed under the patronage of H.M. the King of Italy. Prof. Stanislao Cannizzaro, senator and professor of chemistry at the University of Rome, was honorary president, while the acting president was Prof. Emanuele Paterno, vice-president of the Senate, and professor of chemistry at the University of Rome. The duties of honorary secretary were carried out with efficiency and unfailing courtesy by Prof. Vittorio Villavecchia, Director of the Customs Chemical Laboratories, Rome. In Great Britain a strong joint committee was formed, upon which 15 societies interested in chemistry were represented by 33 delegates. Of these delegates 30 were members of the Society of Chemical Industry, which naturally took a prominent part in the organisation of the British representation at the Congress. In this they were materially assisted by the experience of Mr. C. G. Cresswell, who acted as honorary secretary to the joint committee, and whose services in that capacity were cordially appreciated by the delegates. The efforts of the joint committee were so successful that 70 British members joined the Congress.

The first experience the visitors had of Italian hospitality was a reception on April 25th, by the Chemical Society of Rome, at the Grand Hotel Excelsior. This was attended by a large number of foreign members, who were received by their Italian colleagues. The formal opening of the Congress took place on April 26th, in the New Palace of Justice, a magnificent building of travertine and white marble, designed by Calderini. The numerous court-rooms proved admirably adapted for the work of a congress containing 16 sections and sub-sections. The ground floor of the building was devoted to the administrative work of the committee, there being offices for the Press, post and telegraph services, distribution of guides, tickets, and last, but not least, an inquiry office, where courteous officials were willing and anxious to smooth down any of the little difficulties that strangers to Rome might encounter. As each member arrived he obtained his ticket and badge; there was no overcrowding, and altogether the reception arrangements were very well organised. The inaugural ceremony took place in the main hall of the palace, in the presence of the King and Queen of Italy, who were accompanied by three Ministers. Commendatore Persichetti delivered an address of welcome on behalf of the City of Rome, and Senator Paterno followed with an eloquent discourse on the relation of industrial chemistry to human progress. The Minister of Public Instruction, Signor Boselli, greeted the Congress in the name of the Government. At 3 o'clock the technical work of the Congress commenced.

A few remarks may here be made on the general organisation of these International Congresses, especially as many think that a knowledge of foreign languages is necessary in order to participate in them. English is one of the official languages, French, German, and Italian being the other three. Records are only published in these languages; but a speaker is usually allowed to speak in any other language he prefers. At Rome 39 countries were represented, with about 19 different languages. As a rule French is the prevailing language; German comes next; but English represents the largest population. The members of the organising committee are necessarily of the nationality of the country in which the Congress meets. There is a permanent International Committee of Congresses consisting of the presidents of former Congresses. The duty of this committee is to bring to the notice of governments all decisions of the Congress which may be of international importance. Committees are also appointed to report upon special subjects, such as the standardisation of analytical methods, the transport of dangerous goods, &c. These committees report to the general meeting of the Congress, which then passes such votes as may be deemed desirable.

Each section carries on its work independently; but when questions of mutual interest are to be discussed, two or more sections may hold a joint meeting. The first meeting of each section is presided over by a chairman nominated by the executive committee, and the first business is to appoint president, vice-presidents, secretary, and assistant secretaries. A president of a different nationality is chosen each day; but the secretarial duties are continuous throughout the session of the Congress. An assistant secretary is chosen for each of the official languages. Their duty is to report to the secretary of the section, who in his turn sends a report to the general secretary of the Congress. A daily bulletin is issued containing a short summary of the meetings held, the programme for the day, a list of visitors with their local addresses, and any official announcements for the information of the members. The full report of all the papers read is published after the lapse of at least a year, and is becoming a very important publication. The report of the Berlin Congress, for instance, occupies four volumes of about 1,000 pages each. About 490 papers were read at the sixth Congress, and in many cases these gave rise to discussions much longer than the papers themselves. It will, therefore, be evident that, in the time at our disposal, it would be impossible to give even a summary of the scientific work done at the Congress, and I can only glance briefly at some of the most important topics dealt with.

In *Section I.*, Analytical Chemistry, Prof. G. Lunge presented the report of the International Commission on Analysis. This Commission of 44 members was nominated in Paris in 1900, and enlarged in Berlin in 1903. The whole of their proceedings have been published separately in book form. The section sat seven times, and 48 papers were read.

Section II., Inorganic Chemistry, held seven meetings, during which 26 papers were read.

Section III.A, Metallurgy and Mining, was well attended, and 26 papers were contributed.

Section III.B Explosives, recommended the appointment of a special commission in order to arrive at an international method of testing explosives, as to their mechanical and chemical stability. This was adopted by the Congress in plenary sitting, as was also the recommendation that the term "safety explosive" should only be used to indicate relative safety in handling. Sixteen papers were read in three sittings.

In *Section IV.A*, Industry of Organic Products, 34 papers were read on various subjects connected with organic chemistry.

Section IV.B, Dyestuffs, was not so well attended as usual, there being but 18 papers. A resolution emanating from this section was passed by the Congress for transmission to the various Governments. It was to the effect that unfading inks should be prescribed by law for all public documents, commercial correspondence, and book-keeping.

Section V., Sugar Industry, held six meetings, at which 41 papers were read. The Congress approved and resolved to transmit to the various Governments a resolution calling for unification of analytical methods of testing commercial products, especially those containing sugar, for financial or customs purposes. Five other resolutions were passed by this active section in connection with the sugar industry.

Section VI.A, Starch Products, was the smallest at this Congress, only six papers being read at three meetings.

Section VI.B. Fermentation, produced, on the other hand, the largest number of communications, namely, 60, which occupied seven sittings. It was recommended and endorsed by the unanimous vote of the Congress, that a permanent International Commission be formed for the unification of methods of analysis of malt, and for the adoption of areometers and densimeters for use in breweries and distilleries.

Section VII., Agricultural Chemistry, was specially active in producing resolutions for presentation to the various Governments. The following were adopted by the Congress for that purpose:—

That the commercial nomenclature be determined of the various products obtained in the condensation of sulphur vapour, in connection with the agricultural use of these products.

That a permanent commission be instituted, composed of chemists, physicists, and naturalists, for studying the natural and artificial productivity of the soil in order to collect data for the preparation of agricultural maps.

That in all countries permanent experimental fields be instituted, of a type similar to that at Rothamsted, in England, for the purpose of ascertaining the natural and artificial production of wheat, and of other crops in different climates.

That it is desirable that the States of South America take measures to prevent the wanton waste and destruction of those plants that have a special and high value for the principles they contain.

That all substances used to combat parasites and diseases in crops be submitted to analytical control; that for these products there be adopted, in all countries, common methods of analysis, and that the International Commission for the Analysis of Manures and Cattle Foods be charged to propose and promote the common analytical methods for the examination of such substances. This section also presented to the General Assembly some resolutions of the Second International Dairy Congress, at Paris, 1905, with regard to the unification of methods of analysis of butter and milk.

Section VIII., A and B, Sanitary, Medical, and Pharmaceutical Chemistry, was also very industrious, 56 papers being read in eight meetings. A full report of this section appeared in the "Chemist and Druggist," May 19, 1906.

Section VIII. C, Bromatology, sat seven times, and received 50 communications. The resolutions proposed by this section and approved by the Congress, referred to the unification of analytical methods for food products, the prohibition of artificial colouring matters for foods that are naturally coloured, and a recommendation that instruction in the chemistry of food-products should be associated with the study of pharmacy. In connection with this section a meeting of municipal chemists was held, which also passed resolutions advocating the unification of legislation concerning the purity and genuineness of foods.

Section IX., Photo-Chemistry and Photography, had a short, but highly interesting meeting. In two sittings 12 papers were read.

Section X., Physical Chemistry and Electro-Chemistry met seven times, 37 papers being read. This section reported to the Congress that Prof. W. Nernst had presented a report on the numerical value of gas constants which had been adopted.

Section XI., Law and Political Economy in Relation to Chemical Industry, discussed seven questions in six meetings. On each question a resolution was passed by the section, and these were communicated to the plenary meeting of the Congress. They referred to the transport of explosive substances, the independence of patents, priority rights in patents, the international protection of trade marks, inventions made by employees, the protection of manufacturing secrets, and the Customs' duty on liquid hydrocarbons.

The general meeting of the Congress at which these resolutions were passed was held on May 3rd. The next business was a discussion on the formation of two new sections; but this was referred to the organising committee of the nextt Congress.

Dr. L. Mond then gave an invitation, on behalf of the joint organising committee in London, for the Congress to meet in London in 1909.

Prof. Tilden supported Dr. Mond's invitation. He was authorised to say, on behalf of the British Government, that official assistance would be given to the arrangements for the reception of the Congress.

Dr. Divers, as Chairman of the Joint Committee of British Societies, and President of the Society of Chemical

Industry, supported the motion; and Prof. **Meldola**, President of the Chemical Society and delegate of three other societies, also made a speech with the same object.

The invitation was unanimously accepted by the meeting, and the last week in July of 1909 was adopted as being the most convenient date. Sir William Ramsay was elected as acting president, and Sir Henry Roscoe as honorary president. The organising committee for the next Congress was then chosen, the members being those of the Joint Committee of British Societies already referred to.

It should here be mentioned that the arrangements for issuing the invitation were made at a meeting of some of the British members of the Congress, which was held on April 29th, in the Palace of Justice. The organising committee has since met in London, and appointed an executive committee to take the preliminary steps towards carrying out their work.

The final meeting of the Congress closed with a hearty vote of thanks to the Italian organising committee who had done so much to render the Rome Congress both instructive and agreeable. The Rome Congress was successful, not only from the technical and social, but also from the financial point of view. Prof. Villavecchia has been good enough to send me the following particulars, which are of special interest to us in view of the approaching Congress here in 1909:—

The Italian Government contributed 70,000 frs.; the Italian societies and private individuals, 85,000 frs.; the subscription fees of members of the Congress, and ladies, 43,000 frs.—204,000 frs. in all. After the Congress there remained in the treasury 74,000 frs. for the compilation and printing of the proceedings. The executive committee of the Congress, foreseeing that, after the publication of the general report, there would remain at least 20,000 frs., has announced a competition for 20 purses of 1000 frs. each. These are to be awarded to young Italian chemists who wish to read papers before the Seventh International Congress of Applied Chemistry in London, 1909. Those wishing to take part in the competition will send a summary of the paper which they propose to read to the president of the Sixth Congress before March 31, 1909.

The treasurer of the Rome Congress, Prof. G. Giorgis, is to be congratulated on so successful a termination to his labours.

It would be difficult to imagine a better way of applying the surplus funds than that devised by the organising committee. The 20 successful competitors will be heartily welcomed here, and their advent will do much to promote the friendly feeling that already so happily prevails between Italian and British chemists.

Prof. Villavecchia was also kind enough to send me a list of the members of the Congress, classified according to nationalities. The chief of these are:—Italy, 1100; France, 233; Germany, 231; Austria, 138; United States of America, 101; England, 70; Russia, 69; Belgium, 58; Chili, 43.

In order to give opportunities for social intercourse, it is usual to arrange for receptions and excursions, and the Italian organising committee are to be congratulated on the success which attended their efforts in this direction. No city is so rich as Rome in historical associations and the monuments of antiquity, and the visitors soon found that the time at their disposal was far too short to see even half the objects that they desired.

Unfortunately, the two chief excursions which had been arranged for by the organising committee had to be abandoned at the last moment on account of a strike of the Italian sailors.

For some of the 40 illustrations, showing the organisers of the Congress and the scenes visited, I wish to express my thanks to H.M. the King of Italy, Senator Paterno, Com. Col. G. Vitali, Profs. V. Villavecchia, E. Mattirolo, A. Piutti, R. Nasini, and the Editor of the "Chemist and Druggist." Those who wish to study the details of the Congress will find the fullest account yet published in the latter Journal from May 5 to May 19.

On April 27th, the Municipality of Rome gave a conversazione at the Capitol. In the rooms of this historic building, and surrounded by beautiful examples of the art of Ancient Greece and Rome, the members of the Congress had an opportunity of meeting many members of Roman society.

On Sunday, April 29, an excursion to Tivoli was arranged, in which most of the visitors took part. Here the beautiful Villa d'Este, with its magnificent views of the surrounding country, was visited. In the evening, Dr. and Mrs. Ludwig Mond entertained a number of the delegates in the splendid rooms of the new Hotel Regina. Among other interesting things seen here was a new development of colour photography, shown by Dr. R. L. Mond, which seems to hold out hopes of advance in that fascinating, but elusive, branch of science.

On the afternoon of April 30 a garden party was given by the organising committee on the Palatine Hill.

On the evening of May 1, the International Association of Artists gave a charming entertainment to the members of the Congress at their rooms in the Via Margutta.

On May 2, the chief banquet of the meeting was held at the Hotel Excelsior, 320 members being present. After dinner a number of speeches were made in many languages. The most hearty reception was given to Mr. K. Matsubara, the representative of Japan, who delivered an excellent speech in English. Sir Henry Roscoe spoke on behalf of Great Britain.

On April 30, a banquet was given by the Italian Association of Sugar Manufacturers to their foreign colleagues.

The great social event of the Congress was the State Banquet, on May 5, at the Palace of the Quirinal, to which six British members of the Congress were invited. It was held on May 5, at 20 o'clock, Italian time. While I was able to obtain photographs of most of the other places of interest in connection with the Congress, I could not procure good ones of the Quirinal through the usual channels. H.M. the King of Italy has, however, been good enough to send some excellent photographs of the beautifully decorated rooms in which we were entertained. The letter accompanying the photographs refers to the London Congress of 1909 in the following friendly terms:—

"Italy is in perfect sympathy with England in all that means progress, scientific and intellectual, and this, I trust, will be evinced by my compatriots at the Congress you mentioned."

I have only referred to the Congress at Rome because of the title of the paper, but we have received similar hospitality from our colleagues of four other nations, and the time has now happily arrived when we have an opportunity of reciprocating their courtesies. It is to be hoped that all who can contribute towards the success of the 1909 meeting in any way will do so, and that our foreign colleagues will then carry away with them as happy recollections of our country as we have of theirs. If I have succeeded in enlisting your sympathy and support for the International Congress of Applied Chemistry of 1909, the chief object of this paper will have been achieved.

Discussion.

Prof. W. A. **Tilden** cordially endorsed what Mr. Reid had said with regard to the extreme kindness and hospitality they received from their friends in Rome. It would be difficult, even in London, to successfully emulate the entertainment then provided, but the time was not very far off when they would have to receive their foreign guests here, and out of these Congresses they might gather some very useful lessons. Both in Berlin and in Rome, special features of the Congresses might be remarked. In Berlin everything was done on a gigantic scale. In Rome, though perhaps less ambitious, they were in some respects even a little more successful. He deprecated any attempt to vie with their German friends in the lavishness and costliness of the entertainment. It was unnecessary to spend at the rate of £6 per guest, which was, roughly, what it cost in Berlin, and he could not but think that to a large extent it represented money thrown away. He was glad to hear that their friends in Rome, though they gave a great amount of gratification, succeeded in saving from the general fund a surplus, which they were going to devote to the very useful purpose of sending some of their young men to attend the Congress in London. With regard to the work of the Congress itself, he was inclined to think that the papers were the least important part. The real benefit derived from the Congresses resulted from the opportunity for intercourse provided between men of different nations. He could not help thinking that the practical and technical man would get more, on the whole, out of conversation with his friends, than from the hearing of formal papers, and it was a question which he thought might be taken into consideration by the committees, whether the Sessions should be extended into the afternoon. The only drawback to his enjoyment in Rome was the unfortunate multiplicity of languages. All the official business was conducted in Italian, of which he could only recognise a word here and there. In London, they had, fortunately, a polyglot President, but he hoped he would not exercise his faculty too freely, and he should be glad if the number of languages was limited. It was not difficult for most of them to follow French and German, but when it was extended to other languages it was a little confusing, and he confessed that he lost a great deal that he should like to have heard.

He went to Berlin and to Rome as an appointed representative of the British Government, and, on his return, it was his duty to draw up a report, which was printed and circulated in the principal Government offices. As far as official reticence would allow, they had received an assurance that Government support would be given to the next Congress, but they must not expect too much. For instance, he felt sure they would not be allowed to meet in the House of Commons, and he did not think they could expect the Government to hand over to the committee a pecuniary subsidy. What would be done would be to provide rooms, attendance, police, lighting, &c. The German Government contributed a substantial sum, and the Italian Government a still more substantial sum, but he was afraid they would not get that here, and he thought if they got that kind of countenance from persons in high places which the importance of the Congress entitled it to, with accommodation for the meetings, they must be satisfied.

Mr. **Walter F. Reid** said it would be difficult to limit the languages at an International Congress. If they were to be international, they must take people as they were, and as they took us.

Yorkshire Section.

Meeting held at Leeds on Monday, December 3, 1906.

MR. F. W. BRANSON IN THE CHAIR.

THE PREPARATION OF STANDARD SULPHURIC ACID.

BY F. W. RICHARDSON.

In April, 1905, North and Blakey (this J., 1905, 395) gave a summary of the methods which have been suggested for standardising solutions of sulphuric acid, and recommended the use of pure sodium bicarbonate made by a method they describe. The chief objection to an entirely volumetric method for the preparation of a standard acid is the use of burettes. It is almost impossible to get a very accurate result when using volumes of solutions under ordinary laboratory conditions. The acid may indicate a temperature of 15·5° C., or 60° F. when in bulk, but in the burette it may speedily reach a much higher temperature in a warm laboratory. Moreover, it is not easy to get the titration nearer than to one or two drops, and this, apart from errors of expansion or contraction, may mean an excess or deficiency of 0·2 per cent. Another source of error arises from the use of methyl orange for acidimetry as indicator, since it is slightly, but decidedly, sensitive to free carbon dioxide. In the analysis of samples of soda ash, I have found quite 1 per cent. more sodium carbonate with litmus than with methyl orange.

A solution of barium hydroxide is adapted for the quick and accurate standardisation of sulphuric acid; it is free from impurities, such as sulphates, carbonates, and various metals, while alkali salts are seldom found in it. The method of procedure is as follows:—5 c.c. of dilute sulphuric acid, of known specific gravity, is pipetted into a counterpoised platinum dish, quickly weighed, and then titrated with a filtered saturated solution of baruim hydroxide. A blank experiment is first made with 5 c.c. of the acid, using phenolphthalein as indicator, in order to ascertain to within 0·1 c.c. how much of the baryta solution will be needed to give a slight alkaline reaction. It is then easy to titrate the acid in the platinum dish to half a small drop, *i.e.*, to 0·025 c.c. The neutralised solution is evaporated on the water bath, and when a white residue remains, another platinum dish is used as a cover, and a steadily increasing heat (preferably from a chimney Argand burner) is applied up to bright redness to remove the organic matter added as phenolphthalein; the residue consists of pure barium sulphate. Knowing the gravity of the acid, it is easy to calculate how much barium sulphate should be obtained from 5 c.c. of the acid.

If the original sulphuric acid contained non-volatile matter, lead sulphate, &c., the result shown by such a method would be higher than the truth. The acid commonly used does not give more than 0·008 per cent. of residue, when evaporated; therefore no inaccuracy could arise from this source. Compared with the older method of determining the sulphuric acid by precipitation with barium chloride, the results obtained are singularly close, despite the known sources of error inherent in the latter process. The baryta process is quicker, the only real source of error being the possible addition of an excess of baryta solution; with a little care and the use of a half-saturated solution of baryta, the error should not be greater than 0·02 c.c. of the saturated solution.

As an example of this method, about 5 litres of normal sulphuric acid were made by diluting 150 c.c. of concentrated acid. 5 c.c. of the acid weighed 5·183 grms., and the baryta method gave 0·652 grm. of barium sulphate. From the gravity at 60° F., 5 c.c. of the acid should weigh 5·178 grms., and therefore should give 0.6514 grm. of barium sulphate, or 5·473 per cent. H_2SO_4. The solution is then diluted to the required strength.

An acid of sp. gr. 1·0321 at 15·5° gave the following results:—

Methods.	Weight of acid used, grms.	Barium sulphate obtained, grms	Per cent. sulphuric acid.
Barium hydroxide	5·162	0·5875	4·937
Barium chloride	5·168	0·5883	4·935

These results are practically identical.

Recently the dipping refractometer of Zeiss has come into use as a valuable adjunct for the standardisation of solutions within a certain limited range of strength; a determination of the strength of the above acid with this instrument gave 4·928 per cent. of sulphuric acid—very near to the gravimetric results. As it is easy to use, this instrument will render valuable aid in obtaining a dilute acid very nearly of the strength required; on the other hand, the specific gravity method extends the accuracy of the estimation to at least a further decimal point.

My attention has been called to a paper by Drs. Wagner, Rinck, and Schultze, published in the "Chemiker Zeitung" for November 28th, 1906, on the standardisation of sulphuric acid, in which the authors also titrate with baryta water, evaporate to dryness, and heat to constant weight; they also use the dipping refractometer.

Discussion.

Mr. F. W. **Branson** said he had found lacmoid a very delicate indicator for dilute solutions (about 1 in 100,000) of alkali carbonates, $N/10$ sulphuric acid being used. To obtain extreme accuracy it was well to compare the end reaction tint with a standard containing an identical quantity of alcoholic solution of lacmoid with a minute but known amount of sulphuric acid, a correction being of course necessary for the amount of acid in the standard.

Mr. D. **McCandlish** asked if Mr. Richardson had taken the precaution of testing the sulphuric acid used for soluble sulphates, as their presence would cause the sulphuric acid determination to be wrong.

Mr W. P. **Bloxam** said that in regard to the estimation of sulphuric acid by precipitation with solution of barium chloride, one method recommended for purification of the sulphate from the chloride gave remarkable results. On washing the impure precipitate with a hot solution of ammonium acetate, and testing the washings for freedom from chloride, a clear solution was obtained, which actually contained barium and SO_4 groups. The explanation suggested was that in the filtrate a state of equilibrium was reached in which barium acetate and ammonium sulphate were present in solution. When using barium chloride solution (10 per cent. concentration), satisfactory estimation could, however, be effected by first adding the calculated amount of barium chloride solution, both solutions being maintained at the boiling temperature, and shortly afterwards a few cubic centimetres more of the boiling solution of barium chloride (Chem. Soc. Trans., 1895, **67**, 277). As a means of controlling the value of sulphuric acid solutions—made as recommended by Mr. Richardson—the speaker had found Sörensen's sodium oxalate method to be absolutely trustworthy. Carminic acid had proved the best indicator, its solution being so sensitive to bases in presence of carbon dioxide that ordinary distilled water reacted alkaline to it, but after careful re-distillation the water showed neutral reaction.

Mr. H. G. **Bennett** confirmed Mr. Bloxam's statement as to the advantages of carminic acid as an indicator, and pointed out that it was very effective in artificial light, and altogether superior to litmus. He had found it very useful in connection with the determination of nitrogen by Kjeldahl's process.

Mr. F. W. **Richardson**, in reply, said that he did not care for volumetric methods, and the barium hydroxide process obviated any inaccuracies which might occur in measuring apparatus. He had found no difficulty in using the barium chloride precipitation if ten drops of hydrochloric acid and only a slight excess of barium chloride were added. The great advantages of his plan was the elimination of all titrations and their replacement by two simple weighings. He had tested the sulphuric acid used for all impurities, which he found present only in negligible amounts.

Meeting held at Leeds, on Monday, January 21, 1907.

MR. F. W. BRANSON IN THE CHAIR.

THE PRESENT DEVELOPMENT OF THE ANALYSIS OF TANNING MATERIALS.—Part II.

BY

PROF. H. R. PROCTER, M.SC., F.I.C., AND H. G. BENNETT, B.SC.

(*Contribution from the Leather Industries Laboratories of the University of Leeds.*)

The present paper is a continuation of one on the same subject very recently read before the Society, and is partly due to the fact that further experiments have now enabled the authors to make definite suggestions as to details and numerical quantities in the process they have suggested for the determination of tannins, and they desire to urge their adoption by the Commission of the International Association of Leather Trades Chemists now sitting, and also by the American Leather Chemists' Association. Unfortunately, also, certain misprints occurred in the previous paper with regard to quantities, which it is here desirable to correct. Further experimental work has shown in a very strong light the importance of what is usually known as the "acidity" of the hide-powder employed. With an unchromed powder it has been found necessary to add definite quantities of some acid. In chromed powders, on the other hand, the requisite acid is supplied by the hydrolisation of the chrome salt itself, and differences in the degree of basicity of the salt and the quantity of it absorbed have been shown to have a small but material effect upon the absorption of the tannin by different powders. It is, therefore, very desirable that methods should be adopted for the rigid control of these points in the powder used, and, as has been previously pointed out, the easy determination of chlorides is one of the strongest reasons for employing chromium chloride rather than other salts in the preparation of the powder. It would obviously be most convenient to determine the chlorine direct in the ready chromed powder, but no simple means is known by which this can be accomplished. Wünsch's method, dependent on the digestion of the powder with fuming nitric acid, has been found unsatisfactory from the difficulty of obtaining a sufficiently complete destruction of the organic matter without evolution of free chlorine, and the Carius' method of heating with fuming nitric acid and silver nitrate in a sealed tube, though perfectly accurate and reliable, requires special apparatus, and is too laborious for frequent use in the technical laboratory. Attempts were made to dissolve the powder in alkalis and to bring the chlorine into a condition in which it could be satisfactorily estimated by standard silver nitrate, but were not successful. So that it has been found most simple in practice to employ an indirect method.

In chroming the hide-powder, a practically complete absorption of the chromium takes place, though a considerable proportion of chlorine is left in the residual liquor in the form of sodium chloride, produced by the action of the sodium carbonate used in rendering the solution basic. As a known and definite quantity of chloride and base is employed in the chroming, it is only necessary to estimate chlorine volumetrically in the residual liquor and wash-waters from the powder in order to determine the amount absorbed. If any appreciable quantity of unabsorbed chromium is present, it is desirable first to precipitate it by boiling for a short time with slight excess of ammonia, filtering off the chromium hydroxide, and rendering the filtrate neutral by the successive addition of a little formic acid and of magnesium oxide, free from chlorides, when the washings are made up to a definite volume, and an aliquot part is titrated with $N/10$ silver nitrate in the presence of potassium chromate. It is obvious that though this method will give an accurate result as regards the chlorine absorbed, it will not distinguish between that present as hydrolisable chromium salt and any portion which is combined with stronger bases, and it is therefore necessary that the hide-powder used should be carefully freed from lime and all other alkaline bases.

It is also necessary in the preparation of the hide-powder to wash it free from the sodium chloride which exists in the chroming solution, and it is desirable that this should be done as quickly as possible. It is clear, of course, that any such washing will free the powder from some of the acid it has absorbed with the chrome salt, the washing process involving, therefore, two functions: first, the reduction of the sodium chloride to a negligible quantity by what is practically a repeated dilution, and, second, a continuous hydrolysis of the chloride. The powder may be considered "washed" when the first of these processes is complete, any further washing being merely a reduction in the acidity of the powder.

To find out how quickly this stage was reached, a series of experiments was made in which the chlorine in the wash liquors was estimated in the manner just described. The powder was squeezed, first by hand and afterwards by a press, put back into the vessel in which it was chromed, and made up to the same volume as before with distilled water. Fifty c.c. of each of the squeezings were titrated with silver nitrate. A typical set of results is as follows:—

50 c.c. from—

1st	squeezing	required	9·2	c.c. $N/10$ silver nitrate solution
2nd	,,	,,	1·1	,, ,, ,, ,, ,,
3rd	,,	,,	0·4	,, ,, ,, ,, ,,
4th	,,	,,	0·25	,, ,, ,, ,, ,,
5th	,,	,,	0·2	,, ,, ,, ,, ,,

Further squeezings resulted in no appreciable reduction in the quantity of silver nitrate necessary, and, as this corresponds to a quantity of hydrochloric acid which is absolutely negligible in the non-tannin residues, even if non-volatile, the washing may be regarded as finished when 50 c.c. tested in this way require no more than 0·2 c.c. $N/10$ silver nitrate. Obviously, it is impossible to wash completely "free" from chlorides (or sulphates) till the whole of the basic chromium salt has been hydrolised and only chromium hydroxide remains.

In the previous article the authors suggested that the chroming of the powder was most conveniently and satisfactorily conducted with a quantity of water ten times the weight of the dry powder, but they have subsequently observed that some powders of very voluminous nature and fibrous texture are more conveniently manipulated with rather more water. This does not necessitate any increase in the quantity of chromium salt used, since its more rapid absorption by such finely divided powders fully compensates for the small difference in dilution.

Notwithstanding the greatest care in the manipulation, small differences will arise from the employment of different hide-powders, partly due to texture, and partly due to the presence of traces of acids or bases, and chemical changes in the hide-substance produced in the previous treatment may also have an unknown influence. It is, therefore, desirable that different chemists should, as far as possible, draw their supplies from one uniform source. So long as the powder is free from lime, acids, and soluble matter, it is not essential that it should be so finely ground, or woolly in texture, as was necessary for use in the filter bell; and apparently larger quantities of non-tannins are absorbed by extremely finely-ground powders, probably on account of surface attraction.

The authors have found that a very satisfactory powder, as regards complete absorption of tannin and low absorption of the non-tannin matters may be prepared from the hide sawdust produced in the manufacture of pickers from limed buffalo hide. This is thoroughly purified from lime and soluble matter by treatment with acid and thorough washing, and is then carefully dried at a low temperature and re-ground. Using 6·5 grms. of this powder in the manner described below, quite satisfactory detannisations can be accomplished even with the most obstinate of materials, so that the question again becomes merely one of the extent to which soluble non-tannin matters are absorbed. In this respect the buffalo hide-powder just described stands in a very satisfactory light, giving higher non-tannins than any other powder yet used which gives complete absorption of tannin. This is illustrated in the following comparative analyses by the authors' method:—

Material analysed.	Powder used.	Non-tannins.	Tannins.
		per cent.	per cent.
1 Mangrove extract..	"Buffalo" "Hungarian"	30·4 29·8	54·9 55·5
2 Mimosa D	"Buffalo" "Hungarian"	12·6 10·8	35·9 37·7
3 Solid quebracho extract	"Buffalo" "Hungarian"	15·0 14·0	23·4 24·4

The "Hungarian" is a very finely ground, fibrous and extremely pure powder, containing traces of acid, while the "Buffalo" is somewhat granular. Perhaps no greater contrast in texture is possible than is presented by these two powders.

In conclusion, the authors propose that in the analysis of tanning materials the soluble non-tannin matters shall be determined in the following manner:—

The moisture in the air-dry powder is determined and the quantity equal to 6·5 grms. actual dry hide-powder is calculated, which will be practically constant if the powder be kept in an air-tight vessel. Any multiple of this quantity is taken according to the number of analyses to be made, and wet back with 10 times its weight of distilled water.

Two grms.[*] per 100 of dry powder, of crystallised chromic chloride ($Cr_2Cl_6.12\ H_2O$)[†] is now dissolved in water, and made basic with 0·6 grm.[*] Na_2CO_3 by the gradual addition of 11·25 c.c. of $N/1$ solution, thus making the salt correspond to the formula $Cr_2Cl_3(OH)_3$. This solution is added to the powder and the whole churned slowly for one hour. In laboratories when analyses are continually being made, it is still more convenient to keep a 10 per cent. stock solution of the chroming material. This is made by dissolving 100 grms. of the normal salt in a little distilled water in a litre flask, and very slowly adding a solution containing 30 grms. of anhydrous sodium carbonate, with constant stirring, finally making up to mark with distilled water and well mixing. Of this solution, 20 c.c. per 100 grms. of dry powder should be used.

When the chroming is complete, the powder is then squeezed in linen under a press to free it as far as possible from the residual liquor, and washed until the following test is satisfied:—

Make up the powder with distilled water to the same volume as when it was being chromed. Mix well, and take 50 c.c. of the filtrate from this, add one drop of 10 per cent. potassium chromate solution, and four drops $N/10$ silver nitrate—a brick red colour should appear. Four or five squeezings are usually sufficient. The powder is then squeezed to contain 70—75 per cent. water and the whole weighed. The quantity Q containing 6·5 grms. dry hide is thus found, weighed out, and added immediately to 100 c.c. of the unfiltered tannin infusion, along with $(56·5—Q)$ c.c. of distilled water.[‡] The whole is corked up and agitated for 15 minutes in a rotating churn of not less than 60 revolutions per minute. It is then squeezed immediately through linen. Add 1 grm. of kaolin to the filtrate, stir and filter through folded filter of size sufficient to hold the entire filtrate, returning till clear. Evaporate 50 or 100 c.c. of filtrate. The weight of residue must be corrected for the dilution by multiplication by 3/2. The non-tannin filtrate must give no turbidity with the gelatine-peptone solution described, or with a 1 per cent. gelatine 10 per cent. salt solution.

Discussion.

The CHAIRMAN said that if the suggested method was adopted as the international method it would be an enormous gain. Was the hide-powder really made from buffalo hide? If an English product could be substituted it would be an advantage.

Mr. WILKINSON presumed that the powder mentioned was not exactly from the skin of the buffalo, but ordinary ox hides.

Mr. H. G. BENNETT, in reply, said that "pickers" were manufactured from the hides of the true buffalo (*Bubalus buffalus*), which was common throughout Asia and Eastern Europe. They were a cheap class of hide, and the sawdust obtained in the manufacture of pickers from them was also cheap and readily obtainable, being therefore a convenient source for the preparation of hide-powder.

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[*] In Part I. of this investigation these figures were printed totally wrong, and sodium carbonate, not hydrate, should be used

[†] Kahlbaum.

[‡] A reservoir of distilled water connected with a self-filling burette is a great convenience.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, & MACHINERY.

(Continued from page 40.)

English Patents.

Furnaces ; Regenerative ——. H. Gewecke, Herford, Germany. Eng. Pat. 13,751, June 15, 1906.

The claim is for a combination of dampers and valve-boxes so arranged that when the operation of reversing the direction of the flow of the gases takes place, the connections to the regenerators and furnace are first closed. The gas, air, and flue connections are then reversed, and lastly the connections to the regenerators and furnace are opened again. The various dampers are connected to a disc in such a manner that the operations are performed in the above order by rotating the disc.—W. H. C.

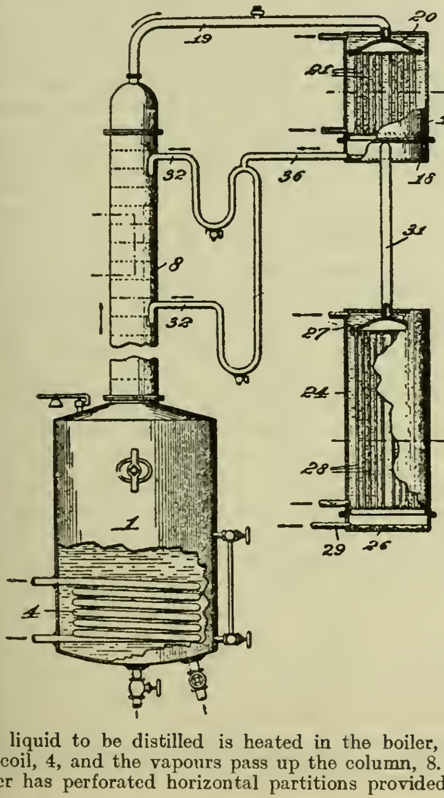
Centrifugal machine for separating solids from liquids. H. J. Haddan, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 19,729, Sept. 4, 1906.

The claim is for improvements in the apparatus described in Eng. Pats. 3807 of 1904, and 10,874 and 19,109 of 1905 (this J., 1905, 268 ; and 1906, 631, 418). It consists in providing an inner rotating bowl and fixed scrapers, which serve to bring the separated solids within the sphere of action of the scraper wheels. In a modification of the apparatus, a fixed inclined scraper is attached to the inner drum or to the liner.—W. H. C.

United States Patent.

Still and condenser ; Continuous ——. R. W. Erwin, St. Louis, Mo. U.S. Pat. 836,022, Nov. 13, 1906.

The claims, two in number, are for the apparatus as hereinafter figured and described.



The liquid to be distilled is heated in the boiler, 1, by the coil, 4, and the vapours pass up the column, 8. The latter has perforated horizontal partitions provided with overflow pipes, which are capped above and sealed below by cups. The vapours pass from the top of the column by the pipe, 19, into the hollow head, 20, of the tubular separator, 16. The hollow head, 20, is connected by the pipes, 21, with a lower chamber, 18, from which any condensed liquid is returned to the still by the pipes, 36, 32. The uncondensed vapours pass on by the pipe, 31, to the hollow head, 27, of the condenser, 24. The vapours are condensed in the pipes, 28, and collect in the lower chamber, 26, from which the condensed liquid flows away by the pipe, 29.—W. H. C.

French Patents.

Drying wet materials reduced to grains, chips, or small pieces ; Apparatus for ——. A. Huillard. Second Addition, dated Aug. 10, 1906, to Fr. Pat. 318,562, Feb. 10, 1902.

The Addition relates to the provision of suspended rakes in the first and last compartment of the drying tower, to assist in moving the materials, which have been found liable to clog at these points. Further, the vertical cylindrical shoots by which the material passes from the first to the second, and from the last but one to the last chamber, are divided into four compartments by vertical partitions. The cylindrical shoot is closed above and below by plates which are fastened to and rotated by the central shaft, and which have the form of a circle with one quadrant cut away. They are fastened to the shaft at an angle of 180° to one another, so that no vertical compartment of the shoot can be open above and below at the same time. The object of the arrangement is to prevent the air from passing through the shoot instead of through the perforated division plates.—W. H. C.

Furnaces ; Regenerative gas —— *for reheating.* F. Siemens. First Addition, dated Aug. 20, 1906, to Fr. Pat. 333,299, June 23, 1903.

See Eng. Pat. 14,947 of 1906 ; this J., 1907, 12.—T. F. B.

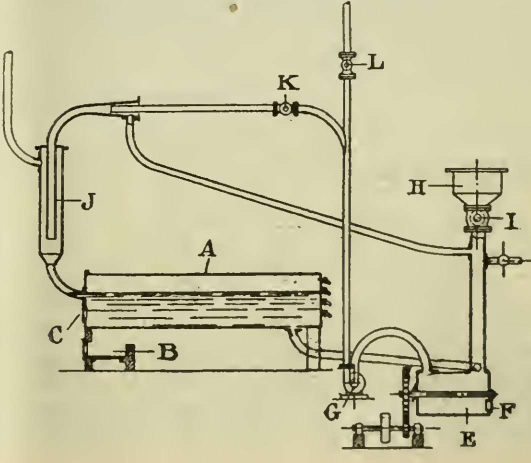
Separating liquids ; Centrifugal apparatus for ——. C. G. P. de Laval and E. E. F. Fagerstrom. Fr. Pat. 369,339, Aug. 28, 1906.

See Eng. Pat. 18,708 of 1906 ; this J., 1906, 1113.—T. F. B.

Separating solid materials of different densities ; Apparatus for ——. J. M. Draper. Fr. Pat. 369,370, Aug. 30, 1906. Under Int. Conv., July 5, 1906.

See Eng. Pat. 15,285 of 1906 ; this J., 1907, 12.—T. F. B.

Solution, by the aid of heat, of slightly soluble bodies ; Apparatus for the ——, *with or without pressure.* G. Faure and L. Vannot. Fr. Pat. 369,378, Sept. 1, 1906.



The material to be dissolved is fed from the hopper, H, into the agitator-mixer, E, and the solvent is heated in the boiler, A, provided with a furnace, B. The heated solvent flows from the boiler, A, into the mixer, E, where it dissolves some of the soluble matter, and is then withdrawn by the centrifugal pump, G, and returned through the froth-breaker, J, to the boiler, A, the circulation occupying only a comparatively short time. When the solution is sufficiently concentrated, the tap, K, is shut, and the solution is pumped away for further treatment through the tap, L. The residue in E is washed and then withdrawn through the door, F, and any fine mud carried over and deposited in A is withdrawn through C.
—W. H. C.

Distillation and evaporation of liquids in vacuo; Method and apparatus for the ——. O. Unglaub. Fr. Pat. 369,551, Sept. 7, 1906. Under Int. Conv., Sept. 8, 1905.

See Eng. Pat. 18,172 of 1905; this J., 1906, 1032.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 42.)

Coal discovery in South Staffordshire. Morning Post, Jan. 29, 1907. [T.R.]

The miners engaged at the Earl of Dudley's Baggeridge Wood sinkings, on the fringe of the Black Country, near Wolverhampton, have struck a large seam of the famous ten-yard coal of South Staffordshire at a depth of 556 yards. The seam is 20 ft. thick, of superior quality, and practically inexhaustible. The sinking operations have extended over a period of nearly ten years, involving a cost of many thousands of pounds. The discovery has verified predictions respecting the existence of coal measures under sandstone rocks to the west of South Staffordshire. Coal-field machinery is rapidly being installed, and when the colliery is in full working order a daily output of two to three thousand tons is anticipated. While engaged in sinking, the miners discovered valuable deposits of iron ore, equal to best Cumberland hematite. These discoveries should restore the commercial prosperity of South Staffordshire and East Worcestershire to the degree that was enjoyed thirty years ago.

Gas manufacture; Present position of —— *in relation to coke ovens.* F. Schreiber. J. Gasbeleucht., 1906, **49**, 925—929.

After making a comparison of horizontal and vertical gas retorts, the author discusses the differences in the working of gas retorts and coke ovens. Attention is then drawn to the plan of compressing small coal into briquettes under a pressure of 200 atmospheres, with the object of obtaining a harder and more coherent coke than is otherwise possible from a gas coal. The old process of Cooper (Eng. Pat. 5713 of 1882; this J., 1883, 372), of treating coal with lime before distillation in order to fix the sulphur, was not successful mainly owing to the impossibility of obtaining an intimate mixture of the lime and lump coal. By using small coal, however, intimate mixing becomes practicable, and the results of tests with and without addition of lime are shown in the following table:—

	Without lime.	With 3·5 per cent. of lime.
Ash of coal, per cent	5·24	8·74
Coke, percentage yield	68·56	69·77
„ per cent of ash	7·43	12·60
„ „ sulphur	1·03	1·36
„ heating value, Cals.	7610	7279
Gas, yield, cb m per metric ton	320	340
„ heating value, Cals	4850	4800
„ illuminating power, Hefner units (argand)	12·5	11·8
(flat-flame)	7·9	7·17
Sulphur in crude gas, grms H_2S per 100 cb m	447	85
Sulphur in purified gas, grms S per 100 cb m	62·18	16·49
Ammonia as sulphate, per cent	0·839	1·05
Cyanogen as $K_4Fe(CN)_6$, grms per 100 cb m.	275·4	201·70
Tar, per cent.	6·6	5·8

It would appear to be possible, therefore, by use of fine gas coal in the form of briquettes, to produce in gas retorts a hard, firm coke, whilst by addition of a suitable quantity of lime, a higher yield of ammonia, and gas of better quality, requiring less expensive purification than usual, will be obtained.—A. S.

Naphthalene; Removal of —— *from coal-gas.* Report of the investigation of the Southern District Association of Gas Managers. J. Gas Lighting, 1906, **96**, 521—525.

A series of determinations of the amount of naphthalene and also of the vapours of other hydrocarbons present in the purified gas was made at six different gas works, three of which experienced much trouble from the deposition of solid naphthalene from the gas, either in the manufacturing plant on the works, or in the service-pipes in the district of supply, or in both, whilst in the other three no such trouble was experienced. The results showed that the amount of naphthalene was in many cases higher at the works where no naphthalene trouble occurred, and that the amount of the vapours of other hydrocarbons which are liquid at the ordinary temperature was much higher at those works. Immunity from deposition of solid naphthalene is therefore due not so much to the presence of a lesser quantity of naphthalene as to the fact that the latter is accompanied by a higher proportion of other hydrocarbon vapours, which separate out together with the naphthalene if the gas is cooled; under these circumstances the naphthalene is deposited as a solution instead of a solid, and such solution flows to the siphon wells and causes no further trouble.

Experiments were made at two works to determine the effect of removing from the hot gas, before the condensers, the finely divided tar-particles mechanically carried along with the gas (amounting in some cases to one-third of the whole tar production). The results showed that such treatment effects a considerable reduction in the amount of naphthalene left in the gas after cooling, but it was also found that when the amount of "light-oils" formed during carbonisation falls below a certain minimum, the quantity of liquid separating in the condenser is too small to dissolve the whole of the naphthalene simultaneously deposited, with the result that the condenser becomes blocked with a pasty mass of naphthalene crystals and adhering tar. Experiments were further made to ascertain the effect of adding crude xylene vapour to the gas in the condensers; the results obtained were very variable, great reduction of the naphthalene being obtained in some cases, whilst in others hardly any effect was produced. So far it has not been found possible to maintain continuously the right conditions for bringing about a constant reduction of the amount of naphthalene in this manner.
—H. G. C.

Water-gas; Manufacture of benzolised ——. A. O. Jones. J. Gas Lighting, 1906, **96**, 680—684.

The author gives an account of the theory and practice of the production of "blue" water-gas, and of benzolised water-gas, with especial reference to the manufacture of the latter gas as carried out at the West Bromwich Gas Works by means of the Dellwik water gas plant. From the average working results of the past five years it is shown that the materials used for the production of 1000 cb. ft. of water-gas enriched with benzol to give an illuminating power of about 17 candles, and containing 5–6 per cent. of carbon dioxide, are as follows:—Coke to generator, 36·93 lb.; breeze to boilers, 20·44 lb.; benzol used to enrich to 17 candles, 0·63 gallon; purified blue water-gas per ton of coke, 60,637 cb. ft.; and the cost per 1,000 cb. ft. as follows:—Fuel (coke at 9s. 6d., breeze at 4s.), 2·32d.; gas making, &c. wages, 0·91d.; carting fuel and removing refuse, 0·16d.; enrichment (to 17 candles), 6·09d.; purification, 0·64d.; repairs and maintenance, 0·45d.; water, oil, waste, and other sundries, 0·24d.; total, 10·81d. The plant not being worked continuously, the figures for fuel are rather higher than would be the case with a plant worked continuously. The manufacturing cost of the coal-gas produced during the same period, which had also an illuminating power of about 17 candles, was 12·53d. per 1,000 cb. ft. The calorific power of the benzolised water-gas was 420 B.T.U. per cb. ft., and that of the coal-gas 640 B.T.U.—H. G. C.

English Patents.

Coke; Process of and apparatus for removing sulphur and other impurities from ——. W. S. Simpson, London. Eng. Pat. 25,574, Dec. 8, 1905.

An exhaust pump is connected with the retort, after exits have been stopped, or with a hermetically-sealed vessel, to which the coke has been transferred whilst in a highly heated condition, so as to draw out all the sulphur, gases, and impurities from the coke. The vessel may be stationary, or set in motion in any suitable manner.—C. S.

Burning tar and like fuel in furnaces; Mode and means for ——. S. Ballard, Worcester. Eng. Pat. 1559, Jan. 20, 1906.

Tar is injected by the aid of steam into a series of horizontal retorts, arranged above a fire, and the combustible vapours produced are led off to the point of consumption. The front of each retort is made in two portions, the upper portion, which is fixed, carrying part of the tar-feeding apparatus; whilst the lower is hinged, to afford access to the interior of the retort. The tar injector is so constructed as to be readily taken to pieces for cleaning or the like.—H. B.

Water-gas; Means for generating steam for conversion into —— *in suction and pressure gas-producer plants.* F. Sellers, C. Capel, and F. G. Wallis, London. Eng. Pat. 19,115, Aug. 27, 1906.

The steam required for the production of water-gas in the producer (which may be of either the suction or pressure type) is generated in a pan, arranged beneath the fire-grate, and kept filled with water to a constant level, by the conjoint action of heat radiated from the fire-grate above, and the conducted heat obtained by passing the exhaust gases of the engine through a chamber beneath the pan. In another form of apparatus, the pan is replaced by a tubular heat-interchanger, which is heated by radiation from the fire-grate above, and also by the hot exhaust gases which are led through it.—H. B.

Gas and air; Process for producing a constant mixture of ——, *and apparatus therefor.* Aktienges. f. Selas-Beleuchtung, Berlin. Eng. Pat. 21,847, Oct. 3, 1906. Under Int. Conv., Oct. 7, 1905.

The process consists in providing a double adjustment of the gas and air inlet ports to the mixing chamber from which the gaseous mixture is forwarded to the service main by a fan or blower. The first adjustment depends on the consumption of the mixture, the inlet ports being reduced or increased in cross sectional area as the demand for gas falls or rises. As the gas and air is drawn into the mixing chamber by the suction of the fan, this single regulation is insufficient, owing to the fact that the resistances of the air and gas to the increased or diminished suction are not proportional. A second adjustment of the area of the ports is, therefore, arranged to take place, dependent on the first, and capable of independent regulation with regard to the different resistances of the gas and air. In one form of apparatus, the mixing chamber consists of a vertical cylinder, with inlet ports for gas and air, and an outlet port for the mixture. A second cylinder, with corresponding ports, slides within the first. The first adjustment, dependent on the consumption, is effected by some form of governor, which causes the inner cylinder to move vertically within the outer one, thus diminishing or increasing the area of the inlet ports; the outlet port is, however, arranged so that it is not altered. The second adjustment is obtained by causing the inner cylinder to rotate with respect to the outer as it rises or falls, the rotation being caused by an independently adjustable guide.—W. H. C.

Coal and other gas; Condensing apparatus suitable for use in the purification of ——. F. Clark, Southend, Essex. Eng. Pat. 26,998, Dec. 27, 1905.

The apparatus is of the type in which a horizontal rotary shaft extends through a series of vertical casings or chambers, which are connected together through central openings, and in each of which there rotates a disc, fixed upon the rotary shaft. the gas passing in succession from chamber to chamber, and flowing over each disc from the centre to the periphery on the one side, and in the reverse direction on the other side. The chambers are separated from each other, except at the central openings, so as to offer a large cooling surface to the air; their inner walls and the sides of the discs are provided with radially disposed blades, and spraying pipes are fixed in the upper parts of the chambers. The chambers are connected up in two sets, with valves for changing at will the course of the gas, and for controlling the supply of water or liquor to the spraying pipes. On passing through the first set, the gas is subjected to dry treatment, whereby tarry matter, naphthalene, &c., are deposited; on flowing through the second set, it encounters the water-spray, and is further cleansed and cooled. From time to time the gas- and water-valves are operated so that the second set of chambers become the first, receiving the crude gas, and subjecting it to dry treatment, whilst the first set now become the second, and expose the gas to the wet treatment, the water serving at the same time to wash out the tar, naphthalene, &c., deposited during the previous cycle.—H. B.

Incandescent gas mantle. A. I. van Vriesland, Scheveningen, Holland. Eng. Pat. 18,152, Aug. 13, 1906.

See Fr. Pat. 369,627 of 1906; following these.—T. F. B.

Filaments of incandescent electric lamps. A. Bourdos, R. Rothschild, and J. W. Sutcliffe, London. Eng. Pat. 26,855, Dec. 23, 1905.

Pitchblende is immersed in a 20 per cent. solution of hydrochloric acid (or "other chlorine-yielding solutions, having a corresponding chlorine strength") as long as any gas is liberated; the pumice-like mass and pulverulent precipitate produced are washed with water, and are then kept at a red-heat, so as to drive out all volatile substances, lead, tin, &c. After cooling, the infusible mass is reduced to powder, formed into a plastic mass by the addition of a binding material, such as caoutchouc, and shaped into filaments, or used for coating filaments of carbon, &c. The filaments are then placed in an air-tight chamber containing powdered charcoal and graphite, heated to a high temperature, until the oxygen compounds are reduced to a metallic condition, and finally flashed in hydrocarbon gas as usual.—H. B.

Tungsten filaments for incandescence electric lamps; Manufacture of ——. A. G. Bloxam, London. From J. Lux, Vienna. Eng. Pat. 7803, March 31, 1906.

A tungstate of an amino-derivative of diphenyl is mixed with an agglutinant to form a paste, with or without the addition of oxides of tungsten sufficient for the oxidation of the carbon in the agglutinant; the paste is formed into filaments; the latter are subjected to dry distillation and finally heated electrically to incandescence in a vacuum or in an inert or reducing atmosphere. There is thus obtained a sintered, metallic filament, consisting of tungsten. According to another method, such filaments are obtained by impregnating or smearing cotton threads with tungsten dioxide, then dipping them, as often as is required, alternately into a solution of ammonium para- or metatungstate, and a solution of the hydrochloride of an amino-derivative of diphenyl, next drying and carbonising the threads, and finally heating them electrically to incandescence in a reducing gas in presence of steam, to remove the carbon, oxygen, and volatile products of the reaction. —H. B.

United States Patents.

Coke oven. M. E. Rothberg and A. Ernst, Cleveland, Ohio. U.S. Pat. 833,340, Oct. 16, 1906.

Beneath a battery of ovens, and extending centrally the whole length of the battery, is a main flue, into which the hot gases from the combustion flues of the ovens are discharged. Two regenerator chambers are arranged parallel to, and one on each side of, the main flue; and by means of suitable valves at the end of the latter, the hot gases may be directed at will through either of the regenerators, from the other end of which they escape into the chimney. A fan, situated at the chimney end of the battery, draws a supply of air through passages in the base of the ovens and discharges it, through a suitable valve, into that regenerator through which the hot gases are not flowing; the hot air, on issuing from the other end of the regenerator, is directed into two hot-air flues, which are situated alongside the regenerators, and passes up therefrom into the combustion-flues of the ovens, where it meets the supply of gas. The valves controlling the hot-gas and air currents are reversed periodically.—H. B.

Gas: Art of generating ——. C. Ellis, Assignor to Combustion Utilities Co., New York, N.Y. U.S. Pat. 835,506, Nov. 13, 1906.

A current of air, mixed with the products of combustion, is forced through a bed of hot fuel. The proportion of products of combustion in the mixture is such that it contains an amount of carbon dioxide equal to that capable of being produced from the fuel by combustion. —W. H. C.

Gas-producer. A. M. Levin, Chicago, Ill. U.S. Pat. 835,626, Nov. 13, 1906.

A tubular vaporiser is heated by the gas from the generator, and the steam is conducted into a mixing-box, where it is mixed with air and delivered into the generator. The proportions of air and steam are regulated by a valve, which is operated by a thermostat.—W. H. C.

Carburetting air and other gases; Automatic apparatus for ——. E. Bouchaud-Praceiq, Assignor to The Portable Gas Fountain Synd., Ltd., Paris. U.S. Pat. 835,745, Nov. 13, 1906.

See Eng. Pat. 6185 of 1905; this J., 1905, 838.—T. F. B.

Gas producer. L. Boutillier, Paris. U.S. Pat. 835,847, Nov. 13, 1906.

See Eng. Pat. 9942 of 1904; this J., 1904, 709.—T. F. B.

Gas; Method of manufacturing ——. P. Schmidt, Hanover, Germany. U.S. Pat. 836,054, Nov. 13, 1906.

See Fr. Pat. 338,626 of 1903; this J., 1904, 653.—T. F. B.

Gases; [Automatic recording] Apparatus for analysis of ——. H. J. Westover. U.S. Pat. 833,274, Oct. 16, 1906. XXIII., page 115.

Gas analysis; Apparatus for ——. E. Schatz, Frankfort on Maine, Germany. U.S. Pat. 835,559, Nov. 13, 1906.

See Fr. Pat. 359,352 of 1905; this J., 1906, 394.—T. F. B.

French Patents.

Smokeless combustible products, and their process of manufacture. Soc. Houillère de Flines-les-Raches. Fr. Pat. 361,902, Nov. 11, 1905.

The process described for the manufacture of smokeless combustible bodies, generally anthracitic, consists in placing briquettes, prepared in the usual manner with resin, in a closed vessel, and heating them out of contact with air to a temperature sufficient to remove the binding material, without sensibly affecting the volatile constituents of the combustible body. The claims also cover the industrial products obtained by this process.—W. C. H.

Cement [for binding patent fuel, artificial stone, &c.]; Manufacture of ——. A. F. Avezard. Fr. Pat. 369,317, Aug. 28, 1906. IX., page 96.

Charcoal; Mineral-vegetable ——. Mdlle. C. Badoil. Fr. Pat. 369,279, Aug. 29, 1906.

Vegetable charcoal, produced by the destructive distillation of waste vegetable products such as the shells of the earth-nut, &c., is ground to a powder and mixed at a temperature of from 30° to 40° C., with from 10 to 70 per cent. of heavy petroleum or other mineral oil. When the larger percentage of petroleum is used, a little tar and cheap coal dust is added to the mass, which is then subjected to pressure to obtain a harder product and to prevent the exudation of the oil.—W. H. C.

Petroleum briquette. G. Guilhot and G. Baedewyns. Fr. Pat. 369,341, Aug. 29, 1906.

The claim is for a briquette formed of a mixture of petroleum, water, caustic soda or caustic potash, linseed or other vegetable oil, wood charcoal, loamy-earth, and peat.—W. H. C.

Coke-ovens; New arrangement of regenerative ——. E. Coppée. Fr. Pat. 369,212, Aug. 24, 1906.

Two regenerator chambers pass longitudinally underneath the whole length of the battery of ovens, and are flanked on either side by waste-gas collecting conduits, which also extend the whole length of the battery, and each of which is connected to the regenerator lying next to it, at one end of the battery. At the other end the collecting flues are closed, and the regenerators are connected to a reversing valve so that when one regenerator is connected to the chimney, the other is open to the air. The gas- and air-inlets and the waste-gas outlets of the vertical flue combustion chambers are alternately connected with the right- and left-hand collector flue and with two gas-supply mains which run parallel with the battery of ovens on each side. The gas-supply mains are also provided with valves, so that by simply reversing these and the valve on the regenerators, the course of the gases may be reversed.—W. H. C.

Coke oven; Regenerative ——. V. Defays. Fr. Pat. 369,262, Aug. 27, 1906. Under Int. Conv., June 11, 1906.

According to this invention, in the case of continuous burning, regenerative ovens, the flues in the base of the oven communicate directly, at each of their ends, with one of the regenerative chambers, the gases being brought to one or the other of these chambers according to the position of dampers arranged in the flues. Air is supplied to the burners by one of two groups of horizontal flues, which extend the whole length of the furnace; one of the groups is in constant communication with one of the regenerative chambers, and the other with the second chamber. The dampers arranged in the flues of the base of the oven are controlled by the simple movement of the air-reversing valve. The gas is supplied by channels, the lateral walls of which are composed of the refractory blocks that form the flues in the base, the upper part of these flues being closed with slabs, perforated with holes. —W. C. H.

Inflammability and efficiency of liquid combustibles used for motive purposes; Process of increasing, by means of acetylene, the ——. C. Roth. Fr. Pat. 369,306, Aug. 10, 1906. Under Int. Conv., Sept. 4, 1905.

Liquid combustibles, such as petrol and alcohol, are saturated with acetylene gas, and then used in motors in the usual way. If a greater enrichment is desired, a liquid such as acetone, in which acetylene is much more soluble than in petrol, &c., is saturated with the gas and added to the liquid in the desired proportion, or some acetone may be added to the liquid and the mixture may then be treated with the gas. If it is desired to use proportions of acetylene greater than can be dissolved in the combustible, the gas is introduced directly into the carburetter or other suitable part of the motor, to mingle with the air and combustible vapour.—H. B.

Distilling coal for the production of illuminating gas; Process of ——. O. Guillet. Fr. Pat. 361,909, Nov. 13, 1905.

A current of steam is passed through the retort, so as to sweep out rapidly the gas produced, conserve the light-giving hydrocarbons, and prevent the formation and deposition of soot, &c.—H. B.

Gas from heavy oils, for operating motors; Producer for production of permanent ——. J. E. M. Briest. First Addition, dated 7th Aug., 1906, to Fr. Pat. 360,541, Dec. 16, 1905 (this J., 1906, 529).

Devices are described herein, for use in conjunction with the apparatus mentioned in the principal patent, so as to ensure the automatic control of the gas production in accordance with the consumption and to permit of varying the proportions of air and combustible in the gaseous mixture.—H. B.

Cooling apparatus for blast-furnace gases. Soc. Anon. des Hauts Fourneaux et Forges de Dudelange. Fr. Pat. 369,305, Aug. 9, 1906.

THE apparatus is of the type described in Fr. Pat. 368,731 (this J., 1907, 22), in which the discs are not immersed in water, but are irrigated by water directed upon their faces by radially disposed pipes arranged between alternate pairs of discs. According to the present invention the discs are stationary, whilst the water-distributing pipes are disposed radially upon the horizontal rotary shaft, the perforations on the pipes being so placed that the pipes and shaft are caused to rotate by the issuing water, without the assistance of any other driving power. —H. B.

Carburetting gas; Process of ——. F. Dannert. First Addition, dated Aug. 10, 1906, to Fr. Pat. 364,210, March 13, 1906 (this J., 1906, 877).

THE refractory lining of the producer is replaced, from a suitable level above the fire-grate upwards, by an annular body of cast iron, which is hollow, so as to provide a series of superheating chambers for the steam and hydrocarbon respectively, the superheated steam being led beneath the fire-grate and the hydrocarbon vapours entering the fuel at the reducing zone. The construction of the cast iron piece is such that the chambers are readily accessible for cleaning purposes.—H. B.

Gas producers. J. J. Deschamps. Fr. Pat. 369,216, Aug. 25, 1906. Under Int. Conv., Aug. 25, 1905.

THE lower part of the producer, surrounding the combustion zone, is constructed of metal without the usual refractory lining. The inner face of this metallic casing is provided with horizontally arranged ribs or equivalent projections, which take up ashes and cinders from the fuel, so as to produce automatically a refractory lining, and which prevent the air current from flowing up the metal walls. If preferred, a refractory lining of any desired form may be provided beforehand. Surrounding the lower part of the casing is a double-walled jacket, in which water is circulated, to protect the casing from injury by the fire. —H. B.

[*Suction*] *Gas producer.* E. Bardot. Fr. Pat. 369,540, Sept. 7, 1906.

INSTEAD of steam, generated in the usual manner by the heat of the producer-gas, the producer is fed with "pulverised" water, which enters the apparatus along with the air supply. The pulverising device, which is attached to the side of the producer, is a cup-shaped vessel fitted with horizontal diaphragms of wire gauze; the water drops into it and is broken up finely by the gauze, through which the air rushes at each suction-stroke of the engine. When the producer is first lit up, a pivoted lid, carrying a small gutter, is slipped over the pulveriser, and the gutter directs the water supply through a by-pass channel, directly into the producer; in this way an adequate water-feed is ensured before the suction of the engine is available to operate the pulveriser. The hot gases, on their way from the producer to the scrubber, pass down through an air condenser consisting of a cylinder containing vertical air-tubes, through which an upward current of cold air is maintained by the exhaust gases of the engine, these gases being delivered in an upward direction through the top of the casing to which the air tubes are attached. —H. B.

Gases; Process of carburetting ——. G. Houlon. Fr. Pat. 369,618, Sept. 11, 1906.

THE apparatus comprises a reservoir for liquid hydrocarbon, a vaporising coil, and an injector for delivering the vapour into the service-pipe. The reservoir, which is kept partly filled with the hydrocarbon liquid, is fitted at the top with a valve-controlled pipe, leading into the service-pipe; at the bottom it is connected to the vaporising coil, and is fitted internally with a perforated pipe, through which a quantity of the gas to be carburetted may be pumped, so as to maintain any desired pressure within the reservoir. When the apparatus is put into action, the carburetted gas stored above the liquid in the reservoir is at first admitted into the service-pipe, so as to maintain a supply of gas therein, until the vaporising coil has been heated by means of a suitable burner. When the coil is hot enough to operate, the supply of gas from the reservoir is shut off, and the liquid hydrocarbon is admitted to the coil. The vapour thus generated, entering the service-pipe through the injector, aspirates the weak gas into the service-pipe and forces it through the latter at a pressure which is determined by the degree to which the coil is heated, and the pressure maintained in the reservoir. —H. B.

Mantle for incandescence gas lighting A. I. van Vriesland. Fr. Pat. 369,627, Aug. 13, 1906.

A FABRIC for making an inverted incandescence mantle is obtained by stretching a smooth, flat piece of suitable textile material (knitted or otherwise) over a mandrel having the shape of an inverted mantle. The fabric thus formed may, if desired, be treated with alkaline or other solutions, which cause it to contract, and so remove irregularities. In a mantle so prepared, the thickening of the fabric at the bend, which occurs when the usual tubular fabrics are employed, is avoided.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 43.)

Petroleum from Alsace. E. Graefe. Petroleum, 1907, 2, 278—280.

Burning oil.—A sample from the Pechelbronn refinery, water-white in colour and of mild odour, had the sp. gr., 0·798; viscosity, 1·07; sulphur content, 0·038 per cent.; Wijs' iodine value, 5·79; flashing-point, 45° C.; calorific value, 10,662 cals. Distilled in an Engler flask, 32·5 per cent. of distillate passed over up to 200° C., 75 per cent. up to 250° C., and 96 per cent. below 300° C. The light given with a "10-line burner" averaged 6·7 Hefner candles, with only slight fluctuation, the distillate being therefore superior to that examined by Engler (this J., 1888, 202), though the consumption per candle hour (4·17 grms.) was about the same.

Crude oil A.—This blackish-brown, opaque oil, containing 1 per cent. of water, gave the sp. gr., 0·889; flashing-point, 27° C.; sulphur content, 0·67 per cent.; calorific value, 10,701 cals. On distillation, only 16 per cent. passed off below 250° C., and 29 per cent. below 300° C. The content of asphaltum pitch (Holde method) was 11·5 per cent., and of asphaltum 1·74 per cent. The residue above 300° C. gave, on distillation, 89·6 per cent. of distillate (sp. gr., 0·863), 5·6 per cent. of coke, and 4·8 per cent. of loss; and furnished, by the Zaloziecki method, 2·36 per cent. of paraffin (m.pt., 53·6° C.), equivalent to 2·12 per cent. of the crude oil.

Crude oil B.—The opaque, blackish-brown oil contained 5·5 per cent. (by vol.) of water, which left, on evaporation, 9·76 per cent. of saline matter, containing chlorine equivalent to 3·5 per cent. of the water, and consisting of magnesium chloride and sulphate, sodium chloride, and calcium sulphate. The sp. gr. of the water-free oil was 0·890; flashing-point, 39° C.; sulphur content, 0·34 per cent.; asphaltum pitch, 17·3 per cent.; asphaltum, 4·3 per cent.; heat of combustion, 10,715 cals. The distillation test gave results analogous to those of sample *A*, both oils furnishing about 25—30 per cent. of burning oil. The distillate from the residue above 300° C. had the sp. gr., 0·848, and contained 3·91 per cent. of paraffin (m. pt., 56·2° C.).

When subjected to the cracking process, the following results were obtained :—

Fraction.	Sp. gr.	Iodine value (Wijs').
Original oil	0·890	8·1
I. 0—20 per cent.	0·7843	2·4
II. 20—40 ,,	0·8447	6·5
III. 40—60 ,,	0·8739	16·8
IV. 60—80 ,,	0·8879	21·4
V. 80—85 ,,	0·9018	36·7

thus showing that the quantity of unsaturated hydrocarbons increased with the progress of the distillation. The high iodine value (30·9) of the asphaltum, in comparison with that of the crude oil, favours Höfer's hypothesis of the formation of asphaltum by the elimination of hydrogen under the action of oxygen.—C. S.

Petroleum production of Borneo. Oil and Col. Tr. J., Feb. 2, 1907. [T.R.]

THE Nederlandsch Indische Industrie en Handel Maatschappij supplies the following figures regarding the production of the Borneo oil-fields in 1905 and 1906 ; the quantities are in tons :—Production of crude oil, 1906, 353,430 ; 1905, 421,695 ; intake of refineries, 335,172,347,635 ; output of refineries—kerosene, 111,633, 145,739 ; other products, 193,372, 166,061 ; shipments—kerosene, 123,718, 123,714 ; other products, 169,666, 151,842. Crude oil in stock above ground, Dec. 31, 1906, 12,370 ; Dec. 31, 1905, 46,649 ; stocks awaiting shipment —kerosene : 19,040, 31,237 ; other products, 26,800, 24,652. Total stocks of crude and products, 1906, 58,210 ; 1905, 102,538. During the fourth quarter of 1905 a large fountain was struck, which abnormally increased production, and resulted in excessive stocks at the end of the year.

"Benzine" ; [Russian] Commercial ——. M. Rakusin. Chem.-Zeit., 1907, **31**, 6—8.

Production.—The highest yield of " benzine " is secured by treating the crude oil near the wells, owing to the loss sustained by evaporation during transport to a distance, and storage. Anapa oil gives the largest yield of any Russian crude petroleum, namely, 27·79 per cent., whilst Bibi-Eibat oil gives 4·88 per cent., and Grosny oil 2·88 per cent., as compared with 11·45 per cent. from Pennsylvania oil, and 3·41 per cent. from Campina (Roumanian) oil. Refining the "benzine" near the centre of consumption, on the other hand, has the advantage of giving a better quality product, and one more suitable to the special purpose in view (*e.g.*, extracting fats). Grosny "benzine," though of very low density, contains about 30 per cent. of distillate boiling above 100° C., and is rectified in a special manner, by redistilling the mixed fractions boiling up to 150° C. in a special apparatus, fitted with a suitable dephlegmator.

Properties and uses.—Refined " benzine," analysed in the works laboratory at Grosny, had the sp. gr., 0·7225, and yielded 48·50 per cent. of fractions boiling up to 95° C., 15·00 per cent. between 95° C. and 110° C., 16·30 per cent. between 110° C. and 125° C., 10·50 per cent. between 125° C. and 150° C., and 8·00 per cent. of residue. The most volatile products, " petroleum ether " and light "benzine," are largely used for eliminating grease spots, and as solvents in the rubber and other industries. The heavier sorts are employed for extracting bones, and there is an increasing outlet for " benzine " for motor use. " Ligroin," of which relatively large amounts are furnished by Grosny oil, is now permitted to be utilised as fuel in Russia, and has a heating effect of 11,279 cals. Burned in atomising burners at the Wladikavkas Railway works, it has been safely used for some time.

The following specification for " benzine " was drawn up by the firm of Nobel, and has been accepted by most Russian consumers. Sp. gr., not exceeding 0·717 for light, and 0·725—0·729 for heavy kinds ; reaction neutral ; complete evaporation, without any lasting disagreeable smell, when poured on filter-paper ; minimum content of fraction boiling up to 95° C. in the Glinsky apparatus, 90 per cent., with not more than 5 per cent. boiling above 100° C. The heavy kind must not begin to boil lower than 40° C. The residue above 100° C. must not leave any grease spot, at the end of an hour, when poured on to filter-paper. In determining the sp. gr., an allowance of 0·00080 must be made for expansion for each degree above or below the standard temperature (15° C.). When shaken with half its volume of sulphuric acid (sp. gr., 1·53) for three minutes, the " benzine " mixture must not show any yellow-brown coloration. The neutrality test is performed in the same way as for burning oil.

Storage.—To prevent waste by leakage or evaporation, the storage vessels of sheet-iron should be carefully riveted, and placed in a shaded situation, besides being covered with an insulating layer of loam. In warmer districts, an insulating jacket is provided, leaving a free space for the circulation of air between it and the storage vessel. For quantities up to 5 tons, horizontal cylinders may be arranged in underground wooden sheds, well lighted and ventilated. The foundation may be of wood, covered with sheet-iron, or of brickwork, the former being cheaper. The " benzine " is filled into casks in a separate underground room, with an iron or brick floor. To guard against explosion, the vessels are fitted with Hentze fusible plugs, and protective gauze.

Transport.—The newly-sanctioned " benzine " tank cars on the Russian railways are provided with special discharging siphon devices of 2-in. pipe, and also with fusible plugs and wire gauze.—C. S.

ENGLISH PATENTS.

Ammonia from gas liquor ; Method of obtaining ——. A. Fillunger, Mährisch, Austria. Eng. Pat. 11,077, May 11, 1906.

SEE Fr. Pat. 365,769 of 1906 ; this J., 1906, 977.—T. F. B.

Lubricating oil and process for obtaining same. W. Oppenheimer and T. O. Kent, London. Eng. Pat. 24,318, Nov. 24, 1905.

BY arresting the distillation of water-gas tar during the treatment described in Eng. Pat. 4271 of 1904 (this J., 1905, 722), a lubricating oil is furnished by the residue, the viscosity of which oil increases with the length to which distillation has been carried.—C.S.

Lubricating oil and process for obtaining same. W. Oppenheimer and T. O. Kent, London. Eng. Pat. 24,319, Nov. 24, 1905.

PITCH from oil or water-gas tar is distilled in a retort or other suitable vessel, until all the volatile fractions have passed over, the distillate being rectified to raise the flashing point to the desired extent.—C. S.

Oils for lubricating purposes. H. Carter and J. T. Newell. Eng. Pat. 9202, April 18, 1906. XII., page 102.

Hydrocarbon oils ; Emulsifiable compositions from ——. F. W. Klever, Cologne, Germany. Eng. Pat. 27,254, Dec. 30, 1905. Under Int. Conv., Jan. 4, 1905.

THE hydrocarbon oils are mixed with alkali oleates and high-boiling alcohols (which may be partly replaced by ordinary alcohol) under pressure. The product is specially intended for cleansing firearms from the corrosive deposit left in the bore by " nitric gunpowders."—C. S.

Oils ; Treating vegetable and mineral ——. J. Harris. Eng. Pat. 22,430, Oct. 10, 1906. XII., page 102.

Paraffin wax ; Refining ——. J. Mijs, Bussum, Holland. Eng. Pat. 495, Jan 8, 1906.

THE crude or partly refined wax is powdered, and the powder further refined by treating with alcohol in the cold.—B. N.

UNITED STATES PATENTS.

Retort for the distillation of woods. P. Brown, Tacoma, Wash., Assignor to Troy Chemical Manuf. Co., Ltd., Troy, Idaho. U.S. Pat. 835,747, Nov. 13, 1906.

THE retort is combined with a surrounding spiral flue (communicating with a furnace at the discharge end of the retort), and a series of closed, corrugated cylinders, mounted end to end inside the retort, for the charge of wood. The cylinders are fitted with valve-controlled openings for discharging gases and tar vapours into the retort. The retort is connected with a condenser.—C. S.

Acetates; Process of making ——. H. O. Chute, Cleveland, Ohio. U.S. Pat. 835,501, Nov. 13, 1906.

Crude pyroligneous acid is distilled, preferably under pressure, to remove the more volatile constituents (wood spirit, &c.), the residual liquid is separated from insoluble impurities, and distilled (by means of steam at about atmospheric pressure) under reduced pressure. The vapours of acetic acid thus obtained, are condensed in coils serving as the heating coils of a vacuum evaporator, the condensed acid is neutralised, and the resulting acetate solution is concentrated in the vacuum evaporator by the heating coils referred to.—A. S.

Ammonia from gas; Extraction of ——. W. Feld, Hönningen on Rhine, Germany. U.S. Pat. 837,045, Nov. 27, 1906.

See Fr. Pat. 369,258 of 1906; following these.—T. F. B.

Petroleum; Apparatus for the rectification of ——. E. A. Barbet, Paris, Assignor to E. Jandrier, Peace Dale, R.I. U.S. Pat. 836,732, Nov. 27, 1906.

See Fr. Pat. 322,265 of 1902; this J., 1903, 292.—T. F. B.

French Patents.

Ammonia; Process for washing —— *from distillation gases, and for regenerating the washing liquid.* W. Feld. Fr. Pat. 369,258, Aug. 27, 1906.

The gases, containing ammonia and carbon dioxide, are caused to pass through a strong solution of a magnesium salt, whereby an ammonium salt is formed, and magnesium carbonate precipitated. By subsequent distillation of the mixture thus formed, ammonia and carbon dioxide are again evolved, the magnesium salt being re-formed. Solidification during either operation is liable to occur, but may be prevented by the addition of a salt of ammonium or of the alkalis.—F. Sodn.

Lubricating and rust-preventing compound; Process of making a ——. F. W. Klever. Fr. Pat. 360,960, Dec. 27, 1905. Under Int. Conv., Jan. 4, 1905.

See Eng. Pat. 27,254 of 1905; preceding these.—T. F. B.

Petroleum briquettes. G. Guilhot and G. Baedewyns. Fr. Pat. 369,341, Aug. 29, 1906. II., page 84.

German Patents.

Pitch from tar or tar oils; Process for recovering —— *by heating with sulphuric acid.* M. Wendriner. Ger. Pat. 170,932, May 2, 1905.

Tar, after being heated in the usual way with sulphuric acid, is further treated with superheated steam at a high pressure; this is said to decompose the sulphonated compounds formed, and to leave a neutral pitch, insoluble in water, and free from sulphur.—T. F. B.

Petroleum and the like; Process for solidifying ——. C. Stiepel. Ger. Pat. 174,712, July 3, 1904.

Petroleum is solidified by mixing it with a potash or soda soap and a suitable proportion of salt. As much of the latter as possible is used, without destroying the homogeneity of the product.—T. F. B.

Mineral oils and their residues; Process for removing asphaltic and resinous matter from ——. B. Diamand. Ger. Pat. 173,616, July 26, 1904.

The resinous and asphaltic constituents of mineral oils or mineral oil residues are said to be removed by addition of a mixture of benzine (petroleum spirit) and amyl alcohol; the oils can then be used for lubricating purposes. —T. F. B.

Petroleum; Process for working up German crude ——. F. Seidenschnur. Ger. Pat. 169,952, Oct. 5, 1905.

In order to avoid the decomposition of certain petroleum constituents, the crude oil is introduced, in small quantities at a time, into a suitable vessel which can be strongly heated; a high vacuum is maintained in the vessel, and superheated steam passed into the oil, so that it may be distilled as rapidly and as completely as possible. The above process is said to give a high yield of good lubricating oils.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

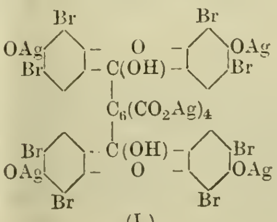
(*Continued from page* 44.)

p- and m-Nitrobenzophenone; Alkaline reduction of ——. P. Carré. Compt. rend., 1907, **144**, 34—35.

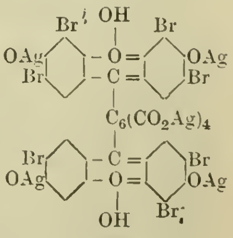
Fifty grms. of *p*-nitrobenzophenone were dissolved in 1 litre of alcohol, and the solution mixed with 70 grms of caustic soda. To the boiling mixture 100 grms. of zinc powder were added in small portions at a time. On cooling the solution obtained by extracting the product with boiling toluene, reddish spangles, which consisted of a mixture of azo- and azoxy-benzophenone, were deposited. On reducing this mixture with ammonium sulphide, *p*-hydrazobenzophenone was obtained, which crystallised from alcohol in white needles containing 1 mol. of water of crystallisation. These melted at 130° C., the anhydrous substance at 162° C. On oxidation with mercuric oxide the foregoing compound furnished *p*-azobenzophenone crystallising from toluene in red plates. m.pt. 219° C. *m*-Nitrobenzophenone gave a corresponding series of derivatives which have already been described by Elbs and Wogrinz (this J., 1903, 703).—J. C. C.

Colour and fluorescence; Relation of —— *to constitution.* A. G. Green. Chem. Soc. Proc., 1907, **23**, 12—13.

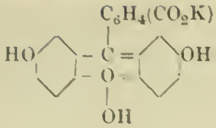
In a paper bearing the above title (this J., 1907, 43). O. Silberrad has described a number of complex phthaleins formed by the condensation of mellitic and pyromellitic acids with resorcinol. From the fact that the silver salts of these phthaleins correspond to the substitution of hydrogen by silver, not only in all the carboxyl groups of the mellitic residue, but also in the two phenolic hydroxyl groups of each xanthene ring, it is concluded that "neither the colour nor the fluorescence of these compounds is dependent on the presence of quinone linkings, for in many cases, a quinonoid structure is impossible." This conclusion Silberrad is inclined to extend to the phthaleins in general. A study of the phthaleins of phenol and quinol, which the author has had in progress for some time past, has brought to light several facts pointing to an opposite conclusion, and strongly confirming the view that the coloured salts of these phthaleins have a quinonoid structure. It therefore appears advisable to point out that Silberrad's deductions are in no sense necessary, but that, on the contrary, his compounds may be represented with equal or greater probability upon a quinonoid type. For instance, in place of the carbinol formula (I.), for the silver salt of the octobromo-hexahydroxy-*p*-dixanthylbenzene-tetracarboxylic acid, the ortho-quinone formula (II.) may be substituted. This latter is analagous to (III.) the formula proposed by the author for the potassium salt of quinolphthalein (Ber., 1906, **39**, 2365; this J., 1906, 749).



(I.)



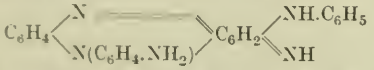
(II.)



(III.)

Safranines ; New method of formation of asymmetric ——. P. Barbier and P. Sisley. Bull. Soc. Chim., 1906, 35, 1282—1285.

The method consists in condensing *p*-diaminoazo-compounds with monoamines. Example: 28 grms. of *p*-diaminoazobenzene hydrochloride were mixed with 13 grms. of aniline hydrochloride and 150 c.c. of 94 per cent. alcohol, and the mixture heated in an enamelled autoclave for eight hours to 160° to 170° C. After this time steam was blown through to remove any volatile substances, and the dyestuff precipitated from the filtered solution by adding salt. The product consisted of two dyestuffs, which are easily separated by taking advantage of their different solubilities in salt solutions. The more soluble dyestuff, which is formed only to a small extent, is intensely red, and gives a dark green crystalline hydrochloride. It is probably *asym*-phenosafranine. The second dyestuff, less soluble in salt solution, is violet and is precipitated as a microcrystalline powder with a metallic reflex. This is *asym*-anilidophenosafranine.



$$C_6H_4\left\langle\begin{matrix}N & \text{——} & \\ N(C_6H_4.NH_2) & & \end{matrix}\right\rangle C_6H_2\left\langle\begin{matrix}NH.C_6H_5\\ NH\end{matrix}\right.$$

and gives beautiful violet-blue shades on silk and cotton mordanted with tannin and tartar emetic.

By heating together 30 grms. of *p*-diaminoazotoluene dihydrochloride, 15 grms. of *o*-toluidine hydrochloride, and 150 c.c. of 94 per cent. alcohol as described above, an *asym*-tolusafranine was obtained as a crystalline powder with a metallic reflex and giving a vivid red solution in water. It gives splendid red and rose shades on silk and cotton, at the same time the shades are bluer than those furnished by the corresponding phenosafranine.—J. C. C.

Erratum.

This J., 1907, p. 43, col. 2, line 1, also line 4 and line 10, from top, *for* "Pyrone" *read* "Pyrane."

English Patents.

Anthracene derivatives ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 352, Jan. 5, 1906.

See Fr. Pat. 362,140 of 1906 ; this J., 1906, 752.—T. F. B.

Anthracene dyestuffs ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9102, April 17, 1906.

See Fr. Pat. 365,305 of 1906 ; this J., 1906, 923.—T. F. B.

Colouring matters [dyestuffs] of the anthracene series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,324, May 2, 1906.

See Fr. Pat. 365,920, of 1906 ; this J., 1906, 979.—T. F. B.

Indoxylic compounds [Indigo] ; Manufacture of——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 12,243, May 25, 1906.

Indoxyl derivatives are prepared by heating acetylphenylglycine, its homologues, analogues or derivatives, with aluminium chloride, bromide, or iodide, preferably in absence of air. Example: Equal parts of dried and finely powdered acetylphenylglycine and aluminium chloride are heated in an atmosphere of hydrogen to about 250° C. When the evolution of hydrochloric acid is complete, the mass is allowed to cool, added to a boiling dilute solution of caustic soda, and air passed through the liquid, whereupon indigo is formed.—A. S.

o-Carboxyphenylthioglycollic acid ; Manufacture of ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 11,174, May 12, 1906.

See Fr. Pat. 366,612 of 1906 ; this J., 1906, 1036.—T. F. B.

United States Patents.

Dyestuffs ; Monoazo ——, *and process of making same.* T. Kroeber, Assignor to Soc. Chem. Ind. in Basle, Basle. Reissues, Nos. 12,555, 12,556, and 12,557, dated Nov. 13, 1906, to U.S. Pats. 805,918, 806,415, and 797,441.

See Addition, dated May 10, 1905, to Fr. Pat. 351,125 of 1905 ; this J., 1905, 1168.—T. F. B.

Dyestuff ; Monoazo ——, *and process of making same.* T. Kroeber, Assignor to Soc. Chem. Ind. in Basle, Basle. U.S. Pat. 835,539, Nov. 13, 1906.

See Addition of June 19, 1905, to Fr. Pat. 351,125 of 1905 ; this J., 1906, 922.—T. F. B.

Dyestuff ; Red violet to violet-blue [thioindigo] ——, *and process of making same.* G. Engi, Assignor to Soc. Chem. Ind. in Basle. U.S. Pat. 836,309, Nov. 20, 1906.

See Eng. Pat. 11,760 of 1906 ; this J., 1906, 751.—T. F. B.

Dyestuff ; Triphenylmethane ——, *and process of making same.* W. Herzberg and O. Scharfenberg, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 835,682, Nov. 13, 1906.

See Fr. Pat. 359,002 of 1905 ; this J., 1906, 369.—T. F. B.

Dye [dyeing compound] ; Process of making a cold ——. C. Henry, Paris. U.S. Pat. 835,754, Nov. 13, 1906.

See Fr. Pat. 355,391 of 1905 ; this J., 1905, 1227.—T. F. B.

Dyestuff ; Yellow anthracene ——. R. E. Schmidt, Elberfeld, and P. Tust, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 836,220, Nov. 20, 1906.

See Fr. Pat. 364,005 of 1906 ; this J., 1906, 923.—T. F. B.

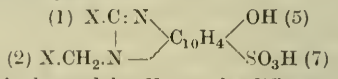
Dyestuff and process of making same ; Azo ——. K. Schirmacher, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 837,128, Nov. 27, 1906.

See Fr. Pat. 366,110 of 1906 ; this J., 1906, 979.—T. F. B.

French Patents.

Hydroxynaphthobenzaldehydinsulphonic acids and their derivatives ; Process of making ——. L. Cassella und Co. First Addition, dated Nov. 18, 1905, to Fr. Pat. 361,393, April 18, 1905 (this J., 1906, 65).

In the acids of general formula:



$$\begin{matrix}(1)\ X.C:N\diagdown & & \diagup OH\ (5)\\ | & C_{10}H_4 & \\ (2)\ X.CH_2.N\ —\diagup & & \diagdown SO_3H\ (7)\end{matrix}$$

the radicals denoted by X may be different. Example: One mol. of 1 : 2-diaminonaphthalene - 5 - hydroxy - 7 - sulphonic acid is condensed with 1 mol. of benzaldehyde or *m*-aminobenzaldehyde in presence of sodium bisulphite, and the intermediate compound condensed with a second mol. of *m*-aminobenzaldehyde or benzaldehyde. *m*-Nitrobenzaldehyde may be also employed, the nitro-group being subsequently reduced.—J. C. C.

Dyestuffs for cotton ; Process for preparing diazotisable [azo] ——. L. Cassella und Co. First Addition, dated Nov. 20, 1905, to Fr. Pat. 361,397, April 19, 1905 (this J., 1906, 260).

5-**Hydroxynaphthomonoaminobenzaldehydin - 7 - sulphonic** acid, when combined with (for example) diazobenzene chloride in alkaline solution, furnishes a red dyestuff, which dyes unmordanted cotton scarlet. When diazotised and developed on the fibre, the shade becomes brighter and stronger.—J. C. C.

Dyestuffs ; Manufacture of new condensation products and leuco-derivatives of sulphurised vat —— [Leucothioindigo derivatives]. Badische Anilin und Soda Fabrik. First Addition, dated August 16, 1906, to Fr. Pat. 367,709, June 25, 1906 (this J., 1906, 1143).

The products obtained by condensing chloral or its hydrate, alcoholate, &c., with thiosalicylic acid or its derivatives or analogues, when treated with strong alkalis, furnish compounds similar to those prepared by the aid of formaldehyde, and are perhaps identical with them. Example : 50 kilos. of thiosalicylic acid are heated with 60 kilos. of chloral hydrate in an oil-bath for one hour to 130°—140° C. On crystallisation from alcohol, the product is obtained in colourless leaves, m.pt. 102° C., insoluble in dilute alkalis, but readily soluble in organic solvents. To convert this into the leuco-derivative, 50 kilos. dissolved in 125 kilos. of alcohol are mixed with 125 kilos. of caustic potash of 40° B. The alcohol is distilled off, and the residue heated at 170°—180° C., until it assumes a yellowish-brown colour, and becomes thick. The product is dissolved in water, and the leuco-derivative precipitated with hydrochloric acid. It is sparingly soluble in cold water, readily so in dilute alkalis. The latter solution, when treated with potassium ferricyanide, does not yield thioindigo in the cold as does thioindoxyl. In another example of this preparation, the alcohol is omitted, and the mixture is heated to 240°—250° C. Other examples of the condensation of analogous substances are also given.—J. C. C.

2-Amino-5-naphthol-7-sulphonic acid ; Process for the manufacture of aryl derivatives of ——. Act.-Ges. für Anilinfabr. Fr. Pat. 369,570, Sept. 8, 1906.

Aryl derivatives of 2-amino-5-naphthol-7-sulphonic acid are prepared by heating the acid to a high temperature in a closed vessel, with an aqueous solution of the hydrochloride of a primary aromatic base, together with a certain quantity of the free base. Example : A mixture of 10 parts of the aminonaphtholsulphonic acid, 30 parts of aniline, 15 parts of hydrochloric acid of 15° B., and 200 parts of water is heated in a closed vessel for twelve hours at 150°—160° C. The mixture is then rendered alkaline by addition of sodium carbonate, the excess of aniline removed by a current of steam, and the sodium salt of phenyl-2-amino-5-naphthol-7-sulphonic acid precipitated from the solution by means of sodium chloride.
—A. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(Continued from page 46.)

Cotton ; Hygroscopic action of ——. O. Masson and E. S. Richards. Roy. Soc. Proc., 1906, 78 A, 412—429.

The authors have determined the amount of moisture which is absorbed by cotton when exposed to an atmosphere of known humidity. "Absorbent" cotton-wool was employed, which, after being washed with distilled water and dried, was wound round the bulb of a thermometer and brought to a constant weight by exposing it for 24 hours in a desiccator containing phosphorus pentoxide. It was then transferred to a porous pot suspended in sulphuric acid (free from oxides of nitrogen) of known strength (and therefore of known vapour pressure), by which means the interior of the pot was kept constant as to humidity by evaporation from its walls. It is not sufficient to expose the dry cotton to the atmosphere of given humidity until its weight becomes apparently constant, for the rate of absorption, which rapidly diminishes, becomes almost inappreciable before absorption is complete. The quantity of hygroscopic moisture required by a given quantity of cotton to put it in true equilibrium with an atmosphere of given humidity, below the saturation value, is therefore ascertained by taking the mean of the apparent equilibrium values reached by absorption (cotton initially dry) and evaporation (cotton initially over-moist). The progress of either change can be followed by observing the characteristic temperature curve given by the thermometer.

The following table shows the amount of moisture absorbed by 0·948 grm. (W) of pure cotton over sulphuric acid solution at 20° C. ; p is the actual pressure of water-vapour in the atmosphere employed, P is the saturation pressure of water-vapour at the same temperature, Ma is the weight of moisture absorbed by the sample of dry cotton of weight W, after exposure in the apparatus until further absorption appears negligible. Me is the weight of moisture retained by the same sample after it has been supersaturated by exposure over water and then allowed to evaporate in the apparatus until further loss appears negligible, and M is the arithmetic mean of Ma and Me, and is taken as indicating the amount of absorbed moisture which is required to establish true equilibrium.

Acid employed.			Ma	Me	M	M/W
Sp. gr. 20° C.	H_2SO_4 per cent	p/P				
1·6516	73·8	0·050	0·0120	0·0145	0·0132	0·0139
1·5724	67·0	0·100	0·0175	0·0198	0·0186	0·0196
1·4850	59·0	0·198	0·0264	0·0311	0·0288	0·0304
1·4167	52·6	0·294	0·0356	0·0406	0·0381	0·0402
1·3672	47·2	0·408	0·0441	0·0497	0·0469	0·0495
1·3282	43·1	0·500	0·0509	0·0593	0·0551	0·0581
1·3028	40·5	0·556	0·0530	0·0655	0·0592	0·0624
1·2887	38·8	0·598	0·0599	0·0690	0·0644	0·0679
1·2368	32·3	0·710	0·0716	0·0840	0·0778	0·0821
1·1930	26·8	0·794	0·0860	0·1002	0·0931	0·0982
1·1616	23·2	0·844	0·0989	0·1107	0·1048	0·1106
1·1398	20·3	0·874	0·1045	0·1250	0·1148	0·1210
1·1226	18·1	0·894	0·1114	0·1300	0·1207	0·1274
1·0686	10·3	0·952	0·1378	0·1606	0·1492	0·1574
1·0378	6·2	0·972	0·1563	0·1792	0·1678	0·1770

By multiplying the last columns by 100, the percentage absorption is shown.

Cotton containing a definite proportion of moisture resembles an aqueous solution in that it exercises a vapour tension which is, at different temperatures, a constant fraction of that of pure water. Different weights of the same cotton have the same vapour tension when they contain the same percentage weights of hygroscopic moisture, and the results are not influenced by tight or loose packing. Filter paper gives results very similar to those obtained with cotton-wool. It is also shown that, by observing the rate of rise of temperature of dry cotton when first exposed to moist air, the pressure of aqueous vapour in the atmosphere may be determined, thus providing a new method of hygrometry. (See also this J., 1904, 1143.)—J. C. C.

Dyeing of animal textile fibres ; Phenomena accompanying the ——. P. Gelmo and W. Suida. Monatsh. Chem., 1906, 27, 1193—1198.

In continuing their researches (see this J., 1906, 472), the authors made use of wool the same as that previously employed. Separate portions of the wool were boiled for an hour with alcoholic solutions of sulphuric, hydrochloric, and phosphoric acids. The wool was well washed and titrated with $N/10$ solutions of ammonia, and sulphuric and hydrochloric acids. Other portions of this wool after boiling with the alcoholic acids were boiled for an hour with ammonium carbonate and well washed before titrating.

	Proportion of		
	NH_3.	HCl.	$\frac{1}{2}H_2SO_4$
Wool treated with alcoholic H_2SO_4	1	1·34	1·83
,, ,, ,, ,, HCl.	1	4·40	4·62
,, ,, ,, ,, H_3PO_4	1	3·95	4·34
Boiled with ammonium carbonate before titration—			
Wool treated with alcoholic H_2SO_4	1	12·50	13·40
,, ,, ,, ,, HCl.	1	8·0	8·9
,, ,, ,, ,, H_3PO_4	1	5·46	6·01

Treatment with alcoholic acids diminishes the basic character of the wool, but increases the acid character. The wool after treatment with these alcoholic acids was dyed with Magenta, Nile Blue, Crystal Violet, and Crystal Ponceau. The basic dyestuffs were badly taken up, but the wool was strongly coloured by the acid dyestuffs. Phosphoric acid has the least effect of the three acids on the intensity of the shade. Some wool was placed in alcohol which was saturated with hydrochloric acid gas, the saturation being complete in 25 hours. The wool was removed and well washed. It could not be dyed with basic dyestuffs but took up acid dyestuffs strongly, the colour not being removed by soaping. The wool after treatment with this alcoholic hydrochloric acid was allowed to stand in contact with cold dilute ammonium carbonate solution and well washed. It was found that basic dyestuffs were not taken up by the wool after this treatment. Acid dyestuffs were strongly taken up, but the colour was removed on soaping. Wool was allowed to stand in contact with a solution of sodium nitrite, and hydrochloric acid for 15 hours at the ordinary temperature, then well washed and titrated.

	Proportion of		
	NH_3	HCl	$\frac{1}{2}H_2SO_4$
Wool treated with 1 per cent. of its weight of sodium nitrite	1	5·9	7·1
Wool treated with 1 per cent. solution of sodium nitrite	1	2·12	2·69

Wool so treated becomes coloured yellow on exposure to light. Dried wool was treated with phosphorus trichloride. This treatment did not appreciably affect its behaviour to dyestuffs.—F. Shdn.

Dyeing and ionisation. L. Vignon. Compt. rend., 1907, **144**, 81—83.

In a previous communication (this J., 1906, 1038) the author showed that wool and silk take up sulphuric acid and barium hydroxide from aqueous solutions, the proportion of acid or base thus fixed by the fibre becoming greater the more dilute is the solution. The conclusion was drawn that the absorption of dissolved substances by fibres (for example, the exhaustion of dye-baths) is connected with the ionisation of such substances in solution. In order to test this view, the author determined the electrolytic conductivity of solutions of sulphuric acid, Roccellin, Orange II., Magenta, and picric acid, at concentrations such as are used in the dyeing industry, and at different temperatures. It was found that the ionisation of the dyestuffs is greatly increased by dilution (except in the case of picric acid) and by rise of temperature, conditions which also have a favourable influence on the dyeing process.—A. S.

Sodium chloride in commercial stannic chloride ; Detection and determination of ——. P. Heermann. Chem.-Zeit., 1907, **31**, 27—28.

The ordinary works method for the rapid detection and approximate determination of sodium chloride in stannic chloride consists in precipitating the former by fuming aqueous hydrochloric acid. The author finds that much smaller quantities of sodium chloride can be detected by using alcoholic hydrochloric acid as precipitant. Experiments with stannic chloride of trade strengths (50° and 58° B.) showed that by using as precipitants (1) alcoholic hydrochloric acid (99·5 per cent. alcohol saturated with dry hydrochloric acid gas) ; (2) fuming aqueous hydrochloric acid (sp. gr. 1·19) ; and (3) 96 per cent. alcohol, the content of sodium chloride can be approximately determined. The following table shows the percentages of sodium chloride in stannic chloride necessary to give a reaction with the different reagents :—

Strength of stannic chloride.	Alcoholic acid.	Fuming aqueous acid.	96 per cent. alcohol.
58° B. ...	0·1 per cent., turbid after 2—3 mins.	1 per cent., ppt. after a few mins.	4 per cent., ppt.
50° B. ...	0·2 per cent., turbid after 2—3 mins.	1·5 per cent., turbid after 1—2 mins	8 per cent., ppt. after several mins.

—P. F. C.

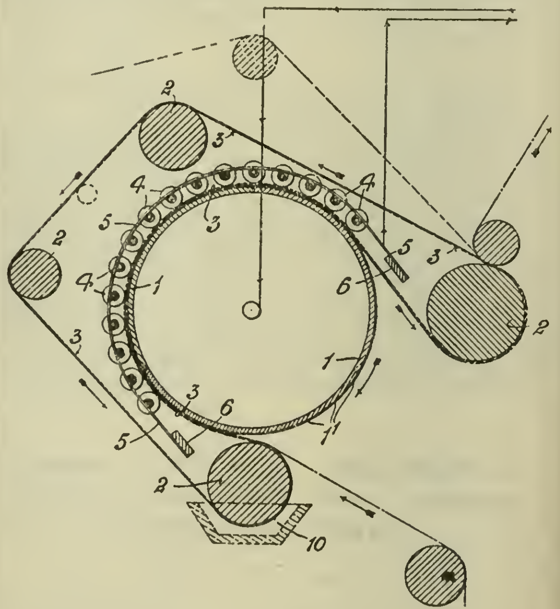
English Patents.

Wool ; Apparatus for extracting the yolk out of ——. G. Malard, Tourcoing, France. Eng. Pat. 26,811. Dec. 22, 1905.

See Fr. Pat. 360,183 of 1905 : this J., 1906, 474.—T. F. B.

Titanium compounds, and the manufacture thereof. J. Barnes, H. Spence, and P. Spence and Sons, Ltd. Eng. Pat. 6329, March 16, 1906. VII., page 93.

Textile or other fabrics or substances ; Method and means for reproducing designs or the like on ——. J. Wilson, Bradford. Eng. Pat. 2939, Feb. 7, 1906.



A view of the arrangement of the apparatus is shown in the figure. The design or printing cylinder, 1, is mounted on insulated bearings, and is connected with one pole of a source of electric current, the other pole of which is connected with an endless band, 3, of conductive material (aluminium wire cloth or the like), either by means of the frame, 5, supporting the rollers, 4, or by other suitable means. The surface of the printing cylinder is filled up with enamel or other non-conducting material to the level of the designs, which are of conductive material. The fabric to be treated is rendered conductive by impregnation with a suitable mordant, dyestuff, or other chemical, and is passed between the printing cylinder, 1, and the endless band, 3. The endless band, 3, of conductive material is pressed against the printing cylinder by means of the tension rollers, 2, and the set of small rollers, 4, the latter being carried by a frame, 5, secured to bars, 6, which are mounted adjustably in slots in the framework of the apparatus. When the fabric is subsequently dyed, washed, or otherwise treated, the portions which have been in contact with the design on the cylinder, and which have consequently been submitted to electrolytic action, will be coloured a different shade to the other portions.—A. S.

UNITED STATES PATENTS.

Viscose; Process of producing lustrous threads, &c., from ——. M. Müller, Altdamm, Germany. U.S. Pat. 836,452, Nov. 20, 1906.

SEE Eng. Pat. 10,094 of 1906; this J., 1906, 753.—T. F. B.

Silk, artificial; Method of manufacturing textile fibres or ——. J. Vermeesch, Schaerbeek, Belgium. U.S. Pat. 836,620, Nov. 20, 1906.

LUSTROUS textile fibres are obtained by discharging a solution of cellulose in cuprammonium through capillary orifices, and passing the filaments first into a precipitating bath composed of a solution of glycerylmonosulphuric acid in water mixed with glycerin, and next into a neutralising bath composed of a solution of sodium chloride. The filaments are now freed from copper salts by treatment with a dilute solution of sodium bisulphate, and washed with water, to which, if desired, a small quantity of glycerin may be added.—A. S.

Silk, artificial; Production of —— and artificial hair from casein. F. Todtenhaupt, Cologne Ehrenfeld, Germany. U.S. Pat. 836,788, Nov. 27, 1906.

SEE Eng. Pat 25,296 of 1904; this J., 1905, 1063.—T. F. B.

Silk; Process of ungumming and dyeing raw natural ——. P. Schmid, Basle, Switzerland. U.S. Pat. 836,464, Nov. 20, 1906.

SEE Eng. Pat. 2359 of 1906; this J., 1906, 924.—T. F. B.

Dyeing apparatus. S. W. Cramer, Charlotte, N.C. U.S. Pat. 835,813, Nov. 13, 1906.

THE apparatus comprises a receptacle with pipes for supplying and withdrawing the dye-liquor. The upper end of the receptacle is closed by a removable perforated cover. The material to be dyed is placed on a perforated false bottom, which can be moved vertically up and down inside the receptacle by means of a motor. The false bottom is supported on springs so that an approximately even degree of pressure on the charge can be maintained when the material is unequally distributed. When the dyeing is finished, the cover is removed, the false bottom moved to the top of the receptacle, and the dyed material removed.—A. S.

Dyeing, &c. [textiles]; Apparatus for ——. T. A. S. Wood, London. U.S. Pat. 835,927, Nov. 13, 1906.

SEE Eng. Pat. 14,344 of 1906; this J., 1906, 1090.—T. F. B.

Circulating liquids in dye vats; Apparatus for ——. L. Dumons, Roubaix, France. U.S. Pat. 836,101, Nov. 20, 1906.

SEE Fr. Pat. 322,172 of 1902; this J., 1903, 295.—T. F. B.

FRENCH PATENTS.

Silk, artificial; Tubular apparatus for forming gaseous "sheaths" for the filaments emerging from the forming nozzles in the manufacture of ——. H. E. A. Vittenet. Addition, dated Nov. 4, 1905, to Fr. Pat. 361,568, June 19, 1905.

SEE U.S. Pat. 828,155 of 1906; this J., 1906, 845.—T. F. B.

Cellulose esters [for artificial silk]; Process for the manufacture of ——. Knoll et Cie. Fr. Pat. 369,123, Aug. 10, 1906. Under Int. Conv., Aug. 22 and Sept. 15, 1905.

CELLULOSE (1 part) is introduced into a mixture of glacial acetic acid (8 parts), benzene sulphinic acid (4—8 parts), and acetic anhydride (3 parts). When the acid mixture is kept at a temperature of 50°—60° C., the cellulose is dissolved completely in the course of 1½ hours. When the solution is poured into water, alcohol, or other precipitant, the sulphinic and acetic esters are precipitated. Hydro- or oxycellulose may also be employed. The advantages claimed for such solutions are that they may be kept for very long periods without losing their viscosity, and that they may be spun directly into threads without getting rid of acid, which is not the case with sulphuric acid solutions.—G. W. McD.

Silk, artificial; Manufacture of ——. Soc. Anon. pour l'Etude Ind. de la Soie Serret. Fr. Pat. 369,170, Aug. 23, 1906.

THE threads of artificial silk made from nitrocellulose are first treated in one of the usual denitrating solutions until they are no longer soluble in alcohol-ether or other collodion solvent. They are then impregnated with a solution of aluminium chloride or other analogous salt, capable of being slowly decomposed by the small quantity of nitro-compounds still left in the threads.—A. S.

Ramie, rhea, and analogous fibres; Process and apparatus for decorticating, hackling, and degumming fibrous matters, especially ——. D. E. Radclyffe. Fr. Pat. 368,996, August 17, 1906.

FIG. 1.

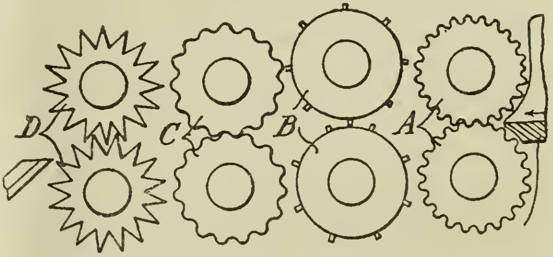
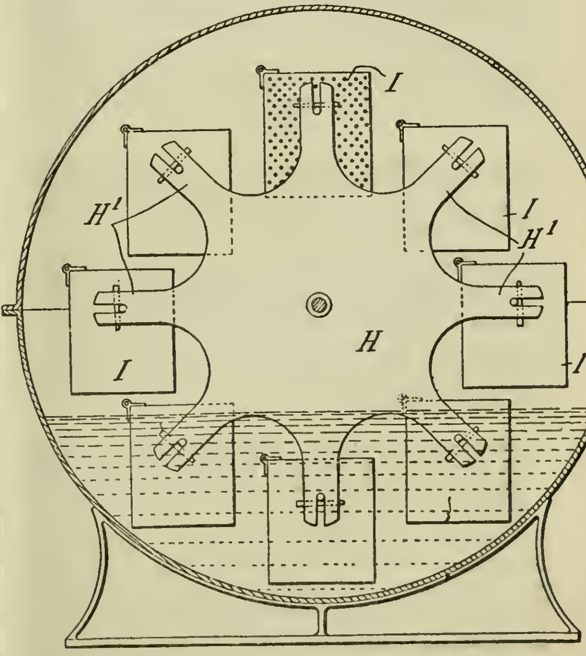


FIG. 2.



STEMS, &c., of ramie, hemp, and similar fibre-yielding plants are passed, preferably in the green and undried state, between a series of pairs of rollers, A, B, C, D (see figures), by means of which they are successively crushed, scutched, crushed, and hackled. The fibrous ribbons thus obtained are received in cages, I, which are then placed upon the radially projecting arms, H^1, of two parallel discs, H, within a boiler, G. Here, while the cages are rotated, the fibres are boiled with water, or with solutions of suitable chemical reagents, and are afterwards washed. The action may be assisted by the introduction of steam into the upper part of the boiler. During the operation the fibres are maintained in a position parallel to one another. The cages are next removed from the boiler, and the fibres thus degummed are dried. The fibres are then ready for the operation of spinning.—E. B.

Fibrous substances; Process and apparatus for retting and decorticating and subsequently cleaning and drying —— preparatory to separating the fibres. C. R. Rogers. Fr. Pat. 369,138, Aug. 22, 1906.

THE material (flax, ramie, &c.) is boiled with water, to which emulsified linseed oil has been added, and is afterwards passed through two or three sets of breaking rollers. It is sprinkled with water containing emulsified linseed oil whilst passing between the first two rollers, and with water alone whilst passing through the remaining sets of rollers. It is finally passed over a drying table, and is then ready for the operations of scutching, carding, &c. The linseed oil emulsion is prepared by heating a mixture of 100 parts of linseed oil with a solution of 13·5 parts of caustic soda in 22 parts of water, to 35° C., with thorough agitation, allowing to stand for 2—7 days, mixing the whole with three times its weight of water, and boiling.—A. S.

Dyeing, bleaching, and washing of textile materials; Apparatus for the ——. A. Holle und Co. Fr. Pat. 369,103, July 5, 1906.

THE apparatus comprises two vats, or one vat divided into two compartments, connected with a circulating pump. The liquid-supply pipes, where they enter the vats, are closed by adjustable hollow conical plugs, which are affixed to perforated pipes, carrying the bobbins of yarn, or to a perforated plate or other suitable device, according to the nature of the material to be treated. Pipes with the necessary cocks and connections to the pump are also provided, so that: (1) the liquor can be supplied to either of the two compartments, and also withdrawn from either of them, or from both at the same time; (2) steam or compressed air can be forced or drawn through the liquor-supply pipes, in order to displace the liquor from the bobbins, or to steam or oxidise the dyed material, &c. —A. S.

Dyeing yarn in the form of cops or on bobbins; Apparatus for ——. H. L'Huillier. Second Addition, dated Aug. 24, 1906, to Fr. Pat. 350,981, Jan. 24, 1905 (this J., 1905, 888; 1906, 475).

THE present Addition relates to means for preventing the movement of the cops of yarn during the dyeing operation. The lower ends of the perforated tubes carrying the cops are fixed on a plate, whilst the pointed upper ends pass through the meshes of a sheet of gauze of metal-wire, or other suitable material, held in a frame. The individual wires or threads of the gauze press down on the cops, and hold them in place.—A. S.

Discharge-resists for "vat" dyestuffs [Indanthrene, indigo, &c.] on coloured grounds, dischargeable with hydrosulphites; Production of ——. P. Ribbert. Fr. Pat. 368,335, July 24, 1906.

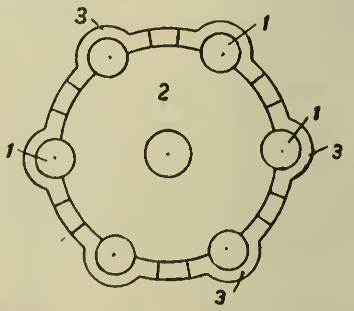
DISCHARGE-RESIST mixtures, capable of simultaneously discharging dyestuffs dischargeable with sulphoxylates or hydrosulphites (hyposulphites), and preventing the fixing of dyestuffs, such as Indigo, Inadnthrene S, Flavanthrene, Thioindigo Red, are made (i.) from alkali salts of sulphoxylates, along with metallic salts, such as lead sulphate, lead sulphite, lead acetate, zinc acetate, zinc sulphate, aluminium acetate, chromium acetate, &c.; (ii.) from amino- and arylamino-salts or derivatives of sulphoxylic acid, together with ammonium salts, and with or without organic acids or acid mineral salts; (iii.) from heavy metallic or alkaline-earthy sulphoxylate-aldehyde salts, with ammonium salts, and "acid compounds," such as aluminium sulphate, organic acids, acid salts, and sulphur. For example: A *white* discharge-resist mixture is prepared by dissolving 150—200 grms. of Rongalite C in a solution of British gum, adding 125—250 grms. of zinc acetate, and 0—50 grms. of zinc sulphate. The mixture is heated to dissolve the zinc salts. It is then cooled, and stirred while cooling. "The zinc salt of Rongalite C" separates out in minute crystals. 100—150 grms. of ammonium chloride are next added, and the whole is heated until the zinc salt has dissolved, whereupon the mixture is cooled. After its weight has been made up to 1000 grms., it is ready for use. Another *white* discharge-resist mixture, suitable for resisting Indigo and Thioindigo Red, consists of 150—250 grms. of "zinc sulphoxylate" and 100—150 grms. of ammonium chloride, heated together until completely dissolved, in a solution of gum. After cooling, 150—200 grms. of finely-divided sulphur are added, and then 30—100 grms. of either acetic acid or lactic acid. The mixture should be ground before use. A *yellow* discharge-resist mixture is prepared by adding lead sulphate (200—300 grms. of precipitated paste) and lead acetate (180—200 grms.) to a mixture made by heating together until sufficiently thick, and then cooling, British gum (100 grms.), either China clay or dextrin (60 grms.), water (140 grms.), gum solution (30—60 grms.), and Hydrosulphite NF (300—350 grms.). *Blue* discharge-resists may be obtained with Chromoglaucin, Phenocyanin, and similar dyestuffs, in conjunction with chromium acetate and Hydrosulphite NF, &c. For *green* patterns a mixture of the blue and yellow mixtures may be employed.

The above mixtures are printed upon tissues dyed with dyestuffs which are dischargeable with hydrosulphites (hyposulphites), *e.g.*, Paranitraniline Red. The tissues are then dried, and cover-printed with alkaline mixtures of Indanthrene S, Indigo, Flavanthrene, &c., containing a sufficient quantity of hydrosulphite (hyposulphite) or sulphoxylate to effect the discharge of the coloured ground. After again being dried, the tissues are steamed at 103°—106° C., during three minutes, in a Mather Platt steaming apparatus. They are then again dried. If yellow or green discharge-resists have been applied, the tissues are next chromed. In the case of mixtures containing zinc sulphoxylate, the tissues, after steaming, should be treated at a temperature of about 50° C. with dilute acid for a short time. Finally, in all cases, the tissues are soaped at 60°—80° C. for 2—3 mins.—E. B.

Printing calico and other fabrics; Apparatus for ——. J. V. Hulme. Fr. Pat. 369,475, Sept. 5, 1906.

SEE Eng. Pat. 18,168 of 1905; this J., 1906, 691.—T. F. B.

Drying chamber (for sized yarns). C. H. Vandamme. Addition, dated July 6, 1906, to Fr. Pat. 367,536, June 25, 1906 (this J., 1906, 1137).



THE drying chamber of yarn-sizing apparatus is fitted with a special roller, over which the yarn passes on entering the chamber from the sizing trough, and which has a very smooth surface to prevent the yarn sticking thereon. For this purpose the roller may be enclosed in a thick glass tube, preferably reinforced, or the surface of the roller may be of highly polished or enamelled metal; or again, the roller may be formed, as illustrated in the drawing, by partially embedding a series of glass rods, 1, in grooves in a wooden roller, 2, and holding these rods in place by means of bands, 3, at their extremities.—C. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

United States Patent.

Paper ; Process of colourably coating ——. E. J. and E. Taylor, Lynchburg, Ohio. U.S. Pat. 835,579, Nov. 13, 1906.

The patent relates to a process of enamelling paper or coating it with a colour-mixture. The enamel or colour-mixture is first applied to one side of the web of paper, and distributed evenly thereon, the spreading devices acting with gradually diminishing energy. The web of paper is then dried by a blast of hot air, passed over a heated roller, treated with another current of hot air, and passed over a second heated roller. A coating of the same or a different colour is next applied to the other side of the web of paper in a similar manner.—A. S.

French Patents.

Paper and other surfaces ; Treatment [Colouring] of ——. H. C. Mitchell. Fr. Pat. 369,301, Aug. 2, 1906. Under Int. Conv., July 4, 1906.

Paper or other surfaces are coated with a fine deposit of ampblack by passing the sheets over a lamp burning petroleum in a suitable manner. The black or other pigment may also be applied to the surface by injectors or other suitable distributing devices. Patterns may be produced on the paper by covering portions of its surface with templates or by imparting a reciprocating motion to the pigment-distributors. When the paper has been coloured, the pigment is fixed by passing the sheet through a bath of a solution of shellac.—J. F. B.

Skins, hair, &c. ; Dyeing and secretage of ——. C. and E. Pichard. First Addition, dated Aug. 8, 1906, to Fr. Pat. 355,121, June 9, 1905.

In the process described in the main patent (this J., 1905, 1227), other fluids under pressure and in particular water vapour may be used advantageously instead of compressed air.—S. R. T.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 48.)

Sulphuric] acid manufacture ; Economy of heat in ——. A. Zanner. Z. angew. Chem., 1907, **20**, 6—9.

Considerable waste of heat is said to occur in the pyrites burners. The author points out that if this were economised, it could not only be profitably used in other parts of the process, but the higher temperature attained in the burners would ensure more thorough roasting of the pyrites. He suggests jacketing the burners, or making certain parts hollow upon which no stress comes, and filling them with non-conducting substances. Doors should be made to close with springs, so that they need not remain uselessly open, and the admission of excess of air be guarded against. There should not be too much raking and agitation of poor ores, with the consequent admission of cold air and lowering of temperature. Attention to these points means less exposure of the workmen to the heat, the possibility of using longer channels between burners and Glover tower, with consequent better settlement of dust, and better roasting, or saving of fuel with poor ores requiring external heat. Even with mechanical roasters there is room for improvement in these respects. In the chambers, the question is not how to keep in the heat, but how profitably to lead away and utilise the surplus, as has been done for example by Meyer, who uses it, in his tangential chambers, to heat water.
—J. T. D.

Cuprous sulphate. F. Foerster and F. Blankenberg. Ber., 1906, **39**, 4428—4436.

The amount of copper taken up by an acidified solution of cupric sulphate is such as to produce equilibrium in the reversible reaction $2Cu^{\cdot} \rightleftharpoons Cu^{\cdot\cdot}+Cu$. The concentration of cuprous salt when this is reached is very small, being, for a 1/1 molar solution of cupric sulphate with $N/1$ free sulphuric acid at 25° C., $6{\cdot}67 \times 10^{-4}$ mol. of Cu_2SO_4. The equilibrium constant is of course $C_{Cu^{\cdot}}{}^{2}/C_{Cu^{\cdot\cdot}}$, which has the value at the ordinary temperature (assuming complete dissociation for cuprous sulphate and 17 per cent. for cupric sulphate) $0{\cdot}66 \times 10^{-6}$; its value increases as temperature rises, so that when a solution in equilibrium at a high temperature is cooled, metallic copper separates. In neutral solutions the formation of cuprous salt is favoured by the tendency of the sulphate to hydrolyse; but the highest concentration that can be reached in this way is still only very slight, and as the total copper-concentration increases, the proportion of cuprous to cupric copper diminishes, as the form of the equilibrium constant shows. In the case of solutions forming complex copper ions, the same state of things does not exist, and a high concentration of cuprous compound may be possible. Ammonio-copper compounds form an instance of such a thing; and, as is well known, an ammonio-cupric solution may be almost completely converted, by taking up copper, into ammonio-cuprous salt. Here, too, the proportion of cupric to cuprous salt depends on concentration, and is greater as the concentration rises; but the authors have been able to reach such a concentration of cuprous salt as to allow ammonio-cuprous sulphate to crystallise out, unmixed with cupric salt, in colourless transparent prisms and needles. These, washed with alcohol and dried out of contact with air, gave analytical figures agreeing with the formula, $[Cu(NH_3)_2]_2SO_4,H_2O$. The crystals cannot be obtained free from a superficial coating of cupric salt, which ruins their transparency. They are very unstable—they can be kept in a perfectly dry state in a sealed tube for some weeks, but the least trace of moisture causes their decomposition into metallic copper and cupric compound, and the same decomposition occurs when they are heated.—J. T. D.

Sulphuric acid ; Determination of —— by the benzidine method. C. Friedheim and O. Nydegger. [XXIII., page 116.

Chlorine ; Cost of electrolytic production of ——. G. H. Harrison. XIA., page 99.

English Patents.

Saturated solutions of salts ; Method of obtaining ——, and apparatus therefor. E. Hermite, Paris. Eng. Pat. 2466, Jan. 31, 1906.

For the preparation of saturated solutions of salts, *e.g.*, for electrolytic purposes, a conical vessel with its lower part perforated, is filled with the salt, and disposed in a tank containing the liquid to be saturated. Fresh supplies of salt and of liquid are added as required.—A. S.

Titanium compounds and the manufacture thereof. J. Barnes, Accrington, and H. Spence and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 6329, March 16, 1906.

Soluble double pyrophosphates of titanium and alkali are prepared by mixing together alkali pyrophosphates and basic titanium sulphate. In the case of the sodium compound, 2 parts of basic titanium sulphate, containing 11 per cent. of titanium dioxide and 15 per cent. of sulphur trioxide, are taken to 1 part of sodium pyrophosphate.
—C. S.

Ammonium nitrate ; Method for the manufacture of pure —— from sodium nitrate and ammonium sulphate. R. Wedekind und Co., Uerdingen a/Rhein, Germany. Eng. Pat. 19,465, Aug. 31, 1906. Under Int. Conv., Oct. 21, 1905.

See Fr. Pat. 369,389 of 1906; following these.—T. F. B.

Zinc ; Process for the direct production of metallic —— from zinc sulphide, and the subsequent utilisation of the sulphur and regaining of the flux desulphurating the zinc sulphide. Rheinisch-Nassauische Bergwerks-und Hütten A.-G., W. Borchers and A. Graumann. Eng. Pat. 24,096, Oct. 29, 1906. X., page 98.

UNITED STATES PATENTS.

Hydrochloric acid gas ; Purification of ——. W. Hasenbach, Mannheim, Germany. U.S. Pat. 834,977, Nov. 6, 1906.

HYDROCHLORIC acid is freed from impurities, more especially arsenious chloride, by washing with hydrocarbon oils, *e.g.*, oils produced by the distillation of brown coal (lignite). It is claimed that, on absorption by distilled water of the washed gases, chemically pure hydrochloric acid is obtained without further purification. The oil is regenerated by washing with water, or with water containing calcium hydroxide to which sufficient hydrochloric acid to dissolve the calcium hydroxide is afterwards added.—A. G. L.

Liquid [Sulphuric acid] ; Purifying ——. W. Hasenbach. Mannheim, Germany. U.S. Pat. 836,034, Nov. 13, 1906.

SULPHURIC acid is purified from arsenic by saturating it with hydrochloric acid, in order to convert the arsenic into arsenious chloride. This is then removed by treating the liquor with a mineral oil at a low temperature.—B. J. S.

Bicarbonates ; Process of manufacturing alkali ——. J. G. Behrens, Bremen, Germany. U.S. Pat. 835,771, Nov. 13, 1906.

SEE Fr. Pat. 365,059 of 1906 ; this J., 1906, 928.—T. F. B.

Lithium salts ; Process of obtaining ——. C. Poulenc, Paris. U.S. Pat. 836,781, Nov. 27, 1906.

SEE Fr. Pat. 361,517 of 1905 ; this J., 1906, 884.—T. F. B.

Alumina and similar products ; Continuous gas kiln for the calcination of ——. R. Brosse. First Addition, dated May 26, 1906, to Fr. Pat. 361,268 of Dec. 30, 1905.

THE object of the present Addition is to economise in fuel and cost of handling. The fuel is used to better advantage by having horizontal instead of vertical burners between the chambers. The size of the chamber is also much reduced. The cost of handling is lessened by charging more simply at the centre of the floor of each chamber, and charging the lowest chamber first. The introduction of dampers to prevent chambers still in action from being cooled during the recharging of others also contributes to economy.—F. SODN.

Nitrogen in distillery residues ; Process for the utilisation of ——. J. Effront. Fr. Pat. 369,630, Aug. 22, 1906. XVII., page 109.

Ammonia ; Process for washing —— *from distillation gases, and for regenerating the washing liquid.* W. Feld. Fr. Pat. 369,258, Aug. 27, 1906, III., page 87.

Iron pyrites ; Treatment of —— *[in an electric furnace]*. L. A. David. Fr. Pat. 369,251, Aug. 27, 1906. XI*B*., page 101.

Ammonium nitrate ; Manufacture of —— *from sodium nitrate and ammonium sulphate.* R. Wedekind und Co., G.m.b.H. Fr. Pat. 369,389, Aug. 31, 1906. Under Int. Conv., Oct. 21, 1905.

AN aqueous solution containing ammonium sulphate and an excess of sodium nitrate is evaporated until it has become saturated with ammonium nitrate at a temperature of 50° C. or above. Most of the sodium sulphate crystallises out during the evaporation, together with some sodium nitrate. The solution is cooled until the separation of ammonium nitrate commences (the solution becomes turbid), and then sufficient water is added to the mother liquor to let the ammonium nitrate crystallise out free from sodium salts, when the liquid cools to the ordinary temperature.—F. SODN.

Oxygen ; Automatic apparatus for the instantaneous supply of ——. M. Bayod y Martinez. Fr. Pat. 369,468, Sept. 4, 1906.

THE apparatus comprises a generating vessel and a washing bottle. The generator consists essentially of an inner cylinder, containing an alkali peroxide or other substance reacting with water to give oxygen, and an outer cylinder containing water. A side-tube conveys the gas to the second vessel, where it is washed with water. By means of a regulating valve any desired pressure may be obtained. Where a continuous supply of gas is needed, two generators may be connected to one washing bottle. An apparatus adapted for direct inhalation is also figured.—F. SODN.

VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 48.)

Glass production ; U.S. census of ——. Oil, Paint, and Drug Rep., Jan. 21, 1907. [T.R.]

THE following table presents a comparative summary of the statistics for the manufacture of glass as returned at the censuses of 1905 and 1900 :—

		1905.	1900.
Establishments		399	355
Capital	dols.	89,389,151	61,423,903
Wage earners		63,969	52,818
Total wages	dols.	37,288,148	27,084,710
Miscellaneous expenses		5,911,507	3,588,641
Cost of materials		26,145,522	16,731,009
Value of products		79,607,998	56,539,712

Following is a comparative summary, showing the quantity and cost of materials used in the manufacture of glass for 1900 and 1905 :—

		1905.	1900.
Materials used, total cost	dols.	25,145,522	16,731,009
Glass, sand	tons	769,792	581,720
	dols.	1,547,147	846,822
Sodium carbonate	tons	215,462	157,779
	dols	4,068,804	2,259,939
Sodium sulphate	tons	53,905	53,257
	dols.	802,611	518,590
Sodium nitrate	tons	11,915	10,770
	dols.	511,854	320,937
Limestone	tons	115,655	91,015
	dols.	274,209	181,717
Lime	cwt.	933,074	794,679
	dols.	241,755	147,901
Arsenic	lb.	2,676,650	2,349,261
	dols.	92,574	112,630
Carbon	tons	3,750	4,155
	dols.	22,333	17,000
Manganese	lb.	3,096,939	1,493,538
	dols.	101,279	57,493
Litharge	lb.	9,613,649	8,386,106
	dols.	555,130	490,200
Potash	lb.	5,446,338	4,406,211
	dols.	228,608	186,847
Grinding sand	tons	410,856	265,438
	dols.	332,013	166,040
Rouge	lb.	1,098,536	837,536
	dols.	29,869	24,747
Plaster of Paris	tons	33,939	23,066
	dols.	169,988	108,531
Fire clay or pot clay	lb.	42,910,286	32,151,017
	dols.	290,444	221,183
Pots, not including those made at works	dols.	432,591	381,147
Flattening stones	dols.	22,266	16,344
Fuel :—Total cost	dols.	6,243,006	3,203,146
Natural gas, cost	dols.	2,777,157	1,575,278
Oil	galls.	13,346,660	12,690,856
	dols.	526,868	409,158
Coal	tons	1,488,476	755,463
	dols.	2,748,766	1,074,074
All other fuel	dols.	190,215	144,636

ENGLISH PATENTS.

Glass articles ; Manufacture of ——. R. E. H. Jonkergouw, and L. A. Destrez, Paris. Eng. Pat. 16,165. July 17, 1906. Under Int. Conv., April 11, 1906.

A FRIT is first formed by mixing sand or ground quartz, sodium carbonate or potassium carbonate or nitrate, borax, minium, and chalk, with or without the addition of a metal oxide as a colouring agent, and burning the mixture for two hours at a temperature of 1,500° to 2,000° ; the resulting frit is cast into water, if difficulty fusible, or is cast dry, if easily fusible. It is then ground, and any excess of water removed by air-drying. The mixture is next moulded in special moulds, in which it is heated for two hours to a temperature of 750° to 1,000°, after which the articles formed are removed from the moulds and allowed to cool very slowly. The articles obtained are claimed to be as transparent as glass. The special moulds used are made from a mixture of two parts of clay, two of kaolin, two of ground quartz, and four of plaster, which is burnt at a temperature of from 1000° to 2000°. They do not adhere to the glass articles. —A. G. L.

Enamelled iron sheets, tablets, signs, window letters, badges or other objects of a like nature; Manufacture of ——. W. M. and P. G. Burnham, trading as Burnham and Co., London. Eng. Pat. 15, 715, July 11, 1906.

THE iron or steel articles to be enamelled are first electroplated with a thin film of copper, after which the enamel is applied directly and fixed by heat. In the case of small articles, the sheet from which they are cut is conveniently electro-plated. (Reference is directed to Eng. Pats. 259 of 1861; 7892 of 1895; and 14,219 of 1903, this J., 1895, 754; 1904, 607.)—A. G. L.

UNITED STATES PATENTS.

Glass; Process and apparatus for drawing sheet ——. I. W. Colburn, Franklin, Pa. U.S. Pat. 836,439, Nov. 20, 1906.

SEE Eng. Pat. 18,663 of 1906; this J., 1907, 18.—T.F.B.

Glass; Apparatus for the manufacture of continuous sheets of ——. E. Fourcault, Lodelinsart, Belgium. U.S. Pat. 837,212, Nov. 27, 1906.

SEE Fr. Pat. 366,383 of 1906; this J., 1906, 985.—T. F. B.

Silica or the like; Apparatus for working fused ——. J. F. Bottomley, Wallsend, and A. Paget, North Cray. U.S. Pat. 836,558, Nov. 20, 1906.

SEE Eng. Pat. 18,437 of 1904; this J., 1905, 846.—T. F. B.

FRENCH PATENTS.

Glassworks; Gas furnaces, with heat recuperation, for ——. C. Deselle. Fr. Pat. 369,384, Aug. 31, 1906. Under Int. Conv., Sept. 22, 1905.

THE furnace described is a pot-furnace, arranged above the gas-producer, the gas being supplied to the furnace by a central pipe or flue, which also introduces the secondary air supply. The central flue comprises a central gas-supply pipe, and air-supply conduits, arranged in the wall of the flue, preferably round the central pipe, and opening either into this pipe below the combustion chamber, or at the opening of this chamber, or partly and simultaneously by both passages. The combustion chamber or burner is arranged above the flue, and this is provided with air-passages, communicating with the atmosphere, for cleaning the central pipe. The whole is in combination, or not, with air-supply conduits arranged in the pillars and in the crowns supported by the pillars. The combustion chamber has a central crown, above the central pipe or flue, and has openings for the escape of flame. Multiple and separated openings for the escape of gas and flame may be arranged in pairs about the same axis and form tuyères and air conduits, situated in the wall of the central flue. Or there may be several gas-supply pipes arranged circularly and alternately or not with the air conduits to open together into the combustion chamber. The "cleaning circuit" consists of a system of passages, by which atmospheric air may be introduced into the lower part of the central gas-supply pipe to burn off the soot that may be deposited there. The claims also include the arrangement, in the pillars supporting the crowns, of air-supply conduits to the combustion chamber, and of chimneys for the withdrawal of the products of combustion. (See Fr. Pat. 344,894 of 1904, and First Addition thereto; this J., 1904, 1216.)—W. C. H.

Glass plates; Process and arrangement for fire-polishing ——. P. T. Sievert. Fr. Pat. 369,409, Sept. 1, 1906. Under Int. Conv., June 8, 1906.

THE glass plates, suspended by one edge, are introduced into, and withdrawn from a furnace, always in a vertical direction; the operation is performed preferably several times, the furnace being capable of accommodating the whole length of the plates. The softening of the glass plates, under the reheating to which they are subjected, is carried to such a point that, at the time of polishing, a stretching or thinning out of the plates is produced by their own weight, which goes on progressively and proportionally to the rate at which they are withdrawn from the furnace, as they pass through the upper layers of it, which are hotter than the lower layers. The arrangement for carrying out the process comprises a support, which carries the glass plate by one of its edges, and can be raised or lowered over the furnace, and works in connection with a rolling table (for the glass plate), which can be brought beneath the support in such a way that the latter raises the plate directly from it. The plate is fixed to the support, either by hand, by gripping the plate between two bands or plates of iron, or automatically, by means of a system of electro-magnets, which, when excited, grip the plate between their poles, and an iron band that acts as an armature.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 50.)

Portland cement; The specific gravity of ——. D. B. Butler. Proc. Inst. Civil Eng., 1906, **166**, [4]. Paper No. 3625.

THE author tested a large number of samples of black, well-burned, and yellow, under-burned Portland cement clinker, and found that the specific gravities of all samples fresh from the kiln were practically identical. The varying specific gravities of different specimens of weathered cement are due to the water and carbon dioxide absorbed by the clinker, and give no indication whatever of proper calcination. The only information, in fact, afforded by the specific gravity is in respect of corroborating the presence of slag or other adulteration. After igniting weathered cement for a short time at a red-heat, the specific gravity reverts to that originally possessed by the fresh clinker before aëration. The following relation holds good:—

$$\frac{1}{A} = 0{\cdot}008x + 0{\cdot}0055y + \frac{100-(x+y)}{100\,(B-0{\cdot}048)}$$

where A and B represent respectively the specific gravity of the weathered cement before and after ignition, and x and y are the respective percentages of water and carbon dioxide.—O. R.

Lime-silica series of minerals. A. L. Day and E. S. Shepherd. Amer. J. Sci., 1906 [4], 22, 265—302. Chem. Abs. Amer. Chem. Soc., 1907, 1, 28.

THE authors' experiments on the fusion of mixtures of lime and silica, lead them to conclude that besides wollastonite, the only other lime-silica mineral that exists is the orthosilicate. Tricalcium silicate has long been supposed to have a real existence and to be the principal constituent of Portland cement, but not only was no trace of a compound of tricalcium silicate composition found, but it was proved both from microscopic examination and from the determination of the transformation temperature characteristic of the orthosilicate that both the orthosilicate and free lime are present in all compositions between the metasilicate and pure lime. Many samples of supposed tricalcium silicate prepared by investigators engaged upon the Portland cement problem were also examined by the sensitive method of refractive indices without finding any other substance present than the orthosilicate, with free lime in excess. The reason why free lime has been so consistently overlooked in the study of mixtures of this character probably lies in the fact that when lime is once crystallised, as it can be after melting in the electric arc, it is but very slowly attacked by water, and does not respond to the usual tests for it. The orthosilicate itself was found to exist in three solid modifications in enantiotropic relation to each other; the first is stable to about 675°, the second from 675° to 1410°, and the third from 1410° to the melting-point, which occurs at 2080° C. All of these crystal modifications are attacked by water with a loss of several parts per cent. of their lime. There are three eutectics in the series, lime-silica, the first, between pure silica and the metasilicate, occurring at 37 per cent. lime, and melting at 1407°; the second, between the metasilicate and the orthosilicate, at 54 per cent. lime, m. pt. 1430°; and the third, between the orthosilicate and pure lime, at 67·5 per cent. lime, m. pt. 2015° C. The density of fused calcium oxide is 3.32, its hardness 3+. It fuses in the electric arc and crystallises in the isometric system upon cooling. Silica begins to melt at about 1600° to a liquid of extreme viscosity. At all temperatures above 1000°, pure quartz changed into tridymite and pure quartz glass crystallised as tridymite, so that above this temperature tridymite is the stable phase of silica. In the presence of fused chlorides, silica was found to crystallise as quartz below 760°, and as tridymite above 800°. Crystalline quartz changes to tridymite above 800°, and tridymite reverts to quartz at 750° under the same conditions. The transformation is therefore enantiotropic and occurs at about 800°, but the change is extremely slow. Pure tridymite has a density of 2·318, and the pure quartz glass, 2·213. The purest natural quartz has a density of 2·654.

English Patents.

Bricks, tiles, lumps, and other articles; Manufacture of silica fire-proof, non-conducting, sound-resisting, or porous ——. C. H. Sankey, London. Eng. Pat. 3353, Feb. 12, 1906.

Equal measures of silica (flint or sand, washed, calcined at a high temperature, and finely powdered), coke, and a fibrous material (*e.g.*, hay, cork, peat, sawdust, hair, bone) are mixed, together with water, to which one-eighth part of sodium silicate solution (140° T.) has been added. The mass is moulded, preferably under great pressure, into bricks, &c., which are dried and fired at a temperature "sufficiently high to drive off the soda."—A. G. L.

Silica cements, crucibles, and other articles; Manufacture of ——. C. H. Sankey, London. Eng. Pat. 3353A, Feb. 12, 1906.

In making cements for use with silica bricks, &c., the silica is mixed with a highly absorbent material (*e.g.*, barley-meal or kieselguhr), which retains the water necessary for the proper moulding. Silica crucibles may be made in the same way.—A. G. L.

United States Patent.

Bricks, stone, and artificial stone; Process for treating ——. T. D. Ball, Lamar, Mo. U.S. Pat. 835,742, Nov. 13, 1906.

Cement blocks and the like, whilst in a plastic state, are mixed with an oleaginous body and lead oxide or carbonate or white lead, which are caused to penetrate the pores, and to harden and to waterproof the product.—A. G. L.

French Patents.

Sandstone; Hardening of friable ——. C. de la Roche, France. Fr. Pat. 361,886, Nov. 4, 1905.

Blocks of silicious stone, that would be rejected in the ordinary course, owing to insufficient strength, are cut to the desired shape, and hardened by: (1) saturating with milk of lime, or with a solution in acetic acid of lime, magnesia, or alumina; (2) subjecting to high-pressure steam in an autoclave, as in the sand-lime brick process. Where the lime, magnesia, or alumina is added in the form of acetate, the acetic acid is expelled as soon as the pressure inside the autoclave reaches from 2—3 atmospheres (115°—120° C.), with formation of true silicates. The acid dissolves in the water, which condenses inside the autoclave, and is recombined with lime, magnesia, or alumina, in a receptacle constructed for the purpose in the bottom of the steaming chamber. The application of this process of substituting acetate of lime for slaked lime in the ordinary sand-lime brickmaking process constitutes another portion of the same invention.—O. R.

Ceramic products [Bricks]; Process and material for removing efflorescences and spots from ——. G. Franche. Fr. Pat. 361,895, Nov. 9, 1905.

According to this invention, a jet of sand is played upon the surfaces of ceramic products, at the time of their manufacture, to remove efflorescences and spots, that soil the products, and injure their adhesion to mortar.—W.C.H.

Ceramic products; Manufacture of light (weight) ——. M. J. Silvestre, sen. Fr. Pat. 369,417, Sept. 5, 1906.

This is a process for obtaining articles such as bricks, tiles, &c., that shall be light in weight, and consists in adding dried and powdered vegetable material to the plastic mass—the added material being ground to a fineness, and added in a proportion, suited to the requirements of the finished article. The vegetable material is of course destroyed in the process of burning, leaving a burnt product light in weight.—W. C. H.

Stones, artificial, made with slaked lime; Hardening of —— *by means of carbon dioxide or gases containing the same.* E. Schwanenberg and A. Rinne. Fr. Pat. 369,206, Aug. 24, 1906.

Artificial stones, consisting of lime and suitable filling materials, are hardened by the action of carbon dioxide, or furnace gases containing the same. The gas must be at a temperature between 35° C. and 110° C., and must not be saturated with aqueous vapour.—O. R.

Stones, artificial, containing slaked lime; Hardening of —— *by means of carbon dioxide.* E. Schwanenberg and A. Rinne. Fr. Pat. 369,207, Aug. 24, 1906.

Artificial stones, consisting of lime and suitable filling materials, are hardened by the alternate action of (1) carbon dioxide to induce the formation of carbonate, and (2) a heating process to expel the water set free in the reaction.—O. R.

Cement or concrete blocks; Process for rendering —— *impermeable to water.* J. M. Rauhoff. Fr. Pat. 369,284, Aug. 28, 1906.

See U.S. Pat. 830,003 of 1906; this J., 1906, 930.—T. F. B.

Cement [for binding patent fuel, artificial stone, &c.]; Manufacture of ——. A. F. Avezard. Fr. Pat. 369,317, Aug. 28, 1906.

The patent relates to the manufacture of a binding material of universal application composed of the following: (1) 25 parts of calcined magnesia containing 5 per cent. of carbon dioxide, 40 parts of gypsum, 10 parts of powdered casein, 9 parts of fuller's earth, 15 parts of silica or powdered glass, and 1 part of red lead. (2) 100 litres of magnesium chloride solution of 15° B., 5 litres of sulphuric acid of 5° B., 1 litre of a 5 per cent. solution of albumin, and 15 grms. of gum tragacanth. To a mixture of the solid ingredients (1), and the pulverised material to be cemented, the quantity of liquid (2), that must be added varies according as pressure is to be employed or not. If moulded without pressure, two to seven hours must be allowed for setting, before the contents may be removed from the mould. If pressure be employed, the contents may be removed at once.—O. R.

X.—METALLURGY.

(*Continued from page* 53.)

Mineral and metal production of the United States in 1906. Eng. and Min. J., Jan. 5, 1907. [T.R.]

The following table summarises the estimated production of minerals and metals in the United States in 1906, so far as it has been possible to collect the statistics. The figures for copper, lead, and spelter are based on reports received directly from the producers, who have communicated their actual output during the first 11 months of the year, together with their estimates of probable production in December; in many cases the estimates are for only the last few days of December. The other statistics are based on the reports of producers, State mine inspectors, and special correspondents:—

Product.	Unit.	1905.		1906.	
		Quantity.	Value.	Quantity.	Value.
			Dollars.		Dollars.
Non-metallic—					
Coal, bituminous	Short ton (*a*)	310,285,015	353,724,917	335,738,059	409,455,752
Coal, anthracite	Short ton	78,731,523	178,788,244	71,018,433	169,580,506
Garnet	„	3,694	114,625	5,442	187,095
Graphite, crystalline	Pound	4,260,656	170,426	4,079,333	131,866
Iron ore	Long ton (*b*)	44,578,456	94,768,122	49,670,000	103,570,000
Limestone flux	Long ton	14,098,000	6,739,200	14,228,500	9,390,810
Petroleum	Barrel	139,728,839	118,769,513	131,061,505	96,593,274
Phosphate rock	Long ton	1,933,286	9,713,296	2,102,067	10,552,376
Pyrites	„	200,280	651,796	204,896	77,600
Manufactured—					
Alundum (fused alumina)	Pound	3,612,000	252,840	4,331,233	303,186
Arsenic, white	Short ton	773	50,225	8,315	83,150
Bromine	Pound	899,434	139,432	1,250,000	168,750
Coke	Short ton	28,404,112	72,284,336	32,568,926	99,960,968
Copper sulphate	Pound	52,278,996	2,352,555	48,534,129	3,009,106
Copperas	Short ton	21,103	147,721	18,546	129,822
Crushed steel	Pound	812,000	56,840	837,000	58,590
Graphite artificial	„	4,595,500	313,979	4,868.000	312,764
Lead, sublimed white	Short ton	6,977	697,700	8,000	8,000,000
Zinc, oxide	„	65,403	5,232,240	68,549	5,483,920
Zinc-lead, white	„	7,200	540,000	5,749	488,665
Metallic—					
Aluminium	Pound	11,350,000	3,632,000	14,350,000	5,166,000
Copper	„	871,634,245	136,837,860	915,000,000	178,699,500
Gold	Oz. fine	4,265,742	88,180,700	4,702,235	97,155,201
Iron, pig	Long ton	22,702,397	377,540,862	25,521,911	490,275,910
Lead	Short ton	319,744	30,133,490	364,336	38,962,092
Mercury	Flasks (*c*)	30,650	1,189,220	27,276	1,063,764
Silver	Oz. fine	56,101,600	35,373,181	57,358,267	38,301,160
Zinc	Short ton	201,748	23,733,635	225,395	27,939,964

(*a*) Short ton = 2000 lbs.; (*b*) Long ton = 2240 lbs.; (*c*) Flask = 75 lbs.

Steels; Nickel-silicon ——. L. Guillet. Bull. Soc. d'Encour., 1906, Rev. Metal., 3, 418—437.

The experiments were made with alloys prepared by adding quantities of silicon up to 10 per cent. (in most cases up to 5 per cent.) to the three different classes of nickel-steel, *viz.*, perlitic, martensitic, and γ-iron or polyhedric steels (this J., 1903, 213). Micrographic examination of the alloys showed that nickel-silicon steels may be divided into seven classes, according to their micro-structure:—(1) perlitic steels; (2) steels containing both perlite and graphite; (3) steels containing the whole of the carbon in the form of graphite; (4) martensitic steels; (5) steels containing both martensite and graphite, and at times also ferrite; (6) polyhedric (or γ-iron) steels; (7) steels containing γ-iron and graphite, and which may also contain ferrite and martensite. When silicon is added to a nickel-steel, the transformation point of the latter is raised, and it is possible by such addition to convert a martensitic steel into one with a ferrite structure, or a polyhedric into a martensitic steel. When the amount of silicon added is sufficiently large to cause separation of graphite, steels of a very complex structure, containing simultaneously γ-iron, ferrite, martensite, troostosorbite, and graphite, may be obtained. The nickel hinders the separation of carbon in the form of graphite by the silicon. In ordinary carbon steels, graphite is separated so soon as the amount of silicon reaches about 5 per cent., whatever be the proportion of carbon in the steel; but in nickel-steels the amount of silicon required to cause separation of graphite is less the higher the carbon content of the steel. Prolonged annealing at 900° C. was found to cause no change in the state of the carbon in nickel-silicon steels. With respect to the mechanical properties of the steels, those having a perlitic structure exhibit a breaking strain and elastic limit much higher than the corresponding nickel-steels, but the elongation and resistance to shock are lower. The martensitic steels have a very high breaking strain, and are very brittle. Polyhedric nickel-steels are improved by addition of silicon. After quenching (in water at 20° C.), the steels heated to 850° C., the perlitic steels show still higher breaking strain and elastic limit, but become very brittle. The effect of quenching on the martensitic and polyhedric steels is the same as on nickel-steels of similar structure. For industrial purposes it would appear that the addition of silicon to nickel-steels is not to be recommended, at least not in proportions greater than 2 per cent.—A. S.

Zinc and iron; Alloys of ——. S. Wologdine. Bull. Soc. d'Encour., 1906, Rev. Metal., 3, 539—546.

The author prepared alloys containing up to about 10 per cent. of iron by heating galvanised iron wire in a bath of molten zinc covered by powdered wood charcoal. The fusing-points of the alloys were determined, and they were examined microscopically. The author confirms Le Chatelier's statement as to the existence of a definite compound of zinc and iron, $FeZn_{10}$, melting at about 750° C. Solid solutions of the two metals are not formed.—A. S.

Copper; Preparation of pure ——. E. Vigouroux. Bull. Soc. Chim., 1907 [4], 1, 7—10.

The process depends on the reduction of cuprous chloride by metallic aluminium. A concentrated solution of cuprous chloride is obtained by the action of hydrochloric acid, assisted by the occasional addition of nitric acid, on copper turnings. This is rapidly filtered, and the filtrate received in a large volume of boiling water. The precipitated cuprous chloride is washed by decantation, and reduced by metallic aluminium (in large pieces) in presence of distilled water. After picking out from it the residual pieces of aluminium, the metallic copper is washed by decantation with water, heated with hydrochloric acid in absence of air, washed with distilled water and with alcohol, dried, and heated gently in a current of hydrogen.—A. S.

Silicon, crystallised; Purification of ——, *and the effect of the presence of impurities in the preparation of copper silicide.* E. Vigouroux. Bull. Soc. Chim., 1907 [4], 1, 16—19.

Crystalline silicon, according to the author, almost invariably contains iron, which cannot be removed by the usual washing with hydrochloric acid. The failure, up to the present, to prepare copper silicide giving correct analytical figures (this J., 1907, 51) is to be attributed to the presence of iron in the silicon. Pure silicon, free from iron, can be obtained by heating crystalline silicon with hydrofluoric acid diluted with its own volume of water, in a platinum retort, fitted with a reflux condenser, for several hours. After cooling, the silicon is filtered off, washed, and heated with strong sulphuric acid in a platinum dish for 1—2 hours, the heating towards the end being such as to cause evolution of white fumes of sulphur trioxide. After again cooling, the acid is diluted with water, and the silicon washed.—A. S.

Manganese; New silicide of ——. G. Gin. Compt. rend., 1906, **143**, 1229—1230.

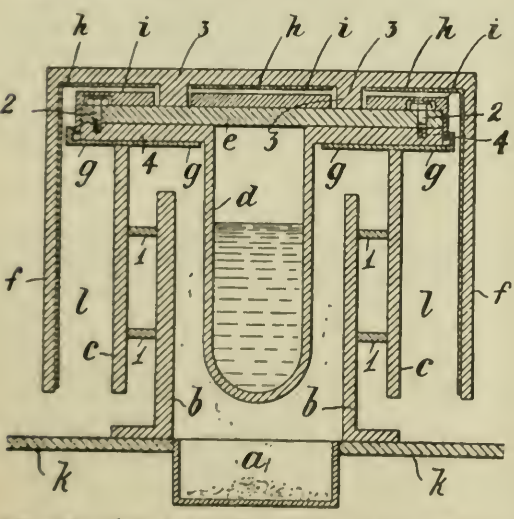
This silicide is an industrial product obtained by the reduction of rhodonite in the electric furnace. The crystals (of which complete analyses are given) contain about 95 per cent. of a manganese silicide of formula, Mn_3Si_2. The crystals are formed in prisms, as much as 5 cm. long, somewhat similar in appearance to metallic nickel; they are very fragile, but in hardness between glass and corundum, having a sp. gr. of 6·05, and melting at 1250°—1300°C. The substance at a red heat burns with incandescence in chlorine; oxygen, under similar circumstances, only tarnishes the surface: gaseous hydracids attack it rapidly. Sulphuric acid has no action on it, but nitric and hydrochloric acids attack it when warmed. It is also attacked by fused alkali hydroxides and carbonates.—J. T. D.

Manganese sulphide; Solubility of carbon in ——. H. Houdard. Compt. rend., 1906, **143**, 1230—1232.

Manganese sulphide, heated in the electric furnace, dissolves carbon, in quantity increasing with the time of action, up to a maximum of about 3·2 per cent. The process appears to be one of simple solution, for the relative proportions of sulphur and manganese are not altered by the introduction of the carbon. The carbon exists in solution in the form of graphite, whether originally introduced as graphite, diamond, or amorphous carbon.
—J. T. D.

English Patents.

Muffles or furnaces [for steel and steel alloys]; Highly heated ——. W. F. L. Frith and C. J. Grist, London. Eng. Pat. 26,578, Dec. 20, 1905.



The patent relates to a muffle or furnace for heating steel or steel alloys surrounded by mercury or mercury vapour (see Eng. Pat. 26,577 of 1905; this J., 1907, 52). The vessel, d, in which the metal is heated, has a broad flange, 4, and is hermetically closed by the cover, *e*, fastened down by the screws, 2. It is heated by a furnace, *a*, placed below the level of the floor plate, *k*, and is surrounded by an inner wall, b, supported by the floor, *k*, an open space being left between the top of the wall, *b*, and the underside of the flange, 4. This inner wall is again surrounded by an outer wall, *c*, supported by brackets, 1, from the inner wall, *b*, and leaving a space between its lower edge and the floor, *k*. The flange, 4, of the vessel, *d*, rests on and is supported by the upper edge of the wall, *c*; a layer of non-conducting material, *g*, with upturned edges, being interposed to protect the flange from the heat. A hood, *f*, is supported by legs, 3, upon the cover, *e*, of the vessel, *d*. The cover, *e*, is protected by the insulating plates, *i*, *i*, *i*, and the interior of the hood, *f*, is also lined with non-conducting material, *h*. The vessel is heated and the heat is retained by the annular space, *l*, and the joint between the flange, 4, and the cover, *e*, is protected from the action of the heat so that the chances of leakage are reduced.—W. H. C.

Cast iron and the like; Hardening of ——. V. H. Blackman, London. From H. Emett, New Westminster, B.C. Eng. Pat. 27,218, Dec. 30, 1905.

Cast iron is hardened without being rendered brittle by adding to the molten metal a mixture of 8 lb. of flowers of sulphur, 1 lb. of dry red lead, and 4 oz. of lampblack, in the proportion of 1 lb. of the mixture to from 25 to 40 lb. of iron; for special purposes as much as 1 lb. of the mixture to 8 lb. of iron may be used. The mixture may be added conveniently by placing it at the bottom of the ladle into which the metal is run from the furnace on its way to the moulds.—A. G. L.

Thermite; Method of binding —— *into solid briquettes.* J. Büchel, Vorarlberg, Austria. Eng. Pat. 13,764, June 15, 1906.

The thermite powder is made into briquettes by the use of gum tragacanth as a binding agent. A small cavity is formed in the briquette and filled with thermite powder without the binding material. In order to retain this in position, the briquette is then coated with a thin layer of priming material, consisting of a metallic peroxide and a solution of acetone and celluloid. When the acetone has evaporated, the briquette is covered with a glazing or varnish to protect it against shocks and moisture.—W. H. C.

Aluminium alloy; Method of and means for casting ——. W. A. McAdams, Bay Shore, New York. Eng. Pat. 16,168, July 17, 1906.

The material of which the mould is made is composed of a mixture of 10 lb. of carborundum and 12 oz. of sugar, to which 10 oz. of yellow clay are preferably added. The mass is moulded with a little water. On pouring the aluminium alloy into the mould, the sugar decomposes, and a solid body is formed around the alloy, which body, being an excellent conductor, quickly removes the heat from the alloy. Where the latter is of such a nature as to generate gases, 20 oz. of finely divided carbon may be added to the above mixture. When the casting has been removed from the mould, the latter may be ground up, and used over again with the addition of more sugar.
—A. G. L.

Zinc; Process for the direct production of metallic —— *from zinc sulphide, and the subsequent utilisation of the sulphur and regaining of the flux desulphurating the zinc sulphide.* Rheinisch-Nassauische Bergwerks- und Hütten-A.-G., Stolberg, W. Borchers, and A. Graumann, Aix-la-Chapelle, Germany. Eng. Pat. 24,096, Oct. 29, 1906. Under Int. Conv., Nov. 3, 1905.

Pulverised and unroasted zinc sulphide is mixed with finely-divided metallic iron. The mixture is continuously fed into an electric furnace, preferably of the resistance type in which the charge forms the resistance, where, at a temperature between 1000° and 1500° C., it is decomposed into metallic zinc, the vapour of which is condensed in any usual way, and ferrous sulphide, which is tapped off at intervals in the molten state. This ferrous sulphide is then roasted, in an oxidising atmosphere, with the object of producing sulphur dioxide, which is used for the manufacture of sulphuric acid. The iron oxide produced, which may still contain a small quantity of sulphur, is then subjected to a reducing atmosphere, either by heating it with carbon, or by passing hot reducing gases over it.

The iron sponge obtained is mixed with a fresh quantity of zinc sulphide, and the cycle of operations is repeated. —A. G. L.

United States Patents.

Detinning; Method of ——. K. Goldschmidt and J. Weber, Essen-on-the-Ruhr, Germany. U.S. Pat. 836,028, Nov. 13, 1906.

Sheet-iron objects are cleaned preparatory to detinning by first treating them with a solution of sodium hydroxide whilst in a heated state, with the object of removing dirt, and then heating them suddenly to a temperature varying from 600° to 800° C., according to the nature of the object to be detinned, in this way the solder being melted off in five to seven minutes and at the same time the caoutchouc is destroyed (caoutchouc strips in the folds). The tinned articles for this purpose of sudden heating, are, after the alkali treatment, introduced into a hearth-furnace, so arranged that the fire enters at one side of the hearth-pit and escapes at the other, these fire-gases *en passant* coming into contact with the materials, contained in a perforated cylindrical receptacle, and suspended over the hearth-pit. Thus, a rapid heating of the materials in the perforated vessel by the furnace-gases is effected, the solder flowing out and being collected.—A. G. L.

Reducing ores; Process of ——. J. Herman, Lincoln, Neb. U.S. Pat. 831,160, Sept. 18, 1906.

The ore to be treated (more especially, copper ore) is reduced by means of hot gases consisting of a mixture of carbon monoxide and dioxide in regulated proportions. This mixture is produced by blowing air through two chambers containing fuel, one on either side of a central shaft down which the ore is fed. The hot reducing gases are led to the bottom of this shaft, pass up through the ore, and are met at a point above the reducing zone by a blast of air, which burns the excess of carbon monoxide, oxidises any sulphur in the ore, and preheats the latter before it comes into contact with the reducing gases lower down the shaft. The reduced metal may be obtained in the form of globules or as a coherent powdery mass according to the composition of the gaseous reducing mixture. In the latter form it lends itself especially to extraction with solutions of ferric chloride, or of cupric and sodium chlorides, and subsequent electrodeposition of the copper.—A. G. L.

Ores; Process of treating ——. W. A. Hendryx, Los Angeles. U.S. Pat. 836,380, Nov. 20, 1906.

See Eng. Pat. 1916 of 1905; this J., 1906, 481.—T. F. B.

Detinning tin-scraps, &c.; Process of ——. K. Goldschmidt and J. Weber, Assignors to T. Goldschmidt, Essen-on-Ruhr, Germany. U.S. Pat. 836,496, Nov. 20, 1906.

See Fr. Pat. 356,228 of 1905; this J., 1905, 1311.—T.F.B.

Iron-silicon-aluminium alloys; Process of improving the magnetic qualities of ——. R. A. Hadfield, Sheffield. U.S. Pat. 836,497, Nov. 20, 1906.

See Eng. Pat. 6426 of 1906; this J., 1906, 889.—T. F. B.

Steel from ordinary iron; Manufacture of ——. A. Massott, jun., Mutterstadt, Assignor to F. André, Haardt, Germany. U.S. Pat. 836,520, Nov. 20, 1906.

See Fr. Pat. 362,371 of 1906; this J., 1906, 700.—T. F. B.

Steel alloy. A. de Dion and G. Bouton, Puteaux, France. U.S. Pat. 836,567, Nov. 20, 1906.

See Fr. Pat. 344,095 of 1904; this J., 1904, 1095.—T. F. B

Iron-silicon alloys; Process of improving the magnetic qualities of —— R. A. Hadfield, Sheffield. U.S. Pat. 836,754, Nov. 27, 1906.

See Eng. Pat. 6426 of 1906; this J, 1906, 889.—T. F. B.

Furnace; Smelting ——. W. J. Watson, Ladysmith, British Columbia. U.S. Pat. 836,548, Nov. 20, 1906.

The patent relates to a furnace for smelting sulphide ores. The furnace consists of two chambers, in one of which the ore is smelted to matte, whilst the other is for the conversion or oxidation of the matte. The "matting-chamber" is provided with low-pressure tuyères and a slag-spout, and its bottom slopes downwards from the slag-spout to a passage at the bottom of the opposite side of the chamber leading to the converting chamber. The latter is lined with basic material. and is provided with high-pressure tuyères and with an overflow spout at a lower level than the slag-spout in the "matting-chamber." A flue is provided for carrying off the furnace gases from both chambers, and in this flue is a tilting grate, on to which the ore is charged for delivery into one or the other of the chambers.—A. S.

Copper, zinc, &c.; Wet method of extracting —— *from their ores.* D. Lance, Paris. U.S. Pat. 836,587, Nov. 20, 1906.

See Addition of Aug. 18. 1904, to Fr. Pat. 342,865 of 1904; this J., 1905, 90.—T. F. B.

Alloy; Pyrophoric ——. C. A. von Welsbach, Vienna. U.S. Pat. 837,017, Nov. 27, 1906.

See Addition to Fr. Pat. 337,320 of 1903; this J., 1906, 1211.—T. F. B.

Metals and alloys; Production of fused —— *from oxides, &c.* C. Vautin, London. U.S. Pat. 837,160, Nov. 27, 1906.

See Eng. Pat. 10,881 of 1905; this J., 1906, 763.—T. F. B.

French Patents.

Nickel; Metallurgical process for ——. A. H. Imbert. Fr. Pat. 361,887, Nov. 4, 1905.

Advantage is taken in this patent of the difference in specific gravity of iron and nickel to produce, in one operation, from the mineral a ferro-nickel containing 80 per cent. of nickel. For this purpose the nickel ore (garniérite, &c.) is smelted as usual to an alloy containing 40 per cent. of nickel and 56 per cent. of iron, and this is run in the molten condition into a special converter, in which a current of air is directed against the surface of the molten metal by means of a vertical pipe, which can be raised and lowered in the converter, and approaches to about 2 cm. from the surface of the metal. The iron, the lighter of the two metals, is oxidised first, and the oxide produced is absorbed by silica, which is introduced from time to time in the form of hot sand or flints. The slag is occasionally rabbled off the surface of the metal, the converter, which is mounted on trunnions, being inclined for the purpose. Finally, the alloy obtained is poured out through the opening through which the silica was introduced.—A. G. L.

Cooling apparatus for blast-furnace gases. Soc. Anon. des Hauts-Fourneaux et Forges de Dudelange. Fr. Pat. 369,305, Aug. 9, 1906. II., page 85.

Alloys of iron and steel; Self-hardening ——. J. Churchward. Fr. Pat. 369,153, Aug. 22, 1906.

See U.S. Pat. 832,773 of 1906; this J., 1906, 1050.—T. F. B.

Steel; Manufacture or treatment of ——. R. A. Hadfield. Fr. Pat. 369,198, Aug. 24, 1906.

See U.S. Pat. 834,904 of 1906; this J., 1906, 1153.—T. F. B.

Furnace for roasting and volatilising ores, &c. S. I. Clawson. Fr. Pat. 369,566, Sept. 8, 1906. Under Int. Conv., Sept. 9, 1905.

See U.S. Pat. 829,843 of 1906; this J., 1906, 934.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 56.)

Chlorine; Cost of electrolytic production of ——. G. H. Harrison, Eng. and Min. J., Jan. 19, 1907. [T.R.]

The following are particulars of the work done by 16 Hargreaves-Bird cells at the Piedmont works of the West

Virginia Pulp and Paper Co., during the month of May, 1906:—

PERIOD, 31 DAYS.

Ampères	2,600
Volts	56·92
Volts per cell	3·56
Electric h.p. used in cell room	198·5
Total e.h.p. used by plant	270·0
Steam consumed (boiler h.p.)	24·7
Current efficiency	90·0 per cent.
Soda ash produced	120,900 lb.
Chlorine gas	81,511 lb.
Limestone used } = CO_2	247,758 lb.
Coke used	31,000 lb.

Each cell produces chlorine equivalent to 460 lb. of bleaching powder, 35 per cent., per 24 hours. The repairs on a Hargreaves-Bird plant amount to about 5s. per ton of the "bleach" produced. The cost of each cell, including royalty in England, is about £200.

(*A.*)—ELECTRO-CHEMISTRY.

Chloroform; Electrolytic preparation of ——. R. Trechcinski. J. russ. phys.-chem. Ges., 1906, **38**, 734—740. Chem. Zentr., 1907, **1**, 13.

THE author has prepared chloroform by the electrolysis of an aqueous-alcoholic solution of calcium chloride. Platinum electrodes are used, and the calcium chloride solution is contained in a glass vessel with a concave bottom, placed in a larger thick-walled beaker. The gases and chloroform vapours are led off, through a tube bent at right angles, to an absorption-apparatus. The yield is increased if alcohol be added to the spent electrolyte solution, and then the current passes through again.

Bromoform can be obtained in a similar manner by the electrolysis of calcium bromide solution.—A. S.

ENGLISH PATENTS.

Filaments of incandescent electric lamps. A. Bourdos, R. Rothschild, and J. W. Sutcliffe. Eng. Pat. 26,855, Dec. 23, 1905. II., page 83.

Tungsten filaments for incandescence electric lamps; Manufacture of ——. A. G. Bloxam. From J. Lux. Eng. Pat. 7803, March 31, 1906. II., page 83.

Furnaces; Electric ——. C. E. Pettit, London. Eng. Pat. 131, Jan. 2, 1906.

A REGULATOR is employed for varying the furnace voltage, independently of any movement of the furnace electrodes, as, for example, where a transformer is used by cutting out or inserting sections of coils controlling the voltage of the current supplied to the furnace. Similarly, with a direct current or alternating current generator, the length of the field coils of the generator may be varied, or, if a transformer is used in conjunction with a generator, a regulator for varying the length of the high or low tension coils of the transformer is employed. (Reference is directed to Eng. Pats. 17,060 of 1889; 2904, 4866, and 22,261 of 1898; 15,920 and 17,027 of 1900; 561 of 1902; and 5790 of 1904; this J., 1890, 869; 1901, 367, 977; 1905, 341.) —B. N.

Furnace; Electric ——. C. Bingham, London. Eng. Pat. 7340, March 27, 1906.

THIS invention relates to an electric furnace, with a number of top electrodes, the furnace being combined with a transformer, and portions of the primary or secondary coils are cut out or brought into circuit in order to vary the furnace-voltage. If an alternating generator be used, in place of the transformer, portions of the coils of the exciters are similarly cut out or brought into circuit for the same purpose.—B. N.

Galvanic cells. H. A. E. W. L. Femerling and F. W. Pörscke, Hamburg, Germany. Eng. Pat. 234, Jan. 3, 1906.

SEE Fr. Pat. 362,280 of 1906; this J., 1906, 643.—T. F. B.

Textile or other fabrics or substances; Method of and means for reproducing designs or the like on ——. J. Wilson. Eng. Pat. 2939, Feb. 7, 1906. V., page 90.

UNITED STATES PATENTS.

Alkaline earth metals; Electrolytic process of making bases of the ——. A. Brochet and G. Ranson, Paris. U.S. Pat. 835,661, Nov. 13, 1906.

SEE Eng. Pat. 1849 of 1901; this J., 1902, 352.—T. F. B.

Pigments; Production of —— *by electrolysis.* E. D. Chaplin. U.S. Pat. 836,177, Nov. 20, 1906. XIII*A*., page 103.

Insulating material and method of manufacturing the same. G. Kelly, Hinsdale, Ill. U.S. Pat. 835,685, Nov. 13, 1906.

A "FABRIC impregnated with zinc oxide" is disintegrated, and mixed with rubber, sulphur, and "liquid glass." The composition is then vulcanised under heat and pressure. —W. P. S.

FRENCH PATENTS.

Casein and albuminoids; Process for rendering —— *insoluble.* R. Desgeorge and F. Lebreil. Fr. Pat. 361,896, Nov. 9, 1905. XIV., page 106.

Metallic salts for pharmaceutical or other uses; Electrolytic preparation of ——. L. Bolle und Co., G.m.b.H. Fr. Pat. 369,573, Sept. 8, 1906.

AQUEOUS solutions of sulphates, acetates, or chlorides of iron, manganese, magnesium, lead, zinc, tin, or copper, are submitted to electrolysis, after the addition of a suitable quantity of acid, in an apparatus with non-oxidisable electrodes, but without a diaphragm. The use of solid or liquid aliments prepared in this way, and destined to act favourably on the human system, is also claimed.—B. N.

Hypochlorite solutions; Electrolytic process for making ——. W. P. Digby. Fr. Pat. 369,601, Sept. 10, 1906. Under Int. Conv., Oct. 28, 1905.

SEE Eng. Pat. 21,949 of 1905; this J., 1906, 1156.—T. F. B.

Cement for electrical purposes; Insulating ——. J. A. Yates. Fr. Pat. 369,603, Sept. 11, 1906.

THE cement consists, preferably, of a mixture of 32 per cent. of resin, 20 per cent. of zinc oxide, and 48 per cent. of marble in the form of dust. The resin is first melted, and the other ingredients are then added; after heating the mixture, with thorough agitation, the cement is allowed to cool.—B. N.

(*B.*)—ELECTRO-METALLURGY.

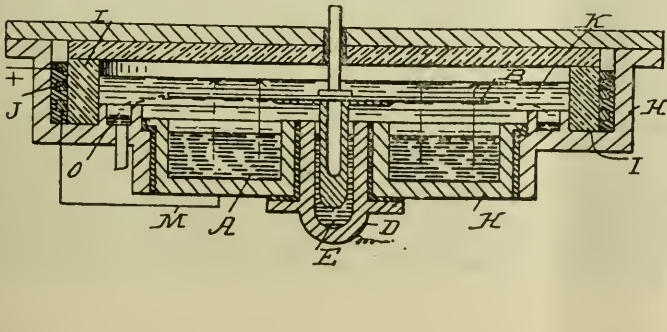
Oxides; Anodic formation of ——, *and passivity.* E. Müller and F. Spitzer. Z. anorg. Chem., 1906, **50**, 321—354.

ON electrolysing strongly alkaline, ammoniacal solutions of copper salts with platinum or iron anodes, the latter become coated with a black deposit, consisting mainly (*e.g.*, 95·5 per cent.) of cupric oxide. The authors explain its formation as follows:—In the electrolyte there is a condition of equilibrium represented by the expression: $Cu(NH_3)^{\cdot\cdot}_x \rightleftharpoons Cu^{\cdot\cdot} + xNH_3$. Owing to the great complexity of the copper-ammonia ion, the concentration of cupric ions is so small that no precipitation of cupric hydroxide occurs, notwithstanding the high concentration of hydroxyl ions in the strongly alkaline solution. When the current passes, however, a vigorous oxidation of ammonia takes place at the anode, and the concentration of cupric ions increases, until the solubility product of cupric hydroxide is exceeded, when cupric hydroxide is separated; the hydroxide is more or less completely dehydrated by electroendosmotic action, and adheres to the anode in the form of the black deposit mentioned above. Similar anodic deposits of oxides can be obtained from alkaline solutions of copper tartrate, alkaline ammoniacal silver solutions, and alkaline solutions of silver cyanide and thiosulphate, alkaline solutions of nickel and cobalt tartrates and cyanides, and cobalt oxalate, alkaline solutions of ferric tartrate, and from alkaline ammoniacal solutions of aluminium salts. The processes involved in the anodic formation of oxides may be classified in the following manner: (A) The ions are formed by the anode metal taking up an electric charge. In these cases the oxide of the metal of the anode is formed. On anodic polarisation with a positive current, metal ions go into solution from the anode, and are precipitated by the hydroxyl ions, the precipitated hydroxide being deposited on the anode, either as it is separated, or after dehydration by electroendosmotic action. (B) The ions are produced by the charging of ions of lower valency. The anode metal is unattackable, and the oxide is formed from a metal present in the electrolyte. On passing the current, the metal ion is converted into one of higher valency, and owing to the lesser solubility of the higher hydroxide, separation occurs. (C) Simple ions are produced from those of a complex character by oxidation of a portion of the complex. This case has been described above with reference to ammoniacal copper solutions. (D) Simple ions are formed from complex oxygenated anions by an increase of the concentration of hydrogen ions at the anode. Hydroxides are formed in this manner when the metal in solution is capable of forming an amphoteric hydroxide, which would be dissociated according to the scheme: $M^{\cdot} + OH' \rightleftharpoons MOH \rightleftharpoons MO' + H^{\cdot}$. If the metal be present in solution as the anion, MO', and a current be passed with an unattackable anode until oxygen is evolved by discharge of hydroxyl ions, then the concentration of hydrogen ions increases until the separation of the hydroxide, MOH, becomes possible, owing to displacement of the equilibrium represented by the expression given above.

An attempt was made to ascertain the cause of the passivity of base metals under certain conditions, and to this end platinum electrodes were coated with films of iron, nickel, and cobalt oxides, respectively, and were then compared with electrodes of these metals with respect to the ease with which evolution of oxygen took place on anodic polarisation in sodium hydroxide solution. The results obtained show that if allowance be made for differences of surface-condition, the oxide-coated platinum anodes behave in a manner quite similar to anodes of the corresponding metals on anodic polarisation in sodium hydroxide solution under similar conditions. In the experiments where somewhat different results were obtained, it was found that as the surface of the metal anode was modified in the direction of making it more finely-divided or "spongy," the results approached more closely those obtained with oxide-coated platinum anodes. The authors put forward these results as a confirmation of the view that the passivity of iron, nickel, and cobalt is due to the formation of a film of oxide on the metal. They draw attention especially to experiments in which a platinum anode was polarised in an iron solution for so short a time that no change could be detected by the naked eye, yet the anode afterwards behaved quite differently from an ordinary platinum anode, resembling much more nearly an anode of "passive" iron.—A. S.

English Patents.

Electrolysis of alloys, fused salts, solutions, ores, or chemical compounds; Process and apparatus for ——. E. Ashcroft, London. Eng. Pat. 146, Jan. 2, 1906.



The current passes through a coil, J, placed between an outer casing, H, of magnetic material, and a lining of refractory material, I, and then through M to the anode, A, of lead-silver alloy, &c. From the anode the current passes through the fused electrolyte, K, such as lead chloride, to the cathode, B, which floats in the liquid metal, E, in the pocket, D. The lines of magnetic force, shown by the arrows, cut the lines of current flow in the disc, B, and cause the latter to revolve, the deposited metal being thus projected into a concentric trough, O. The cathode may have grooves, vanes, or channels for directing the flow of the deposited metal. Conduits may be used on its lower face to direct the metal to the periphery, thence to connected conduits on the upper face, which direct the deposited metal to the centre of the cathode and into the pocket, D.—B. N.

Copper ores and copper waste; Electrolytic process for the treatment of —— *for the recovery of pure copper.* L. M. Lafontaine, Paris. Eng. Pat. 2989, Feb. 7, 1906.

See Fr. Pat. 363,701 of 1906; this J., 1906, 856.—T. F. B.

United States Patents.

Electrodeposition of metals; Process for the ——. J. A. Nussbaum, Charlottenburg, Assignor to Siemens und Halske A.-G., Berlin, Germany. U.S. Pat. 832,024, Sep. 25, 1906.

Smooth dense deposits of metals are obtained electrolytically, by adding to aqueous solutions of their ordinary salts small quantities of colloids, which wander towards the cathode, *e.g.*, seed mucilages (linseed), mucilage from roots or bulbs (salep), vegetable gums, albumin, glutin, chondrin, mucin, &c. Thus, copper may be readily plated with the ordinary current density from a solution of copper and sodium chlorides, to which 0·2 per cent. of linseed mucilage has been added.—A. G. L.

Electroplating; Apparatus used in ——. A. J. Leaver, London. U.S. Pat. 835,960, Nov. 13, 1906.

See Eng. Pat. 516 of 1906; this J., 1906, 937.—T. F. B.

French Patents.

Brass; Electrodeposition of —— *on iron and steel.* E. L. Lecoq. Fr. Pat. 361,892, Nov. 7, 1905.

Brass can be directly plated on iron and steel electrically by using a bath of the following composition: Sodium carbonate, 3 kilos.; sodium bisulphite, 4; copper acetate, 2·25; zinc sulphate, 1·1; potassium cyanide, 6·5; stannous chloride, hydrated, 0·1; lead acetate, 0·1; potassium carbonate, 1·25; zinc chloride, 0·25 kilo.; ammonia, 2 litres; water, to make up to 100 litres —A. G. L.

Iron pyrites; Treatment of —— [*in an electric furnace*]. L. A. David. Fr. Pat. 369,251, Aug. 27, 1906.

Iron pyrites, preferably freed from copper, and dried, are fused at a very high temperature in an electric furnace, in a regulated current of dry air, metallic iron and sulphur dioxide being produced. The furnace used is preferably provided with an automatic stoking device; the pyrites may be mixed with iron oxide; if the latter is silicious, calcium sulphate is added as a flux, calcium silicate and sulphur dioxide being produced. The molten iron is best converted into steel or ferro-alloys in a second electric furnace, into which it is run from the first. The sulphur dioxide is used for making sulphuric acid. Its high temperature is claimed to render it specially fit for the contact process. If the chamber process is used, the heat of the gases is utilised to concentrate chamber acid in a Glover tower.—A. G. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page 57.*)

Cocoanut oil; Detection of —— in butter and other fats and oils. J. Hanuš. Z. Untersuch. Nahr. Genussm., 1907, **13**, 18—24.

The following method was suggested by Haller's experiments on the alcoholysis of fats (this J., 1906. 1159, 1226):—5 grms. of the melted fat are heated for 15 mins. in a thermostat at 50° C., then mixed with 30 c.c. of $N/10$ alcoholic potassium hydroxide solution, shaken until completely clear, and again placed for eight minutes in the thermostat. The liquid is next neutralised with dilute sulphuric acid (2 c.c. of which = 30 c.c. of the alkali), made up to 145 c.c. with water, and rapidly distilled after the addition of a few fragments of pumice stone. 30 c.c. of alcoholic distillate are collected in a graduated cylinder, and then the aqueous fraction in a flask holding 100 c.c. The distillation should be finished within forty-five minutes. The two fractions are washed into Erlenmeyer flasks (a little alcohol being used to bring the esters in the aqueous fraction into solution), the free fatty acids neutralised, and the esters in each fraction saponified by heating them for about forty-five minutes on the water bath under a reflux condenser with 40 c.c. of $N/5$ potassium hydroxide solution. When cold, the excess of alkali is titrated with $N/10$ hydrochloric acid, the result giving the amount of alkali required to saponify the respective esters derived from the 5 grms. of fat. The following table gives some of the results thus obtained:—

Fat.	$N/10$ potassium hydroxide solution required to saponify the esters in the	
	alcoholic fraction.	aqueous fraction.
	c.c.	c.c.
Butter, three samples	24·4 to 26·30	7·90 to 9·30
Cocoanut oil, five samples	10·65—17·20	38·30—43·90
Butter, + 2 per cent. of cocoanut oil	24·50	10·50
Butter + 7 per cent. of cocoanut oil	23·40	14·50
Lard	0·6	1·6
Lard + 7 per cent. of cocoanut oil	2·0	4·5

The author concludes that, assuming that the esters in the aqueous distillate from butter require less than 10 c.c. of the alkali (which requires further confirmation), a higher value will indicate the presence of cocoanut oil.—C. A. M.

Cholesterol and phytosterol; Fatty acid esters of ——, and the anisotropic liquid phases of cholesterol derivatives. F. M. Jaeger. Rec. trav. chim. Pays-Bas, 1906, **25**, 334—351; Chem. Zentr., 1907, **1**, 13—15.

The increase in the melting point of phytosterol from rape oil, by the addition of small quantities of cholesterol, is due, in the author's opinion, to the two alcohols, notwithstanding differences in crystallographic symmetry being capable of forming mixed crystals in all proportions. Esters of cholesterol and phytosterol were prepared and examined. The cholesterol used was purified by recrystallisation from absolute alcohol, and melted at 149·2° C. The phytosterol, m.pt. 137° C., was obtained from the fat of Calabar beans; it has since been found by Windaus (this J., 1907, 69) to consist of a mixture of about 90 per cent. of α-phytosterol, m.pt. 136° C., identical with the sitosterol of wheat and rye (this J., 1903, 501), and 10 per cent. of β-phytosterol, m.pt. 170° C. These two isomorphous modifications of phytosterol cannot be distinguished under the microscope. The esters prepared and examined were the formates, acetates, propionates, normal- and iso-butyrates, normal- and iso-valerates, caproates, caprylates, caprates, benzoates, phthalates, and cinnamates. The crystals of the cholesterol esters are larger than those of the corresponding phytosterol derivatives, and are obtained more easily. Esters of cholesterol acquire a more or less deep yellow colour on exposure to air and light, whereas those of phytosterol remain colourless. Most of the esters of cholesterol were found to possess two liquid phases, *viz.*: an anisotropic and an isotropic liquid phase, and the transition points of the phases are given in a table. The formation of the anisotropic liquid from the solid phase is frequently indicated by a display of colours. No formation of anisotropic liquid phases was observed with phytosterol esters, but the normal valeric ester of phytosterol appears to possess two solid phases, melting at 67° and 30° C. respectively. The influence of varying quantities of phytosteryl acetate on the melting point of cholesteryl acetate is shown in the following table:—

Cholesteryl acetate, per cent. Phytosteryl aetate, ,,	100 0	90 10	80 20	73·3 26·7	60 40	42.4 57·6	20 80	10 90	0 100
Melting point	112·6°C.	117° C.	120·5° C.	122·5° C.	125° C.	128° C.	129·1° C.	129·2° C.	129·2° C.

—A. S.

Butter analysis. J. Bellier. XVIII*A*., page 110.

English Patents.

Oils and other organic bodies; Decomposition of ——. J. Harvey, Liverpool, and E. T. B. Simpson, Wakefield. Eng. Pat. 175, Jan. 2, 1906.

See Fr. Pat. 364,587 of 1906; this J., 1906, 894.—T. F. B.

Emulsifiable matter; Manufacture of ——. E. Wörner, Berlin. Eng. Pat. 1719, Jan. 23, 1906.

Egg yolks, brain substance, or other animal or vegetable products containing phosphorus in the form of an organic compound, are extracted with chloroform or other organic solvent, and the extract treated with bromine or iodine, or a mixture of halogens, and allowed to stand, after which a fat or fatty oil is added and the mixture heated until the solvent has been expelled. Finally, the oil is cooled and filtered. It is claimed that the product thus obtained forms an intimate and lasting emulsion with water, which renders the fat easily digestible. It is thus suitable as a substitute for codliver oil, or it can be used as the vehicle in ointments, &c., or as a lubricant for tools.—C. A. M.

Oils for lubricating purposes. H. Carter and J. T. Newell, London. Eng. Pat. 9202, April 18, 1906.

To mask the unpleasant fumes given off by overheated lubricating oil in internal combustion engines, the oil is mixed with a small quantity of gum benzoin, storax, gum olibanum, gum thus, cascarilla, wintergreen oil, lavender oil and cinnamon oil, dissolved in methylated spirit.—C. S.

Oils and fats; Process of bleaching ——. H. A. Metz and P. S. Clarkson, New York. Eng. Pat. 11,983, May 22, 1906.

See Fr. Pat. 366,630 of 1906; this J., 1906, 1056.—T. F. B.

Oils; Treating vegetable and mineral ——. J. Harris, London. Eng. Pat. 22,430, Oct. 10, 1906.

This is a development of Eng. Pat. 4290 of 1906 (this J., 1906, 938). Vegetable oils are heated at a temperature between 100° and 180° F., according to the nature of the oil, whilst ozone is blown through them by means of a pipe or coil for about 15 to 30 minutes, until there is an appreciable increase (say, 0·5 per cent.) in the amount of free fatty acids. They are then, whilst still hot, treated with an aqueous solution of alkali (preferably caustic soda) of about 10° B., and the impurities that separate skimmed off the surface. They are next dried by means of a current of air blown through them, more heat being applied if they have cooled, and finally are treated with about 5 per cent. of an aluminous earth and filtered in a press. In the case of mineral oils for burning, the crude distillate is heated in an open vessel at a temperature below its flashing point, and treated with ozone until it becomes denser and loses its more volatile constituents. It is then mechanically mixed with about 6 per cent. of filtering material, consisting of about 1 part of animal charcoal mixed with about 3 parts of aluminous earth, and filtered in a press, the resulting colourless filtrate being sweeter and having a higher flashing point than the original oil.—C. A. M.

French Patent.

Calcium soap ; Process for converting —— into sodium or potassium soap. P. Krebitz. Fr. Pat. 369,523, Sept. 6, 1906. Under Int. Conv., Sept. 18, 1905.

The calcium soap is heated to a temperature of from 60° to 100° C., in a closed vessel, with ammonium carbonate and sodium or potassium chloride or sulphate. The calcium is completely precipitated as carbonate, sodium or potassium soap is formed, and the ammonia unites with the acid radical of the sodium or potassium salt present. The reaction proceeds at ordinary temperatures, but heating the mixture in closed vessels is the best way of effecting the change. There is but little loss of ammonium salt, as the ammonium carbonate may be regenerated by treating the ammonium chloride or sulphate with the precipitated calcium carbonate.—W. P. S.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(Continued from page 59.)

(*A.*)—PIGMENTS, PAINTS.

Regulations for the manufacture of paints and colours. Jan. 21, 1907. Statutory Rules and Orders, 1907, No. 17.

These regulations apply to all factories and workshops in which dry carbonate of lead or red lead is used in the manufacture of paints and colours, or lead chromate is produced by boiling. The following are the chief amendments in the draft already proposed (this J., 1906, 702) :—The manufacture of varnish paints does not come under these regulations. The meaning of "lead process" is extended to cover any manipulation of any lead colour giving rise to dust, or the manufacture and manipulation of lead chromate produced by boiling in the colour-house. In regulations 1 and 2, the words "lead colour" replace the words "dry lead colour." Regulation 2 is now made to read :—"No lead process shall be carried on, save either : (*a*) with an efficient exhaust draught and air guide, so arranged as to carry away the dust or steam as near as possible to the point of origin, or (*b*) in the case of processes giving rise to dust, in an apparatus so closed as to prevent the escape of dust." In regulation 4, the words, "or at the roller mills connected with the grinding in oil of lead colour" are added after "in a lead process." Also the following addition is made : "or other duly qualified medical practitioner, if appointed for the purpose by the Chief Inspector of Factories by a certificate under his hand, and subject to such conditions as may be specified in that certificate."

English Patent.

Lead sulphate ; Converting —— into a basic pigment and preparing paint therefrom. W. Mills, London. Eng. Pat. 27,036, Dec. 28, 1905.

A basic lead sulphate is prepared by treating precipitated lead sulphate with aqueous ammonia. A soluble salt of lead is precipitated hot with ammonium sulphate, and the hot liquor run off. The wet precipitate is washed with water on a filter-bed, and transferred to a revolving vessel, where it is stirred continuously with an equal weight of water, and about 0·16 part of ammonia, sp. gr. 0·880. The product, on washing and drying at 80° C. has approximately the composition, $PbSO_4,Pb(OH)_2$, and is obtained as a fine powder, which can be ground with linseed oil to produce a white paint.—B. J. S.

United States Patent.

Pigments ; Producing —— by electrolysis. E. D. Chaplin, Boston, Mass. U.S. Pat. 836,177, Nov. 20, 1906.

An alkali hydroxide and a soluble acid salt of lead, such as lead oxychloride, are first produced electrolytically, and these are then mixed in order to precipitate lead hydroxide, the latter being carbonated to produce white lead. A portion only of the alkali hydroxide may be used for precipitating lead hydroxide, the remainder being converted into alkali bicarbonate, which is mixed with the lead hydroxide and carbonated.—B. N.

French Patent.

Pigment ; White ——. J. Giband and O. Bang. Second Addition, dated Aug. 22, 1906, to Fr. Pat. 341,539 of March 25, 1904 (this J. 1904, 873).

Barium carbonate or natural dolomite may partly or wholly replace the calcium carbonate which is mixed with the zinc sulphide or the mixture of zinc sulphide and barium sulphate.—A. G. L.

(*B.*)—RESINS, VARNISHES.

Sandarac ; Further studies on ——. A. Tschirch and M. Wolff. Arch. Pharm., 1906, **244**, 684—712.

When treated by the method of Tschirch for the systematic examination of resins, sandarac is found to contain *sandaracinic acid*, $C_{22}H_{34}O_5$; *sandaracinolic acid*, $C_{24}H_{36}O_3$; *sandaracopimaric acid*, $C_{22}H_{30}O_2$; *sandaracoresene* $C_{22}H_{38}O_2$; a bitter principle ; and essential oil. Sandaracinic acid is removed from the ether solution of the resin by shaking out with ammonium carbonate solution. It has no sharp melting point, becoming coloured at 175° C., softening at 180° C., and melting between 186°—188° C. It is optically inactive. Sandaracinolic and sandaracopimaric acids are removed by shaking out with sodium carbonate solution. The former gives a lead salt which is insoluble in alcohol, whereas the lead compound of the latter is soluble. Sandaracinolic acid shows no definite melting point, but fuses between 265° and 275° C. Sandaracopimaric acid forms small crystals in flat rosettes, and is identical with the *i*-pimaric acid of Henry (this J., 1901, 1222) ; it melts at about 170° C., sintering at 168° C.—J. O. B.

English Patent.

Polishing, varnishing, and other purposes ; Process of manufacturing substances suitable for —— from resins and the like. G. Elkeles and E. Klie, Berlin. Eng. Pat. 11,090, May 11, 1906.

Hard resins, such as copals and the like, can be converted into light-coloured products that can be used as substitutes for shellac, by transforming them into chlorine compounds. This is best done by dissolving them in an aqueous solution of an alkali, which is then treated with chlorine or a hypochlorite, and the resulting product precipitated by the addition of an acid. Admixture of an oil or oleic acid to the resin before chlorination increases the softness of the product. Claim is also made for a method of rendering the chlorinated resin soluble in alcohol by means of slight oxidation, *e.g.*, with a dilute acidified solution of potassium permanganate.—C. A. M.

United States Patent.

Pitch oil [Turpentine] and other ethereal oils obtained by destructive distillation of resinous substances ; Process for purifying ——. A. Hesso, Wilmersdorf, Germany. U.S. Pat. 835,907, Nov. 13, 1906.

See Eng. Pat. 7934 of 1906 ; this J., 1906, 1161.—T. F. B.

(C.)—INDIA-RUBBER, &c.

India-rubber ; Influence of the washing water on ——. R. Ditmar. Gummi-Zeit., 1907, 21, 392—393.

By a series of vulcanisation tests in presence of sodium, magnesium, and lead chlorides, it is proved that the presence of sodium or lead chlorides has no effect whatever in the steam cure ; magnesium chloride, however, exerts a somewhat injurious influence. In the hot air cure, on the other hand, litharge being added as a sulphur carrier, even traces of chlorides have a positively destructive action. It is further proved experimentally that chlorides acting on litharge under vulcanisation conditions in presence of sulphur, bring about the formation of lead chloride in the steam cure, but hardly at all in the hot air cure ; without sulphur there is no action whatever. Hence it is concluded that the injurious effect of chlorides is due to the preliminary formation of sulphur chloride ; this at vulcanisation temperatures would rapidly destroy the rubber, but in presence of steam it would itself be destroyed and rendered innocuous, especially if a basic oxide were present to bind the hydrochloric acid produced. The technical significance of these experiments lies in the fact that rubber may take up chlorides from the water with which it is washed.—W. A. C.

India-rubber ; Deresinified ——. F. Frank, E. Marckwald, and F. Liebschütz. Gummi-Zeit., 1907, 21, 366—368.

In view of the fact that rubber, from which the resin has been partially extracted, is now on the market as a commercial product, the authors have made investigations with respect to its vulcanising qualities. Nine widely different sorts of rubber were available, both in the virgin and deresinified condition. Two series of experiments were made. In the first, the 18 specimens were mixed with 8 per cent. of sulphur and vulcanised for two hours under a pressure of five atmospheres. In the second, mixings of 25 parts of rubber, 25 of brown substitute, 48 of barytes, 2 of sulphur, and 0·5 of lime were vulcanised for 1½ hours under the same pressure. The products were tested mechanically. It is found almost throughout that an increase in strength, after vulcanisation, is brought about by deresinification. The deresinified rubbers are free from stickiness, and have lost the characteristic odours of the parent rubbers ; they are also in many cases lighter in colour.—W. A. C.

Para rubber ; Price of ——. Kew Bulletin, 1906, 241. [T.R.]

The general tendency in the price of Para rubber in the last 30 years has been an upward one, although some of the variations are rather remarkable. At no period has the price remained fixed throughout any particular year, the nearest approach occurring in 1897 with a range of 3d. only ; the greatest deviation from it in 1879 with a range of 2s. The plantation rubber, according to statistics, first began to appear in marketable quantities in 1903, although exports on a smaller scale from Ceylon were made in 1901. Samples had been submitted as early as 1882 from there, and in 1898 from the Straits Settlements. It is stated that " the most remarkable development in Ceylon Agriculture during 1905 was the planting of rubber, under which there were, at the end of 1905, some 40,000 acres, as compared with 11,000 in 1904 and 7,500 in 1903, and the value of rubber exported in 1905 was Rs. 557,945 as compared with Rs. 221,000 in 1904."—(Colonial Report, No. 494, Ceylon, 1906.)

India-rubber ; Vulcanising of —— *by means of carbon bisulphide.* Factory and Workshop Acts, 1891, 1895, and 1901. Special Rules. [T.R.]

I.—*Duties of employers.*

1. No child or young person shall be employed in any room in which bisulphide of carbon is used.

2. After May 1, 1898, no person shall be employed for more than five hours in any day in a room in which bisulphide of carbon is used, nor for more than two-and-a-half hours at a time without an interval of at least an hour.

3. In vulcanising waterproof cloth by means of bisulphide of carbon—

(*a*) the trough containing the bisulphide of carbon shall be self-feeding and covered over ;

(*b*) the cloth shall be conveyed to and from the drying-chamber by means of an automatic machine ;

(*c*) no person shall be allowed to enter the drying-chamber in the ordinary course of work ;

(*d*) the machine shall be covered over and the fumes drawn away from the workers by means of a downward suction fan maintained in constant efficiency.

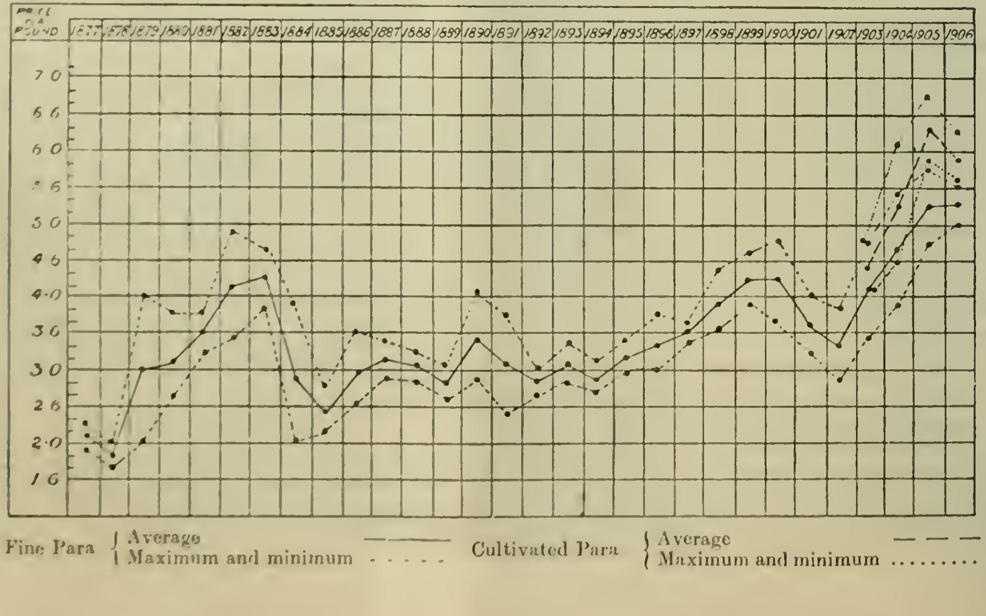
4. Dipping shall not be done except in boxes so arranged that a suction fan shall draw the fumes away from the workers.

5. No food shall be allowed to be eaten in any room in which bisulphide of carbon is used.

6. A suitable place for meals shall be provided.

7. All persons employed in rooms in which bisulphide of carbon is used shall be examined once a month by the

Prices of fine Para rubber during each year, from 1877 to 1906 inclusive, in London and Liverpool and of cultivated Para (Ceylon and Straits Settlements) from 1903 to 1906 inclusive.



certifying surgeon for the district, who shall, after May 1, 1898, have power to order temporary or total suspension from work.

8. No person shall be employed in any room in which bisulphide of carbon is used, contrary to the direction of the certifying surgeon given as above.

9. A register in the form which has been prescribed by the Secretary of State for use in india-rubber works shall be kept, and in it the certifying surgeon will enter the dates and result of his visits, with the number of persons examined, and particulars of any directions given by him. This register shall contain a list of all persons employed in rooms in which bisulphide of carbon is used, and shall be produced at any time when required by H.M. Inspector of Factories or by the certifying surgeon.

II.—*Duties of persons employed.*

10. No person shall enter the drying room in the ordinary course of work, or perform dipping except in boxes provided with a suction fan carrying the fumes away from the workers.

11. No person shall take any food in any room in which bisulphide of carbon is used.

12. After May 1, 1898, no person shall, contrary to the direction of the certifying surgeon, given in pursuance of Rule 7, work in any room in which bisulphide of carbon is used.

13. All persons employed in rooms in which bisulphide of carbon is used shall present themselves for periodic examination by the certifying surgeon, as provided in Rule 7.

14. It shall be the duty of all persons employed to report immediately to the employer or foreman any defect which they may discover in the working of the fan or in any appliance required by these rules.

Arthur Whitelegge,
Chief Inspector of Factories.

Note.—These Rules are required to be posted up in conspicuous places in the factory or workshop to which they apply, where they may be conveniently read by the persons employed. Any person who wilfully injures or defaces them is liable to a penalty not exceeding five pounds. Occupiers of factories and workshops, and persons employed therein, who are bound to observe these Rules, are liable to penalties in case of non-compliance.—(Factory and Workshop Act, 1891, Section 9, and Factory and Workshop Act, 1901, Sections 85 and 86.)

United States Patents.

Gutta-percha; Method of extracting ——. E. C. Larsen, Singapore, India, Administratrix of A. Arnaud. U.S. Pat. 836,512, Nov. 20, 1906.

The process claimed consists of crushing the leaves from which gutta-percha is to be extracted, to a pulp, adding gutta in small pieces, and boiling. The special treatment of isonandra leaves and buds is also claimed. The raw material is crushed to a pulp, mixed with 15—20 per cent. of gutta in small pieces, and heated at 110°—125° C. The resulting product is cut up, and washed by means of heated rollers and a stream of cold water. —A.S.

Fibrous substances; Process for agglomerating ——. C. A. C. de Caudemberg, Nice, France. U.S. Pat. 837,193, Nov. 27, 1906.

See Fr. Pat. 354,801 of 1905; this J., 1905, 1118.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 59.)

Carpinus betulus, L. [*Hornbeam*]*; Constituents of the leaves of* ——. *Contribution to the knowledge of ellagic acid and tannic acids.* K. Alpers. Arch. Pharm., 1906, **244**, 575—601.

No evidence of the presence of an alkaloid or a glucoside in the leaves of the hornbeam (*Carpinus betulus, L.*) could be obtained, but there is present a tannin substance which decomposes very easily, partly even during the extraction of the leaves with 40 per cent. alcohol, ellagic acid being separated. 1750 grms. of dried young leaves (from 4·5 kilos. of fresh leaves) yielded about 30 grms. of crude tannin-substance. The latter resembles in many respects the ellagitannic acid of myrobalans, algarobilla, and divi-divi (compare Zölfell, this J., 1891, 834), but differs from the latter in that it is not of a glucosidal character. On hydrolysis, it yields ellagic acid and gallic acid. The ellagic acid thus separated and also ellagic acid prepared from gall-nuts were examined. The most probable formula for ellagic acid dried at 150°—180° C. is that given by Graebe (see Perkin and Nierenstein, this J., 1905, 1087), but the author considers it likely that the water present in the air-dried substance is not merely water of crystallisation, but that ordinary ellagic acid is hexahydroxydiphenyldicarboxylic acid, which on drying at 180° C., loses 2 mols. of water, and forms the corresponding lactone as formulated by Graebe. Pure ellagic acid can be heated to 180°—200° C. without changing colour; at 450°—480° C. it chars without melting. It dissolves in concentrated sulphuric acid with a yellow colour, and the solution does not become darker on heating to 160°—180° C. A solution of pure ellagic acid in excess of potassium hydroxide solution darkens only very slowly on standing.—A. S.

Glue and gelatin; Determination of the value of ——. E. Halla. Z. angew. Chem., 1907, 20, 24—27. (See Trotman and Hackford; this J., 1906, 104.)

Chemical methods of ascertaining or comparing the value of glues or gelatins depend upon the determination of the glutin contained in the sample; and this has usually been done either by determining the total nitrogen of the sample and calculating to glutin, or by precipitating the glutin as tannate, and either weighing this or determining volumetrically the amount of tannic acid needed to effect the precipitation. None of these methods is accurate, for commercial glues contain nitrogenous substances other than glutin, and the composition of the glutin tannate is not invariable. The author finds that the amount of nitrogen contained in a precipitate of glutin tannate is exactly the same as that in the amount of glutin from which it was formed; and he also finds from analysis of a number of samples of pure glutin that dry glutin contains 17·615 per cent. of nitrogen. Accordingly in the analysis of a glue he precipitates the glutin as tannate and determines the nitrogen in the precipitate by Kjeldahl's method. The sample (10 grms.) is allowed to swell in water over night, then dissolved and made up to 500 c.c. The solution is filtered through a dry filter, 25 c.c. are taken, mixed with 50 c.c. of 5 per cent. alum solution, precipitated with 100 c.c. of 1 per cent. tannin solution, and the precipitate filtered off and washed.—J. T. D.

Thioglutin. W. S. Sadikoff. Z. Chem. Ind. der Kolloide, 1907, 1, 193—200.

Although caustic alkalis, when acting alone, rapidly destroy the adhesive properties of glutin by hydrolysis, the same alkalis, *e.g.*, caustic soda or lime, in presence of carbon bisulphide, form thio-derivatives of glutin which are characterised by tendencies in the direction of condensation, as shown by the fact that their jellies, on exposure to air, gradually become insoluble in boiling water. Solutions of thioglutin gelatinise on cooling; the minimum concentration at which gelatinisation of the solutions can take place depends on the position on the "scale of hydrolysis" (gelatinising power) of the original glutin. When a solution or jelly of thioglutin is evaporated slowly at the ordinary temperature, the surface becomes covered with a condensation product, which forms a deep red film, which can be swollen by water, but which is insoluble even on boiling. This product is called thioglutan. Changes in the "adhesive complex" of thioglutin can take place in two directions: condensation to insoluble derivatives and hydrolysis to non-adhesive products. The former phenomenon depends on surface tension, and the formation of the red film protects the underlying portions from condensation; a similar film of a grey colour is formed if the thioglutin be exposed under a layer of petroleum: the films formed at higher temperatures are not red. Concentrated jellies of thioglutin, protected by their condensation films, can be preserved unchanged without further condensation or hydrolysis, but if the jelly be dissolved, the adhesive complex undergoes progressive degradation. The water is supposed to be fixed in the jelly in a state of colloidal combination, whereas in the solution it becomes free and exerts hydrolytic activities. Dilution, presence of hygroscopic salts, previous degradation of the glutin, &c., by weakening the bond between water and colloid, favour the hydrolysis of the jellies. Thioglutin forms compounds with tannin in solution with caustic soda, and these compounds possess higher adhesive properties than the thioglutin itself. The degree of hydrolysis of any thioglutin may be expressed in terms of its adhesive complex; four degrees are recognised by glueing strips of paper together with the thioglutin, and with its tannin compound, and testing the resistance of the joints towards cold and hot water. Thioglutin of the highest degree of adhesiveness cannot be prepared from ordinary glutin when caustic soda is employed, because hydrolytic degradation takes place too rapidly; caustic lime, however, can be used satisfactorily. Thioglutin can only be analysed after precipitation by alcohol, in which case the dried product is thioglutan; thioglutin itself exists only in the form of a colloidal combination with water. The greater the degradation which takes place during the process of thionisation, the greater is the proportion of combined sulphur. Normal thioglutin contains 3—4 per cent. of sulphur, and about 4 per cent. of calcium; when its adhesive qualities are normal it contains about 0·6 per cent. of sulphur in the form of sulphides decomposed by acids. Thioglutan prepared by alcohol can be split up by cold water, after drying, into an insoluble portion poor in sulphur and calcium, and a soluble, non-adhesive portion rich in sulphur. The preparation of thioglutin direct from collagen is complicated on the one hand by the formation of condensed thio-collagen derivatives, and on the other hand by the production of hydrolysed thioglutins with very low adhesive properties.—J. F. B.

English Patent.

Extracts from bark and other vegetable matters: Process of obtaining soluble ——. The Bakau Co., Ltd., and J. Meikle, Glasgow. Eng. Pat. 26,550, Dec. 20, 1905.

The patent relates to a continuous process of extracting tannin and other soluble substances from bark or other vegetable materials, and of evaporating the resulting extracts, the whole of the operations being carried out under reduced pressure. The extractor is connected, on the one hand, with a multiple-effect evaporator, and, on the other, with a pump and a series of receptacles for the extract, these latter being, in turn, connected with the evaporator. The receptacles are provided with suitable connections, so that whilst the contents of one are being discharged into the evaporator, the others are being filled from the extractor. The steam from the evaporator is drawn, preferably through a condenser, into the extractor, and the condensed water utilised therein for extracting the soluble matters.—A. S.

French Patents.

Leather; Fixation of fat in the tanning of ——. J. Lund. Fr. Pat. 369,388, Aug. 31, 1906. Under Int. Conv., Sept. 1, 1905.

The fixation of fat in skin fibres is assisted by the use of a body such as albumin or gluten, which is readily emulsifiable and able to combine with tannic acid. Equal proportions of either of the above with dégras or lanoline are recommended.—S. R. T.

Hides; Process of tanning —— *by the aid of sulphite cellulose lyes.* W. H. Philippi. Fr. Pat. 369,608, Sept. 11, 1906.

It has been proposed previously to prepare a liquor suitable for tanning hides from sulphite cellulose lyes by neutralising them with lime, and then adding metallic sulphates such as alum or sulphate of iron, and separating the precipitate (see this J., 1895, 976). The liquors thus obtained, however, contain lime, which is objectionable. According to the present patent, the lyes are treated first with sodium carbonate, and then with alum, and filtered, in order to obtain a tanning liquor. The hides are preferably subjected also to the action of dilute hydrochloric acid, either after or during the tanning process, in order to improve their colour.—A. S.

Leather, artificial: Manufacture of ——. S. Meers. Fr. Pat. 369,220, Aug. 25, 1906.

Strips or sheets of canvas or other suitable material are coated with nitrocellulose, and calendered, after which a mixture of a drying oil and colouring matter, with or without caoutchouc, is applied. The surface is then pressed or grained and varnished. The product is not sensitive to changes of temperature, is unattacked by hot or cold water, is pliable, and practically non-inflammable. —S. R. T.

Leather, artificial; Manufacture of felted and incrusted ——. J. Foltzer. Fr. Pat. 369,402, Sept. 1, 1906.

Cellulose dissolved in cuprammonium solution or other solvent is led from a reservoir on to a revolving surface, whilst one or more felting machines blow animal or vegetable fibres on to it as it leaves the orifice. The cylinder revolves in a bath of coagulating liquid such as sulphuric acid, &c. The coagulum is detached from the revolving surface by a knife, and, after being pressed between two cylinders, enters a second bath containing concentrated caustic soda or potash solution, where complete precipitation, under tension, takes place. The excess of liquor is then removed, and the material is at the same time stamped with the desired design, and finally washed in dilute acid.—S. R. T.

Casein and albuminoids. Process for rendering —— *insoluble.* R. Desgeorge and F. Lebreil. Fr. Pat. 361,896, Nov. 9, 1905.

The invention depends upon the power which casein has of absorbing certain bodies such as oxides or acids under the influence of an electric current, at the same time becoming insoluble and supple. An electrolytic bath containing water (1000), sulphuric acid (150), and tannic acid (500), is employed if great suppleness be required, but the result may be varied by replacing the sulphuric and tannic acids by other similar substances, according to the desired nature of the final product. The casein is fixed to the anode, whilst the cathode is formed by a plate of a material insoluble in the electrolyte.—S. R. T.

XV.—MANURES, &c.

(*Continued from page* 60.)

Sugar beet plant; Significance of external appearance of —— *caused by various manurial conditions, for the valuation of the beetroot and the judgment of the manurial requirements of the soil.* H. Roemer and G. Wimmer. XVI., see below.

United States Patent.

Fertilisers; Process of making ——. A. Vasseux, Hal, Belgium. U.S. Pat. 835,692, Nov. 13, 1906.

The by-products (see also this J., 1906, 823) are concentrated, treated with sulphuric acid, and the potassium sulphate allowed to crystallise. The crystals are removed from the liquid portion containing organic nitrogen compounds.—W. P. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 60.)

Sugar beet plant; Significance of external appearance of ——, *caused by various manurial conditions, for the valuation of the beetroot and the judgment of the manurial requirements of the soil.* H. Roemer and G. Wimmer. Z. Ver. deut. Zuckerind., 1907, 1—58.

The authors give the results of experiments on the cultivation of beetroot in soil treated with varying quantities of nitrogenous, potash, and phosphate manures. The following are some of their conclusions :—Excepting under very abnormal conditions, all beetroots develop fairly regularly up to the end of June, independently of the nature of the manuring. In the presence of a normal supply of nutriment, *i.e.*, a slight excess beyond what is actually required under normal conditions, the weight of the beetroot increases 2—3-fold during July—October, the weight of the head + fresh leaves increases from July to August and then decreases, and the sugar content of the root increases rapidly during July—October.

Deficiency of nitrogenous manure.—The weight of the root increases less rapidly than under normal conditions ; the weight of the head + fresh leaves decreases from July onwards ; the sugar content of the root though high in July, attains its maximum in September. The final sugar content of such roots is very high, and is generally higher as the deficiency of nitrogen increases.

Excess of nitrogenous manure.—The weight of the root increases during July—October, 3—4-fold ; the weight of the head + fresh leaves increases rapidly during July—August, then falls slightly, but is still greater in October than in July ; the sugar content of the root is lower than under normal conditions. In order to obtain a good crop of beetroot, there should be, together with sufficient potash and phosphate, a slight deficiency of nitrogen when the growth of the root has ceased.

Great deficiency of potash.—The plant grows irregularly ; when the supply of soluble potash is exhausted, the growth of the plant ceases. If the plant then becomes extremely brown in colour it may soon die. The leaf growth is extremely vigorous in July ; the head is more luxuriant than when the plant is more abundantly supplied with all nutrient materials ; the head + leaves diminish in weight very much, however, during the later stages of growth. The sugar content of the root is low in July, and increases very little subsequently.

Just sufficient potash (*i.e* , *just sufficient for the requirements of the plant under normal conditions*).—Under these conditions there may be a slight deficiency of potash towards the end of the growth. The growth of the root is rapid at first and then slackens ; under favourable conditions the weight of the root may increase two-fold during July—October ; the head and leaves grow vigorously at first, and subsequently decrease to about 60 per cent. of their weight in July. The sugar content increases regularly during July—October, but does not become so great as when a more abundant supply of potash is present.

Great deficiency of phosphoric acid.—The weight of the root increases 1—2-fold during July—October. The head and leaves grow rapidly during July—August. The sugar content of the root is fairly high in July (lower than with nitrogen deficiency, but higher than with potash deficiency), increases regularly till October, but is always somewhat lower than when the plant is supplied more abundantly with phosphates.

Just sufficient phosphoric acid.—With very favourable conditions of growth, there may be a deficiency of phosphoric acid in the last stages. The root grows normally until August, and then less rapidly than when a normal quantity of phosphate is supplied ; the weight of the root increases about two-fold during July—October. The sugar content of such roots is high, and does not differ from that of roots grown under normal conditions.

Over-manuring.—With an excess of nitrogenous, potash, or phosphate manure, there may be a relative deficiency, if one or other of these is in great excess. The abnormality of the growth of the plant, however, caused by such deficiency, is slight. Nematodes withdraw nitrogen, potash, and phosphoric acid (as well as other nutrient substances) to nearly the same extent from the plant. The nutrient material, thus withdrawn, is converted into insoluble or difficultly soluble forms, and, hence, cannot be absorbed again in the same year. Consequently, if a soil containing nematodes is treated with only as much manure as is required for a soil free from nematodes, the beetroot will suffer from want of nutriment. Since the extent of the deficiency of nutriment from this cause, is liable to variation, the abnormality of the growth of the root will be irregular. Hence, beetroot grown in soil containing nematodes very often presents several rootlets. The injurious action of nematodes may be prevented to a considerable extent by treating the soil with a more abundant supply of manure.—L. E.

Sugar beetroot ; Catalase topography in the ——, and a contribution to the knowledge of the same. V. Staněk. Z. Zuckerind. Böhm., 1907, **31**, 207—217.

In his investigations on the catalases of the sugar beetroot, the author determined the catalytic activity of the samples, by measuring the volume of oxygen evolved from hydrogen peroxide. The following conclusions were drawn from the experiments :—The catalases of the beetroot are very sensitive towards acids ; their activity is reduced by the natural acidity of the root, as well as by the addition of even the weakest acids, *e.g.*, carbonic acid. If the action of the acid has not been of long duration, the activity of the catalases may be partially restored by addition of alkali. The activity of the beetroot catalases is also diminished by alkalis, but to a less extent than by acids. When the beetroot pulp is kept, either exposed to the air, or under water, its catalytic activity decreases. For the investigation of the distribution of the catalases throughout the root, the author employed seed beetroot which had been stacked throughout the winter. The catalases are distributed very irregularly throughout the root ; the catalase content increases towards the head and surface of the root ; it is greatest in the top section and in the outer layer at that part ; it is least in the centre of the root. It is probable that the distribution of the catalases may be different during germination, growth, and maturation, from that above described.—L. E.

Sucrose and reducing sugars ; Determination of —— in liquid sugar products. F. G. Wiechmann. Internat. Sugar Comm., Berne, 1906 ; Z. Ver. deut. Zuckerind., 1907, 65—75. (See also this J., 1906, 656.)

The author has determined the percentages of sucrose and reducing sugars in a number of syrups, (A) by the volumetric cupric-reduction method (on the unclarified solution), (B) by the gravimetric method (on the clarified solution), and (C) by the Herzfeld-Meissl method (on the clarified solution). In every case, the percentage of invert sugar determined by method (A), was higher than that obtained by methods (B) or (C), whereas the percentage of sucrose determined by method (A), was always lower than that obtained by method (B). For the determination of sucrose and reducing sugars in liquid sugar products, the author recommends: (1) that Soxhlet's modification of Fehling's solution should be employed: (2) that the sugar solution should be clarified with basic lead acetate; (3) that the gravimetric method should be used exclusively; (4) that the following mode of procedure should be adopted :—*Sucrose determination.* 26 grms. of the sample are dissolved in about 75 c.c. of water, and clarified with basic lead acetate, any excess of the latter being precipitated with 10 per cent. sodium chloride or sulphate solution. The solution is made up to 100 c.c. and filtered ; 50 c.c. of the filtrate are treated with 5 c.c. of 38 per cent. hydrochloric acid, heated in a water-bath, within three minutes, to 67°—70° C., maintained for five minutes as closely as possible at 69° C. (with continuous shaking), rapidly cooled, and made up to 100 c.c. ; 50 c.c. of the cooled solution are diluted to 1 litre ; 25 c.c. of the diluted solution (= 0·1625 grm. of sample) are neutralised with about 25 c.c. of a 0·17 per cent. solution of crystallised sodium carbonate, 50 c.c. of Fehling's solution then being added. The mixture is heated to boiling in about four minutes, and kept in ebullition (*i.e.*, with bubbles of steam rising from the centre of the liquid as well as from the sides of the vessel) for exactly three minutes, over a small flame. The solution is then removed from the flame, and treated with 100 c.c. of boiled, cold, distilled water, the whole being filtered through an asbestos filter in the usual way. The cuprous oxide is weighed as such, the weight of copper being obtained by multiplying that of the cuprous oxide by 0·888. The amount of sucrose (R), corresponding to the weight of copper, is found from the German Government tables. This gives the total sugar in terms of sucrose.

Reducing-sugar determination.—4 c.c. of the original clarified solution are made up to 100 c.c. ; 50 c.c. of the diluted solution (0·52 grm. of sample) are boiled with 50 c.c. of Fehling's solution, this, and the subsequent operations, being executed as above described. The amount of sucrose (B), corresponding to the weight of copper obtained, is subtracted from the amount of sucrose (A), previously determined, the remainder representing the sucrose content of the sample. The amount (B) multiplied by 1·05 represents the reducing-sugar content of the sample.—L. E.

Rice and maize starches in wheat starch ; Employment of polarised light for the microscopic detection of ——. G. Gastine. Compt. rend., 1907, **144**, 35—37. (See also this J., 1906, 655.)

A small quantity of the starch under examination is suspended in a drop of water ; the suspension is placed on a microscope slide, and dried first by exposure, and finally by heating for a few moments at 120°—130° C., or for a longer time at 100° C. The preparation is then mounted in Canada balsam, and examined (1) in ordinary polarised light ; (2) in polarised light modified by transmission through a selenite plate. With ordinary polarised light, the grains of rice starch appear brilliantly illuminated in the dark field, and present a granitic structure. In chromatic polarised light, the blue and orange tints present a characteristic network of lines. Maize starch gives a similar network, the meshes of which, however, are much larger than those obtained with rice starch. Maize starch also polarises brilliantly. Millet, buckwheat, rye grass starches, and many others (even the finest) show appearances similar to those of rice and maize starches. The characteristic form of the grains of bean and haricot starches, and their very brilliant polarisation, renders their determination easy. In the case of wheat starch, the groups formed of these grains, of very varied size and irregularly placed, give a very characteristic appearance under the microscope ; seen in chromatic polarised light they do not present a symmetric network of lines. The above method permits of the employment of a lower magnification (300 diameters instead of 600) than that required in the method previously described (*loc. cit.*). Hence, with the aid of a micrometer stage, the whole extent of the preparation may be more rapidly examined ; the characteristic foreign substances may be determined, and thus a quantitative estimate of the adulteration obtained. The author recommends the employment of his method previously described (*ibid.*) in conjunction with his new method, as a means of mutual control.—L. E.

Waste waters purified by bacterial beds ; Determination of organic matter in ——. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1906, **24**, 755—757.

In the analysis of waste waters, before and after bacterial treatment, the organic non-sugar is indirectly determined by subtracting sugar + mineral matter from the total dry substance. This method gives results which are neither accurate nor comparable. In sulphating the mineral matter, its weight is considerably increased, and a deduction of 1/10th of this weight is not a sufficient compensation for the increase. Hence, the values obtained for the organic non-sugar content of the water, before and after treatment, are too low ; the error is more serious in the second case, since it affects a smaller quantity of organic non-sugar, and, therefore, the purification appears to be more efficient than is actually the case. The organic non-sugar in waste waters can only be accurately determined by the direct methods described by Calmettes and Rollant (*Recherches sur l'épuration biologique et chimique des eaux d'égout*). If one of these methods is not employed, the author recommends direct incineration of the dry residue from the water (and lixiviation, if necessary) for the determination of the true ash content. The amount of organic non-sugar is then obtained by subtracting from the dry residue the sum of the sugar and mineral matter. —L. E.

Sugar ; Composition and valuation of raw ——. H. Claassen. Centr. Zuckerind., 1906, **15**, 12. Chem. Abs., Amer. Chem. Soc., 1907, **1**, 112.

For the valuation of raw sugars the relative percentage of sucrose crystals and syrup in the raw sugars should be estimated, and the properties of this syrup determined. A good method for the purpose is that of Koydl (Oest. Ung. Z. Zuckerind, 1906, 277). Fifty grms. of the raw sugar are digested with a saturated solution of sucrose in 82 per cent. alcohol containing 5 per cent. of acetic acid. The mass is brought upon a filter, washed successively with saturated solutions of sugar in alcohols of 86, 91, and 96 per cent. strength, and finally with absolute alcohol. The product is dried, weighed, and the composition of the removed syrup calculated from the analysis of the raw sugar and the yield of pure crystals. Analyses by this process of nine sugars from badly boiled massecuites showed a condition of supersaturation in the syrups present, the latter having polarisation of from 62·88° to 66·95° and purities of 78·7 to 83·5. The author shows that crystallisation of the sucrose from the supersaturated films of syrup, which bore relations of 1 : 6·1 to 1 : 8·1 to the pure crystals, does not take place during storage, owing to the high viscosity of the liquid coating.

French Patent.

Crystallising apparatus [" *Malaxeur* "] *for sugar massecuites ; Continuous* ——. Soc. des Raffinerie et Sucrerie Say. Fr. Pat. 369,319, Aug. 28, 1906.

The apparatus consists of a water-jacketed trough, in which is situated a helical shaft, carrying blades which convey the massecuite from one end of the trough to the other. At intervals, in the length of the trough, are disposed a number of hollow, transverse frames, provided with openings through which the conveyor shaft passes. Water is circulated through these frames, and through the jacket of the trough, in order to reduce the temperature of the massecuite to the desired degree.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 63.)

Alcoholic fermentation by yeast ; Origin of the succinic acid produced in ——. R. Kunz. Z. Unters. Nahr. u. Genussm., 1906, **12**, 641—646. (Compare this J., 1906, 998.)

The author has used his method for the determination of succinic acid in wine (Z. Unters. Nahr. u. Genussm., 1903, **6**, 721) to decide the question whether this acid is a by-product of the fermentation of the sugar, or is a product of the vital metabolism of the yeast cell. Having proved that, when the liquid was purified in a suitable manner, this method was perfectly reliable for the accurate determination of succinic acid in yeast cell-juice, the author conducted several fermentation experiments with this juice. In the first place it was found that yeast cell-juice, as prepared, already contained considerable quantities of succinic acid, and that the fermentation of sugar by the juice could be carried on for twenty-four hours without any increase in the quantity of succinic acid originally present. After forty-eight hours' fermentation, an increase in the quantity of succinic acid was observed, but this increase was even more pronounced when the yeast cell-juice was preserved without the addition of sugar, in which case, a production of succinic acid was recorded after only twenty-four hours. For instance, the quantity of succinic acid in 100 c.c. of cell-juice, originally containing 0·0809 grm., increased to a maximum of 0·1015 grm. after three days without the addition of sugar, whereas, after four days' fermentation with sugar, the quantity of succinic acid was only 0·0914 grm. Moreover, in the fermentation of wines by living yeast, the quantity of succinic acid produced amounts to about 0·102—0·108 grm. per 10 grms. of alcohol, whilst in the above fermentation by yeast cell-juice, the same quantity of alcohol was produced with an increase of only 0·01 grm. in the quantity of succinic acid. Consequently, it is concluded that in alcoholic fermentation the succinic acid is not produced from the sugar, but is probably derived from the cell-substance of the yeast itself by an " autolytic " process of fermentation.—J. F. B.

Sicilian wines; Presence of boric acid in ——. E. Azzarello. Gaz. chim. ital., 1906, 36 [2], 575—587.

The author examined 84 different kinds of wine from various parts of Sicily. 500 c.c. of wine were treated with excess of potassium hydroxide, distilled under reduced pressure (40—50 mm.) to expel the alcohol, and then evaporated in a platinum dish on the water-bath. The charred residue was moistened with dilute sulphuric acid, extracted three or four times with boiling water, the acid solution neutralised and evaporated to dryness in a platinum dish, and tested for boric acid by Castellana's method (this J., 1906, 445). This test is stated to be rendered more delicate by passing a current of coal-gas through the mixture of the substance and ethyl sulphate, and then igniting the gas in a Bunsen burner. The characteristic green coloration is obtained even if only 0·1 mgrm. of boric acid be present. All of the wines examined contained boric acid, the quantity being greatest in the case of wines prepared from grapes grown on clayey soils. In six wines, the boric acid was determined quantitatively as potassium borofluoride, KBF_4, by Gautier's method ("Analyse des Vins," 1891, p. 124). In four of the wines, prepared from grapes grown on sandy soils, the amount of boric acid varied from 0·0191 to 0·0289 part per 1000, whilst the remaining two wines from grapes grown on clayey soils contained, respectively, 0·0391 and 0·041 part of boric acid per 1000.—A. S.

Potato-spirit; German —— in 1906. Chem. and Drug., Feb. 2, 1907. [T.R.]

The German potato crop of last year was not so abundant as that of 1905, but there will be an active campaign, in spite of the agreement of 90 per cent. of the distillers to reduce the production of spirit to 82 per cent. In spite of the increased consumption and the necessarily increased export, it was impossible to dispose of the continuous supply which was sent out by the distillers, so that at the end of May the stores amounted to 1,654,242 hectolitres. At the end of September the supplies under Customs control were 774,908 hectolitres, in addition to some 300,000 hectolitres which had been previously removed. Nevertheless, the basis-prices were maintained into the new campaign. The unexpectedly small production of October and November made it possible for the "Centrale" to dispose of a large part of their stocks and at the same time to maintain selling-prices, which were not reduced until December. The price, paid to distillers on account and subsequently adjusted, of 40 marks for the new campaign was fixed in accordance with the 82 per cent. averages, and fines for over-production are fixed at 4 marks up to 1 per cent., 10 marks up to 7 per cent., and 15 marks for anything beyond that.

Alcohol; Industrial —— in Russia. Bd. of Trade J., Jan. 24, 1907. [T.R.]

The Austro-Hungarian Consul in Moscow reports that the appearance of denatured alcohol in the Russian chemical trade has revolutionised business in that connection, and caused an important advance in the price of acetic acid and of other products in whose manufacture it enters. Formerly methylated spirit was required for the production of polish, lacs, &c., as well as for illuminating, and in its manufacture acetic acid was at the same time produced. As denatured spirit is principally required now, the production of methylated spirit and with it the production of acetic acid has fallen off. Prices of vinegar, acetate of soda, and lead acetate have advanced about 70 per cent.

English Patents.

Diastatic substance and method of producing same. J. Takamine, New York. Eng. Pat. 12,227, May 25, 1906.

See U.S. Pat. 826,699 of 1906; this J., 1906, 901.—T. F. B.

Saccharometer. H. Noffke. Eng. Pat. 26,264, Dec. 16, 1905. XXIII., page 115.

Cleaning material [for breweries, &c.]. R. Paul, Ipswich, and A. H. Gillman, London. Eng. Pat. 2877, Feb. 6, 1906.

Claim is made for the use as cleansing agent, especially in fermentation industries, of an alkali salicylate, or of salicylic acid in equivalent quantity, mixed with an alkali hydroxide in such proportion that the alkali is in large excess. Suitable proportions mentioned are 1 to 1½ parts of sodium salicylate with about 2 parts of alkali hydroxide. Special claim is also made for an aqueous solution containing about 0·3 to 0·5 per cent, of an alkali salicylate or an equivalent quantity of salicylic acid. —C. A. M.

French Patents.

Beer wort; Process and apparatus for fermenting and treating ——. H. E. Deckebach. Fr. Pat. 369,583, Sept. 10, 1906.

See U.S. Pat. 803,576 of 1906; this J., 1906, 947.—T. F. B.

Saccharine liquids [Grape musts]; Process of sulphitation and de-sulphitation of ——. E. A. Barbet. First Addition, dated Nov. 3. 1905, to Fr. Pat. 361,869, Oct. 27, 1905. (See this J., 1907, 29.)

The process described in the original specification for white wine musts can be extended to red wine musts by effecting the sulphitation in the following manner: A comparatively small quantity of grapes is first pressed, so as to occupy only one-half or three-quarters of the capacity of the first tun. This juice is then treated with double the quantity of sulphur dioxide used for white wines. After this stage the vintage is conducted in the ordinary manner, the juices which drain off being treated with twice the usual proportions of sulphur dioxide, and the residual un-sulphured marcs being mixed with the doubly sulphured juices from the previous operations. De-sulphitation is effected in the apparatus described in the specification, the clear juice being passed through the apparatus and then returned to the marcs, from which it extracts a further quantity of sulphurous acid, which is in its turn removed by the apparatus, and so on until the whole is purified.—J. F. B.

Wines; Process for improving —— before fermentation. E. A. Barbet. First Addition, dated Nov. 3, 1905, to Fr. Pat. 361,483, May 18, 1905. (See this J., 1906, 947.)

The process described in the original patent for deodorising and concentrating grape musts before fermentation, by distilling them under reduced pressure, can also be applied for eliminating the objectionable products of micro-organisms, *e.g.*, the odours of rotten grape-seeds or of acetic acid. When the distillation is effected by the application of heat, the treatment has the additional advantage of sterilising the must.—J. F. B.

Champagne wines and sparkling ciders; Process and apparatus for manufacture of ——. E. A. Barbet. Fr. Pat. 361,914, Nov. 15, 1905.

By employing the method described in Fr. Pat. 361,483 (this J., 1906, 947), for improving the flavour by boiling the must before fermentation, the objectionable earthy and mouldy odours are removed, and a quantity of juice, otherwise unsuitable for fine champagnes, is made available. The sterilised must is then fermented in closed vessels under pressure by means of pure cultures of fine-vintage yeasts. The fermented wine is racked off into bottles, also under pressure, passing first through counter-pressure filters such as are employed for filtering and racking beer under pressure. By fermenting under pressure the gas becomes far more intimately combined with the wine than if it were merely introduced mechanically. The musts can be preserved for months before fermentation by treatment with sulphur dioxide; in this case the sulphurous acid is eliminated during the process of heating before fermentation.—J. F. B.

Nitrogen in distillery residues; Process for the utilisation of ——. J. Effront. Fr. Pat. 369,630, Aug. 22, 1906.

The residues, such as grains, are treated with sodium bisulphate and then heated in a closed vessel to a temperature of 180° to 200° C., a current of hot air being meanwhile passed through the vessel. The vapours are condensed. About 50 per cent. of the total nitrogen is thus obtained in the distillate in the form of ammonium salts. The dry residue is now powdered and heated in a furnace to a temperature of 700° C., in a current of superheated steam and air. The distillate contains the remainder of the ammonia together with methyl alcohol. Beetroot and molasses residues are treated, preferably, with resin (colophony) in place of sodium bisulphate, and are then dried in an atmosphere consisting alternately of air and carbon dioxide, the vapours being condensed and collected in acid. The dry mass is next extracted with hot water, the solution is filtered, and the insoluble residue distilled at a temperature of 700° C., as described above.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 64.)

(A.)—FOODS.

Butter analysis. J. Bellier. Ann. Chim. anal. appl., 1906, 11, 412—424. Chem. Zentr., 1907, 1, 134—136.

The first method described by the author is based upon the insolubility of the magnesium salts of the non-volatile, insoluble fatty acids. Two grms. of the butter are saponified with 10 c.c. of $N/1$ alcoholic potassium hydroxide, the solution is neutralised with $N/2$ sulphuric acid, then one drop of $N/1$ alcoholic potash added, and the whole diluted with water to 50 c.c. Ten c.c. of a solution containing 100 grms. of crystallised magnesium sulphate per litre are now added, the precipitate is caused to agglomerate by agitation and heating, and then, after cooling, is collected on a weighed filter, washed until the filtrate and washings amount to 120 c.c., and dried. The weights of magnesium salts obtained from 2 grms. of fat are: 1·79—1·84 grms. from butter, 1·98—1·99 grms. from "margarine," 2 grms. from lard, and varying weights from cocoanut oil; the weights of ash after incineration of the precipitate are: 0·137—0·138 grm. from butter, "margarine," and lard, and 0·156—0·157 grm. from cocoanut oil. The filtrate from the magnesium salts is treated with 5 c.c. of $N/10$ sulphuric acid, the precipitate filtered off, dissolved in alcohol, and titrated with $N/10$ caustic potash, of which 1·3—2 c.c. are consumed in the case of butter, and 8—9 c.c. in that of cocoanut oil; with "margarine" and lard, no fatty acids are precipitated by the sulphuric acid. In the sulphuric acid solution, the volatile acids may be determined by distillation, and titration of the distillate.

For the detection and approximate determination of cocoanut oil and "margarine" in butter, use is made of the different quantities of copper sulphate required to precipitate the insoluble fatty acids of butter, "margarine," and cocoanut oil. The copper solution is prepared by dissolving 21·85 grms. of crystallised copper sulphate and 50 grms. of sodium sulphate in water, and diluting to 1 litre; 20 c.c. of the solution should exactly precipitate the insoluble fatty acids in 1 grm. of butter. One grm. of the butter is saponified and neutralised as described above, and 20 c.c. of the copper solution are added gradually, the whole being heated to 80° C. and vigorously agitated. After cooling, the precipitate is filtered off, and the filtrate tested with a few drops of the copper solution. If no turbidity or only a very slight one is produced, the absence of cocoanut oil is indicated; 10 per cent. of cocoanut oil causes a distinct turbidity. For a quantitative determination, sufficient copper solution is added to precipitate the whole of the insoluble fatty acids, the precipitate is collected on a weighed filter, washed till free from sulphates, dried, and weighed. Butter yields 0·99 grm., and cocoanut oil 1·05—1·06 grms. of copper salts, the corresponding weights of ash being 0·141—0·142 grms., and 0·177 and 0·178 grms. respectively. Lard and "margarine" yield the same weights of copper salts as cocoanut oil, but after incineration, the weight of ash is the same as from butter, so that if an excessive weight of copper salts is obtained, and a corresponding increase of the weight of the ash is found, the only adulterant is cocoanut oil, and its quantity can be calculated, an excess of 0·00036 grm. of cupric oxide corresponding to 1 per cent. of cocoanut oil.—A. S.

Cocoanut oil; Detection of —— in butter and other fats and oils. J. Hanuš. XII., page 102.

English Patents.

Dehydrating vegetable and animal substances [Foodstuffs]; Apparatus for ——. E. W. Cooke, New York and J. F. Kelly, Pittsfield, Mass. Eng. Pat 87, Jan. 1, 1906.

The claim is for improvements in the apparatus described in Eng. Pat. 14,855 of 1905 (this J., 1905, 1319). An air-mixing box is provided in front of each series of drying chambers, to which independent supplies of hot and cold, moist, or dry air can be delivered from a train of apparatus, so that the condition of the air passing through the drying chambers can be regulated as to temperature and moisture as desired. The train of apparatus consists of a furnace, an air heater and refrigerator, and suitable fans and mains, so that two independent currents of air in any desired state of temperature and hygroscopicity can be delivered to the mixing boxes. By means of a thermometer and hygrometer the condition of the external air, and of the air entering and leaving the drying chambers is ascertained, and the supplies varied accordingly. Dampers are provided in the outlet box, which is common to all the drying chambers, so that the pressure of the air within them can be regulated.—W. H. C.

Dry products from liquids or semi-liquids [e.g., milk]; Means and apparatus for obtaining —— J. Mecredy, and D. M. A. G. Hawes, London. Eng. Pat. 1479, Jan. 19, 1906.

The claim is for the process and apparatus. The liquid (milk) is injected, with or without air, and in an atomised condition, vertically upwards into a cylindrical chamber, into which a current of heated air is delivered in a tangential direction near the top. The liquid is evaporated, and the solid matter in the form of a powder either falls to the bottom into suitable receptacles, or is caught by a gauze or muslin lining arranged within the cylinder and capable of being rotated by the tangential air current. The excess air escapes through screened openings near the bottom of the cylinder.—W. H. C.

French Patents.

Cocoa and chocolate rich in albumin; Process of manufacturing —— without alteration of the flavour. Soc. Riquet & Co. Fr. Pat. 369,234, Aug. 25, 1906.

In order to incorporate dried albumin with cocoa and chocolate, the albumin must be thoroughly softened by steeping in water. The roasted beans are steeped for 24 hours in contact with the albumin and water before proceeding with the manufacture. In the manufacture of chocolate, where sugar is permissible, the preparation and softening of the albumin is considerably facilitated by employing a 40—60 per cent. solution of sugar instead of pure water for the steeping.—J. F. B.

Solids from liquids [milk, &c.]; Method and apparatus for the recovery of ——. Merrell Soule Co. Fr. Pat 369,337, Aug. 28, 1906.

The liquid is first partially concentrated in a vacuum pan at a low temperature so that the properties of the material are not damaged. The concentrated liquid is then injected in the form of spray into a chamber where it meets a current of specially dried and heated air. The warm and dry air rapidly absorbs the remaining moisture, and passes forward with the solid, which is now in the form of a dry powder, to another chamber, where they are separated.—W. H. C.

(*B.*)—SANITATION; WATER PURIFICATION.

United States Patents.

Garbage; Process of treating ——. J. W. Sewell, Belleview, Ky.. Assignor to T. C. Pardington, Cincinnati, Ohio. U.S. Pat. 835,689, Nov. 13, 1906.

The garbage is agitated in a closed vessel and at the same time subjected to the action of steam under high pressure, the steam being introduced into the vessel in a series of jets. The vapours are condensed and "the pressure afterwards equalised in a second vessel, by opening a communication between the two vessels."—W. P. S.

Sewage disposal; Process of ——. J. W. Keegan, Santa Rosa, Cal. U.S. Pat. 836,323, Nov. 20, 1906.

The sewage matter is subjected to an initial treatment in a bacterial bed wherein uniform activity is maintained by periodically shifting the position of the region of defective anaerobic activity. The effluent from the bed is then submitted to a succession of "anaerobic" treatments until the bacteria have been eliminated.—W. P. S.

Sewage-disposal apparatus. J. W. Keegan, Santa Rosa, Cal. U.S Pat. 836,386, Nov. 20, 1906. (See preceding patent.)

The apparatus consists of an initial anaerobic bed provided with means for shifting the position of the region of defective anaerobic activity, and a series of communicating bacterial beds sufficient in number to substantially eliminate all anaerobic bacteria.—W. P. S.

Water; Process of making potable and aerated ——. R. T. Gunn, Norfolk, Va. U.S. Pat. 835,886, Nov. 13, 1906.

Air is subjected to a pressure sufficient to destroy all germs or bacteria, and is then allowed to expand simultaneously with a spray of distilled water into a suitable receiving tank. The air may be scrubbed before being compressed.—W. P. S.

(*C.*)—DISINFECTANTS.

English Patent.

Composition for dipping or pouring sheep, goats, dogs, and other animals. J. G. Hume, Dune, N.B. Eng. Pat. 14,818, June 30, 1906.

The composition is made as follows:—Mercuric chloride (1 lb.), and sodium chloride ($\frac{1}{2}$ lb.) are dissolved in 1 gall. of water and precipitated by a solution of ammonia (22 oz.), made up to a volume of 1 gall. with water. After drawing off sufficient water to leave a moist precipitate of 6 pints, half a pint of ammonia is added to the precipitate, together with methylated spirit, and a solution of soft soap sufficient to produce 1 gall.—G. W. McD.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 65.)

Paper; Specks in ——. G. Dalén. Mitt. königl. Materialprüfungsamt zu Gross-Lichterfelde West,. 1906 **24**, 235—245.

The author enumerates the various kinds of specks which are liable to appear as faults in paper, arranging them according to the following classification:—*Group* A.—Specks which appear darker than the surrounding paper by reflected light and lighter by transmitted light, *e.g.*, marks due to rosin, grease, froth, sand, knots of matted fibres, specks of insufficiently disintegrated material, groups of plant cells incrusted with silica or calcium compounds, specks of starch paste.

Group B.—Specks which appear darker or of a different colour both by reflected light and by transmitted light, *e.g.*, specks of iron rust, bronze, lead, coal, colouring matter, sealing wax. india-rubber, coloured fibres, unresolved fibre-bundles of wood or straw (splinters), "sheave" of flax or hemp, hulls of cotton seeds, mildew stains.

Group C.—Specks which are invisible or scarcely apparent in the paper at first, but which show up when the paper is treated in some way, as in calendering, coating, parchmentising, oiling, or preparing for photographic processes, *e.g.*, knots, bleaching-powder residues, calcium sulphate, starch, iron, rosin, grease, sand, lumps of mineral loading, mechanical wood fibres. After discussing the origin, appearance, and effects of these faults, the author proposes the following scheme of systematic examination when only small quantities of material are available: (1) Examine the speck microscopically with a low power and without mounting medium. (2) Treat the speck first with alcohol, then with ether. Specks of grease are unchanged by cold alcohol but soluble in ether; specks of rosin from the size are soluble in alcohol, but specks of resin from the wood pulp dissolve with difficulty in ether and hot alcohol; the latter specks often leave a residue of calcium sulphate or sulphite. (3) If the speck is insoluble, treat with boiling water, and note whether it forms a lump or hollow in the paper, pick out the speck, mount it on an object glass, and resolve it into its constituent cells. Specks of insufficiently disintegrated material yield to water alone; in the case of mildew stains the fungus filaments can be seen on and amongst the fibres. If the speck resists water, treat with caustic soda, and if this fails to soften it. treat with chromic acid; incrusted silicious cells can thus be detected. (4) Special reactions: calcium sulphate crystallises from hydrochloric acid in needles; iron, identified by ferrocyanide, may occur either as metallic iron, rusty pipe-scale, or as a pulverulent deposit from ferruginous water. (5) Test for starch and calcium sulphite. (6) Test entire sheets for invisible spots by painting with reagents, *e.g.*, indicators and potassium iodide and starch; Wurster's "di-solution" is a good test for bleaching-powder residues Lastly, some of the paper may be sensitised with silver, exposed to light, and developed; in other cases tests may be made by fumigating with vapours of reagents.—J. F. B.

Pergamyn. [*Grease-proof imitation parchment paper.*] H. Hofmann. Papier-Zeit., 1906, **31**, 4190—4192, 4331—4332.

Pergamyn, better known in this country under the name of grease-proof imitation parchment paper, is prepared from strong Mitscherlich sulphite wood pulp by beating it until it acquires a gelatinous consistency. The author has endeavoured to ascertain whether there is any chemically recognisable difference between the beaten pergamyn pulp and the wood pulp half-stuff from which it was prepared. In view of the fact that in Germany the gelatinised hydrated cellulose has received the name of "Zellstoffschleim," the author turned his attention particularly to an examination of the gummy and pentosan constituents of the two pulps. He found, however, that the removal of the gums from the wood pulp by means of 5 per cent. caustic soda in no way interfered with its suitability for the preparation of pergamyn by long beating. The original pulp and the pergamyn both yielded equal quantities of water-soluble constituents, both contained pentosans and methylpentosans, yielding xylose on hydrolysis. and these pentosans. as measured by their furfural constants, were actually rather less in the pergamyn than in the original half-stuff. Consequently the gums and other pentosans play no part in the gelatinisation of the pulp. But it was conceivable that this gelatinisation might be the result of a degradation or hydrolysis of the cellulose under the chemical action of water, with the production of mucilaginous carbohydrates (hemicelluloses) possessing an inferior resistance to hydrolysis by acids. The author, therefore, boiled equal quantities of wood pulp half-stuff and pergamyn pulp with 6 per cent. sulphuric acid under standard conditions, and determined the sugar produced by hydrolysis in a given time. The result showed, however, that the resistance of the beaten pergamyn was not inferior to that of the original wood pulp. On this last observation the author bases his opinion that "no hydration of the cellulose takes place in the beater," and that "Zellstoffschleim" consists of cellulose beaten into fine fibrillæ, in which condition it imparts a gelatinous consistency to the pulp in suspension in water. The author has extended the above method of expressing the chemical condition of the cellulose in terms of the yield of sugar on hydrolysis to an investigation of the effect of dry heating on various pulps. He found that when sulphite wood pulp was heated in a drying oven it suffered a progressive chemical change, and that on subsequent hydrolysis with acid it yielded increased quantities of sugar (xylose), proportional to the degree and duration of the heating. The degradation of the sulphite wood cellulose by heat was scarcely perceptible after heating for four hours at temperatures below 90° C., but became definite and distinct at temperatures between 90° and 100° C. Other pulps, such as straw, raw wood, and rye, suffered no change at 100° C.—J. F. B.

English Patent.

Celluloid ; Manufacture of ——. C. Claessen, Berlin. Eng. Pat. 20,037, Sept. 8, 1906.

See Fr. Pat. 364,604 of 1906 ; this J., 1906, 906.—T. F. B.

United States Patent.

Half-stuff from peat-turf ; Method for the production of ——. C. Esser, Weiner-Neustadt, Austria, Assignor to Pilgrim Paper Co., New York. U.S. Pat. 836,069, Nov. 13, 1906.

See Eng. Pat. 9589 of 1901 ; this J. 1901, 830.—T. F. B.

French Patents.

Cellulose esters [for artificial silk] ; Process for the manufacture of ——. Knoll et Cie. Fr. Pat. 369,123, Aug. 10, 1906. V., page 91.

Silk, artificial ; Manufacture of ——. Soc. Anon. pour l'Etude Ind. de la Soie Serret. Fr. Pat. 369,170, Aug. 23, 1906. V., page 91.

Plastic material which is transparent, imputrescible, and of great strength ; Process for the manufacture of a —— *[from cellulose]*. E. Crumière. Fr. Pat. 369,635, Sept. 3, 1906.

A solution of cellulose is formed into films, sheets, or other desired forms, and before being treated with a coagulating agent, *e.g.*, a mineral acid, is submitted to a prolonged drying by exposure to the air. It is stated that the cellulose solution during the drying undergoes gradual oxidation, and that the resulting product is stronger than those obtained hitherto.—A. S.

Hides ; Process of tanning —— *by the use of sulphite-cellulose lyes.* W. H. Philippi. Fr. Pat. 369,608, Sept. 11, 1906. XIV., page 106.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 67.)

Quinine and cinchona bark in 1906. C. F. Boehringer und Soehne. [T.R.]

The following figures have been compiled relative to the business in quinine and cinchona bark during 1900—1906 :—

Year.	Cinchona bark.						Quinine.	
	Imports into United Kingdom. lb.	Exports from Java.	Stocks of bark on Dec. 31st.		Range of unit at sales.		Estimated content at sales in	
		Amsterdam. lb.	London. packages.	Amsterdam. packages.	London. Pence per lb.	Amsterdam. Cents per ½ kilo.	London. ozs.	Amsterdam. ozs.
1900	4,604,000	10,780,000	9,621	13,775	$1\frac{11}{16}$—$2\frac{1}{2}$	8·00—12·25	2,000,000	8,800,000
1901	4,765,000	12,799,000	10,298	13,100	$1\frac{5}{8}$—2	7·25—10·45	1,800,000	11,500,000
1902	4 447,000	13,346,000	8,080	16,952	$1\frac{3}{8}$—$1\frac{3}{4}$	4·90— 8·65	1,400,000	11,300,000
1903	3,343 000	13,725,000	5,458	16,072	$1\frac{1}{4}$—$1\frac{1}{2}$	6·20— 8·20	1,150,000	11,680,000
1904	3,205,000	14,451,000	6,169	15,813	$1\frac{1}{4}$—$1\frac{7}{16}$	6·25— 7·50	650,000	13,100,000
1905	3,500,000	15,399,000	7,614	38,925	$\frac{3}{4}$—$1\frac{1}{8}$	4·75— 6·55	1,100,000	10,900,000
1906	2,750,000	13,516,000	5,043	20,636	$\frac{3}{4}$—$\frac{7}{8}$	4·00— 5·10	775,000	15,750,000

Alkaloidal salts and other organic substances ; Behaviour of —— *with solvents, especially chloroform in the "perforation" extraction process, and the reducing action of alkaloids.* A. Simmor. Arch. Pharm., 1906, **244**, 672—684.

A table of experimental results is given, which shows that with alkaloidal salts in neutral aqueous solution, and also, in some instances, in the presence of excess of acid, there is a marked tendency to dissociation when the solution is "perforated" with chloroform for one hour, so that more or less considerable traces of free bases can subsequently be detected in the chloroform extract. The least dissociation occurs with salts of strong bases and strong acids, as, for instance, nicotine and atropine salts. Weak bases, such as narcotine, show much more marked dissociation. Non-alkaloidal substances, such as salicylic acid, santonin, cantharidin, and picrotoxin, which form alkali-compounds, also show more or less dissociation when "perforated" with chloroform ; but less in the presence of an excess of alkali. Benzene behaves similarly to chloroform, but since it is a less active solvent for alkaloids, the amount of dissociation is not so great. Amyl alcohol and isobutyl alcohol remove the free base from morphine salts, especially from the acetate ; from acid solutions the morphine is also removed as a salt. In another series of experiments, in which the aqueous suspension of free alkaloids was "perforated" with chloroform for eight hours, it was found that in many cases a slight but distinct decomposition of the chloroform resulted, so that evidence of the presence of chlorine in the residues was obtained. This was so with all the alkaloids treated except morphine, narcotine, and papaverine. The amount of decomposition is, however, so small that it has no practical significance.

Behaviour of alkaloids towards salts.—Free morphine in aqueous and in alcoholic solution is a powerful reducing agent to silver nitrate ; its salts in aqueous solution have also marked reducing action, but the alcoholic solutions less so. No other free alkaloids approach morphine in the strength of their reducing action ; some act in the cold after some hours, and others only on warming. Caffeine has no action whatever under any conditions. No alkaloidal salts, except those of morphine, show reducing properties. Morphine, aspidospermine, emetine, and hydrastinine have marked reducing action on gold chloride. Other free bases show less powerful action ; and morphine salts do not act so strongly as towards silver nitrate. With mercuric chloride, emetine, nicotine, and hydrastinine give reduction in the cold ; most other alkaloids only form calomel after more or less heating. Reduction to metallic mercury only occurs with the three first-named bases. Strychnine, brucine, and caffeine show no action, and no alkaloidal salts give any reduction. A number of alkaloids besides morphine give the Prussian blue reaction with potassium ferricyanide and ferric chloride solutions with more or less rapidity. Atropine, quinine, cinchonine, cocaine, narcotine, solanine, and veratrine have scarcely any reaction. With potassium permanganate in the presence of sulphuric acid, morphine, thebaine, codeine, and emetine have a powerful reducing action; with other bases this is less intense. Atropine and cocaine have practically no reducing action.—J. O. B.

Conine; Reaction for ——. Gabutti, Boll. Chim. Farm., through Pharm. J., 1907, **78**, 59.

When a solution of sodium nitroprusside is added to a dilute solution of conine, no colour is produced at first, but on standing, or more quickly on stirring, a red tint is developed, which changes finally to yellow. It disappears on warming and reappears as the liquid cools. Acids destroy the colour, alkalis change it to bright yellow. Piperazine, piperidine, amines, and nicotine give no reaction under similar conditions.

Elaterin. F. v. Hemmelmayr. Monatsh. Chem., 1906, **27**, 1167—1182.

From analyses of elaterin (prepared from *Ecballium elaterium*) and its derivatives, the author considers the formula to be $C_{24}H_{34}O_6$ or $C_{24}H_{32}O_6$. The molecule of elaterin contains two hydroxyl groups, two carbonyl groups, and an acetyl group. It crystallises from glacial acetic acid in large granular crystals, melting at 225° C. The bromine addition compound, monobromelaterin, is a sulphur-yellow amorphous powder melting at 112° C., and decomposing at 118° C. Diacetylelaterin is a yellow amorphous substance melting at 124° C. Elaterin forms an amorphous dihydrazone, which sinters at 158° C., and begins to evolve gas at 170° C. It is hydrolysed by alcoholic sulphuric acid to elateridin, $C_{22}H_{30}O_5$ or $C_{22}H_{28}O_5$, a white amorphous substance, very slowly dissolved by potassium hydroxide solution, and melting between 140° and 150° C. On treating elateridin with acetic anhydride, a monoacetylelateridin could alone be produced, which melted between 140° and 150° C. When elaterin is boiled with potassium hydroxide solution, elaterinic acid, $C_{22}H_{32}O_6$, is produced, which melts between 70° and 80° C. The methyl ester and hydrazone of this substance were prepared. On oxidation with chromic acid, elaterin yields an amorphous substance, melting at 115°—120° C. (See Pollak, this J., 1906, 1066.)—F. Shdn.

Artemisia oils; Notes on some new ——. *II.* F. Rabak. Pharm. Rev., 1906, **24**, 324—325; Chem. Zentr., 1907, **1**, 165. (See also this J., 1905, 1320.)

Oil from *Artemisia frigida*, Willd, distilled in August, 1905 (yield, 0·3 per cent.), had the sp. gr. 0·933; α_D (100 mm.) = — 23° 40′; acid value, 2; ester value, 35; saponification value after acetylation, 139. It had an odour resembling that of cineol, was soluble in 0·5 vol. of 90 per cent. alcohol, reduced ammoniacal silver nitrate solution, but gave no reaction with Magenta-sulphurous acid reagent. Oil distilled from *Artemisia ludoviciana*, Nutt., in 1905 (yield, 0·27 per cent.), had a yellowish-green colour, becoming yellow on standing. It had the sp. gr. 0·931; α_D (100 mm.) = – 17° 20′; acid value, 0; ester value, 26; saponification value after acetylation, 116. This oil also had an odour recalling that of cineol, but less pleasant than that of *A. frigida* oil; the presence of cineol was detected in both oils by means of phosphoric acid. *A. ludoviciana* oil reduces ammoniacal silver solution, and gives a faint aldehyde reaction with Magenta-sulphurous acid. Oil distilled from *Artemisia caudata*, Mich., in 1905 (yield, 0·13 per cent.), was of a light yellow colour, had the sp. gr. 0·8418; α_D (100 mm.) = – 24° 20′; acid value, 0; ester value, 29. On standing for a long time it loses its sweetish odour, and becomes viscous. It dissolves to a turbid solution in 2 vols. of 90 per cent. alcohol, reduces ammoniacal silver solution, and gives an aldehyde reaction with Magenta-sulphurous acid.—A. S.

Oil from Erigeron canadensis. F. Rabak. Pharm. Rev., 1906, **24**, 326; Chem. Zentr., 1907, **1**, 165—166. (See also this J., 1905, 1321.)

Oil distilled in August, 1905, from the fresh plant (yield, 0·52 per cent.), was of a light yellow colour, had an odour resembling that of caraway oil and reminiscent of that of limonene, and on standing gradually acquired an acrid flavour. It had the sp. gr. 0·8567; α_D (100 mm.) = + 82° 10′; acid value, 0; ester value, 39, and after acetylation, 67. On standing, a brownish resinous mass and some crystals separated. The oil reduced ammoniacal silver solution, and gave an aldehyde reaction with Magenta-sulphurous acid.—A. S.

Thiobenzanilide; Formation and properties of ——. [*Simple method for the preparation of benzaldehyde.*] R. Ciusa. Atti R. Accad. dei Lincei Roma, 1906, **15** [2], 379—384; Chem. Zentr., 1907, **1**, 28—29.

Thiobenzanilide, $C_6H_5.C(:S).NHC_6H_5$, is formed by the action of phosphorus pentasulphide on benzophenoneoxime $(C_6H_5)_2C:NOH$. When it is reduced with zinc dust in boiling alkaline solution, and the reaction-product boiled with dilute hydrochloric acid, benzaldehyde is formed. The method is recommended as being a very simple one for the preparation of aldehydes from the corresponding acids.—A. S.

Chloroform; Electrolytic preparation of ——. R. Trechcinski. XIA., page 100.

English Patents.

Emulsifiable matter; Manufacture of ——. E. Wörner. Eng. Pat. 1719, Jan. 23, 1906. XII., page 102.

Alcohol separation process. N. L. G. Whitehouse and N. C. Beetlestone, London. Eng. Pat. 4,274, Feb. 21, 1906.

Claim is made for the purification of ethyl or methyl alcohols by the action on them of an alkali carbonate and carbon dioxide under pressure. The solid compound (alkyl-alkali carbonate) so formed can be separated from non-reacting impurities, and decomposed by heat to recover the alcohol.—F. Shdn.

Boracic [Boric] acid esters; Manufacture of ——. G. W. Johnson, London. From Verein. Chininfabriken Zimmer und Co., G.m.b.H., Frankfort on the Maine, Germany. Eng. Pat. 11,574, May 17, 1906.

The menthyl ester of boric acid is prepared as follows:—Menthol (46·8 parts) and boric acid (6·2 parts) are heated at 140° C., until the boric acid is dissolved and water cannot be identified in the reaction mixture. A clear liquid is thus obtained, which, after being cooled to 60° C., is mixed with an equal quantity of alcohol. Fine crystals separate out with a m. pt. of 150° C., soluble with difficulty in water and alcohol, but easily soluble in ether and benzene. For the preparation of the bornyl ester a mixture of borneol (23·1 parts), boric acid (3·1 parts), and xylene (80 parts) is boiled until aqueous vapours cease to be given off. The xylene is distilled off, and the residue, which solidifies on cooling, is triturated and boiled with methyl alcohol in which the bornyl ester of boric acid is almost insoluble.—G. W. McD.

Fatty acid derivatives; Manufacture of brominated ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,323, June 22, 1906.

See Addition of June 21, 1906, to Fr. Pat. 362,370 of 1906; this J., 1906, 1173.—T. F. B.

Dialkylbarbituric acids; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 25,494, Nov. 12, 1906. Under Int. Conv., Nov. 28, 1905.

Claim is made for the manufacture of dialkylbarbituric acids by heating dialkylmalonic acid esters and urea with the di-sodium salt of cyanamide.—F. Shdn.

United States Patent.

Menthol compound. R. Berendes, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 836,914, Nov. 27, 1906.

See Fr. Pat. 367,057 of 1906; this J., 1906, 1117.—T.F.B.

French Patents.

Isoborneol; Manufacture of ——. Fabr. Bâloise de Prod. Chimiques. Fr. Pat. 369,257, Aug. 27, 1906. Under Int. Conv., May 3 and 5, 1906.

See Eng. Pats. 19,960 and 19,961 of 1906; this J., 1907, 32 and 67.—T. F. B.

Camphene; Manufacture of ——. C. Weizmann, and The Clayton Aniline Co., Ltd. Fr. Pat. 369,449, Sept. 4, 1906. Under Int. Conv., March 1, 1906.

See Eng. Pat. 5032 of 1906; this J., 1907, 32.—T. F. B.

Aldehydes; Manufacture of ——. E. C. Spurge. Fr. Pat. 369,599, Sept. 10, 1906. Under Int. Conv., Oct. 26, 1905.

See Eng. Pat. 21,814 of 1905; this J., 1906, 1066.—T.F.B.

Metallic salts for pharmaceutical or other uses; Electrolytic preparation of ——. L. Bolle und Co., G.m.b.H. Fr. Pat. 369,573, Sept. 8, 1906. XI*A*., page 100.

German Patents.

Narceine and homonarceine; Process for preparing derivatives of ——. Knoll und Co. Ger. Pat. 174,380, Feb. 8, 1905.

Products said to be of value in therapeutics are obtained by treating with dimethyl sulphate or diethyl sulphate, narceine or homonarceine in the form of their alkali salts, or in presence of alkalis or alkaline-earths: the products thus obtained are not esters, but contain the free carboxylic acid group, and can be converted into salts or esters in the usual way.—T. F. B.

Morphine and its derivatives; Preparation of acetylated ——. Knoll und Co. Ger. Pat. 175,068, May 24, 1905.

Morphine, or one of its monoalkyl, mono- or diacyl, or alkylacyl derivatives, is acetylated by warming with sulpho-acetic acid, or with a mixture of sulphuric acid and acetic anhydride. The acetyl derivatives thus obtained differ from the known triacetylmorphine and diacetylcodeine in physical properties, and are said to be of medicinal value.—T. F. B.

C-C-Dialkylbarbituric acids; Process for preparing ——. E. Merck. Ger. Pat. 174,178, Oct. 29, 1904.

Dialkylmalonuric amides, obtained from dialkylacetylcyanoureas, are converted into dialkylbarbituric acids by treating with concentrated acids.—T. F. B.

5-*Mono- and dialkyl*-2-*imino*-4.6-*dioxypyrimidines; Process for preparing* ——. Chem. Fabr. auf. Aktien, vorm. E. Schering. Ger. Pat. 174,940, Nov. 15, 1904.

Alkylation of malonylguanidine results in the formation of 5-monoalkyl-2-imino-4.6-dioxypyrimidines; further alkylation of the latter gives the 5-dialkyl derivatives, which can be converted into the corresponding dialkylbarbituric acids.—T. F. B.

Tannin-cinnamic acid compounds; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 173,729, July 13, 1905.

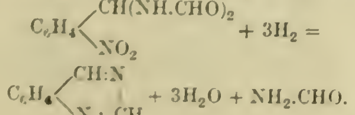
Compounds of tannin and cinnamic acid, which are decomposed by alkalis, are obtained by the interaction of the two substances in presence of acetic anhydride and phosphorus pentachloride, oxychloride, or the like. They are of medicinal value.—T. F. B.

Bismuth tannate approximating to bismuth ditannate in composition: Process for preparing a ——. Chem. Fabr. von Heyden, A.-G. Ger. Pat. 172,933, July 14, 1905.

A normal bismuth salt is added to a solution of a tannate, the base of which forms a soluble salt with the acid radical of the bismuth salt, the precipitate is washed with water, or other suitable solvent of tannin, and dried, the temperature being kept low during the whole process. The product is a yellow powder, containing about 20 per cent. of bismuth sesquioxide (the product dried at 100° C. contains 24·7 per cent.). The aqueous extract (made in the cold) is slightly acid, and gives a faint blue coloration with ferric chloride. The salt is soluble in cold sodium hydroxide solution and in dilute salt solution.—T. F. B.

Quinazoline; Process for preparing —— *from o-nitrobenzaldehyde.* J. D. Riedel, A.-G. Ger. Pat. 174,941, Oct. 20, 1905.

The product obtained by condensing 2 mols. of formamide with *o*-nitrobenzaldehyde, in presence of gaseous hydrochloric acid, is reduced to quinazoline by means of zinc dust and dilute acetic acid, according to the equation:



$$C_6H_4\left\langle\begin{matrix}CH(NH.CHO)_2\\NO_2\end{matrix}\right. + 3H_2 =$$

$$C_6H_4\left\langle\begin{matrix}CH:N\\N:CH\end{matrix}\right. + 3H_2O + NH_2.CHO.$$

—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 67.)

United States Patent.

Photographic paper; Self-toning ——. C. S. Poulsen, Valby, Denmark. U.S. Pat. 836,461, Nov. 20, 1906.

See Eng. Pat. 19,850 of 1905; this J., 1906, 198.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 68.)

Powder and explosives of low freezing point. V. Vender. Z. ges. Schiess. u. Sprengstoffwesen. 1906, 2, 21—22.

The glycerol esters containing organic acids and nitro groups are compounds which can be used as explosives, and as they have a low freezing point, they possess advantages in this respect over nitroglycerin, and can be usefully employed in conjunction with this latter body to lower the freezing point of gelatin explosives. Dinitroacetin is prepared by nitrating monoacetin (40 parts) in a mixed acid containing 100 parts of nitric acid of sp. gr. 1·513, and fuming sulphuric acid (25 parts), containing 25 per cent. of sulphur trioxide. The nitration is carried out at a temperature not exceeding 25° C., and the product is washed, first with cold water, and afterwards with a dilute solution of sodium carbonate at 70° C. Dinitroacetin is a yellowish coloured oil of sp. gr. 1·45 at 15° C., and contains 12·5 per cent. of nitrogen. It is insoluble in water, benzene, and carbon bisulphide, but easily soluble in acetone, ethyl alcohol, and nitroglycerin. It readily gelatinises guncotton containing a high percentage of nitrogen. A product containing dinitroglycerol (70 per cent.) and dinitroformin (30 per cent.) is prepared as follows: Glycerol is mixed with half its weight of dry oxalic acid and heated, first to 100° C., and afterwards for 20 hours at 140°—150° C. The mixture is then nitrated with mixed sulphuric acid and nitric acid, and the resulting product, after washing with a dilute solution of sodium carbonate, can be used directly for the manufacture of a non-freezing explosive.—G. W. McD.

English Patents.

Hydrocarbon oils; Emulsifiable compositions from ——. F. W. Klever. Eng. Pat. 27,254, Dec. 30, 1905. III., page 86.

Cellulose; Nitration of ——. G. C. de Briailles, Paris. Eng. Pat. 2902, Feb. 6, 1906.

See Fr. Pat. 364,349 of 1906; this J., 1906, 911.—T. F. B.

Explosive compounds. B. G. Reschke, Hamburg, Germany. Eng. Pat. 20,309, Sept. 12, 1906.

The patent relates to explosives containing ammonium nitrate and essential oils, particularly adapted for use in underground mines. The following are given as examples of such explosives: A. Ammonium nitrate (90·0 per cent.) and wintergreen oil (10 per cent.). B. Ammonium nitrate (92·8 per cent.), fennel oil (4·2), and olive oil (3 per cent.). C. Ammonium nitrate (86·7 per cent.), wintergreen oil (2·8), paraffin (4·5), dinitrobenzene (1·0), and copper oxalate (5 per cent.).—G. W. McD.

Explosives. O. Silberrad, Blackheath, Kent. Eng. Pat. 18,692, Sept. 15, 1905.

The object of the invention is to produce a series of nitroglycerin explosives having any desired power and velocity of detonation. A product of the most suitable consistency is obtained by mixing nitroglycerin jelly, containing 4 per cent. of collodion-cotton, with a "dope" containing wood-meal (30 per cent.) and sodium nitrate (70 per cent.), in the proportions of 53 parts of jelly to 47 parts of dope. The same consistency is obtained with a "dope" containing resin or bituminous coal (12 per cent.) and sodium nitrate (88 per cent.), in the proportion of about 34 parts of jelly to 66 parts of dope. The difference in the absorptive properties of the dopes is utilised in order to produce explosives of different powers and velocities of detonation. The following mixtures form the basis of the finished explosive, and are used in varying relative proportions to each other, according to the work required to be done by the explosive: (A) Nitroglycerin (85·84 per cent.), soluble nitrocellulose (3·52), naphthalene (0·82), resin (0·82), and sodium nitrate (9·0 per cent.). (B) Sodium nitrate (70 per cent.) and wood-meal (30 per cent.). (C) Sodium nitrate (88 per cent.) and resin or bituminous coal (12 per cent.). (D) Sulphur (1·0 per cent.), sodium benzoate (0·1), and ammonium perchlorate (3·9 per cent.). The finished explosive contains of mixture A, 58·3 per cent.; of mixture D, 5 per cent.; and varying relative percentages according to circumstances of mixtures B and C. Naphthalene is used for the purpose of preventing exudation. Resin is added to reduce the velocity of detonation and retard hydrolytic decomposition. The sodium benzoate is used for the purpose of improving the keeping qualities of the explosive, whilst the sulphur and ammonium perchlorate are added for the purpose of rendering it possible to use the explosive with small detonators.—G. W. McD.

French Patent.

Nitro-explosives; Process and apparatus for increasing the density of fusible ——. C. E. Bichel. Fr. Pat. 369,371, Aug. 30, 1906.

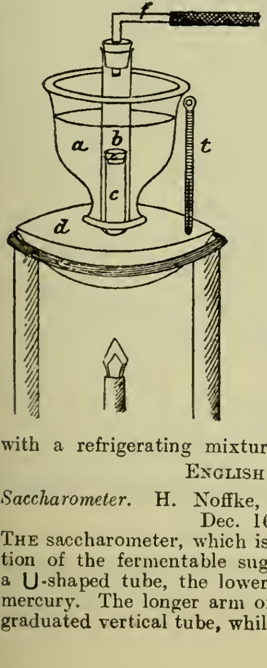
Fused nitro-compounds such as trinitrotoluene, picric acid, &c., are placed in a water-jacketed mould, provided with a lid fitting air tight, and furnished with a branched pipe, by means of which the mould may be either evacuated or placed under the pressure of compressed air, carbon dioxide, or other gases. By evacuating the mould containing the fused nitro-compound, the contained air bubbles are first removed. Compressed air or carbon dioxide is then allowed to enter, and the fused mass cooled by means of the water-jacket. Under this treatment the density of the nitro compounds is increased. The density of trinitrotoluene, for example, rises from 1·35 to 1·60 at two atmospheres, and to 1·62 at four atmospheres. The density of picric acid can be increased from 1·62 to 1·67, and that of trinitronaphthalene from 1·23 to 1·32.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 69.)

APPARATUS, &c.

Sublimation apparatus; A new ——. V. Sckworzow. Z. angew. Chem., 1907, **20**, 109.



The apparatus is shown in the accompanying figure. The substance to be sublimed is contained in the tube, *c*, closed by a plug, *e*, of porous material (chalk or earthenware). This tube is placed in a larger glass tube, *b*, the lower end of which projects through a cork in the tubulus of the glass vessel, *a*, into the heating-bath, *d*, which is also provided with a thermometer, *t*. The tube, *b*, is connected by a glass tube, *f*, with a calcium chloride tube, or, if it be desired to work under diminished pressure, with a pump. The vessel, *a*, is filled with cold water, or, if necessary, with a refrigerating mixture.—A. S.

English Patent.

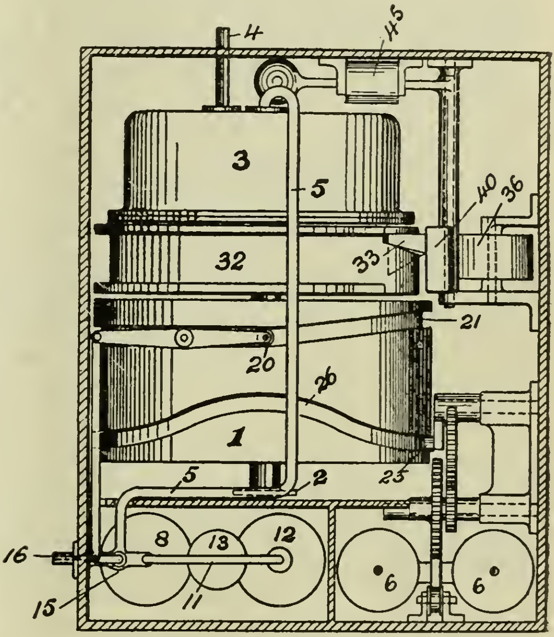
Saccharometer. H. Noffke, Berlin. Eng. Pat. 26,264, Dec. 16, 1905.

The saccharometer, which is intended for the determination of the fermentable sugar in beer wort, consists of a U-shaped tube, the lower part of which is filled with mercury. The longer arm of the U-tube is formed by a graduated vertical tube, whilst the shorter arm is enlarged to form a bulb, into the neck of which fits a grooved glass stopper of the kind used for dropping vessels. The groove in the stopper can be made to register with a hole in the neck of the bulb. A weight is placed on the stopper to keep it in place when using the saccharometer. 0·5 c.c. of the beer wort is introduced into the bulb, and 0·2 c.c. of barm added, and the mercury level is adjusted to the zero point on the graduated tube. The percentage of fermentable sugar in the wort is estimated from the rise of mercury in the graduated tube caused by the carbon dioxide evolved during the fermentation.—A. S.

United States Patent.

Gases; [Automatic recording] Apparatus for analysis of ——. H. J. Westover, Mount Vernon, N.Y. U.S. Pat. 833,274, Oct. 16, 1906.

Fig. 1.



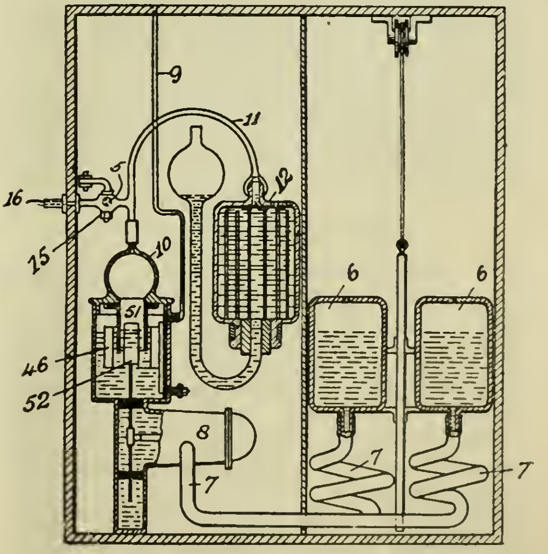


Fig. 2.

The accompanying Fig. 1 shows a plan view of the apparatus, the top of the casing being removed; and Fig. 2 is an elevation of the parts in which the analysis is effected. The gas to be analysed enters the reservoir, 3, through the pipe, 4, and passes as required through the pipe, 5, and stop-cock, 15, into the analytical apparatus. The main drum, 1, and recording drum, 32, are caused to revolve on a horizontal shaft by the toothed wheel, 2, or otherwise; the rollers, 20 and 25, running in the cam grooves, 21 and 26, on the periphery of the revolving drum, cause the three-way cock, 15, to open and shut, and the pressure vessel, 6, to rise and fall, at the proper times. The analysis is effected as follows: Assuming the previous analysis to have been completed, the pressure vessel, 6, rises, the cock, 15, is opened to the atmosphere (at 16), and the contained liquid, flowing through the flexible tubes, 7, into the vessel, 8, drives the gas out of the measuring vessels, 51 and 10, until only the negligible amount of gas in the small-bore tube, 11, remains; the annular float, 46, and the central float, 52, rise at the same time to their highest limits, the bottom of the former pressing up against the bottom of the latter. The cock, 15, now turns so as to admit fresh gas from the supply tube, 5, into the vessel, 10, the pressure vessel, 6, descends, the floats descend, and the gas fills the measuring vessels and float chamber. At this point the rotation of the drum causes the cock, 15, to close entirely, the pressure vessel, 6, again ascends, and the contained liquid drives the gas out of the apparatus, through the tube, 9, into the atmosphere, until the liquid reaches the bottom of the vessel, 51; a definite volume of the gas to be analysed is now entrapped, at atmospheric pressure, within the vessels, 51 and 10. The liquid continues to ascend in these vessels and drives the gas into the absorption vessel, 12, where the constituent to be determined is absorbed by the solution. The floats, 46 and 52, are again at their highest points, with the bottoms in contact. The pressure vessel now descends again, and the liquid falls in 10 and 51; so long as the pressure in the latter vessels does not fall below that of the atmosphere (as admitted by the tube, 9), the two floats, 46 and 52, descend at the same speed, but sooner or later, according to the amount of gas removed by the absorption, the pressure in 51 and 10 will fall below that outside, the float, 46, will descend more rapidly than float 51, and the two will separate. The greater the proportion of gas absorbed, the sooner will this separation occur. Now, these two floats form part of an electric circuit (not indicated in these figures), which includes the electromagnet, 45, shown in Fig. 1. This electromagnet, when in action, holds back a recording finger, 40, which normally tends to press a strip of recording paper (rising from the drum, 36) against the raised ink surface, 33, on the recording drum, 32. The time at which the two floats separate, therefore, so as to break circuit, controls the time at which the recording strip is pressed against the inked surface on the drum. The inked surface is narrow at one end, and grows gradually broader towards the other end, as indicated in Fig. 1; hence, the greater the proportion of the absorbed gas, the broader is the mark printed upon the recording strip of paper.—H. B.

INORGANIC—QUANTITATIVE.

Zinc; Volumetric determination of ——. J. A. Muller. Bull. Soc. Chim., 1907 [4], **1**, 13—16.

In the method proposed by Pouget for the volumetric determination of zinc (this J., 1899, 865), in which excess of iodine is added to zinc sulphide, and the excess titrated with thiosulphate, a difficulty is experienced owing to the particles of sulphide becoming coated with sulphur formed by action of the iodine. The author modifies the method in the following manner: The zinc sulphide is precipitated in the usual manner, and the excess of hydrogen sulphide is removed by heating to about 50° C. and drawing through, by aid of a pump, a current of carbon dioxide. Some boiling water is next added, the zinc sulphide dissolved in hydrochloric acid, and the hydrogen sulphide set free determined by adding excess of iodine and titrating the excess with thiosulphate.—A. S.

Cobalt; Separation of —— from manganese and iron by potassium nitrite. W. Funk. Z. anal. Chem., 1907, **46**, 1—4.

The separation of cobalt, as potassium cobaltinitrite, from manganese and iron has been recommended, but the author finds the method to be satisfactory only in the case of separating manganese from cobalt. In the presence of sulphates, there should be a less quantity of cobalt present, and in any circumstances the amount of manganese should not greatly exceed that of the cobalt, in order to ensure the success of the separation. Iron is successfully separated from cobalt provided that only small quantities of both metals are present, and these in solution as chlorides. The preliminary reduction of the iron to the ferrous state, proposed by Rose, is useless, since it is reoxidised by the nitrous acid afterwards liberated.—F. Sodn.

Sulphuric acid; Determination of —— by the benzidine method. C. Friedheim and O. Nydegger. Z. angew. Chem., 1907, **20**, 9—22.

The authors find that the amount of benzidine sulphate carried away in the filtrate and washings is very considerable, but that the precipitate of sulphate always contains "adsorbed" chloride, and that by properly choosing the concentration of the solutions the errors arising from these two causes can be made to compensate one another. The sulphuric acid or sulphate should be diluted so as to contain 0·1—0·2 per cent. of H_2SO_4, and is precipitated by an equal volume of benzidine solution, made by dissolving 6·7 grms. of the base, adding 20 c.c. of hydrochloric acid of sp. gr. 1.12, and diluting to 1 litre. After 10—15 minutes, the precipitate is filtered off and treated exactly as in Raschig's prescription (this J., 1903, 883, 1066). The presence of other substances, provided they do not attack the benzidine, and are not present in too great quantity, does not interfere with the determination—there should not be more, per molecule of sulphuric acid, than 10 mols. of hydrochloric acid, 15 of nitric acid, 20 of acetic acid, 5 of alkali salt, or 1—2 of ferric salt. The presence of ferric salts is no more disturbing than that of ferrous salts, and the authors find that in the case of pyrites, the reduction of ferric to ferrous salts prescribed by v. Knorre and by Raschig is not necessary. The complete removal of the nitric acid is not even necessary; after solution of the pyrites, a single evaporation to dryness with hydrochloric acid is sufficient, and the titration of the solution in hydrochloric acid of the residue so obtained gives accurate results.—J. T. D.

Sodium chloride in commercial stannic chloride; Detection and determination of ——. P. Heermann. V., page 90.

ORGANIC—QUALITATIVE.

Cocoanut oil; Detection of —— in butter and other fats and oils. J. Hanuš. XII., page 102.

Conine; Reaction for ——. Gabutti. XX., page 113.

ORGANIC—QUANTITATIVE.

Glue and gelatin; Determination of the value of ——. E. Halla. XIV., page 105.

Sugar; Composition and valuation of raw ——. H. Claassen. XVI., page 108.

Sucrose and reducing sugars; Determination of —— in liquid sugar products. F. G. Wiechmann. XVI., page 107.

Butter analysis. J. Bellier. XVIII*A*., page 110.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 70.)

Radioactinium. O. Hahn. Phil. Mag., 1907, **13**, 165—180.

Further work on radioactinium (this J., 1906, 559) has shown that it is produced directly from actinium, and itself is the direct source of actinium X. Radioactinium emits only α-rays, the β-rays previously observed coming from actinium B, one of the disintegration products. For the separation of radioactinium, an actinium solution which has been standing for a few months in order to attain a condition of equilibrium with respect to its radioactivity, is precipitated several times with ammonia in order to remove actinium X, which remains in solution. The precipitate is dissolved in hydrochloric acid and precipitated with sodium thiosulphate as previously described (*loc. cit.*). The series of actinium products, and their period of decay and kind of radiation are shown in the following table:—

Product.	Time to be half transformed.	Radiation.
Actinium	—	Rayless
Radioactinium	about 19½ days	α-rays
Actinium X.	10·2 days	α-rays
Emanation	3·9 secs.	α-rays
Actinium A } active	36 mins.	rayless
Actinium B } deposit	2 mins.	α-, β-, and γ-rays

—A. S.

National Physical Laboratory. Times, Feb. 2, 1907. [T.R.]

The Board of Treasury have appointed a Committee to inquire generally into the work now performed at the National Physical Laboratory, with special reference to the character of the tests undertaken there and the lines on which any further development of the work of the laboratory should proceed. The Committee will consist of:—The Right Hon. G. W. Balfour (chairman), Sir Andrew Noble, Bart., K.C.B., F.R.S., Sir J. Wolfe Barry, K.C.B., F.R.S., Mr. W. J. Crossley, M.P., and Mr. R. Chalmers, C.B. Mr. G. C. Upcott, of the Treasury, will act as secretary to the Committee.

Trade Report.

Notice of Accidents Act, 1906.

Statutory Rules and Orders, 1906, No. 933.

The following is the text of an Order, dated Dec. 22, 1906, made by the Secretary of State under the Notice of Accidents Act, 1906, requiring the reporting of certain classes of dangerous occurrences in factories and workshops, whether personal injury is caused or not:—

In pursuance of Section 5 of the Notice of Accidents Act, 1906, I hereby extend the provisions of the said Act requiring notice of accidents in factories and workshops to be given to an inspector to the following classes of occurrences in a factory or workshop (including any place which for the purpose of the provisions of the Factory and Workshop Act, 1901, with respect to accidents is a factory or workshop, or is included in the word factory or workshop, or is part of a factory or workshop) whether personal injury or disablement is caused or not:—

All cases of—

Bursting of a revolving vessel, wheel, emery wheel, or grindstone moved by mechanical power;

Breaking of a rope, chain, or other appliance used in raising or lowering persons or goods by aid of mechanical power;

Fire affecting any room in which persons are employed and causing complete suspension of ordinary work therein for not less than 24 hours.

H. J. Gladstone.

United States imports and exports for fiscal year ended June 30, 1906.

Oil, Paint, and Drug Rep., Jan. 21

The following table shows the imports and exports of certain articles:—

Imports.

	$
Chemical, drugs and dyestuffs	74,477,137
Oils	13,723,948
Glass and glassware	7,507,823
Seeds	5,388,043
Spices	5,188,116
Fertilisers	4,446,360
Lead in ore	3,534,876
Cement	1,394,447

Exports.

	$
Candles	609,188
Celluloid and manufactures thereof	340,825
Cement	1,165,161
Chemical, drugs, dyestuffs, and medicines	16,296,642
Fertilisers, other than crude	766,982
Glass and glassware	2,433,904
Glue	298,796
Gunpowder and other explosives	3,568,038
Matches	72,297
Mercury	324,937
Naval stores	20,075,585
Oils, animal	577,218
Oils, mineral	77,025,196
Oil, vegetable (other than cotton)	2,232,661
Paints, pigments and colours..................	3,773,064
Paraffin and paraffin wax	8,808,245
Perfumery and cosmetics	534,095
Soap	2,781,179
Starch	1,490,797
Varnish	839,070

India; Revised Valuation Tariff of ——.

The tariff valuations in British India have been revised as from Jan. 1st last; the Customs notification, containing the new tariff in full, is reprinted in the "Board of Trade Journal" for Jan. 17, 1907.

New Book.

Customs Tariff of the United Kingdom from 1897–8 to 1906–7. [Cd. 3,198.] Price 3d.

This return gives particulars of the duties at present enforced on commodities imported into the United Kingdom, together with a statement showing the various alterations which have been made in the Customs Tariff of this country since 1897.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

949. Radford. Regenerative gas-heated furnaces. Jan. 14.

1076. Shaw. Concentrating or evaporating apparatus. Jan. 15.

1077. Camacho (Eastman). Vacuum production. Jan. 15.

1263. Jouve and Gautier. *See under* II.

1290. Reckliess, and Anton und Lehmann A.-G. Rotating drum filter.* Jan. 17.

1448. Robert. Drying chamber or steriliser.* Jan 19.

1595. Douge. *See under* V.

1603. Crawford. Receptacle for the transport, storage, and use of malt or other material deteriorating on exposure to air. Jan. 22.

1692. Kunick. Drying liquids. Jan. 22.

1741. Poncet. Rotary drying machines. [Fr. Appl., March 16, 1906.]* Jan. 23.

1843. Kestner. Abstracting from a liquid gases dissolved therein, and purifying water. [Fr. Appl., Jan. 24, 1906.]* Jan. 24.

2111. Wiart. Process for instantaneously producing a vacuum in a vessel. [Fr. Appl., Jan. 29, 1906.]* Jan. 28.

2148. Mecredy and Hawes. Apparatus for obtaining dry products from liquids and semi-liquids. Jan. 28.

2182. James and Richardson. Production of liquid air and other liquid gases. Jan. 29.

2242. Wiart. Means for producing a vacuum by instantaneous condensation of steam.* Jan. 29.

2373. Gill. Filters. Jan. 30.

2596. Prollius. Centrifugal separators. Feb. 1.

Complete Specifications Accepted.

1770 (1906). Cotton. Reverberatory furnaces. Jan. 30.

1852 (1906). Siemens Bros. and Co., and Gordon. Apparatus for measuring temperatures. Jan. 30.

4473 (1906). Mills (Hendricks). Desiccating apparatus. Jan. 30.

5997 (1906). Ducco. Rotary furnaces. Jan. 23.

16,002 (1906). Haddan (Aktiebolaget Separator). Centrifugal separator. Jan. 23.

16,009 (1906). Hoffmann. Rotary filters. Jan. 23.

18,405 (1906). Berretz. Shaft furnaces or kilns. Jan 30.

18,576 (1906). Von Seemen. Evaporating device. Feb. 6.

22,760 (1906). Whiteman (Hooven). Centrifugal separators. Jan. 23.

26,085 (1906). Aktiebolaget Separator. Centrifugal separator bowls. Feb. 6.

II.—FUEL, GAS, AND LIGHT.

Applications.

909. Helps. Bunsen burners. Jan. 14.

1075. Wise (Solvay et Cie). Continuous heat-regenerating arrangement for coke ovens.* Jan. 15.

1263. Jouve and Gautier. Purification of gases. Jan. 17.

1313. Daniels, Higgins, and Daniels. Gas producers for use with bituminous coal or other fuel containing volatile matters. Jan. 18.

1446. Robert. Artificial fuel from waste or refuse.* Jan. 19.

1562. Wise (Jones, Julia Mfg. Co.). *See under* XXIII.

1604. Wilputte and Brown. Regenerative coke ovens. Jan. 22.

1640. Campbell and Craig. Gas producers. Jan. 22.

1724. Holland. Gas producers. Jan. 23.

1780. Broad. Carburetters for producing combustible gas. Jan. 23.

1884. Potter. Manufacture of incandescent mantles. Jan. 25.

1971 and 1972. Parker. Distillation of coal and other hydrocarbonaceous substances. Jan. 25.

2090. Lessing. *See under* VII.

2123. Siemens und Halske A.-G. Manufacture of incandescence filaments for electric lamps from metallic thorium containing oxide. [Ger. Appl., March 29, 1906.]* Jan. 28.

2201. Clinch-Jones. Manufacture of combustible gas. Jan. 29.

2226. Verey and Downes. Manufacture of peat blocks or peat fuel. Jan. 29.

2676. Felten und Guilleaume-Lahmeyerwerke A.-G. Manufacture of water-gas. [Ger. Appl., Feb. 3, 1906.]* Feb. 2.

Complete Specifications Accepted.

929 (1906). British Thomson-Houston Co. (General Electric Co.) Filaments for incandescent electric lamps. Jan. 23.

1100 (1906). Lake (Trump). Gas producers. Jan. 23.

1257 (1906). Blakeley. Tar fog extractor for gases Jan. 23.

1936 and 1942 (1906). Lake (Heyl and Patterson, Inc.). Coal and like washers. Jan. 30.

2154 (1906). Grayson. Artificial fuel. Jan. 30.

2368 (1906). Tully and Shadbolt. Apparatus for the manufacture of gas. Feb. 6.

3809 (1906). Clapham and Clapham. Apparatus for extracting tarry and like matter from gases. Jan. 30.

7189 (1906). Bloxam (Lux). Manufacture of metallic filaments for electric incandescent lamps. Jan. 23.

13,787 (1906). Wilton. Gas washers. Feb. 6.

24,818 (1906). Winand. Working medium for internal combustion engines. Jan. 23.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

965. Agostini. Manufacture of paraffin candles.* Jan. 14.

1970. Parker. Treatment of pitch. Jan. 25.

2314. Wynne. Purification of petroleum oils. Jan. 30.

Complete Specifications Accepted.

1257 (1906). Blakeley. *See under* II.

3809 (1906). Clapham and Clapham. *See under* II.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

1472. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs and intermediate products. Jan. 19.

1592. Imray (Meister, Lucius, und Brüning). Manufacture of α-oxythionaphthenes. Jan. 21.

1593. Imray (Meister, Lucius, und Brüning). Manufacture of sulphurised dyestuffs. Jan. 21.

1594. Imray (Meister, Lucius, und Brüning). Manufacture of sulphurised leuco-bodies. Jan. 21.

1946. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of 4-nitro-2-chloro-diphenylamine and its derivatives. Jan. 25.

2255. Ostrogovich und Silbermann. Production of induline and induline-like colours. Jan. 29.

2568. Holliday and Sons, Turner, and Dean. Direct cotton dyestuffs. Feb. 1.

2592. Imray (Meister, Lucius, und Brüning). Manufacture of a red vat dyestuff and intermediate products. Feb. 1.

Complete Specifications Accepted.

3449 (1906). Arnold, Fox, Scott, and Roberts. Manufacture of nitro compounds. Jan. 23.

7029 (1906). Imray (Soc. Chem. Ind. in Basle). Manufacture of azo dyestuffs. Jan. 23.

14,191 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur, and of leuco compounds thereof. Jan. 30.

14,507 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Jan. 23.

23,864 (1906). Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of sulphurised dyestuffs. Jan 23.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

912. Walton. Dyeing and bleaching machines. Jan. 14.

973. Johnson (Chem. Fabr. Griesheim - Elektron). Removal of fatty or oily matter from wool, hides, skins, &c. Jan. 14.

1193. Blumenthal and Wolff. Mordanting fibrous materials.* Jan. 16.

1383. Mérou. Waterproof washable fabric. [Fr. Appl., Feb. 6, 1906.]* Jan. 18.

1549. Johnson (Kalle und Co.). Production of discharge effects on textile fibres or fabrics. Jan. 21.

1595. Douge. Recovery of volatile solvents distributed in the form of vapour in factories, especially artificial silk factories. [Fr. Appl., Jan. 22, 1906.]* Jan. 21.

1764. Gottlieb. Treatment of flax or like fibrous material. Jan. 23.

2356. Biedermann. Production of two-coloured or many-coloured effects on fabrics dyed in the piece. Jan. 30.

2428. Pickles and Pickles. Schreinering apparatus.* Jan. 31.

2626. Copley. Reinforcing or maintaining the strength of liquor in dye baths and the like. Feb. 2.

Complete Specifications Accepted.

27,222 (1905). Dreaper. Manufacture of artificial silk and like filaments. Jan. 30.

2906 (1906). Bousfield (Soc. Anon. Fabr. de Soie Artific. de Tubize). Manufacture of artificial silk. Jan. 30.

5836 (1906). Bailey. Machine for washing and treating textile piece goods. Jan. 30.

11,669 (1906). Tagliani. Dyeing indigo resist articles in the continuous vat. Jan. 23.

12,842 (1906). Friedrich. Washing and drying artificial threads. Feb. 6.

15,160 (1906). Ribbert. Preparation of discharge resists under vat dyestuffs on colours capable of discharge by hydrosulphites. Feb. 6.

18,508 (1906). Turlur. Yarn dressing and drying machines. Jan. 30.

19,107 (1906). Lederer. *See under* XIX.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

974. Johnson (Chem. Fabr. Griesheim-Elektron). Removal of arsenic from liquids and gases. Jan. 14.

1256. Jaubert. Decomposition of chlorates and perchlorates by combustion. [Fr. Appl., May 23, 1906.]* Jan. 17.

1625. Van Berckelaer. Manufacture of sulphates of iron and zinc and their derivatives.* Jan. 22.

1638. Crowther. Manufacture of ferric sulphate. Jan. 22.

1744. Knowles. Manufacture of carbonic acid gas. Jan. 23.

1844. Benker. Manufacture of sulphuric acid and neutral sodium sulphate from sodium bisulphate. [Fr. Appl., Nov. 21, 1906.]* Jan. 24.

2090. Lessing. Extraction of cyanogen from gases. Jan. 28.

2133. Johnson (Badische Anilin und Soda Fabrik). Manufacture of barium cyanide and barium oxide. Jan. 28.

2144. Humfrey. Manufacture of litharge. Jan. 28.

2484. Newton (Bayer und Co.). *See under* XX.

2534. Grossmann. Treatment of ammonia liquors before and after distillation. Feb. 1.

Complete Specifications Accepted.

2685 (1906). Winstanley. Lime treating machines. Jan. 23.

12,538 (1906). Gaillard. Apparatus for concentrating sulphuric acid. Jan. 30.

13,882 (1906). Walkey. Conversion of tribasic phosphate of lime into monobasic phosphate of lime and oxide of calcium. Jan. 30.

13,970 (1906). Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of aluminium hydroxide and aluminates. Jan. 23.

21,461 (1906). Garroway. Manufacture of acetate of alumina and by-products. Jan. 23.

27,290 (1906). Cie. des Prod. Chim. d'Alais et de la Camargue. Removal of silica from aluminate of soda in the manufacture of alumina. Jan. 30.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

1197. British Thomson-Houston Co. (General Electric Co.). Treatment of refractory materials. Jan. 16.

1381. Miller. Manufacture of artificial asphalt. Jan. 18.

1636. Ohlsson. Partially impregnating wood and other materials. Jan. 22.

1646 and 1647. Collos Portland Cement Co. (Colloseus). Manufacture of cement. Jan. 22.

1766. Wilmer. Artificial marble. Jan. 23.

1958. Roman Brick Co., Ltd., and Schauermann. Manufacture of bricks, pottery, building and like blocks. Jan. 25.

2131. Matcham. Cement kilns, and burning cement therein.* Jan. 28.

2442. Laeufer. Artificial wood. [U.S. Appl., Jan. 31, 1906.]* Jan. 31.

2460. Brooks (Asbestos Wood Co.). Production of refractory materials.* Jan. 31.

2605. Charles. Manufacture of artificial stones and building materials. [Ital. Appl., March 1, 1906.]* Feb. 1.

Complete Specifications Accepted.

1635 (1906). Nay and Ravello. Cement composition Jan. 23.

9785 (1906). Berglund. Manufacture of bricks of calcareous sand or the like. Feb. 6.

11,686 (1906). Wakefield. Non-heat-conducting composition for boilers and steam-pipes. Jan. 30.

20,298 (1906). South, Payne and Payne. Cement. Jan. 23.

24,477 (1906). Weaver. Concrete mixtures. Feb. 6.

X.—METALLURGY.

Applications.

3310A (1906). Crowley and Payne. Alloy or spelter for surfacing metals to facilitate joining. Oct. 25.

906. Cowper-Cowles. Removal of scale and oxide from metallic surfaces. Jan. 14.

1085. Cowper-Coles. Magnetic separators.* Jan. 15.

1174. Powell. Manufacture of steel. Jan. 16.

1259. Frith (Grist). Treatment of steel and steel alloys. Jan. 17.

1344. Merralls. Cyaniding process and apparatus.* Jan. 18.

1431. Boult (Proeckelt, and Nordböhmische Automobil Zentrale). Soldering aluminium, aluminium alloys, &c. Jan. 19.

1537. Heskett. Continuous extraction of zinc from its sulphide. Jan. 21.

1615. Twynam. Concentration of argillaceous iron ores. Jan. 22.

1639. Gutensohn. Recovery of tin from tin slag. Jan. 22.

1699. Pratt. Refining copper. Jan. 22.

2058. Sulman. Separation of zinc from its sulphate. Jan. 26.

2361. Schieber. Welding copper, nickel, and their alloys. Jan. 30.

2377. Hadfield. Improving the magnetic qualities of a magnetic body. [U.S. Appl., July 5, 1906.]* Jan. 30.

2436. Nettell and Nettell. Treatment of complex and other ores. Jan. 31.

2446. Fraser and Blackie. Obtainment of metallic lead. Jan. 31.

Complete Specifications Accepted.

24,647 (1905). Sterne (Block). Drying air for metallurgical operations. Feb. 6.

25,122 (1905). Hybinette. Process of separating metals. Feb. 6.

800 (1906). Sterne (Block). Desiccation of air in metallurgical operations. Jan. 23.

960 (1906). Webb, Brettell, and Adamson. Smelting iron and other metals. Jan. 23.

8667 (1906). Coslett. Treatment of iron or steel to prevent oxidation or rusting. Jan. 30.

8894 (1906). Dannert. Production of metallic alloys. Jan. 23.

12,729 (1906). Rousseau. Melting and converting furnaces for steel and other metals. Jan. 30.

17,699 (1906). Jayne and Knight. Apparatus for extracting gold from auriferous sand by amalgamation. Jan. 30.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

1628A (1906). Schmitz. Electroplating apparatus.* Jan. 21.

1080. Soc. des Proc. Gin pour la Métallurgie Electrique. Electric induction furnaces. [Fr. Appl., March 7, 1906.]* Jan. 15.

1658. Grönwall, Lindblad, and Stalhane. Electric smelting furnaces. [Swed. Appl., Jan. 26, 1906.]* Jan. 22.

1678. Connolly. Insulating materials. Jan. 22.

Complete Specifications Accepted.

1628 and 1628A (1906). Schmitz. Electroplating apparatus. Jan. 30.

2552 (1906). Betts. Electric furnaces. Feb. 6.

9435 (1906). Edwards (Hille und Muller). Depositing metal coatings on sheet metal by electrolysis. Jan. 30.

22,319 (1906). Dannert. Increasing the electric capacity of spongy lead plates for storage batteries. Jan. 23.

28,370 (1906). Hiorth. Electric furnaces. Feb. 6.

28,959 (1906). Hiorth. Electric smelting furnaces. Jan. 30.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

1470. Steimel. Purification of lubricating oil.* Jan. 19.

1771. Savary. Antiseptic soaps.* Jan. 23.

2493. Fischer (Knopf). Production of oil and elements of ointments soluble in water.

2519. Soc. Franç. La Crêmouline. Super-alkalinated dry soap in compressed cakes. [Fr. Appl., Jan. 7, 1907.]* Jan. 31.

Complete Specifications Accepted.

26 917 (1905). Harvey and Simpson. Decomposition of oils and other organic bodies. Jan. 30.

6712 (1906). Jackson. Detergent. Feb. 6.

18,810 (1906). Arcêluz. Lubricating composition. Jan. 30.

21,172 (1906). Boult (Van de Kerckhove). Treatment of vegetable oils. Feb. 6.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

3413 (1906). Ellis. Paint and varnish remover. Jan. 23.

(*B.*)—Resins, Varnishes.

Application.

2559. Laboschin. *See under* XX.

(*C.*)—India-Rubber.

Applications.

1426. Morris and Mitchell. Resilient material. Jan. 19.

2065. Brownlow. Artificial rubber.* Jan. 28.

2289. Passmore. Preparation or regeneration of rubber. Jan. 29.

Complete Specification Accepted.

2791 (1906). Jackson. Manufacture of india-rubber and like compositions. Feb. 6.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

973. Johnson (Chem. Fabr. Griesheim-Elektron). *See under* V.

Complete Specification Accepted.

2230 (1906). Glasel. Tanning and depilating hides and skins. Feb. 6.

XV.—MANURES, &c.

Complete Specification Accepted.

26,887 (1905). Thompson (Schlutius). Manufacture of artificial manures. Jan. 30.

XVI.—SUGAR, STARCH, GUM, &c.

Complete Specification Accepted.

2859 (1906). Ahrberg. Centrifugal machines used in the manufacture of sugar. Feb. 6.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

978. Goldsmith, and The British Xylonite Co Purification of alcoholic and other substances. Jan. 14.

1101. Mackenzie (Deckebach). Process for cooling wort.* Jan. 15.

1602. Crawford. Process and apparatus for brewing. Jan. 22.

1603. Crawford. *See under* I.

1959. Elsner and Guttwein. Drying green malt. [Ger. Appl., May 9, 1906.]* Jan. 25.

2591. Reynaud and Frestadius. Treatment of pot-ale. Feb. 1.

Complete Specifications Accepted.

1962 (1906). Faulkner, and Savilles, Ltd. *See under* XVIII*A*.

3885 (1906). Reid, Le May, Christian, and Adlam. Treatment of beer, stout, cider, and other fermented liquids. Jan. 23.

16,741 (1906). Cousins. Treatment of spirituous liquors. Jan. 30.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

1041. De Crignis. Production of a readily-digested foodstuff from grain.* Jan. 15.

1667. Harrison. Food materials.* Jan. 22.

Complete Specifications Accepted.

1962 (1906). Faulkner, and Savilles, Ltd. Production of material for use as yeast food from brewers' grain. Jan. 23.

10,767 (1906). Bath and Allard. Antiseptic compound for preserving milk. Jan. 30.

22,006 (1906). Müller. Manufacture of an alimentary product. Jan. 23.

27,153 (1906). Kurz. Preservation of meats. Jan. 30.

(*B.*)—Sanitation; Water Purification.

Applications.

1079. Ryder and Wilson. Materials for purifying air.* Jan. 15.

1843. Kestner. *See under* I.

1879. Craven. Treatment of sewage. Jan. 25.

1940. Chabanel. Treatment of sewage. Jan. 25.

2166. Krüger. Water purifying apparatus.* Jan. 28.

Complete Specifications Accepted.

10,050 (1906). Candy. Treatment of hard water. Jan. 23.

14,968 (1906). Ogden. Apparatus for purifying the medium in sewage and other filtering beds. Jan. 23.

17,997 (1906). Evans-Jackson (Oesterr. Verein f. Cellulose-fabr.). Purifying the water used in factories. Feb. 6.

(*C.*)—Disinfectants.

Complete Specification Accepted.

20,680 (1906). Houghton. Antiseptic compounds. Jan. 30.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

1314. Langheck und Co. Covering paper or other surfaces with gelatin. [Ger. Appl., May 18, 1906.]* Jan. 18.

1903. Schmidt. Restoration and re-application of the waste waters of paper machines. Jan. 25.

1975. Rylance and Hills. Manufacture of waterproof paper. Jan. 26.

2026. Wetter (Knoll und Co.). Manufacture of acid esters from cellulose or its transformation products.* Jan. 26.

2113. Jacobs, Jacobs, and Brockwell. Non-inflammable substitute for celluloid. Jan. 28.

2432. Howarth. Blotting paper. Jan. 31.

2511. Feeny (Bemberg A.-G.). New cellulose compound.* Jan. 31.

Complete Specifications Accepted.

5219 (1906). Harrison (Parker). Reclaiming pulp from waste water. Jan. 30.

14,253 (1906). Pantin and Tolputt, Exors. of Abel (Act.-Ges. f. Anilinfabr.). Manufacture of cellulose esters of fatty acids. Jan. 30.

19,107 (1906). Lederer. Cellulose compounds and their application for the manufacture of filaments, films, &c. Jan. 30.

23,684 (1906). Scheufelen and Scheufelen. Removing glaze from printed paper. Feb. 6.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

942. Daege, Knoll, and Knoll. Compounds suitable for use in medicine and pharmacy.* Jan. 14.

1948. Imray (Basle Chemical Works). Manufacture of camphene.* Jan. 25.

2484. Newton (Bayer und Co.). Manufacture of new iodine preparations. Jan. 31.

2520. Bedford and Williams. Reduction of organic substances. Jan. 31.

2559. Laboschin. Rendering volatile oils, balsams, &c., soluble in water.* Feb. 1.

2565. Boult (Miersch). Obtaining aromatic sulphonic acids and their alkali salts from sulphonating mixtures.* Feb. 1.

2586. Soc. Anon. Etabl. Poulenc Frères, and Fourneau. Preparation of amino-acid alcohols and their derivatives. [Fr. Appl., Feb. 1, 1906.]* Feb. 1.

Complete Specifications Accepted.

678 (1906). Tompkins. Production of chloracetic ether. Jan. 23.

3449 (1906). Reid and others. *See under* IV.

7297 (1906). Lance and Elworthy. Manufacture of methyl alcohol from methane. Jan. 23.

8266 (1906). Weizmann, and Clayton Aniline Co. Manufacture of isobornyl esters. Jan. 30.

15,064 (1906). Anhalt-Ges. Production of permanently clear tinctures. Jan. 30.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

993. Schwartz. Preparation of paper for photographic purposes.* Jan. 14.

1229. Wishart. Daylight development of photographic plates and films. Jan. 17.

1314. Langheck und Co. *See under* XIX.

1454. Smith. Manufacture of films for photographic and other purposes. [Ger. Appl., Jan. 19, 1906.]* Jan. 19.

1883. Croft. Photographic printing papers or surfaces. Jan. 25.

1928. Hans. Producing photographs on porcelain, metal, glass, &c. Jan. 25.

2155 and 2156. Cooper. Photographic printing-out papers. Jan. 28.

2461. Smith and Merckens. The bleach-out process of colour photography. [Ger. Appl., Feb. 2. 1906.]* Jan. 31.

2462. Smith and Merckens. Sensitising bleaching-out colours. [Ger. Appl., Feb. 3, 1906.]* Jan. 31.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

1354. Haffner. Manufacture of matches. [Belg. Appl., Jan. 18, 1906.]* Jan. 18.

1357. Haffner. Ignition mass for matches. [Belg. Appl., Feb. 21, 1906.]* Jan. 18.

1784. Rheinische Dynamitfabrik. Manufacture of plastic nitroglycerin explosives. [Ger. Appl., Feb. 10, 1906.]* Jan. 23.

1860. Cocking. Manufacture of nitrocellulose. Jan. 24.

2286. Wessel. Manufacture of explosives. [Appl. in Norway, Feb. 7, 1906.]* Jan. 29.

Complete Specifications Accepted.

1573 (1906). Grobet. Manufacture of safety explosives. Jan. 30.

2985 (1906). Laszczynski. Manufacture of explosives. Jan. 23.

16,809 (1906). Thompson. Machines for cutting explosive powder strips. Jan. 23.

19,781 (1906). Silberrad. Explosives for propellant purposes. [Secret Document under Sect. 44, Patents Act, 1883.] Jan. 23.

1354 (1907). Haffner. Manufacture of matches. Feb. 6.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Applications.

1562. Wise (Jones, Julia Mfg. Co.). Method of and apparatus for analysing gases. Jan. 21.

2419. Grossmann. Portable refractometer. Jan. 31.

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THE DETERMINATION OF HIGHER ALCOHOLS IN SPIRITS.

Part I.—The "Ester-Iodine" Method.

BY C. H. BEDFORD, D.SC., M.D., I.M.S., AND R. L. JENKS, F.I.C.

(From the Central Excise Laboratory for India, Kasauli.)

(Communicated by the Hon. Sec. of the Section.)

In a report recently furnished by one of us to the Government of India ("On the Quality, Manufacture and Excise-Control of Alcoholic Liquors in India") reasons were given for determining the higher alcohols in the very large number of potable spirits then examined by means of the Allen-Marquardt process rather than by any other existing method. At the beginning of the investigation all recognised methods had been carefully tested comparatively, with the result that Röse's chloroform process and Savalle's sulphuric acid method and their various modifications were definitely rejected as being unsound theoretically, and as giving misleading results in practice. The Allen-Marquardt process (Allen's "Commercial Organic Chemistry," 1898, vol. i., p. 154) was found, after due trial with known weights of pure alcohols, to have the objection that although amyl alcohol by itself can be determined with a high degree of accuracy, the intermediate alcohols (normal butyl, isobutyl, and normal propyl) are also returned but with notably low results, whilst, in addition, isopropyl alcohol is theoretically undeterminable by the method, owing to its oxidation to acetone instead of to an acid. It appears, then, that this method gives in the case of spirits neither amyl alcohol only nor the whole of the alcohols higher than ethyl.

Section I. of Table A records some of many actual results in illustration of the above. Throughout the table the quantities are stated in milligrams and the amounts found are calculated as a percentage of the amount taken. This is a somewhat severe mode of returning the results as the quantities dealt with are so small, but it appears the most convenient for the purpose in view.

The losses shown in Section I. may be due to two causes :—(1) The failure of carbon tetrachloride to extract the intermediate alcohols from the alcoholic brine solution (density, 1·1); or (2) loss by washing the tetrachloride extract before oxidation.

Section II. of the table shows that part of the losses observed arise from the second cause, *i.e.*, in the later stages when the carbon tetrachloride solution of the higher alcohols is washed with (*a*) saturated brine to remove the small quantity of ethyl alcohol also dissolved in the tetrachloride, and (*b*) with saturated sodium sulphate to remove chlorides and any remaining traces of ethyl alcohol.

It was thus clear that the results obtained by the Allen-Marquardt process practically represent amyl alcohol together with small percentages of lower alcohols, and, for the purposes of the Government inquiry above referred to, the process was adopted on the following grounds :—

(1) The method is an accepted one and many results obtained by it are on record.

(2) The Indian liquors under investigation were mainly of the pot-still type, and direct fractionation indicated a great preponderance of amyl over other higher alcohols.

(3) No time was then available for re-examining the whole question and devising a new method.

(4) Amyl alcohol is the most important higher alcohol from the point of view of physiological activity.

Patent-still spirits (unless sophisticated), and more particularly when "rectified," show very moderate amounts of fusel oil by this method, and it was clear that fairly large quantities of, say, normal propyl and isobutyl alcohols might be present and yet escape determination. In view of the very extended use of patent-still spirit for potable purposes and the injurious effects popularly attributed to it when sold in the form of cheap spirits, a method of determining accurately the intermediate alcohols (*i.e.*, those between ethyl and amyl) has become necessary. For this purpose, the losses caused by the washing stages were first examined, known weights of the chief higher alcohols in dry carbon tetrachloride being washed with various agents, the tetrachloride being then separated and oxidised.(1) It was found that washing with saturated sodium sulphate solution caused practically no loss in the case of the butyl alcohols dissolved in carbon tetrachloride, but that it removed a large percentage of the two propyl alcohols.

Saturated calcium chloride solution gave excellent results with the two butyl alcohols and normal propyl alcohol, though an appreciable amount of isopropyl alcohol was removed by it. These results indicated a mode of improving the washing stages of the Allen-Marquardt process, but left for further treatment the defective extraction from the brine preparation; and, what is the most practical disadvantage of the whole method, the serious length of time (three days) required to complete an analysis by it.

Under these circumstances, the method of esterifying with nitrous acid a solution of the higher alcohols in carbon tetrachloride, liberating the nitrous acid and titrating with permanganate, as put forward by Beckmann, was again examined, earlier attempts to utilise the method having failed. Various modifications of the process have been described by him from time to time, each differing from the last to a considerable extent (Z. Untersuch.-Nahr.- u. Genussm, 1899, 709; 1904. 1059; 1905, 143; and this J., 1900, 383; 1902, 193; also "Analyst,"1905, 369.)

Section III. of Table A. shows the kind of results obtained by the 1901 method, which made its adoption impossible for the purposes of the previously-mentioned Government inquiry. The second and improved set of results was obtained by separating the aqueous solution of nitrous acid from the tetrachloride, and then filtering it before titration. The determination of nitrous acid by permanganate solution in the presence of various alcohols and of the organic matter derived from the ice is theoretically unsound, and this step alone renders all forms of the Beckmann method unworkable. Other details are equally open to criticism. By the 1901 method a large proportion of the intermediate alcohols present is extracted, and the amyl alcohol factor cannot fairly be used for the whole amount found unless this is clearly realised and allowed for. Further, the mode of washing is tedious and costly in material. By the entirely different 1905 method, little more than amyl alcohol is extracted, and of this an appreciable amount is lost again by the mode of washing adopted. For example :—

Section IV. of Table A. shows how readily plain water removes the alcohols from their solution in carbon tetrachloride. In every instance the amount lost was found in the aqueous washings by simply oxidising and titrating a distillate. It was therefore necessary both to revise the conditions for extraction and to substitute a trustworthy method for the fallacious permanganate titration. (2)

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(1) The results with isopropyl alcohol were carried out to complete the series after a method for determining this alcohol (*vide infra*) had been devised.

Dunstan and Dymond (Pharm. J. (3), **19**, 741, and Sutton's "Volumetric Analysis" (1904), 270) have shown how to determine organic nitrites by allowing them to act on an acid solution of potassium iodide in a flask void of oxygen, and then titrating the liberated iodine with thiosulphate. We have successfully applied the method with certain modifications to the present purpose. The apparatus figured in Sutton (*loc. cit.*) proved difficult of manipulation, owing to the softening action of the carbon tetrachloride on the rubber joint, and the rapid deterioration of all rubber tubes which occurs in India. We prefer to use an ordinary pear-shaped separator funnel of about 12 oz. capacity and 3½ in. in diameter, provided with a well-ground stopper and tap, the stem of which is about 5/16 in. broad, and is cut to a length of 2 in., terminating with a chisel edge. This is connected by a clean-bored rubber stopper to a round-bottomed flask of 8 or 9 oz. capacity. The whole is conveniently hung in a 3½ in. ring (wrapped with cotton) on an ordinary retort-stand, and the contents of the lower vessel can thus be vigorously shaken even without removing it from the stand. A 2½ in. ring (also wrapped with cotton) is brought up to the base of the flask whenever it is desired to fix the whole rigidly, and is lifted an inch or so higher when it is necessary to shake the contents of the upper vessel. The tap and its socket must be rigorously clean and dry before use, and should be freely covered with vaseline, so that the whole appears translucent when in position. When the flask has been freed from air by boiling, the flame is removed with one hand; the tap is simultaneously closed with the other, and then screwed firmly into exact position with both hands. If the tap is properly dried and greased at the start it will remain airtight and will move freely when the apparatus is quite cold, though it may appear to be jammed whilst cooling is taking place.

This form has proved most satisfactory in working, one special feature being that, if the glass stopper is always placed in the funnel whenever liquid is passed through the tap to the lower vessel, the risk of air being carried into the latter is greatly diminished. When a solution of amyl nitrite in carbon tetrachloride was added to the acid solution of potassium iodide in the vacuous flask, only a small amount of decomposition took place. It required persistent shaking and subsequent standing for nearly 24 hours to effect liberation of iodine equivalent to all the nitrite present. By boiling the iodide solution down to about 10 c.c., adding the carbon tetrachloride solution and then running in about 20 c.c. of strong alcohol (*e.g.*, S.V.R.) the nitrite is quantitatively decomposed, usually after vigorous shaking for a few minutes, though it is desirable to allow the flask to stand for about an hour before actual titration and to keep it under observation for some hours longer. This hindrance to the rapidity of the method is most marked in the case of amyl alcohol by itself; the lower alcohol nitrites decompose much more readily and their presence (as in mixtures) appears to hasten the decomposition of the amyl compound itself. Section V. of Table A gives the results of the first three experiments made in this manner on an unknown solution of commercial amyl nitrite in carbon tetrachloride in support of the statements made by Dunstan and Dymond (*loc. cit.*). Section VI. shows results obtained by esterifying known weights of various alcohols dissolved in carbon tetrachloride and determining them by the iodine method. As regards the details of esterification, passing dried nitrous acid gas into the carbon tetrachloride solution proved tedious and inconstant. Beckmann's method of adding 1 grm. of sodium nitrite and 2 grms. of acid potassium sulphate (powdered together) gives excellent and rapid results if the vessel used is dry; is of small capacity, *i.e.*, with a small air space above the liquid; and is kept stoppered. A small tapped and stoppered separating funnel of about 170 c.c. capacity (or less) for 100 c.c. of carbon tetrachloride serves the purpose well. High results are always obtained if discernible moisture is present, but if the liquid and vessel are absolutely dry the time of esterification must be lengthened. The degree of moistness resulting in the method described later for the extraction gives good results. These analyses showed that if the higher alcohols could be accurately extracted by carbon tetrachloride, a much quicker method than oxidation by chromic acid (Allen-Marquardt), and one far more accurate than any process involving titration by permanganate (Beckmann), would be available for their determination. It only remained to investigate the conditions under which (*a*) any, or (*b*) all of the alcohols higher than ethyl alcohol are quantitatively removed from spirits by means of carbon tetrachloride. As Allen-Marquardt's method appears to return practically amyl alcohol only it seemed most important to ascertain first the conditions for the extraction of the *whole* of the higher alcohols. By combining the two methods it was presumed that a measure of the intermediate alcohols (*i.e.*, the butyls and propyls) could be arrived at by difference. This was expected to be of particular interest in the case of rectified spirits and to possibly give desirable information with regard to patent-still spirit. The conditions for rigidly extracting amyl alcohol only are also under examination and the details will be set forth in Part II. of this communication.

Conditions for extracting total higher alcohols.—A large number of experiments were made with spirit of different strength as regards ethyl alcohol, with different substances for saturating it, and with different washing agents. The first point is of greater importance than appears to have been generally realised, and the fact that in Allen-Marquardt's process the proportion of ethyl alcohol in the brine preparation (density, 1·1) may vary considerably is certainly one cause of variability in the results. Finally, it was found that by (1) diluting the spirit to be examined(3) to 20 per cent. by vol. of ethyl alcohol; (2) adding to 30 c.c. of this 25 grms. of dry granular calcium chloride (cooling under the tap meanwhile); (3) shaking this with two successive quantities of 50 c.c. of carbon tetrachloride; (4) washing the resulting 100 c.c. of carbon tetrachloride with two successive quantities of 30 c.c. each of saturated calcium chloride solution (density, 1·4); (6) esterifying the washed carbon tetrachloride solution of the higher alcohols as above; and (7) finishing by the iodine method described above, excellent determinations of the *total* alcohols (higher than ethylic alcohol) were readily obtained. The method can easily be completed in one day.

This process resembles in many details that described by Beckmann in 1901. That method, though stated to be one for the determination of amyl alcohol, certainly extracts from the spirit a very large percentage of the intermediate alcohols present also. His mode of washing the tetrachloride is accurate, though tedious, but we consider that the use of permanganate solution is a fatal source of error. By saturating the spirit (at 20 per cent. vol.) rather more thoroughly (*i.e.*, using 25 instead of 20 grms. of solid calcium chloride), and finishing by the iodine method, the whole of the alcohols higher than ethyl alcohol is determined with accuracy except in the case of one alcohol (*vide infra*). Section VII. of the table shows the results obtained by our method from known weights of the individual higher alcohols dissolved in carefully rectified alcohol diluted to 20 per cent. by volume. It will be noticed that isopropyl alcohol gives a result 30 per cent. too low, and, after many trials, we conclude that a minus error of this magnitude is unavoidable. The sources of error are doubtless (1) the extreme hygroscopicity of this alcohol, so that the amount weighed out always contains water; and (2) the difficulty of separating isopropyl alcohol from its solution in ethyl alcohol. The other results show errors of about 5 per cent., which may be expected when the nature of the process as a whole is considered. In the case of the amyl alcohol determination, for instance, the result would give 590 parts per 100,000 of alcohol instead of 570, which is sufficiently near for practical purposes. Similarly, Section VIII. shows the results obtained on mixed standards. Allowing for the 30 per cent. loss on the isopropyl alcohol, the total results are only 3 per cent. and 5 per cent. respectively lower than the theoretical. The spirit, in which these mixed standards were made up, was previously put through the process, and a small quantity of higher alcohols found, which was also allowed for. Beckmann laid stress in 1901 on the amount and method of shaking in order to secure constant results. In the 1905 method shaking by hand only is advised. We extract in 24 oz. cylinders provided with carefully ground taps and stoppers. These are shaken—two at a time—for seven minutes in a Dunstan shaker, which can readily be adapted to hold them as follows:—The sliding cross-piece is removed and depressions cut in the wall of the car furthest from the wheel on either side of the one already provided in the machine. Each cylinder is placed in the car lengthwise, stopper downwards, with the sloping shoulder near the tap resting in the depression made for it. To receive the stoppered end of the cylinder an ordinary wooden match-box stuffed with cotton wool is placed as a buffer in the corner, with one "striking face" of the box uppermost, and secured in position by a tack. This forms a resilient surface, and if a vertical slit is made in the forward face of the box in the direction of its grain, the flat stopper-head enters and rests on the cotton wool and the whole cylinder is prevented from moving laterally. A band of webbing passed over the cylinders where the shoulders rise above the level of the car, and fastened with a buckle, forms a rapid means of securing the cylinders in the car.

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(2) It should perhaps be mentioned that reference to the original papers was impossible, so that the English abstracts have been relied on.

(3) The sample is first neutralised with standard alkali (acid estimation), boiled under reflux condenser with excess of standard alkali and neutralised (ether determination), boiled for an hour under reflux condenser with Hewitt's reagent (to fix aldehydes), and then distilled before estimation of higher alcohols.

Determination of intermediate alcohols.—A number of samples of spirits were examined by Allen-Marquardt's method, and the total volume of decinormal barium hydroxide solution required to neutralise the acids derived from 100,000 parts of alcohol were calculated in each case. Each spirit was also examined by the "ester-iodine" method now described, and the volume of decinormal iodine equivalent to the esters of the total higher alcohols also calculated per 100,000 parts of alcohol. If the first figure measures practically amyl alcohol, the difference between the two is a measure of the intermediate alcohols (butyl and propyl). In Table B these results are tabulated, the baryta figures having been multiplied by 0·0088 (the amyl factor), and the iodine-less-baryta results by 0·0074. This last is the factor for butyl alcohol, and no doubt propyl alcohol (factor, 0·0060) was also present. As, however, the method fails to return 30 per cent. of the isopropyl alcohol, and 70 per cent. ×0·0076 is nearly 100 per cent. × 0·006, this approximation seems the most satisfactory, especially as no evidence exists for using the mean molecular weight. In the last column the ratio of amyl alcohol to intermediate alcohols is calculated. The rectified spirits show a markedly high ratio of intermediate alcohols, as might be expected, and it seems just possible that this ratio may give some reliable analytical evidence as to the dilution of pot-still spirits with patent-still spirits. This point we are at present investigating. The instances here given of spirits marked "patent-still" were undoubted samples of patent-still origin. Unfortunately, they had all been sophisticated as regards their fusel-contents, so that their indications on this question cannot be accepted. Genuine blends of patent-still spirits with pot-still are at present under examination, but we prefer to leave for the second portion of this paper the point above indicated. As before stated, we have definite indications that Allen-Marquardt's mode of extraction does not return amyl alcohol only in all cases; our work in this direction, also, is not yet complete.

It has, however, seemed desirable to publish at this stage our methods: (1) for extracting the whole of the higher alcohols (except a portion of isopropyl alcohol) from spirituous liquors; and (2) for rapidly determining higher alcohols in a carbon tetrachloride extract (ester-iodine method), the actual interpretation of the result in regard to any spirit (*i.e.*, the factor to be employed) being dependent only on the conditions selected for making the extract.

TABLE A.—*Determinations of higher alcohols by different methods under various conditions.*

Alcohol.	Mgrms. taken.	Mgrms. found.	Yield.
I.—Allen-Marquardt Process.			
			per cent.
Amyl (*a*) ..	200	189	94·5
(*b*) ..	156	156	100
(*c*) ..	100	93	93
(*d*) ..	51	56	110
n-Butyl (*a*) ..	200	79 and 64	39 and 32
(*b*) ..	146	52 ,, 54	30
(*c*) ..	100	62 ,, 36	62 and 36
(*d*) ..	50	35	70
Isobutyl (*a*) ..	200	80 and 55	40 and 27
(*b*) ..	147	50 ,, 40	34 ,, 27
(*c*) ..	100	52 ,, 26	52 ,, 26
n-Propyl (*a*) ..	200	45 ,, 61	22 ,, 30
(*b*) ..	160	30 ,, 21	19 ,, 13
(*c*) ..	100	29 ,, 31	29 ,, 31
Isopropyl (*a*) ..	200	14 ,, 13	—
(*b*) ..	100	13 ,, 11	—
II.—Losses caused by the washing stages in Allen-Marquardt's process. Known weights of each alcohol were dissolved in 100 c.c. of dry carbon tetrachloride, and the solution washed with (A) *50 c.c. of saturated brine,* (B) *50 c.c. of saturated sodium sulphate, and finally oxidised*			
Amyl	169	170	100
n-Butyl	130	133	100
Isobutyl	132	104	78
n-Propyl	120	73	61
Isopropyl	123	63	51
III.—Beckmann's 1901 Method.			
(*a*) Amyl	167 84	280 233	167 278
n-Butyl	88	117	133
n-Propyl ..	175	378	216
(*b*) Amyl	84	73	87
Isobutyl ...	175	182	104
n-Butyl ...	88	71	81
IV.—Showing the effect of washing carbon tetrachloride containing known weights of higher alcohols with plain water (Beckmann, 1905).			
Amyl	169	132	78
n-Butyl	97	74	76
n-Propyl	120	38	32
V.—Determination of amyl nitrite in carbon tetrachloride iodometrically.			
Amyl nitrite ..	—	157	—
Amyl nitrite ..	—	161	—
Amyl nitrite ..	—	161	—
VI.—Determination of known weights of higher alcohols in carbon tetrachloride by esterification and iodine liberation ("ester-iodine" method).			
Amyl	169	167	99
n-Butyl	130	132	101
Isobutyl	132	123	93
n-Propyl	120	122	101
Isopropyl	124	123	99
VII.—Determination of known weights of higher alcohols in aqueous alcohol by the "ester-iodine" method			
Amyl	114	118	104
n-Butyl	162	173	107
Isobutyl	153	161	105
n-Propyl	120	114	95
Isopropyl	123	86	70
VIII.—A mixture of amyl, 40 per cent; n-butyl, 17 per cent; isobutyl, 16 per cent; n-propyl, 18 per cent.; isopropyl, 9 per cent. (30 per cent. loss allowed for).			
Mixture as above	184	189	103
IX.—A mixture of amyl, 9 per cent.; n-butyl, 20 per cent.; isobutyl, 20 per cent.; n-propyl, 40 per cent.; isopropyl, 11 per cent. (30 per cent. loss allowed for).			
Mixture as above	152	160	105

Table B.—*Showing the ratio of intermediate alcohols (butyl and propyl) to amyl alcohol in spirits :—*

	Amyl alcohol. (*a*)	Intermediate alcohols. (*b*)	Ratio amyl to intermed. alcohols.
	Per 100,000 of ethyl alcohol.	Per 100,000 of ethyl alcohol.	
Rectified spirits—			
English	142	741	5·2
Indian	209	850	4·0
Pot-still spirits—			
Irish	664	780	1·2
Indian	291	380	1·2
Patent-still spirits—			
Cheap whiskey (1)	461	923	2·0
Cheap whiskey (2)	416	667	1·6
Cheap brandy....	384	556	1·4

(*a*) Calculated from Allen-Marquardt result.

(*b*) Propyl and butyl alcohols calculated from total alcohols (by ester-iodine method) less Allen-Marquardt result.

Discussion.

Mr. A. C. Chapman said the main difficulty of the problem lay in the extraction of the higher alcohols rather than in their estimation when extracted, and he was somewhat surprised to learn that the authors had succeeded in effecting so sharp a separation of *n*-propyl from ethyl alcohol, as the numbers they had given went to show. The authors had apparently found that amyl alcohol was practically the only one extracted by the Allen-Marquardt process, and this was confirmed by his own experience, for whenever he had determined the mean molecular weight of the fatty acids obtained, the results had invariably pointed to valeric acid, with much smaller proportions of butyric acid, and practically none of the lower acids. Schidrowitz and Kaye had already found the Beckmann process exceedingly unreliable, though more recently Beckmann himself had introduced a modification of the process which rendered it capable of giving more trustworthy results. He (Mr. Chapman) did not think that it would be safe to assume that the Allen-Marquardt process estimated only the amyl alcohol, and that the other higher alcohols could be estimated by difference in the manner proposed by the authors. The Allen-Marquardt process possessed at least one great advantage over the other processes, in that the actual oxidation products of the extracted alcohols were obtained, and could, if necessary, be used for purposes of examination and identification. It was true that isopropyl alcohol could not be estimated by this process, but even in the process as modified by the authors, there was a loss of about 30 per cent. He was much struck with the very high results which the authors had obtained, the total higher alcohols in several cases amounting to more than 1,000 parts per 100,000 parts of absolute ethyl alcohol. Might this not be due to the failure in some cases to separate completely the last traces of ethyl alcohol ?

Meeting held at Burlington House on Monday, Feb. 4, 1907.

MR. E. J. FRISWELL IN THE CHAIR.

CHEMICAL COMPOSITION OF RUBBERS.

BY PHILIP SCHIDROWITZ, PH.D., AND FREDERICK KAYE, A.R.C.SC.

I.—THE CHEMICAL COMPOSITION OF SOME MOTOR TYRE RUBBERS.

Introduction.

In view of the immense importance which the pneumatic motor tyre industry has attained during the last decade, it is somewhat remarkable that there is so little concerning the chemical composition of motor tyre rubbers to be found in the literature of this subject. It occurred to us, therefore, that an examination of tyres of representative makes would in any case be of interest, and that it might possibly also lead to results of some practical utility, inasmuch as there is little doubt that tyre failures are not infrequently to be attributed to defects in the rubber mixings employed.

During the course of the work, the results of which are recorded below, and also in regard to such conclusions as we have been able to arrive at, we have striven to keep in mind the practical desiderata required of a pneumatic tyre and the technical difficulties involved in its production. The main attribute demanded of a penumatic tyre is that it shall *absorb*, but not resist, the obstacle. This it does by virtue of the air-cushion contained in the inner-tube. In order that this absorbing or enfolding action of the air-cushion may have full play it is necessary that the tyre cover should not be too hard or too resistant. The cover, then, must possess considerable resilience or elasticity, combined with a degree of toughness or hardness, to resist the mechanical and frictional stresses due to the surface over which it may have to pass. If the cover is too hard, the interior air-cushion does not get fair play ; if the cover is too soft, it will be rapidly cut to pieces, and its value as a protective be at an end. But yet another point has to be kept in mind, which is that excessive hardness not only diminishes the value of the services of the air-cushion, but that it leads to cracking and stripping. These brief considerations will serve to indicate the general nature of the difficulties with which the pneumatic tyre maker is beset. These difficulties may be broadly classified as (*a*) mechanical, (*b*) chemical. Under (*a*) there are the difficulties connected with selection, preparation and insertion of the constructive fabrics employed in connection with the rubber, the methods of attachment, and so on. With these we have no concern in the present communication. Under (*b*) we understand all that pertains to the preparation of the rubber substance employed.

The quality of the rubber mixing and its suitability for the purpose desired depends mainly :—(*a*) On the quality of the rubber as such ; (*b*) on the state of vulcanisation ; (*c*) on the quantity of the admixtures (mineral matter, substitutes, recovered rubber) ; (*d*) on the nature of (*c*).

Discussion of these in detail will be deferred until after the experimental work and its results have been described.

Experimental.

The samples.—Seventeen covers[1], representing the goods of seven leading makes at home and abroad, were examined. The general character of the samples will be gathered from Tables I. and II. Some of these were practically new tyres, others again had been run for some time. As a rule, the quality of the rubber forming the tread differs very considerably from the quality of the rubber forming the sides and the layer next to the tread, but separated from the same by a constructive fabric. The reason for this is obvious, and it is that the tread must possess a degree of hardness which is not necessary, and indeed is undesirable in the other layers. The rubber of the tread and of the succeeding layer were in every case analysed separately, after, it is scarcely necessary to say, removing the intervening constructive fabric.

Preparation of samples.—For the preparation of homogeneous samples, Weber[2] recommends the use of a pair of differential mixing rollers. These are very good, but when not available, both manufactured rubber goods and crude rubbers may, as a rule, be reduced to a perfectly satisfactory condition for sampling by first rolling to a thin sheet by the aid of an ordinary pair of metallurgical rollers, and subsequently passing the sheet through an ordinary domestic mincing machine fitted with a plate having a large number of small perforations. In the case of fairly hard goods (*i.e.*, those containing a large amount of mineral matter), the fine threadlike masses obtained by " mincing " may readily be reduced to a coarse powder by passing through a coffee machine.

Analytical methods.—Except where specially referred to, the methods employed were generally the well-known methods of Henriques as modified by Weber[3], with such slight deviations as were necessary in particular circumstances. The " total sulphur," however, was estimated by the exceedingly rapid and convenient sodium peroxide method[4], which, in common with Esch[5], we have found to give very satisfactory results.

Apparatus.—For the extractions by means of solvents (in the estimation of resin, substitutes, and so on) we employed an extraction apparatus (Fig. 1), the lower part of which consists of a lipped flask, A., with mercury seal, the upper of a mantle and reflux condenser in one piece. The substance to be extracted is placed in an ordinary extraction shell, the latter being supported by the inner tube, B. Essentially this apparatus is the same as that devised by Wiley for ether extractions of agricultural and food products. We have made some slight modifications in the shape of the flasks, &c., of the general apparatus. We have found that, in practice, this form of apparatus has great advantages over the forms which require either corks or ground glass connections. For the purpose of estimating the substitutes (*i.e.*, matter saponifiable or capable of extraction by alcoholic potash) we have found the little piece of apparatus (Fig. 2), which we had specially made for the purpose, exceedingly useful. It consists of a flask similar in all respects to the ordinary lipped extraction flask referred to above, except that it is fitted with a ground-in stopper with two leading tubes as shown in the figure. For the saponification process the flask is fitted to the mantle and condenser of the main apparatus (Fig. 1) by means of a mercury seal. When the saponification is completed, the flask is removed, the solid contents are washed in the ordinary way, and the ground-in stopper is then inserted. The stoppered flask is placed in a drying-oven, one of the tubes passing through the stopper being connected with the gas supply, and the other to the burner.[6] The drying is then completed in the well-known manner. With regard to the efficiency of this form of extraction apparatus for rubber goods, we have never found any appreciable increase in the weight of material extracted (even when using as much as 4 or 5 grms.) after five to six hours' boiling.[7]

In the tables below, the brackets indicate that the samples are of the same make, identity of lettering that the figures refer to different parts of the same tyre.

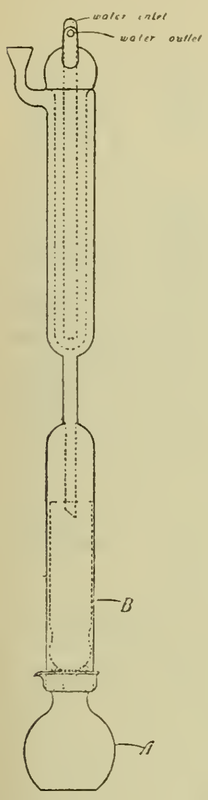

Fig 1

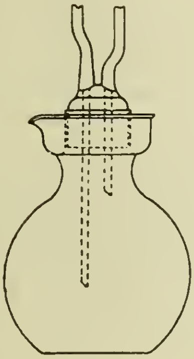

Fig 2

TABLE 1 —*Covers.*

Mark.	A.	B.	C.	D.	D′.	E.	E′.	F.	G.	G′.
Part of tyre	Tread.	Tread.	Tread.	Tread.	†Body.	Tread.	†Body.	Tread.	Tread.	†Body.
Condition, &c.	Good.	Good.	Good ; very little used.	Very badly flaked and " sun-cracked."	Good.	Badly cut, but not " sun-cracked."	Good.	Good ; little used.	Good.	Moderate.
Specific gravity : apparent	—	1·135	1·5312	1·2901	0·9567	1·272	0·9803	1·3000	1·315	0·9506
India-rubber	per cent. 70·00	per cent. 69·10	per cent. 45·40	per cent. 53·07	per cent. 83·76	per cent. 65·00	per cent. 78·71	per cent. 30·82	per cent. 52·08	per cent. 85·10
Organic extract	6·10	5·80	4·80	3·13	4·54	7·90	7·53	9·50	6.92	3·89
Sulphur : Total	5·20	5·80	6·30	4·00	4·90	9·80	7·90	2·78	3·50	6·36
Sulphur of Vulcanisation	3·13	3·14	2·46	2·12	2·94	3·97	4·73	0·97	1·72	0·76
Sulphur : Free	1·80	2·30	2·80	1·27	1·96	4·22	3·17	1·32	1·24	5·60
Sulphur in mineral matter	0·27	0·36	1·04	0·61	—	1·61	—	0·49	0·54	—
Mineral matter	18·70	19·30	43·50	39·80	6·80	17·30	5·86	56·80	37·50	4·65
Fatty substitutes	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
Organic extract : rubber	8·02	7·70	9·50	5·50	5·10	10·80	8·70	23·50	11·90	4·30
Co-efficient of vulcanisation	4·40	4·50	5·40	3·90	3·50	6·10	6·00	3·14	3·30	0·89
Sulphur (excl. mineral sulphur) : rubber .	7·04	7·80	11·6	6·4	5·80	12·6	10·3	7·4	5·7	7·5
Oxidation (" sun-cracking " test)—mgrms. of oxygen absorbed per sq. cm.	—	(*a*) 4·8 (*b*) 4·1	—	1·8	—	(*a*) 6·6 (*b*) 5·9	[3·9]	—	2·4	—

Mark.	H	H′.	J.	J′.	K.	K′.	L.
Part of tyre	Tread.	† Body.	Tread.	†Body.	Tread.	†Body.	Tread.
Condition, &c	Badly worn and hard; somewhat "sun-cracked."	Moderate; rather stiff; somewhat cracked.	Good, but rather hard.	Good.	Moderate.	Poor; cracked.	Moderate; somewhat "sun-cracked.
Specific gravity apparent	1·0760	0·9892	1·5250	1·360	1·322	1·0939	1·151
India-rubber	per cent. 70·02	per cent. 84·64	per cent. 38·15	per cent. 84·44	per cent. 43·16	per cent. 68·16	per cent. 68·93
Organic extract	6·16	7·12	2·80	8·95	4·49	17·98	4·80
Sulphur: Total	7·40	6·10	3·15	3·60	5·35	7·66	6·40
Sulphur of vulcanisation	4·28	4·24	2·01	3·05	2·48	6·82	2·85
Sulphur: Free	1·04	1·86	0·70	0·55	0·90	0·84	3·20
Sulphur in mineral matter	2·08	—	0·44	—	1·27	—	0·35
Mineral matter	16·42	2·12	55·90	3·01	27·50	6·2	19·87
Fatty substitutes	Nil.	Nil.	Nil.	Nil.	S. in pyridine* ex. 0·70	—	Nil.
Organic extract: Rubber	8·08	7·75	6·60	9·50	9·40	20·8	6·96
Coefficient of vulcanisation	6·18	5·09	5·2	3·60	5·7	10·0	4·10
Sulphur (excl. mineral sulphur): Rubber	7·6	7·2	7·1	4·2	9·40	11·2	8·7
Oxidation ("sun-cracking") test—mgrms. of oxygen absorbed per sq. cm.	4·2	—	—	—	0·9	[1·2]	2·0

* Yields 19·50 pyridine extract, (less sulphur.)
† "Body"=sides and layer running under tread.

C and D, small calibre tyres.
E, large calibre tyres.

Table II.—*General nature† of mineral matter in tyre rubbers*:—

A.	B and C.	D.	D′.	E.	E′.	F.	G.	G′.
Mainly zinc and magnesium; some lead and aluminium.	Mainly zinc, magnesium, and lead.	Mainly zinc and magnesium; no lead.	Good deal of aluminium and iron; no lead.	Mainly lead, some magnesium and aluminium.	Mainly magnesium, aluminium, and iron; some calcium.	Much zinc, good deal of magnesium; some aluminium and iron; no lead.	Much as F., but more zinc and less magnesium	Much as F., but less zinc and magnesium.

H.	H′.	J.	J′.	K.	K′.	L.
Magnesium; some aluminium and calcium.	Good deal of iron (as oxide); some magnesium; No lead.	Chiefly zinc, and lead; some magnesium.	Chiefly zinc and magnesium; very little lead.	Good deal of lead and magnesium; some zinc and aluminium.	Good deal of magnesium; some calcium, iron, and aluminium.	Chiefly zinc and lead; some magnesium.

† Note 1.—The above table does not represent an exhaustive analysis of the mineral matters present in the mixings, but is intended to give a general idea of the nature of the bulk of the mineral matter present.

Note 2.—Zinc is generally present as oxide; magnesium as oxide or carbonate; lead as PbO or Pb_3O_4; aluminium as china clay, &c.; iron as ferric oxide or filings; antimony as sulphide ("golden sulphide"); calcium as oxide or carbonate.

Notes on the Analytical Figures.

Samples A and B, although derived from different tyres (of the same make), show remarkably even results, indicating particularly careful manufacture. The total mineral matter is very moderate, and the conclusion to be drawn, in view of the fact that this particular make has a very good reputation, is that a high proportion of mineral matter is not essential in a tyre cover.

Samples C and D illustrate the differences which may occur in the mixings of a particular make. The tyres are of identical size and *apparent* quality. Tyre C was practically new, and in good condition, tyre D had only run a few weeks, but had cracked very badly indeed. It will be noticed that the "suncracking" or oxydation figure for D is very low. Compared with C, the differences in regard to the specific gravity, co-efficient of vulcanisation, and the absence of lead in D, are worthy of note. The cause of the bad behaviour of D possibly lay in the unsuitability of the mineral matter, but we are inclined to the view that in this case the fault lay in the physical condition of the rubber rather than in its chemical composition.

Tyre E (Samples E and E′) was of larger calibre than the tyres of the same make, C and D. *Sample D′* gave figures which indicate a high class, well vulcanised mixing. It is obviously a higher class mixing than E′ (same make but larger calibre), the higher percentage of resin, coefficient of vulcanisation, and specific gravity of the latter comparing unfavourably with the former. Sample E contained a good deal less mineral matter than C and D. The condition, however, was not good. The high resin content, and high total and free sulphur, are in this regard worthy of notice. In this connection also the high "suncracking" figure is of interest.

Samples F and G, although of the same make and same class of tyre, obviously differ very considerably. There is little doubt that G represents a much better mixing than F. The extremely high resin content of F indicates that a very poor quality of rubber was employed, or that some abnormal condition prevailed.

Sample G.—The moderate quality of this sample was obviously due to under-vulcanisation.

Sample H did not present a satisfactory appearance. The co-efficient of vulcanisation is high, and the quality of rubber employed was, probably, not satisfactory. H′ was not a brilliant specimen of the rubber-maker's art, but it is obvious that the co-efficient of vulcanisation is higher than it need be in a soft mixing of this description—provided, of course, that a high class of rubber is employed.

Sample J. is a tyre that would probably not last well in use. The mineral matter, and consequently also the specific gravity, are very high.

Sample K is very hard. The "suncracking" figure is very high. The mixing contains pitch, or a similar material. The character of the acetone extract was also unsatisfactory, being dirty in appearance, and no separation of sulphur crystals took place. This was a sample of which it could be said with little hesitation that it did not represent a high-class article. The corresponding "inner layer" (*i.e.*, main body of cover) K′. also gave figures which appear to explain its obviously poor physical qualities.

General Observations.

In the remarks made above more stress has been laid on the samples which were apparently unsatisfactory than on those which showed no apparent fault. It must be clearly understood, nevertheless, that where we have referred to a particular figure or circumstance, and have drawn a conclusion, such conclusion only applies to the particular case in point, and that it is not meant to convey any dogmatic generalisation. Those who are acquainted with rubber work will readily appreciate the necessity of a statement of this kind, for nothing can be more misleading than the application of the results of a particular case to any and every kind of mixing.

In the introductory part of this paper we pointed out that the quality of a mixing depended on four main considerations. It is now possible (again without wishing to draw, in the present state of our knowledge, any sweeping conclusions) to refer to these in connection with the figures obtained.

In regard to the quality of the rubber generally employed, this, if we except K, and possibly J, was apparently in all cases very fair, in some cases distinctly high-class. With regard to the state of vulcanisation, it is worthy of note that generally the samples which showed undesirable features exhibited either a very low (G′) or a high (E′, H, and K′) co-efficient of vulcanisation. It must be remembered, however, that the co-efficient of vulcanisation is by no means an absolute figure, and that a low class rubber will require a great deal more sulphur in the curing than fine Para. It is not astonishing, therefore, frequently to find a high figure for the co-efficient of vulcanisation associated with a high percentage of resinous matter.

Except in the cases of K and K′., the materials, other than rubber, appeared to consist solely of mineral matter.[8] With regard to the quantity of the mineral matter it is necessary to speak with a great deal of reserve. It is occasionally stated that mineral matter, and all other admixtures, are merely adulterants, and are used for no other purpose than that of immediate economy. With this view we cannot concur, and, indeed, we believe that practical rubber men are unanimous in the opinion that for many purposes a certain proportion of mineral matter, varying in nature according to the object to be achieved, is an absolute necessity. We doubt very much whether vulcanisation alone is capable of producing an article suitable for a tyre cover. Attempts in this direction would, probably, result in the production of tyres of a brittle and non-resilient nature. At the same time, the question whether some makers do not go too far in regard to the *quantity* of mineral matter in covers is open to argument. We are aware that the quantity of mineral admixture which will be readily supported by one rubber will be excessive for another, and that the degree of vulcanisation, &c., must be taken into consideration, but we are inclined to think that the use of as much as 50 or 60 per cent. of mineral matter is a false economy. It certainly is the case that excellent covers can be produced, containing as little as 20 per cent.

We have spoken so far, in our general observations, principally of the mixtures constituting the *tread*. The layers underlying the tread (and forming also the sides of the cover) call for no further particular comment, inasmuch as it appears to be recognised that for the manufacture of this part of the cover, a very pure mixing is required. We have already dealt with special points in connection with this part of the subject above.

A few words with regard to the so-called "suncracking"(9) or oxidation test are necessary in explanation of the figures recorded. In the samples D and K^1, which were very badly suncracked, it will be noticed that the figures are very low. One might, *a priori*, have thought that they would have been high, but the probable explanation is that the surfaces of these samples are already so fully oxidised that they were incapable of absorbing more than a very small further quantity. The figures for E and K, on the other hand, were high, possibly indicating that these samples were liable to suncracking. We are inclined to agree with Weber (*loc. cit.*) that this test may be a very useful one when applied to new covers, and we also believe that in many cases it may afford valuable confirmatory evidence of the nature of the trouble in a tyre that has failed.

Conclusions.—Whatever views may be entertained regarding the quality of the rubber, vulcanisation, and mineral matter, in regard to the composition of pneumatic tyre covers it is plain from the results obtained by us that manufacturers are by no means agreed on these points, and that nothing approaching to finality in this very difficult question has yet been reached. It is apparent also from the widely divergent results obtained with tyres of the same kind (*i.e.*, size) and make, that in some cases the process of manufacture can scarcely be conducted on practical scientific lines. That very excellent results may be obtained by practical scientific supervision, at any rate as regards evenness of quality, is shown, for instance, by samples A and B. Finally, we think we are justified in saying, as an inference from our results, that where failures occur a chemical examination of the rubber employed may be distinctly useful.

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(1) An investigation of some "inner tubes" has been commenced, and will be referred to on another occasion.

(2) The Chemistry of India-rubber (Griffin, London, 1902).

(3) *Loc. cit.*

(4) Von Konek Z.f. angew. Chem., 1903, 16, 516.

(5) Chem.-Zeit., 1904, 200.

(6) Where great accuracy is required it is preferable not to use coal gas, but hydrogen.

(7) This refers to the extraction of resins by means of acetone.

(8) The generally high proportion of organic extract to rubber and the rather high co-efficients of vulcanisation appear, in some cases, to point to "re-made rubber," but the methods at our disposal are not sufficiently exact to warrant a definite inference in this regard, although we think that in the case of K^1 the presence of "re-made" rubber is highly probable.

(9) Acetone-peroxide method.

II.—ON THE COMPOSITION OF SOME NEW CRUDE RUBBERS.

The literature on the chemistry of crude rubbers is, relatively speaking, still very scanty. We believe, therefore, that a description of the results of an examination of some new(1) crude rubbers may not be without interest. We have taken this opportunity, in addition, to examine the method recently proposed by Ditmar, and have obtained some figures bearing on the condition of the nitrogen in one of the crude rubbers, and some few facts regarding the nature of the resinous matters contained in the rubbers, and the rôle of the benzene-insoluble compound. We think it best to deal with the various points referred to in conjunction with the general analytical figures, &c., obtained in regard to each individual rubber.

1. *Rubbers from Uganda.*—Two samples of crude *Funtumia elastica* from the Mabira forest were examined. We were informed that in both cases a rough attempt at washing had been made at the place of collection. Both specimens were wild (native) rubbers, but work on the scientific plantation system is now in hand on the property from which these rubbers emanate.

No. 1 consisted of rough sheet rubber 4—9 mm. thick, translucent, and of a dark amber colour. No. 2 consisted of sheet rubber 2½ to 3 mm. thick, also translucent, and amber in colour. From the figures obtained, and the general characteristics of the rubber, this was obviously a much better sample than No. 1.

The analytical figures obtained from these rubbers were as follows :—

	No. 1.	No. 2.
	per cent.	per cent.
Moisture	1·4	2·52
Resin	13·39	6·35
Mineral matter	1·16	4·32
"Organic impurities and dirt" (exclusive of resin)	2·53	Trace
India-rubber (by difference)	81·52	86·81
Nitrogen	1·33	1·08
Nitrogen as proteids	8·31	6·75
Specific gravity at 15° C.	0·9582	0·9488

The above results were obtained by the Ditmar process(2), which appeared to work fairly well in these cases. It will be noticed that there is a considerable discrepancy between the results from the "organic impurities" and the nitrogen expressed as "proteids." It is possible that this discrepancy may be explained to some extent by the assumption that (*a*) the nitrogen is partly present in a form soluble in benzene, or (*b*) that the bulk of the nitrogen is present in a much lower form than in proteid matter. As we experienced considerable difficulty in obtaining an entirely satisfactory separation by the centrifugal process as described by Ditmar, it is possible that part of the discrepancy is due to this cause. The latter hypothesis received some confirmation from a subsequent analysis of No. 2 in which the rubber was estimated directly (see below), the result showing 83·40 per cent.

2. *Mexican rubber.*—A sample of *Castilloa elastica* from La Zacualpa plantation was examined. It consisted of a slab of black rubber 9—10 mm. thick, which could be split up into a number of thin layers. The rubber had not been washed or purified in any way, and contained a good deal of mechanical dirt. A laboratory washing caused a loss of roughly 12 per cent. After extracting(3) with hot water, rolling, and subsequently forcing the wet mass through a mincing machine, and repeating these operations several times, the rubber presented the appearance of a light grey mass, and was then of a very strong and elastic character. It was partially dried, rolled, and finally completely dried in a vacuum. It was then in a crepe-like condition.

The following were the general analytical results obtained from the crude and washed rubber respectively :—

	Crude rubber.	Washed rubber.
	per cent.	per cent.
Moisture	3·25	—
Resin	10·31	12·10
Mineral matter	4·95	2·89
"Organic impurities and dirt" (exclusive of resin)	16·42	—
India-rubber (by difference)	65·07	—
Nitrogen	1·40	0·28
Nitrogen as proteids	8·75	1.75
Specific gravity at 15° C.	1·0195	—

We have said above that the loss in washing was roughly 12 per cent. It follows, therefore, that the washing has not appreciably diminished the resin content of the rubber, but the mineral matter and nitrogen were very considerably reduced. It appeared to us that an examination of the substances removed by washing might be of interest, and with this end in view, cold and hot water extracts were prepared as follows :—100 grms. of the finely-divided crude rubber were digested for two days with 500 c.c. of water in the cold. The solution was filtered, and the rubber washed and pressed and then repeatedly extracted in the same manner until the solutions obtained were colourless. The various filtrates were united and further examined. The residual rubber was then similarly extracted with water at 65° C. The extract so obtained will be referred to as the hot extract.

The cold extract was neutral to litmus. At first it was of a light brown colour, but rapidly deepened to a very dark brown. On boiling the "cold extract" no precipitate was obtained, but the addition of a few drops of dilute mineral acid to the (unheated) cold extract gave rise to a considerable precipitate. On filtering in the cold, and subsequently heating the filtrate to boiling, a further precipitate was produced. The following figures were obtained by the examination of the various products referred to.

The figures are percentages referred to the original rubber :—

	Cold extract.	Hot extract.
	per cent.	per cent.
Total solids	8·1	3·6
Mineral matter in above	1·4	1·2
Total nitrogen as proteids	2·13	1·85
Coagulable nitrogen as proteids (by heat and acid)	1·66	1·54
Coagulable proteids (acid in cold)	—	1·09
Weight of matter separated by acidifying	2·94 } Total 3·34	1·78 } Total 2·27
Weight of matter separated by subsequent boiling	0·40	0·49
Percentage of proteids in separable matter	49·8	68·0

It is apparent, therefore, that while a considerable proportion of the nitrogen in the crude rubber is present in the form of soluble true proteid matter, the nature of the remainder of the soluble nitrogen is doubtful. There are references in literature to the presence of alkaloids and ammonia salts in latex, but we have not observed any quantitative figures of a definite nature. The subject is one which we hope to pursue in the future.

With regard to the quantity and nature of the mineral matter in the combined hot and cold extracts, this amounted to 2·6 per cent., of which 0·37 consisted of aluminium salts expressed as alumina, and 1·02 per cent. of potassium salts expressed as potassium oxide. Seeing that the total ash in the original rubber was under 5 per cent. the high proportion of potash is worthy of note. Bruce (R.B.B. circular on Para Rubber in Ceylon, No. 6, 1905) has shown that the fresh leaves of Para rubber may contain a similarly high proportion of this metal, and it is interesting to note in conjunction with the work referred to that the latex also may absorb so high a proportion.

3. *Ceylon Plantation rubbers.*—Three samples produced on the Dangan plantation were examined. They were prepared from the first tappings of young trees—about five years old, the latter being tapped on the half-spiral system. The latex, after collection, is diluted with several volumes of water, strained through flannel to remove mechanical dirt, and then coagulated either naturally or by the addition of a small quantity of acetic acid, in flat round dishes. The round "biscuits" so obtained, which are at this point of the consistency of cheese, are rolled out in order to remove as much water as possible and subsequently dried and packed for export.

These samples are of particular interest, as they appear to represent a series of experiments regarding the most suitable manner for coagulation and treatment applied to the same batch of latex. In the following table will be found a description of the samples and of the general analytical results obtained :—

Ceylon plantation rubbers (Hevea Brasiliensis):—

No.	Description.	Moisture.	Resin.	Mineral matter.	"Dirt and† organic impurities."	India-rubber.*	Nitrogen.	Nitrogen as proteids.	Specific gravity at 15° C.
		per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
1	Very thin biscuit, ⅛ to ⅓ mm. in centre to 1 mm. at edges; translucent; light amber colour; edges somewhat darker	0·73	1·36	0·74	12·52	84·15	0·17	1·06	0·9160
2	Thin biscuit, from ¾ (centre) to 1 mm. (edges); translucent; light amber colour, but a good deal darker in centre, although latter thinner than edges	0·45	2·42	0·69	6·60	89·84	0·60	3·75	0·9202
3	Biscuit; even thickness of 3 to 4 mm.; even amber colour; translucent; some air bubbles	0·36	2·69	0·33	2·92	93·70	0·16	1·00	0·9097

* Direct determination.

† By difference.

The above analyses—the analytical methods will be referred to below—are of considerable interest. The most striking feature is the high proportion of the substances classed as "dirt and organic impurities" in No. 1, and the comparatively small amount in No. 3. The explanation, we think, is that the greater part—if not practically the whole—of the "dirt and organic impurities" consists of the highly insoluble, oxygen-containing matter which is present to a greater or less degree in all rubbers. It is, in fact, there is little doubt, the formerly so-called "nervous principle" (4) which swells to an enormous extent in solvents, but is practically insoluble therein. If the figures given for the three samples in this regard be taken in conjunction with the description of their physical characteristics, it will be observed that the thinnest sample contains the highest proportion, and the thickest sample the lowest. Without desiring to dogmatise, and keeping in view the fact that much more work in this direction will be necessary before a definite opinion can be expressed, the results appear to lend point to the opinion which has been somewhat freely expressed, that very thin biscuits do not, in practice, give the best results, although the preparation of rubber in this form has, in other respects, considerable advantages. It has, indeed, been strongly contended that ultimately plantation rubber will have to be made in the form of blocks, or thick pieces, in order to avoid oxidation, heating in transit, and consequent "tackiness" or lack of elasticity, &c. However this may be, it is plain from the figures from No. 3 that very high-class rubber in this particular regard—and quite apart from other considerations of quality and composition—may be produced in biscuit form, provided the biscuit possesses a certain thickness.

In the course of the examination of the above samples it became apparent that Ditmar's process was not directly applicable to rubbers containing an appreciable amount of the enormously distensible material referred to. It is quite impossible to separate this matter from the benzene solution by centrifugal action. Although our experience was that the process was very useful for some classes of rubbers, we found it necessary to make a decided modification for others—such as No. 1 in the above table, for instance. We proceeded on the lines suggested by Ditmar as regards sampling, drying, and extraction of resin and heating with benzene, and at this point deviated from his method as follows:—The benzene solution was allowed to cool, and the contents of the flask were then transferred to a graduated flask. The boiling flask was washed out several times with small quantities of hot benzene, the washings transferred to the graduated flask, and after cooling the contents of the latter to 15° C., the flask was made up to the mark. The whole was then allowed to stand for a short time, and subsequently as much of the clear liquid as possible was poured through a weighed Soxhlet tube, containing glass wool as a filtering material. Operating in this way, we found (when a total of 110—130 c.c. was being dealt with) that there was rarely any difficulty in obtaining 50 c.c. to 60 c.c. of clear filtrate. The whole, or an aliquot part of this, was then (*a*) either evaporated in a tared dish and the residue weighed, or (*b*) it was precipitated with alcohol, and the precipitate (purified and dried as described by Fendler (5)) so obtained weighed.

We find that method (*a*) is more rapid and convenient. The results for *india-rubber* in the above table were obtained in this manner. We suggest that the principle of this method is preferable in all cases to that involving decantation after whirling,(6) or to that of weighing the residue(7) in the tube, even where this is possible. In several cases we were able to weigh the residues, after washing with alcohol and ether, and the following may be quoted as examples:—

Dirt and Organic Impurities.

By difference, per cent.	By direct weighing, per cent.
(*a*) 6·60	(*a*) 6·22
(*b*) 2·92	(*b*) 4·57

In other cases the discrepancies were somewhat larger, but it is plain that the indirect method is far more reliable, first because the weight of the rubber brought to the balance is far greater than that of the residue in the tube, and secondly because it is next to impossible, when there is an appreciable quantity of the swollen "nervous" matter on the filter, to be sure that the whole of the rubber-containing benzene solution has been thoroughly washed out.

4. *Rubbers from Malay Peninsula.*—Three samples of Malay *Hevea brasiliensis* were examined.

No. 1 was a "crepe" rubber of good appearance. It was 1—2 mm. thick and of a pale cream colour. It contained a somewhat large quantity of the highly distensible body referred to above, but we are inclined to think that this was due to the sample not having been very carefully preserved, or that it was of considerable age.(8) Otherwise it had all the characteristics of a high class rubber. No. 2 was a thin biscuit rubber, consisting of two layers, and of a light cream colour. It had been coagulated by means of nitric acid, and the sample originated from a museum, where it had apparently been kept for some time. It was extremely hard, but whether this condition was due to age or a result of the process of coagulation employed, we are unable to say. The analytical figures are very interesting. No. 3 was a thin sheet rubber of a light cream colour, 1—2 mm. thick. It was very tough and leathery, and obviously much modified. Here, again, the analytical figures are of interest as throwing some light on the changes that have taken place. It need scarcely be said that the Malay samples are not put forward as representative of the high-class rubbers that are now produced in the Peninsula, but we think they are of particular interest, inasmuch as there is very little in literature on the composition of rubbers which have been modified in this manner.

The analytical figures are as follows :—

Malay rubbers (old or badly modified).

	1.	2.	3.
	Per cent.	Per cent.	Per cent.
Moisture	0·26	0·30	0·33
Resin	3·45	1·76	3·26
Mineral matter	0·17	0·46	0·17
"Dirt and organic impurities"	9·42(9)	21·48(9)	37·23(10)
India-rubber	86·7(10)	76·0(10)	59·01(9)
Nitrogen	0·47	0·43	0·20
Nitrogen as proteids	2·94	2·69	1·30
Specific gravity at 15° C.	0·9246	0·9222	0·9261

In samples 1 and 2, the rubber was directly determined by evaporating a part of the benzene solution, as described above. In the case of 3, the residue obtained by prolonged whirling, after diluting with petroleum ether, washing repeatedly with a mixture of benzene and the latter, and finally coagulating by means of alcohol and ether, was weighed.

This was repeated with another portion of the same sample, an attempt being made in this case to determine whether a prolonged *cold* benzene extraction might not give better results. This was not the case, a higher figure for the "impurities," namely 40·0 per cent., being obtained.

Note on the resins in the above rubbers.—It has long been considered that a closer study of the nature of the resins occurring in different rubbers is most desirable. This is a subject which we hope to pursue in the future. In the meantime we think it may be of interest to give some figures which we have obtained for the total alkali absorbed by the resins in the rubbers described above. The results are expressed in c.c. of $N/10$ alkali required to fully neutralise and saponify 1 grm. of the resin in each case.

The following figures were obtained :—

	1.	2.	3.
Uganda	8·83	6·70	—
Mexican	16·61	—	—
Ceylon	6·03	27·03	30·2
Malay	17·54	3·21	12·70

The low figures in the case of Ceylon No. 1, which was appreciably different from the other samples, and in the case of Malay No. 2, which was coagulated by nitric acid, are worthy of note, for otherwise the figures for the various groups of rubbers are fairly comparable *inter se.*

It is possible that a study of the bromination products of the saponified "resins" may be a convenient method, *inter alia*, for investigating these substances, for the preliminary experiments in this direction appear to indicate that two bromo-derivatives, or two series of bromo-derivatives, may be obtained, the one easily soluble, the other insoluble in alcohol.

Conclusions.—From the above we conclude :—

(*a*) That Ditmar's process is not directly applicable to all crude rubbers.

(*b*) That the most reliable method is a direct determination of rubber by evaporation from a solvent—after removing moisture and resin.

(*c*) That the figures given in literature for "india-rubber" or "caoutchouc" which are obtained by difference by merely subtracting resin, moisture, mineral matter and "proteids" from the total are unreliable.

(*d*) That a study of the "insoluble" bodies in crude rubbers, particularly in crude plantation rubbers, might yield important practical results in regard to "nerve" and the differences arising from origin, methods of preparation, &c.

We desire, finally, to express our thanks to the Mabira Forest Rubber Company, to the Land Company of Chiapas, to the Rubber Plantations, Ltd., and to Mr. T. W. Wellsted, for supplying us with the samples from Uganda, Mexico, Ceylon, and Malaya respectively.

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(1) New in the sense that they represent fresh sources of market supply.

(2) Gummi-Zeit., **20**, 364.

(3) The rubber previously well sampled and reduced to a fine filamentary condition was employed for this extraction.

(4) Gladstone and Hibbert, J. Chem. Soc., 1888, 679 ; Seeligman, "Le Caoutchouc et la Gutta Percha," Paris, 1896 ; Weber, this Journal, 1900, and *idem.*, "The Chemistry of India-Rubber," Griffin. 1902, &c. It is practically certain that the term of "nervous principle," as applied to this substance is a misnomer. It was—until Weber's work disproved the assumption—at one time believed to be the cause of the "nerve" of india-rubber. It appears to us, at any rate when present beyond a certain amount, to be a highly undesirable constituent, and certainly not a measure of "nerve."

(5) This Journal, 1904, 764.

(6) Occasionally, where there is much finely-divided dirt, and the filtrate does not run quite bright, it is convenient, after making up to the mark, to whirl the contents of the flask, or a part thereof, prior to filtration.

(7) And estimating rubber by difference.

(8) We have since been informed that it was one to two years old.

(9) By difference.

(10) Direct determination.

DISCUSSION.

Mr. R. **HOFFMANN** asked if the resin was detrimental to the sample ; when the analyses were the highest in rubber, were the samples the best ? He had heard lately that rubbers in which there was a certain amount of resin turned out better in manufacture than those quite free. As a planter, he was anxious to know what was the best article to send to the tyre manufacturer, because this planting industry was quite in its infancy. There was lately an exhibition in Ceylon, and there they decided that a thicker sample was much better, and the recommendation lately was to make blocks 3 ins. thick. A further recommendation was made quite recently, that they were to endeavour to produce rubber with about 9 per cent. to 10 per cent. of moisture, as the criticism on these plantation rubbers was that they were not quite so strong in "nerve" as those from the Amazon, because they were extracting all the moisture. They had been trying to give something like 94 to 95 per cent. of pure rubber, but of course they would be only too pleased to put or leave in the moisture, because, naturally, they would thus get 10 per cent. more for their product.

Mr. W. F. **REID** said analyses of caoutchouc up to the present had been very indefinite. As so much depended on the method, he should have been glad to have had a full description of the one used by the authors. He had always found that the figures obtained were, as in the case of soluble and insoluble nitrocellulose, entirely dependent on the method of carrying out the analysis. In making analyses of tyres, for instance, there were other things present besides india-rubber. Pitch was found in one of those samples, but he knew that sometimes the cotton fabric used was prepared with pitch to prevent it rotting, and when analysed this would of course be present in the rubber.

Dr. **SCHIDROWITZ** said the pitch in this case was not in the fabric, but in the rubber.

Mr. **REID** said pitch was present in the fabric, and after the tyre was vulcanised most of it would be in the rubber, and least in the fibre, so that a section of the whole should be taken. These tyres had recently been treated by the hundredweight, dissolved completely, and the total quantity of fibre and of rubber obtained. There was a process known as the Tixier process, now being worked on the commercial scale in France, where tyres were dissolved and the tyre rubber precipitated ; it came out purer than it went in, because the processes of devulcanising and precipitation left in solution the resinous substances which were the result of oxidation, or were present in the original crude rubber. Terpineol was a better solvent than even bisulphide of carbon. Either of these samples shown here would make clear solutions in terpineol, the sediment would go to the bottom, and there would be no lumps retaining the original form of the pieces of rubber. The authors seemed to think that this elastic material which remained was injurious to the quality of the rubber, but he thought it was the other way, and that most rubber manufacturers attached great importance to it. Unvulcanised rubber from which the organic net work had been separated was not so strong as the original rubber. The organic net work, after it was dried, contained material which was extremely tough. Some crude rubbers were known to contain a very large quantity of resin, a Mexican rubber, very largely made, contained over 25 per cent. These resinous materials were, perhaps, more interesting from a scientific point of view than the rubber itself, and he quite agreed with the author that their study would well repay trouble, and in them they might possibly find something to throw light on the origin of rubber itself. He had worked for many years on the synthesis of rubber, but hitherto without success: he had found one thing, however, that isoprene could be produced from these resinous materials, and this was one of the decomposition products of caoutchouc itself. It was possible that in the latex, substances were present from which the rubber was derived, and which were coagulated with the rubber. Rubber in most cases contained all the ingredients of the latex except the water. He should like to hear the method by which the author was able to extract everything out of the rubber in an apparatus of the kind shown. He should hesitate himself to consider the extraction complete, for he had a sample 60 years old under examination, and a portion of it was still saturated with moisture. The material to be analysed must be in a state of fine powder, which was not easy to obtain.

Mr. L. Myddelton Nash asked if the specific gravities were taken on the original samples; because, if so, the percentage of dirt in them would affect the results, and also they must be more or less full of air bubbles. He should like to know what were the proteids in india-rubber, and whether the percentage of them present was any criterion of value. With regard to " mineral matter " and " dirt," what was the difference between them? He supposed the mineral matter was the ash of the rubber after the dirt had been mechanically removed. With regard to the percentage of mineral matter, fairly high figures were given. He had had samples of asbestos packing, the core of which was guaranteed to be pure rubber, and found up to about 80 per cent. of mineral matter—chiefly zinc oxide. Mr. Reid suggested terpineol, but surely that was a very difficult solvent to evaporate, on account of its high boiling point.

Mr. Reid said he did not suggest that the terpineol was evaporated; the india-rubber was precipitated from it.

Mr. Philip said he considered that of all processes for rapidly determining the value of a manufactured rubber, the Henriques method of saponification with alcoholic potash was the most satisfactory. It enabled one to make a rapid determination of the sum of the resins, substitute and mineral oil taken altogether, and it was his experience that if this test condemned a rubber, that particular rubber would generally not withstand the ordinary moist and dry heat tests as specified by the Admiralty.

When treating vulcanised rubber with solvents, such as acetone, pyridine, &c., some difficulty is often experienced in rapidly getting it into a sufficiently finely divided state, a very satisfactory method, however, was to use an ordinary meat-chopping machine of the well-known type, in which two steel plates with holes drilled in them revolved relatively to each other; by this means the rubber could be rapidly obtained in a pulverulent form.

Mr. Reid had spoken of worn-out rubber tyres being dissolved on a large scale in France; it was a novelty to him to hear that vulcanised rubber, in which there was anything from 2 per cent. to 6 per cent. of sulphur, was capable of being readily dissolved, and it was still more astonishing to hear of its re-precipitation; was it the sulphur compound that was dissolved, or was it claimed that the solvent actually devulcanised the rubber; when the rubber was recovered by this method, was it as a matter of fact in the form of unvulcanised caoutchouc, or was it merely the vulcanised material?

Mr. Clayton Beadle said block-rubber fetched top prices in the London market. It could be made in foot cubes, uniform in composition throughout, and this was, in his opinion, the ideal form.

Some of the difficulties of working on a rubber estate were referred to. For instance, taking an estate of 1000 acres, the latex amounting sometimes to 200 galls. per diem, it was of the utmost importance that this should be brought to the central station, where it was going to be coagulated, within six hours; because, from the moment the latex came away from the tree, it began to undergo some sort of putrefaction, and more or less approached the condition of coagulation. He supposed that the resin was an oxidation product. Rubber produced by vacuum drying underwent the minimum amount of oxidation. Rubber manufacturers desired that the composition of the rubber should be uniform.

Dr. Stevens thought the authors had analysed two very poor samples of plantation rubber if he understood aright the figures quoted, namely, resin, 6·5 per cent., ash, 4·5 per cent., and proteids, 7 per cent. He had examined a number of plantation rubbers, and the average figures would be about ½ per cent. of moisture, 4 per cent. of resin, 2 per cent. nitrogen as proteids, and practically no ash at all. It was questionable whether it was an advantage to remove all resin; he believed manufacturers would prefer a rubber which contained some. Para did not contain very much, but what there was, no doubt, considerably modified the vulcanisation process. They had heard very little about the analysis of vulcanised rubber, compared with which the examination of crude rubber was simple. The author said the ordinary processes were well-known; there were a great number of them, and perhaps some of them were well known, but there was a great difference of opinion as to their value. There was a question of pyridine extraction, and some German authorities asserted that pyridine dissolved some of the rubber; if it did, it was inapplicable. Again there was the question of determining the mineral matter, and he should like to know how the authors did that. Was it merely the ash of the rubber? The sulphur of vulcanisation was often retained in the mineral matter, and in that case a high result was obtained. Did the authors estimate the rubber by difference, or employ one of the methods worked in Germany by treatment with higher oxides of nitrogen; because there again, by different methods varying results were obtained. Apparently the tensile strengths of these samples had not been determined; in his opinion this was of great importance and a very valuable indication taken in conjunction with the analysis. Some of the analyses gave somewhat startling figures. For instance, 23 per cent. of resin (he presumed from an acetone extract) and a vulcanisation coefficient of six were high. In vulcanised india-rubbers the vulcanisation coefficient was a good indication of the value of the rubber, and of the care exercised in the manufacture. Where it was either too high or too low, the rubber was generally inferior. With regard to the action of acetone peroxide, he did not know of any work done by this method on crude rubber. It was originally devised by Weber and applied by him to tyre covers, with respect to which he was not aware of any other data on the matter. The paper would have been of far greater value if they knew how the vulcanised samples were analysed.

The Chairman said in his early days, especially when he was engaged in photographic work, he was taught that the action of light tended to cause rubber to become insoluble, but he had not heard from any one that evening any remarks as to whether that was the case or not. In the light of modern work, it appeared to him that this was a matter that deserved some attention. It struck him possibly that the " nerve " substance of which they had heard, was the product of the action of light, because his recollection of this matter was that the portion of rubber which had been acted upon by light, swelled up to an enormous extent in the solvent but did not dissolve, and that the inner portions which the light did not reach were the portions which dissolved.

Dr. Schidrowitz in reply to the Chairman's question, said that it was generally accepted by rubber workers that samples must be shielded from light as much as possible. Dealing with the questions in connection with his second paper, he said in reply to Mr. Hoffman that there appeared to be little doubt that resins from different trees differed in character. In the preliminary tests which they had made, they found that part of the resin was free acid and a part combined, but the quantity of alkali absorbed by different resins differed very appreciably. The role which the resins played was still somewhat doubtful, but the fact remained that, in the finest rubber—such as fine Para and fine plantation rubbers—the resin was very low. Whether, and to what extent the inferiority of other rubbers was due to resin was one of those questions which still required investigation. As to the form in which plantation rubber should be put up, he could only say, as far as his experience went, he believed that very thin forms were not good. He rather thought that the block form, if the block could be made under satisfactory aseptic conditions, would be best. He believed that a machine had been devised for imitating, on practical manufacturing lines, the process of smoking and drying on the Amazon. Whether rubber produced by this process had yet appeared on the market he could not say, but if it had, it would be of interest to know how it turned out. The question of moisture that might be left in the block was very important. He did not think that the resins were formed by oxidation of the crude rubbers. The general view was that they were present as such in the latex.

Dr. Stevens had entirely misunderstood him. If he referred to the table of Ceylon plantation rubbers he would see that they could be made of very high-class quality. With regard to the highly distensible so-called "fibrous" matter in crude rubber he disagreed with Mr. Reid. Weber had shown that the amount of this was very small in many high-class rubbers, that it could have no practical importance in the sense of giving rubber its valuable quality of "nerve." Seeing that high-class rubbers frequently contain very little of this matter and low-class rubbers a good deal, it was difficult to understand how it could have the properties ascribed to it. Moreover, Weber's work in this respect had not been controverted and his (the speaker's) experience in this regard confirmed Weber.

With regard to the questions in connection with the first paper, he thought that those dealing with methods of analysis were based on misapprehensions. They had stated in the paper quite clearly that the methods which they had employed were, for all practical purposes, those of Henriques as modified by Weber. They had made one or two modifications in the apparatus which were referred to in the paper. These methods were perfectly well known, and as far as his experience went, were those adopted by most practical rubber workers. He did not think it necessary to reproduce the whole of Henriques' and Weber's work in the paper. The methods were certainly not perfect, and they were all striving to improve them, and when one was face to face with certain undesirable technological results, and the figures obtained by certain methods of analysis distinctly pointed out the path along which one should go to remedy these, whilst the analytical deductions were confirmed by experience, he thought that was all they could expect for the present. Mr. Reid had suggested that the pitch which they obtained in the case of one tyre, might have come from the canvas which was impregnated with that material. In view of the quantity obtained, however that was obviously out of the question. He was aware that it had been said that pyridine dissolved vulcanised rubber, but when one got a pyridine extract indicating the presence of pitch, bitumen, or similar matter, it was not difficult to determine whether the extract consisted substantially of these matters or of rubber. Mr. Reid was quite wrong if he thought that they extracted the rubbers with solvents from a block or piece. They reduced the samples to very fine flakes or threads by methods well known to every practical rubber worker, and they had referred to this in the paper. By using the extraction apparatus referred to on rubber in this condition it was possible to get a thorough extraction of resin in five to six hours. One might go on extracting for another five or six weeks, but got no increased yield, which surely indicated that the method was for all practical purposes a good one. Besides there was nothing new in this in principle. A remark had been made with regard to the saponification process. If this were applied in the original Henriques form to vulcanised rubbers, you got entirely erroneous results inasmuch as the resins were acted on by the potash. It was necessary, therefore, to extract with acetone first, as Weber had pointed out. Dr. Stevens had referred to the fact that the process of determining mineral matter by incineration might give results which were as much as 1 per cent. to 2 per cent. too high. What if it did? Weber had already pointed this out, but saw that in the case of most technological analyses, that was a matter of no practical importance, and he entirely agreed with Weber. Besides, his experience was that the indirect determination of mineral matter, or that by the method based on dissolving the rubber, gave far more erroneous results. Of course he was speaking of manufactured rubbers.

With regard to the "devulcanising" process referred to by Mr. Reid, he would like to know more about it. Not a week passed but some new so-called devulcanising process came out, and he had yet to learn that a real devulcanising process—*i.e.*, one that removed the sulphur from the rubber molecule—had been devised.

PRESENTATION OF PORTRAIT OF PETER GRIESS, F.R.S., &c., BY WATSON SMITH, TO THE LONDON SECTION.

In presenting to the Section a portrait of the late Johann Peter Griess, F.R.S., a former Vice-President of the Society, who died suddenly in August, 1889, Mr. WATSON SMITH read extracts from letters from Griess and Caro, bearing upon the subject of Griess's discoveries. The first is taken from a letter, written early in 1887, in which Griess thus describes his discovery of the diazo reaction:—

"Dr. B. W. Gerland, when working in the laboratory of Prof. Kolbe in Marburg, investigated the action of nitrous acid on amidobenzoic acid at Kolbe's request. (See also Annalen, Aprilheft, 1858.) Thus the oxybenzoic acid was prepared, indicating a chemical change then considered of much importance. In like manner, I investigated a means of converting picramic acid (amidodinitrophenylic acid) into the oxydinitrophenylic acid, $C_6H_2(NO_2)_2(OH)_2$, but I obtained instead of this latter a compound possessed of such striking and peculiar properties that I at once concluded it must belong to a completely new class of compounds. Analysis soon showed me that this peculiar compound had the composition $C_6H_2(NO)_2N_2O$. Naturally, I soon submitted many other amido compounds in like manner to the action of nitrous acid, and obtained thus in almost every case the corresponding diazo compound. But the circumstance to which I was indebted for my success in obtaining the diazo compounds was that of the treatment of the amido compounds with nitrous acid *in the cold*, whereby the immediate conversion of the diazo compounds into other products was prevented, whereas in the earlier experiments of Hunt and Gerland a higher temperature was always attained, and consequently no diazo compounds could exist. Having obtained these diazo compounds, I then tried their action upon all possible substances, amongst which, of course, are the numerous class of amido compounds. I found that the diazo compounds combine directly with these, forming frequently brilliantly coloured substances, which dye directly animal fibres. The first colouring matter thus prepared by me, which I obtained in the years 1861-62, was the benzene-azo-*a*-naphthylamine 'Phil. Trans.', 1864, Pt. III., 679). It was first prepared on the large scale, to the best of my recollection, in the years 1865-6, by Caro, who was then chemist in the works of Messrs. Roberts, Dale & Co., of Manchester. I first recommended the oxyazobenzene obtained by me for use as a dyestuff in Liebig's 'Annalen,' **137** (1866), page 88."

In this article, Griess describes what he then termed "*Phenol-Bidiazobenzol*" and *Phenol-Diazobenzol* and he modestly suggests their application in the following words :—" Sowohl diese Verbindung als auch das Phenoldiazobenzol könnten als gelbrothe Farbstoffe Verwendung finden."

Of the first azo-dyestuffs, prepared in 1862 or 1863, specimens which Griess sent to Watson Smith for the Manchester Royal Jubilee Exhibition, were shown, and presented with the portrait to the London Section, together with a covering letter, dated May 2, 1887, in which Griess claims the first discovery and introduction into commerce of the benzidine dyestuffs.

In a letter, dated Jan. 12, 1907, Dr. H. Caro says that Griess may certainly be called the " Father of the azo dyestuff industry." He also gives the dates of his first publication, " On a New Series of Bodies in which Nitrogen is substituted for Hydrogen " ("Phil. Trans." 1864 [3], 679). (also Annalen and Proc. Roy. Soc., 1860—1866). and of his first German patent for the production of azo colours, the first for a red azo dyestuff in Germany (Ger. Pat., March 21, 1878, the corresponding Eng. Pat. being 3698, Oct. 4, 1877).

The CHAIRMAN said the thanks of the Section were due to Mr. Watson Smith for the present of this very fine portrait and historical specimens of the first azo colouring matters. He proposed to ask the Council to take charge of this portrait on behalf of the Section, and hang it in the Council rooms, until such time as the Section should itself have the power to give it house-room.

Dr. CAIN said there were one or two points in the narrative Mr. Watson Smith had given which differed from accepted history. With regard to the first azo dye, all histories, both German and English, referred to the first dye of this class as being aminoazobenzene, which was actually manufactured in London for the first time in 1863. Griess's first discovery appeared to be in 1864. As regarded the benzidine colours, he always understood they were discovered by Böttiger in Berlin, and manufactured by the Berlin Actien-Gesellschaft in 1884. According to Griess, he was the first to make those and bring them into commerce.

Mr. WATSON SMITH said he had not only taken his account from Griess's autograph letters to himself, but he had carefully compared their text with that of the joint biographical sketch in the Berichte of 1891 (**24**, 1007—1070), by von Hofmann, Emil Fischer, and Caro. Caro here shows conclusively that Griess preceded Böttiger as to the benzidine colours.

The CHAIRMAN said he might perhaps clear up the matter mentioned by Dr. Cain. Aminoazobenzene oxalate was undoubtedly the first dyestuff of this series brought into the market by Messrs. Simpson, Maule and Nicholson. It was discovered by the late Frederick Field by passing a stream of nitrous gas into an alcoholic solution of aniline. As the reaction was carried out at the temperature of the air, and the aniline was impure, phenolic bodies and tarry matters were produced, but the mass underwent a change and was converted into aminoazobenzene, which was separated, purified, and sold in the form of an oxalate, its constitution being quite unknown. Griess having shortly before isolated diazoamidobenzene (Annalen, 1862, **121**, 258), as it was then called, wished to prepare a large quantity, and having heard of or seen some of Field's compound, purchased some with the object of working with it to obtain a quantity of diazobenzene anilide, but it was found to be not the substance he had discovered, but the isomeric aminoazobenzene. Griess first made an analysis of Field's substance, and showed how it was related to his own product, and Kekulé afterwards pointed out how the change came about. His own reading pointed to the fact that Griess had commenced these studies about the year 1858, because he was then at work on the substitution of nitrogen for hydrogen in organic amido compounds. Griess published a paper in 1862 in the Annalen (**121**, 257). as well as the one mentioned by Mr. Watson Smith in 1864. At any rate, at the time when in conjunction with A. G. Green he published some papers on the relation of diazobenzene anilide to aminoazobenzene,* he discovered that in addition to the introduction of aminoazobenzene by Field and Simpson, Maule and Nicholson, another firm, Messrs. J. J. Müller and Co., of Basle, a year or two later, by acting on aniline nitrate with sodium stannite, had also obtained an aniline yellow which proved, when examined by Griess and Martius,* to be an aminoazobenzene compound.

New York Section.

Meeting held at Chemists' Club on October 17th, 1906.

CHAIRMAN'S ADDRESS.

BY GEORGE C. STONE.

ABSTRACT.

The author attributed the present unsatisfactory condition of analytical chemistry to faulty education and lack of recognition of good work. Schools and colleges were so ambitious in their programmes of study, that their finances could not stand the strain, and their instructors were consequently overworked. The excuse frequently offered by instructors that the students came badly prepared was a bad one, for the right course was to refuse admittance to such students, who then would be unable to graduate and lower the status of the profession. Next, as to the teaching pursued, one method of teaching analysis was to give the student a scheme for the determination of the various elements, and a series of common substances to analyse. Such schemes were, as a rule, complicated and slow, and not broad enough. But a course of rapid technical methods was worse, and could only end in disaster; they were not suitable for general work. It were far better to systematically teach group separations and that of their members, combinations suitable for weighing, methods of solution, calibration of apparatus, and gas and volumetric analysis. Checks on the accuracy of methods and instruction in the underlying principles should not be omitted.

In works, the best check was to sample and weigh all the raw materials and products of a process, make fairly complete analyses of all, and then make a regular ledger account and trial balance of the elements. Many college laboratories were too well equipped and everything was too convenient. If students had to exercise more ingenuity in adapting means to ends, it would be a very useful training. All chemists should practise teaching. It was always wanted.

In works, the laboratory was insufficiently paid in comparison with the manufacturing departments. It was looked upon rather as a necessary evil than as the most valuable means of controlling and improving processes. Not being a producing department, its accounts were all on the wrong side of the ledger, and commercial men, who usually controlled salaries, often failed to see how it contributed to the profits. The man who stayed in the laboratory and did good work there, was just as much entitled to good pay as the man in the manufactory. Employers and the public needed teaching how to discriminate between chemists. Works managers, especially those who had risen from the ranks, often either expected too much from the laboratory, or failed to understand the reports ; but the chemist had often himself to blame for the latter, as he either failed to make himself understood, or adopted a form that was not immediately available. The chemist should, however, be told for what purpose his analyses were wanted, or he could not be expected to give the desired information in the most available form. In small works, the chemist, from mere repetition, was in danger of degenerating into a mere " tester." In the East of America they were rarely overworked, but they frequently were in the West, where they often had to help in the office as well.

Reverting to the subject of the education of a chemist, the author thought that where courses in chemical

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* Friswell and Green, Chem. Soc. J., 1885, 47, 917, and 49, 746

* Zeit.-Chem. N.S., Vol. 2, 132 (1866).

engineering were given, chemistry should be the main subject, and engineering confined to a grounding in the main principles. Colleges were making a mistake in specialising their courses so much. These should be broad, and consist almost entirely of chemistry, physics, and mathematics. If a really first-class training in chemistry as a profession could not be given, it would be better to abandon the subject.

Another thing that was doing harm was the great desire to do research work. The recent graduate whose researches in manufacturing lines were valuable, was so rare that he might almost be said not to exist. It took a thorough knowledge of processes and costs to fit a man to advise and devise changes. Practical suggestions for improvement usually came from the staff in the particular department, or from the administrative staff in the central office.

Without wishing to discourage research work, he doubted very much whether the best training for students was research. If allowed at all, the work should be simple, and the results should admit of easy and certain check. The proper place to learn it was the works laboratory, and if those who wished to take it up would first study the analytical methods used there, check them, correct the errors in them, and, at the same time, acquaint themselves with the works' processes and their cost, they would soon be in a position to make researches profitable both to themselves and their employers. They should not overlook the value of "proximate" analysis in their desire to resolve everything into its ultimate elements. For instance, in the case of refractory clays, a knowledge of the minerals present was often more valuable than that of the elements present. In alloys, a knowledge of the compounds formed by the smaller so-called impurities with the main metals, would be of great value. The number of methods proposed for such "proximate" discriminations was small and might well be increased. This form of research would accomplish much of scientific value, and be of great help to the technologist.

Meeting held at Chemists' Club on Friday, January 25, 1907.

GEORGE C. STONE IN THE CHAIR.

A SELF-FILLING BURETTE.

BY N. J. LANE, B.SC.

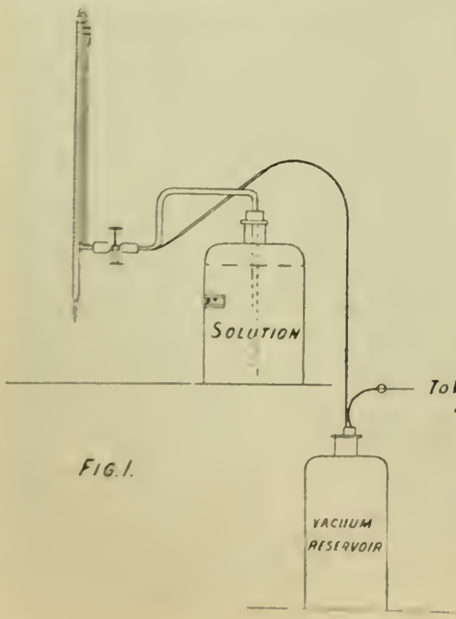


FIG. 1.

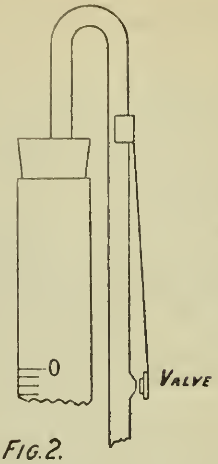


FIG. 2.

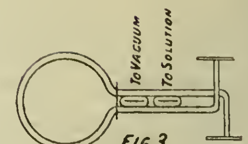


FIG. 3.

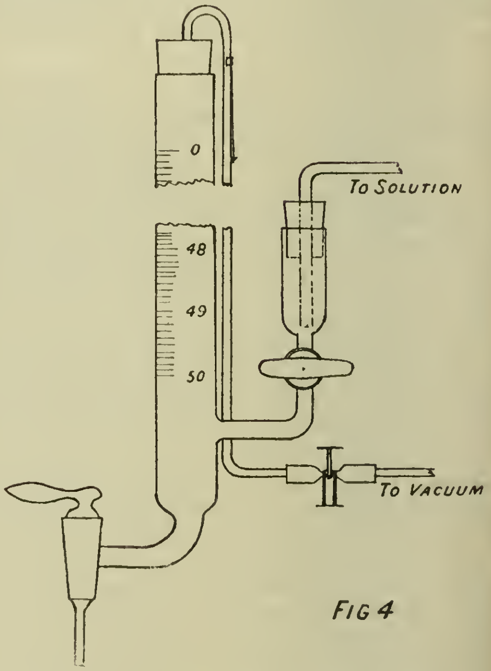


FIG 4

The burettes formerly used in the U.S. Appraiser's Laboratory were filled by suction on a tube passing through a cork in the top of the instrument, the vacuum being obtained by the mouth. This was objectionable where many persons used the burette. The present form was designed as an improvement: the burette itself is of the ordinary form, with a filling tube in the back, which is connected by extra heavy wall black-rubber tubing, with a bent glass tube reaching to the bottom of the bottle containing the solution. A glass tube, about 3 mm. bore, is bent double, passed through a cork, and inserted in the top of the burette, so that it is parallel with it. This tube is again bent at a right angle, so as to be also parallel with the filling tube, and cut off at about the same length. It is then connected with the vacuum reservoir by extra heavy black-rubber tubing. It should be arranged so that it almost touches and is parallel with the supply tube. On the tubes is placed a strong pinchcock, with the vacuum tube nearest the bend (Fig. 3). A pinhole is blown near the top of the 3 mm. tube, leaving a slight projection, which is closed automatically, when the vacuum is in use, by a valve made of a copper disc, 6 mm. in diameter, with a piece of soft rubber fixed on it by means of rubber cement or spirit varnish, this disc being soldered to a piece of thin brass spring wire, 0·5 mm. thick and 55 mm. long, which is also soldered to a strip of brass, 5 mm. wide and 0·25 mm. thick, and long enough to almost encircle the 3 mm. tube, and this is cemented to the tube with thick spirit varnish (Fig. 2). The valve must nearly, but not quite, touch the pinhole opening, and should be readily drawn in by the vacuum. It should not close the pinhole absolutely, as it then would not release as it should when the burette is used. The vacuum reservoir may consist of a heavy bottle of 2 to 3 litres capacity, or, in large laboratories, of a 5-gallon wrought-iron petroleum spirit can. A number of burettes can be connected with the same reservoir by means of a brass pipe, having copper tubing connections soldered in it.

For potassium permanganate, silver nitrate, and solutions which act on rubber, a burette with a glass stopcock is used, having a filling tube with glass stopcock bent up at a right-angle, ending in a cup, 10—12 mm. in diameter and 45—50 mm. deep; this carries a rubber cork, through which the tube from the solution passes. This tube is bent at a right-angle, and cut off 30—35 mm. below the cork, so as to form an air space (Fig. 4). The vacuum tube is connected in the manner described above.

To use the apparatus, the vacuum reservoir is exhausted (10—20 ins. is sufficient), the pinchcock is opened until the solution rises in the burette to a little above the zero mark; it is then closed, and opened slightly so that the solution flows back into the bottle, and the zero point is reached. After using, the solution remaining in the burette can be returned to the bottle in the same way.

An arrangement of a number of burettes in the above manner has been found to be of great convenience, fourteen easily finding room on a tiled shelf, 7 ft. 3 ins. long by 19 ins. wide, and has been found in all respects satisfactory.

Scottish Section.

Meeting held at Glasgow on Tuesday, January 22, 1907.

MR. JOHN S. MACARTHUR IN THE CHAIR.

THE REDISTRIBUTION OF THE NITROGEN IN THE DISTILLATION OF COAL.

BY JAMES McLEOD.

Within the past decade enormous strides have been made in the recovery of the nitrogen of coal in the form of ammonia and of cyanogen during the destructive distillation of coal. The amount of ammonium sulphate produced in Scotland during 1905 was 17,953 tons from the ammoniacal liquor from gas works, 19,594 tons from blast furnaces, 46,344 tons from shale works, and 7,137 tons from producer gas plants, coke ovens, &c. This amounts to 91,028 tons. For 1906, Messrs. Bradbury and Hirsch give 95,000 tons as the production for Scotland. The price of ammonium sulphate has ranged from about £11 12*s*. 6*d*. to £12 12*s*. 6*d*. per ton, f.o.b. Hull. The average for the year being £12 0*s*. 9*d*. per ton; the 95,000 tons represent a value of £1,143,562 10*s*.

On submitting coal to destructive distillation the nitrogen present in it is partly retained by the coke and partly eliminated as free nitrogen, which at the moment of liberation probably combines with hydrogen and with carbon, to form ammonia and cyanogen respectively, and partly remains as free nitrogen. It also remains combined with carbon and nitrogen to form bases, such as pyridine. The aim of this paper is to apportion the amount of the total nitrogen of the coal going to form each of these products.

The proportion of the nitrogen of the coal which goes to form ammonia is not large. Knublauch and also Lundin (this J., 1896, 106, 530) give this proportion as 12 to 14 per cent. of the total nitrogen. At the Provan Works during 1906, approximately 227,413 tons of coal were carbonised, and 8,073,161 galls. of ammoniacal liquor were produced. This liquor contained on an average 1·9 per cent. of ammonia, equivalent to 1·56 per cent. of nitrogen. The average of the nitrogen in the 80 coals tested being 1·434 per cent., the 227,413 tons of coal contained 3261·1 tons of nitrogen; therefore, assuming the specific gravity of the gas liquor to be 1·020, the percentage of total nitrogen existing as ammonia works out at 17·10 per cent. This is considerably higher than that found by Lundin and Knublauch.

These estimations of nitrogen were done on average samples of the coals taken from the railway wagons, which were first of all partly emptied by the tipping machine so as to allow of an inspection of the whole depth of the coal in the wagon. The wagons have end doors, and just enough coal is allowed to run out when the tipping platform is tilted to permit the sampler to get to the bottom of the wagon. The exigencies of the work do not permit of the whole wagon being emptied, broken, and sampled. Some of our coals are not screened as they might be, and consequently the percentage of ash is increased by clay and shale, and the amount of nitrogen falls as a rule, though not always, with the rise in the amount of ash.

The table shows that the amount of nitrogen varies from 0·915 in Hattonhill Shale to 1·873 in Shields Main Cannel. It is somewhat remarkable that these two extremes should belong to the same class of coal. Carrick Anderson found over 2 per cent. in some Scotch coals (this J., 1899, 1099), but the ash in the samples used would, I believe, be less than the works samples used in the tests given here.

As a whole the coking coals are high in nitrogen, but there are notable exceptions, for instance, Balbardie (80) only shows 0·917 per cent. of nitrogen. The percentage of nitrogen in the coal is not a reliable guide as to the amount of ammonia and cyanogen which may be expected, as has been pointed out by Carrick Anderson. The factors governing the amounts of cyanogen and of ammonia produced might be summed up as follows:—(1) The physical condition of the coal when introduced into the retort: if the lumps are very small the heat takes longer to penetrate the whole of the charge, consequently the products differ. (2) The amount of extraneous moisture the coal contains: practical experience shows an increased amount of carbonic acid, sulphuretted hydrogen, tar, and ammonia if the coal is wet. (3) The temperature of the distillation: high heats produce a marked increase in the amount of cyanogen, and also influence the amount of nitrogen retained by the coke.

Wide differences will be noted in the table in the percentage of the total nitrogen retained by the coke, the minimum being 30·2 per cent., the maximum reaching the extraordinary amount of 89·6 per cent., Wellsgreen Cannel (72) giving the former figure, Muiravonside Coking (14) the latter. It does not follow that a high percentage of nitrogen in the coke means a high percentage of the total nitrogen retained by the coke, this being dependent on another factor, *viz.*, the percentage of the coke on the coal carbonised. Thus Thankerton coke contains 1·936 per cent., and this is the highest percentage of nitrogen I have yet found in coke, yet the percentage of the total nitrogen retained by this coke is but 67·8, as compared with Muiravonside at 89·6 per cent., the percentage of coke from the former coal being 56·7, and from the latter 69·8. The amount of nitrogen in the coke varies from 0·575 per cent. in Hattonhill (53) to 1·936 per cent. in Thankerton (10). Knublauch found in 20 coals from different places, including Scotland, that the percentage of the total nitrogen remaining in the coke averaged about 50 per cent. The average of the 80 coals tested here works out at 58·3 per cent. of the total nitrogen retained by the coke. The average amount in the coke is 1·374 per cent. The cokes used in these tests were obtained from the coal-testing plant in use at Provan. Owing to our method of carbonising on the large scale, it would be extremely difficult to obtain always the cokes from given coals carbonised. It is known that the temperature of carbonisation has an important bearing on the amount of nitrogen retained by the coke, as also has the rate of heating, especially if the charges are small. The amount of coke obtained by the testing plant agrees closely with that obtained in practice, and I believe that the nitrogen retained will differ but little in the two cases.

The amount of tar produced at Provan Works during 1906 may be taken as approximately 1,833,104 galls.

(of the assumed average sp. gr. 1·17). The amount of nitrogen found in the tar averaged 1·35 per cent. Twelve samples drawn at different times were tested, and the nitrogen varied only from 1·275 to 1·407 per cent. The tests are as follows:—1·307, 1·275, 1·315, 1·400, 1·378, 1·345, 1·407, 1·359, 1·379, 1·401, 1·341, 1·301.

The nitrogen exists in the tar in the form of basic substances, traces of ammonia, pyridine, quinoline, aniline, &c., having been found. Taking the average percentage of nitrogen in the tar as 1·35, and the coal carbonised at 227,413 tons, or the tar produced as 1,833,106 galls., the percentage of the total nitrogen remaining in the tar amounts to 3·9 per cent. This is almost double that found by Knublauch.

The nitrogen existing as cyanogen is of great interest and importance. I am unable to give exact figures on this point, as the cyanogen recovery plant at Provan is unable to deal with the whole of the gas produced, and so a considerable proportion of the gas requires to be "by-passed" from the plant. The proportion so "by-passed" cannot be measured. Taking, however, the production of crude "cyanide" cake at a time when the plant was dealing with all the gas produced, I find that the gas from 5,000 tons of coal produced 6½ tons of crude ferrocyanide cake approximately. Twelve analyses of different samples of this cake, taken at various times, gave the following percentages of sodium ferrocyanide:—44·80, 49·68, 50·95, 54·47, 49·86, 47·74, 40·15, 57·83, 53·09, 45·53, 46·48, 50·18 per cent.; the average of above is 49·23 per cent. Six and a half tons of crude cake represent 3·076 tons of sodium ferrocyanide, or 0·8499 ton of nitrogen. This gives 1·18 per cent. of the total nitrogen in the form of cyanogen. Knublauch's figure is somewhat larger than this.

The amount of nitrogen remaining in the gas is determined by the proportions of the total nitrogen distributed among the bodies already discussed. If the nitrogen in the gas is estimated by analysis, either directly or indirectly, the result is considerably too high. This is due to the admission into the gas of nitrogen from the atmosphere when the retorts are filled. Carbonisation begins at once, and so the gas generated should drive a portion of the air out of the retort before the lid is closed, but the ascension pipe might still contain some air. Again, when the retort is opened for the purpose of cleaning the ascension pipe during the process of carbonisation, a further amount of air may enter and mix with the gas. If some recent low tests of the nitrogen be taken, *viz.*, 1·7, 1·7, 2·8, 1·3, 3·2, 2·8, 2·6, the average gives 2·3 per cent. by volume. Taking the weight of a cubic foot of nitrogen at 60° and 30″ as 518·85 grains, roughly, the percentage of the total nitrogen works out at 49·3 per cent.

Summary of results.

	Per cent. of total nitrogen.
Nitrogen in the coke	58·3
„ in the tar	3·9
„ in ammoniacal liquor	17·1
„ in cyanogen	1·2
„ in gas (by difference)	19·5
	100·0

These results then point to a considerable amount of atmospheric nitrogen entering the gas. Knublauch states that about 30 per cent. of the total nitrogen goes into the gas, yet he gives an analysis of gas containing 2·25 per cent. in the crude state, and this would of course be higher in the purified gas, and would mean 50 per cent. at least of the total nitrogen. The disturbing factor of the nitrogen getting into the gas from the atmosphere prevents certainty on this point. Some nitrogen might also enter through cracks in the retorts.

In estimating the nitrogen in the coals, cokes, and tars, the Kjeldahl-Gunning method was used, the oxidations being easily accomplished in this way. Blanks were done with all the reagents used, and the trace of nitrogen so found was deducted from the total.

As the distillations numbered about 380, a rapid method had to be employed. A large tin vessel, cylindrical in shape, and holding about 10—12 galls., was fitted with four condensing tubes passing through the side near the top and out through the bottom. These condensing tubes were of tin containing some lead and not of pure tin, as advocated by Dyer. Two of the metal tubes were soon replaced by glass tubes and tried against each other. No loss of ammonia was observed with the alloyed tubes as compared with the glass tubes. The standard solutions used were *N*/10 caustic soda and *N*/10 sulphuric acid. The distillation was carried on in the apparatus shown until at least 300 c.c. had come over.

The outlet of the condenser tube passes through a rubber cork, which fits into a suction flask, provided with catch bulbs or thistle funnels fused on to the suction tube. The funnel was provided with a plug of cotton wool moistened with standard acid. Throughout the tests carried out in this apparatus, in no case was the acid in the wool plug neutralised, even where an insufficiency of acid was present in the flask, showing that all the ammonia had dissolved in the water of condensation.

The method used for determining the cyanogen in the crude cake was the usual iron process; I may, however, add that the Feld method is certainly much easier to work.

For the nitrogen in the gas, indirect estimation was used in the Orsat-Muencke apparatus. This apparatus has limitations as to accuracy, but it has strong advantages. It is easily handled, clean, not wasteful of chemicals, and extremely rapid. I have done a complete analysis of coal gas, including three explosions, in 44 minutes, and this time might be shortened a little with two absolutely fresh solutions of cuprous chloride. The absorption of carbon monoxide is the weakest point of the Orsat apparatus, as shaking to ensure rapid absorption is not readily done. The new apparatus consists of two Orsats joined by a rubber tube, filled in the centre by a glass capillary tube to avoid a wide space. The bulbs in the second portion contain ammoniacal nickel nitrate for the absorption of benzene, fuming sulphuric acid, and water in the first, second, and third bulbs respectively. A mercury explosion pipette takes the place of the fourth bulb. About 10 c.c. of residual gas, after removing the absorbable constituents, is mixed with about 90 c.c. of air, passed into the explosion bulb, passed back again to mix it, and then exploded by means of coil and storage cell. The explosions take place very quietly and with certainty. The rest of the procedure is as usual.

My best thanks are due to my chief, Mr. Webster, and to my assistant, Mr. J. Graham, for assistance rendered in carrying out the work described in this paper.

Name of coal.	Nitrogen in coal.	Nitrogen in coke from coal.	Total nitrogen in the coke.
	per cent.	per cent.	per cent.
1. Daldowie Cannel	1·498	1·491	57·8
2. Lochwood Drumgray	1·435	1·469	62·7
3. Haughrigg Coking	1·666	1·736	72·1
4. Fedderland Coking	1·335	1·379	72·3
5. Glenfore Coking	1·246	1·606	89·0
6. Struther Steam	1·603	1·869	71·1
7. Clydeside Cannel	1·446	1·267	53·5
8. Hillhouserigg Cannel	1·218	1·421	74·2
9. Greenrigg Coking	1·218	1·442	72·6
10. Thankerton Jewel	1·617	1·936	67·8
11. Roughrigg Coking	1·647	1·680	66·2
12. Greenhill Upper Drumgray	1·365	1·484	61·8
13. Carfin Main	1·071	1·211	66·8
14. Muiravonside Coking	1·176	1·509	89·6
15. Roughcraig Coking	1·867	1·803	56·9
16. Chapelhall Splint	1·519	1·449	55·3
17. Bothwell Ell	1·232	1·691	83·4
18. Hollandbush Coking	1·484	1·484	62·1
19. Auchinbegg Splint	1·400	1·512	61·4
20. Bredisholm Ell	1·393	1·365	58·4
21. Auldton Virtuewell	1·302	1·313	69·4
22. Craigrigg Coking	1·008	1·519	70·8
23. Boghead Cannel	1·323	1·148	54·3
24. Wilsontown Coking	1·400	1·425	55·2
25. Birkrigg Heading	1·512	1·162	57·9
26. Riddochhill Splint	1·540	1·148	44·9
27. Darngavill Heading	1·663	1·425	49·7
28. Calderburn Coking	1·498	1·162	42·0
29. Carfin Screened Splint	1·512	1·180	42·3
30. Muirkirk Splint	1·414	1·323	51·5

Name of coal.	Nitrogen in coal.	Nitrogen in coke from coal.	Total nitrogen in the coke.
	per cent.	per cent.	per cent.
31. Chapel Splint	1·415	1·288	53·2
32. Northrigg Coking	1·141	0·952	50·6
33. Parkhead Cannel	1·547	1·449	54·9
34. Southrigg Coking	1·145	1·292	72·7
35. Roachsoles(Ræbog)Coking	1·677	1·498	62·2
36. Thrashbush Coking	1·383	1·544	68·3
37. Quarter Splint	1·299	1·145	50·7
38. Bargany Coking	1·075	0·858	48·4
39. Lanemark Cannel	1·285	1·393	65·5
40. Poniel Whole Seam	1·299	1·344	57·2
41. Douglas Coking	1·299	1·439	64·2
42. Foulshiels Whole Seam	1·232	1·043	48·7
43. Ellismuir Cannel	1·286	1·286	57·1
44. Climpy Coking	1·300	1·059	48·5
45. Woodside Splint	1·482	1·488	59·8
46. Eastrigg Splint	1·236	1·247	67·5
47. Kenmuir Ell	1·554	1·380	50·6
48. Greenfield Splint	1·402	1·352	57·0
49. Carmuir Coking	1·526	1·341	54·7
50. Reddingrigg Splint	1·229	1·139	58·7
51. Netherburn Splint	1·631	1·633	58·2
52. Mansfield Coking	1·610	1·474	58·8
53. Hattonhill Shale	0·915	0·575	40·8
54. Blantyreferme Ell	1·710	1·738	58·3
55. Earnock Splint	1·563	1·463	55·1
56. Auchincruive Splint	1·359	1·330	58·5
57. Braidhurst Ell	1·608	1·467	53·1
58. Bogfield Splint	1·435	1·250	49·2
59. Castlehill Screened	1·824	1·586	51·4
60. Drumshangie Whole Seam	1·709	1·421	49·5
61. Muiryett Coking	1·279	1·052	51·0
62. Carfin Shale	1·019	0·642	40·2
63. Dykehead Main	1·551	1·457	55·3
64. Westrigg Splint	1·394	1·394	66·9
65. Howmuir Coking	1·464	1·789	67·9
66. Blacktongue Coking	1·540	1·561	65·8
67. Fernigare Splint	1·757	1·453	51·1
68. Daldowie Ell	1·467	1·507	67·2
69. Belhaven Splint	1·726	1·604	52·7
70. Udston Splint	1·824	1·722	55·6
71. Clydeside Splint	1·421	1·078	46·4
72. Wellsgreen Shale	1·127	0·637	30·2
73. Crofthead Heading	1·113	1·211	64·2
74. Holytown Ell	1·557	1·162	41·6
75. Shields Main Cannel	1·873	1·600	45·5
76. Allanton Virtuewell	1·617	1·575	55·6
77. Merryton Virtuewell	1·407	1·225	49·8
78. Skellyton Virtuewell	1·533	1·330	49·9
79. Newbattle Cannel	1·400	1·617	60·9
80. Hopetoun (Balbardie Coking)	0·917	1·050	71·3
Averages of above	1·434	1·374	58·3

Sydney Section.

Meeting held on Tuesday, August 21st, 1906.

DR. R. GREIG SMITH IN THE CHAIR.

A POSSIBLE NEW COMMERCIAL SOURCE OF ALCOHOL.

BY E. A. MANN.

(This J., 1906, 1076—1078.)

Mr. E. A. MANN replied in writing to the discussion, and thanked Mr. Steel for calling his attention to Ligar's paper and the patent application referred to, of which he was unaware. The former certainly covered practically all the ground traversed in his own paper. It did not, however, state what variety of *Xanthorrhœa* was referred to, but Dod's patent mentioned *X. hastilis.* It would be interesting to ascertain what proportion of sugar was present in those species which occurred in the Eastern States of Australia. *X. Preissii* was the only one growing in any quantity in Western Australia. Ligar mentioned a yield of only a little over one-tenth of a gallon of proof spirit per bushel, which was very small compared with that obtained in West Australia in the spring growth.

The objection raised by Mr. Steel as to the commercial utility of the discovery was not a serious one. Ligar mentioned that in a certain locality in Victoria there were enough grass trees to supply 500 plants a week for ten years. These figures, if each multiplied by ten would not exhaust the supply in Western Australia, where there were thousands of acres covered with this plant, and the trees were now being ruthlessly cut down and burnt.

It was out of the question (on account of their slow growth) to cultivate the trees, but he thought the existing supply could be utilised and turned to profit, and he understood that the matter was now under consideration by commercial men in Western Australia. The value of the gum seemed to be very questionable, and recent inquiries in London seemed to indicate that the price it could command would not pay for shipment. A trial shipment of the plants had been made for further investigation.

Obituary.

CORNELIUS O'SULLIVAN, F.R.S.

Cornelius O'Sullivan was born at Bandon, County Cork, Ireland, and received his education at the Cavendish School at Bandon. His early taste for science was in no way satisfied at this school; it was by attending the classes held in Bandon under the Science and Art Department that his mind received the fuller scientific development he sought for, and that in 1863, at an examination under that Department, he obtained a scholarship at the Royal School of Mines. After a three years' course of study there, Prof. A. W. von Hofmann, who had already recognised his chemical ability and enthusiasm, appointed him an assistant at the Royal College of Chemistry. When, soon afterwards, Hofmann accepted the call to the Chair of Chemistry at the Berlin University, he took O'Sullivan with him as private assistant, and to his intimate contact and friendship with that great investigator and teacher, O'Sullivan undoubtedly owed much of the investigational acumen and exactitude of manipulation which he showed in such a marked degree in his later researches.

The firm of Messrs. Bass and Co., of Burton-on-Trent (then under the management of Mr. Michael Thomas Bass and Mr. John Gretton), were the first English brewers to recognise the value of science in practical brewing, and about the middle of the last century turned for assistance to Profs. Graham, Liebig, and Hofmann, and it was on Hofmann's recommendation that O'Sullivan was, in 1867, appointed assistant brewer and chemist at their Old Brewery, becoming later on head brewer, and then chief brewer to the firm.

In 1875, Messrs. Bass determined to establish a separate laboratory department, and whilst O'Sullivan still kept the supervision of the chemical work, his brother James joined him as assistant in that department, and thus left him freer for his duties in the brewing department.

The practical bearing of the epoch-making researches of Pasteur at once appealed strongly to O'Sullivan; he followed their progress keenly, and was ever ready to apply their teaching, as far as possible, in his brewing practice. But his chemical bent and training soon brought him face to face with the interesting, but then almost uninvestigated, chemical changes going on in the mash tun, and led him to turn his own attention more particularly to the study of starch and its transformations, and of barley and malt, the main sources from which the brewer obtains his starch and its transformation products.

O'Sullivan's first important investigation, "On the Transformation Products of Starch" (J. Chem. Soc., 25, 579), appeared in 1872, and may fairly be considered as the pioneer work on this subject. Before this work, the products of the action of diastase on starch were generally considered to be dextrin and glucose, for though Dubrunfaut, in 1847, had proved that the sugar, produced in this action is not glucose but a distinct sugar, to which he gave the name, maltose, this fact had been almost overlooked and forgotten, and O'Sullivan may be said to have rediscovered maltose and established its composition and properties. This research was followed by a long series of others on the chemistry of starch, and in them O'Sullivan elucidated and defined the influence of temperature on enzymic action, greatly improving the knowledge of the influence of mashing heats on the composition and behaviour of beer worts. The detection of raffinose in barley, in which it is only present to the extent of less than 0·1 per cent. and its isolation, shows O'Sullivan's skill and exactitude as an investigator. Besides his work on starch, O'Sullivan published, alone and in conjunction with others, important work on some of the other carbohydrates. To him were due the first exact methods of carbohydrate analysis, and the science of brewing owes him much.

In 1884 O'Sullivan was awarded the Longstaff medal by the Chemical Society, and in the following year he was elected a Fellow of the Royal Society. He was an original member of the Society of Chemical Industry and of the Institute of Chemistry, served on the Councils of both these Societies, and of the Chemical Society, and for ten years was a member of the Publication Committee of our Society. He was elected an honorary member of the Institute of Brewing in 1893. He died at his residence, Burton-on-Trent, on Jan. 8th, and was buried at Bandon. By his death the chemistry of brewing has lost its greatest pioneer.

The following is a list of O'Sullivan's principal contributions to chemistry, which were all presented to the Chemical Society and published in its Transactions: "On the Transformation Products of Starch," 1872 and 1879; "On Maltose," 1876; "On the Action of Malt Extract on Starch," 1876; "α- and β- Amylan: Constituents of some Cereals," 1882; "On the Estimation of Starch," 1884; "Researches on the Gums of the Arabin Group: Part I., Arabic Acid; its Composition and the Products of its Decomposition (1884), and Part II., Geddic Acids; Gedda Gums (1891)"; "Presence of Raffinose in Barley," 1886; "Sugars of some Cereals and Germinated Grain," 1886; "Arabinon, the Saccharone of Arabinose," 1890. In conjunction with F. W. Thompson: "Invertase, a Contribution to the History of an Unorganised Ferment," 1890; and "Estimation of Cane Sugar," 1891. In conjunction with A. L. Stern: "The Identity of Dextrose from different sources, with Special Reference to the Cupric Oxide Reducing Power," 1891.

PROFESSOR DMITRI IVANOVITCH MENDELÉEFF.

Dmitri Ivanovitch Mendeléeff was born on Feb. 7, 1834, at Tobolsk in Siberia, the youngest child of a family of seventeen. He received his early education at the Tobolsk gymnasium, of which his father was Director, and continued his studies at the University of St. Petersburg, where he obtained the M.A. degree, for which he prepared a dissertation on specific gravities and volumes, and problems involving these.

After teaching at Simferopol, in the Crimea, and at Odessa, he went in 1860 to Heidelberg, where he established a private laboratory. In 1861 he published investigations on the absolute boiling points of liquids. These fundamental experiments were afterwards amplified, and further explained by Andrews, who termed the absolute boiling point, "the critical temperature."

In 1863, he returned to St. Petersburg as Professor of Chemistry at the Technological Institute, and three years later was appointed to the chemistry chair in the University. Soon after this appointment, he began to write his "Principles of Chemistry," of which seven editions have appeared in Russian and three in English; the work was also translated into German. It was whilst engaged in writing the first edition of this work (1868—1870) that the Periodic Law occurred to him, and in March, 1869, he laid his ideas on the subject before the then youthful Russian Chemical Society. Arguing upon the basis that the two signs or manifestations of matter are (1), mass, and (2), individuality, and that both matter and the chemical elements are indestructible, his deduction was that there must be some bond of union between mass and the chemical elements, and hence also between the properties of an element and its atomic weight. This conception led him to compare the atomic weights and typical properties of the elements, and the result was a paper read before the Russian Chemical Society in March, 1869, "The Correlation of the Properties and Atomic Weights of the Elements." This paper included practically all the points of the Periodic Law as now generally accepted, and in subsequent articles only further applications of the same principles are to be found.

In his text-book, Mendeléeff stated that, although, when arranging the Periodic System, he made use of the previous researches of Dumas, Gladstone, and Pettenkofer on the atomic weights of allied elements, he was unacquainted with the work of De Chancourtois and of Newlands, the latter of whom, five years previously, had called attention to the periodicity of the properties of the elements ("Law of Octaves") when arranged in the order of their atomic weights, and had suggested that the unoccupied spaces in the table might be filled by elements then undiscovered, or by known elements the atomic weights of which had not been accurately determined ("Chem. News," 1866, 113 and 130). It was, however, reserved for Mendeléeff to arouse the genuine interest of the scientific world. This was practically due to the fact that he had such a profound belief in the universality of the principle he had enunciated) that he did not hesitate to prognosticate from it, and even to correct accepted atomic weights. He foretold not only the existence, but also the general properties and chemical behaviour of new and then undiscovered elements, to fill up blanks in the table he had constructed, and when gallium, scandium, and germanium were isolated, it was found that they fulfilled these predictions in a most striking manner. Moreover, the researches of Roscoe and Zimmermann have shown that he was correct in altering the atomic weight of uranium from 120 (which was generally accepted in 1869) to 240, and thus making it correspond with the Periodic System.

Mendeléeff was also fully alive to the importance of the application of chemistry to manufacturing industry, and his work on the "Principles of Chemistry," contains many details of industrial chemical processes, together with various suggestions for the practical utilisation of minerals contained in Russian soil. He published a work on "Naphtha production in America and the Caucasus" (1877), for the purposes of which he visited Pennsylvania. He has also made investigations of the nitro-compounds, with the view of providing a smokeless powder for the Russian Government.

An essay of singular originality and power was published by Mendeléeff in 1902, entitled, "An Attempt towards a Chemical Conception of the Ether." Starting with the assumption that the ether possesses both mass and materiality, and by extrapolation inserting a zero group in the Periodic System and a zero series of elements lighter than hydrogen, he deduced that in this series one element should have an atomic weight many times less than that of hydrogen, *i.e.*, less than 10^{-6} if $H = 1$; it should have a monatomic molecule like argon and helium, and its exceedingly small density, or, in other words, the exceedingly rapid motion of its molecules, should enable it to permeate and penetrate all matter and space. This gaseous element he believed to be the ether, and he was satisfied that the recently discovered physico-chemical phenomena connected with radio-activity could be satisfactorily explained by assuming the emission of a portion of this ether and the entrance of new ether into the sphere of attraction of particles of normal mean velocity, if it were supposed that uranium and thorium, having the highest atomic weights among the elements, would have in the highest degree that power of attraction which lies between gravity and chemical affinity, and which would cause the accumulation of ether atoms round their molecules.

Mendeléeff was personally well known to English chemists, and was for eight years a member of this Society, and was present at a Meeting of our London Section in 1905. In 1882, jointly with Lothar Meyer, he was awarded the Davy medal of the Royal Society for his researches on the periodic classification of the elements, and ten years later he became one of that Society's foreign members. In 1889 he was the Faraday lecturer to the Chemical Society, on which occasion he delivered a memorable discourse on his Periodic Law; and in 1905 he received in person the crowning honour at the disposal of the Royal Society, in the shape of the Copley medal.

Mendeléeff died on Feb. 2nd of inflammation of the lungs. The Tsar directed that the cost of the funeral should be defrayed by the State.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

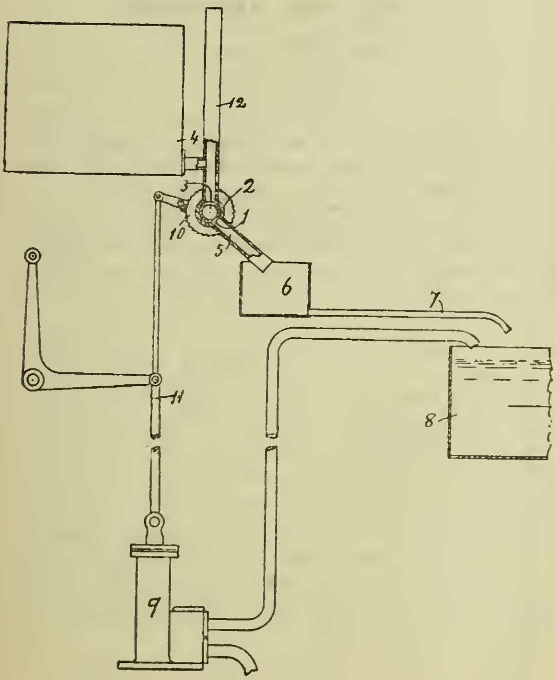
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 82.)

English Patents.

Mixing liquids in proportional quantities; Appliances for ——. J. Hargreaves, Farnworth-in-Widnes. Eng. Pat. 958, Jan. 13, 1906.



One of the liquids is delivered by the pump, 9, into the tank, 8, and is mixed with a determined proportion of the other liquid, which is stored in the tank, 4. A hollow plug, 1, having an opening, 3, is rotated in the casing, 2, by the ratchet and pawl mechanism, 10, actuated from the pump-rod, 11. The liquid in the tank, 4, flows into the hollow plug, 1, when the opening, 3, is in the uppermost position, and the air in the plug escapes through the pipe, 12. When the plug is rotated, the charge of liquid is delivered through the pipe, 5, into the small tank, 6, from which it flows by the pipe, 7, into the mixing tank, 8. At every stroke of the pump, 9, one plug-full of liquid from the tank, 4, is discharged into the mixing tank. If the latter is situated at a higher level than the tank, 6, a second pump, worked by the same crank, is used to pump the liquid from 6, into the rising main of the pump, 9.—W. H. C.

Separators; Centrifugal ——. R. Haddan, London. From Aktiebolaget Separator, Stockholm. Eng. Pat. 16,002, July 14, 1906.

In centrifugal machines for separating solids from liquids, provided with several curved or conical perforated plates, between which the mass to be treated has to pass, trouble has been experienced, due to temporary blocking of the discharge apertures. To obviate this a perforated drum provided with scrapers, which may or may not project into the delivery openings, is arranged so that it may be rotated, either in the same direction but at a different speed, or in a contrary direction to that in which the plates are rotated.—W. H. C.

Impregnating liquids [beer, &c.] with gases and raising them under the action of such gases; Apparatus for ——. G. Chenot and L. Van Genechten, Brussels. Eng. Pat. 17,062. July 28, 1906

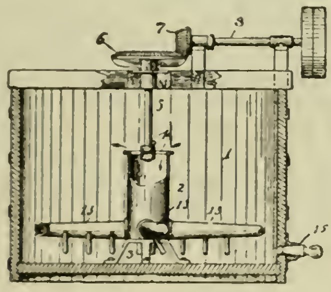
By the action of a valve operated by a float, the liquid is admitted from a cask or other receptacle into the upper compartment of the apparatus, which consists of a vessel divided by a horizontal partition into two chambers. The liquid flows into the lower chamber by a valved pipe, and is impregnated with the gas, which enters by a valved perforated pipe. As soon as the upper vessel is full, the float rises and the valve is reversed, the supply of liquid is stopped, and the pressure of the gas forces the liquid from the lower vessel into the rising delivery main. When the upper vessel is empty, the float falls and the valve returns to its first position, so that the operations of filling, aerating, and elevating the liquid are repeated so long as the supply of gas is maintained.—W. H C.

UNITED STATES PATENTS.

Gas-generator. C. L. Gerrard, Columbus, Nebr. U.S. Pat. 836,495, Nov. 20, 1906.

The apparatus consists of a generator head, with an opening extending from the bottom, an inlet pipe connected with one side, and an outlet pipe leading from the opposite side. Below the generator head a case is attached, which has an opening at the top that fits on to the opening in the bottom of the head. The side of the case has an opening provided with a door. A receptacle for an acid solution can be placed in the case, the receptacle having an open neck which fits into the opening in the bottom of the generator head. A tube of acid-resisting material fits loosely into the receptacle, and is supported by the neck of the latter by a flange. The tube is closed at the lower end, and is provided with holes through which the acid passes into the tube below the level of the solution, and a hole above the level for the escape of gas. The top of the generator head is provided with an opening in a line with this tube, so that a metallic rod can be inserted through the opening, and partially immersed in the acid in the tube, and means are provided for holding the rod in such position as required. The closed end of the tube serves to support the rod, and to conserve the heat resulting from the chemical reaction of the acid on the metal.
—W. C. H.

Agitating and mixing apparatus. L. C. Trent, Vantreat, Cal. U.S. Pat. 836,717, Nov. 27, 1906.



A vertical cylinder, 2, is mounted on a footstep, 3, in a vat, 1, which is provided with a plugged outlet, 15. The top, 4, of the cylinder, 3, is below the level of the liquid in the vat. The cylinder is provided with hollow radiating arms, 13, and can be rotated by the shaft, 5, driven by the mechanism, 6, 7, 8. When the cylinder is rotated, the liquid in the vat is drawn into the open upper end of the cylinder, as indicated by the arrows, and is thrown out from the hollow arms below.—W. H. C.

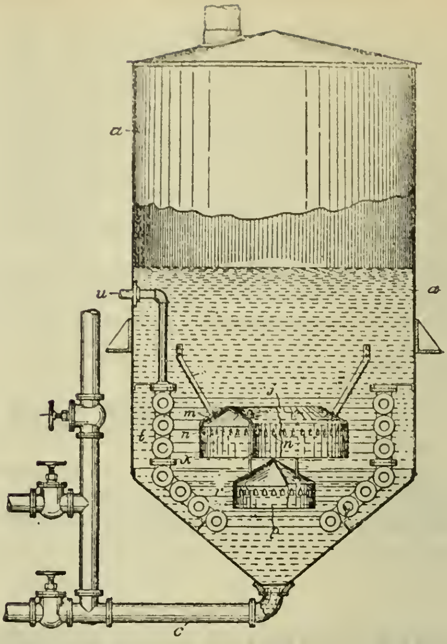
Kiln and dryer; Combined continuous ——. G. Curley, Salt Lake City, Utah. U.S. Pat. 837,547, Dec. 4, 1906.

Air is passed through a series of continuous, parallel flues, which pass over the heat-radiating surface of a series of kilns. The air becomes heated, and is conveyed, by cross flues, to another series of parallel flues, which pass below a continuous drying chamber or tunnel provided with valved outlets.—W. H. C.

[*Separating*] *machine; Centrifugal* ——. B. Ljungström, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 837,695, Dec. 4, 1906.

See Fr. Pat. 356,916 of 1905; this J., 1906, 9.—T. F. B.

Treating liquids with gases; Apparatus for ——. H. P. Dyer, Assignor to The Dyer Co., Cleveland, Ohio. U.S. Pat. 838,091, Dec. 11, 1906.



A cylinder, *a*, having a conical bottom, *b*, has a pipe, *c*, connected to its lowest point, through which liquid or gas can be delivered into the vessel, and by which the treated liquid can be drawn off. The vessel is provided with a heating coil connected at *u*, and with a circular gas collector and distributer, *p*, suspended above the inlet from the pipe, *c*, and provided with gas-escape apertures, *r*. Above the collector, *p*, is suspended an annular gas collector and distributor, *j*, having a ridged top, *m*, and vertical concentric sides, *k*, *l*, provided with gas-escape apertures, *n*.
—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 85.)

Anthracite discovery in Russia. Bd. of Trade J., Feb. 7, 1907. [T.R.]

Large deposits of anthracite have been discovered in the Russian territory of the Orenburg Cossacks. The depth is 56 in., and the vein extends about 133 miles north to south, and at about the same distance in a southerly direction from the great Siberian railway. The value of this discovery lies in the proximity of the coal fields to the Ural iron and steel industry, which is at present mainly dependent upon wood and charcoal for fuel, and in the discovery in the neighbourhood of deposits of brown hematite.

Peat; The Ziegler process for coking ——. O. K. Zwingenberger. Eng. and Min. J., 1907, 83, 143—145.

The Ziegler process for coking peat, with recovery of the by-products (see Eng. Pat. 19,241 of 1901; this J., 1902, 1127), is, it is stated, being worked on the large scale at Oldenburg and Beuerberg in Germany and at Redkino in Russia. The raw peat is pressed into blocks of about twice the size of ordinary bricks, and is dried in the air and by waste gases until its water-content is reduced to about 25 per cent. The gases produced on carbonisation are used to heat the retorts. The peat is divided into two kinds according to its content of ash, and the residues from the two kinds, after distillation, are distinguished as "peat coke" and "half-coke." The yields of products are stated to be as follows:—

Peat coke....	33%	Half-coke.....	45—50%
Tar..........	4—5%	Tar..........	2%
Tar water ...	41%	Tar water.....	38%
Gases	22%	Gases	15%

Peat coke is used for metallurgical purposes and as a substitute for charcoal; half-coke may be used in place of coal as fuel. The composition and heating value of peat coke and half-coke are shown in the following table :—

	Peat coke.		Half-coke.
	per cent.	per cent.	per cent.
Carbon	87·8	86·0	73·89
Hydrogen	2·0	1·9	3·59
Nitrogen	1·3	1·3	1·49
Sulphur	0·3	0·3	0·20
Oxygen	5·5	5·2	14·52
Ash	3·2	3·0	2·50
Moisture	0·0	0·0	3·80
Calorific value	14,500 B.T.U.		12,400 B.T.U.

The tar obtained from the peat is somewhat similar to that from lignite, but usually contains more phenolic compounds than the latter.

The output of a plant capable of treating 35,000 tons of air-dried peat per year in four retort-ovens is as follows :—Peat-coke, 33·3 per cent. (11,655 tons); ammonium sulphate, 0·4 per cent. (140 tons); calcium acetate, 0·6 per cent. (210 tons); methyl alcohol, 0·2 per cent. (70 tons); and tar, 5 per cent. (1,750 tons). The tar yields 245,800 galls. of light oil, 80,800 galls. of heavy oil, 117 tons of paraffin wax, 504 tons of creosote oil, and 78 tons of asphaltum, &c.—A. S.

Ammonia ; Formation of —— in the destructive distillation of coal. M. Mayer and V. Altmayer. J. Gasbeleucht., 1907, **50**, 25—31 and 49—54.

For investigating the conditions which determine the yield of ammonia in the carbonisation of coal, the method employed by the authors consisted in heating about 20 grms. of the coal in a horizontal, electrically-heated porcelain tube, fitted with a thermo-element for indicating the temperature, the gases evolved being first scrubbed with sulphuric acid, to collect the ammonia, and then analysed to determine the free nitrogen. At the beginning of each experiment the air was driven out of the apparatus by means of a current of nitrogen-free carbon dioxide. The nitrogen left in the coke was also determined. Four kinds of coal were experimented with, at temperatures ranging from 600° to 1000° C., and the conclusions arrived at are the following. The maximum yield of ammonia is attained with a temperature of about 800° C. Though at higher temperatures a larger proportion of the total nitrogen is expelled from the coal, possibly in the form of ammonia, the latter is decomposed into its elements and merely augments the yield of free nitrogen. To the instability of ammonia at all practicable carbonising temperatures is due the fact that the ammonia recoverable represents only a fraction of the nitrogen in the coal ; in works practice, the greater the proportion of ammonia in the gases evolved, the larger the incandescent retort surface, and the longer the contact of the gases with the latter, the greater will be the destruction of the ammonia. When coal is carbonised in a current of carbon dioxide, a larger proportion of its nitrogen is expelled ; the yield of ammonia, however, is not increased, but somewhat lessened. On the other hand, distillation in a current of nitrogen leads to a slight increase in the yield of ammonia. If carbonate or oxide of iron be added to the coal before distillation, a notable diminution in the yield of ammonia is observed; on the other hand, lime or calcium carbonate causes a distinct increase ; it is thus clear that the composition of the ash may have an important influence upon the yield of ammonia.

The production of ammonia from the residual coke by means of steam was investigated by heating the coke in a current of nitrogen, saturated with water at 95° C. The maximum yield was obtained at 800° C., but even at temperatures exceeding 900° C., such as are required for producing half-water-gas, the yield was practically the same. The total yield of ammonia, on carbonisation followed by treatment of the coke with steam, may amount to 50—60 per cent. of the nitrogen in the coal.
—H. B.

Gas oils [Carburetting] ; Valuation of ——. A. Spiegel. J. Gasbeleucht., 1907, **50**, 45—49.

The method proposed by the author for determining the market value of gas oils is based on the belief that the percentage of hydrogen is a criterion of their suitability for carburetting purposes ; that is, the richer the oil is in hydrogen, the greater its carburetting value. The percentage of hydrogen in oils varies widely, being highest in those of the paraffin class and lowest in tar oils, such as anthracene oil, the carburetting value of which is practically *nil.* In testing an oil, the hydrogen is first determined by an elementary analysis, and from the result the commercial value is calculated on the following lines. A " fundamental price " is ascribed to all oils, on the basis of their containing a certain percentage of hydrogen (7 per cent. is the figure proposed by the author). Any surplus of hydrogen, shown by the analysis, is regarded as " extra-percentage," to which a market price is also ascribed. Preferably the hydrogen is stated in parts per 1000, instead of per cent. For example, assume that in Germany the " fundamental price " is fixed at 250 pfennigs per 100 kilos. of oil, and that each " degree of strength " (*i.e.*, each part of surplus hydrogen per thousand of oil) is valued at 15 pfennigs. If the oil contain 12 per cent. (120 per thousand) of hydrogen (and therefore $120-70=50$ " degrees of strength "), its market price is :— $(50\times15)+250=1000$ pfennigs per 100 kilos. The analysis of a number of different sorts of oil are quoted to show the value of the method. The figure 7 is put forward tentatively as the standard for the fundamental price, until a larger collection of data is available. The actual market values to be ascribed to the fundamental price and degrees of strength respectively, will naturally be fixed by local considerations, being lowest in producing centres and highest in importing countries.—H. B.

Carbon ; Separation of —— from carbides. C. Hahn and A. Strutz. VII., page 150.

English Patents.

Gas producers. H. H. Lake, London. From E. N. Trump, Syracuse, U.S.A. Eng. Pat. 1100, Jan. 15, 1906.

See U.S. Pat. 813,600 of 1906 ; this J., 1906, 527.—T.F.B.

Combustion engines ; Method of producing a working medium for two-stroke cycle internal ——. P. Winand, Cologne. Eng. Pat. 24,818, Nov. 5, 1906. Under Int. Conv., Nov. 9, 1905.

In Eng. Pat. 3006 of 1906 (this J., 1906, 582) is described a method of producing a working medium for gas motors, in which a diluent, consisting of a portion of the cooled products of combustion, is added to a mixture of volatile hydrocarbon and oxygen-bearing gas. In adapting the same principle to a two-stroke cycle engine, water or an equivalent liquid is injected into the products of combustion in the cylinder, either towards the end of the expansion period, or during the compression period. The steam thus produced mixes with the gaseous products left in the cylinder at the end of the expansion stroke, and together with these gases constitutes the diluting agent for the next charge of explosive mixture.—H. B.

Coal gas and analogous gases ; Treatment of —— for the extraction of tar and ammonia therefrom. W. Feld, Hönningen on Rhine, Germany. Eng. Pat 26,262, Dec. 16, 1905.

See Fr. Pat. 369,258 of 1906 ; this J., 1907, 87.—T. F. B.

Tar-fog extractor for the extraction of tar from all kinds of gases. W. Blakeley. Dewsbury. Eng. Pat. 1257, Jan. 17, 1906.

In using screens of wire-gauze and the like for extracting tar from gases, it is found that certain kinds of tar are apt to choke up the screens. According to this invention, the obstruction of the meshes is prevented by causing the gas containing the tar to pass through the screen from one face and then from the other alternately. To effect this, plane screens of gauze are mounted pivotally in a horizontal casing (through which the gas flows always in one direction) in such a manner that the screens can be turned round on a horizontal axis. From time to time the screens are turned round, so that the front and back faces are alternately exposed to the incoming gases. Jets of steam may be directed upon the faces of the screens. —H. B.

Filaments for incandescent electric lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co of Schenectady, N.Y., U.S.A. Eng. Pat. 929, Jan. 12, 1906.

Incandescence filaments are constructed of nitride of cerium, yttrium, lanthanum, or other like metal, the nitride of which is stable at high temperatures. In order to obtain the nitride, nitrogen is brought into contact with the metal at a red heat, whereupon a powerful exothermic combination occurs.—H. B.

Incandescing bodies for electric incandescent lamps; Manufacture of ——. A. Just and F. Hanaman, Bucharest, H. Landesberger, and I. Salzmann, Vienna, and Verein. Elektricitäts A.-G., Ujpest, Hungary. Eng. Pat. 3225, Feb. 9, 1906.

See Fourth and Fifth Additions to Fr. Pat. 347,661 of 1904; this J., 1906, 877, 976.—T. F. B.

Filaments; Metallic —— for electric incandescent lamps. A. G. Bloxam, London. From J. Lux, Vienna. Eng. Pat. 7189, March 24, 1906.

In order to produce exceedingly thin metallic filaments (of a diameter of 0·01 mm. or less), the finely powdered metal (say tungsten) is mixed with an easily reducible oxide or sulphide of a metal which is volatile at a comparatively low temperature (*e.g.*, oxide of zinc), and with an organic agglutinant; the paste is formed into fine filaments as usual, and the latter are heated to incandescence in a suitable mixture of gases or in a vacuum. The volatile metal and other volatile matters are thus expelled, and the filament shrinks to a very much smaller diameter. Instead of using the volatile metal as oxide or sulphide, it may be used in the metallic form, the refractory metal in that case being employed in the form of oxide or sulphide; or both metals may be in the form of oxide or sulphide. —H. B.

United States Patents.

Briquetting; Process of ——. R. Schorr, San Francisco, Cal. U.S. Pat. 836,897, Nov. 27, 1906.

The pulverised coal is heated and mixed while hot with the organic binding agent, which has been previously heated and melted. The mixture is next reduced to a granular or floury condition by continued mixing under an air blast, and is then delivered to the briquetting press, whilst still in this condition.—W. H. C.

Coal compound [*Briquette*]; W. Hammick, Pittsburg, Kans. U.S. Pat. 838,403, Dec. 11, 1906.

This process for the manufacture of coal briquettes consists in mixing small particles of coal with a solution of glue, as a binding material, and moulding the mixture. Simultaneously with the moulding operation, crude oil is applied to the surface of the moulded mass, to add to its combustibility, and give a finished appearance to it, and protect it from climatic changes.—W. C. H.

Lignite; Process of treating ——. L. Sterne, London. U.S. Pat. 838,281, Dec. 11, 1906.

By this process, the lignite, when obtained from the mine, is exposed to the air for sufficient time only to dry the surfaces of the particles and render them porous, and then the lignite is coated with oil, such as crude petroleum, to prevent the evaporation of the contained moisture, and consequent disintegration of the particles.—W. C. H.

Gas-producer. C. L. Armstrong, St. Louis, Mo. U.S. Pat. 837,026, Nov. 27, 1906.

The producer consists of a shell or generator provided with a "header" at each end. The upper "header" is provided with a cover, and means of introducing the fuel through it. Means are also provided in the walls of the shell for establishing a circulation between the "headers," and a series of inclined water tubes open into the bottom "header," and span the space between the walls of the generator, and serve as a grate for the charge of fuel. A steam and air injector leads from the top "header" through the cover into the space above the charge of fuel, and drives the producer gas downwards through the charge. The gas is withdrawn from a point below the grate, and above the water-sealed ash-pit. —W. C. H.

Gas-producer. H. Riché, Paris. U.S. Pat. 837,121, Nov. 27, 1906.

This apparatus for the production of mixed gas comprises a fuel chamber, of enlarged cross-sectional area, provided at the top with a means of introducing the fuel, and at the bottom with a step-grate furnished with troughs. From the side of the column of fuel, and near the bottom of it, a combustion chamber extends at an angle with respect to the producer; this chamber is provided with air-inlets, and immediately above the end of it, remote from the producer, is a purifying column, from the top of which the gases are conveyed by a conduit to a gas washer. (See also Eng. Pat. 27,533 of 1902; this J., 1903, 411; and Fr. Pat. 352,908 of 1905; this J., 1905, 961.)—W. C. H.

Gas-producer. L. C. Parker, Rochester, N.Y. U.S. Pat. 837,584, Dec. 4, 1906.

The generator consists of a vertical fuel chamber, with a feed-hopper on the top, and a "dumping-grate" below the hopper and above the fuel column. Round the lining wall of the generator are two annular passages, one near the bottom of the fuel column, and the other near the top of the generator; a third annular passage may be arranged about half-way between the other two passages. Communication is established between the annular passages and the interior of the generator by means of tapering openings in the lining wall, and the upper and lower annular passages are connected by two vertical pipes, each of which is provided near the top with a steam-jet to create a down-current of gas. There is also an inlet-port and an exhaust-port attached to the apparatus. From the centre of the grate a gas-collecting pipe is suspended, which has an open bottom extending down into the top of the fuel column, and a perforated top to allow the free passage of gas into the spaces above the fuel column.—W. C. H.

Gas-producer. F. Thiele, Hildesheim, Germany. U.S. Pat. 837,755, Dec. 4, 1906.

The producer described has a vertical fuel chamber of brickwork, surrounded by an outer casing. The vertical chamber or shaft is composed of two parts, one above the other, the lower or primary, and the upper or secondary shaft. A plate is secured to the inner wall of the casing almost on a level with the top of the primary shaft, and a second plate is fitted into a recess between the two shafts. Between these two plates is a sand seal.—W. C. H.

Gases; Apparatus for purifying ——. F. Pettit, Assignor to W. A. Barrows, jun., Sharpsville, Pa. U.S. Pat. 836,826, Nov. 27, 1906.

The apparatus described consists of a water chamber provided at one end with water- and gas-inlets, and at the other with water- and gas-outlets, so that the gas passes through the chamber, in a continuous course, over an unbroken surface of water. The roof of the chamber is composed of a number of transverse arches, within which are curved baffles, arranged to allow passages for the gas both above and below them, the lower edges of the baffles being above the water surface and their concave surfaces directed towards the point of entrance of the gases. On entering, the gases are made to impinge upon the surface of the water, and are kept in contact with it, during their passage through the apparatus, by means of the series of arches forming the roof.—W. C. H.

FRENCH PATENTS.

Peat ; Treatment of —— [for the preparation of fuel] with an alternating current, without marked heating, after preliminary removal of water. J. B. Bessey. Fr. Pat. 368,313, July 23, 1906. Under Int. Conv., July 24, 1905.

THE peat is first mechanically freed from a portion of the water, for instance in a press, and the remainder of the water is then separated by submitting the peat to the action of an alternating current for two successive periods between and subsequent to which the additional water which has separated is removed. A current of 1200 ampères at 200 volts per ton of solid matter contained in the peat is specified as being suitable for the process. It is mportant not to raise the temperature of the peat above 100° C. in order to conserve the materials which serve to bind the mass together.—R. S. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(Continued from page 87.)

Petroleum ; Solubility of unsaturated hydrocarbons of —— in acetone. Perdit and Jaguboff. Abhandl. der Bakuer Abteil. kaiserl. russ. techn. Ges., 1906 [7]. Petroleum, 1907, 2, 325—326.

THE authors have examined the process patented by Landsberg (Ger. Pat. 166,452 of 1904 ; this J., 1906, 634), and find that the separation of the tarry constituents is not nearly so complete as is claimed. It was found that from petroleum fractions of higher specific gravity than 0·88, acetone dissolves unsaturated hydrocarbons, which are characterised by high iodine value, high specific gravities, and deep colour. The solubility of both unsaturated and saturated hydrocarbons in acetone decreases with increase of density. The explosion-temperature of lubricating oil distillates rises as the content of unsaturated hydrocarbons falls, notwithstanding the decrease in the specific gravity. The viscosity of lubricating oils is increased by removal of the unsaturated hydrocarbons by means of acetone.—A. S.

Water from the bore-holes of the Grosny oil-field ; Examination of the ——. K. Charitschkow. J. russ. phys.-chem. Ges., 1906, 38, 881—883. Chem. Zentr., 1907, 1, 295.

THE results of the analyses of six different specimens of water from bore-holes of the Grosny oil-field are given in tabular form. All of the waters had an alkaline reaction, and were characterised by the presence of ammonia and methyl, and other amines. The waters differ from those obtained from the Baku oil-field by their lower content of salts and their similarity to alkaline mineral waters.
—A. S.

Gas oils [Carburetting] ; Valuation of ——. A. Spiegel. II. page 143.

Lubricating oils containing saponifiable fats ; Determination of the saponification value of ——. H. Schreiber. XII., page 158.

ENGLISH PATENT.

Pitch ; Manufacture of —— from coal tar. J. Wetter, London. From Rud. Rütgers, Chem. Fabr. f. Theerprodukte, Berlin. Eng. Pat. 3192, Feb. 9, 1906.

EXPERIMENTS have shown that in the process for the manufacture of pitch described in Eng. Pat. 23,680 of 1904 (this J., 1905, 492), the previous separation of the heavy oils is not necessary ; the tar may be heated directly while conducting into it air or other gases containing oxygen or ozonised air, whereupon the pitch is formed. The process may be accelerated by the presence of catalytic agents such as copper salts.—D. B.

UNITED STATES PATENT.

Petroleum distillate ; Process of deodorising ——. J. Armstrong, Baltimore, Md. ; W. E. F. Armstrong, Administrators of J. Armstrong. U.S. Pat. 837,655, Dec. 4, 1906.

PETROLEUM distillates are deodorised by shaking with a reagent prepared by treating chloride of lime with water, separating the clear solution, and adding to it, in succession, sodium carbonate and potassium bichromate solutions.
—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(Continued from page 89.)

Rosaniline and phenylated Rosanilines ; Action of hydrogen sulphide on ——. R. Lambrecht. Ber., 1907, **40**, 247—255.

BY the action of ammonium hydrosulphide on Rosaniline salts, carbothiol bases containing a CS group instead of the carbinol group were prepared. These possess similar properties to the corresponding bases previously prepared from Malachite Green and Crystal Violet (this J., 1905, 192). They dissolve in excess of mineral acids to colourless solutions, but with acetic acid in presence of alcohol, hydrogen sulphide is evolved. On heating these carbothiol bases alone, or on evaporating their alcoholic solutions, they undergo molecular change with formation of coloured amorphous substances of unknown constitution. *p*-Rosaniline Blue (Kalle und Co.), when treated with hydrogen sulphide in alcoholic-acetic acid solution, gave triphenyl-*p*-leucaniline. Similarly, Diphenylamine Blue (Farbwerke Krefeld) gave a leuco-compound, which, however, indicated that the original substance was a very impure triphenyl-*p*-Rosaniline.—J. C. C.

Di-p-dimethylaminoindigo. M. Freund and A. Wirsing. Ber., 1907, **40**, 204—206.

DI-*p*-DIMETHYLAMINOINDIGO has been prepared by the following series of reactions :—*Nitrile of p-dimethylaminophenylglycin*, $(CH_3)_2N.C_6H_4.NH.CH_2.CN$.—9 grms. of *p*-dimethylphenylenediamine dissolved in 60 c.c. of alcohol, were heated with 16·5 c.c. of an 11 per cent. solution of hydrocyanic acid and 5·5 c.c. of a 37 per cent. solution of formaldehyde in an autoclave for 2 hours at 100° C. On cooling, the nitrile separated in brown crystals and by recrystallisation was obtained in nearly white needles, m. pt. 80°—81° C. The substance is readily soluble in the usual organic solvents. *p-Dimethylaminophenylglycin*, $(CH_3)_2N.C_6H_4.NH.CH_2.CO_2H$.—10 grms. of the nitrile were boiled with 21·2 c.c. of aqueous caustic potash (1 c.c. =0·1512 grm. KOH) for 40 minutes ; ammonia was evolved, and a clear solution resulted. On evaporation and crystallisation of the residue from dilute caustic potash and alcohol, silvery leaflets of the potassium salt were obtained. *Di-p-dimethylaminoindigo.*—5 parts of sodamide were fused in a nickel crucible and 3 parts of the dry potassium salt added. After stirring for a few minutes, and subsequent cooling, the product was poured into water. The solution was filtered, and air blown through the filtrate, when the new substance separated in green flakes. It is sparingly soluble in alcohol, with a brownish-green colour, moderately soluble in amyl alcohol or toluene, with a dirty green colour, and readily soluble in chloroform, acetone, benzene, nitrobenzene, or ethyl acetate, with a beautiful green colour. The substance dissolves in dilute acids, and also in concentrated sulphuric acid, with a blue colour. Its solution in acetic acid dyes wool bright green, and when reduced by sodium hyposulphite it produces a green shade on wool.—J. C. C.

Emeraldine. W. Nover. Ber., 1907, **40**, 288—297.

BY the electrolytic reduction of nitrobenzene the author has isolated a new green reduction product which is identical with Emeraldine. This is also obtained by the oxidation of *p*-aminodiphenylamine—a substance formed in the above process by the condensation of phenylhydroxylamine and aniline. The first product of this oxidation is known to be phenylquinonedi-imine, and by treating this with dilute acids, Emeraldine results. The base dissolves readily in most organic solvents, and is thus distinguished from Nietzki's Aniline Black.—J. C. C.

Sulphide dyestuffs. H. Wichelhaus. Ber., 1907, **40**, 126—129.

When natural dyestuffs, containing the phenolic group, such as Brasilin, Hæmatoxylin, Maclurin, Euxanthone, &c., are heated with sulphur in absence of air, hydrogen sulphide is given off, and sulphur dyestuffs are obtained, which are insoluble in most solvents, but dissolve in sodium sulphide. Example: 3 parts of Maclurin and 6 parts of sulphur are heated to 250°—300° C. for 6 to 8 hours. The product is dissolved in caustic soda, and precipitated with acid. Similarly, synthetic dyestuffs, such as Gallacetophenone, Aurin, and Fluorescein were examined, and, in the latter case, it was found that the same product is obtained when a mixture of resorcinol and phthalic anhydride is used. The resulting dyestuff contains sulphur, but is different from Gattermann's Thiofluorescein; it has a red shade, and appears to be of practical use.—J. C. C.

English Patents.

Indigo; Process of making ——. A. Rahtjen and C. Stephan, Hamburg. Eng. Pat. 1596, Jan. 22, 1906.

See Fr. Pat. 365,109 of 1906; this J., 1906, 923.—T. F. B.

Dyestuffs; Manufacture of azo ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Basle. Eng. Pat. 7029, March 23, 1906.

See Addition of June 19, 1905, to Fr. Pat. 351,125 of 1905; this J., 1906, 922.—T. F. B.

p-Aminodiphenylaminesulphonic acid; Manufacture of a new ——. C. D. Abel, London. From Act. Ges. f. Anilinfabr. Berlin. Eng. Pat. 13,772, June 15, 1906.

The new acid is obtained by acting on *p*-aminodiphenylamine with sulphuric acid monohydrate or fuming sulphuric acid containing not more than 20 per cent. of anhydride at temperatures between 100° and 130° C. The product is sparingly soluble in hot water, from which it cystallises in fine needles arranged in concentric bunches. Its sodium salt is readily soluble in water.—D. B.

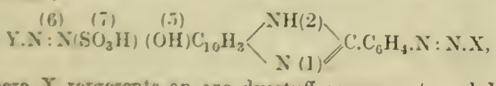
Colouring matters containing sulphur [*Thio-indigo dyestuffs*] *Manufacture of* ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,507, June 25, 1906.

See Fr. Pat. 367,739 of 1906; this J., 1906, 1143.—T.F.B.

United States Patents.

Azo dyestuff; Red ——, *and process of making same.* A. Schedler, Assignor to the Soc. of Chemical Ind. in Basle, Switzerland. U.S. Pat. 837,736, Dec. 4, 1906.

Anhydroaminoalphylacidyl-1.2-diamino-5-naphthol-7-sulphonic acid is combined with 1 mol. of an aromatic diazo compound, and the resultng monoazo dyestuff is further diazotised, and combined with an azo dyestuff component, in order to obtain dyestuffs of the general formula:



$$\overset{(6)}{Y.N:N}\overset{(7)}{(SO_3H)}\overset{(5)}{(OH)}C_{10}H_3\left\langle\begin{matrix}NH(2)\\N(1)\end{matrix}\right\rangle C.C_6H_4.N:N.X,$$

where X represents an azo dyestuff component, and Y, "a diazo derivative of an aromatic amido compound." These dyestuffs dye unmordanted cotton in clear yellowish-red to bluish-red shades, very fast to light and acids. Special claim is made for the dyestuff obtained by combining 1 mol. of anhydroaminoalphylacidyl-1.2-diamino-5-naphthol-7-sulphonic acid with 1 mol. of diazotoluene, diazotising the resulting product, and combining with naphtholsulphonic acid. The brownish-red powder so obtained is soluble in water, and dyes unmordanted cotton in red shades fast to light and acids.—A. S.

Dyestuff; Anthracene ——, *and process of making same.* M. H. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 837,840, Dec. 4, 1906.

See Fr. Pat. 355,100 of 1905; this J., 1905, 1223.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page 92.*)

English Patents.

Wool slivers after backwashing, etc.; Drying of ——. R. Kleinjung, Leipzig, Germany. Eng. Pat. 6385, March 16, 1906.

The machine consists of two vertical series of horizontal hollow metal rollers which are heated in some suitable manner. These two series are placed a certain distance apart in a closed casing. The rollers in the two series are not placed in the same horizontal plane. The band of sliver enters at the top of the casing and passes backwards and forwards in a zig-zag course from one series of rollers to the other, leaving the casing near the bottom. A heating apparatus is fixed at the bottom and a current of hot air is drawn up through the moving bands of sliver, by means of a fan.—A. B. S.

Glossy or silky effects on fabrics or other material; Producing ——. L. Lilienfeld, Vienna. Eng. Pat. 4597, Feb. 24, 1906.

In the process of producing a silky lustre on fabrics by the application of viscose or a similar product, the effect is much improved by first applying to the surface a waxy, resinous, or fatty matter either alone or mixed with other bodies. The fabric may be treated with a solution of these substances in a suitable solvent, such as benzene, or they may be applied in the fused state.—A. B. S.

United States Patents.

Bleaching [*textiles*]. K. Reinking, E. Dehnel, and H. Labhardt, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 837,730, Dec. 4, 1906.

See Eng. Pat. 12,517 of 1906; this J., 1906, 807.—T. F. B.

Padding and ornamenting burlap or similar fabrics; Process of ——. P. Richter, Tenafly, N.J. U.S. Pat. 837,122, Sept. 27, 1906.

Claim is made for a process of treating a fabric by passing it through a sizing and colouring composition, so as to form a ground colour, and simultaneously applying a pattern by a heavier layer of the same composition. —A. B. S.

Fabrics; Method of treating —— *to render them impervious.* W. Spaulding, East Pepperell, Mass., Assignor to Vellumoid Paper Co., Worcester, Mass. U.S. Pat. 837,005, Nov. 27, 1906.

The fabric is saturated with an emulsion containing 10 parts of casein, 80 parts of water, and 6·4 parts of borax, by weight. It is then treated with formaldehyde and dried, being finally wetted and dried again.—A. B. S.

French Patents

Silk, artificial; Manufacture of ——. E. Crumière. First Addition, dated Sept. 1, 1906, to Fr. Pat. 361,048, Nov. 27, 1905 (this J., 1906, 691).

A current of ozone is passed through a solution of caustic soda for about five minutes. The cotton which is to be employed in the manufacture of the artificial silk is immersed in this, and the current of ozone continued for about 30 minutes, with constant movement of the material. The ozone is then stopped, and the liquid raised to the boil during 30 minutes. The cotton, thus prepared, is rinsed and dried. It dissolves much more readily in ammoniacal cupric hydroxide than untreated cotton.—A. B. S.

Dyeing machine for silk, cotton, and other textile materials. J. Garel. First Addition, dated Aug. 6, 1906, to Fr. Pat. 362,261 of Jan. 6, 1906 (this J., 1906, 756).

The machine described in the original patent has been improved by using an electric motor to raise and lower the frame supporting the dyeing reels, and also by fitting a motor to turn these reels. The direction of rotation of the latter is reversed automatically.—A. B. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 93.)

United States Patent.

Leather ; Process for dyeing ——. F. J. Oakes, New York, N.Y. U.S. Pat. 837,105, Nov. 27, 1906.

The leather is treated, while moist, with a solution of an alkali sulphide and then with a solution of a salt of some metal, *e.g.*, acetate of iron, which is capable of forming an insoluble sulphide with the alkali sulphide. Finally, a solution of a dyestuff, such as logwood, is applied, which is capable of forming a colour lake with the metal used. —A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 94.)

Salt deposit in Utah. Railway Age. Bd. of Trade J., Feb. 7, 1907. [T.R.]

An enormous deposit of pure salt has been found on the west side of the Utah desert, not far from the Nevada State line. It is fifteen miles long and eight miles wide. Excavations to the depth of more than six feet are still in solid salt. It is asserted that this section was once the bed of the Great Salt Lake.

Ammonia soda process ; The ——. H. Ost. Chem.-Zeit., 1907, **31**, 67—69.

The author compares at some length the figures for strengths and proportions of solutions to give the best yield, given by Schreib and by Fedotieff, with some results of actual work. The following example of figures from actual practice is given (all figures represent grms. per litre) :—Original brine, 322 NaCl ; after saturation with ammonia, 246 of sodium chloride + 81·6 ammonia ; saturated again with salt, 161 of chlorine = 265 sodium chloride + 81·6 of ammonia (1·06 equivalent). After carbonating, in the clear mother-liquor, there were 174 of chlorine, 78·2 of ammonia (0·94 equivalent). The volume of liquid, through separation of sodium bicarbonate and volatilisation of ammonia and water, has lessened to the extent of 7·5 per cent.—hence the increased chlorine concentration. Of the total ammonia in the carbonated liquor (78·2 grms.), 21·0 were volatile (ammonium carbonate), 57·2 of ammonia as ammonium chloride. The liquor contains, of total chlorine, 174 grms., that corresponding to the 57·2 grms. NH_3 being 119 grms. Cl, or 68·5 per cent. of the total ; hence 68·5 per cent. of the total sodium chloride has been precipitated as sodium bicarbonate, or, from 1 litre of the ammoniacal liquor, 260 grms. of $NaHCO_3$, equivalent to 164 grms. of calcined sodium carbonate. Losses in the further treatment somewhat reduce these figures, so that the ultimate yield corresponds to 62—65 per cent. of the original salt, or only 240 grms. of bicarbonate, or 150 grms. of calcined carbonate, per litre of ammoniacal liquor.—J. T. D.

Alkaline-earth carbonates, carbon, and nitrogen ; Products from ——. O. Kühling. Ber., 1907, **40**, 310—319.

The author has investigated quantitatively the production of cyanides and cyanamides when carbonates of barium, strontium, and calcium in admixture with carbon are heated in a stream of nitrogen. The temperature was varied from 900° to 1400° C., the nitrogen was used dry and moist, and the carbon-carbonate mixtures were used alone, and also with 10 and with 30 per cent. of the corresponding chlorides. The results show clearly that the tendency to absorb nitrogen, which in all cases rises with the temperature, is greatest with barium, and least with calcium, and that the product is with barium chiefly cyanide, and with calcium chiefly cyanamide, strontium being in every respect intermediate between the other two. Addition of chloride favours the reaction, lowering the temperature at which reaction begins ; but in the case of barium this is effected by small percentages of chloride, and larger proportions lessen the amount of nitrogen absorbed, whilst with both strontium and calcium the effect of the chloride increases with the percentage, certainly up to 30 per cent. The addition of chloride seems also to favour the production of cyanide as compared with cyanamide. Moisture in the nitrogen acts in all cases unfavourably towards the absorption of nitrogen. The effect of moisture in favouring the reaction between calcium carbide and nitrogen, observed and made use of by Frank and Caro, is no doubt rightly attributed by them to the reaction of the water on the carbide with formation of lime, which no doubt reacts on the carbide and nitrogen in such a way as to be continually regenerated—$CaO + CaC_2 + N_2 = Ca(CN)_2 + CaO$. In the author's experiments there is no carbide originally present, but there is, at the temperature of the experiment, lime produced by the dissociation of the carbonate, so that moisture is not necessary for the production of lime.—J. T. D.

Ammonium carbonate ; Synthesis of —— *from acetylene and nitric oxide at a high temperature.* O. Angelucci. Gaz. chim. ital., 1906, **36** [2], 517—522.

In his experiments the author used a tube such as is employed for the weighing of copper oxide obtained by reduction of Fehling's solution. A layer, about 3 mm. thick, of spongy platinum was placed in the tube on an asbestos plug, the gas-inlet being about 0·5 cm. distant. The arrangement of the apparatus was such that about 2 cm. below the platinum the temperature was considerably below 100° C., whilst the platinum itself was heated to about 800° C. The first experiments were with mixtures of acetylene, oxygen, and nitrogen. The chief products were carbon monoxide and dioxide, steam, and unchanged nitrogen ; traces of hydrocyanic acid were formed, but no ammonia or oxides of nitrogen. With a mixture of acetylene and nitric oxide, ammonium carbonate was formed in considerable amounts, together with water, carbon monoxide, nitrogen, and small quantities of hydrocyanic acid. Only very small quantities of ammonia were formed when the acetylene was replaced by coal-gas. —A. S.

Bleaching powder ; Study of ——. E. Schwarz. Z. angew. Chem., 1907, **20**, 138–143.

After a discussion of the investigations of Ditz, Winteler, and von Tiesenholt (this J., 1901, 247, 248, 896 ; 1902, 913, 1074, 1075 ; 1906, 426), the author shows that a chlorinated strontia can be obtained in an analogous manner to chlorinated lime. The highest attainable proportion of available chlorine in chlorinated strontia is only 11·54 per cent., but just as in the case of lime, the most favourable proportion of water for the chlorinating process is about 1—2 per cent. above that required for the formation of the hydroxide. In further experiments "synthetic" bleaching powder, consisting principally of calcium hypochlorite and calcium chloride, was prepared by acting on calcium chloride with hypochlorous acid, and mixing the product with such a quantity of calcium chloride that the mixture contained the same percentage of available chlorine as commercial bleaching powder. The "synthetic" and commercial products were then subjected to the action of carbon dioxide. It was found that from the commercial product, 83·04 per cent., from the synthetic product only 45 per cent., at the most, of the available chlorine (hypochlorite chlorine + equivalent quantity of chloride chlorine) was expelled by the carbon dioxide. This result appears to confirm the view that bleaching powder is not merely a mechanical mixture of hypochlorite and chloride, but is a chemical compound of the formula, CaCl.OCl, given by Odling.—A. S.

Persulphates; Decomposition of ——. M. G. Levi and E. Migliorini. Gaz. chim. ital., 1906, **36** [2], 599–619.

THE authors have determined the rate of decomposition of solutions of potassium, sodium, and ammonium persulphates. The potassium and ammonium salts were of 99·5—99·6 per cent. purity, but the sodium salt only about 90 per cent., containing sulphate and chloride. The amount of decomposition was determined by titrating the free sulphuric acid formed. The reaction proved to be monomolecular. At 30° C. no decomposition could be detected after two days in dilute solutions. The following values for the reaction-velocity constant (K) were determined with solutions of 2—4 per cent. strength, the time being reckoned in minutes :—

Temperature.	Potassium salt.	Sodium salt.	Ammonium salt.
°C.			
41	0·000017	0·000014	0·000017
56	0·00027	0·00030	0·00039
76	0·0029	0·0032	0·0041
90	0·0204	0·0211	0·0204

The formula for monomolecular reactions does not hold strictly in the case of the ammonium salt, owing to secondary reactions (oxidation). With a 25 per cent. solution of ammonium persulphate at 56° C., the value, K = 0·00064, was obtained. An addition to the persulphate of the corresponding alkali or of sulphuric acid accelerated the rate of decomposition, sulphuric acid having the greatest influence in this respect. In hot solutions which have undergone decomposition in presence of ammonia, nitric acid could be detected. Platinum black accelerates the decomposition, even at the ordinary temperature, but bright platinum has no effect. Concentrated solutions of ammonium persulphate decompose at 20° C., even in absence of platinum. In presence of platinum black, alkali has a greater accelerating effect than sulphuric acid on the rate of decomposition. Indeed, platinum black is less active in acid than in neutral solutions of persulphates. Other finely-divided metals, especially lead, have a similar action to platinum black. This effect of finely-divided lead explains the low yield of persulphate obtained at lead peroxide electrodes. Lead sulphate is produced at first, and this is afterwards oxidised to lead peroxide. It is stated that platinum black is capable of causing the oxidation of ammonium sulphate to nitric acid.
—A. S.

Silicates, double, of calcium and aluminium; Influence of alkali chloride solutions on ——. F. H. Campbell. Landw. Vers.-Stat., 1906, **65**, 247—252. Chem. Zentr., 1907, **1**, 213.

Two calcium aluminium silicates prepared from calcium and aluminium chlorides and sodium silicate, and well washed with water, were treated with solutions of sodium, potassium, lithium, and ammonium chlorides, and the amount of calcium dissolved determined. Drying the silicate at 100° C. considerably increased its power of resistance against the alkali chloride solutions. The rate at which the silicate was attacked was greater at 32·5° C. than at 25° C., but the total amount of calcium dissolved was not notably different. A relation between the concentration of the alkali chloride solution and the quantity of calcium dissolved was observed only at concentrations considerably below the maximum. With solutions of low concentration, the salts may be arranged in the following order :—LiCl, NaCl, KCl, NH_4Cl, according to their action on the silicates, lithium chloride having the least effect.—A. S.

Calcium sulphate; Solubility of —— in phosphoric acid solutions. W. C. Taber. J. Physical Chem., 1906, **10**, 626—629. Chem. Zentr., 1907, **1**, 324.

THE curve representing the solubility of calcium sulphate in phosphoric acid solution at 25° C. shows a maximum corresponding to a solution containing 230 grms. of phosphoric anhydride per litre. The detailed results are given in the following table :—

Phosphoric anhydride.	Calcium sulphate.	Sp. gr. at 25° C.	Phosphoric anhydride.	Calcium sulphate.	Sp. gr. at 25° C.
Grms. per litre.			Grms. per litre.		
0·0	2·126	—	145·1	7·920	1·106
5·0	3·138	1·002	204·9	8·383	1·145
10·5	3·734	1·007	312·0	7·965	1·221
21·4	4·456	1·016	395·7	6·848	1·230
46·3	5·760	1·035	395·7	6·848	1·230
105·3	7·318	1·075	494·6	5·573	1·344

—A. S.

Calcium ammonium sulphates; Two new ——. J. D'Ans. Ber., 1907, **40**, 192—194.

THE author has already prepared an ammonium syngenite, $(NH_4)_2Ca(SO_4)_2.H_2O$. By boiling under a reflux condenser a 30 per cent. solution of ammonium sulphate with gypsum till no anhydrite remains, the salt $(NH_4)_2Ca_5(SO_4)_6,H_2O$ is formed, recognisable by its crystalline form, which is identical with that of the corresponding potassium salt. It is separated by filtering off the hot mother-liquor by the pump, and washing rapidly with water, 50 per cent. alcohol, absolute alcohol, and ether. By using 40 per cent. ammonium sulphate solution and proceeding in exactly the same way, a salt, $(NH_4)_2Ca_2(SO_4)_3$, is obtained. If this be boiled too long with the solution, it decomposes, forming syngenite and the pentacalcium salt. Both of these salts are decomposed by water.—J. T. D.

Barium sulphide; Valuation of ——. L. Wessely. Chem.-Zeit., 1907, **31**, 71—72.

THE sample is finely pounded, and 10 grms. are very gradually introduced into 500—700 c.c. of boiling water, with continual shaking. Any lumps which form must be taken out and powdered again. When solution is complete, the whole is poured and rinsed into a litre flask, cooled, made up, and filtered. Of the filtrate, 25 c.c. are titrated with $N/10$ hydrochloric acid and methyl orange, then 300 c.c. of water, 2 c.c. of dilute hydrochloric acid, and a measured volume of $N/10$ iodine solution nearly equal to the volume of acid required in the first titration are placed in a roomy flask, and 25 c.c. of the barium sulphide solution allowed to flow in with shaking. The slight excess of barium sulphide is now titrated by iodine solution and starch. If more than a few tenths of a c.c. are needed, the experiment should be repeated, using a correspondingly greater amount of iodine solution in the first instance. (One c.c. of $N/10$ iodine = 0·0084745 grm. of barium sulphide.)—J. T. D.

Copper or cupric oxide; Processes observed during the solution of —— in fused potassium hydroxide. G. Antonow and B. Malyschew. J. russ. phys.-chem. Ges., 1906, **38**, 884—890. Chem. Zentr., 1907, **1**, 325.

THE authors state that commercial potassium hydroxide contains a peroxide, which renders it capable of decolorising potassium permanganate solution. This property is lost if the hydroxide be melted in a current of hydrogen, but is regained by heating in an open silver crucible, the silver being attacked during the operation with formation of a black powder. The blue solution produced on dissolving the mass obtained by fusing copper or cupric oxide with potassium hydroxide, with access of air, also decolorises potassium permanganate solution, but this is due to the presence of cuprous oxide. It would appear that cupric oxide in presence of alkali decomposes peroxides readily. The decomposition of cupric oxide by fusing with alkali begins only at temperatures above 300° C. The solution of copper in fused alkali is explained by the author in the following manner :—The alkali becomes peroxidised, and thus causes the atmospheric oxygen to become "active," and the latter then oxidises the copper. Under ordinary conditions, however, the peroxide cannot dissolve to any considerable extent, as the reducing action preponderates, and cuprous oxide is formed.—A. S.

prous metaphosphate. V. Auger. Compt. rend., 1907, **144**, 199—200.

TAPHOSPHORIC acid at a low red heat is poured upon ess of copper turnings in a platinum crucible, the lid which is at once put on, and the temperature kept till the evolution of hydrogen slackens, when the liquid decanted into another platinum crucible. As the ss cools, the clear liquid becomes turbid from the aration of metallic copper; but determination of the allic copper and the cupric phosphate in the cold duct shows that the substance when red-hot was cup-s phosphate. By allowing the melted mass to fall drop drop into methyl chloride, transparent, pale-yellow, ssy masses of cuprous phosphate, in excess of acid, are ained, which can be kept for some days in sealed es, but even under these circumstances they gradually ompose, forming the cupric salt and copper.—J. T. D.

omium sulphate in which the acid is wholly dissimulated. quilibrium of solutions of chromic salts. A. Colson. ompt. rend., 1907, **144**, 79—81.

ROMIUM sulphate of commerce, dissolved in water addition of a little sulphuric acid, was exposed to t for many months, then evaporated to dryness at the nary temperature. The residue was taken up with hol to separate the insoluble violet salt, the alcoholic tion evaporated *in vacuo*, and the green scales remain- kept *in vacuo* for a month. These scales have the nula, $Cr_2(SO_4)_3,6H_2O$, and have the peculiarity that um chloride produces in their aqueous solution a cipitate corresponding to not more than one-fortieth he sulphuric radical which they contain. Cold solu-s of chromic sulphate appear to contain four salts in ilibrium—the violet salt, and the three green salts: $SO_4)_3,6H_2O$; $O.Cr_4.(SO_4)_5,18H_2O$; and $Cr_2(SO_4)$ $)_2(SO_4H)_2$. When they are heated, condensation of chromic compounds and production of free acid ır.—J. T. D.

d acetate solution; Action of carbon dioxide upon ——. A. Altmann. Z. anorg. Chem., 1907, **52**, 219—228.

EN carbon dioxide is passed into an aqueous solution lead acetate, the proportion precipitated decreases rise in concentration and in temperature. This is in the following table of results, in which the per-ages of lead salt precipitated are given. At the ıer temperatures precautions were taken against loss evaporation, the time required for each experiment ving from 2½ to 5 hours.

mp. C.	2N solution.	$N/1$ solution.	$N/2$ solution.	$N/4$ solution.	$N/5$ solution.	$N/50$ solution.
0	32·80	49·63	67·11	73·12	77·02	80·21
0	27·24	41·48	61·96	69·30	70·25	77·24
0	26·47	46·47	57·52	66·65	69·04	71·92
0	24·36	40·37	49·36	61·09	64·42	69·52
0	6·32	12·27	23·25	32·25	34·80	48·25

he composition of the precipitates was also examined, they were all found, where tested, to consist of the mal carbonate, $PbCO_3$. If, however, the solution heated to boiling point for a long time before precipi-on by carbon dioxide, the acetic acid liberated by rolysis being allowed to escape, the stronger solutions e a mixture of the normal carbonate and the basic oonate, $2PbCO_3,Pb(OH)_2$, and the $N/5$ solution ded a precipitate of the basic salt only. This method principle the same as Thénard's French process for te lead manufacture; the precipitate is, however, se and crystalline, and probably unsuited for technical . It is noted that solutions of lead acetate are ampho-c.—F. SODN.

muth peroxides. V. Oxidation of bismuth compounds n presence of sodium hydroxide, and the so-called "sodium etrabismuthate." A. Gutbier and R. Bünz. Z. anorg. 'hem., 1907, **52**, 124—126.

addition to their previous work (this J., 1906, 263, 264, , 883), the authors have repeated the experiments of Lorch (Inaug.-Dissert., München, 1893; Gmelin-Kraut, 1897 [II.], 2, 1005), who claimed to have obtained "sodium tetrabismuthate" by the action of sodium peroxide and chlorine on bismuth hydroxide. No homogeneous products could be obtained, and the authors conclude that it is impossible to produce in this way derivatives of the so-called "bismuthic acid." The products obtained contained from 1·49—4·70 per cent. of active oxygen, 70·09—88·22 per cent. of bismuth oxide, 6·83—20·01 per cent. of soda (Na_2O), and 2·48—7·00 per cent. of water.
—A. S.

Plumbic acid; Colloidal ——. J. Bellucci and N. Parravano. Atti R. Accad. dei Lincei Roma, 1906 [5], **15**, II., 542—549. Chem. Zentr., 1907, **1**, 222—223.

A COLLOIDAL solution of plumbic acid, PbO_2, aq., can be obtained by hydrolysis of potassium plumbate, $[Pb(OH)_6]K_2$. On treating this salt with water, it is completely hydrolysed and a dark, chestnut-brown alkaline solution is obtained, from which, by dialysis, a colloidal solution of plumbic acid, containing only a very small quantity of potassium hydroxide, can be separated. This solution can be filtered, boiled, and frozen without decomposition. On passing a current of high E.M.F. through the solution, the lead peroxide travels to the anode, and eventually is partially coagulated. The colloidal solutions always contain potassium hydroxide, though sometimes in such small quantity that it cannot be detected by litmus paper. In a solution analysed by the authors there was 98 per cent. of lead oxide to 2 per cent. of potassium oxide.—A. S.

Tellurides; Preparation and properties of ——. C. Whitehead. George Washington Univ. Bull., 1906, **5**, 65—68.

THE tellurium used was obtained from the residues accumulated in the electrolytic refining of copper. These, after removal of the gold and silver, were found to consist largely of alkali tellurites and selenites. After reduction, the tellurium and selenium were separated by treating with nitric acid (sp. gr., 1·16) saturated with chromic acid, evaporating, and adding much nitric acid to precipitate the telluric acid. This was obtained by recrystallisation as hexagonal plates having the formula, $H_2TeO_4.2H_2O$, which was then reduced, or converted to the oxide by heating.

Hydrogen telluride.—This is best prepared by allowing water to drop on to aluminium telluride. It is also obtained by using a tellurium cathode in the electrolysis of water.

Alkali tellurides.—Those of *sodium*, *potassium*, and *lithium* are prepared by fusing tellurium with twice its weight of alkali carbonate, and one-tenth its weight of charcoal. They decompose on contact with the air, and form purple solutions like permanganates. The solution of ammonium telluride is pink in colour.

Calcium telluride is prepared by heating one part of calcium carbide with four parts of tellurous oxide.

Strontium telluride is prepared by maintaining a mixture of 20 grms. of strontium salicylate and 7·5 grms. of tellurium oxide, at a white heat, for 30 minutes.

Barium telluride is prepared by heating barium hydroxide with tellurium and charcoal.

The alkaline-earth tellurides and magnesium telluride are all decomposed by air, carbon dioxide, or alcohol. They are soluble in water.

The *tellurides of magnesium, aluminium, iron, zinc, cadmium, copper, chromium, lead,* and *silver* are prepared by melting together the respective elements. In the case of lead, a large excess of this metal is used, and the ingot subjected to electrolysis in a bath of lead acetate. The lead dissolves, leaving crystals of the telluride. A similar method is employed in the case of silver telluride, a bath of silver nitrate and some nitric acid being used. A double *telluride of copper and lead*, resembling iron pyrites, results when copper telluride is dissolved in molten lead, and the product electrolysed in a bath of lead acetate.—F. SODN.

Iodine in marine algæ. F. Scurti. Gaz. chim. ital., 1906, **36** [2], 619—625.

THE author examined two kinds of algæ, *viz.*, *Sargassum linofolium* and *Cystoseira discors*, from the Gulf of Naples the iodine being determined by Bourcet's method (this J., 1899, 613). For *Sargassum linofolium* the content of ash ranged from 5 per cent. in May up to 40 per cent. in August, and of iodine from 0·017 per cent. in October to 0·1275 per cent. in April. The percentage of ash in *Cystoscira discors* varied from 12 per cent. in May to 34 per cent. in August, and the iodine content ranged from 0·0085 per cent. in August up to 0·04554 [per cent. in April. The conclusion drawn by the author is that the content of iodine varies with the different stages of growth of the algæ, being at a maximum in spring and a minimum in autumn. Brown algæ contain more iodine than the green kinds. The highest content of iodine is found at the beginning of the period of maturation, but if the algæ remain in the sea, the percentage of iodine rapidly falls again.—A. S.

Carbon; Separation of —— from carbides. C. Hahn and A. Strutz. Metallurgie, 1906, **3**, 725; Chem.-Zeit, 1907. **31**. Rep. 33.

CALCIUM carbide is decomposed by dry steam according to the equation: $CaC_2+H_2O=CaO+2C+H_2$. Acetylene is formed only when wet steam is used. Hydrochloric acid gas decomposes calcium carbide with the production of flame: $CaC_2+2HCl=CaCl_2+2C+H_2$. Similar results are obtained with the carbides of aluminium, manganese, and silicon. By the action of ammonia on calcium carbide, calcium cyanamide is produced: $CaC_2+2NH_3=CaCN_2+3H_2+C$. The carbon, separated on decomposing manganese carbide with hydrochloric acid, possesses a lustre similar to that of graphite. On decomposing carborundum (silicon carbide) with dry steam at 1300°—1400° C., a gaseous mixture containing 32 per cent. of hydrogen, 4·2 per cent. of carbon monoxide, and 10·8 per cent. of carbon dioxide is produced.—A. S.

Carbon; Solubility of ——, in barium and strontium carbides. H. M. Kahn. Compt. rend., 1907, **144**, 197—199.

BARIUM and strontium carbides, like calcium carbide, dissolve carbon when heated with it in the electric furnace, to an extent increasing with the time of heating (and hence with the temperature) to about 6 per cent. The results with longer periods of heating (consequently at higher temperatures) are irregular, and indicate that ebullition has been taking place.—J. T. D.

"*Nitron*" *as a microchemical reagent.* [*Detection of acids and of saccharin.*] H. L. Visser. XXIII., page 167.

Electrolytic oxidation in presence of fluorine ions. M. G. Levi and F. Ageno. XI*A*., page 156.

Oxygen; Process for furnishing a continuous supply of pure —— for organic analysis. A. Seyewetz and Poizat. XXIII., page 168.

ENGLISH PATENTS.

Chromic acid; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim Elektron, Frankfort-on-the-Maine, Germany. Eng. Pat. 12,618, May 30, 1906.

IN the manufacture of chromic acid from alkali chromates or bichromates, or from chromic acid containing sulphuric acid, a mixture of chromic acid and alkali bisulphate is first obtained in the usual way. This is then stirred and heated until all water has been driven off, and finally the whole is melted. When allowed to cool down to 150° C., the acid and bisulphate are found as two immiscible layers, which are readily separated. The chromic acid obtained in this way contains 1½ to 2 per cent. of bisulphate, and is thus much purer than that made by the ordinary and more tedious process.—F. SODN.

Sodium perborate; Manufacture of ——. G. W. Johnson London. From the Gold- und Silber- Scheide- Anstal vorm. Rössler, Frankfort-on-the-Maine, Germany Eng. Pat. 503, Jan. 8, 1906.

THIS process for the manufacture of sodium perborat consists in treating a solution of sodium peroxide and bori acid, or an alkali borate, approximately in molecula proportions, with sufficient carbon dioxide or alkali bicar bonate, to cause the excess of alkali to combine with th carbon dioxide or alkali bicarbonate, to form a norma carbonate. The sodium peroxide may be replaced b potassium-sodium peroxide, or by potassium peroxide and sodium salts added, if necessary, to provide in solutio the sodium required for the formation of sodium per borate.—W. C. H.

Ferrocyanides from cyanogen contained in gases; Pro duction of ——. J. Y. Johnson, London. From W Feld, Hönningen on Rhine, Germany. Eng. Pat 5775, March 9, 1906.

SEE Fr. Pat. 365,410 of 1906; this J., 1906, 928.—T. F. B

Lixiviation apparatus, particularly adapted for the extrac tion of sodium nitrate from caliche. W. Hunt, Glasgow From R. T. Love, Toco, Chile. Eng. Pat. 7007 March 23, 1906.

BENEATH the usual false bottoms of the leaching tanks chambers are provided, in which the extracting liquor i first heated by means of steam-pipes, or the like. It then passes upwards through the false bottom and the caliche, or other material to be treated, into a gutter in the uppe part of the tank, above the level of the material to be treated. From this gutter the liquor passes down a vertical pipe into the heating chamber. Circulation is thus continuously effected, and the temperature is readily controlled and maintained.—F. SODN.

Aluminium hydroxide and aluminates; Manufacture o ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 13,970, June 18, 1906.

SEE Fr. Pat. 367,728 of 1906; this J., 1906, 1146.—T. F. B.

Acetate of alumina and by-products; Manufacture of ——. J. R. Garroway, Glasgow. Eng. Pat. 21,461, Sept. 28, 1906.

BY this process, solid aluminium acetate and magnesium sulphate are produced by the reaction of a highly concentrated solution of aluminium sulphate and a strong solution of magnesium acetate. In place of the latter, the use is suggested of an acetate of a metal which has a soluble sulphate.—W. C. H.

Ferrous carbonate; Manufacture of —— in the cold. A. Flügge, Hanover, Germany. Eng. Pat. 27,316, Nov. 30, 1906. Under Int. Conv., Nov. 30, 1905.

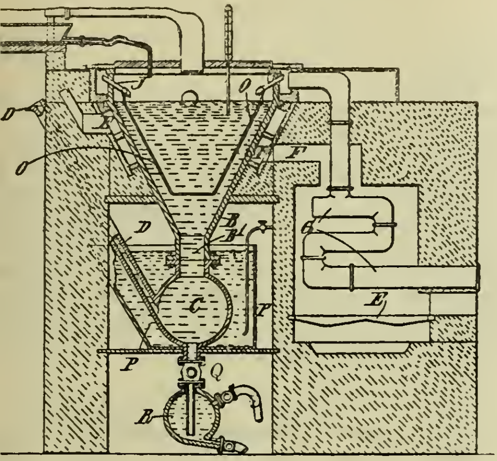
BY a process previously described by the inventor, a paste of ferrous carbonate with a large proportion of potassium sulphate can be obtained. The present invention is that of a process for removing the potassium sulphate, and consists in mixing the paste with sufficient water, free from air, and saturated with carbon dioxide, to dissolve the potassium sulphate, and then removing the solution from the ferrous carbonate by sedimentation and centrifugal action.—W. H. C.

UNITED STATES PATENTS.

Boric acid; Process of manufacturing ——. O. Best, Daggett, Cal. U.S. Pat. 837,378, Dec. 4, 1906.

TO make boric acid from borosilicates without forming "jelly," the boric acid is set free by means of a suitable acid, enough lime or other base added to precipitate the silicic acid, and the liquid filtered.—E. S.

phuric acid ; Apparatus for concentrating ——. L. ;tange, Aix-la-Chapelle, Germany. U.S. Pat. 837,592,)ec. 4, 1906.



: cast-iron concentrating pan, B, communicates at its ·r part through the passage, B¹, with the chamber, C, ·h is fed with fresh acid through the pipe, D. Heating ;, F, communicating with the fire-place, E, pass around uppcr portion of the pan. The pipes, G, are heated ·ases from the fire-place, and convey a current of heated ·r gases over the surface of the acid, through an annular air distributing conduit. To these hot-air distributing s, the inner vessel, O, constructed of acid-resisting erial, and having an opening in its bottom (not shown), ıspended, serving to maintain convection currents in heated acid. The chamber, C, is subjected to cooling flow of water in the containing tank, P, and at its om communicates by means of a valve, Q, with the el, R, for the discharge of slush from the pan.—E. S.

s ; Process of preparing solutions of —— [sulphite quor]. H. Howard, North Woburn, Mass. U.S. Pat. ;6,500, Nov. 20, 1906.

process of preparing solutions of gases consists in ially saturating a liquid with gas, and then expelling gas from one portion of the liquid by heat. The ·lled gas is cooled by transferring its heat to further ions of the liquid, and is afterwards absorbed in a ion of the original liquid, thus increasing the gas ent of the liquid to the desired extent. The portion quid from which the gas has been expelled is subjected ntact with additional gas to again partially saturate nd the operation repeated if desired. The claims also ıde the preparation of a sulphite liquor, containing an ss of sulphur dioxide, by expelling sulphur dioxide a portion of the sulphite liquor by heat ; the expelled hur dioxide is cooled by causing it to impart its heat ırther portions of the liquor. The relatively concen·d sulphur dioxide that has been expelled is freed from ture, then absorbed in a portion of the original liquor, ·eby the content of the gas is increased to the desired unt. The portion of liquid from which the gas has expelled is brought into contact with additional hur dioxide to restore its content of the gas.—W. C. H.

ganese peroxide sulphate and process of making same. . Bazlen, Assignor to Badische Anilin und Soda Fabrik, ıdwigshafen on Rhine, Germany. U.S. Pat. 837,777, ec. 4, 1906.

Eng. Pat. 17,981 of 1903 ; this J., 1904, 749.—T. F. B.

French Patents.

rates and perchlorates ; Electrode for the manufacture ——. M. Couleru. Fr. Pat. 361,901, Nov. 11, 1905. [*A*., page 157.

Oxides of nitrogen ; Apparatus for production of —— by electric means. I. Moscicki. Fr. Pat. 369.387, Aug. 31, 1906. XI*A*., page 157.

VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 95.)

Borate glasses ; Some chemical characters of ——. C. H. Burgess and A. Holt. Trans. Eng. Ceramic Soc., 1905–6, **5**, 163—171.

The authors have continued their study of the alkali borates (this J., 1905, 88), in the hope of throwing some light on the analogous, but much more difficultly fusible, silicates. Mixtures of 8 (molecular) parts of boric anhydride to 5 of sodium oxide are still glasses, but if less than 2 of boric anhydride to 3 of sodium oxide are present, glasses cannot be obtained, even by sudden cooling of the liquid mass. A glass of the composition, $3Na_2O,2B_2O_3$, can be devitrified in a few seconds by gentle warming with a Bunsen flame, but a glass of the composition, $Na_2O,4B_2O_3$, requires hours or days. Glasses in which the ratio, $B_2O_3 : Na_2O$ exceeds 4 : 1 cannot be completely devitrified ; whilst the glass, $Na_2O,40B_2O_3$, cannot be devitrified at all. Many glasses appear to consist of solutions of the two compounds, Na_2O,B_2O_3, and $Na_2O,4B_2O_3$, in each other, no intermediate compounds existing. Similarly, lithium appears to form only one definite borate, $Li_2O,2B_2O_3$, whilst the alkaline-earths form at least three compounds. When coloured metallic oxides are dissolved in acid sodium borates, the authors believe that complexes are formed, but they have been unable to determine whether the metal, *e.g.*, copper, forms a complex with the alkali or with the boric acid. When copper oxide is continuously added to borax, the melting point sinks until one-twelfth equivalent of copper has been added ; a larger amount causes a continuous rise. This appears to be due to a compound of borate and copper oxide being first formed ; after the glass is saturated, the infusible network of oxide and copper borate stiffens the mass. Copper oxide added to boric anhydride does not lower the melting point, copper borate being insoluble in boric anhydride.—A. G. L.

Porcelain, Parian, semi-porcelain, and earthenware ; Minute structure of ——, with a note on the crystallisation of glazes. J. W. Mellor. Trans. Eng. Ceramic Soc., 1905-6, **5**, 74—92.

The author publishes and discusses a series of 23 microphotographs, illustrating the microstructure of porcelain and earthenware. In mixtures containing 65 parts of felspar to 35 parts of china clay or quartz, finely ground, the particles remain sharply defined when the mixtures are fired up to 1000° C. ; just above 1100° the felspar shows signs of softening, and the china clay fragments are slightly diminished in size, but the quartz is only slightly affected. At 1200° the quartz begins to be attacked, the china clay loses its identity, and signs of translucency appear. At 1300° the whole fuses to an almost homogeneous mass, and gas bubbles appear. Similar changes take place when a mixture of ball clay (25 parts), china clay (30 parts), Cornish stone (15 parts), and flint (30 parts) is fired. The contraction in volume is not proportional to the porosity, because the firing produces certain changes in specific gravity of the constituents. Thus, crystalline felspar expands by about 6 per cent. on fusion, and crystalline silica changes into another crystalline variety above 800° C., expanding at the same time by 13·8 per cent. In bone china, made from bone ash (50 parts), china clay (25 parts), and Cornish stone (25 parts). the separate constituents lose their identity, even when the ware is "easy fired" at 1270° C. Bone china, properly fired at 1310° C., is a vitreous, and almost homogeneous mass. At higher temperatures, at 1350° C., the mass loses its shape, and fumes of phosphorus are given off ; the loss in phosphoric anhydride may amount to 1 per cent., depending on the temperature and the organic matter, as well as reducing gases, present. Hard porcelain, in which the action between the constituents has proceeded further than in semi-porcelain or earthenware, contains crystals probably identica with sillimanite, aluminium mono-silicate, $Al_2O_3.SiO_2$. "Feathering" and "starring" of glazes appear to be due to the ware having been kept too long at the temperature, 830° C., most favourable to crystallisation; there appears to exist a regular zone, from 790° C. to 860° C., at which crystallisation goes on rapidly, and the articles must be quickly cooled through this range. For every different glaze there is a different temperature for the maximum rate of crystallisation.—A. G. L.

Potters' ovens and kilns; Principles of the construction and firing of ——. J. Burton. Trans. Eng. Ceramic Soc., 1905-6, **5**, 122—148.

English Patent.

Enamelled bricks and tiles, enamelled terra-cotta, and similar ware; Manufacture of ——. A. Shelmerdine, Liverpool. Eng. Pat. 659, Jan. 10, 1906.

The object of the invention is to remedy defects, such as cracks and chippings, in enamelled bricks, tiles, and terracotta. For this purpose, the damaged part of the ware is heated, in an oxidising flame, to a temperature below that at which the enamel is affected, and another enamel of relatively low fusing point is applied to it, after which the whole surface is smoothed over with a suitable instrument. Or else, the more fusible enamel may be applied to the damaged part in the cold, and the whole then heated to a similar temperature and smoothed over as above.
—A. G. L.

United States Patents.

Glass-melting furnace. W. O. Amsler. Assignor to the Amsler Engineering Co., Pittsburg, Pa. U.S. Pat. 836,731, Nov. 27, 1906.

The furnace described comprises a tank divided into two compartments by a bridge wall, the compartments being connected with one another by a passage. Within the bridge wall is an air space, above and near the passage connecting the compartments. In the air space means are provided for circulating a cooling fluid, these means consisting of "an angular, horizontally-disposed cooling plate provided with passages for a cooling fluid, and vertically-disposed cooling plates also formed with passages for a cooling fluid."—W. C. H.

Glass; Apparatus for drawing continuous sheets of ——. E. Fourcault, Lodelinsart, Belgium. U.S. Pat. 837,821, Dec. 4, 1906.

See Fr. Pat. 366,383 of 1906; this J., 1906, 985.—T. F. B.

Ceramic ware; Manufacture of glazed or enamelled ——. A. Bigot, Paris. U.S. Pat. 838,496, Dec. 11, 1906.

See Fr. Pat. 323,657 of 1903; this J., 1903, 496.—T. F. B.

French Patent.

Ceramic industry; Mechanical washer for earthy materials for the ——. M. Roubaud. First Addition, dated Aug. 31, 1906, to Fr. Pat. 359,549, Nov. 4, 1905. (See this J., 1906, 374.)

The modifications described in this Addition to the principal Patent are that the paddles on the horizontal shafts are increased in number, and may have instead of a flat, a partially helicoidal form, being curved slightly in the direction of the radius, in order to slowly and regularly raise the material to be washed during half of their course, whilst during the other half the materials are deposited. Another modification is that the horizontal shafts are lowered in the metal or masonry of the wall of the vat, which necessitates the provision of water-tight joints or stuffing-boxes, in which the shafts are mounted. These may consist of a caoutchouc washer, which embraces the end of the shaft and is held in position in a groove, by a plate bolted over the groove.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page 96.*)

Floor tiles and cement; Comparison of the thermal expansion of ——. J. W. Mellor. Trans. Eng. Ceramic Soc., 1905-6, 5, 159—162.

The author measured the coefficient of expansion of floor tiles and of cement-sand mixtures in order to see whether the "springing" of floor tiles could be due to a difference of the coefficients of expansion of the tiles and the cement, leading to their separation. The mean coefficients of thermal expansion, multiplied by 10^7, found by him are, for "easy" fired tiles, 71·4; for "correct" fired tiles, 70·3; for "hard" fired tiles, 69·0; for neat cement, 92·0; for one part of cement to one of sand, 66·0; and for one of cement to four of sand, 63·0 per degree C. He believes that the difference in expansion of the tiles and floating is too small to produce a strain sufficiently great to cause separation.—A. G. L.

English Patent.

Building purposes; Composition suitable for ——. W. Spittler, Vienna. Eng. Pat. 11,086, May 11, 1906.

See Fr. Pat. 366,095 of 1906; this J., 1906, 986. Reference is directed under Section 1, Subsection 6, of the Patents Act, 1902, to Eng. Pat. 11,259 of 1891.—T. F. B.

United States Patents.

Refractory article and method of producing the same. E. G. Acheson, Stamford, Ontario, Assignor to W. A. Smith, Niagara Falls. U.S. Pat. 836,353, Nov. 20, 1906.

By this process refractory coherent articles are made by mixing a finely-divided compound of silicon, carbon, and oxygen, with or without the addition of a metallic oxide, or an oxidising agent, with carbon. The mixture is moulded into shapes, and fired under oxidising conditions. Articles produced by the process are claimed as a new manufacture.—W. C. H.

Refractory material and method of making the same. E. G. Acheson, Stamford, Ontario, Assignor to W. A. Smith, Niagara Falls, U.S. Pat. 836,354, Nov. 20, 1906.

This invention is for the production of refractory materials which when heated are self-bonding. The self-bonding material contains a compound of silicon, carbon, and oxygen, and either an oxidising agent or a metallic oxide, with or without free carbon. The presence of an oxidising agent in the mixture containing the silicon, carbon, and oxygen compound is an essential feature of the method.
—W. C. H.

Cement; Anhydrous hydraulic ——, *and process.* E. J. Winslow, Chicago, Ill. U.S. Pat. 837,169, Nov. 27, 1906.

The powdered cement described is adapted to be set by the admixture of water, and consists mainly of a mass of powdered anhydrous cement mixed with a suitable quantity of dry ground asbestos, the latter being divided into separate component fibres, which are intimately commingled with the cement in a ball-mill.—W. C. H.

Cement compounds; Process of making ——. H. M. Perry, Assignor to E. J. Winslow Co., Chicago, Ill. U.S. Pat. 837,717, Dec. 4, 1906.

In this process for making hydraulic cement compounds, sifted, measured quantities of powdered cement are discharged in a shower over measured quantities of shredded fibre, and the two ingredients agitated until the fibres are charged and coated with the powder. The mixture is then moistened to a limited degree only, by the admission of controlled quantities of steam or water, and the mass further agitated and pugged until uniformly moistened. The moistened material is then passed through a forming nozzle under pressure, and transferred from the nozzle to a set of rolls, and passed successively through several pairs of rolls, while confined between flexible webs of material travelling with the moulded material. Finally, the material is hydrated by subjecting it to the action of steam and pressure in a closed chamber.—W. C. H.

Cement compounds ; Apparatus for making ——. H. M. Perry, Assignor to E. J. Winslow Co., Chicago, Ill. U.S. Pat. 837,718, Dec. 4, 1906.

The apparatus consists of a casing comprising an upright shaft, from the top of which a "laterally-deflected" portion extends. Shredded or separated fibre can be introduced into the receiving end of this latter portion by means of an air-blast. Regulated quantities of powdered cement are introduced by a sprinkling device through the top of the deflected portion, near the upright portion. The descending fibre and cement are discharged by a conveyor-belt into the upper part of the vertical portion of the casing. Within this vertical portion is an agitator comprising a vertical rotating shaft to which a number of blades or vanes are attached, which induce upward air currents, whereby the precipitation of the ingredients to the bottom of the casing is retarded. Charges of the mixture of dry ingredients are received into a batch-mixer, into which regulated quantities of steam or water can be introduced, and means are provided in it for thoroughly mixing the materials, which pass on to a forming apparatus. (See also preceding abstract.)
—W. C. H.

Cement from blast-furnace slag ; Process for manufacturing ——. H. Colloseus, Berlin. U.S. Pat. 837,918, Dec. 11, 1906.

See Fr. Pat. 356,276 of 1905; this J., 1905, 1307.—T.F.B.

X.—METALLURGY.

(*Continued from page* 99.)

Iron industry in Japan. Bd. of Trade J., Feb. 7, 1907. [T.R.]

A company has been formed to work a recently discovered process for reducing the iron sand found in extensive deposits on the Japanese coast. The iron sand contains no sulphur nor phosphorus. The deposit to be worked lies between Muroran and Hakodate ; in some places it is 45 miles in length, 1800 feet wide, and 4 to 10 ft. deep.

Alloys of aluminium and copper. H. C. H. Carpenter and C. A. Edwards. Eighth report to the Alloys Research Committee. Inst. Mech. Eng., Jan. 18, 1907. Engineering, 1907, **83**, 127—129, 158—162.

The authors have carried out a systematic examination of aluminium-copper alloys, of which the detailed results are given in tables and curve-diagrams. It was found, in agreement with Guillet (this J., 1905, 1019, 1237), that for industrial purposes the only useful alloys are those containing not more than 11 per cent. of aluminium at one end of the series, and those containing not less than 96 per cent. of aluminium at the other end. Some of the alloys containing from 7 to 10 per cent. of aluminium are, in certain respects, equal to or even superior than high-quality steels of the same general character. The alloys containing from 0·1 to 9 per cent. of aluminium show a clearly-marked true yield point, and possess a very high and almost constant ductility (elongation × reduction of area), although the tenacity increases as the content of aluminium rises. So-called "aluminium bronze" or "gold," containing 10 per cent. of aluminium, exhibits just as high tenacity and ductility in the form of small chill castings as in rolled bars. An addition of 0·1 per cent. of aluminium raises the angle of twist of copper, in torsion tests, by 90 per cent., and lowers the electrical conductivity by 23 per cent. Alloys containing between 5 and 10 per cent. of aluminium give very good results in dynamic stress tests. Two of the alloys examined, containing respectively 7·35 and 9·9 per cent. of aluminium, gave specially good results when tested under alternating stress, the maximum stress under which they were capable of bearing an unlimited number of reversals closely approximating to the stress at the elastic limit as determined in a tensile test; in this respect these alloys are markedly superior to irons and steels hitherto examined. In sea-water, the alloys containing from 1 to 10 per cent. of aluminium are superior to Muntz metal and naval brass, being practically incorrodible, whether tested alone or bolted to a plate of mild steel. In ordinary tap water the alloys are slightly but appreciably corroded. The alloy containing 9·9 per cent. of aluminium appears to be specially interesting, on account of its close resemblance in physical and mechanical properties to Swedish Bessemer rolled steel containing about 0·35 per cent. of carbon. The alloys rich in aluminium are of less importance technically than those rich in copper. The addition of copper (up to 4 per cent.) to aluminium causes a decrease of ductility and increase of tenacity. Further additions, beyond 4 per cent., of copper, cause a decrease of both ductility and tenacity. The alloys containing from 0 to 4 per cent. of copper roll and draw well, and their mechanical properties are improved considerably by mechanical working (rolling or drawing). These alloys were examined as to suitability for the manufacture of cooking utensils by exposing them for six hours to the action of boiling water and boiling solutions of organic acids of the highest concentration likely to be met with in cooking operations. The results are shown in the following table :—

Percentage of copper in alloy.	Loss in pounds per sq. ft. per hour in boiling :			
	Water.	1 per cent. oxalic acid solution.	1 per cent. acetic acid solution.	2 per cent. citric acid solution.
0·00	Nil.	0·0010	0·0002	0·0001
1·57	„	0·0019	0·0002	0·0002
2·36	„	0·0020	0·0001	0·0002
3·74	„	0·0021	0·0002	0·0002
4·74	„	0·0022	0·0002	0·0002
5·34	„	0·0023	0·0003	0·0003

—A. S.

Copper-nickel alloys. W. Guertler and G. Tammann. Z. anorg. Chem., 1907, **52**, 25—29.

The freezing-point curve of alloys of copper and nickel is a continuous curve, rising almost, though not quite, in a straight line, from the melting point of copper (1083° C.) to that of nickel (1451° C.). At every point of this curve mixed crystals form ; the crystals which separate on solidification are β-crystals (non-magnetic), but on cooling, these are transformed into α-crystals (magnetic). The transformation temperature falls with increase of copper, from 320° C. for pure nickel to 30° C. for about 60 per cent. of nickel.—J. T. D.

Zinc-thallium and zinc-iron alloys. A. v. Vegesack. Z. anorg. Chem., 1907, **52**, 30—40.

Melted zinc will dissolve about 2·5 per cent. of thallium, whilst melted thallium will dissolve about 5 per cent. of zinc. On cooling any alloy containing less than 95 per cent. of thallium, crystals of the zinc-thallium alloy separate at a temperature of 416° C., and when the temperature falls below this, zinc separates till the eutectic composition (95 per cent. of thallium) is reached at 291° C., when eutectic solidification occurs. Alloys containing more than 95 per cent. of thallium separate thallium at temperatures just below 295° C., till the eutectic composition and solidifying temperature are again reached. Zinc-iron alloys, containing from 11 to 24 per cent. of iron deposit crystals of unknown composition above 777° C., at which temperature the crystals and the mother-liquor react to produce the compound, $FeZn_3$, which separates while the temperature remains stationary. When the temperature falls again, and reaches 662° C., this compound and the liquid react and form $FeZn_7$, which separates. These two compounds seem not to form mixed crystals with one another, but as the cooling goes on, the compound, $FeZn_7$, and the liquid form mixed crystals of varying composition, the limit of which is a crystal containing 7·3 per cent. of iron, which at 422° C reacts again with the liquid, and deposits an alloy containing

0·7 per cent. of iron. In general, these alloys become harder and more brittle with increase of iron, and the compound, $FeZn_7$, appears to expand in crystallising.
—J. T. D.

Manganese silicide ; New —— described by Gin. P. Lebeau. Compt. rend., 1907, **144**, 85—86.

The industrial product examined by Gin (this J., 1907, 98), contained 5 per cent. of impurities ; and in view of the difficulty of ascertaining the exact distribution of the silicon amongst the metals present, the authors consider the evidence insufficient to prove the existence of a silicide intermediate between $SiMn_2$ and SiMn. No such intermediate silicide has been obtained by the author or by Vigouroux, both of whom have closely investigated the compounds of manganese and silicon.—J. T. D.

Silicon tetrachloride ; Action of —— on chromium. E. Vigouroux. Compt. rend., 1907, **144**, 83—85.

Metallic chromium, heated in a porcelain tube to about 1200° C. in a stream of the vapour of silicon tetrachloride, is gradually converted into the silicide, Cr_3Si_2, already obtained and described by Lebeau and Figueras (this J., 1903, 800).—J. T. D.

Chromium boride. E. Wedekind and K. Fetzer. Ber., 1907, **40**, 297—301.

Chromium-thermite, previously made into a paste with liquid air, was placed over a quantity of pure boron in a corundum-lined Hessian crucible, and ignited in the usual manner. A completely-fused crystalline regulus was obtained, which after pulverisation in a steel mortar and treatment with hydrochloric acid, nitric acid, and *aqua regia*, left a silver-white crystalline powder, extraordinarily resistant to all acid and alkaline reagents. It could only be decomposed for analysis by fusion with sodium peroxide, which converts it into chromate and borate. Analysis showed the formula to be CrB, though the substance always contained a small excess of chromium. Chromium boride has a sp. gr. of 5·4, and a hardness of 8 ; it conducts electricity, and is practically infusible in the oxyhydrogen flame. It exhibits weak magnetic properties.—J. T. D.

Copper or cupric oxide ; Processes observed during the solution of —— in fused potassium hydroxide. C. Antonow and B. Malyschew. VII., page 148.

Tellurides ; Preparation and properties of ——. C. Whitehead. VII., page 149.

English Patents.

Tinned sheet-iron boxes and other tin articles; Cleaning —— to render same suitable for recovering the tin therefrom. K. Goldschmidt and J. Weber, Essen on Ruhr, Germany. Eng. Pat. 415, Jan. 6, 1906.

See U.S. Pat. 836,028 of 1906 ; this J., 1907, 99.—T. F. B.

Thermic mixtures for use in the aluminothermic process. H. Goldschmidt, Essen on Ruhr, Germany. Eng. Pat. 788, Jan. 11, 1906.

See Fr. Pat. 361,197 of 1905 and Addition thereto ; this J., 1906, 593 and 765.—T. F. B.

Air ; Desiccation of —— in metallurgical operations. L. Sterne, London. From L. Block, Mamaroneck, N.Y., U.S.A. Eng. Pat. 800, Jan. 11, 1906.

The air is first subjected to the action of cold spray or rain in order to condense a portion of the moisture which it contains, and is then further dried by passing it through a chamber containing a series of condensing surfaces, cooled by the circulation of cold brine or by ammonia vapour.—A. S.

Galvanising or tinning wire ; Coating of articles by means of molten metal or alloy, more especially intended for ——, and apparatus therefor. O. E. Wilson, Manchester. Eng. Pat. 3130, Feb. 8, 1906.

The wire or other article, as it emerges from the bath of molten coating-metal, passes through two concentric nozzles, into the annular space between which is directed a flame or a jet of superheated steam, carbon dioxide, air, or other gas, whereby the excess of molten metal on the wire is caused to drop back into the bath.—A. S.

Furnaces ; Rotary ——. A. Ducco, Turin, Italy. Eng. Pat. 5997, March 12, 1906.

See Fr. Pat. 364,366 of 1906 ; this J., 1906, 890 —T. F. B

Furnaces and the like ; Gas-heated [crucible] ——. J. King, jun., Stockton Heath, and J. R. Burnett, Latchford, Cheshire. Eng. Pat. 7450, March 28, 1906.

The furnace claimed is a crucible furnace, and is composed of a fire-clay cylinder enclosed by a metal shell, and supported by a metal base-plate. On this plate rests a hollow fire-clay block, which is placed over a central air inlet, formed in the base-plate ; this block supports a plumbago or other crucible. The air passes from the interior of the block through lateral openings in its upper part, into the space around the crucible. Surrounding the block is a circular gas-burner, and around this burner another series of holes in the base-plate, through which a further supply of air is admitted. About half-way between the crucible and the fire-clay cylinder of the furnace there is hung a fire-clay or plumbago shell, resting by means of a flange at its upper end on a ledge formed in the fire-clay cylinder. The whole furnace being closed, except for the air and burner openings, this shell forces the flame to go first upwards between the crucible and the shell, and then downwards between the shell and the furnace, on its way to the chimney, which must create a strong draught.—A. G. L.

Furnaces ; Crucible. J. Borbeck, Altenau, Germany. Eng. Pat. 13,021, June 5, 1906.

The tipping crucible furnace described is provided with an annular blast channel. A metal ring of trough-shaped section is built into the bottom of the furnace walls, its outer side being closed by the sheet-iron casing of the furnace. From this annular channel the blast goes in two directions, through vertical channels in the furnace walls to the sides of the crucible and directly over the ash-pit. Two pipes also communicate with the usual hollow trunnions by which the tipping is effected, so that the blast can be regulated without interruption whilst pouring.
—A. G. L.

Alloys : Method of producing metallic ——. F. Dannert, Berlin. Eng. Pat. 8894, April 12, 1906.

See Fr. Pat. 366,866 of 1906 ; this J., 1906, 1102.—T. F. B.

Case-hardening steel and iron articles. A. W. Machlet, Elizabeth, U.S.A. Eng. Pat. 11,069, May 11, 1906.

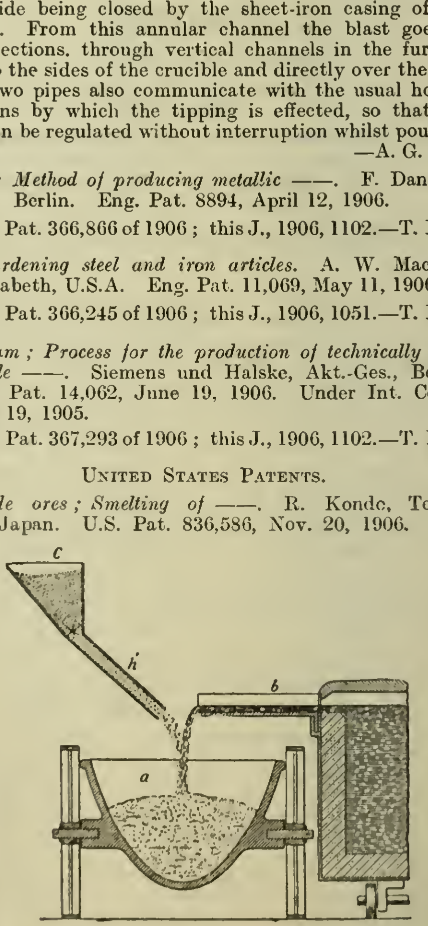
See Fr. Pat. 366,245 of 1906 ; this J., 1906, 1051.—T. F. B.

Tantalum ; Process for the production of technically pure ductile ——. Siemens und Halske, Akt.-Ges., Berlin. Eng. Pat. 14,062, June 19, 1906. Under Int. Conv., Aug. 19, 1905.

See Fr. Pat. 367,293 of 1906 ; this J., 1906, 1102.—T. F. B.

United States Patents.

Sulphide ores ; Smelting of ——. R. Kondo, Tokyo, Japan. U.S. Pat. 836,586, Nov. 20, 1906.



A briquette, termed a "smelting-brick," is claimed, composed of "a conglomerate mass of matte and sulphide ɪrc charging-material smalls." The method of making he smelting briquettes or " bricks " is also claimed, and t consists in causing a stream of " sulphide ore charging malls " passing from the hopper, *c*, down h^1, to mingle vith a stream of molten matte overflowing at *b*, and triking very nearly the centre of the vessel, *a*, the con-lomerate " smelting-brick " being thus formed within the essel, *a*.

Iagnetic body ; Process of improving certain magnetic qualities of a ——. R. A. Hadfield. Sheffield. U.S. Pat. 836,755, Nov. 27, 1906.

'HE total magnetic and electric loss in a magnetic body ılloy) is reduced by heating the body (alloy) to a tempera-ure of from 700° C. to 800° C., maintaining this tempera-ure for not less than 10 consecutive hours, and then lowly cooling.—A. G. I..

Iagnetic alloy. R. A. Hadfield, Sheffield. U.S. Pat. 836,756, Nov. 27, 1906.

'HE iron-silicon-manganese alloy claimed contains 1 ɔ 5 per cent. of silicon, and less than one-half per cent. f manganese.—A. G. L.

ron-silicon-manganese alloys ; Process of improving the magnetic qualities of ——. R. A. Hadfield, Sheffield. U.S. Pat. 836,757, Nov. 27, 1906.

. MAGNETIC alloy, of high magnetic permeability and ectric resistance and of low hysteresis action, is obtained y adding to an alloy of iron and silicon a proportion of ıanganese not sufficient to impair its magnetic qualities, ıen heating the alloy to a relatively high temperature elow its melting-point, allowing it to cool, reheating to temperature below that first employed, and finally ɔoling.—A. G. L.

ron-silicon-manganese alloys ; Process for improving the magnetic qualities of ——. R. A. Hadfield, Sheffield. U.S. Pat. 837,682, Dec. 4, 1906.

HE alloy, which is low in carbon, is made by melting ɔgether iron and silicon, and adding manganese in pro-ɔrtion not sufficient to impair its magnetic properties. he alloy is cast into ingot form, and worked to the required ze and shape, then heated to a temperature above its ·itical point, and finally cooled. It is claimed that the ıagnetic permeability and electric resistance are increased, ıd the hysteresis action of such an alloy treated in the ıanner described is reduced.—O. F. H.

[agnetic alloy. R. A. Hadfield, Sheffield. U.S. Pat. 836,758, Nov. 27, 1906.

HE alloy claimed consists of iron with 1 to 5 per cent. of licon, and less than 1 per cent. of aluminium.—A. G. L.

[agnetic materials ; Method of making ——. R. A. Hadfield, Sheffield. U.S. Pats. 836,759, 836,760, and 836,761, Nov. 27, 1906.

MAGNETIC material of high permeability and of low ysteresis action is obtained by alloying a magnetic sub-ance with silicon, heating the mass, and working it into sheet, or reducing it to a thin body, heating the sheet : thin body to a temperature below its melting point, lowing it to cool, reheating it to a temperature below ıat first employed, and again allowing it to cool.

U.S. Pat. 836,760 differs from the above only in that the ıaterial is worked mechanically into a sheet after it has een heated for the first time at a high temperature, and ı that the second temperature employed, whilst still elow the melting point of the alloy, is different from or bove the first temperature.

U S. Pat. 836,761 is identical with the Pat. 836,760, except ıat the second temperature is below the first.—A. G. L.

ron-silicon-aluminium alloys ; Process of improving the magnetic qualities of ——. R. A. Hadfield, Sheffield. U.S. Pat. 836,762, Nov. 27, 1906.

. MAGNETIC alloy of high magnetic permeability and ectric resistance, and of low hysteresis action is produced by adding aluminium to an alloy of iron and silicon, and then heating the alloy to a relatively high temperature below its melting point, allowing it to cool, reheating to a temperature below that first employed, and again allowing it to cool.—A. G. L.

Converters ; Process of restraining the ebullition in ——. A. Zenzes, Charlottenburg, Germany. U.S. Pat. 836,909, Nov. 27, 1906.

IN order to prevent or restrain the ebullition of a " blown " charge of molten iron in a steel-converter, a quantity (up to 10 per cent.) of molten iron of the same kind as that used for the charge, is introduced into the converter before " running-off."—A. S.

Furnace for sulphating zinc-bearing ores. G. O. Angell, Philadelphia, Pa. U.S. Pat. 837,273, Dec. 4, 1906.

THE furnace consists of a roasting and sulphating chamber, wherein blende may be roasted and converted into zinc sulphate by blowing steam and air through the heated ore. The steam and air are supplied by a series of perforated tubes, embedded at different levels in the walls of the furnace. The roasting chamber is heated by a number of external fire-places, the hot gases from which pass by separate flues into an annular flue at the base of the furnace, and thence directly to the interior. There is also a separate fire-place connected with a flue leading to the centre of the base of the roasting chamber, and the gases from the furnace are drawn off by a draught stack opening centrally from the roof.—O. F. H.

Furnace for roasting, &c. A. V. Leggo, Ballarat, Vic. U.S. Pat. 837,576, Dec. 4, 1906.

SEE Eng. Pat. 21,160 of 1905 ; this J., 1906, 591.—T. F. B.

" *Chloridising* " *apparatus* [*for ores*]. J. E. Greenawalt, Denver, Colo. U.S. Pat. 837,560, Dec. 4, 1906.

IN this apparatus there is a combined chlorinating and cooling chamber, and a condensing chamber. The ore is charged in at the top of the chlorinating chamber into the upper or chlorinating zone, passes through the lower or cooling zone, and is mechanically discharged. The chlorinating gas also enters at the top of the chamber and passes through it in the same direction as the ore, whilst the fumes or residual gases are withdrawn from below and conducted to the condensing chamber. Means are also provided for moistening the ore after it has left the chlorinating chamber.—O. F. H.

Copper ores ; Process of treating ——. E. H. Hamilton, Anaconda, Mont. U.S. Pat. 837,562, Dec. 4, 1906.

THE process consists in introducing calcium carbonate or other alkaline-earth compounds into the charge of matte and silicious flux in an acid-lined converter. By this means a readily fusible slag of a double silicate of iron and calcium (or other alkaline-earth metal) is produced, with consequent rapid separation of copper sulphide.—O. F. H.

Metallurgical vessels ; Manufacture of ——. A. L. J. Queneau, South Bethlehem, Pa., Assignor to New Jersey Zinc Company, New York. U.S. Pat. 837,724, Dec. 4, 1906.

VESSELS with composite walls are made by first forming a hammered wad of cup-shaped layers of different moist plastic mixtures, and by finishing in a forming machine. —O. F. H.

Metallurgical vessel. A. L. J. Queneau, South Bethlehem, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 837,883, Dec. 4, 1906.

SEE Fr. Pat. 354,319 of 1905 ; this J., 1905, 1071.—T. F. B

Metal-depositing apparatus. W. A. Hendryx, Denver, Colo. U.S. Pat. 837,832, Dec. 4, 1906.

THE apparatus comprises a leaching tank from which the solution is conveyed by means of a pipe into a closed revolving vessel containing a precipitating agent in granular form, and provided with means for its agitation. The precipitating agent is retained in the vessel by a screen or grating, and the solution and precipitate pass out by the outlet pipe, which is connected with a filter and collecting device.—O. F. H.

Nickel from copper ; Separation of ——. R. R. Maffett, Bayonne, N.J., Assignor to International Nickel Company, N.J. U.S. Pat. 838,125, Dec. 11, 1906.

The matte containing copper and nickel or other metals, is fused with an alkali polysulphide, or with an alkali polysulphide and sulphur, or with a charge containing an alkali sulphate and carbon, together with sulphur. In the last case the alkali sulphate is reduced to sulphide, which combines with the added sulphur, and acts as polysulphide upon the matte.—O. F. H.

Steel ; Process of hardening ——. S. N. Brayshaw, Manchester. Assignor to G. Nash, New York. U.S. Pat. 838,375, Dec. 11, 1906.

See Eng. Pat. 25,004 of 1905 ; this J., 1907, 21.—T. F. B.

German Patents.

Gold ore ; Continuous process and apparatus for the lixiviation of —— *with potassium cyanide solution.* A. H. Rasche. Ger. Pat. 170,566, March 8, 1904.

The patent relates to a process in which the ore is circulated instead of the cyanide solution. The lixiviation tank has a narrowed lower part, and the ore collecting therein is withdrawn by a conveyor and again introduced at the upper part of the tank. It is claimed that the process results in a considerable saving of time.—A. S.

Pyrites, burnt ; Process for removing zinc from, and for utilising —— *for the production of iron ore by smelting.* Elektrische Zinkwerke G.m.b.H. Ger. Pat. 173,103, March 20, 1904.

The burnt pyrites is treated in a reverberatory furnace having two hearths. The material is first desulphurised on the second hearth by the aid of the waste gases from the preceding charge, and is then, either on the same hearth, or after being raked on to the first hearth, heated in presence of a reducing agent to the volatilising temperature of zinc, and finally to the fusing point. It is preferable to mix the burnt pyrites, previous to desulphurisation, with ground charcoal or coke, in order to ensure decomposition of the zinc sulphate which is always present.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 101.)

(A.)—ELECTRO-CHEMISTRY.

Aluminium anode ; Optical study of the film deposited by electrolysis on an ——. O. M. Corbino. Il nuovo Cimento, Sept., 1906. Electrician, 1907, 58, 569.

By measurement of phase differences of the light reflected at the surfaces of the film and the metal plate respectively, the thickness of the film has been determined. The thickness is proportional to the E.M.F. of formation, whilst the capacity is inversely proportional. If the process of formation is continued for a long time, the thickness increases, whereas the capacity is very little changed. It seems probable, therefore, that the stratum which forms the dielectric lies directly on the metal surface, and is only a small and constant portion of the total thickness measured, the rest of the film being conductive. Films formed in sulphuric acid or sulphate solutions rapidly and continuously increase in thickness for a very long time ; they break down, however, at tensions exceeding 25 volts. In tartrate solutions, although the film forms much more slowly, it can be formed under tensions as high as 145 volts.—R. S. H.

Peroxide of copper ; Formation of —— *by electrolysis.* E. Müller and F. Spitzer. Z. Elektrochem., 1907, 13, 25—27.

By the anodic oxidation of copper in 12 to 14 N-caustic soda solutions, with high current density ($>$0·1 ampère per sq. cm.), the authors have obtained a yellow peroxide of copper. The oxide, which may be in the hydrated form, separates as a cloudy deposit from the anode, and is fairly stable in the cold strong alkaline solution. It possesses marked oxidising power, decomposing hydrochloric acid, forming aldehyde from alcohol, and nitrite from ammonia. Even under the most favourable conditions, less than 10 per cent. of the current is usefully employed in forming the oxide, the rest being taken up in generating oxygen gas. By a comparison of the deficiency of oxygen over the theoretical quantity, the authors have come to the conclusion that copper goes into solution at the anode in the trivalent form, corresponding to an oxide of the formula, Cu_2O_3.—R. S. H.

Electrolytic oxidation in presence of fluorine ions. M. G. Levi and F. Ageno. Atti R. Accad. dei Lincei Roma, 1906 [5], 15, II., 549—555 ; Chem. Zentr., 1907, 1, 212—213.

The authors have studied the effect of fluorine ions on the electrolytic oxidation of chromium salts and sulphites. The experiments were made in vessels of platinum or of glass coated with paraffin wax. With bright platinum electrodes, no oxidation of chromium salts in sulphuric acid solution takes place in absence of hydrofluoric acid. In presence of $N/4$ to $N/2$ hydrofluoric acid at 50°—60° C., a yield of about 50 per cent. of chromic acid is obtained with bright platinum electrodes, and a yield of 75—80 per cent. with platinised electrodes. The yield is increased by reducing the anodic current-density.

Dithionates are produced from sulphites in absence of free acid if a higher potential be employed than is required for the formation of sulphate. If the effect of fluorine ions is to increase the anode potential, the yield of dithionate should be increased by addition of a fluoride. This was found to be the case. No dithionate is produced with platinised electrodes, whether a fluoride be present or not.—A. S.

Ozone ; Preparation of —— *by electrolysis.* F. Fischer and K. Massenez. Z. anorg. Chem., 1907, 52, 202—218.

By the electrolysis of sulphuric acid McLeod obtained oxygen containing 17 per cent. of ozone (Chem. Soc. Trans., 1886, 49, 591), but the platinum wires used as electrodes were rapidly destroyed. The authors have found that by cooling the anode with water, it may be preserved. Its exact form and surface area are of great importance in determining the extent of ozonisation. The best results were obtained with an anode consisting of a narrow platinum tube connecting two vertical glass tubes containing copper wires. The platinum tube was also enclosed in glass, except an exposed strip 2·4 sq. mm. in area. This facilitates the ready escape of the gas from contact with the metal. The platinum tube was first polished by working the apparatus for some hours with acid of sp. gr. 1·3, which attacks the anode somewhat, and renders it much more efficient. After this preliminary treatment, an acid of sp. gr. 1·085, and a current density of 58 ampères per sq. cm., gave oxygen containing 17·14 per cent. of ozone, the electrodes remaining quite unattacked. The cathodes used were of lead, and the whole apparatus was immersed in cold water during an experiment, a stream of water also being forced through the anode.—F. Sodn.

English Patents.

Batteries ; [Porous material for] secondary ——. A. P. Strohmenger, Harrow-on-the-Hill. Eng. Pat. 1396, Jan. 18, 1906.

Porous nitrocellulose bags are used to completely enclose the plates coated with active material. The sheets of porous material are folded, and at the lines of junction are cemented by a partial solution of the substance and by the application of pressure. The envelope may be reinforced at its edges by strips of similar material.—B. N.

Spongy lead plates ; Increasing the electrical capacity of —— *for storage batteries.* J. Diamant, Györ, Hungary. Eng. Pat. 22,319, Oct. 9, 1906.

The activity of spongy lead plates may be prolonged by renewing the surfaces of the plates after they have come dense. This may be done by cutting off the dense rfaces, or, preferably, the plate may be made in separate yers, so that the exposed part may be turned with its eviously exposed surface inwards. It is advantageous effect the interchange of the surfaces before the appear- ice of any great reduction of capacity.—B. N.

ilaments for incandescent electric lamps. The British Thomson-Houston Co., Ltd. From General Electric Co., of Schenectady. Eng. Pat. 929, Jan. 12, 1906, II., page 144.

ilaments ; Metallic —— for electric incandescent lamps. A. G. Bloxam. From J. Lux. Eng. Pat. 7189, March 24, 1906. II., page 144.

zone generators. N. Van der Sleen, Haarlem, Holland. Eng. Pat. 6711, March 20, 1906.

HE ozone generator, described in Eng. Pat. 24,543 of 98 (this J., 1899, 1029), is provided with a cover or se to prevent the entrance of aqueous vapour.—B. N.

ydrazo derivatives ; [Electrolytic] manufacture of ——. O. Imray, London. From F. Darmstädter, Darmstadt, Germany. Eng. Pat. 6924, March 22, 1906.

EE U.S. Pat. 833,513 of 1906 ; this J., 1906, 1103.—T. F. B.

erilising apparatus ; Electric —— [for water and other liquids]. A. Douilhet. Eng. Pat. 8332, April 6, 1906. XVIII*B*., page 164.

itric acid ; [Electrolytic] processes for concentrating ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 18,603, Aug. 20, 1906.

EE Fr. Pat. 368,716 of 1906 ; this J., 1907, 24.—T. F. B.

United States Patents.

urnace ; Electric ——. K. Birkeland and S. Eyde, Christiania. U.S. Pat. 837,277, Dec. 4, 1906.

EE Eng. Pat. 20,003 of 1904 ; this J., 1905, 34.—T. F. B.

orage batteries ; Cleaning ——. J. W. Aylsworth, East Orange, N.J., Assignor to Edison Storage Battery Co., Orange, N.J. U.S. Pat. 837,773, Dec. 4, 1906.

HE metallic surfaces of an alkaline storage battery are eaned by introducing into the battery a hot, weak kaline solution. After several hours, the solution is moved, and fresh hot solution introduced, the operations ing repeated as many times as is necessary.—A. S.

raphite ; Production of ——. E. G. Acheson, Stamford, Ontario, Canada. U.S. Pat. 836,355, Nov. 20, 1906.

HE object of this invention is to obtain a " soft, unctuous, id non-coalescing graphite." The process consists in eating in an electric furnace a charge composed essen- ally of carbonaceous material and carbide-forming aterial, the latter forming more than 20 per cent., y 30 to 45 per cent., by weight of the charge, but less ian the theoretical proportion required for the pro- iction of a carbide.—W. C. H.

ycollic acid ; [Electrolytic] Process for the manufacture of ——. O. Liebknecht, Frankfort-on-the-Maine, Germany. Assignor to The Roessler and Hasslacher Chem. Co., New York. U. . Pat. 837,083, Nov. 27, 1906.

LYCOLLIC acid is prepared by the electrolytic reduction oxalic acid, dissolved in dilute sulphuric acid, in the thode compartment of an electrolytic apparatus, with e aid of electrodes (*e.g.*, of lead) having a cathodic over- ltage. The electrolyte is kept warm during the process, id the sulphuric acid is of such concentration that it excludes the oxalic acid from substantial participation the conductivity."—A. S.

ater ; Apparatus for the sterilisation of —— by means of an electric current. Water sterilising apparatus. M. Otto, Assignor to American Ozone Co. U.S. Pats. 837,107, 837,108, and 837,109, Nov. 27, 1906. XVIII*B*., page 164.

French Patents.

Positive nickel plates for alkaline accumulators ; Peroxidation and formation of ——. P. Gouin. First Addition, dated Nov. 17, 1905, to Fr. Pat. 360,664, March 4, 1905 (this J., 1906, 545).

To facilitate the formation of nickel oxide and increase its conductivity, silver nitrate may be employed. This should not be mixed with the solutions of nickel salt, but used independently. The solution of silver nitrate is poured over the surface of the layers of oxide previously formed on the plate, and the heating is effected as described in the main specification. A proportion of 2 grms. of silver salt to 10 grms. of nickel oxide formed is sufficient for carrying out the process, and nearly all this silver is subsequently recovered.—R. S. H.

Electric transformer furnaces. [Induction furnaces]. O. Frick. Fr. Pat. 369,267, Aug. 27, 1906. Under Int. Conv. Dec. 18, 1905.

In order to reduce the self induction caused by the diffusion fields from the primary and secondary of induction furnaces, one or more closed circuit conductors are placed in the diffusion field, preferably having two coils wound in contrary directions, and surrounding the iron core. These coils are so arranged that the main field can influence no inductive action upon them, whereas the lines of force of the diffusion field pass through them, and give rise to a current which opposes the diffusion field. —R. S. H.

Chlorates and perchlorates ; Electrode for the manufacture of ——. M. Couleru. Fr. Pat. 361,901, Nov. 11, 1905.

The construction of the electrode, which is intended for the industrial electrolytic manufacture of these compounds, is so carried out that a uniform distribution of the current to the thin sheet of platinum serving as anode is accomplished. The cathode is of iron, and the construction of the electrode in the form of a grating with wings assists the rapid removal of the hydrogen from the sphere of reaction. —R. S. H.

Peat ; Treatment of —— [for the preparation of fuel] with an alternating current, without marked heating, after preliminary removal of water. J. B. Bessey. Fr. Pat. 368,313, July 23, 190 . II., page 145.

Oxides of nitrogen ; Apparatus for production of —— by electric means. I. Moscicki. Fr. Pat. 369,387, Aug. 31, 1906. Under Int. Conv., Sept. 1, 1905.

The electrodes are arranged co-axially, and the annular space between them is traversed by a magnetic field, the lines of which are perpendicular to the shortest distances between the electrodes. In this manner a rapidly rotating arc is obtained in the annular space, practically covering the whole surface of the electrodes. The air is only subjected once to the action of the arc and thus a high efficiency can be obtained.—R. S. H.

German Patent.

Amines ; Process for the electrolytic preparation of ——. C. F. Boehringer und Soehne. Ger. Pat. 175,071, Nov. 14, 1905.

The process consists in preparing amines by the electrolytic reduction of hydrochloric acid solutions of oximes or of condensation products of aldehydes and ammonia. The process possesses an advantage over the method of reducing in sulphuric acid solution (Ger. Pats. 141,346 and 143,197), in that the hydrochlorides of the amines can be recovered directly by evaporating the solution after electrolysis. The oximes or aldehyde-ammonia compounds are dissolved gradually in the electrolyte whilst the reduction is proceeding.—A. S.

(*B*)—ELECTRO-METALLURGY.

Alloys of silver and copper, silver and tin, silver and lead ; Distillation of ——. H. Moissan and T. Watanabe. Compt. rend., 1907, 144, 16—19.

The alloys, usually about 40 grms., were distilled by means of the electric furnace, using a current of 500 ampères at 110 volts.

Silver and copper.—The alloys used contained as nearly as possible equal parts of the two metals, and the time of distillation (counted from the point at which the alloy was liquid) was varied from 1 to 15 minutes. About 35 seconds elapsed before volatilisation commenced. After 4 minutes the proportion of silver in the residue was slightly less than in the original alloy, but at this point a rapid drop in the proportion of silver occurred, and after 15 minutes' heating, the composition of the residue was, Ag. 3·62 per cent., and Cu. 95·22 per cent. The boiling point of copper is thus considerably higher than that of silver.

Silver and tin.—It has already been established that the boiling point of tin is higher than that of copper. The alloy of silver and tin contained Ag. 36·98 per cent., and Sn. 64·04 per cent. The same conditions as before were observed, and volatilisation commenced 10 seconds after fusion. After 10 minutes' heating, the composition of the residue was, Ag 2·93 per cent., and Sn. 93·65 per cent.

Silver and lead.—The composition of the alloy was: Ag. 46·24 per cent., and Pb., 52·95 per cent., and the longest time of heating was 2½ minutes, owing to the great rate at which lead distils. At the end of this time the residue contained 93·81* per cent. of silver. Of the above metals, lead is, therefore, more volatile than silver, silver than copper or tin, and consequently their boiling points, according to the authors, lie in the order here given.—J. C. C.

Metal vapours in electric sparks; Mode of formation and spectrum of ——. B. Walter. Ann. der Physik, 1906, (4) 21, 223—238. Chem. Zentr., 1907, 1, 225.

If electric sparks be produced between electrodes made of metallic alloys, and then a self-induction coil be placed in the circuit, the spectra of the different components of the alloy are not affected alike. With brass electrodes, for example, the intensity of the zinc lines is diminished, whilst the copper lines are hardly affected; and the same effect is observed if one electrode be of zinc and the other of copper. Also, the intensities of different lines in the spectrum of one and the same metal are altered in different degrees. The differences in the behaviour of copper and zinc cannot be due to the different volatility of the two metals. The formation of metal vapour in electric sparks occurs almost exclusively at the negative pole and is due to cathodic disintegration. In the spark spectrum the predominant lines are those of the metal, which, under the given conditions, is more easily disintegrated. In order to compare the relative disintegration of brass, copper, and zinc, three similar tubes, with electrodes of the three metals mentioned, were connected in series, and currents at different E.M.F. passed through. In all cases the zinc cathode showed least and the copper cathode most disintegration, so long as the gas-pressure remained the same and the zinc did not melt. On disintegration, the metallic particles become more or less strongly charged electrically, and they lose this charge only when they reach about the middle of the spark-gap; this accounts for the varying structure of the spectrum at different portions of the spark-gap (spark-lines from charged particles, arc lines from uncharged). Increase of the self-induction introduced into the circuit causes an increase in the number of uncharged, incandescent particles.—A. S.

English Patent.

Copper and other metals; Electro deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 8924, April 12, 1906.

The patent relates to improvements in the electro-deposition of copper or other metals from solutions which have to be maintained in an oxidised state. The solution from which the metal is to be deposited, is projected by centrifugal force in the form of a fine spray, thus bringing it into intimate contact with air, and maintaining it in "the oxidised state." The liquid, after being treated to free it from air, *e.g.*, by conveying it through a vessel containing broken granite or felspar, may also be subjected to the action of strong light (*e.g.*, sunlight or rays from an arc lamp), either during aeration, or before or after it is aerated or passed through the vessel. It is stated that "strong light, such as daylight, has a considerable effect on the solution, which it clarifies."—B. N.

German Patents.

Rust-preventing coating of tin or zinc; Process for the electrolytic deposition of a ——, *especially on iron and steel.* W. Pfanhauser and F. Fischer. Ger. Pat. 171,034, Feb. 14, 1905.

It is stated that adherent, bright, and uniform coatings of relatively great strength are obtained by using the iron or steel as cathode in a fused electrolyte, consisting of a compound of the coating metal.—A. S.

Nickel deposits; Process for obtaining ——, *using aluminium or magnesium contacts.* Elektro-Metallurgie, G.m.b.H. Ger. Pat. 172,921, June 20, 1905. Addition to Ger. Pat. 127,464, Feb. 15, 1899.

The patent relates to a process of obtaining electrolytic deposits of nickel, using aluminium or magnesium contacts, and consists in adding to the electrolyte, besides conductive salts such as ammonium chloride or alkali sulphates or citrates, a sufficient quantity of sodium hydroxide to maintain an alkaline reaction of the solution.—A. S.

Cerium and other so-called cerite metals (lanthanum, neodymium, praseodymium, &c.,); Process for obtaining metallic —— *by the electrolysis of the chlorides of the metals.* W. Borchers and L. Stockem. Ger. Pat. 172,529, Sept. 24, 1905.

The solution of the chloride is mixed with calcium chloride in about the proportion corresponding to the formula: $CeCl_3 + CaCl_2$, the mixture (or the double salt) is dehydrated and fused, and the fused mass submitted to electrolysis in the usual manner. It is claimed that the addition of calcium chloride hinders the formation of oxide during the subsequent operations of evaporating, calcining, and fusing. It is advantageous to add to the mixture a small proportion of fluorspar. It is stated that by this method cerium chloride containing phosphatic impurities can be satisfactorily treated by the electrolytic process.—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 103.)

Dierucin; Occurrence of —— *in rape oil.* C. L. Reimer. Ber., 1907, 40, 256—257.

In the discussion between Marcusson and Lewkowitsch (this J., 1906, 1106; 1907, 24) reference was made to the author and Will's discovery of dierucin in rape oil (Ber., 1886, 19, 3320), and Marcusson quoted Stohmann and Kerl to the effect that the diglyceride was only found in rape oil that had been refined by sulphuric acid, and not in the crude oil. The author asserts that this statement is incorrect, and that the oils from which the dierucin had crystallised, had not been refined in any way. In his opinion the dierucin was probably formed in the oil through the hydrolytic action of water on the trierucin and was not originally present in the rape seed, for the separation of the diglyceride was exceptional, and was only noticed in the case of some twelve barrels of rape oil out of many thousand examined. Yet there was only a small proportion of moisture present in any of the oils, so that this explanation is not altogether satisfactory. Possibly the hydrolysis might have been started through the seeds being transported in a moist state and in warm weather.—C. A. M.

Lubricating oils containing saponifiable fats; Determination of the saponification value of ——. H. Schreiber. J. Amer. Chem. Soc., 1907, 29, 74—75.

The ordinary method of saponification with alcoholic potassium hydroxide solution is tedious, and tends to give too high values, due, in part, at all events, to the action of the alkali on the glass. The addition of benzene to the alcoholic alkali has been found to obviate these drawbacks. About 5 grms. of the oil are mixed with 25 to 50 c.c. of approximately $N/2$ alcoholic potassium hydroxide solution, and 25 to 50 c.c. of benzene, so as to obtain a clear solution on warming the flask. Where it has been necessary to use as much as 50 c.c. of the benzene, a little neutral alcohol may be required to make the solution quite clear. The Erlenmeyer flask is then heated on the top of a hot water bath, but not in direct contact with the steam, and the solvent that evaporates is condensed by means of a reflux condenser. Thirty minutes was found sufficient for the saponification of any oil tried, and the presence of benzene did not interfere with the titration. Test experiments with mixtures of known composition are described to show the accuracy of the method.—C. A. M.

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* Note.—93·81 is given in the text, but in the table the figure is given as 96·81.

English Patents.

Oils, fats, resins, syrups, varnishes, and the like; Preparation for uncolouring ——. T. Macherski and E. Koperski, Brest-Litowsk, Russia. Eng. Pat. 22,942, Nov. 8, 1905.

Bone black or other form of carbon, preferably purified by extraction with hot hydrochloric acid and then washed and dried, is intimately mixed with finely-powdered zinc in the proportion of about 1 to 7 per cent., and with 10 to 70 per cent. of graphite, the quantities of these substances varying with the amount of colour to be removed. In the case of edible oils and sugar solutions, the decolorising power of the mixture is increased by the addition of 0·1 to 1·0 per cent. of sodium carbonate. The preparation is used with oils, &c., in the proportion of 1 to 10 per cent.—C. A. M.

Fat-melting pans or digestors; Impts. in ——, applicable also to oil boiling and distilling apparatus. Fullerton, Hodgart, and Barclay, Ltd., and A. J. Liversedge, Paisley. Eng. Pat. 5841, March 10, 1906.

Claim is made for a cylindrical apparatus, with flat or only slightly domed bottom, the axis of which is inclined at an angle (of say 30° to 40°) from the vertical. This causes the heat to be applied beneath the material to a greater extent than in ordinary vertical pans. It also promotes the circulation of the contents, and thus shortens the time of extraction, whilst the chance of the substance burning through too long a stationary contact with the heated wall of the apparatus is reduced. The heating is preferably done by means of a steam jacket, and in this case it is advantageous to admit the steam at two or more points, preferably below the material, instead of only at one point.—C. A. M.

United States Patents.

Butter, oils, fats, &c.; Apparatus for refining ——. W. F. Jensen, Lincoln, Nebr. U.S. Pat. 837,069, Nov. 27, 1906.

The apparatus consists of an air-tight tank having a conical bottom and provided at the top with a pipe which is in connection with an exhaust pump. A second pipe also enters the top of the vessel and reaches nearly to the bottom. The oil, &c., is placed in the vessel and there subjected to a blast of air. The bottom of the second or air-inlet pipe terminates in a perforated diaphragm, the perforations being so constricted as to admit, during the action of the exhaust pump, only a limited supply of air to the tank.—W. P. S.

Saponifying fats and oils; Method for obtaining material for ——. M. Nicloux, Paris. U.S. Pat. 837,710, Dec. 4, 1906.

See Fr. Pat. 335,902 of 1903; this J., 1904, 327.—T. F. B.

Soap; Apparatus for producing bars of ——. K. E. Markel, Warrington. U.S. Pat. 838,127, Dec. 11, 1906.

See Eng. Pat. 23,187 of 1904; this J., 1905, 897.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 105.)

(*A.*)—PIGMENTS, PAINTS.

Lead acetate solution; Action of carbon dioxide upon ——. A. Altmann. VII., page 149.

English Patents.

White lead; Drying of pulp ——. H. A. E. Smith, London. Eng. Pat. 2045, Jan. 26, 1906.

The pulp falls from a hopper, at a rate which can be regulated, upon the external surface of two or more steam-heated cylinders, which have both a rotative and reciprocative motion. The latter motion, which is produced by a combination of a worm and worm-wheel carrying an eccentric pin connected with a fixed rod, distributes the pulp evenly over the cylinders, and prevents the latter from becoming grooved. The dry white lead is removed from the cylinders by scrapers, and falls directly into the barrels. As the whole machine is enclosed in a casing connected with a chimney, no dust is disseminated.—M. J. S.

Paint and varnish remover. C. Ellis, New York. Eng. Pat. 3413, Feb. 12, 1906.

See U.S. Pat. 817,141 of 1906; this J., 1906, 434.—T. F. B.

(*B.*)—RESINS, VARNISHES.

English Patents.

Oils, fats, resins, syrups, varnishes, and the like; Preparation for uncolouring ——. T. Macherski and E. Koperski. Eng. Pat. 22,942, Nov. 8, 1905. XII., this page.

Varnishes, lacquers, and the like; Apparatus for measuring the resistance to scratching of ——. A. P. Laurie, Colinton, and F. G. Baily, Juniper Green, Midlothian. Eng. Pat. 3486, Feb. 13, 1906.

The inventors claim the use of a blunt point, applied with a known and variable pressure, to a surface coated with a varnish, lacquer, or enamel, to determine by scratching the hardness and toughness of the layer, in the manner and with the apparatus described in this J., 1906, 819—820.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Rubber industry of Northern Nigeria. Bd. of Trade J., Feb. 7, 1907. [T.R.]

Rubber formed nearly three-fourths of the total value of the exports from Northern Nigeria for the year 1905-6, namely, about £101,207, but it is feared that this has been obtained at the cost of a considerable destruction of the rubber vines, by digging up the roots, from which a very low grade rubber is prepared. However, the new Forestry Proclamation (which came into operation on 1st October, 1906) holds the purchaser responsible that no "root rubber" is bought or exported. The regulations also contain full rules for tapping, &c., which so far as possible will be enforced by the increased political staff.

India-rubber; Influence of barium sulphate on the vulcanisation and oxidation of ——. R. Ditmar. Gummi-Zeit., 1907, 21, 418—419.

Peruvian rubber was mixed with 4 per cent. of sulphur and rising proportions of sifted precipitated barytes (barium sulphate), and vulcanised for two hours at six atmospheres pressure. The products were tested mechanically. It is found that the addition of barytes up to 25 per cent. leaves both breaking strain and elongation approximately the same as when barytes is absent. In the oxidising test, rubber with 4 per cent. of barytes shows a maximum of avidity, absorbing 1·29 per cent. of oxygen in two and a half days at 100° C.; with 6 and 7 per cent. of barytes, the oxidisability diminishes.—W. A. C.

ENGLISH PATENT.

Cement composition. J. Nay, Bordeaux, France, and V. Revello, Cardiff. Eng. Pat. 1635, Jan. 22, 1906.

THIS cementing composition is made by mixing thoroughly in approximately equal proportions rubber (caoutchouc), dissolved to form a thick solution in benzine or other rubber solvent, and white lead. The mass is made plastic or liquid to the required degree, to suit the materials to be united, by the admixture of a rubber solvent and linseed oil.—W. C. H.

UNITED STATES PATENTS.

Vulcanising process. H. W. Morgan, Cleveland, Ohio. U.S. Pat. 837,865, Dec. 4, 1906.

RUBBER, gutta-percha, or the like is dissolved in a suitable solvent, sulphur is added, and the mixture is subjected to the action of ozone, and afterwards vulcanised.—A. S.

Rubber and ebonite: Treatment and utilisation of waste vulcanised ——. V. de Karavodine, Assignor to B. Roux, Paris. U.S. Pat. 838,419, Dec. 11, 1906.

SEE Fr. Pat. 338,945 of 1903; this J., 1904, 991.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 106.)

Tan-bark; Consumption of —— in the United States. U.S. Forest Service Circular, No. 42. [T.R.]

THE reports of 477 tanneries show that 799,755 cords of hemlock bark and 304,290 cords of oak bark were consumed in the United States during 1905; the total value amounted to $8,232,457. The consumption is less than that of 1900 by 512,020 cords; the consumption of extracts, however, has increased from 67,043 barrels (of 500 lb.) to 292,399 barrels (hemlock, 52,430; oak, 187,635; chestnut, 51.224; palmetto, 1110 barrels).

Tannin; Direct determination of —— [in quebracho bark and extract]. H. Franke. Pharm. Centralb., 1906, **47**, 599.

0·20 GRM. of tannin (or 50 c.c. of a solution obtained by extracting 20 grms. of the bark with 1000 c.c. of water) is dissolved in 100 c.c. of water and treated with 50 c.c. of 40 per cent. formaldehyde. The mixture is gently boiled, and 25 c.c. of 25 per cent. hydrochloric acid are added. After heating for ten minutes, the precipitate aggregates; the mixture is allowed to stand for 30 minutes, the precipitate is collected, washed first with water, then with alcohol, and finally with ether; it is then dried at 110° C. and weighed as methylene-quebracho-tannic acid. $C_{19}H_{16}O_{17}$. In the case of extracts, an equivalent amount is dissolved in water, and an aliquot portion taken for the determination. The method compares favourably with the hide-powder process.—J. O. B.

ENGLISH PATENT.

Leather; Drying ——. E. Pim, Maghull, Lancs. Eng. Pat. 310, Jan. 5, 1906.

THE leather butts are hung in a closed chamber, the air of which is not changed, but is kept below the point of saturation by the presence in the chamber of pipes, which are artificially refrigerated by the circulation of cold water or by other suitable means. The moisture which condenses on the pipes falls into gutters, by which it is conveyed out of the chamber.—M. J. S.

UNITED STATES PATENTS.

Detanning mineral- or chrome-tanned leather or leather-waste; Process for ——. A. R. Weiss, jun., Hilchenbach, Germany. U.S. Pat. 837,016, Nov. 27, 1906.

THE patent relates to a process of detanning mineral- or chrome-tanned leather or leather-waste preparatory to the manufacture of glue therefrom. The material is treated with an alkaline solution, washed thoroughly in water, steeped in hydrochloric acid, again washed with water, and neutralised.—A. S.

Composition of matter [Artificial leather]. W. H. Smith, Philadelphia, Pa. U.S. Pat. 837,351, Dec. 4, 1906.

THE product claimed consists of stearic acid, 3 parts; Chinese wood-oil (tung oil), 5; acetone, 50; nitrocellulose 20; a pigment, 12; and pulverised leather, 10 parts. —A. S.

Leather; Artificial ——, and process of making same. S. Meers, New York. U.S. Pat. 837,700, Dec. 4, 1906.

SEE Fr. Pat. 369,220 of 1906; this J., 1907, 106.—T. F. B.

XV.—MANURES, &c.

(*Continued from page* 106.)

UNITED STATES PATENTS.

Fertiliser; Process of making ——. W. R. Luckey, Evadale, Tex. U.S. Pat. 838,036, Dec. 11, 1906.

SUCCESSIVELY superimposed layers of organic material are treated with a solution of a mixture of approximately equal parts of potassium hydroxide, ammonium nitrate, copper sulphate, and soda ash. Subsequently the layers are sprinkled with sodium chloride and slaked lime, and lastly sulphuric acid may be, but is not necessarily, added. The layers are then left undisturbed until the organic matter is decomposed.—E. S.

Manure; Process of preparing ——. J. Hammerschlag, Strassburg, Germany. U.S. Pat. 838,108, Dec. 11, 1906.

SEE Fr. Pat. 340,449 of 1904; this J., 1904, 831.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 103.)

Beetroot samples; Preservation of —— by packing in diffusion pulps. M. de Molinari. Bull. Agric., 1906, **22**, 567—570. Bull. Soc. chim. Belg., 1907, **21**, 45.

BEETROOTS required for analysis can be preserved for several days without appreciable changes in their sugar contents, provided they are kept entire. But when the beets are cut up in quarters, and are packed in diffusion pulp, as is the general practice, considerable losses of sugar take place; such losses were found to amount to 2·09 and 1·80 per cent. in the course of only two days.—J. F. B.

Aldol, penta-erythrose, and the action of copper acetate on the hexoses. A. F. McLeod. Amer. Chem. J., 1907, **37**, 20—50.

Aldol and penta-erythrose.—Aldehydes, in which the carbon atom carrying the aldehyde (CHO) group has one or more hydrogen atoms attached to it, undergo, in part, an aldol condensation on treatment with alkali. The author has observed that acetaldehyde does not condense to aldol if the alkalinity is below a certain limit (0·1 per cent. in the case of sodium and calcium hydroxides). Formaldehyde is, of all the aldehydes, most sensitive towards alkalis. By treating an aqueous mixture of formaldehyde and acetaldehyde with alkali (less than 0·1 per cent. of the latter), a condensation occurs, which, according to Nef, proceeds thus:—

$$3\mathrm{HOCH}\!<\; + \mathrm{H\text{-}CH_2CHO} \longrightarrow$$

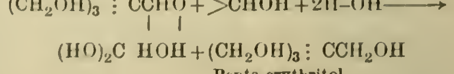
Hydroxymethylene

$$\mathrm{HOCH_2CHHCHO} + 2\mathrm{HOCH}\!<\; \longrightarrow$$

Hydracrylic aldehyde

$$\mathrm{(HOCH_2)_2CHCHO} + \mathrm{HOCH}\!<\; \longrightarrow \mathrm{(HOCH_2)_3CCHO}$$

ββ′-Dihydroxyisobutyric aldehyde — Penta-erythrose



$$\mathrm{(CH_2OH)_3 : CCHO} + \;>\!\mathrm{CHOH} + 2\mathrm{H\text{-}OH} \longrightarrow \mathrm{(HO)_2C\ HOH} + \mathrm{(CH_2OH)_3 : CCH_2OH}$$

Penta-erythritol

The author has tested the validity of the above scheme by treating a mixture of acetaldehyde and formaldehyde 1 mol.:3 mols.) with small quantities of sodium hydroxide, and has obtained crude penta-erythrose as a thick, yellowish oil which appeared to contain relatively large amounts of $\beta\beta'$-dihydroxyisobutyric aldehyde. The crude penta-erythrose was very soluble in water and alcohol, and reduced Fehling's solution on warming; attempts to convert it into the solid state, or into a crystalline derivative, were unsuccessful. On reduction with sodium amalgam in dilute acid solution, it yielded a fair amount of crude penta-erythritol. The author also showed that hydracrylic aldehyde was an intermediate product of the above reaction: by treating an aqueous solution of a mixture of formaldehyde and hydracrylic aldehyde (2 mols.:1 mol.) with small quantities of sodium hydroxide, an almost quantitative yield of crude penta-erythrose being obtained.

Action of aqueous copper acetate on the hexoses.—The author has also determined the amounts of cuprous oxide, carbon dioxide, and formic, glycollic, and oxalic acids, formed from 100 grms. of dextrose, lævulose, and *d*-galactose, by eight hours' heating on a boiling water-bath with an excess—10 mols.—of aqueous copper acetate. It was found that more oxygen was taken up during the decomposition of lævulose than during that of dextrose; this was due, in part, to the fact that less unchanged sugar was found at the end of the experiment in the case of lævulose than in that of dextrose. More carbon dioxide was formed in the decomposition of lævulose than in that of dextrose. The amounts of oxygen taken up, and of carbon dioxide formed, in the oxidation of *d*-galactose were noticeably less than in the case of lævulose or dextrose. The author has also shown experimentally, (1) that the formic acid and carbon dioxide obtained in the oxidation of the hexoses, cannot be produced by decomposition of the oxalic acid formed as an intermediate product; (2) that the oxalic acid obtained cannot be produced by an oxidation of glycollic acid; (3) that the carbon dioxide obtained from the hexoses cannot be produced, to any appreciable extent, by an oxidation of formic acid.—L. E.

Sugar; Method for the determination of ——. I. Bang. Biochem. Zeits., 1906, 2, 271—290. Chem.-Zentr., 1907, 1, 375.

The method is based on the fact that cuprous oxide in presence of potassium thiocyanate forms cuprous thiocyanate if the solution contain no fixed caustic alkalis, but only alkali carbonate. The copper left unreduced by the sugar is determined by conversion into cuprous thiocyanate by hydroxylamine. The copper solution is prepared by dissolving 250 grms. of potassium carbonate, 50 grms. of potassium bicarbonate, and 200 grms. of potassium thiocyanate in about 600 c.c. of water at 50°—60° C., cooling to 30° C., adding 12·5 grms. of crystallised copper sulphate dissolved in 75 c.c. of water, allowing to stand for 24 hours, filtering, and making up to 1 litre. In carrying out the determination, 10 c.c. of the sugar solution are treated in a 200 c.c. flask with 50 c.c. of the copper solution, the solution is heated to boiling, and boiled gently for three minutes. The whole is then rapidly cooled, and titrated till colourless with a solution containing 6·55 grms. of hydroxylamine sulphate and 200 grms. of potassium thiocyanate in 2 litres. 50 c.c. of the copper solution correspond to about 60 mgrms. of sugar (50 mgrms. of dextrose = 0·1376 grm. of copper). The method is stated to be as accurate as the gravimetric process.—A. S.

Sugar; New test for ——. H. J. H. Fenton. Lancet. Jan. 26, 1907. Pharm. J., 1907, 78, 107.

The reaction depends upon the fact that all carbohydrates of the hexose, or polyhexose type (such as dextrose, lævulose, cane sugar, milk sugar, or maltose) yield a certain amount of bromo-methyl furfural, $CH_2Br.C_4H_2O.CHO$, when acted upon by hydrobromic acid under appropriate conditions; and further, that the latter substance reacts with malonic ester in presence of alkalis, giving rise to a product the solutions of which exhibit a powerful blue fluorescence. The conditions most favourable for the action of hydrobromic acid are obtained when phosphorus tribromide is dissolved in some inert solvent, such as toluene, and the solution is heated with the carbohydrate in presence of water; excess of water, however, must be avoided. The test is most conveniently applied in the following way: Pour a small quantity (4 or 5 c.c.) of the sugar solution on to an excess of solid anhydrous calcium chloride so as to form a semi-solid or pasty mass. Add to this 10 c.c. of toluene containing two or three drops of phosphorus tribromide, and then carefully boil the mixture for a few minutes. Pour off the toluene solution and, after cooling, add to it about 1 c.c. of malonic ester and a little alcohol. On neutralising the mixture by adding alcoholic potash, drop by drop, a characteristic pink colour will usually be observed. The mixture is now considerably diluted with alcohol and a few drops of water, when, if sugar were originally present, the solution will exhibit a beautiful blue fluorescence. The reaction appears to be a specific one for carbohydrates which contain six or more atoms of carbon in the molecule, and may therefore be used to distinguish hexoses from pentoses or other lower sugars.

Erythritol; Synthesis of ——. Lespieau. XXIV., page 169.

Starch; The diastatic conversion of ——. H. Van Laer. XVII., see below.

Starch and glycogen [in foodstuffs]; Quantitative separation of ——. E. Bauer and E. Polenske. XVIIIA., page 163.

English Patent.

Oils, fats, resins, syrups, varnishes, and the like; Preparation for uncolouring ——. T. Macherski and E. Koperski. Eng. Pat. 22,942, Nov. 8, 1905. XII., page 159.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 110.)

Starch; The diastatic conversion of ——. H. Van Laer. Bull. Soc. chim. Belg., 1907, 21, 8—20.

In a critical review the author gives an account of the recent work of Maquenne and Roux, Fernbach, and Wolff (see this J., 1905 and 1906), on the composition of starch and its saccharification by malt extract. For purposes of comparison the main conclusions of earlier workers are set forth as representing the views hitherto accepted. The substantial identity of the soluble component (amylose) of the starch granule and the insoluble modification of it formerly known as "amylocellulose," had been foreshadowed by Duclaux and by Brown and Heron. The hypothesis of the existence of a separate gelatinisable constituent, amylopectin, is accepted by the author, although the body has not yet been isolated. Dealing with the new work on the saccharification of starch by malt diastase, the author points out that none of the earlier work has been controverted; it has merely been extended and the results interpreted in a somewhat different manner. The fact that the resistance of the so-called "stable-dextrin" to further saccharification is only relative, according to the conditions and time, and not absolute, had long been recognised. Ling and Davis had obtained 96—97·6 per cent. of maltose by the prolonged saccharification of certain starches. Ling had also shown that dextrose is invariably formed as a product of the saccharification when the conversion is effected at temperatures above 60° C.; this circumstance will have to be taken into account by the French chemists when they extend their investigations to higher temperatures. The conversion of amylose must be regarded as taking place, at temperatures below 60° C., very rapidly and without the production of dextrins; the "stable dextrin" which then remains is to be regarded as the product of the liquefaction of the amylopectin constituent; this dextrin exists ready formed in all preparations of "soluble starch." Dextrins of quite another kind are produced from the amylose itself when saccharification is conducted at temperatures above 60° C. These dextrins are easily saccharified by malt diastase, and correspond with the maltodextrins of Brown and Morris. The dextrinous products of the saccharification of ordinary starch at high temperatures are mixtures of both kinds of dextrin, the older investigators attributing their complexity to the modification of the diastase by heat, whilst the more recent investigators attribute it to the heterogeneous nature of the starch granule itself.—J. F. B.

Saccharomyces ; Influence of spectral colours on the sporulation of ——. J. E. Purvis and G. R. Warwick. Camb. Phil. Soc. Proc., 1907, **14**, 34—40.

Cultures of *S. cerevisiæ I., S. Ellipsoideus I., S. Pastorianus II.*, and English brewery yeast were brought into a fresh, healthy condition, and then sown on gypsum blocks for sporulation tests at 24°—25° C. These tests were made in boxes with fronts of glass of different colours, and observations were made at certain intervals of time. It was found that the red rays, or rays of low refrangibility, accelerated the formation of spores more than when the cells were incubated under the influence of white light ; and they appeared to stimulate the activity of the sporulation more quickly than when the development took place in the dark, although in the latter case the sporulation seemed to be completed in about the same time as in the red light. The green rays appeared to retard the development of the spores. The blue and the violet rays retarded the sporulation more markedly than the green rays. The ultra-violet rays and radium rays were still more effective in the retardation, and they appeared to have the further effect of influencing detrimentally the vitality of the cells when the latter were exposed to them for some time.—J. F. B.

Spores ; Chemical action of ——. J. Effront. Monit. Scient., 1907, 81—87.

When a solution containing soluble starch, coagulated egg-albumin, and a small proportion of sodium phosphate is heated in an autoclave for two hours at 110° C., and afterwards maintained at 45° C., the starch and albumin undergo considerable hydrolysis, which is caused by diastatic and proteolytic enzymes secreted by spores of *Bacillus subtilis*. Bacterial spores can thus be brought to a peculiar condition in which, although they lose the essential properties of living cells, they preserve their power of producing enzymes. The secretion of the latter increases with the difficulty experienced by the spore in developing, and reaches a maximum when the spore becomes completely sterile. The chemical actions taking place in milk, wine, or beer after sterilisation are to be attributed to the presence of such bacterial spores arrested in their development. Seeing that the spores of *Bacillus subtilis* are always present in food, and that they are capable of exerting such a high diastatic power, it is probable that they play an important part in digestive phenomena.—T. H. P.

Caramel ; Fullers' earth test for —— *in vinegar.* W. L. Dubois. J. Amer. Chem. Soc., 1907, **29**, 75—77.

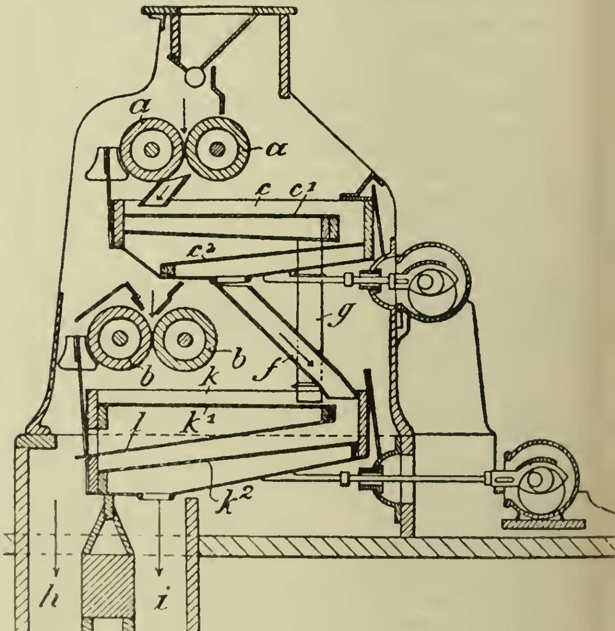
In examining the value of this widely-employed method, eleven samples of pure cider vinegar, as different as possible in appearance, were treated with various specimens of fuller's earth in the proportion of 25 grms. to 50 c.c. The mixture was allowed to stand for 30 minutes and then filtered, and the colour of the filtrate compared in a Duboscq's colorimeter with that of the untreated vinegar filtered in the same way. It was found that the amount of colour removed varied from nothing to 72 per cent., and that the proportion also varied with the nature of the earth. Thus, for example, a sample of vinegar which would have been regarded as pure when treated with one earth, would be considered doubtful on the results obtained with a second earth, and condemned on those given by a third earth. No sample of earth gave uniform results. Thus one which removed no colour from one sample of pure vinegar, removed 72 per cent. from another pure sample. In the author's opinion the test can only be regarded as a preliminary one. If all colour is removed, it may be concluded that caramel is present, and if little or none is removed, the vinegar may be regarded as pure, but in the case of the large number of vinegars which lose from 25 to 75 per cent. of their colour on treatment with fullers' earth, the method is quite unreliable.—C. A. M.

English Patents.

Malt extract or wort ; Production of ——. F. Faulkner, Birmingham. Eng. Pat. 7702, March 30, 1906.

The grist is subjected to a preliminary mashing at an initial temperature of about 125° F., and the liquid is continuously circulated through the mash during this preliminary operation, which lasts for thirty to forty minutes. This operation is conducted in a special cylindrical vessel with a conical lower portion. A perforated false-bottom is provided above the discharge opening, so as to support the grain. During the mashing process the liquor which percolates through the false bottom is withdrawn by an external pump from the bottom, and is returned and distributed over the top of the grist. At the end of the operation the liquor is pumped into a decoction tank, in which it is rapidly boiled. The drained mash is discharged through trap-doors in the perforated bottom and is passed out of the apex of the tun by means of a screw conveyor. At the same time it is mixed with the boiling liquor from the decoction vessel by means of an external mixing machine in such a manner that the mixed mash arrives in the mash-tun proper at an initial temperature of 158° F.—J. F. B.

Malt ; Process for obtaining a high return of extract from ——. C. Lean, London. From Gebr. Seck, Dresden, Germany. Eng. Pat. 13,838, June 16, 1906.



The steely tips of the malt corns which in the usual way of milling remain attached to the husks and escape complete saccharification, are separated from the husks in a special mill, and are reduced to an easily saccharifiable paste by boiling them, either alone or together with the other grits, before mashing them with the malt-flour and husks. The malt is first crushed between the rollers, *a*, *a*, (see figure), and the product falls on to the first sieve, c^1, of the first sieve-box, *c*. This sieve allows the flour and the fine grits to pass through and delivers them through the pipe, *g*, on to the sloping floor, *l*, whence they pass to the outlet, *h*. The husks and coarser grits pass from the sieve, c^1, to the sieve, c^2, through which the grits pass and are delivered by the pipe *f*, to the second sieve box, *k*, and thence to the outlet, *i*. The husks with the adherent steely tips, then go through the second pair of rollers, *bb*, and the product is treated on the sieve, k^1, which discharges the flour on to the floor, *l*, and thence to *h*. The husks and steely tips are separated by the sieve, k^2, the steely tips and coarse grits passing through the outlet, *i*, to a copper in which they are boiled to a paste.—J. F. B.

Beer, stout, cider, and other fermented liquids; Process of treating ——, and apparatus therefor. P. C. Reid, Kelvedon, Essex, P. K. le May, Hatfield, Herts, T. W Christian, St. Albans, Herts, and E. G. Adlam, Bristol Eng. Pat. 3885, Feb. 16, 1906.

The beer is run from the fermenting vats into conditioning vessels; the gas evolved in the latter is stored in a gasometer. The beer is next pasteurised in a vessel which contains (1) a coil, through which brine, at the temperature required for pasteurisation, is passed; (2) a removable perforated chamber, which is charged with hops. The beer is then forced, by pressure of the carbon dioxide in the gasometer, into a refrigerator, where it is cooled to about 60° F.; it is next forced into two chilling and carbonating vessels successively, where it is chilled to about 30° F. (by cold brine passing through coils in the interior of the vessels), and carbonated with gas from the secondary fermentation. The beer is then drawn off, filtered, and racked off into casks or bottled. A sterile liquid, without yeast deposit, is thus obtained. The same process, in which the conditioning, pasteurisation, chilling, and carbonating are effected in one vessel, is also claimed.—L. E.

Impregnating liquids [beer, &c.] with gases and raising them under the action of such gases; Apparatus for ——. G. Chenot and L. van Genechten. Eng. Pat. 17,062, July 28, 1906. I., page 141.

Brewers' grains or draff; Treatment of ——, for the production therefrom of materials suitable for use as yeast-food and for other purposes. F. Faulkner, Birmingham, and Saville's (1902), Ltd., Manchester. Eng. Pat. 1962, Jan. 25, 1906.

The object of this invention is to extract the nitrogenous and starchy matter remaining in grains or draff, and to convert it into a digestible food-product. The grains are immersed, preferably directly after removal from the mash-tun and whilst still hot, in water containing about 0·5 per cent. of sulphurous acid; the mixture is digested under pressure (*e.g.*, 50 lb. per sq. in.) for about one hour. The pressure is then released, and about 0·5 per cent. of sulphuric acid added to the mixture, which is again digested, under about the same pressure as before, for about two hours. The treatment with sulphurous acid converts the nitrogenous matter into a digestible form; that with sulphuric acid saccharifies the starch. The liquor is then neutralised with whiting or chalk, filtered, and concentrated *in vacuo* to a density of about 1400.—L. E.

United States Patent.

[Spirit] Distilling and rectifying apparatus. U. Lorentz, Cristobal, Canal Zone, Panama. U.S. Pat. 837,696, Dec. 4, 1906.

The claim is for a cylindrical still column formed of burnt clay, glazed on the outside but unglazed within. The column is filled with a series of superposed concavo-convex partitions or diaphragms, also formed of porous, unglazed burnt clay. Each alternate diaphragm has its concave side uppermost and has the apex cut away so as to admit, and be supported by, the apex of the diaphragm next below, which has its convex side uppermost. The upper sides of the diaphragms are provided with ridges to direct the flow of the "mash" down the column.—W. H. C.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 111.)

(*A.*)—FOODS.

Starch and glycogen [in foodstuffs]; Quantitative separation of ——. E. Bauer and E. Polenske. Schweiz. Woch. Chem. Pharm., 1907, **45**, 20—21.

When 0·1 grm. of a mixture of soluble starch and glycogen is dissolved in 30 c.c. of water, and the solution is treated with 11 grms. of finely-powdered ammonium sulphate. The starch is precipitated and collected on a tared filter, and washed with a solution of 11 grms. of ammonium sulphate in 30 c.c. of water. The bulked filtrate is diluted with about five times its volume of water, and treated with about 500 c.c. of alcohol, which precipitates the glycogen. This is collected on a tared filter, dried, and weighed. The starch precipitate is washed free from ammonium sulphate with 50 per cent. alcohol, and also dried and weighed. Applying this method in the case of flesh or sausage meat, the starch, if present, is first rendered soluble by treatment with 8 per cent. alcoholic potash, and the solution precipitated with alcohol. Starch and glycogen are thus thrown down together, when they are separated as described above.—J. O. B.

Fluorine in mineral waters; Causes affecting the determination of ——. P. Carle. Compt. rend., 1907, **144**, 201—203.

In determining fluorine in the solid residue from a mineral water, the silica must be removed by an alkaline treatment. If it be rendered insoluble by evaporation with hydrochloric acid there is danger of fluorides being decomposed, and the fluorine escaping either as hydrofluoric acid or silicon fluoride. It must also be noted that calcium fluoride is slightly soluble in water containing carbon dioxide. The author concludes from his own work that:—(1) Natural mineral waters (including sea-water) nearly all contain fluorine; only four or five out of 93 showed none. (2) The average amount is 7 mgrms. per litre; or, excluding those containing alkali bicarbonates and certain sulphur waters, 5 mgrms. per litre. (3) Usually the content of fluorine increases with the alkalinity of the water. (4) Sulphur waters show great variations—from none to 14 mgrms. per litre. (5) Table waters containing calcium bicarbonate nearly all contain 5 mgrms. per litre. (6) Sea-water contains 12 mgrms. per litre.—J. T. D.

Spores; Chemical action of ——. J. Effront. XVII., page 162.

English Patents.

Brewers' grains or draff; Treatment of —— for the production therefrom of materials suitable for use as yeast-food and for other purposes. F. Faulkner and Saville's (1902), Ltd. Eng. Pat. 1962, Jan. 25, 1906. XVII., this page, next column.

Tea; Preparation or treatment of ——. J. Wetter, London. From Kaffee-Handels A.-G., Bremen, Germany. Eng. Pat. 18,612, Aug. 20, 1906.

See Fr. Pat. 368,804 of 1906; this J., 1907, 30.—T. F. B.

United States Patents.

Butter, oils, fats, &c.; Apparatus for refining ——. W. F. Jensen. U.S. Pat. 837,069, Nov. 27, 1906. XII., page 159.

Cacao product and process of making same. J. E. Bloom, New York. U.S. Pat. 837 782, Dec. 4, 1906.

Cacao materials are first reduced to a paste. A certain amount of the native fat or oil is then removed, and the residue is incorporated with a percentage of fat which will give to the finished product a proportion of olein,

palmatin, and stearin such as occurs in human fat. The preparation is finished in a dry and pulverised condition.
—G. W. McD.

(*B.*)—SANITATION; WATER PURIFICATION.

Water-bacteria; The effect of copper on ——. K. F. Kellerman and T. D. Beckwith. Bull. U.S. Dept. Agric., 1906, No. 100. 5—18.

The results of experiments on the resistance of various bacteria to copper sulphate are given. The experiments were conducted in special "resistance-glass" test-tubes, each containing 10 c.c. of triple-distilled water, portions of which had been treated previously with the desired amounts of copper sulphate (1 of $CuSO_4$ to 10,000—1,000,000 of H_2O). The least resistant bacteria were *B. subtilis*, *B. prodigiosus*, *B. liquifaciens phosphorescens*, *B. coli*, *B. caudatus*, and several others. Further experiments on the effect of carbon dioxide on *B. coli* and *B. typhi*, with and without copper, show that the resistance of the bacilli in question is increased by the presence of carbon dioxide in the water. In solutions containing calcium monocarbonate and copper sulphate, the bacteria were killed rapidly, whilst in solutions charged with carbon dioxide and copper sulphate, the bacteria were able to persist in considerable numbers, in spite of the fact that most of the copper must have remained in solution. Experimenters are practically agreed that it is possible to sterilise drinking water by exposing it to the action of clean metallic copper; perhaps this opinion should be qualified by adding that the action is more rapid if the water contain no free carbon dioxide. It must, however, be mentioned that actual experiments show only a slight difference in the toxicity of metals because of the presence or absence of carbon dioxide. It is also shown that a copper precipitate or a copper-iron precipitate is highly toxic to *B. coli* and *B. typhi* in water whose alkalinity is chiefly due to monocarbonate; and, conversely, the action of these precipitates will be reduced if the water contains free carbon dioxide.
—W. P. S.

English Patents.

Trade effluents; Combined means for treating ——. B. and A. Broadbent, Huddersfield. Eng. Pat. 4537, Feb. 24, 1906.

Refuse soap suds, or other trade effluents, are mechanically agitated in a tank into which is simultaneously sprayed or discharged the necessary proportion of sulphuric or other acid to "crack" the suds. The solids are then allowed to fall to the bottom, and the separated water drawn off through a grease trap. Special claim is made for an apparatus which comprises in a single sud tank an acid sprayer, radial agitators, a grease trap of the usual type, and a discharge pipe.—C. A. M.

Sterilising apparatus; Electric ——, [*for water and other liquids*]. A. Douilhet, Bordeaux. Eng. Pat. 8332, April 6, 1906. Under Int. Conv., April 10, 1905.

The apparatus is similar in arrangement to an ordinary drinking-water filter in which the water is forced through a porous cylinder. The cylinder forms the anode, and is made of carbon or of porcelain partly covered with platinum. It is insulated from the outer metallic wall of the apparatus, and this outer wall constitutes the cathode. The pipe supplying the water to the apparatus is provided with a tap which, when open, connects the cathodes with a supply of electricity. The current may be from 0·02 to 0·05 ampere at a pressure of 3·5 to 4 volts, according to the size of the apparatus. The apparatus is arranged either to work under pressure, or by suction, as in existing household filters.—W. P. S.

Water; Treatment [softening] of hard ——, *for laundry use and other cleansing purposes.* F. Candy, London. Eng. Pat. 10,050, April 30, 1906.

Waste, soapy water, which has been used in a laundry, is added to the hard water, the quantity of soapy water required for softening a given volume of hard water depending on the amount of soap present in the waste and on the degree of hardness of the water. To each gallon of the water are also added from 7 to 30 grains of weighting material, such as bauxite, fuller's-earth, or clay, and from 7 to 20 grains of a precipitant, such as aluminium sulphate. The treated water is then passed into a settling tank such as that described in Eng. Pat. 7238 of 1902 (this J., 1903, 377), and if further clarification be desired, the water may be filtered.—W. P. S.

Water; Purification of ——. H. Reisert, Cologne, Germany. Eng. Pat. 14,339, June 22, 1906.

See Fr. Pat. 369,056 of 1906; this J., 1907, 40.—T. F. B.

United States Patents.

Water; Apparatus for the sterilisation of —— *by means of an electric current.* M. Otto, Paris, Assignor to American Ozone Co., Niagara Falls, N.Y. U.S. Pat. 837,107, Nov. 27, 1906.

The water and a supply of ozone are admitted to a mixing chamber, which is in connection with a tank in which the treated water is collected. The supply of water and ozone is regulated by means of a hydraulic piston, which operates a rheostat and a valve on the water-pipe, the supply of water to the piston being in turn regulated by the rise and fall of the water in the collecting tank. The water may enter through an emulsifier, the supply drawing ozone from the primary mixing chamber; the water passes from the emulsifier into a secondary mixing chamber, and thence to the primary chamber. A hydraulic seal forms a separating chamber for the excess of ozone in the treated water, and allows of its return to the mixing chamber.—W. P. S.

Water sterilising apparatus. M. Otto, Paris, Assignor to American Ozone Co., Niagara Falls, N.Y. U.S. Pat. 837,108, Nov. 27, 1906.

The water is delivered through an emulsifier into a vertical receiving column, the inflow of the water drawing in a quantity of ozone. A hydraulic seal is placed at the bottom of the column, and means are provided for the discharge of the excess of ozone, and of the sterilised water.
—W. P. S.

Water sterilising apparatus. M. Otto, Paris, Assignor to American Ozone Co., Niagara Falls, N.Y. U.S. Pat. 837,109, Nov. 27, 1906.

The apparatus consists of an emulsifier, a mixing column, and a hydraulic seal. The water is passed through the emulsifier into the mixing column, where it meets a supply of ozone. The hydraulic seal permits the ozone from the sterilising column to ascend to the emulsifier.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 112.)

Wood used for pulp in the United States. U.S. Forest Service Circular, No. 44. [T.R.]

The amount of wood used for pulp making by 164 companies in 1905 was 3,192,223 cords, valued at $17,735,665; the increase in quantity over the 1904 consumption is 4·6 per cent., and 60 per cent. over 1899. 4,168,964,000 lb. of pulp were manufactured; 1,096,794 cords of wood were treated by the mechanical process, 1,630,393 cords by the sulphite process, and 464,936 cords were converted into "soda" pulp. The average amounts of pulp obtained in 1905 per cord of wood by the three processes were: Mechanical, 2372 lb.; soda, 1033 lb.; sulphite, 1009 lb. Spruce wood forms 70 per cent. of the total used for pulp making, and is chiefly treated by the sulphite process; the next in importance are poplar, treated mainly by the "soda" process, and hemlock, mainly converted into sulphite pulp.

Papyrus for modern paper-making. E. L. Selleger. Papier Fabrikant; through Paper Making, 1907, **26**, 65.

The papyrus reed is quite suitable for making paper according to modern methods, and attempts are being made to introduce it as a raw material. The stem should yield a mixture of two kinds of fibres, one kind very slender with an average length of 1·5 mm., and 0·01 mm. wide, the other kind about 5 mm. long, and 0·025 mm. wide, these larger fibres constituting from 15 to 20 per cent. of the whole. The treatment of the material is the same as with straw, except that a smaller proportion of caustic soda is required, owing to the lower percentage of silica in the papyrus.—J. F. B.

English Patents.

Filters or strainers for the recovery of waste products [waste water from paper factories, &c.]; Rotary ——. F. Hoffmann, Reichenberg, Bohemia. Eng. Pat. 16,009, July 14, 1906.

The waste water containing fibres in suspension is conducted into a vessel in which a horizontal cylindrical perforated filter is rotated. The cylinder or drum is supported from a shaft by a single crown of arms attached to the middle of the cylinder, and has the "rails" fastened to the inner periphery of the drum inclined at an angle both to the surface, and the radii of the drum. The clear water is drawn off from the interior of the drum at a point well below the level of the shaft, so as to increase the filtering surface, and a continuous band working over rollers is arranged in the tank to press any particles which do not of themselves easily adhere to the surface of the drum. Any fibres which may pass through the filter are caught by the rails and returned with part of the water by a separate trough and a pump to the tank. The pump may be driven by a turbine operated by the clear water flowing from the drum.—W. H. C.

Batteries; [Porous material for] Secondary ——. A. P. Strohmenger. Eng. Pat. 1396, Jan. 18, 1906. XIA., page 156.

United States Patents.

Gases; Process of preparing solutions of ——. [*Sulphite liquor*]. H. Howard. U.S. Pat. 836,500, Nov. 20, 1906. VII., page 151.

Cellulose derivative and process of making same. G. W. Miles, Belmont, Mass. U.S. Pat. 838,350, Dec. 11, 1906.

See Fr. Pat. 358,079 of 1905; this J., 1906, 195.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 114.)

Narceine. M. Freund. Ber., 1907, **40**, 194—204.

In this paper the author criticises the work of Tambach and Jäger upon narceine in the light of the results of his own investigations (this J., 1906, 1002). When methyl iodide is allowed to act on sodium-narceine in methyl or ethyl alcohol solution, the methiodide of the methyl ester of narceine, $C_{23}H_{26}(CH_3)NO_8,CH_3I$, is produced, which melts at 208°—209° C. If ethyl iodide be used in place of methyl iodide, the ethiodide of the ethyl ester of narceine, $C_{23}H_{26}(C_2H_5)NO_8,C_2H_5I$, is produced. This crystallises from water with one molecule of water of crystallisation, and melts at 141° C. If crystallised from alcohol it contains a molecule of alcohol and then melts at 181° C. Narceine is unchanged by boiling with a molecular proportion of sodiumin methyl alcohol. At 100° C., narceine unites with methyl iodide to form a methiodide, $(C_{20}H_{20}O_6)COOH.N(CH_3)_3I$, which by repeated crystallisations was obtained in the form of asbestos-like needles melting at 207° C. If dimethyl sulphate act upon narceine in the presence of alcohol, narceine-methyl sulphate, $C_{23}H_{27}NO_8.HSO_4(CH_3)$, melting at 200°—201° C., is produced. This dissociates in water with the formation of narceine. Treatment of it with hydrochloric acid gives narceine hydrochloride, melting at 192° C. When molecular proportions of dimethyl sulphate and alkali act upon narceine, the methyl group attaches itself to the nitrogen atom, contrary to the statement of Tambach and Jäger. If the product of the reaction be treated with hydrochloric acid, the chlormethylate of narceine, $C_{20}H_{20}O_6.COOH.N(CH_3)_3Cl$, melting at 243° C. is produced. When treated with potassium iodide, narceine methiodide is obtained. When the chlormethylate of narceine is treated with strong caustic alkali solution, trimethylamine and narceonic acid, melting at 217° C., are produced, and when this sodium narceine is allowed to interact with two molecules of dimethyl sulphate, and the product treated with potassium iodide, the methiodide of the methyl ester of narceine, melting at 207°—209° C., is obtained. The product obtained by Tambach and Jäger when sodium narceine is treated with one molecule of diethyl sulphate and then with hydrochloric acid, melts at 231° C., and has the constitution $(C_{20}H_{20}O_6)COOH.N(CH_3)_2.C_2H_5Cl$. The base obtained from this melts at 175°—177° C., and has the betaine formula, $(C_{20}H_{20}O_6)CO.O.N(CH_3)_2.C_2H_5$. The chloride melting at 231° C. was esterified with alcoholic hydrochloric acid, and the ethyl ester of the chlorethylate of narceine, $(C_{20}H_{20}O_6).COOC_2H_5.N(CH_3)_2.C_2H_5Cl$, melting at 218°—219° C., was obtained. The same substance is produced by the treatment of the ethiodide of the ethyl ester of narceine with silver chloride. Narceine ethyl ester and ethyl iodide unite, giving the ethiodide of the ethyl ester. If narceine ethyl ester and sodium methoxide be heated on the water-bath there is obtained narcindonine, $C_{23}H_{25}NO_7$, which crystallises with 1½ mols. of water, melts at 168°—169° C., and has the colour of azobenzene. If aponarceine, as obtained by Tambach and Jäger, be treated in the same way, there is an intense red coloration, and narcindonine and narceine can be isolated from the products of the reaction. Since narceine can be regenerated from aponarceine, the author regards aponarceine as a lactone. Then when aponarceine and sodium methoxide interact, there is a re-arrangement of the molecule to form a substituted phenylindandiene, to which the name narcindonine is given.—F. Shdn.

Hordenine; Derivatives of ——. E. Léger. Compt. rend., 1907, **144**, 208—210. (See also this J., 1906, 1115, and 1907. 66.)

The author gives the methods of preparation and the appearance of the crystals of the following derivatives of hordenine. The normal and acid tartrates $(C_{10}H_{15}NO_2)_2,C_4H_6O_6$, and $B,C_4H_6O_6$; the chlormethylate, B,CH_3Cl; the chlorethylate, B,C_2H_5Cl; the bromethylate, B,C_2H_5Br; the iodethylate, B,C_2H_5I; benzoylhordenine hydrochloride, $C_{10}H_{14}(C_7H_5O)NO,HCl$, and hydrobromide. Cinnamylhordenine melts at 55·8° C.; the nitrate was prepared, as well as the hydrochloride, $C_{10}H_{14}(C_9H_7O)NO,HCl,H_2O$. Anisylhordenine hydrochloride, $C_{10}H_{14}(C_8H_7O_2)NO,HCl.H_2O$. When hordenine methyl sulphate is treated with potassium iodide, hordenine methiodide is precipitated, and when this is treated with methyl sulphate and a slight excess of alkali, the methiodide of methylhordenine, $CH_3O.C_6H_4.CH_2.CH_2.N(CH_3)_2.CH_3I,1\frac{1}{2}H_2O$, is produced.—F. Shdn.

Cotarnine; Melting point of ——. D. B. Dott. Pharm. J., 1907, **78**, 78—79.

Cotarnine, prepared by the author by two different methods (oxidation of narcotine by nitric acid and by manganese dioxide and sulphuric acid respectively), and purified by crystallising several times from benzene, was found to melt at 125° C., with apparent decomposition, when heated in the usual way. On heating at 100° C., however, the base loses water, becomes darker, and gradually melts even at that temperature.—A. S.

Alkaloid assays; Chloroform in volumetric ——. A. Panchaud. Schweiz. Wochenschr., **44**, 580. Pharm. J., 1907, **78**, 83.

Solutions of cinchona alkaloids in chloroform have been found on standing to require much less acid for neutralisation than should have been the case. This has been traced to the decomposition of the chloroform by the alkaloid, with production of hydrochloric acid, by which the alkaloid was neutralised. In all cases, therefore, in which chloroform or ether-chloroform is employed to shake out alkaloids, these solutions should be at once distilled, as otherwise the decomposition of the chloroform may in a comparatively short time proceed so far as to neutralise the whole of the alkaloid.

Quinine ; Herapathite reaction for ——. E. H. Madsen. Ber. deutsch. Pharm. Ges., **16**, 442. Pharm. J., 1907, **78**, 83.

Christensen's reagent is recommended for carrying out this test. It consists of iodine, 1 part; 50 per cent. hydriodic acid, 1 part; sulphuric acid, 0·8 part; and 70 per cent. alcohol, 50 parts. If an alcoholic solution of quinine be mixed with 1 c.c. of the reagent, and allowed to stand, the dark herapathite crystals soon make their appearance. The reagent is stable, and the reaction is easily carried out.

Essential Oil [*Artemisia absinthium*] *: Formation and distribution of* —— *in a perennial plant.* E. Charabot and G. Laloue. Compt. rend., 1907, **144**, 152—154. (See also this J., 1906, 907.)

The plant selected for the experiments was wormwood, *Artemisia absinthium*. In the first stage of development, some time before flowering, when the leaves are preponderant, the roots contain no essential oil; the leaves contain more than the stems. When flowering commences, and the stems form the bulk of the plant, the root contains more essential oil than these; the amount of oil in the whole plant increases, the leaves containing twice as much as in the first stage. This formation of oil increases, together with the growth of the plant, to the period of flowering, although the relative proportion of oil to dry material remains the same as in the first stage. When flowering has advanced, in the third stage, the amount of essential oil in the root shows a more marked increase. The same phenomenon has not been recorded with annuals. At the same time, a distinct diminution of the amount of oil occurs in the other organs, especially in the inflorescences, indicating that the odorous principles are consumed by the process of flowering, and that they are most actively formed during the first stage of development. Consequently, to ensure the highest yield of essential oil, it is advantageous to retard the period of flowering, or to distil the crop before this has taken place. When flowering is over, new shoots form, the quantity of oil again increases in the root, and more is also formed in the leaves and stems.—J. O. B.

Lemongrass oil ; West Indian ——. J. C. Umney and C. T. Bennett. Chem. and Drug., 1907, **70**, 138.

The West Indian lemongrass oil coming on the market at the present time has a much lower specific gravity and contains less aldehydes than the specimen examined by Parry in 1903 (this J., 1903, 1147). A typical sample examined by the authors had the sp. gr. 0·879, and contained 75 per cent. of aldehydes. On distillation at the ordinary pressure, 23 per cent. was obtained below 210° C., 46 per cent. below 220° C., 60 per cent. below 225° C., and 82 per cent. below 230° C., the corresponding amounts from East Indian oil being *nil*, 20, 64, and 82 per cent. On fractionation under diminished pressure, greater variations in the values of the specific gravity and refractive index of the different fractions were observed in the case of the West Indian oil than in that of the East Indian oil. The fractions from West Indian oil were optically inactive, whereas those from East Indian oil were lævo-rotatory. Preliminary experiments indicate that West Indian lemongrass oil contains another substance or substances besides citral, which is absorbed by a hot saturated solution of sodium bisulphite.—A. S.

Asulphopyrine ; Commercial ——. F. Zernik. Apoth.-Zeit., 1907, 22, 78.

Asulphopyrine, which has been introduced as a "synthetic" remedy, and stated to be a definite compound of antipyrine and sulphanilic acid, is found to be merely a mixture of, approximately, 10 parts of sodium sulphanilate, 5 parts of antipyrine, and 1 part of sulphanilic acid. —J. O. B.

Novaspirin [*Disalicylic ester of methylene-citric acid*]. K. Witthauer. Berl. Klin Woch., 1907, 76 ; Apoth.-Zeit., 1907, 22, 83.

The disalicylic ester of methylenecitric acid has been introduced under this name as a medicinal remedy. It is a white, odourless, crystalline powder, with a faintly acid taste; m. pt., 150°—152° C. It is nearly insoluble in water. —J. O. B.

Ethers ; New method of preparation of some simple ——. T. Van Hove. Bull. Acad. roy. Belg., 1906, 650—668. Chem. Zentr., 1907, 1, 234—235.

The author has found that quinoline hydrochloride is an efficient agent for effecting the transformation of alcohols into the corresponding ethers. Sixteen grms. of ethyl alcohol, when heated with 0·01 molecular proportion of quinoline hydrochloride at 180° C., yielded in 48 hours, 6·84 grms., and in 96 hours, 9 grms. of ether. Normal propyl ether was obtained by heating 50 grms. of propyl alcohol with 10 grms. of quinoline hydrochloride for six days in a sealed tube at 180° C. From the reaction product, the upper layer was separated, and purified by washing and distillation, a yield of 35 per cent. of pure propyl ether being obtained. A yield of 53 per cent. of isoamyl ether was obtained in an analogous manner.—A. S.

Alcohols, commercial ; Frequent presence of a trace of zinc in ——. G. Guerin. J. Pharm. Chim., 1907, **25**, 97—98.

Commercial rectified ethyl and methyl alcohols frequently have a faintly acid reaction. If such acid alcohols be stored in zinc or galvanised iron vessels, or even brought temporarily in contact with these metals, they become contaminated with a minute trace of zinc.—J. O. B.

Benzoates ; Solubility of certain —— *in water.* R. Paietta. Boll. Chim. Farm., 1906, 485. J. Pharm. Chim., 1907, **25**, 63—64.

Strontium benzoate occurs as a coarse, white, crystalline, somewhat heavy powder. It contains 1 mol. of water of crystallisation which it loses slowly at 130°—140° C. in a current of dry air. One hundred grms. of the saturated aqueous solution contain the following weights of anhydrous salt at the temperatures indicated:—5·31 grms. at 15·7° C.; 5·40 grms. at 24·7° C.; 5·56 grms. at 31·4° C; 5·77 grms. at 40·9° C.

Potassium benzoate, with 3 mols. of water of crystallisation, is more soluble than the strontium salt. One hundred grms. of saturated solution contain of anhydrous salt, 41·1 grms. at 17·5° C.; 42·4 grms. at 25° C.; 44·0 grms. at 33·3° C.; 46·6 grms. at 50·0° C.

Neutral lead benzoate, with 1 mol. of water of crystallisation, is soluble in water to the extent, that 100 grms. of saturated solution contain 0·149 grm. of anhydrous salt at 18° C.; 0·249 grm. at 40·6° C.; and 0·310 grm. at 49° C.

Zinc benzoate, which is anhydrous, is more soluble in cold than in warm water. One hundred grms. of saturated solution contains 2·55 grms. of salt at 15·9° C.; 2·05 grms. at 31·3° C.; 1·62 grms. at 49·8° C.; and 1·45 grms. at 59·0° C.—J. O. B.

Organic compounds ; Relation between structure and odour in ——. G. Woker. J. Physical Chem., 1906, 10, 445—473. Bull. Soc. Chim., 1907 [4] 2, 65.

Substances possessing an odour are nearly always unsaturated compounds. Compounds in which all the hydrogen atoms, originally in combination with at least one carbon atom, have been replaced by groups, have often an odour resembling camphor, if two at least of the substituted groups are identical. Such a system has a maximum of volatility, and in such conditions it is a matter of indifference whether the compound is saturated or unsaturated, but in the former case three of the substituted groups should be identical. Other things being equal, the odour of a compound increases in intensity as the degree of saturation decreases. A maximum odour is obtained in compounds having unsaturated bonds, unsaturated atoms, phenyl or phenyl radicles and carbon atoms the hydrogen atoms attached to which have been replaced by groups.—G. W. McD.

"Nitron" as a microchemical reagent. [*Detection of acids and saccharin.*] H. L. Visser. XXIII., this page, next column.

English Patents.

Chloracetic ether ; Production of ——. H. K. Tompkins, Glasgow. Eng. Pat. 678, Jan. 10, 1906.

Claim is made for the production of chloracetic ester by heating acetylene tetrachloride, or trichlorethylene, with potassium or sodium ethoxide, the dichlorethoxyethylene so formed being decomposed into chloracetic ester by heating with alcohol.—F. Shdn.

Methyl alcohol from methane ; Manufacture of ——. D. Lance, Paris, and Mrs. E. G. Elworthy, St. Albans, Herts. Eng. Pat. 7297, March 26, 1906. Under Int. Conv., March 24, 1905.

Claim is made for the production of methyl alcohol by the oxidation of methane with the following reagents : hydrogen peroxide, with or without the addition of ferrous sulphate or monopersulphuric acid ; monopersulphuric acid alone.—F. Shdn.

Santalol carbonate ; Method of manufacturing ——. M. Dalge, H. Knoll, and A. Knoll, Ludwigshafen, Germany. Eng. Pat. 20,586, Sept. 17, 1906.

Equal parts of guaiacol carbonate and santalol are heated *in vacuo* at 170°—180° C. until no more guaiacol distils over. The santalol carbonate so produced is purified by washing and re-dissolving in dilute alcohol. A second method of preparation consists in heating santolol (200 grms.) with phenyl carbonate (100 grms.) and caustic soda (2 grms.), under diminished pressure at 140°—175° C.—G. W. McD.

United States Patent.

Glycollic acid ; [*Electrolytic*] *Process for the manufacture of* ——. O. Liebknecht, Assignor to the Roessler and Hasslacher Chem. Co. U.S. Pat. 837,083. Nov. 27, 1906. XI*A*., page 157.

German Patent.

Amines ; Process for the electrolytic preparation of ——. C. F. Boehringer und Soehne. Ger. Pat. 175,071, Nov. 14, 1905. XI*A*., page 157.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 115.)

Matches ; Note on the manufacture of ——. M. Dubrisay. Bull. Soc. Chim., 1907 [4], 1, 37—40.

When a match-head containing phosphorus sesquisulphide and chlorate is dried too rapidly, it tends, when struck, to ignite explosively, and project fiery particles. The author has determined the point of ignition of match-heads made from the same paste, dried in the one case slowly, in the other rapidly. The latter products had an ignition point of about 150° C., some 10°—20° C. lower than the former, owing probably, to a too complete dehydration of the composition. Experiments were made by introducing into the paste bodies which would retard dehydration. Ferrous sulphate and aluminium sulphate, to the extent of 0·5 to 1·0 per cent. of the paste, were found to be most satisfactory in this respect.—G. W. McD.

English Patents.

Explosives ; Manufacture of ——. S. Laszczynski, Miedzianka, Poland. Eng. Pat. 2985, Feb. 7, 1906.

See Fr. Pat. 363,919 of 1906 ; this J., 1906, 911.—T. F. B.

Nitro-compounds ; Manufacture of ——. G. E. Arnold, A. S. Fox, A.C. Scott, and H. E. U. Roberts, Faversham, Kent. Eng. Pat. 3449, Feb. 12, 1906.

Starch, dissolved in nitric acid, is added gently to ordinary sulphuric acid of the required strength, or to waste acid from nitrocellulose manufacture ; the nitro-starch is precipitated in flaky masses, the mixture being agitated during precipitation. The precipitate is washed till free from acid, in a shallow pan provided with a strainer, and having an opening at the bottom. The compound is then rendered stable by successive washing and boiling with water, either with, or without addition of alkali, preferably a solution of soda crystals, containing not more than 2 per cent. of sodium carbonate.—L. E

Explosive powder strips ; Machines for cutting ——. J. T. Thompson, Wilmington, U.S.A. Eng. Pat. 16,809, July 25, 1906. Under Int. Conv., Sept. 9, 1905.

See Fr. Pat. 367,945 of 1906 ; this J., 1906, 1232.—T. F. B.

Explosives ; Improved ——, *and process for making the same.* R. Weyel, Bürrigerheide, Germany. Eng. Pat. 21,240, Sept. 25, 1906.

The patent relates to a process for making explosives in plastic and granular form, more particularly nitroglycerin and chlorate explosives, in which these compounds are treated with condensation products of formaldehyde and aromatic amines. A granular explosive is produced as follows :—Ammonium nitrate (85 parts) is worked up in a water-bath with aniline (5 parts), nitroglycerin (5 parts), and a 40 per cent. formaldehyde solution (10 parts). The completion of the reaction is indicated by the homogeneous brown colour of the mixture. While still warm, the explosive is granulated by rubbing through sieves. A plastic explosive is prepared by heating on the water-bath, ammonium nitrate (62 parts), nitroglycerin (26 parts), "formaline solution" (10 parts), and collodion cotton (4 parts), in the manner previously described, and pressing the warm composition in moulds to a density of 1·6. Chlorate explosives are manufactured by heating together anhydroformaldehyde-aniline (5 parts), fir resin (5 parts), and turpentine (5 parts), until they form a solution. The viscous fluid is poured whilst still warm on potassium chlorate (85 parts), and thoroughly mixed therewith. The composition is then passed through a sieve, and formed into cartridges.—G. W. McD.

Explosives for propellant purposes. O. Silberrad, London. Eng. Pat. 19,791, Sept. 26, 1906,

Secret document under Sect. 44, Patents, &c., Act, 1883. —T. F. B.

United States Patents.

Smokeless powder ; Process of manufacturing ——. G. W. Gentieu, Peoria, Ill. U.S. Pat. 837,463, Dec. 4. 1906.

Finely divided nitrocellulose, containing from 15 to 40 per cent. of water, is agitated in a closed drum furnished with revolving arms. A solvent of nitrocellulose, soluble in, and with a lower boiling point than, water, is injected into the drum at a pressure of 125 lb. to the square inch. The nitrocellulose is thus gelatinised, and the solvent is removed and recovered on drying the grains.—G. W. McD.

Explosive coherer-powder. F. Schneider, Langenfeld, Germany. U.S. Pat. 838,216, Dec. 11, 1906.

See Eng. Pat. 17,741 of 1905 ; this J., 1905, 1256.—T. F. B.

French Patent.

Powder ; Flameless —— *for guns.* C. Duttenhofer. First Addition dated Aug. 30, 1906, to Fr. Pat. 364,413 of March 19, 1906 (this J., 1906, 911).

Small quantities of oils, fats, and resins, as well as 1—2 per cent. of such organic acids as lactic acid, tartaric acid, oxalic acid, &c., are added to explosives containing nitrocellulose or nitroglycerin to diminish flame, on firing. —G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 116.)

INORGANIC—QUALITATIVE.

"Nitron" as a microchemical reagent. [*Detection of acids and of saccharin.*] H. L. Visser. Chem. Weekblad, 1906, 3, 743—746. Chem. Zentr., 1907, 1, 302.

The use of "nitron" or diphenyl-endo-anilodihydrotriazole (this J., 1905, 289, 291) for the gravimetric determination of nitric acid is known. Instead of weighing the nitron nitrate, which dissolves to a very slight extent in water, the author compares the depth of the layer of precipitate with that of a corresponding precipitate from a solution of known content of nitric acid in test-tubes of equal diameter. Besides nitric acid, nitrous, chloric, perchloric, oxalic, and salicylic acids yield with nitron almost insoluble salts, which can be distinguished under the microscope by differences of crystalline form. Sulphuric, hydrochloric, formic, acetic, boric, benzoic, tartaric, citric, and phosphoric acids, on the other hand, yield soluble salts. Nitron may also be used for the microchemical detection of saccharin if the latter be first converted into *o*-sulphaminobenzoic acid by the action of dilute alkali.—A. S.

Hydrocyanic acid; Phthalophenone test-paper for the detection of ——. Thiéry. J. Pharm. Chim., 1907, **25**, 51—53.

The following method of applying Weehuizen's test is more sensitive than the original process. Absorbent paper, moistened with a 1:2000 solution of cupric sulphate is dried and cut into suitable strips. An alkaline phthalophenone reagent is thus prepared. 0·50 grm. of phenolphthalein is dissolved in 30 c.c. of absolute alcohol; sufficient distilled water is then added to produce a faint turbidity, when 20 grms. of sodium hydroxide are added. Aluminium dust is then added to the red alkaline solution, a little at a time, until the colour is discharged. The liquid is next diluted to 150 c.c. with distilled water, which has been boiled and cooled, excluded from contact with the air. The reagent is then filtered. It keeps indefinitely. To apply the test, the cupric sulphate test-paper is moistened immediately before use with a few drops of the reagent. It will detect the presence of 1 : 2,000,000 of hydrocyanic acid. Hydrogen peroxide, ferric chloride, nitric acid, and ethyl nitrate do not give a similar reaction. Liquids containing ammonium persulphate, hypochlorites, sodium peroxide, or perchlorates, give a positive reaction, but the colour produced slowly fades, entirely disappearing in a few hours, whereas that given with hydrocyanic acid is permanent for twenty-four hours.—J. O. B.

INORGANIC—QUANTITATIVE.

Metals; Separation of —— by heating in dry hydrogen chloride. P. Jannasch and E. Heimann. J. prakt. Chem., 1906, **74**, 475—487.

Some new applications of the now well-known method due to Jannasch of separating metals by heating them or their salts in a current of dry hydrogen chloride are given in this paper. The procedure generally consists in weighing out the metals into Jannasch's bulb, treating them with a little nitric acid, and then heating to a temperature of up to 350° C. in a stream of hydrogen chloride gas, for 1 to 3 hours, according to the degree of volatility of the chloride which is to be driven off. Thus, tin and cadmium, bismuth and cadmium, bismuth and silver, antimony and lead, antimony and copper, antimony and cadmium, and antimony and silver may readily be separated in this way, the test-analyses quoted being very good. When cadmium is present, it is advisable to interrupt the distillation when the bulk of the volatile chloride has been driven off, and to allow the bulb to cool, after which a few drops of concentrated nitric acid are added, and the heating resumed. The residual cadmium, silver, and lead may be weighed directly in the bulb as chlorides after expelling the hydrogen chloride by a current of dry air; with copper this is impossible, as the residue consists of a mixture of cupric and cuprous chlorides.—A. G. L.

Barium sulphide; Valuation of ——. L. Wessely. VII., page 148.

Fluorine in mineral waters; Causes affecting the determination of ——. P. Carle. XVIIIA., page 163.

ORGANIC—QUALITATIVE.

Sugar; New test for ——. H. J. H. Fenton. XVI., page 161.

Caramel; Fullers' earth test for —— in vinegar. W. L. Dubois. XVII., page 162.

Quinine; Herapathite reaction for ——. E. H. Madsen. XX., page 166.

ORGANIC—QUANTITATIVE.

Oxygen; Process for furnishing a continuous supply of pure —— for organic analysis. A. Seyewetz and Poizat. Compt. rend., 1907, **144**, 86—87.

The oxygen is obtained by the reaction of potassium permanganate in acid solution on hydrogen peroxide. A litre flask contains 500 c.c. of 10-volume peroxide, and its cork is furnished with a tap-funnel, a siphon-tube reaching to the bottom, and a delivery-tube for the gas. The liquid from the funnel (25 grms. of permanganate, 500 c.c. of water, 50 c.c. of concentrated sulphuric acid) is dropped upon and runs down the internal limb of the siphon, which produces a more regular evolution than dropping directly into the peroxide, and the oxygen is delivered directly through the purifiers into the combustion tube. When the peroxide is exhausted, the liquid can be emptied, and fresh peroxide introduced by the siphon tube. The oxygen contains no impurity save a trace of chlorine, which is completely got rid of by passage through potassium hydroxide.—J. T. D.

Halogens; New method of determining —— in organic compounds, by means of metal-ammoniums. E. Chablay. Compt. rend., 1907, **144**, 203—205.

The (liquid) substance, 0·1—0·5 grm. according to the percentage of halogen, is weighed in a little glass bulb, and is then introduced into a large test-tube. The bulb is broken, the tube plunged into an acetone and carbon dioxide freezing mixture, and 5—6 c.c. of ammonia are liquefied in the tube. Should the substance be frozen, the tube is warmed till the ammonia boils, when the substance usually dissolves. A fragment of sodium is now added, and reaction allowed to go on till a permanent blue colour is produced, the tube being, if need be, plunged into the freezing mixture to moderate the action. The excess of ammonia is now allowed to volatilise, and a current of moist air passed through the tube till the excess of sodium is destroyed; water is added, the liquid filtered if necessary, made up, say, to 100 c.c., and 10 or 20 c.c. are taken for the determination of the halogen by silver nitrate and thiocyanate. Solids soluble in ammonia are treated like liquids; others are dissolved in ether, benzene, or toluene, and allowed to fall drop by drop into the sodammonium. If the final liquid is brown through organic matter, the measured quantity is evaporated to dryness in platinum, and heated to low redness to destroy the organic matter, taking care not to volatilise any chloride. The method is very convenient and very accurate.—J. T. D.

Gas oils; Valuation of ——. A. Spiegel. II., page 143.

Lubricating oils containing saponifiable fats; Determination of the saponification value of ——. H. Schreiber. XII., page 158.

Tannin; Direct determination of —— [in quebracho bark and extract]. H. Franke. XIV., page 160.

Sugar; Method for the determination of ——. I. Bang. XVI., page 161.

Starch and glycogen [in foodstuffs]; Quantitative separation of ——. E. Bauer and E. Polenske. XVIIIA., page 163.

Alkaloid assays; Chloroform in volumetric ——. A. Panchaud. XX., page 165.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 117.)

Helium; Preparation of —— by filtration of the gas from clèveite through a silica partition. A. Jaquerod and F. L. Perrot. Compt. rend., 1907, **144**, 135—136.

Helium diffuses rapidly through silica heated to a high temperature, although that substance is quite impermeable to other gases, except hydrogen, and, possibly, carbon monoxide. Consequently by passing gas from clèveite into a small silica flask heated to about 1100° C., and surrounded by a vacuum, pure helium slowly diffuses through the walls of the flask. The gas obtained was practically pure, giving no spectroscopic indication of nitrogen, and only that of the faintest trace of hydrogen, the latter being probably an introduced impurity. The method affords a convenient and ready means of isolating helium from a mixture of gases.—J. O. B.

Radium; Production of —— from actinium. B. Boltwood. Nature, 1906, **75**, 54. Science Abstracts, 1907, **10A**, 23.

The author has shown that, starting with a solution of uranium nitrate carefully purified, the amount of radium formed in eighteen months is less than 1/2000th part of that to be expected from the disintegration theory. This, he thinks, may be explained by actinium being a product intermediate between radium and uranium, so that the production of radium is proportional to the actinium present. In support of this the following experiment is given:—1 kilo. of carnotite is treated so as to separate from it all the actinium, and the solution containing the latter is sealed in a glass bulb. About two months later the emanation is boiled off and tested. The activity corresponds to a content of $5{\cdot}7 \times 10^{-9}$ grm. of radium in the solution. After an interval of over six months the gas is again boiled off, and the radium content is now $14{\cdot}2 \times 10^{-9}$ grm. In 193 days $8{\cdot}5 \times 10^{-9}$ grm. of radium have been produced. This gives $\lambda(\text{year})^{-1}$ for radium as $2{\cdot}2 \times 10^{-4}$. The half-value period is about 3100 years. It is noteworthy that the amount of actinium in a mineral is apparently always proportional to the amounts of uranium and radium.

Carbon suboxide. O. Diels and G. Meyerheim. Ber., 1907, **40**, 355—363. (See this J., 1906, 500; 1891, 662.)

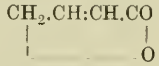
Diels and Wolf have shown that on heating diethyl malonate, a substance of composition represented by C_3O_2, is produced. The authors now find that other substances, and especially malonic acid, yield this compound when heated with phosphorus pentoxide. The preparation from malonic acid is particularly convenient, though the yield is but small, for the substance is easily separated from the other products formed at the same time. The substance forms white crystals melting at −107° C. to a colourless liquid of sp. gr. 1·11 at 0° C., which boils at 7° C. At ordinary temperatures it rapidly changes into a reddish-black amorphous solid, a polymer or mixture of polymers. At higher temperatures the heat evolved by this polymerisation is so considerable that some of the substance is decomposed, carbon monoxide and dioxide being evolved, and a substance left behind which contains less oxygen than the suboxide—whether a still lower oxide of carbon or not is yet unsettled. The polymer formed at low temperatures, when heated, chiefly distils over as carbon suboxide, but is partly decomposed, evolving the two gaseous oxides and leaving a residue which even after heating to redness still contains oxygen. Carbon suboxide and its polymers exhibit marked anhydride characters. The polymer rapidly takes up moisture from the air, and evolves at the same time carbon dioxide. The authors regard the suboxide as a carbon carbonyl, analogous to nickel carbonyl, and ascribe to it the formula CO:C:CO.—J. T. D.

Metal hydrides; Role of —— in reduction processes. S. Fokin. J. russ. phys.-chem. Ges., 1906, **38**, 855—858. Chem.-Zentr., 1907, **1**, 324.

In order to test the view put forward previously (this J., 1906, 935) that the increased reducing power of occluded hydrogen is due to a kind of physical compression, the author carried out a series of experiments, which showed that compressed hydrogen (up to a pressure of 35 atmospheres) effected the reduction of unsaturated hydrocarbons more rapidly and completely and at lower temperatures than hydrogen at atmospheric pressure.—A. S.

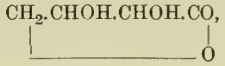
Erythritol; Synthesis of ——. —. Lespieau. Compt. rend., 1907, **144**, 144—148.

Having previously obtained the butene-olide



$$\underbrace{CH_2.CH{:}CH.CO}_{O}$$

by the action of hydrocyanic acid on epichlorhydrin, and converted this into an erythronic lactone



$$\underbrace{CH_2.CHOH.CHOH.CO}_{O},$$

the latter was found to be optically inactive. The presence in the molecule of two asymmetric carbon atoms, which could not neutralise each other, pointed to the possible presence of two bodies in equimolecular proportions, of inverse optical activity. A lævo-rotatory lactone and erythritol were isolated from the original optically inactive lactone. The inactive lactone was treated with brucine in the presence of water. By fractional crystallisation of the solution obtained, brucine erythronates were obtained with rotatory powers varying from $\alpha_D = -25{\cdot}3°$ to $-34°$. The salt with the rotatory power $\alpha_D = -25{\cdot}3°$ yielded a lactone with $\alpha_D = -35°$. When this was hydrogenised a sugar of low reducing power was obtained, forming with phenylhydrazine a hydrazide of m.pt. 145° C., and not erythrosazone. But when this was set aside for some months in a syrupy condition, and exposed to the light, it deposited large crystals of erythritol.—J. O. B.

Cuprous metaphosphate. V. Auger. VII., page 149.

New Books.

The Treatment of Storage Batteries. By R. W. Vicarey. The Electric Accumulator, 15, Queen Street, Cheapside, London, E.C. 1907. Price 2s. 6d. net.

Large 8vo pamphlet, containing 58 pages of subject matter, with 31 illustrations. The following subjects are treated of:—I. Selection of Battery Room, and Battery. II. Correct Erection. III. To Test the Polarity of the Dynamo. IV. Initial Charges, &c. V. Electrolytes. VI. Connecting Cell to Cell, &c. VII. Gradual Sulphating. VIII. Indicators of Irregularities of Plates or Electrolyte. IX. Replacing Old Cells with New Ones. X. Method of Changing Electrolyte if containing Impurities. XI. Methods of Charging; also Overcharging. XII. Temperature of Electrolytes. XIII. Growing and Buckling. XIV. How to Determine whether Positive or Negative at Fault. XV. Scaling and Shedding of Active Material. XVI. Rests of Cells. XVII. Varying Rates of Discharge. XVIII. Local Action. XIX. Keeping Specific Gravity of Electrolyte Adjusted. XX. Glossary.

Physical Chemistry in the Service of Medicine. Seven Addresses by Dr. Wolfgang Pauli. Authorised Translation by Dr. Martin H. Fischer, Professor of Pathology at the Oakland College of Medicine. John Wiley & Sons, New York. Chapman and Hall, Limited, London. 1907. Price 5s. 6d.

Small 8vo volume, containing 156 pages of subject matter, which latter is treated under the following heads:—

I. Physico-Chemical Methods and Problems in Medicine. II. The General Physical Chemistry of the Cells and Tissues. III. The Colloidal State and the Reactions that go on in Living Matter. IV. Therapeutic Studies on Ions. V. On the Relation between Physico-Chemical Properties and Medicinal Effects. VI. Changes wrought in Pathology through Advances in Physical Chemistry. VII. On the Electrical Charge of Protein, and its Significance.

A History of Chemical Theories and Laws. By M. M. Pattison Muir, M.A., Fellow and Prælector in Chemistry of Gonville and Caius College, Cambridge. John Wiley and Sons, New York. Chapman and Hall, Limited, London. 1907. Price 17s. net.

Large 8vo volume, containing 535 pages of subject matter and the alphabetical index. The subject matter is broken up and classified according to the following scheme:—Part I.—The History of the Attempts to Answer the Question: What is a Homogeneous Substance? Part II. The History of the Attempts to Answer the Question: What Happens when Homogeneous Substances Interact? Section I.—History of the Classification of Homogeneous Substances. Section II.—History of the Study of the Conditions and General Laws of Chemical Change.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

2775. Clements and Wheeler. Drying chambers especially for laboratories.* Feb. 4.

2795. Dauber and Gammel. Drying process and apparatus.* Feb. 4.

2874. Knight. Pressure filter. Feb. 5.

2880. Brunner and Puhring. Apparatus for separating liquids from gases or vapours.* Feb. 5.

3112. Pearse. Apparatus for cooling or heating. Feb. 7.

3293. Dolphin. Apparatus for concentrating liquors or solutions by evaporation. Feb. 9.

3302. Soc. l'Air Liquide, and Lévy. *See under* VII.

3428. Tominetti. Filter.* Feb. 11.

3516. Kenyon. Vessels for containing corrosive liquids. Feb. 12.

3650. Stevens. Filter presses. Feb. 14.

Complete Specifications Accepted.

5250 (1906). Bolze. Filtering process and apparatus. Feb. 20.

12,615 (1906). Pritchard, and United Alkali Co. Apparatus for determining the percentage dryness of steam. Feb. 13.

12,616 (1906). Pritchard, and United Alkali Co. Apparatus for bringing liquids and solids into contact. Feb. 13.

18,269 (1906). Reisert. Washing loose filtering media. Feb. 13.

24,548 (1906). Boult (Goldman and Co.). Filters. Feb. 20.

II.—FUEL, GAS, AND LIGHT.

Applications.

2737. Pendrey. Incandescent mantle for heating.* Feb. 4.

2828. Smith and Shaw. Gas plant. Feb. 4.

3098. Wilton. Coke ovens. Feb. 7.

3161. Touzelin. Carburetting air. [Belg. Appl., Feb. 8, 1906.]* Feb. 8.

3204. West. Furnaces and gas producers. Feb. 8.

3270. Jones. Coke ovens. Feb. 9.

3303. Akt.-Ges. f. Selasbeleuchtung. Mixtures of gas and air. [Ger. Appl., Feb. 22, 1906.]* Feb. 9.

3533. Akt.-Ges. f. Selasbeleuchtung. Process and apparatus for mixing and supplying gases. [Ger. Appl., March 3, 1906.]* Feb. 12.

3610. Grobach. Production of air gas. [Ger. Appl., Feb. 14, 1906.] Feb. 13.

3689. Tully. Apparatus for making gas. Feb. 14.

3742. Cowper-Coles. Production of smokeless fuel. Feb. 15.

3911. Wilton. Manufacture of producer gas or suction gas. Feb. 16.

Complete Specifications Accepted.

3213, 3684, and 4081 (1906). Just, Hanaman, Landesberger, Salzmann, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. Feb. 20.

8037 (1906). Hardy Patent Pick Co., and Smith. Apparatus for washing coal, &c. Feb. 13.

8670 (1906). Banke. Manufacture of generator or producer gas. Feb. 13.

9540 (1906). Porter. *See under* XXIII.

11,213 (1906). Farnham. Gas-purifying devices of suction and other gas plant. Feb. 13.

11,279 (1906). Bourdos, Rotschild, and Sutcliffe. Filaments of incandescent electric lamps. Feb. 20.

13,355 (1906). Suski. Fuel briquettes. Feb. 20.

13,681 (1906). Wheatley (Frowein und Wiescher.) Incandescence mantles for gas burners. Feb. 20.

14,281 (1906). Wilke, and Simon-Carvès Bye-Product Coke Oven Co. Vertical flue coke ovens. Feb. 20.

16,600 (1906). Cohen. Manufacture of gas. Feb. 13,

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

2912. Craig. Manufacture of blast furnace pitch. Feb. 6.

3063. Marriott. Coal-tar pitch as a binding and waterproofing material. Feb. 7.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

2766. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of diphenylamine and derivatives thereof. Feb. 4.

2767. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of colouring matters of the safranine series. Feb. 4.

2768. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of blue colouring matters of the safranine series. Feb. 4.

2769. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. Feb. 4.

3167. Holliday and Sons, Turner, and Dean. Dyestuffs for dyeing direct upon cotton and other materials. Feb. 8.

3279. Ransford (Cassella und Co.). Manufacture of sulphide colours. Feb. 9.

3394. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-oxyazo colouring matters. Feb. 11.

Complete Specifications Accepted.

2927 (1906). Belart. Condensing agents for use in making synthetic indigo and other condensation products. Feb. 20.

13,055 (1906). Dreyfus, and Clayton Aniline Co. Separation of sulphonic acids from solutions and obtaining them in the condition of stable compounds. Feb. 13.

25,977 (1906). Johnson (Badische Anilin und Soda Fabrik.). Manufacture of new colouring matters from diphenylamine compounds. Feb. 20.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

2998. Lilienfeld. Production of silk-like effects. Feb. 6.

3130. Green. Production of Aniline Black on textile fibres and fabrics. Feb. 8.

3168. Holliday and Sons, Turner, and Dean. Application of direct dyestuffs. Feb. 8.

3184. Spivey. Treating textile fibres or materials by electrolysis. Feb. 8.

3209. Howorth (Spiegler und Söhne). Dyeing and bleaching rolled up spun yarns in the pack system. Feb. 8.

3333. Hesketh and Cooper. Sizing of yarn.* Feb. 11.

3500. Ges. f. Chem. Ind. in Basle. Dyeing with sulphide dyestuffs cotton mixed with wool or silk. [Ger. Appl.. Dec. 24. 1906.]* Feb. 12.

3536. Barrillot. Method of weighting silk. [Fr. Appl., Feb. 15, 1906.]* Feb. 12.

3609. Newton (Bayer und Co.). Production of bi- and multi-coloured effects on mixed goods by dyeing with sulphur dyestuffs. Feb. 13.

3645. Schneider. Treatment of vegetable fibres or fabrics to produce varying effects in dyeing. Feb. 14.

Complete Specifications Accepted.

3566 (1906). Linkmeyer. Recovery of copper oxide in the manufacture of artificial silk. Feb. 20.

6544 (1906). Jeschke. Manufacture of coloured textile ribbons. Feb. 13.

6654 (1906). Wilson. Machines for printing textile fabrics and the like. Feb. 20.

9254 (1906). Vermeesch. Manufacture of textile fibres or artificial silk. Feb. 13.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Complete Specifications Accepted.

3563 (1906). Seeser. Manufacture of coverings for floors, walls, ceilings, &c. Feb. 13.

5342 (1906). Imray (Meister, Lucius, und Brüning). Dyeing paper pulp. Feb. 20.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

2726. Keith. Manufacture of nitrogen compounds. Feb. 4.

2796. Dickson and Alder. *See under* XV.

2920. Cowper-Coles. Extraction of sulphur from sulphur compounds. Feb. 6.

3106. Steinem. Manufacture of carbonic acid gas.* Feb. 7.

3210. Schulthess. Apparatus for producing hydrate of lime. Feb. 8.

3302. Soc. l'Air Liquide, and Lévy. Separation of gases from their mixtures, particularly air.* Feb. 9.

3435. Johnson (Chem. Fabr. Griesheim-Elektron.). Removal of arsenic from liquids and gases. Feb. 12.

3494. Gans. Aluminosilicates or artificial zeolites. [Ger. Appl., Feb. 23, 1906.]* Feb. 12.

3629. Read. Treatment of barytes for the preparation of barium sulphate or other barium compounds. Feb. 13.

3692. Fischer. Ozonising oxygen or mixtures of gases containing oxygen. [Ger. Appl.. Feb. 16, 1906.]* Feb. 14.

3811. Johnson (Badische Anilin und Soda Fabrik.). Manufacture of stable solid zinc hydrosulphites.* Feb. 15.

Complete Specifications Accepted.

3135 (1906). Kapff. Method of reducing inorganic and organic compounds. Feb. 13.

3583 (1906). Moscicki. *See under* XI.

10,008 (1906). Behrens. Manufacture of alkali bicarbonates and carbonic acid therefrom. Feb. 13.

13.579 (1906). Serpek. Production of compounds of aluminium and nitrogen. Feb. 13.

14,489 (1906). Bloxam (Kirchhoff und Neirath). Manufacture of metal peroxides and organic peroxides. Feb. 13.

18.927 (1906). Guttmann. Manufacture of sulphuric acid. Feb. 13.

VIII.—GLASS, POTTERY, AND ENAMELS.

Complete Specification Accepted.

22,520 (1905). Pilkington. Manufacture of plate or sheet glass. Feb. 13.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

2994. De Karyscheff. Manufacture of refractory materials. Feb. 6.

3063. Marriott. *See under* III.

3196. Stanley. Manufacture of bricks or the like from powdered clay. Feb. 8.

3206. James (Passow). Manufacture of cement from blast-furnace slags. Feb. 8.

3294. Muller. Process of obtaining cement from highly basic blast-furnace slag.* Feb. 9.

3404. Newberry. Manufacture of cement.* Feb. 11.

3409. Froschmaier. Permanent removal of saltpetre from walls. [Ger. Appl., Feb. 10, 1906.]* Feb. 11.

3916. Woodard and Thomlinson. Fireproof and sound-resisting building composition. Feb. 16.

Complete Specifications Accepted.

16,104 (1906) Deidesheimer and Jurschina. Manufacture of artificial stones, bricks, &c. Feb. 20.

17,761 (1906). Kelly. Composition for making roads, &c. Feb. 20.

19,186 (1906). Rauhoff. Rendering surfaces of buildings, blocks, &c. waterproof. Feb. 13.

X.—METALLURGY.

Applications.

2789. Thelberg. Treatment of ores containing zinc sulphide and lead sulphide.* Feb. 4.

3174. Siemens und Halske, A.-G. Manufacture of ductile tungsten or alloys thereof. [Ger. Appl., March 22, 1906.]* Feb. 8.

3208. Hurdley and Hurdley. Manufacture of malleable metal articles. Feb. 8.

3285. Steinhart and Vogel. Treatment of tin ores, concentrates, and the like. Feb. 9.

3308. Keller. *See under* XI.

3374. Landsberg and Boitzheim. Mechanical roasting furnaces. Feb. 11.

3475. Beaver, Stratton, and Claremont. Annealing copper.* Feb. 12.

3507. Mitchell and Vigo. Manufacture of soldering compounds.* Feb. 13.

3557. Aston. Recovery of gold, silver, and the like from jewellers' and other washings or slop liquids. Feb. 13.

Complete Specifications Accepted.

3310A (1906). Crowley and Payne. Alloy for surfacing brass, copper, and white metal for soldering. Feb. 13.

3575 (1906). Mills (Seigle). Extraction of gold, platinum, nickel, silver, copper, and other metals. Feb. 20.

5030 (1906). Annable, and Ferro Alloys Synd., Ltd. Manufacture of ferro chromium. Feb. 13.

17,131 (1906). Moore and Heskett. Direct process of manufacturing iron and steel. Feb. 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

3000. Boult (Elektricitäts A.-G., vorm. Schuckert und Co.). Electrolytic apparatus. Feb. 6.

3184. Spivey. *See under* V.

3308. Keller. Electrical process of refining metal.* Feb. 9.

3631. Jungner. Iron electrodes for accumulators with alkaline electrolytes. [Swed. Appl., Feb. 14, 1906.]* Feb. 13.

3711. Jungner. Production of electro-active, cement-like substances of iron and nickel hydrates for electrodes. [Swed. Appl., Feb. 15, 1906.]* Feb. 14.

3803. Féry and Langlet. Electric resistance furnaces. [Fr. Appl., Feb. 17, 1906.]* Feb. 15.

3834. Jungner. Production of electrodes of magnetic metals by electrolytic oxidation. [Swed. Appl., Feb. 16, 1906.]* Feb. 15.

3914. Reynolds. Electric furnaces. Feb. 16.

3915. Reynolds. Electrical heating apparatus. Feb. 16.

Complete Specifications Accepted.

2993 (1906). Sutton. Separation of particles of different dielectric capacities. Feb. 13.

3455 (1906). Brit. Thomson-Houston Co. (General Electric Co.). Magnetic material for electrical purposes. Feb. 13.

3583 (1906). Moscicki. Apparatus for producing nitric oxide by electricity. Feb. 20.

8712A (1906). Hartnell. Electro-depositing apparatus. Feb. 13.

24,806 (1906). Ferchland. Electrodes for electrolytic purposes. Feb. 13.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

3301. Szigeti and Szilard. Preparations of cod-liver oil.* Feb. 9.

Complete Specification Accepted.

3521 (1906). Middleton, Iveson, and Wilson. Cooling melted fats or fatty substances. Feb. 20.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Complete Specifications Accepted.

16,516 (1906). Ephraim. Manufacture of permanent white paint. Feb. 13.

16,833 (1906). Goddard. Anti-corrosive paint. Feb. 20.

(*C.*)—India-rubber.

Application.

3480. Stange. Production of elastic and plastic substances.* Feb. 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

2891. Inrig. Manufacture of imitation ebony from waste materials. Feb. 5.

3433. Harrison (Ferraguti). Substitute for leather.* Feb. 11.

Complete Specifications Accepted.

3450 (1906). Arnold, Fox, Scott, and Roberts. Manufacture of a colloidal material. Feb. 20.

16,598 (1906). Mills (Patent Leather Co.). Coating leather. Feb. 13.

XV.—MANURES, &c.

Application.

2796. Dickson and Alder. Manufacture of superphosphates and other fertilisers. Feb. 4.

Complete Specification Accepted.

3444 (1906). Harper. Economic disposal of effluent from septic tanks for soil fertilisation. Feb. 20.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

3421. Schmied. Manufacture of brewers' pitch. Feb. 11.

Complete Specifications Accepted.

5157 (1906). Bennett. Mash tun. Feb. 13.

18,045 (1906). Van Rijn. Continuous fermentation of liquids. Feb. 20.

20,144 (1906). Mackenzie (Deckebach). Treating and ageing wort. Feb. 20.

21,916 (1906). Linzel. Apparatus for de-alcoholising liquids. Feb. 20.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

2868. Epstein. Treatment or preparation of chocolate and cocoa. Feb. 5.

3825. Rillardon. Extraction of farinaceous products from cereals. Feb. 15.

Complete Specifications Accepted.

3206 (1906). Galbraith. Treatment of milk, cream, and butter. Feb. 20.

12,783 (1906). Hatmaker. Drying milk and proteid-containing liquids. Feb. 20.

16,674 (1906). Nyeboe and Nissen. Pasteurising apparatus. Feb. 20.

(*B.*)—Sanitation; Water Purification.

Complete Specification Accepted.

3444 (1906). Harper. *See under* XV.

(*C.*)—Disinfectants.

Application.

3789. Schneider. Manufacture of disinfectants. [Ger. Appl., Feb. 16, 1906.]* Feb. 15.

Complete Specification Accepted.

11,166 (1906). White. Liquid compounds for use as insecticides and fungicides. Feb. 13.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

2770. Cantine. Machine for coating paper.* Feb. 4.

3103. Lederer. Manufacture of cellulose esters.* Feb. 7.

3132. Hollands and Laundy. Prepared paper, rag, wood, or other pulp. Feb. 8.

3160. Chapman. Paper-making. Feb. 8.

3378. Angell. Manufacture of commercial paper.* Feb. 11.

Complete Specification Accepted.

5342 (1906). Imray (Meister, Lucius, und Brüning). *See under* VI.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

2744. Keane. Preparation of condensation products of aldehydes with amides of hydroxylic and of dicarboxylic acids. Feb. 4.

3068. Newton (Bayer und Co.). Manufacture of alkyloxy compounds of aromatic hydrocarbons. Feb. 7.

3176. Zeitschel. Production of primary terpene alcohols of the formula $C_{10}H_{17}OH$ from ethereal oils containing linalool or coriandrol or their ethers. [Ger. Appl., Feb. 9, 1906.]* Feb. 8.

3367. Sorger. Production of salicylic acid glycerin ester.* Feb. 11.

3665. Hildebrandt. Manufacture of condensation products from formaldehyde, tannin, and aromatic monohydroxyl-compounds.* Feb. 14.

3929. Lake (Cur. der G. u. F. Speyerschen Studienstiftung). Replacement of the amido group in aromatic amides which contain the residue of arsenic acid. Feb. 16.

3934. Lake (Cur. der G. u. F. Speyerschen Studienstiftung). Manufacture of acid derivatives of *p*-aminophenyl-arsenic acid.* Feb. 16.

Complete Specifications Accepted.

2927 (1906). Belart. *See under* IV.

3135 (1906). Kapff. *See under* VII.

14,122 (1906). Lynde. Manufacture of saccharin. Feb. 13.

14,489 (1906). Bloxam (Kirchhoff und Neirath). *See under* VII.

15,519 (1906). Newton (Bayer und Co.). Manufacture of dialkylbarbituric acids. Feb. 20.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

15,506 (1906). Wagner. Production of coloured photographs. Feb. 20.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

3179. Himalaya. Production of explosives. [U.S. Appl., Feb. 16, 1906].* Feb. 8.

3199. Himalaya. Manufacture of safety high explosives.* Feb. 8.

3200. Himalaya. Increasing the strength of chlorated and other explosives.* Feb. 8.

3201. Himalaya. Manufacture of plastic and safe high explosives.* Feb. 8.

3202. Himalaya. Manufacture of tundra blasting explosives.* Feb. 8

COMPLETE SPECIFICATIONS ACCEPTED.

4114. (1906). Steele. Explosives. Feb. 20.

4115 (1906). Steele. Rendering explosives practically non-hygroscopic. Feb. 20.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

COMPLETE SPECIFICATION ACCEPTED.

9540 (1906). Porter. Apparatus for indicating and recording the percentage of carbonic acid in flue and other gases. Feb. 13.

Journal of the Society of Chemical Industry.

No. 5, Vol. XXVI. MARCH 15, 1907. No. 5, Vol. XXVI.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. Full particulars will appear later.

Birmingham and Midland Section.

Meeting held at Birmingham on Thursday, Dec. 6th, 1906.

MR. ALEX. E. TUCKER IN THE CHAIR.

THE UTILISATION OF ATMOSPHERIC NITROGEN FOR INDUSTRIAL PURPOSES.

BY PERCY F. FRANKLAND, PH.D., LL.D., F.R.S.

Nitrogen was discovered by Rutherford in the year 1772. In 1784, Cavendish showed that in the presence of oxygen and water under the influence of electric sparks, it could be converted into nitric acid. This discovery has been attended with most important consequences from a theoretical point of view. In the hands of Lord Rayleigh it served as the key to the discovery of argon, but it is also on the eve of leading to practical developments of the most far-reaching importance. Whilst Cavendish showed that nitrogen could combine directly with oxygen and yield nitric acid, the discovery was made about the same time by Scheele, that when nitrogen is passed over a mixture of potassium carbonate and charcoal heated to redness, potassium cyanide is formed. These two discoveries, made more than a hundred years ago, thus pointed to the possibility of transforming the free nitrogen of the air into two of the most important and active compounds of nitrogen—nitric acid and potassium cyanide.

The formation of cyanide from atmospheric nitrogen was destined again and again to absorb the attention of subsequent observers, amongst whom I may particularly mention Bunsen, who, in 1845, specially investigated the formation of potassium cyanide during the smelting of iron in blast furnaces. Many attempts to synthetically produce cyanides on an industrial scale followed upon these classical researches of Bunsen. Unexpected difficulties were encountered on the large scale, amongst which were the wear and tear of the plant at the high temperature required, the relatively small yield, and the impurity of the product. Amongst the variations on the original process which were adopted was the substitution of barium carbonate for potassium carbonate. This modification was taken up with some temporary success by Mond in 1882, who heated briquettes composed of barium carbonate, 32 parts; wood charcoal, 8 parts; and tar, 11 parts, in a reducing flame in such a manner as to char the pitch and decompose the carbonate, after which they were submitted to a direct current of gas as rich as possible in nitrogen, and as free as possible from oxygen, carbon dioxide, and water. Such gas was obtained by Mond from the top of the carbon dioxide absorption apparatus in the Solvay process. The gas was first heated to 1400° C.

Much more permanent success in the synthesis of cyanides has attended the use of ammonia instead of free nitrogen in contact with alkalis and carbon heated to a high temperature. These processes, in which ammonia is used, do not strictly come within the scope of this paper, because at the present time ammonia is, of course, not obtained from atmospheric nitrogen.

The original discovery of the formation of cyanide from ammonia is again due to Scheele, who devised a process for making potassium cyanide by heating a mixture of ammonium chloride, charcoal, and potassium carbonate.

Combination of free nitrogen by means of carbides.—The mechanism by which potassium cyanide is formed when nitrogen is passed through a heated mixture of potassium carbonate and carbon has been the subject of much discussion. Berthelot attributed it to a preliminary formation of potassium carbide, C_2K_2, the latter fixing nitrogen with formation of cyanide. This would make the process analogous to his classical synthesis of hydrocyanic acid from acetylene and nitrogen under the influence of the spark discharge. Inasmuch as the mixture of potassium hydroxide or carbonate and carbon when heated to a high temperature gives metallic potassium, and, inasmuch as potassium cyanide is only formed in the mixture in the presence of nitrogen when such a high temperature is used, it has been generally assumed that the preliminary formation of potassium is necessary for the formation of carbide, which then combines with nitrogen. This function of the potassium is, however, in dispute; thus, according to some, the union of $\mathrm{C+N} \leftrightarrows \mathrm{CN}$ takes place to a small extent as a reversible process, and the potassium removes the cyanogen immediately it is formed. Dewar, in 1880, indeed showed that cyanogen is formed in the arc discharge between carbon terminals in nitrogen or air.

Others again suppose that the function of the free alkali metal is that it combines with nitrogen to form a nitride. This is supported by the well-known absorption of nitrogen by magnesium at high temperatures, with formation of nitride; moreover, Geuther and Brieglieb have shown that magnesium cyanide is formed by passing either carbon monoxide or dioxide over heated magnesium nitride. Whatever may be the real function of the alkali metal in cyanide formation, with the advent of cheap sodium attempts were made to produce cyanide by bringing free sodium in contact with nitrogen and carbon at a high temperature. It was only natural that these attempts should have been inaugurated by Castner, the distinguished and highly-original technical chemist, who did so much to render metallic sodium an industrial product at a reasonable price. Twenty years ago sodium was a curiosity; it is now produced in thousands of tons per annum. Castner's process for the use of metallic sodium for cyanide production has, however, been found to be more satisfactory if ammonia, instead of nitrogen, is employed, the reactions being separately carried out thus: $2NH_3+2Na=2NaNH_2+H_2$ (at 300°—400° C.), and $NaNH_2+C=NaCN+H_2$ (fused at dull red heat). This process has been improved by the Deutsche Gold und Silber Scheide Anstalt by utilising the intermediate formation of sodium cyanamide in the above reaction. The process is carried out by melting metallic sodium with charcoal or other carbonaceous matters, in a crucible, and then conducting in ammonia at a temperature of 400° C. to 600° C.; this leads to the formation of disodium cyanamide, Na_2CN_2, which is not decomposed at this temperature. Then, by raising the temperature to 700° C. to 800° C., the excess of carbon interacts, forming cyanide; the whole operation is conducted in the same crucible.

The demand for cyanides for dissolving gold from the poorer ores has acted as an enormous stimulus to the devising of processes for their manufacture, amongst which methods for transforming the free nitrogen of the air into cyanides have been found practicable. In 1889, the world's consumption of cyanide did not exceed 50 tons per annum. At the present time (Beilby, 1905), the entire consumption of cyanide is not much short of 10,000 tons per annum, of which the Transvaal gold field consumes about one-third. In 1894 the price of cyanide in the Transvaal was 2s. per lb.; in 1905 it was only 8d. per lb., or £74 per ton, or £740,000 for the 10,000 tons.

Summary of Cyanide Industry.

Process.	Works where carried on.	Date of Introduction.
Ferrocyanide ($K_4FeC_6N_6 + Na$)	Beckton (Gas Light and Coke Co.). Oldbury (British Cyanides Co. Berlin (Taucha Co.).	1890--1.
Beilby K_2CO_3 or $Na_2CO_3 + NH_3 + C$ (uses minimum quantity of carbon and mass fusible).	Cassel Co., Glasgow.	1992.
Castner ($Na + NH_3 + C$)	Cassel Co., Glasgow. Fabrik Natrium, Frankfurt. Niagara Electrochemical Co. Société d'Electrochimie.	1895--1900.
Siepermann ($K_2CO_3 + C + NH_3$) (uses excess of carbon, and mass infusible).	Stassfurt.	1890.
Readman ($(Ba(CN)_2 + Air$)	Scottish Cyanide Co., Leven.	1895--1903.
"Schlempe" Distillation of beet residues ($(CH_3)_3N \rightarrow HCN$) (at high temperature).	Dessau and Hildesheim.	1900--1902.
Raschen ($NaCNS + HNO_3 \rightarrow HCN$)	United Alkali Co., Widnes.	1898--1899.

Conversion of nitrogen into nitrates.—As already pointed out, the earliest positive property of nitrogen discovered was the possibility of transforming it into nitric acid, effected by Cavendish in 1784.

Great as is the present demand for cyanides, the demand for nitric acid and nitrates is enormously greater. It is at present almost entirely supplied by the vast deposits of sodium nitrate found in the rainless districts of Chili. This product is at present utilised to the extent of about one and a half million tons per annum, one-fifth being used for the manufacture of nitric acid, and four-fifths as manure, nitric nitrogen being the most valuable nitrogenous foodstuff for plants.

Considering that the value of nitrate at Liverpool is now between £10 and £11 per ton, the annual value of the material put upon the market is thus about £15,000,000 sterling. It is obvious that the possibility of producing it artificially is a matter of great interest and importance, especially when it is borne in mind that the supply will at the present rate be exhausted in about 30 years. An enhanced interest has been imparted to this problem by Sir William Crookes, who, on the occasion of his Presidential Address to the British Association in 1898, attempted to prove that the inhabitants of this planet would in the course of a few years be confronted with wheat-starvation, unless a man of science should come like a *deus ex machina* to the rescue. Sir William Crookes' argument depended on the following considerations:—

Wheat crop.—The world's average yield of wheat per acre is 12·7 bushels; Great Britain, Denmark, Norway, New Zealand, Germany, Belgium and Holland each average over 20 bushels per acre; France, Hungary, and Roumania average nearly 20 bushels, the United States has an average of 12 bushels whilst Australasia, India, and Russia average under 10 bushels per acre. To raise the yield from 12·7 bushels to 20 bushels per acre requires 1½ cwt. of sodium nitrate per acre.

Sir William Crookes' figures for acreage under wheat.—In 1891—1895 there were 163,000,000 acres under wheat, out of a maximum area possible of 260,000,000 acres. At the present rate of increase Sir William Crookes computed that in 1931 there would be 746,100,000 bread eaters, requiring 3,357,000,000 bushels of wheat. This would involve an acreage of 264,000,000 acres at 12·7 bushels per acre. To raise 163,000,000 acres from 12·7 bushels to 20 bushels per acre of wheat by means of 1½ cwts. of sodium nitrate per acre, would require 12,000,000 tons of nitrate per annum, in addition to that which is required at present. This would postpone wheat-starvation for 35 to 40 years, but would exhaust the Chili beds in four years.

Let us consider the possibilities of producing this nitrate from atmospheric nitrogen, the atmosphere consisting of nitrogen to the extent of four-fifths by volume:—The weight of atmospheric nitrogen per square yard of the earth's surface is 7 tons, and weight of atmospheric nitrogen over the whole earth is about 4,000,000,000,000,000,000 tons (4 trillions of tons). Now, although from the time of Cavendish it has been known that this atmospheric nitrogen can be converted into nitrates, it has also been known at the same time that the practicable transformation is limited to a very small proportion of the nitrogen present in any given volume of air.

(*Experiment.*—A current of air was blown through an arc discharge, and the resulting product was absorbed by caustic soda, and it was demonstrated that nitric acid had been formed in the reaction.) The spark leads to all the following changes taking place within the sphere of its influence:—$N_2 = 2N$, $O_2 = 2O$, $N + O = NO$, as well as $2N = N_2$ and $2O = O_2$, and under ordinary circumstances only a very small proporton of nitric oxide is formed, because the opposite reactions also take place, thus:—$NO = N + O$; $N + N = N_2$; $O + O = O_2$; in fact, the same mixture of gases, nitrogen, oxygen and nitric oxide are obtained irrespectively of whether nitric oxide or a mixture of nitrogen and oxygen is submitted to electric discharges. It is thus an equilibrium or reversible reaction, $N_2 + O_2 \rightleftharpoons 2NO$. The conditions affecting the equilibrium in this reaction have been carefully studied by Nernst, who has found that the proportion of nitric oxide formed is enormously influenced by temperature, thus:—

Temp. °C.	Temp. °Abs.	Percentage nitric oxide by vol.
1,538	1,811	0·37
1,760	2,033	0·64
1,922	2,195	0·97
2,927	3,200	5·00

Again, he found, as was to be anticipated, that the higher the temperature, the more rapidly was the equilibrium reached, thus:—

Temp. °C.	Temp. °Abs.	Time.
		secs.
1 267	1,540	100·0
1,454	1,737	3·5
1,650	1,923	0·1

From the above it is apparent that a high temperature has the double advantage of increasing the yield of nitric oxide, and increasing the velocity with which it is formed. We must, however, bear in mind that the higher the temperature, the more electric energy is required, and that not only have the gases which combine to be raised to this temperature, but also the large excess of gases which do not combine. The relationship between the advantages and disadvantages of high temperature have been calculated by Haber, thus:—One kilo-watt year (365 days of 24 hours each) would theoretically yield 1174 kilos of nitric acid at 4200° C., or 819 kilos at 3200° C., and from these figures it can be calculated that the increased yield is pecuniarily more advantageous than the smaller cost of the lower temperature.

We have, however, seen that at best only 5 per cent. of nitric oxide are obtained, and we are further confronted with the difficulty of preserving even this small yield, for the gases submitted to the high temperature of the arc will have to cool down, and in doing so, there will be an opportunity for the reverse reaction to take place. Thus, at an absolute temperature of 3200°, the amount of nitric oxide by volume is 5 per cent., whilst at 2200° it is only 1 per cent. So that in slowly cooling from 3200° to 2200°, four-fifths of the nitric oxide would be destroyed. The lower the temperature, however, the longer is the time that is required before equilibrium is established. It follows, therefore, that in order to preserve as much as possible of the nitric oxide formed, the gases must be cooled as rapidly as possible. If they can be cooled below 600°, the possibility of further loss is avoided, because of the transformation of the nitric oxide into nitrogen peroxide by combination with the excess of oxygen present.

Numerous devices have been tried to secure instantaneous refrigeration of the gases which have been exposed to the high temperature of the arc discharge. Thus the gases have been rapidly blown or drawn through the region of high temperature; this was, however, not found to lead to a successful result. Much more success has attended the momentary production of the arc in different parts of the atmosphere. Near Niagara, a firm called "The Atmospheric Products Company" has been attempting to attain this end by means of a series of platinum electrodes attached to rotating frames, electric discharges momentarily taking place as these electrodes pass each other. A direct current of 10,000 volts was employed. Although sodium nitrate was produced by passing the gaseous products through caustic soda, the price was found to compare unfavourably with that of Chili saltpetre.

What appears to be a complete success has, however, been achieved by two Norwegian inventors—Karl Birkeland, Professor of Physics in the University of Christiania, and Samuel Eyde, an engineer in the same city. (The principle of the Birkeland-Eyde arc was demonstrated by means of Ruhmkorff coil and an electromagnet. The spark discharge was passed between the poles, and at right angles to the field of the electromagnet. By this means the spark flame is caused to spread out into a disc.) In the furnace used by Birkeland and Eyde[*] the electrodes are of copper, approaching each other within one-third of an inch. They are hollow, and cooled by circulation of water to prevent fusion. An alternating current of from 3000 to 4000 volts is used, and the diameter of the flame produced is six feet. Since 1903 this has rapidly been developed from the experimental to the industrial scale. At present *Det Norske Kvaelstof Compagnie* has a factory at Notodden in the Hitterdal, capable of turning out from 3000 to 5000 tons of nitrate per annum, and this has been in regular operation since May, 1905. At these works there are three furnaces of 500 k.w. each. The air is supplied by blowers at 50 litres per k.w. per minute. The hot gases from the furnaces pass first through a steam boiler, where they give up part of their heat to raise steam. Then they enter at 50° C. the absorption towers, which are about 50 feet high, built of granite slabs and filled with lumps of quartz over which the water trickles. In tower No. 1, 50 per cent. nitric acid is drawn off; in No. 2, 25 per cent.; in No. 3, 15 per cent.; and in No. 4, 5 per cent. nitric acid is drawn off. The liquid is transferred from tower to tower by compressed air. Tower 5 contains milk of lime; tower 6 is made of wood, and contains beds of dried quick lime. The 50 per cent. acid is added to limestone, and the solution concentrated until the residue can be poured molten into iron canisters. This Norwegian saltpetre is almost anhydrous nitrate of lime containing 13 per cent. of nitrogen. It is estimated that, with the lower prices for electric energy current in Norway, nitric acid can be manufactured at a cost of 30 per cent. less than from Chili saltpetre. 500 to 600 kilos. of pure nitric acid per 1 k.w. per annum is according to Witt the average yield, or say 2 k.w. per annum per ton of nitric acid. To supply 200,000 tons of nitric acid, which is approximately what is now used, otherwise than in agriculture, would require 400,000 k.w.

Calcium cyanamide industry.—Another process for fixing the free nitrogen of the air, which has also been attracting much attention during recent years, is germane to the formation of cyanides from atmospheric nitrogen to which I referred in the earlier part of the paper, and yet it is entirely different in its scope, inasmuch as it renders the combined nitrogen available for other purposes than those for which cyanides can be conveniently used. To Dr. Frank, of Charlottenburg, we owe the observation that barium carbide heated to a high temperature fixes free nitrogen almost quantitatively with formation of barium cyanide, thus: $BaC_2 + N_2 = Ba(CN)_2$; this is the basis of the Readman process.

It was natural to try and realise a similar fixation by means of the much cheaper calcium carbide. Frank found, however, that a very disappointing quantity of calcium cyanide was formed, and the reaction is really different, and takes place as follows: $CaC_2 + N_2 = CaCN_2 + C$ (at 800° C). This reaction does not involve much extraneous heat when once started, as it is strongly exothermic. The product should contain about 30 per cent. of nitrogen, but, as a matter of fact, the product actually obtained contains only about 20 per cent. When calcium cyanamide is treated with water (superheated steam) under suitable conditions, the following reaction takes place: $CaCN_2 + 3H_2O = CaCO_3 + 2NH_3$. This reaction also takes pace in contact with the soil, so that calcium cyanamide can obviously be applied as an ammoniacal manure. From practical trials it would appear to be of intermediate value between ammonium salts and nitrates.

The proposition has been made to produce the calcium carbide at the moment it is required by directing a stream of nitrogen on to the mixture of calcium carbonate and carbon in the electric furnace. Works are shortly to be opened in Italy (with water power of 3000 h.p.) for the manufacture of calcium cyanamide on an industrial scale.

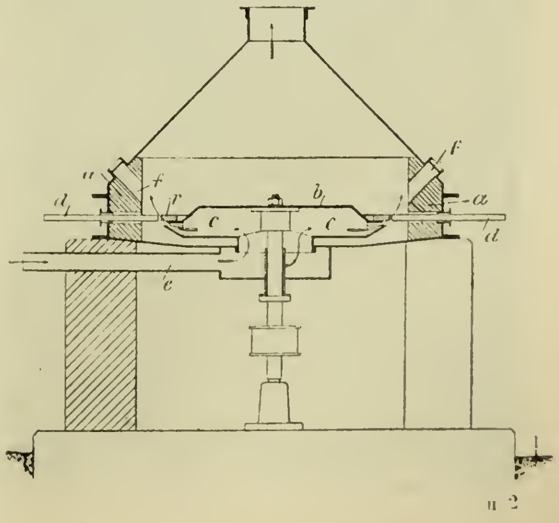
Appended are two specifications of the Badische Anilin und Soda Fabrik for the production of arc discharges suitable for carrying out reactions between gases on a large scale. The second one introduces a method of producing large discharges which is, as far as I am aware, entirely novel.

Specification I.

Improvements in, and apparatus for, the production of reactions in gases by means of electric arcs. Badische Anilin und Soda Fabrik. Eng. Pat. 26,602, Dec. 6, 1904.

This invention relates to the production of reactions in gases by means of electric arcs, and consists in the provision of means whereby, in the production of such reactions, a polyphase current, without restriction as to the number of phases, can be used in one electric furnace in such a manner that large quantities of electric energy can be utilised in a simple manner in one furnace and without employing a magnetic field in the furnace to spread out the arcs. According to this invention, an electric arc, or electric arcs, is, or are, caused to spring between a rotating electrode and surrounding electrodes, and the gases are caused to spread out the arc, or arcs, so that they cover the whole, or nearly the whole, of the space between the circumference of the rotating electrode and

Fig. 1



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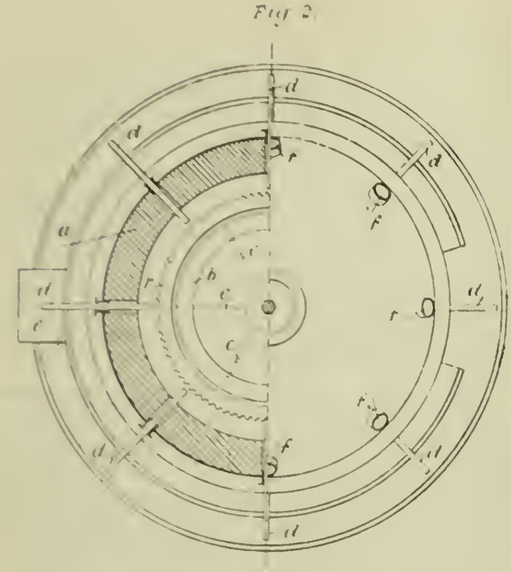
[*] Silvanus P. Thompson; "Electrician," Feb 9, 1906.

Fig 2



the surrounding electrodes, thus compelling the whole, or practically the whole, of the gases which are passed through the apparatus to pass through, and be subjected to the action of, the arc, or arcs.

I do not limit myself to any one precise form of apparatus for carrying out this invention, but my foreign correspondents have found that illustrated in the accompanying drawing to be suitable, and I will describe how this invention may be performed with reference to this drawing.

Fig. 1 represents a vertical section, and Fig. 2 a plan, partly in horizontal section, of the apparatus.

The wall, *a*, of the furnace is lined with fireproof material, and within it the circular disc electrode, *b*, is mounted centrally so as to be capable of rotation. This rotatable electrode is provided with radial wings, *c*, and its outer circumference in the form of a ring, *r*, is made separate and attached afterwards so that it can be removed and replaced by a fresh one. This ring, *r*, can, with advantage, be toothed on its periphery, as shown in Fig. 2. Stationary electrodes, *d*, which must be well insulated, are introduced through the wall of the furnace in the same horizontal plane as that in which the electrode, *b*, is situated, and the said electrodes, *d*, can be adjusted with regard to the said electrode *b*. The gases to be treated pass into the apparatus through the channel, *e*, the arrows indicating the course which the gases take through the apparatus. The holes at *f*, which are covered with glass, or other transparent material, are for enabling the ends of the electrodes, *d*, and the periphery of the electrode, *b*, to be seen when setting the said electrodes.

It is preferred to electrically connect the rotatable electrode, *b*, and the walls of the furnace to earth, so that there is no danger in touching the connections. The well-insulated electrodes, *d*, are connected with the terminals of a generator, or transformer, or other suitable source of electric current. The electrode, *b*, being provided with the radial wings, *c*, constitutes a kind of fan, to the centre of which the gases to be treated are fed, and from the periphery of which they are ejected, so that, in consequence of rapid rotation, the gases are forced through the spaces between the electrode, *b*, and the stationary electrodes, *d*, and drag the arcs with them, and the electric discharge is thus spread through the whole, or practically the whole, of the circumference of the electrode, *b*, and of the annular space through which the gases have to pass between the said electrode, *b*, and the furnace wall. The conditions thus produced are very favourable for reaction in the gases, as the arcs present a very large surface with which all, or practically all, the gases are compelled to come into contact.

The stationary electrodes can be placed radially with regard to the rotating electrode, or they may be situated at any other angle thereto. The gases may be introduced in any suitable manner—for instance, they may be introduced through the aforesaid fan-like arrangement, or they may be led in through the stationary electrodes, or through other ducts arranged for the purpose, and any required number of stationary electrodes may be employed.

Specification II.

Production of stable voltaic arcs of large dimensions. Badische Anilin und Soda Fabrik. First Addition, dated Dec. 9, 1905, to Fr. Pat. 357,358, Aug. 30, 1905.

The details of the process for producing large stable voltaic arcs, described in the principal patent, can be considerably modified as follows:—

I.—It is unnecessary to pass the gases along the electrode fixed in the tube. On the contrary, these large arcs may be obtained by simply introducing the gas into the tube beyond the electrode. In this case it is only necessary to avoid by other means the discharges produced between the electrode and the adjacent parts of the wall of the tube; this is effected by leaving a sufficient space between electrode and tube, or by placing an insulation between them. Otherwise, the arc is formed as described in the principal patent. The electrode can, for example, be made so that it can move in the direction of the axis of the tube; it is first introduced sufficiently far into the tube to allow the gases to pass along it, as previously described. At first, the discharge occurs between the edge of the electrode and the adjacent walls of the tube, but the gas current immediately carries it towards the centre of the electrode. As soon as the arc burns quietly in the middle of the tube, the electrode is withdrawn, so that the gas has no longer to pass along it. This gives the advantage of being able to introduce the gas at lower pressure than in the original process.

Fig.1

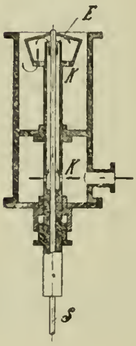
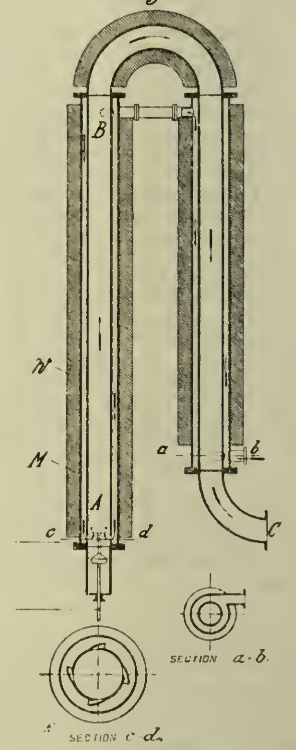


Fig.2.



In the first instance, the electrode may also be placed out of touch with the gas current; it is then necessary to start the formation of the arc by other methods—*e.g.*, by introducing a second electrode, as indicated in the original specification. A part of the gas can also be passed along the electrode according to the process of the principal patent, whilst the remainder is introduced beyond the electrode.

II.—It has been observed that the electrode fixed in the tube wears away very rapidly at the part which is in contact with the arc. Hence, this electrode must occasionally be changed, thus interfering with work. To avoid this, the electrode is so arranged that the spent part can easily be replaced, preferably whilst the apparatus is working. This can be effected by introducing through an opening along the axis of the electrode, E (Fig. 1), a rod, S, of iron, or other suitable material. This rod can be moved forward as the electrode is consumed. This can be done by hand at intervals, or better, mechanically—for example, by a clock-work movement, by means of a gear wheel and endless screw, &c.

III.—As indicated in the principal patent, these large arcs are especially suitable for endothermic reactions in gases. To render the process as perfect as possible from an industrial standpoint, a considerable proportion of the heat contained in the gas after the reaction should be utilised for the process itself. For this purpose, the reaction tube, A, B (Fig. 2), is provided with a jacket, M, surrounded by insulating material, *w*. The gas to be treated is passed between the tubes, A, B, and M, preferably in the inverse sense (in the direction of the arrowheads), whereby they are heated before introduction into the inner tube. To utilise the heat to the fullest extent, the tube should be of sufficient length. To prevent its taking up too much space, the tube A, B, can be joined by a U-tube to a second tube, or, better still, to a number of tubes, each surrounded by a jacket; at its extremity, C, the gas will be cool enough to introduce into the absorption apparatus. The gas can be introduced into the jacket either directly, or with a circular motion; this latter may be produced, for example, by introducing the gas tangentially (see Fig. 2, Section *a–b*). A special device for introducing the gas into the tube, *e.g.*, as shown in Section *c–d* (Fig. 2), produces the circular movement equally well. The transmission of heat can also, of course, be effected by other apparatus.

The apparatus which has just been described has several advantages: First, the mixture of gases produced by the reaction is cooled in the part, B, of the tube, A, B, and also in the extension, if there is one, so that the products formed cannot be decomposed; a materially higher yield is also obtained by introducing the gases hot, and the life of the reaction tube is prolonged in addition. If the process described under (I.) is followed, the use of heated gases presents no difficulties. If, on the other hand, the hot gases pass between the electrode and the tube, as in the principal patent, it is possible that the electrode may melt at the higher temperature employed. It is thus advantageous to cool the electrode; it can, for example, be supplied with orifices, K, by which a portion of the cold gases to be treated may be introduced (see Fig. 1).

The heat contained in the gas after the reaction can also be utilised to evaporate the solutions obtained during the process, such as solutions of nitrites and nitrates produced by treating atmospheric nitrogen with the arcs in question.

Discussion.

Dr. R. S. Morrell asked if basic calcium nitrate was preferred to the normal nitrate as a substitute for sodium nitrate as a fertiliser. He had read that calcium cyanamide was occasionally injurious to vegetation. During the decomposition of the calcium cyanamide in the soil, besides ammonia, another substance was formed, which interfered with plant growth.

Mr. F. R. O'Shaughnessy asked whether Prof. Frankland thought there was any substantial meaning in Sir William Crookes' statement.

Dr. J. B. Readman said he believed that in his experiments, using a mixture of carbon and barium carbonate also calcium carbonate heated in the electric furnace, and having producer gas passed through, he was first to produce cyanamide, though, it was some time after that he recognised it as such, his main object being the production of cyanides using atmospheric air as the source of nitrogen.

Mr. F. D. Ratcliff asked if any work had been done in bringing the fixed nitrogen in refuse into some more marketable form by heating with alkali in electric or other furnaces, and then dissolving out.

Mr. H. L. Heathcote said he thought calcium cyanamide would prove a very useful material for case-hardening steel articles.

Mr. F. H. Alcock said he had heard that day that potassium cyanide was being sold in Coventry at 11d. a lb., and he wondered whether they made their profit by the large quantity sold.

Mr. Stacey Jones said that before the lecture commenced, he had an opportunity of inspecting the apparatus, and he noticed that there came from the mixture of acetylene, hydrogen, and nitrogen a smell of phenylisocyanide, which no doubt could be possibly formed from those elements. Had Prof. Frankland observed the same?

Mr. E. C. Rossiter said he was sorry to see Prof. Frankland did not touch upon the production of useful nitrogen by bacterial methods. If all the waste products from the animal kingdom were properly returned instead of being treated artificially—that is, if they underwent natural decomposition, the ultimate amount of nitrogen useful for plants would neither decrease nor increase. It might be possible to use the nitrogen which was at present being wasted in assisting the growth of wheat by some bacterial method.

The Chairman said that if the result of the bacteriological treatment of sewage was taken—*i.e.*, if the effluent containing free ammonia was passed through a layer of hydrated oxide of iron—a very considerable amount of ammonia was absorbed by the hydrated oxide. He found the amount of ammonia which could be retained by oxide of iron would reach 5 per cent. and sometimes 6 per cent. This seemed to him a most important result, but he had not heard that it had been developed into anything practical. The practical application was too difficult. It was quite easy, of course, to recover the retained ammonia by warming the oxide of iron.

Prof. P. Frankland, in reply, said that Dr. Messel had pointed out that a much more satisfactory product would be obtained by making calcium nitrate basic, instead of leaving it in a deliquescent neutral condition. He had long looked for information with regard to the Ostwald process for producing ammonia from air, but he had not been able to obtain it.

He had not analysed Sir Wm. Crookes' statements carefully. But it seemed to him that he (Sir William) made the case appear more alarming than it was, by suggesting that the world was so entirely dependent upon wheat. There were many foodstuffs which could apparently be obtained in much larger quantity from a given area, and of much greater nutritive value than wheat. But it was probable that long before the state of affairs foreshadowed by Sir William Crookes came to pass, new kinds of agriculture would have arisen in which more profitable crops, from the nutritive point of view, would be cultivated over large districts of the earth's surface. There was no doubt that the deposits of nitrate were being used in a lavish and imprudent manner, but he did not know what else could be done. He was much interested in Dr. Readman's account of how he had handled cyanamide without knowing it. At that time, there was no idea that cyanamide could be of manurial value, and as to what its real manurial value was at the present day he was not prepared to make any statement on his own authority. One would not, however, be surprised if it had a poisonous action. It was a matter of surprise to the scientific world that it was a good manure; as really all cyanogen compounds were regarded as being deleterious to plant and animal life. On the other hand, he believed that the danger of some cyanogen compounds had been rather exaggerated. Mr. Silvester and himself had investigated the poisonous character of thiocyanates, which were said to be extremely deleterious to plant life; but they had come to the conclusion that the poisonous properties of these compounds had been over-estimated. Mr. Ratcliffe had raised the question about the waste of human and other refuse, particularly human refuse. Animal refuse was generally taken care of, and applied to the land. There had, of course, been many attempts to utilise the combined nitrogen of sewage, and those had been attended with a certain amount of reported success, but they had been almost invariably abandoned. Even the application of the sewage, as such, as a manure to land, had been found to be not attended with profit, but with a great amount of loss, as the inhabitants of Birmingham knew to their cost. Birmingham had got a larger establishment for utilising town sewage than any other city in the United Kingdom, and it was a standing expense to the community. They were now employing methods which would not make any attempts whatever to utilise the combined nitrogen in the sewage, but to send it down in as innocuous a form as possible. The figures he quoted as to the price of sodium cyanide were those of Mr. Beilby. In regard to Mr. Jones' question as to the smell arising from the tube, he agreed that having regard to the materials used, that some phenylisocyanide might possibly be produced. Mr. Rossiter had raised the question of bacterial utilisation of nitrogen. That had been practised from time immemorial in villages in India, where the refuse was of a concentrated character, and where there were long periods of dry weather. The manure was mixed with ashes—wood ashes—and exposed to the air in heaps, in which the animal nitrogen was transformed into nitrates. There was a definite caste in India which had been engaged in this occupation of nitrification from time immemorial. That was possible where there was a concentrated sewage, but the modern tendency was for the sewage to be more and more diluted, as the population acquired the habit of taking baths every morning. As to the fixation of ammonia by hydrated oxide of iron, he imagined that the expense of recovering anything from sewage in that way would be prohibitive, owing to the small amount of ammonia present in sewage matter. It was doubtful whether it would be commercially profitable.

Liverpool Section.

Meeting held at the University, on Wednesday, December 12, 1906.

DR. JAMES T. CONROY IN THE CHAIR.

AN INTERESTING CASE OF SOIL ELECTROLYSIS WITH FORMATION OF A LIQUID SODIUM POTASSIUM ALLOY.

BY HENRY BASSETT, JUN.

Now that electricity is so largely used for lighting and power purposes, and wires conveying the current traverse the ground, especially in towns, in all directions, the effects of wandering earth currents, due to leaks from the wires, and earth returns on tramway systems, occasionally attract attention. These earth currents usually manifest themselves by causing the corrosion of metal objects, such as pipes, tramway rails, &c., placed in the ground. In such cases the object attacked acts as anode, the surrounding earth being the electrolyte. In other cases, where we are dealing with the opposite end—that is to say, the cathode—of the huge voltaic cell thus formed, alkaline deposits are found.

The following case, which was brought to my notice some months ago, may be of interest, as it shows the magnitude of the chemical processes which may be caused by such earth currents. On March 6th a bad "earth" occurred at the Brownlow Hill Workhouse, Liverpool. The leak occurred just under a small roadway, and, although the cable had probably been failing there for some time, the leak was only discovered from the fact that horses became restive at that spot owing to shocks which they received, and which, in fact, one could get by touching certain places. The cable affected was one supplying power to a motor at 460 volts. The current was carried by two thick insulated copper cables (a negative and a positive). These were laid about an inch apart on wooden bridges, in a wooden trough, which was then filled with bitumen, a wooden lid being finally laid over the bitumen. This trough was buried in porous sandstone, the top being about 18 inches below the surface of the ground. The leak had possibly been started by a heavy cart causing a crack in the bitumen, through which water had penetrated to the cable. Only the negative cable (which would be at 230 volts below the potential of the earth) was affected. This cable had been joined at the place where the leak occurred, the join having been bound round, perhaps not very carefully, with waterproofed cloth.

According to the clerk of the works, under whose directions the leak was repaired, the material surrounding the leak was still so hot that one could only just touch it, although the current had been switched off for an hour and a half. It was found that the top of the wooden trough had been burnt through, and that a hard substance protruded through the hole thus formed and penetrated to the wire. This substance was so hard that it had to be removed with cold-chisel and hammer, and the workmen, to their surprise, caused big sparks during the operation. They also got rather burnt under the finger nails and on the face by flying chips of the evidently strongly alkaline material. The hard lump had been formed round the negative wire, but the metal was not at all corroded, neither had the insulation of the neighbouring positive wire been affected. The substance removed from the leak was collected, and the engineer, Mr. A. J. Wilson, who had been much struck by its curious properties, asked me to investigate it.

The pieces brought me were dark grey in colour, very hard, very deliquescent, and strongly alkaline. If treated with a little water, small yellow or lavender flames were formed by bubbles of hydrogen catching fire. The mass evidently contained free alkali metal; in fact, on breaking a piece of the hard substance, the crevices in the interior were found to be filled with bright liquid metallic globules, evidently a liquid alloy of sodium and potassium. When these globules came in contact with water they ignited, although the viscous alkaline liquid, with which the lumps of the grey mass soon became covered on exposure to the air, had very little effect on them. Analysis of the hard grey substance showed it to consist chiefly of potassium and sodium hydroxides, with a certain amount of the free metals. There was also a considerable amount of sand from the surrounding sandstone, as well as some silica rendered soluble by the action of the alkali, which must have been nearly fused during the passage of the current. It was quite free from carbonate, sulphate, chloride, &c., neither did it contain any metals other than sodium and potassium. A quantitative analysis gave the following results: KOH, 33·37; NaOH, 32·26; K, liquid alloy 1·00; Na, liquid alloy, ·80; soluble silica, 4·80; sand and earthy matter, 26·36; bitumen and water (by diff.), 1·41; total, 100·00 per cent.

The determination of the free metals was carried out by measuring the amount of hydrogen evolved when a given weight of the substance was decomposed with water in a graduated tube over mercury (·312 grm. substance gave 3·4 c.c. hydrogen at 19° and 470 mm. pressure). Knowing the total amount of potassium and sodium in the substance, the amount of the liquid alloy and its composition can then be calculated. The composition of the alloy, as calculated from the above analysis, is 55·6 per cent. potassium and 44·4 per cent. sodium. According to the researches of Kurnakow(1), such an alloy would be liquid at temperatures above 7° C.

The formation of alkali by the electrolysis of the salts dissolved in surface water is, of course, not very surprising, but the quantity formed in the present case is rather astonishing when it is considered what a very small amount of potassium and sodium salts are present in soils. I had in my possession pieces of the alkaline mixture weighing in all 570 grms., while from what I was told probably not less than 1000 grms. had been formed altogether. The surrounding bitumen for a short distance was also more or less impregnated with alkali.

If the leak had not been discovered, but had been allowed to continue, as often happens in such cases, the alkali would have eventually destroyed the insulation of the neighbouring positive wire and have caused a "short circuit."

The alkali was of course formed by the potassium and sodium first liberated by the electrolysis reacting with water. This must have caused the evolution of a large amount of hydrogen. If this gas had been evolved in any position in which it could have accumulated and have got mixed with air, a violent explosion could quite easily have been caused, either by a light being brought near or simply by a globule of the liquid sodium-potassium alloy coming in contact with water and causing a spark. Many of the explosions in connection with electric light mains, usually attributed to accumulations of coal gas, are very possibly in reality due to hydrogen formed by electrolysis—a suggestion which was first put forward by Mr. Foulger at the Board of Trade inquiry into the explosion which occurred in the conduit of an electric light main in the Euston Road, London, on Dec. 29, 1895.(2)

It seemed pretty certain that the alkali formed in the present case had come from the surrounding soil and sandstone, but as it was just possible that it had come from the bitumen, this was analysed. A piece of the same bitumen as that which had been used in laying the cable gave on ignition 33·2 per cent. of ash, and the amount of alkali extracted from this by boiling with concentrated hydrochloric acid corresponded to 0·18 per cent. potassium oxide and 0·37 per cent. sodium oxide in the bitumen. Now as the total weight of bitumen removed during the repairs, and which might possibly have had its alkali removed, only amounted to about 1200 grms., 6·7 grms. of mixed alkali is the maximum obtainable from this source. However, it is much more likely that none of the alkali had come from the bitumen, for to all appearance this had been very slightly affected. A small amount of potash might likewise have come from the wood of the trough in which the cables were laid, but the amount of this would be still more insignificant than that which could have been derived from the bitumen. It is therefore clear that the alkali could only have come from the surrounding soil.

The sandstone in which the cable was laid was seen under the microscope to consist practically entirely of rounded quartz grains, and, as was to be expected, was found to be very poor in alkali. The alkalis, which were extracted by boiling with concentrated hydrochloric acid, were determined in a piece of sandstone which was obtained from a spot at some distance from the scene of the "earth," so as to avoid any possible contamination with the alkali which had been accumulated there. This sample of sandstone contained only 0·047 per cent. of potassium oxide, and 0·016 per cent. of sodium oxide. The thin layer of surface soil contained a slightly higher amount of alkalis, which were also present in rather different proportions, viz.: 0·056 per cent. of potassium oxide, and 0·055 per cent. of sodium oxide.

Although these quantities are very small, the volume of ground from which they could accumulate was practically unlimited, and the amount of alkali found round the "earth" could all have been obtained from about a third of a cubic metre of the sandstone. Taking the specific gravity of the latter as 2·7, this quantity would weigh 900,000 grms. and would yield 630 grms. of alkali, whereas about 660 grms. were actually formed in the present case. The same amount of alkali could have been obtained from about a fifth of a cubic metre of the surface soil. It will be noticed that the relative proportion of the two alkalis in the surface soil is exactly the same as in the hard alkaline material formed round the "earth." It is therefore probable that the alkali accumulated at the latter had been almost entirely derived from the surface soil, and only to a very slight extent from the underlying sandstone.

It should be mentioned that a few days before the occurrence of the above "earth" the weather had been moderately dry with, however, occasional pretty heavy rain.

Another case of alkali formation.—When I mentioned the above case of electrolysis to Professor Marchant, he told me that he had recently been having some trouble with some of the switches on the basement walls of the electrotechnical buildings of the University of Liverpool. White efflorescences had been forming on these and causing trouble. Professor Marchant gave me some of the efflorescence from one of the switches, and an examination showed that it was simply a mixture of 42·66 per cent. of potassium carbonate, and 12·02 per cent. of sodium carbonate, together with water and a small quantity of alumina and silica. It was only the switches on the negative wires which were thus affected. It is plain that moisture had crept through the walls from the outside soil, and finally on reaching the switch, electrolysis of the dissolved salts had occurred. Potassium and sodium hydroxides had thus been slowly formed, and carbonated by the action of the atmospheric carbon dioxide. The formation of this efflorescence had been noticed for about two months, and by the end of that time it had become so bad that the switch had to be removed and replaced by a new one. It may be mentioned that this switch was placed against a concrete wall which was below the ground level, but tarred on the side in contact with the earth. The ratio of potash to soda is quite different to that found in the case of the workhouse "earth," although the spots at which the two cases of electrolysis occurred are only about 200 yards apart.

It is well known that the insulation of a positively charged wire tends to improve, while that of a negatively charged one nearly always deteriorates.(3) This is due to the phenomenon of "electric endosmose," which drives the moisture (or electrolyte) away from the positive wire and towards the negative wire. This action can be observed in an ordinary electrolytic cell. If the cathode is enclosed in a porous pot, the level of the liquid in the pot gradually rises above the level of the surrounding liquid. This is what is usually observed, but cases are also known in which the effect takes place in the opposite direction. The force tending to drive liquid through such a porous partition is proportioned to the difference of potential between the two sides of the partition, and may be very great.

Insulated wires placed in the soil are subject to similar forces, and, as mentioned above, the insulation of a positive wire improves. Any weak spot in the insulation of a negative wire is, however, soon broken down, and moisture reaching the wire, a leak is started. The insulating material may be regarded as a very slightly porous partition, and in some cases it has been found that leaks may occur without any mechanical break in the insulation, electrolysis also occurring with formation of alkaline liquids under pressure between the insulation and the wire. It appears that on account of this "electric endosmose" about 99 per cent. of the faults which occur on direct current networks occur on the negative wire. At all negative faults alkaline deposits or solutions are formed, and although it is known that these usually contain potash and soda, in only one or two cases do careful analyses of the products appear to have been made. In certain rare cases also the formation of free alkali metal has been observed.

The first record of such a case that I have been able to find is in a letter to the "Electrical World" of July 6, p. 5, 1889, in which an account of an "earth" in Boston, U.S.A., is given. The "earth" in many respects was similar to the one recorded in the present note, for the cable affected was embedded in bitumen and a hard lump was found at the fault, which flashed when wetted.

Another case of the kind does not appear to have been noticed until 1895. In February of that year a serious explosion occurred in Euston Road in one of the conduits of the St. Pancras electric-light system. Major Cardew, during his investigation of the affair for the Board of Trade, found incrustations on some of the insulators supporting the bare copper strips by which the current was carried. These incrustations gave sparks with water, and were found to contain free alkali metal, and from a statement in an editorial note in the "Electrician,"[4] it is plain that a fluid potassium sodium alloy had been formed, as the metal is described as occurring in globules almost as fluid as mercury. As a result of Major Cardew's discovery a committee was formed to investigate the causes of the formation of these alkaline deposits. When the committee inspected the St. Pancras mains (not quite at the place where the explosion occurred), they found an incrustation which flamed on treatment with water, but which in this case contained solid (not liquid) alkali metal. In the

Committee's report is an analysis of the incrustation found on the cables near where the explosion occurred, as follows:—Sodium hydroxide, 7·69 per cent.; potassium hydroxide, 4·88 per cent.; sodium carbonate, 34·40 per cent; potassium carbonate, 52·77 per cent.; also traces of silica, alumina and lime. There appears to have been no free metal in this incrustation at the time of analysis.

Since 1895 numerous cases of alkali metal formation have been noticed, but I have not been able to find any other mention of an occurrence of the fluid alloy, nor any other analysis of the alkaline incrustation.

The second case of electrolysis described in the present note is rather a striking illustration of the respective behaviour of a positively and negatively charged insulated wire in presence of moisture. It was explained how the insulation of the negative switch broke down owing to alkali formation. Now, although the positive switch was placed in an exactly similar position to the negative one, no signs of electrolytic action were shown by it, and although at only a short distance from the negative switch, the leak from the latter did not follow, as might have been expected, the short direct path to the positive terminal, but went a roundabout way to the soil, and then, probably, to some tramway rail several hundred yards away.

Discussion.

The Chairman said it must always be borne in mind that rubber was a very perishable substance, and that, whilst new rubber might be absolutely impervious to water, even under the influence of the current, partially perished rubber might behave like a porous substance. The phenomenon of electric endosmose possessed very great interest. It had found practical application in the patented methods of drying peat by aid of the electric current, and, from what Mr. L. Hargreaves had told him, it was not without influence in the successful working of the Hargreaves diaphragm.

Prof. E. W. Marchant said that the general character of these faults had been known for a considerable time. In Paris and St. Pancras, faults almost identical with those Dr. Bassett had described had come to light, but they occurred in mains laid in earthenware troughs, not in mains laid in bitumen, on what was known as the solid system. The case named by Dr. Bassett appeared to be the first one that had been described with mains laid in bitumen. A recent experiment by F. Fernie, which showed the way in which such faults might be produced, was this:—One of the highly-glazed earthenware tubes that were used for carrying conductors was buried in the ground, the lower end embedded in bitumen, and the upper end about 2 ins. above the level of the ground; a coil of wire was round the outside of the tube, and another round the inside. Water was first poured on the ground round the tube in large quantities, and the tube left for 14 days. The inside remained quite dry, showing that the tube was perfectly water-tight. The two wires were then connected to a lighting circuit of 230 volts pressure the inside being made negative to the outside wire. After an hour or two, drops of moisture appeared on the inner side of the tube, and after two days the tube was half-full of water. On reversing the polarity of the wires, the tube ultimately became quite dry again inside.

That gave a very good idea of the actual force due to endosmotic pressure, which tended to produce faults on a negatively-charged main; it was astonishing that the force was as big as it was.

Of course, the greater number of faults did occur on the negative main. The ratio of faults was something like 100 to 1; for example, in comparing continuous current networks with alternating current networks, wherever there were faults on a d.c. system, they almost always occurred on the negative side. As to the cause of the explosions which sometimes occurred in conduits containing electric mains, he did not think they were often due to the electrolytic production of gas. The amount of leak from ordinary gas-pipes was enormous. The efficiency of a gas system was very low. If the meters of the consumers registered 80–90 per cent. of the amount registered at the station, the gas company considered that they had done pretty well. If there were a spark from any cause independent of electricity, which would ignite that gas, an explosion would occur. In laying cables at the present time, the greatest care was taken to make the pipes as tight as possible, to prevent any gas leaking into them. It was only where there were drawn-in mains with leaky service-boxes that there was risk of ordinary town gas leaking in. With reference to the rubber cables, he had never come across a case in which there was an accumulation of water inside a cable, nor had he ever known a perfectly insulated rubber cable act as a porous substance.

Dr. Bassett, in reply, pointed out that the second case of electrolysis referred to in the paper showed rather clearly the difference between the insulation of a positive and a negative wire, brought about by electric endosmose. The switch affected was the negative one, and a good deal of electrolysis had taken place on it. The positive switch, although placed only a short distance away in an exactly similar position, was absolutely unaffected, and the leak which had caused the formation of alkali on the negative one had taken a very roundabout way, and not the short, direct path between the two switches, as might have been expected.

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[1] J. Russ. Phys. Chem. Soc. (1901), 33, 588; Zeits. anorg. Chem. (1902), 30, 109.

[2] See The Electrician, 34, 308 (1895).

[3] In this connection see an interesting paper, by F. Fernie, in The Electrician, 57, 125 (1906). Several of the statements in the next few lines have been borrowed from this article.

[4] The Electrician, 34, 563 (1895).

London Section.

Meeting held at Burlington House on Monday, January 7, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE DETERMINATION OF INDIGOTIN IN COMMERCIAL INDIGO.

BY CYRIL BERGTHEIL AND R. V. BRIGGS.

Since the communication of our paper on the above subject in June last (this J., 1906, 729), a new method of determination of indigotin has been described by Bloxam (this J., 1906, 735). The method falls under Heads II. and III. of our previous paper (p. 729) (sulphonation of the indigo and volumetric determination of the indigotin by an oxidising or reducing agent), but differs essentially from the methods of these classes previously described, in that a higher degree of sulphonation* is attained by the use of fuming sulphuric acid, and that potassium acetate is used for separating the salt produced, instead of sodium chloride as originally recommended by Rawson (J. Soc. Dyers and Col., 1885, 74). The solution of the salt obtained is titrated either with a solution of potassium permanganate (1 in 1000), and calculation made on the basis that 1 c.c. of permanganate solution is equivalent to 0·002 grm. of indigotin, or with titanium trichloride as described by Knecht (J. Soc. Dyers and Col., 1905, 292). The author claims that, by the employment of his method, pure indigotin can be accurately determined for the first time (p. 740), though he admits that this end can be attained by the use of "the permanganate process" (p. 738), presumably as described by Rawson. It is further claimed that the method is superior to those of the same class published hitherto, in that the impurities are efficiently removed from the solution titrated without loss of indigotin, in which particular the methods of purification by precipitation proposed by Rawson and Grossmann (this J., 1899, 251, and 1905, 308) have failed. It is not evident whereon the author's conclusions are based. His method is standardised on indigotin judged pure by the following criteria :—(*a*) It contains no ash. (*b*) It contains no impurities removable by solvents. (*c*) On analysis, by the method under examination, it yields theoretical figures. It is clear that (*a*) and (*b*) are by no means conclusive proofs of purity, whilst (*c*) is an argument based on the assumption that the method under investigation is correct, and is therefore useless to establish a standard whereby the accuracy of the method is to be demonstrated.

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* The author states that the tetrasulphonic acid salt is obtained; an examination of his figures does not, however, support this conclusion.

We have tested the method on a sample of pure indigotin, prepared as described in our previous paper (*loc. cit*), and containing 10·6 per cent. of nitrogen, corresponding with 99·6 per cent. of indigotin. The details of manipulation have been carried out precisely as recommended by the author, except that we have made the assumption that it is intended that sulphonation should be carried out in a water-oven with the water boiling in the jacket, a point on which the description of the method is not clear. We have found that the results obtained are invariably too low. The following figures were obtained with pure indigotin :—

Indigotin calculated from nitrogen content.	Burette reading.	Indigotin calculated from permanganate, using Bloxam's factor.
per cent.	c.c.	per cent.
99·6	8·40	93·33
99·6	8·45	93·88

The error involved appears to be due to two causes. In the first place, the factor on which the calculation is based is erroneous. This may be shown by its application to a titration of a solution of pure indigotin disulphonic acid, prepared as described in our previous paper (*loc. cit.*). We have shown that if such a solution be titrated with *N*/50 permanganate, and the calculation based on the equality of 1 c.c. permanganate = 0·0015 grm. of indigotin, correct results are obtained. Titration of a solution of disulphonic acid, diluted as recommended by Bloxam, with 1 in 1000 permanganate solution and calculation by his factor. indicated a percentage of indigotin of 97·1, whilst when using *N*/50 permanganate, 99·3 per cent. was indicated, the percentage deduced from the nitrogen content being 99·6. The error cannot be due to the use of the disulphonic acid instead of the more highly sulphonated body, since the equality between indigotin and permanganate is clearly independent of the composition of the salt of indigotin dealt with. From a consideration of these figures it is evident that the relationship between the result obtained by Bloxam's method and an accurate result is as 99·6:97·07, so that multiplication of his results by 1·026 should lead to accuracy. if the method involved no further error than that of the factor used.

The factorial error may be demonstrated in another way. If a sample of pure indigotin is sulphonated as recommended by Bloxam, and an aliquot part of the solution, diluted as described, titrated with 1/1000 permanganate (without salting out), and calculation made on the basis of 1 c.c. of permanganate = 0·002 grm. of indigotin, a result corresponding to 98·45 per cent. of indigotin is obtained. If this same solution be diluted as recommended by Rawson, titrated with *N*/50 permanganate, and calculation made by his factor, a result corresponding to 101·2 per cent. of indigotin is obtained. The excess over the truth in the latter case is explained by the presence of sulphur dioxide in the solution titrated. We have not found it possible to obtain a sample of fuming sulphuric acid free from sulphur dioxide, and it has a considerable action on permanganate. We have found the error due to this cause to correspond to 1—2 per cent. of indigotin in four samples examined. The samples were in each case treated precisely as in the course of an indigo analysis by Bloxam's method, except that titration was performed with *N*/50 permanganate solution, and Rawson's factor applied.* In the particular case under discussion the error amounted to 1·65 per cent. If allowance is made for this error, the result obtained by *N*/50 permanganate approaches very nearly to the truth. On the other hand, a similar deduction will bring the result obtained by Bloxam's method still further from the truth; but if, after making the deduction, the result be multiplied by 1·026, which we have shown in the previous case is necessary in order to allow for the factorial error, a result showing 99·3 per cent. of indigotin is obtained, which is very nearly correct. This error, due to sulphur dioxide, is, of course, eliminated by salting out as recommended by Bloxam, and therefore does not occur if the method be carried to a conclusion as described by its author, but this process was clearly unnecessary in the experiments described above, since no impurities were present, and, further, its employment leads to a second error which would complicate the results. This error is due to loss of indigotin, which invariably occurs in salting out and filtering the sulphonic acid salt.

It is evident from a consideration of the figures obtained by an application of the method to pure indigotin (*vide supra*), that the results cannot be brought into line with the truth by multiplication by the figure 1·026, which we have shown will correct the error in the factor employed, an average result of 96 per cent. of indigotin, still 3·6 per cent. lower than the truth, being obtained by this operation. Loss of indigotin must, therefore, take place during the process, and we have shown this to occur during salting out and filtration by the following experiments :—

A number of indigos were sulphonated, salted out, and redissolved, in the manner recommended by Bloxam, the solutions were made up to 200 c.c., and an aliquot part titrated with *N*/50 permanganate solution. One hundred c.c. of these solutions were then salted out again, dissolved, and made up to volume, and titrated as before. The results are expressed by calculation to the percentage content of indigotin in the original solutions; the differences indicate the losses which have taken place during the salting-out and filtering operations.

	Indigotin in solution, calc. from first titration.	Indigotin in solution, calc. from second titration.	Losses during salting out and filtering.
	per cent.	per cent.	per cent.
I.	46·2	41·4	4·8
II. ...	56·4	51·3	5·1
III. ..	66·0	61·8	4·2
IV. ..	73·2	66·9	6·3
V. ...	78·0	72·0	6·0
VI. ..	90·6	86·4	4·2
VII. .	93·6	88·8	4·8

These figures show that a very considerable loss of indigotin occurs. The filtrates are of a light blue colour when dealing with pure indigotin, the colour probably representing not more than 0·5—1·0 per cent. of indigotin in solution, so that it would appear that the concentrated solution of potassium acetate used for salting-out has an action upon the sulphonic acid. a theory which is borne out by the fact that the filtrates become rapidly lighter in colour on standing, and finally lose their blue colour entirely. This may perhaps account for Bloxam's statement that the loss in the filtrates amounts, under favourable conditions, to one part of indigotin in three million of water.

In the following table we have summarised the results obtained by an application of Bloxam's method of analysis to a series of indigos, with and without the use of the factorial correction, and by the method described by us in our previous paper (*loc. cit.*). We have also shown the result of titrating the solution obtained by Bloxam's method with $N/50$ permanganate and calculation by Rawson's factor.

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* The presence of sulphur dioxide in fuming sulphuric acid throws considerable doubt on the results obtained by Bloxam in determining the conditions under which sulphonation may be effected without loss of indigotin (p. 737); it would have invariably led to too high results unless the salts obtained were crystallised out, in which case another error is involved.

	Titration with 1/1000 permanganate.		Titration with $N/50$ permanganate.		Loss in Bloxam's method due to salting out and filtration.
	Calc. by Bloxam's factor.	Calc. by Bloxam's factor corrected.	Calc. by Rawson's factor.	Sulphonation and calc. by the authors' method.	
I. ...	69·85	71·66	72·0	77·1	5·4
II ..	67·1	68·8	68·4	72·6	3·8
III .	51·6	63·2	63·6	66·0	3·8
IV .	56·1	57·5	57·6	58·2	0·7
V. ..	53·9	55·3	55·2	60·0	4·7
VI .	24·475	25·1	24·5	26·7	1·6
VII	91·3	93·67	93·9	95·7	2·03
VIII.	94·05	96·49	96·3	99·3	2·81

The table shows that the application of the factorial correction to the figures obtained by Bloxam's method brings the results into very close agreement with those obtained by titrating the same solutions with $N/50$ permanganate and calculation by Rawson's factor. The differences, however, between the results so obtained and those derived by the method previously described by us are very considerable, and bear no constant relationship to the purity of the indigo under examination. We have shown that these differences are to be accounted for by losses which occur in salting out and filtration.

The method dealt with in Bloxam's paper does not therefore appear to be reliable as it stands, either in application to pure indigotin or to commercial indigo, so that conclusions drawn from its application to questions of indigo manufacture are valueless. Apart from its inaccuracies, the method is cumbersome and quite inapplicable to work in the indigo districts of India (for which its author designs it), owing to the low temperatures at which it is necessary to work, and the large amount of ice required for this purpose.

Since the foregoing paper was written, a communication has been made by Orchardson, Wood, and Bloxam on the same subject (this J., 1907, 4). These authors state that, by the employment of the method of analysis described by us (this J., 1906, 729), they have obtained results with pure indigotin showing a content of 112—113 per cent., and conclude that our standard indigotin must have attained a purity of only 95 per cent., and have thus given rise to an incorrect factor. This result is obtained by titrating a solution of the sulphonated indigotin at a concentration of 1 in 1000, and it is pointed out that if the solution be diluted to 1 in 5000, results showing a content of 105—106 per cent. are obtained, and that further dilution leads to no lower result.

Had the authors examined the conditions holding when the solution is diluted to the extent recommended by Rawson, and adopted by us in determining the validity of his factor (p. 730), viz., 1 in 10,000, they would not have found this to be the case. We have repeated the titrations of our pure indigotin under each of these conditions of concentration, and, by calculation from Rawson's factor (1 c.c. $N/50$ permanganate = 0·0015 grm. indigotin), have obtained the following results:—

Concentration.	Indigotin per cent. found.
1 in 1000	111·72
1 in 5000	105·25
1 in 10,000	99·96

The results at 1 in 1000 and 1 in 5000 agree substantially with those found by Bloxam and his co-workers. The concentration 1 in 10,000 has been established by Rawson; we have found it correct, and our method does not seek to modify it: we have only dealt with the questions of sulphonation, and purification of solutions of impure indigos.

It is remarkable that, in criticising our method, Bloxam and his coadjutors do not comment upon our method of establishing the purity of our standard by its nitrogen content (p. 731) nor give any indication of the method by which their own is verified. Our attainment of a result indicating 98 per cent. with the B.A.S.F. "indigo pure" of 1898 (p. 731) is unexplained by them, as also is the very close agreement obtained by us between the permanganate method with our modifications and other methods depending on entirely different principles (p. 734).

Other controversial matters raised by Bloxam and his co-workers are undergoing further investigation.

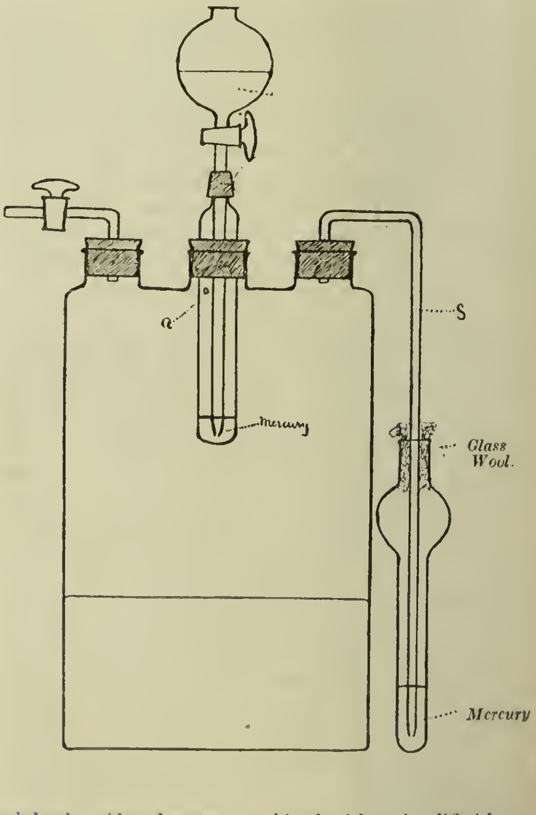
Meeting held at Burlington House on Monday, February 4, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

APPARATUS FOR THE SUPPLY OF CARBON DIOXIDE IN THE DETERMINATION OF NITROGEN IN ORGANIC COMPOUNDS BY THE ABSOLUTE METHOD.

BY G. YOUNG, PH.D., AND B. CAUDWELL, B.A., B.SC.

We have used for some time Blau's method of adding a concentrated solution of potassium carbonate, sp. gr. 1·45—1·5, to a mixture of equal volumes of concentrated sulphuric acid and water, combined with a simplified form of Thiele's gas evolution apparatus (Annalen, 1899, 253, 242), which can be put together in a few minutes from ordinary laboratory glass (Fig. 1). It differs from Thiele's apparatus in the design of the mercury trap and of the safety tube, the working of which requires little explana-



tion. The potassium carbonate solution is filled into the bulb of the dropping funnel, and, the tap being opened, runs down into the trap, then rising through the outer tube passes through the small hole, *a*, Fig. 2, and finally drops into the acid in the Woulff's bottle. Once the stem of the funnel and the mercury trap are filled with the solution the tap is regulated so that the potassium carbonate flows into the acid as required. Should the tap or the delivery tube be closed suddenly or the evolution of the gas become too violent, the excess of carbon dioxide escapes by way of the safety tube, *s*, Fig. 1. The air is driven out of the apparatus completely by dropping about 100 c.c. of the carbonate solution into the acid, after which a current of almost pure carbon dioxide is obtained. In a long series of experiments we have found that the carbon dioxide formed in this manner does not contain 0·1 c.c. of air per 5 litres. The gas issuing from the Woulff's bottle is almost dry, and if passed through two sulphuric acid drying tubes does not cause any increase in the weight of the second.

It is of course necessary in using any such apparatus to take care that the pressure in the nitrometer is not reduced so far as to draw air through the safety tube. With this note of warning, the method can be highly recommended not only for its accuracy and convenience, but also because the rate of evolution of the carbon dioxide is well under control, so that, with a little practice, it can be varied rapidly from the production of a veritable torrent of gas to that of the most gentle current. If the apparatus be set up with a Woulff's bottle of 2—3 litres capacity, and charged with about 800—1200 c.c. of the diluted sulphuric acid, it requires cleaning out and refilling only after a long series of "nitrogen combustions."

Following are references to the literature of the subject: Dumas, Ann. chim. phys, 1831 [ii], **53**, 171. Henry and Plisson, J. d. Pharm., 1830, **249**. Erdmann and Marchand, J. pr. Chem., 1838, **14**, 213. Melsens, Compt. rend., 1846, **20**, 1437. Erdmann and Marchand, J. pr. Chem., 1846, **37**, 150. Simpson, J. Chem. Soc., 1853, **6**, 289. Schiff, Zeits. anal. Chem., 1868, 430. Thudichum and Wanklyn, J. Chem. Soc., 1869, **22**, 293. Ilinski, Ber., 1884, 1349. Groves, J. Chem. Soc., 1880, **37**, 500. Ludwig, *ibid.*, 1880, **38**, 679. Zulkowsky, Ber., 1880, 1096. Gehrenbeck, *ibid.*, 1889, 1694. Kreusler, Z. anal. Chem., 1885, 438. Bernthsen, *ibid.*, 1882, 63. Hufschmidt, Ber., 1885, 1441. Holland, Chem. News, **18**, 1. Johnson, *ibid.*, **50**, 191. Kehrmann and Messinger, Ber., 1891, 2172. Blau, Monatsh., 1892, 277. V. Miller and Kiliani, Kurzes Lehrbuch d. anal. Chemie.

New England Section.

Meeting held at Boston, on Friday, December 7, 1906.

MR. F. E. ATTEAUX IN THE CHAIR.

A COMPARISON OF APPARATUS FOR TESTING THE LIABILITY OF OILS TO PRODUCE SPONTANEOUS COMBUSTION.

BY AUGUSTUS H. GILL, PH.D.

THE object of this paper is to compare the results obtained by apparatus designed by Ordway and Mackey for testing the liability of oils to produce spontaneous combustion. Ordway's apparatus[‡] consists of a horizontal air-jacketted cylinder 4 ins. in diameter and 18 ins. long, in which the oil is heated to a temperature of 100° C. on a ball of cotton waste in a gentle current of air, and compared with a blank of unoiled waste kept at 100°, and at an equal distance from the source of heat. In Mackey's apparatus[§] the cotton is heated in a vertical water-bath in a wire gauze cage 1½ ins. in diameter and 6 ins. long, also in a gentle current of air. The ratio of oil and cotton waste in the Ordway apparatus is 50:50, and in the Mackey, 14:7. The latter apparatus has the advantage that the temperature is perfectly even, 100° C., and that the draught of air is certain, of definite quantity, being produced by tubes of definite size and height, and that the waste is confined in wire cages of definite shape. The Ordway apparatus is in use in America, and the Mackey apparatus in England, and coming into use in America. Besides these two, another was constructed on the Ordway plan. This consisted of a 4-in. tube, jacketed with water, and heated by a flame until 15 lb. pressure was obtained, giving to the blank a temperature of 100°; the cotton waste was confined in wire gauze cages, and, after the temperature had reached 125°, a blast of air at a pressure of 7 lb. was blown through the apparatus at the rate of 0·4 cb. ft. per minute. These changes had the effect of making the apparatus and method more precise, definite, and easy of application; it will be designated as the "new apparatus." The method of manipulation was that described in the writer's "Short Handbook of Oil Analysis," and Lewkowitsch's "Analysis of Fats, Oils and Waxes." The results of the tests are shown in the accompanying table.

Comparison of the various apparatus for the spontaneous combustion test of oils.

Oil.	Mackey apparatus.		Ordway apparatus.		New apparatus.	
	Temp.	Time.	Temp.	Time.	Temp.	Time.
	° C.	mins.	° C.	mins.	° C.	mins.
Olive, containing 5·3 per cent. of free fatty acid; iodine value, 85·4	234* 230	130 130	222 150	180 300	186 196 221	205 190 260
Lard, containing trace of free fatty acid; of iodine value 75·2	234* 234*	80 75	200 215	150 290	192 197 220	185 230 220
Elaine	—	—	178†	165	195	360
Oleic acid of iodine value 60·5	113 158	150 198	178 275	120 190		
Cottonseed, practically neutral; iodine value 108·9	234* 234*	70 75	186 200	135 280	200 198	225 265
Linseed, practically neutral; iodine value 168·1	234* 234*	65 75	160 218	120 240	201 192	165 130
25° Paraffin; iodine value 16·2	97	135			102	280

* This was as high as the thermometer furnished with the apparatus would read; other temperatures represent the maximum temperatures attained.

† Not the same sample as the others. Other figures were: 200° in 150 mins., 174° in 180 mins., 201° in 120 mins. 211° in 195 mins.

[‡] "Technology Quarterly," 4, 346.

[§] This J., 1896, **15**, 90.

The temperature given is the highest reading of the thermometer, and, to show the actual rise due to the oil, should be diminished by 100°.

The Mackey apparatus gives the most concordant results in the shortest time, followed by the "new apparatus," and this by the Ordway apparatus. The widest discrepancy is shown with elaine oil, but as an oil which in Mackey's apparatus exceeds 100° in one hour is dangerous,* there is no fear that a dangerous oil will be passed by it. The sample of elaine oil tested by the Ordway apparatus was interesting from the fact that it had occasioned a large amount of damage to white woollen yarn on bobbins stored in the grease. On opening the cases containing it, a few months after spinning, they were found to be in various stages of charring, from a light brown to a full black, due to the oxidation of the oil. Had the cases not been closed and the air thus shut out, fire by spontaneous combustion would have undoubtedly occurred. In view of these tests the use of the Ordway apparatus may well be abandoned in favour of the Mackey apparatus, which practically leaves little to be desired.

Another use to which the apparatus can be put with very good results is that of the detection of the adulteration of olive oil with a semi-drying oil, as, for example, rape. Any considerable quantity of the latter will manifest itself both by a rise in temperature, and by the shortness of the time of that rise.

In conclusion, I wish to acknowledge the services of Messrs. Mitchell and Tufts, by whom the analytical results were obtained.

Nottingham Section.

Meeting held at Derby on Wednesday, January 23, 1907.

MR. J. T. WOOD IN THE CHAIR.

USE OF STANDARDISED AMMONIA SOLUTION IN ACIDIMETRY.

BY F. J. R. CARULLA.

The volatile nature of ammonia constitutes so obvious an objection to its use as a standard solution in volumetric analysis that one may well wonder how it came to be employed for the purpose. Nevertheless, when properly used the advantages of ammonia solution are sufficiently great to merit all Dr. Fleischer's recommendation. ("Volumetric Analysis," trans. by Pattison Muir, 1877, pp. 34 and 35.) Sutton in his "Volumetric Analysis" has a paragraph on semi-normal ammonia, also recommending it. (1886, 5th Edition.) But R. Rempel (Zeits. f. angew. Chemie of 1889; this J., 1889, p. 820) shows that a solution of semi-normal ammonia may lose nearly one-quarter of its strength in five minutes when exposed to the air in a shallow porcelain basin at ordinary temperature. Twenty c.c. of such a solution were saturated by 7·75 c.c. of normal acid instead of the 10 c.c. that should have been required.

Rempel's article has much value as a warning against other possible sources of loss. Seeing therefore that india-rubber stoppers are so much employed, being frequently indispensable, and in all cases when they can be used, far more convenient than glass, it seemed important to ascertain if any loss of strength occurred through their agency.

Mitchell long ago showed that a sheet of caoutchouc is rapidly penetrated by ammoniacal gas. The results of his researches as detailed by Gmelin (Handbook of Chemistry, Vol. I, p. 25) are, to say the least, disquieting to anyone who has to deal with ammonia and uses india-rubber in any part of his apparatus, for ammoniacal gas was found to be the one which went through in the quickest time.

It was found that the same volume of the gases named obtains access to the air through a sheet of caoutchouc in the times stated:—Ammoniacal gas in 1 minute, sulphuretted hydrogen in 2¼ minutes, carbon dioxide in 5½ minutes, hydrogen in 37½ minutes, oxygen in 1 hour 53 minutes, carbon monoxide in 2 hours 40 minutes.

The following experiments were consequently instituted to ascertain what risk of loss of strength is incurred by the use of rubber stoppers for the vessels containing the semi-normal ammonia solution.

About 2 litres of this solution was prepared, so that 20 c.c. exactly neutralised 10 c.c. of normal hydrochloric acid, using methyl orange as the indicator, and the operation being conducted at 15° C.

About 100 c.c. of this semi-normal ammonia solution at 15° C. were introduced into a 200 c.c. flask, which was then closed by a red rubber stopper, carrying a thermometer which reached into the liquid. The solution was then violently shaken by hand for fully 5 minutes, care being taken that the temperature was maintained at 15° C. A 50 c.c. burette graduated in one-tenth of a c.c. was then filled with the solution that had been shaken, and 10 c.c. of normal hydrochloric acid titrated therewith (titration No. 1). All the remnants of the standard solution of ammonia were returned to the stock vessel, and another 100 c.c. taken out, introduced into the shaking-flask, and closed with the india-rubber stopper carrying the thermometer. The solution was warmed to 20° C., and the shaking repeated as before for 5 minutes. The shaken solution was cooled down to 15° C. while still in the closed flask, introduced into the burette, and 10 c.c. of normal acid again titrated (No. 2). The same operation was gone through with other similar quantities of about 100 c.c. of semi-normal ammonia, warming them up to 25° C. and 30° C. (Nos. 3 and 4). Finally, the strength of the solution in the Winchester was again checked (No. 5). The following were the results obtained:—

Titration No.	*N*/2 ammonia solution shaken at	c.c. required for 10 c.c. *N*/1 acid.
	°C.	
1	15	20·05
2	20	20·20
3	25	20·10
4	30	20-15
5	Not shaken	20·10

It is evident from the above results that the *N*/2 ammonia solution suffered no appreciable loss of strength, but as it might be said that the shaking was precisely what should not be done to prove the permeability or otherwise of the rubber stopper by the ammonia vapours, as the shaking might cause rapid re-absorption rather than evolution of vapours, a further set of experiments was made. In this case the approximate quantity of 100 c.c. of semi-normal ammonia was introduced into the thermometer flask, well closed with the rubber stopper, and kept without shaking at the temperature stated for 10 minutes. The solution was then cooled to 15° C., poured into the burette, and 10 c.c. of normal acid titrated in each case with the results shown (Nos. 6, 8 and 10). A check test of the stock solution was made after every experiment in this series (Nos. 7, 9, 11 and 12).

Titration. No.	*N*/2 ammonia solution kept for 10 mins. at	10 c.c. of *N*/1 acid required of ammonia solution that had been heated	Titration. No.	Check test of stock *N*/2 ammonia solution.
	°C.			
6	30	20·2	7	20·1
8	35	20·1	9	20·1
10	40	20·15	11	20·2
—	—	—	12	20·1 (repeat)

It cannot be said that there was here any loss of strength, especially in view of the fact that as the temperature in the flask rose, the stopper was loosened once or twice to relieve the pressure.

Another series of tests was made to find out if the stock Winchester of *N*/2 ammonia solution underwent any appreciable loss if kept closed with an india-rubber stopper. The following aro the daily results during a week :—

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* Later directions say 200° in two hours.

Titration No.	Day.	10 c.c. $N/1$ acid required for neutralisation.
13	Wednesday	20·15 of $N/2$ NH_4O
14	Thursday	20·075 ,,
15	,, (repeat)	20·10 ,,
16	Friday	20·25 ,,
17	,, (repeat)	20·10 ,,
18	Monday	20·20 ,,
19	Tuesday	20·20 ,,
20	Wednesday	20·20 ,,
21	,, (repeat)	20·30 ,,

No one could assert from the above that the semi-normal ammonia solution had lost any strength, the ordinary errors of manipulation sufficing to account for the differences obtained. For instance, the 20·25 of Friday (T. No. 16) was due to minute leakage at the glass cock of the burette between the barrel and the plug. The personal equation which will vary in the same individual on different days, probably explains why the solution, which was made accurately semi-normal, was found to be weaker throughout the experiments, 10 c.c. of normal acid being on an average neutralised by 20·1 c.c. of the semi-normal ammonia.

It so frequently happens that, when pressed for time, one is tempted to titrate warm solutions, that it was thought desirable to ascertain the errors that might arise from such a practice. It would be reasonable to expect that the thin stream of ammonia issuing from the burette and passing through the warm vapour above the liquid being titrated, might, when this is hot, occasion serious loss. Surprising to say, no such loss appears to occur, as is shown by the following experiments.

A series of 10 c.c. of normal acid was titrated in a 500 c.c. conical flask, at rising temperatures, the $N/2$ ammonia, in all cases except the two last, being run in a stream for the first 19 c.c., the remaining c.c., and up to saturation, being fed in single drops. In the two last experiments (titrations Nos. 33 and 34) the $N/2$ ammonia solution was run in single drops from the beginning. The end temperature after titration being noted, the results are shown in the table :—

Titration No.	10 c.c. of $N/1$ acid titrated at	Required c.c. of $N/2$ ammonia.	End Temp.
	°C.		°C.
22	20	20·20	19
23	25	20·30	22
24	30	20·10	26
25	35	20·29	31
26	40	20·15	36
27	45	20·20	40
28	50	20·20	44
29	55	20·20	48
30	60	20·20	53
	Flask broke, new one obtained.		
31	65	20·30	57
32	70	20·30	60
33	70	20·35	53
34	104	20·40	77

Up to 60° temp. (titrations Nos. 22—30) the titration was conducted in a conical flask with a somewhat wide mouth. Those at 65° to 104° (titrations 32 to 34) were made in an ordinary globular flask with the usual neck, the mouth being narrower than that of the conical flask that was accidentally broken. The test was a crucial one, especially with titrations 33 and 34, each of which lasted quite three minutes, the $N/2$ ammonia solution being added in single drops. There is certain proof here that no material loss of ammonia is sustained by the titration of hot solutions in a flask. Titration No. 34 was made on Jan. 23, when the barometer was abnormally high, exceeding 31 inches, that is nearly 790 mm.

A critical observer may possibly note a slight loss of strength in the semi-normal ammonia in the last experiments when compared with the former ones made two or three days before. The heat employed must tell, even though it be only to a small extent. Such a solution, however, after being made accurate, must become weaker in the course of time, and, as is well known, this is difficult to rectify—unlike bringing down the strength, which is an easy matter. The resort to a factor and to logarithms is necessary if great accuracy in the result is desired.

It need only be added in conclusion that there is no cause for alarm in the use of ammonium hydrate as a standard solution in acidimetry, if it be used with an intelligent knowledge of its properties, and, when the very few difficulties in the way are mastered, the solution is so pleasant to work with that the analyst will come to regard it as a favourite one.

Discussion.

The Chairman asked whether the high boiling temperature (titration No. 34) was not due to the liquid being other than water. He also thought there might be a loss of strength on boiling hydrochloric acid, which was volatile.

Mr. John White questioned the sensitiveness of methyl orange as an indicator for boiling solutions. He had found it quite useless for hot solutions of boric acid.

Mr. Carulla, in reply, said that in all the hot titrations (Nos. 22 to 34) about 100 c.c. of distilled water had been raised to the required temperature, the 10 c.c. of normal acid added, and the mixture just warmed enough to restore the lost heat. The temperature of the pure distilled water was therefore always observed. Loss of strength of the acid solution might have been possible if much stronger, but a centinormal solution of hydrochloric acid, such as these approximately were, could be boiled for a considerable time without any loss by volatilisation. He had found methyl orange a perfect indicator for a centinormal solution of this acid up to 77° C., the end temperature of No. 34 titration. Of course it might be quite untrustworthy with other substances.

Obituary.

FERDINAND FRÉDÉRIC HENRI MOISSAN.

Moissan was born in Paris on Sept. 28, 1852, and at an early age developed an interest in chemistry. He was educated at Meaux, a small provincial town near Paris. His first years of special study were divided between the laboratory of Déhérain (Grignon School of Agriculture), and that of Frémy (Muséum d'Histoire naturelle). He took his B.Sc. in 1874, and his licentiate degree (Physical Science) in 1877, but continued his studies till 1879, when he qualified at the Paris High School of Pharmacy, and having obtained his "first-class" Diploma, became attached to tho official staff as "maitre de conférences et chef de travaux pratiques de Chimie." Next year (1880), he graduated as D. ès Sc., and in 1882 he qualified as "assistant professor of phyisco-chemical sciences." Five years later (1887) just after his memorable isolation of fluorine, Moissan was appointed to the Chair of Toxicology.

When assistant to MM. Decaisne and Déhérain, he published in conjunction with Déhérain a "study of the absorption of oxygen and emission of carbon dioxide by plants kept in a dark room." In 1877 a series of papers was prepared by him on the oxides of the metals of the iron group. This work was collected and presented in 1880 as a thesis for the D. ès Sc. degree. This research considerably extended our knowledge of the reduction products of the oxides of iron, manganese, nickel, and chromium. From 1879 to 1883 Moissan devoted himself chiefly to the study of the chromium compounds, notably the chromous salts, and perchromic acid. It was in the laboratory of Debray, and with the active encouragement of Troost and Friedel, that he commenced his investigation of fluorine, which in 1886 culminated in its isolation, a problem the solution of which had already baffled the efforts of Davy, Faraday, and Fremy. In 1897 Moissan, in conjunction with Dewar, liquefied fluorine at the Royal Institution. The construction of an apparatus of copper in 1899, to replace the costly platinum vessels hitherto employed, simplified the preparation of the element, and the discovery that dry fluorine freed from vapours of hydrogen fluoride does not attack glass served in recent years to facilitate the investigation of its properties. Moissan's chief reason for relinquishing the study of fluorine for his high temperature researches (in 1893), appears to have been the desire, long entertained, to solve the mystery of the origin of the diamond. Induced by his study of the decomposition of the fluorides of carbon, which he hoped would lead to the preparation of a crystallised form of carbon, he examined the properties, and more especially the ash, of diamonds from many sources, and was led to investigate the action of high temperatures upon various forms of carbon, and the separation of the element from fused metals, whilst the examination of the Cañon Diablo iron gave him the final hint. He made a solution of carbon in fused iron, which he then cooled by plunging it into cold water; the enormous pressure on the still molten interior of the mass resulting from the solidification of the exterior caused the carbon to separate partly in the form of minute diamonds. The experiments were in after years repeated with still greater precautions, the result being the confirmation of the earlier work. In electric furnace work, Moissan's pre-eminent position is due not to the design or discovery of a special form of furnace, but rather to the skill with which he investigated in detail a number of individual chemical reactions. In 1893, he succeeded in fusing metallic chromium, and isolating many compounds of tungsten and molybdenum; whilst more recently, he has described methods of preparing iodine pentafluoride by the direct action of fluorine on iodine; also sulphur hexafluoride, directly confirmatory of the sexavalence of sulphur. Moissan's preparation of chromium, tungsten, molybdenum, uranium, titanium, and other metals in a fused form and high degree of purity has greatly enriched our knowledge of the chemical and physical properties of those elements. Observing by chance the formation of calcium carbide around the carbon electrodes, in his early furnace experiments, he was led to discover and determine the conditions of formation, nature, and properties of a large number of metallic carbides, borides, and silicides, most of them up to that time absolutely unknown, or, like the metals already mentioned, only obtainable as fragmentary and impure specimens. As a lecturer he was distinguished by his brilliant exposition of the subject, as well as by his skill in experimental demonstration.

In 1891 Moissan was elected Chairman of the Paris Society of Pharmacy, and in 1899 was nominated Professor of Inorganic Chemistry at the High School of Pharmacy. Elected to the Academy of Medicine in 1888, and to the Academy of Sciences in 1891 to fill the chair left vacant by the death of Cahours, he was, in 1895, called to replace Pasteur on the Seine Hygienic Council, and in 1898 became member of the Consultative Committee of Arts and Manufactures. Moissan was President of the International Congress of Applied Chemistry in 1900, and was promoted in the same year to the Commandership of the Legion of Honour.

In 1896 the Royal Society awarded Moissan the Davy medal, and in 1903 the first Hofmann medal was conferred upon him, jointly with Sir William Ramsay, by the Berlin Chemical Society.

He died on Feb. 20, 1907.

NIKOLAI ALEXANDROWITSCH MENSCHUTKIN.

N. Alex. Menschutkin was born in St. Petersburg, Oct. 24, 1842. He passed through the curriculum of the German St. Petrischule, and subsequently the physicomathematical faculty of the St. Petersburg University, where he also studied chemistry under Professor N. N. Sokoloff, the founder of the first chemical periodical and of the first chemical laboratory in Russia. In the year 1863, Menschutkin proceeded to Germany in order to work in the laboratories of Strecker and Kolbe, and thereafter to France, to study under Wurtz. On his return to St. Petersburg he presented and defended his dissertation, "On the non-replaceable hydrogen of phosphorous acid," and in 1866, he was made lecturer, and twelve years later, professor, in the St. Petersburg University. Whilst at that time Mendeléeff lectured on inorganic chemistry, and Butlerow on organic chemistry, Menschutkin supervised the branch of analytical chemistry. After Butlerow's death in 1886, he was appointed to the Chair of Organic Chemistry. Menschutkin acted also as President of the Chemical Department and Laboratory of the University. On the establishment of the Polytechnikum he received the professorship and became besides the "Dekan" of the Metallurgical Section. Menschutkin is best known through his excellent "*Lehrbuch der analytischen Chemie*," which first appeared in 1871, and since that year has passed through ten editions, and many translations. This work differed from the usual text books by its lucid and truly philosophical exposition of the principles of analytical chemistry.

Amongst his most important researches which affect chemical technology are the following:—"The influence of the isomerism of alcohols and acids on the formation of ethers." This won for him in 1877, the Sokoloff prize of the Russian Chemical Society; a series of researches on the "Etherification of primary, secondary, and tertiary alcohols and phenols"; "The influence of isomerism of the alcohols and acids on the formation of esters," &c.

N. Menschutkin died Feb. 4, 1907.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8d. each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
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French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, & MACHINERY.

(Continued from page 142)

English Patents.

Separator bowls; Centrifugal ——. Aktiebolaget Separator, Stockholm, Sweden. Eng. Pat. 26,085, Nov. 17, 1906. Under Int. Conv., Dec. 16, 1905.

The claim is for the provision of a loose, hollow shell or sleeve, which surrounds the spindle where it projects into the central feed-tube of the centrifugal machine. When this sleeve is removed, the inner surface of the central-feed tube and the slots by which it communicates with the drum can be bored out and polished by suitable tools. The interior surfaces can consequently be made quite smooth, with the result that they can be easily kept clean.—W. H. C.

Pipes; A method of forming a protective lining on the interior surface of ——. N. G. van Huffel, Utrecht, Holland. Eng. Pat. 2435, Jan. 31, 1906.

THE interior surface of the metal pipe is coated with a layer of linseed oil lacquer about 0·1 mm. thick, and the film is then very rapidly dried and hardened by passing a current of air heated to about 140° C. through the pipe. The lacquer hardens in from two to four hours, and then forms a layer which is unaffected by ordinary water, carbon dioxide, or other gases, or by the ordinary salts found in such water. It will also stand heating to a temperature of about 260° C., so that pipes can be joined with soft solder. The varnish, which is stated not to be "broadly new," is made as follows:—Demarara copal is dissolved in a mixture of turpentine with about 75 per cent. of linseed oil; this mixture is then heated for some time to a temperature of over 100° C., when it forms a lacquer which is perfectly fluid at ordinary or moderate temperatures.—W. H. C.

Shaft-furnaces or kilns. J. Berretz, Breinig, Germany. Eng. Pat. 18,405, Aug. 16, 1906.

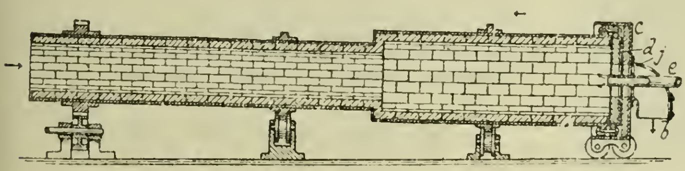
THE claim is for the use of a central grate placed at a considerably lower level than the several side grates of a multi-door, hopper-shaped, shaft-furnace. This arrangement allows the finished burnt material to be removed from the central grate laterally below the side grates. No claim is made for anything covered by Eng. Pat. 10,844 of 1901 (this J., 1901, 1115).—W. H. C.

Evaporating device with a middle chamber withdrawn from the direct heating and having its outlet below into the depositing chamber of the evaporator. R. J. E. von Seemen, Rheinfelden, Switzerland. Eng. Pat. 18,576, Aug. 18, 1906. Under Int. Conv., Aug. 21, 1905.

THE claim is for the provision of an annular chamber closed above but open below, which isolates the central depositing chamber of the evaporator from the surrounding heating space. No circulation of liquid takes places in the annular chamber, the temperature of which can be maintained at any desired point by the introduction of fresh liquid from without. Further, the inner circular wall of the heating chamber is prolonged upwards and outwards above the upper tube-plate as far as the outer wall of the vessel. This forms a funnel-shaped screen, perforated with slots for the upward passage of vapour, which protects the depositing chamber from disturbance. In consequence of these arrangements the contents of the depositing chamber can be maintained in a condition favourable to the deposition of the separated crystals.—W. H. C.

UNITED STATES PATENT.

Kiln; Rotary ——. W. H. Warren, New York, N.Y. U.S. Pat. 839,053, Dec. 18, 1906.



THE claim is for a rotary kiln of the form shown in the figure, with an enlarged portion at the discharge end, which is closed by the double shield, *c*, *d*. The outlet pipe, *j*, *b*, is situated above the floor of the kiln, as shown, so that the material being treated accumulates in a thick layer, to allow of thorough treatment, whilst the treated material is only removed from the upper layer of the accumulation. The gaseous fuel enters by the pipe, *e*.—W. H. C.

FRENCH PATENTS.

Distillation in vacuo; Fractional ——. A. Haeck and J. J. B. Troost. Fr. Pat. 369,675, Aug. 18, 1906. Under Int. Conv., March 15, 1906.

THE process claimed is the application of the method of fractional distillation under vacuum. The condensed vapours are successively withdrawn into a receiver provided with taps so that it may either be isolated, or put into communication with the condensed liquid, with the air, or with the vacuum pump.—W. H. C.

Distillation; Apparatus for ——. Soc. E. de la Brosse et Fouché. Fr. Pat. 370,144, Oct. 1, 1906.

Fig. 1

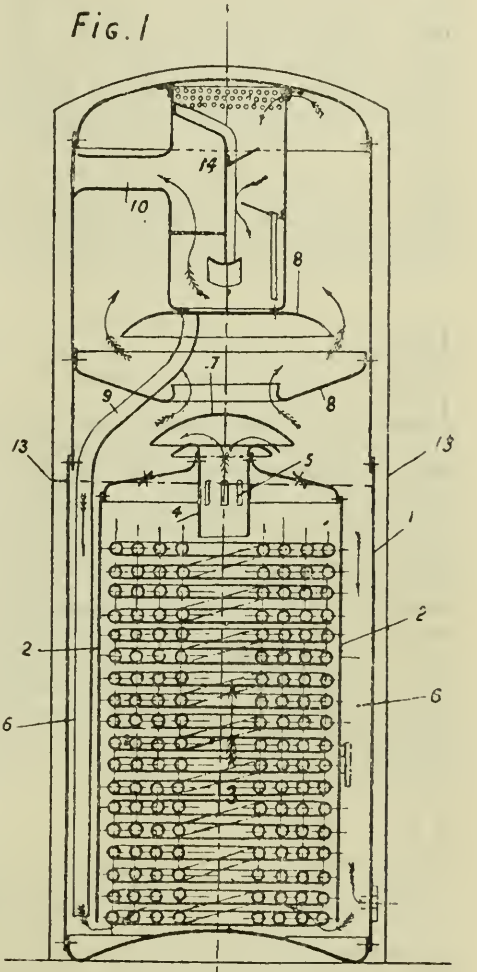
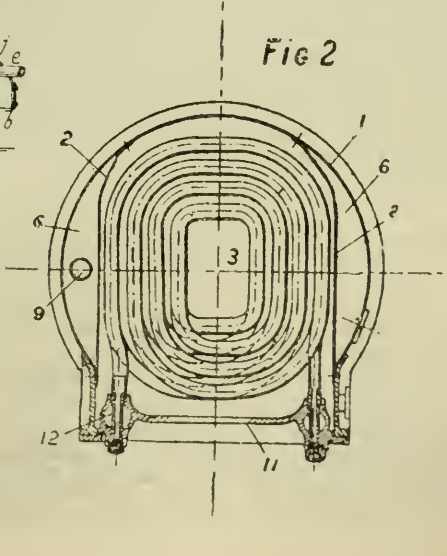


Fig 2



The apparatus consists of a cylindrical vessel or boiler, 1, with an inner chamber, 2, by which it is divided into three compartments, 3, 6, 6, which communicate only at the bottom. The centre compartment, 3, contains a steam heating coil, which is attached to the door, 11, by joints, 12, as shown in Fig. 2, and which can be easily withdrawn for cleaning purposes. The still is filled with liquid to about the level of the dotted line, 13, 13, and steam is admitted to the coil. The vapour formed escapes through the slots, 5, in the pipe, 4, and acts as an ejector withdrawing the liquid from the chamber, 3. The greater part of the liquid is deflected by the hood, 7, flows down the compartments, 6, and returns under the partition, 2, into the centre chamber, 3. The vapour passes upwards, as indicated by the arrows, over the baffles, 8, and enters the purifying chamber, 14, from which it escapes through the pipe, 10, to the condenser. Any drops of liquid carried up by the vapour are separated by the baffles and return to the chamber, 3, either down the compartments, 6, or by the pipe, 9.—W. H. C.

Crystallisation; Process of ——. J. Bock. Fr. Pat. 369,729, Sept. 13, 1906.

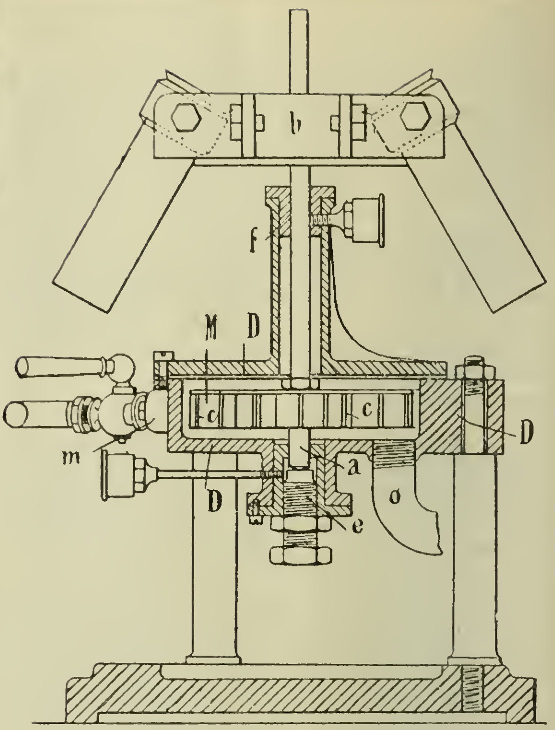
In order to obtain large and perfect crystals by the process of growing small and perfect crystals introduced into a slightly supersaturated solution, it is necessary to avoid the formation of fresh crystals in the liquid. It has been found that the presence of even minute bubbles of air in the liquid favours the production of new crystals. The present invention, which aims at the production of large and perfect crystals in a solution in motion, consists in employing only solutions from which the air has been abstracted, and in allowing the crystallisation to take place in the absence of air. The solutions added to enrich the original one are also deprived of air before addition, and, in order to maintain the liquid in motion and to regulate the speed of growth of the crystals, steam is generated in the liquid by any known means. The whole or part of the vapour generated, is, after liquefying by condensation, returned to the liquid undergoing crystallisation.—W.H.C.

Washing and lixiviation of granular or fibrous materials; Apparatus for ——. W. Fink. Fr. Pat. 369,763, Sept. 14, 1906. Under Int. Conv., July 6, 1906.

The materials are placed in the innermost of two concentric tanks, the outer one of which has unperforated walls whilst the inner has the upper portion of the sides and the conical bottom perforated. The washing liquid is introduced by a system of pipes and valves into the apex of the cone and below the perforated conical bottom of the inner tank; after circulating through the material, it passes out through the perforations in the upper portion of the sides into the annular space between the two tanks, and flows away by a pipe placed near the upper edge of the outer tank.—W. H. C.

Laboratory centrifugal machine driven directly by steam. P. Lequeux. Fr. Pat. 369,765, Sept. 14, 1906.

The head-piece, *b*, carrying the tubes is mounted on a vertical shaft, *a*, to the lower part of which a horizontal turbine-wheel, M, is keyed. The wheel is provided with curved vanes, *c*, and is enclosed in a casing, D. The shaft, *a*, is supported by an adjustable footstep, *e*, placed as far as possible below the wheel, M, so that the condensed steam may not act on the lubricant, and the upper guide-collar, *f*, is kept well below the head-piece, *b*, but also as far as possible above the wheel, M, to give the shaft a steady bearing. Steam which may be obtained from an autoclave, or from a small laboratory boiler, enters the casing by the pipe, *m*, and striking against the vanes, rotates the turbine, the exhaust steam escaping through the pipe, *o*.—W. H. C.



Separating solid substances of different densities; Apparatus for ——. J. M. Draper. First Addition, dated Sept. 22, 1906, to Fr. Pat. 369,370, Aug. 30, 1906.

See Eng. Pat. 20,894 of 1906; this J., 1907, 11.—T. F. B.

Separators; Centrifugal ——. Aktiebolaget Separator Fr. Pat. 369,980, Sept. 24, 1906.

See Eng. Pat. 19,729 of 1906; this J., 1907, 81.—T. F. B.

Filters [for gas]. F. D. Marshall and S. Hersey. Fr. Pat. 369,965, Sept. 22, 1906. Under Int. Conv., March 28, 1906.

The grids, or V-shaped bars, which support the purifying or filtering material are arranged in groups and fastened to frames, so that when the purifier has to be emptied, they can either be removed bodily, or else inclined, to allow the purifying material to be easily removed.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 145.)

English Patents.

Coal and like washers. H. H. Lake, London. From Heyl and Patterson, Incorp., Pittsburg. Eng. Pats. 1936 and 1942, Jan. 25, 1906.

See Fr. Pat. 360,640 of 1906; this J., 1906, 974.—T. F. B.

Fuel, artificial; Manufacture of ——. P. Grayson, London. Eng. Pat. 2154, Jan. 27, 1906.

A hard fuel, not disintegrating whilst burning and not easily fractured, is made by incorporating 80 parts of coal dust, 7 of Portland cement, 10 of tar (preferably wood tar), and 3 of acetic or hydrochloric acid with or without water. Another suitable mixture consists of 85 parts of coal dust, 8 of tar 5 of cement, and 2 of acid. —A. T. L.

Gas; Apparatus for the manufacture of ——. C. B. Tully, New Southgate, Middlesex, and R. G. Shadbolt, Grantham, Lincs. Eng. Pat. 2368, Jan. 30, 1906.

The patent relates to apparatus for the manufacture of producer-gas, water-gas, or semi-water-gas practically free from carbon dioxide, comprising a gas producer having an internal vertical tube of refractory material dividing the interior for about three-fourths of its height from the bottom into two concentric chambers. A feeding hopper at the top of the producer supplies fuel simultaneously to the inner and outer chambers. The invention is applicable to gas producers of various constructions. The producer described is cylindrical, and the outer annular chamber is provided at its lower end with grate-bars, resting on the refractory lining of the producer and on a central tubular casting, which also supports the internal vertical tube. The space below the grate-bars forms an annular chamber for the admission of air, steam, or air and steam. Gas, containing carbon dioxide, is formed in the ordinary manner in the annular part of the producer and passes downwards through heated fuel in the central chamber, the carbon dioxide being converted into carbon monoxide. The gas outlet is at the bottom of the central chamber, and a movable door in the bottom of the outlet casting is rocked by a hand lever for the discharge of ashes. An annular vessel in the upper part of the producer forms a steam generator, but in the manufacture of water-gas a separate steam generator is used. A chimney or waste-pipe at the top of the producer is normally closed by a cock, and is opened when the producer is not in operation. The outlet from the producer may be connected to the gas-cock of an engine, or the producer may be worked by the suction of an exhauster or by pressure. The gas may be carburetted and used for lighting.—A. T. L.

Gas washers. G. Wilton, London. Eng. Pat. 13,787, June 15, 1906.

A gas washer is made up of units each having an inlet and an outlet connected to T-pieces in the gas mains leading to and from the washer. Any unit can be cut off from the remainder, for inspection and cleaning, by valves in the gas- and liquor-inlets and outlets, and the capacity of the washer can be increased by adding additional units at the end. Each unit is divided by horizontal partitions into a number of chambers. Liquor entering the topmost chamber is caused to flow backwards and forwards in a circuitous path over each partition, and escapes from the bottom of the washer through a cock. An overflow pipe from each chamber to the one below is arranged to maintain a suitable depth of liquor. Gas entering at the bottom of the washer passes up through two rectangular openings in each partition and is caused to bubble through the liquor by inverted U-shaped hoods having serrated edges. One or more detachable aprons may be placed over each hood forming additional liquor seals of equal or less depth. These aprons may be perforated where they are immersed in the liquor. The hoods and aprons can be removed endwise through doors at the sides of the washer. The construction of washer described in Eng. Pat. 14,925 of 1888 (this J., 1889, 112) is specifically disclaimed.—A. T. L.

Tarry and like matter from gases; Apparatus for extracting ——. S. B. and T. A. Clapham, Keighley. Eng. Pat. 3809, Feb. 16, 1906.

In apparatus of the type in which the gases pass through and impinge upon perforated plates forming the vertical sides of a bell partly immersed in water in a suitable casing, the capacity is increased by arranging side by side several bells, rectangular in horizontal cross-section. The gases are admitted to the interior of each bell through pipes of rectangular section, leading from a common inlet chamber. The bells are suspended from a single vertical spindle and may rise and fall in the usual manner. A pointer indicates the position of the bells within the casing. The inner plates of each bell have circular perforations, the next rectangular, and so on alternately. —A. T. L.

United States Patents.

Gas-producer. W. H. Bradley, Assignor to A. Gilliland, W. C. Bradley, Belleville, Pa., M. E. Webster, Chicago, and S. L. Bradley, St. Louis, Mo. U.S. Pat. 838,946, Dec. 18, 1906.

The producer has a number of wind-pipes stretched across the producer chamber, each pipe opening at the bottom into a water seal beneath the producer. Each pipe is divided by a partition into parallel chambers, and each of these has a separate air-supply pipe, the latter pipes being connected with opposite ends of two chambers. Each chamber has air-discharge openings on the top along its length.—W. C. H.

Gas; Apparatus for washing and scrubbing ——. S. Hersey, Assignor to Kirkham, Hulett and Chandler, Ltd., London. U.S. Pat. 838,712, Dec. 18, 1906.

See Eng. Pat. 24,467 of 1904; this J., 1905, 1056.—T. F. B.

French Patents.

Gas producers. H. Becker and O. T. Greener. Fr. Pat. 369,682, Aug. 29, 1906. Under Int. Conv., Aug. 11, 1906.

The outer casing of the producer, which is of the usual cylindrical form, is open at the bottom, and rests in a water-sealed ash-pan. It is provided, at its upper part, with a refractory lining as usual, but at the lower part, which surrounds the whole combustion zone, the refractory lining is replaced by a water-jacketed metallic cylinder, which depends from the bottom of the lining to within a short distance of the surface of the water in the ash-pan. There is an annular air-space between the water-jacketed cylinder and the outer casing of the producer; into this space air is blown or sucked, and, mingling with the steam which issues from the top of the water jacket, it flows down to the lower edge of the jacketed cylinder, and thence upwards through the fuel. The cooling action of the water which circulates in the jacket prevents the adhesion of clinker to the sides of the cylinder. There is no fire-grate, the fuel and cinders resting directly upon the ash-pan.—H. B.

Carburetted air; Apparatus for producing ——. T. H. Glasscoe. Fr. Pat. 370,058, Sept. 27, 1906.

See Eng. Pat. 14,226 of 1905; this J., 1906, 1082.—T. F. B.

Air-carburetting apparatus, with automatically and thermostatically controlled valves. T. H. Glasscoe. Fr. Pat. 370,059, Sept. 27, 1906.

The apparatus comprises a carburetter, a gas-holder or equivalent device, a hot-air motor, actuated by a flame, fed with gas from the gas-holder, and a blower, driven by the motor, for delivering a primary air supply to the carburetter and a secondary air supply to be mixed in regulated proportions with the carburetted air produced. The carburetted air and the secondary air supply pass through a mixing chamber before entering the gas-holder, the valve through which the mixture enters the latter being controlled by the movements of the bell, so that a constant pressure is maintained within the holder. The valves which admit the carburetted air and pure air respectively to the mixing chamber are likewise controlled by the movements of the bell, but in opposite senses; *e.g.*, if the gas consumption increases, the descent of the bell causes the carburetted-air valve to open further, and the pure-air valve to close more or less, and *vice versâ.* The ratio of the carburetted to non-carburetted air is thus regulated in accordance with the fact that the air passing through the carburetter at high speed becomes less fully carburetted than at a low speed; and a mixture of constant enrichment is thus provided. In order to allow for variations in the temperature of the atmosphere or of the carburetter, a thermostatic device is provided whereby, owing to the expansion or contraction of mercury therein, a float and lever connected thereto are operated so as to open or close the orifices in the plug of either the pure-air or carburetted-air valve. The orifices in these valves may also be controlled by a lever connected to the diaphragm of an air chamber, which is heated by a flame supported by gas from the holder; as the calorific value of the gas varies, so does the pressure within the air chamber, the movements thus set up in the diaphragm being imparted to the lever.—H. B.

Gas and air; Process and apparatus for obtaining a uniform mixture of ——. Akt.-Ges. f. Selas-beleuchtung. Fr. Pat. 370,176, Oct. 3, 1906. Under Int. Conv., Oct. 7, 1905.

See Eng. Pat. 21,847 of 1906; this J., 1907, 83.—T. F. B.

Filaments of tungsten or molybdenum for incandescent electric lamps; Process of manufacturing ——. J. Lux. Fr. Pat. 369,233, Aug. 25, 1906.

Tungsten or molybdenum, in pulverulent form, is mixed with camphor, pinene hydrochloride, or other aromatic binder capable of volatilising without leaving a residue, and with a little alcohol or other volatile solvent; the mass is formed into filaments under strong pressure, and the filaments are treated electrically in the absence of air, to expel volatile matters.—H. B.

Lighting and heating; New compound for use in [electric] ——. Ateliers Thomson-Houston. Fr. Pat. 369,316, Aug. 28, 1906. Under Int. Conv., Aug. 30, 1905.

See Eng. Pat. 18,485 of 1906; this J., 1907, 42.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 145.)

Hydrocarbons of the benzene series; Oxidation of ——. H. D. Law and F. M. Perkin. Chem. Soc. Proc., 1907, 23, 11.

The authors have examined the products of oxidation of aromatic hydrocarbons by lead peroxide and manganese peroxide in acid solution, by chromyl dichloride, and by persulphates in acid solution in presence of silver salts. The hydrocarbons investigated were toluene, the three xylenes, mesitylene, ψ-cumene, and cymene. In all cases varying yields of the monoaldehydes were obtained. Toluene gave with lead peroxide 24 per cent. of benzaldehyde, with manganese peroxide 5 per cent., with chromyl dichloride 44 per cent., and with persulphates 78 per cent. In the remaining cases, as a rule, the yield with chromyl dichloride was better than with the other oxidising agents, that obtained with persulphates being second. In general, lead peroxide gave a larger quantity of aldehyde than did manganese peroxide.

o-Nitrotoluene; The two modifications of ——. E. Knövenagel. Ber., 1907, **40**, 508—517. (Compare this J., 1907, 36.)

The author confirms Ostromisslensky's results, but states that the existence of the two modifications of *o*-nitrotoluene was discovered in the Chem. Fabrik Griesheim-Elektron in 1903. It was found that the ordinary *o*-nitrotoluene, m. pt., -9·4° C., could be transformed into the other variety, m. pt., -3·6° C., by shaking with sulphuric and nitric acids; 139 grms. of *o*-nitrotoluene are shaken with 105 grms. of 71 per cent. sulphuric acid and 1 grm. of nitric acid (44° B.) for three hours at the ordinary temperature. After separation, drying over quicklime, and filtering, the product melted at -3·6° C. The author finds that when the substance of m. pt., -9·4° C. (*α*-modification) is supercooled with liquid air, it crystallises in the *β*-form, m. pt., -3·6° C. When, however, a small quantity of the fused *α*-modification is added to the fused *β*-modification, the whole crystallises in a short time in the *α*-form when placed in a freezing mixture of ice and salt. The mechanism of the change is discussed in the light of the author's theory of "motoisomerism."
—J. C. C.

Halogen atoms; Introduction of —— *into the benzene ring during the reduction of aromatic nitro-compounds.* J. J. Blanksma. Rec. trav. chim. Pays-Bas, 1907, 25, 365—372; Chem. Zentr., 1907, 1, 464—465.

The formation of chlorinated compounds in the reduction of aromatic nitro-compounds by hydrochloric acid and a metal, or a metallic chloride, may be explained by the following equations:—

$$C_6H_5.NO_2 + 4H = C_6H_5.NHOH + H_2O;$$
$$C_6H_5NHOH + HCl = C_6H_5NHCl + H_2O;$$
$$C_6H_5NHCl \rightarrow Cl.C_6H_4.NH_2 \text{ (ortho and para).}$$

It was to be expected, therefore, that a higher yield of compounds with chlorine attached to the benzene nucleus, would be obtained by reducing slowly or by adding the metal (tin) in small quantities, in order to hinder the transformation of phenylhydroxylamine into aniline, and by adding an excess of acid and working at the boiling point, in order to effect the rapid conversion of phenylhydroxylamine into chloroaniline. By dissolving 10 grms. of nitrobenzene in 100 c.c. of 96 per cent. alcohol and 200 c.c. of 25 per cent. hydrochloric acid, heating to the boiling point, and adding slowly 15 grms. of tin turnings, a yield, on steam distillation, of 6·5 grms. of an oil, consisting of 55 per cent. of *o*- and *p*- chloroaniline, and 45 per cent. of aniline, was obtained, whilst the residue also contained crystals of *p*-chloroaniline. On using stannous chloride instead of metallic tin, the product consisted of 53 per cent. of chloroaniline and 47 per cent. of aniline, whilst with hydrobromic acid instead of hydrochloric acid, an oil consisting of 75 per cent. of aniline and 25 per cent. of bromoaniline was obtained. The products obtained by the reduction of nitrosobenzene with hydrochloric acid and tin and stannous chloride, respectively, contained 33 and 38 per cent. of chloroaniline. *o*-Nitrotoluene, when reduced with tin and hydrochloric acid, yields a mixture of *o*-toluidine with 25·6 per cent. of chloro-*o*-toluidine, whilst with stannous chloride and hydrochloric acid, a product containing 44 per cent. of chlorotoluidine is obtained. Somewhat similar results were obtained with *m*- and *p*-nitrotoluene, larger yields of products with chlorine attached to the benzene nucleus being obtained by use of stannous chloride than by that of tin.—A. S.

Coke-oven products in the United States. Bureau of the Census. Oil, Paint, and Drug Rep., Feb. 9, 1907. [T.R.]

The following table shows the amount and value of by-products obtained from coke ovens in 1900 and 1905:—

	1900.		1905.	
	Quantity.	Value.	Quantity.	Value.
		$		$
Tar, galls.	10,468,733	207,952	26,223,323	613,388
Ammonium sulphate, lb.......	11,984,931	330,921	31,546,781	818,290
Ammonia liquor, galls.	1,572,325	180,642	4,791,468	763,291
Surplus gas	—	225,022	—	843,787
Unclassified	—	7,490	—	108,532
Total value ..	—	952,027	—	3,147,288

The coal tar reported used in by-product ovens in 1905 was 3,317,585 tons. The total quantity of coal coked in 1905 was 37,376,251 tons, of which 3,317,585 tons was coked in by-product ovens. The total quantity of coke produced was 25,143,288 tons, of which 2,422,796 tons was produced in by-product ovens. Of the 19,640,798 tons of coke produced in 1900, the by-product ovens made 906,534 tons. The percentage yield of coke in by-product ovens in 1905 was 73, while the yield of coke for the total coal used was 67·3. The yield of tar per ton of coal used was 7·9 galls., and its value $0·023 per gall. The average yield of tar per ton of bituminous coal is usually accepted as 10 galls. As tar is generally sold in barrels holding 50 galls., the number of barrels reported was 524,466. The quantity of coal coked in by-product ovens from which the ammonium compounds were recovered was 3,255,625 tons. The total quantity of ammonium compounds recovered, calculated as ammonium sulphate, was 62,633,417 lb., an average yield of 19·24 lb. of ammonium sulphate per ton of coal carbonised. The average value of the ammonium sulphate reported was $0·026 per lb., and of the ammonia liquor, $0·159 per gall.

Petroleum export from Roumania. Bd. of Trade J., Feb. 14, 1907. [T.R.]

ACCORDING to the "Moniteur du Pétrole Roumain," the export of petroleum from Roumania amounted in 1906 to 321,119 tons, being an increase of 50 per cent. on the 1905 figures, and 83 per cent. on those of 1904. It consisted of 53,000 tons of crude oil, 197,000 tons of burning oil, and 71,114 tons of benzine, of a total value of 26,400,000 frs., as compared with 14,500,000 frs. in 1905. Last year's export was distributed chiefly as follows: United Kingdom, 28 per cent., France, 27 per cent., Germany, 12 per cent., Italy, 10 per cent., and Austria-Hungary, 5 per cent.

ENGLISH PATENT.

Lubricating composition. F. G. Arcéluz. Eng. Pat. 18,810, Aug. 22, 1906. XII., page 211.

IV.—COLOURING MATTERS AND DYESTUFFS.

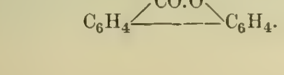
(*Continued from page* 146.)

Polyazo dyestuffs; Formation of new ——. L. Paul Z. angew. Chem., 1907, **20**, 268—272.

THE author finds that when a simple monoazo dyestuff such as that produced by combining diazonaphthalenesulphonic acid with naphthionic acid, is treated with a diazo- or tetrazo-compound, combination takes place with the formation of new dyestuffs; in the latter case, an intermediate compound is formed which can be combined with a further amount of a suitable component. It is considered that, in the above case as an example, the diazo nucleus occupies the ortho position with respect to the azo group in that naphthalene ring which does not contain the amino group. The following monoazo dyestuffs (first named is diazotised and combined with the second) (1) naphthionic acid + naphthionic acid, (2) naphthionic acid + α-naphthylamine, (3) α-naphthylamine + naphthionic acid, (4) α-naphthylamine + salicylic acid, (5) New Coccine, were treated with tetrazodiphenyl, and the resulting intermediate compounds combined with the usual components. The dyestuffs produced varied from yellowish-red to violet, and usually gave corresponding shades on wool and cotton.—J. C. C.

Resoflavin and galloflavin. J. Herzig and R. Tscherne. Annalen, 1907, **351**, 24—37. (See also this J., 1904, 818.)

METHYLRESOFLAVIN when heated on the water-bath with alcoholic potassium hydroxide solution almost completely dissolves, but is re-precipitated unchanged by prolonged warming of the solution after adding excess of acid. The authors inferred from this behaviour that the resoflavin has a lactonic structure, and experiments confirmed this view. By methylation of the alkaline alcoholic solution of methylresoflavin, the corresponding ether-ester was obtained, which on saponification yielded the ether-acid. Analysis of the ether-ester showed that four additional methoxyl groups were present, corresponding to two anhydride linkings in the resoflavin molecule. The difference between the methoxyl values of the ether-ester and the ether-acid corresponded to the formulæ, $C_{14}H_3O_2(OCH_3)_7$, and $C_{14}H_4O_3(OCH_3)_6$, respectively for the two compounds. The parent substance of the ether-ester would then be $C_{14}H_3O_2(OH)_7$, from which resoflavin is derived by elimination of two molecules of water. The formula of resoflavin, $C_{14}H_3O_4(OH)_3$, deduced in this way, is in accord with the analytical values obtained for the acetyl- and methyl-derivatives. The formula for galloflavin deduced in an analogous manner is $C_{14}HO_4(OH)_5$. The properties of resoflavin and galloflavin and their methyl derivatives resemble in many ways those of ellagic acid and its methyl derivative (this J., 1905, 1087; 1906, 258), and the authors intend to continue their work on the supposition that the two first-mentioned dyestuffs are derivatives of diphenylmethylolide,



$C_6H_4\langle{}^{CO.O}_{\,}\rangle C_6H_4$.

—A. S.

Malachite Green; Hydroxyl derivatives of ——. E. Votoček and J. Jelinek. Ber., 1907, **40**, 406—410.

THE authors have prepared new hydroxyl derivatives of Malachite Green by condensing (1) alkylated hydroxyaldehydes with dimethylaniline, and (2) tetramethyldiaminodiphenylcarbinol with phenols or phenol ethers. *Anisaldehyde and dimethylaniline* condensed by the aid of zinc chloride gave a leuco-base, m. pt. 106° C., soluble in the usual organic solvents, and yielding, on oxidation with chloranil in alcoholic-acetic acid solution, a green solution (red in transmitted light) which dyes tannin-mordanted cotton green, fast to alkalis. *p-Ethoxybenzaldehyde and dimethylaniline* gave a leuco-base, m. pt. 125° C., which on oxidation with chloranil or lead peroxide gave a green solution (red in transmitted light) dyeing tannin-mordanted cotton green, fast to alkalis. *Piperonal and dimethylaniline* condensed as above furnished a leuco-base, m. pt. 109—110° C., which on oxidation gave a blue-green solution (cherry-red in transmitted light) dyeing tannin-mordanted cotton greenish-blue. The shades are only affected by alkalis after long treatment. *Tetramethyldiaminodiphenylcarbinol and anisol*: these substances were condensed in presence of concentrated hydrochloric acid. The leuco-base melted at 155° C., and on oxidation gave a blue solution dyeing tannin-mordanted cotton blue-green. By the action of alkalis this is changed to violet. The substance is different from that produced by the condensation of anisaldehyde and dimethylaniline. *Tetramethyldiaminodiphenylcarbinol* and *phenetol* on condensation, as in the preceding case yielded a leuco-base, m.pt. 165° C., which on oxidation gave a solution dyeing tannin-mordanted cotton dull-blue inclining to green, and changing to violet by the action of alkalis. The substance differs from that obtained from *p*-ethoxybenzaldehyde and dimethylaniline. *Tetramethyldiaminodiphenylcarbinol* and *guaiacol*, condensed as above, gave a leuco-base, m.pt. 134°—135° C., which when oxidised furnished a blue-green solution dyeing tannin-mordanted cotton greenish-blue. The leuco-base is identical with that prepared by Fischer from vanillin and dimethylaniline. *Tetramethyldiaminodiphenylcarbinol and β-naphthol* condensed in a similar manner to a leuco-base which could not be obtained crystalline. The dyestuff produced by oxidation dyes tannin-mordanted cotton blue. The crude base was converted into a crystalline acetyl derivative, m. pt. 136° C., which on oxidation gave a green solution dyeing tannin-mordanted cotton green.—J. C. C.

Indanthrene and flavanthrene. III. Halogen derivatives of indanthrene. R. Scholl, H. Berblinger, and J. Mansfeld. Ber., 1907, **40**, 320—325.

MONOCHLOROINDANTHRENE is best obtained by heating anthraquinoneazine (this J., 1903, 1240) with 4—5 parts of concentrated hydrochloric acid in a closed vessel at 150° C. It can be oxidised to monochloroanthraquinoneazine by treatment with nitric acid of sp. gr. 1·285. On heating the latter with concentrated hydrochloric acid at 180° C., 4.4′-dichloroindanthrene is obtained, which forms a blue powder possessing the properties characteristic of indanthrene. 4-Monobromoindanthrene is prepared by heating anthraquinoneazine with hydrogen bromide at 160° C. It crystallises from quinoline in blue needles and yields the corresponding azine by oxidation with nitric acid. On heating the latter base with hydrogen bromide at 180° C., 4.4′-dibromoindanthrene is obtained. For the production of dibromoanthraquinoneazinedibromide, 4 parts of indanthrene are heated with 24 parts of bromine at 100° C. The base has a green colour and yields 3.4.4′-tribromoindanthrene when boiled with quinoline, from which it crystallises in small blue needles.

—D. B.

Indanthrene and flavanthrene. IV. Action of nitric acid on indanthrene. R. Scholl and J. Mansfeld. Ber., 1907, **40**, 326—329.

WHEN indanthrene is boiled with 12 to 15 parts of nitric acid of sp. gr. 1·4, nitrodinitrosotrihydroxyanthraquinoneazine is obtained. It is insoluble in the usual solvents, and forms a reddish-yellow solution with concentrated sulphuric acid. Its solutions in dilute alkali hydroxides or carbonates dye wool in red shades, whilst cotton is dyed a red when boiled with the base in an alkaline hydrosulphite vat. Triaminotrihydroxy-N-dihydroanthraquinoneazine is formed by treating the preceding preparation with a solution of hydrogen sodium sulphide in excess, for an hour, at 70°—80° C. It crystallises from hot nitrobenzene in black-violet needles. For the preparation of tetranitrotetrahydroxyanthraquinoneazine, indanthrene (20 grms.) is boiled with a mixture of concentrated sulphuric acid (80 c.c.) and nitric acid of sp. gr. 1·5 (200 c.c.) in a reflux apparatus. The base thus obtained is slowly acted upon by a solution of sodium acetate in the cold; it is not changed by sodium sulphite or bisulphite, reacts with aniline accompanied by complete or partial substitution of the nitro groups by anilido-residues, and yields tetraminotetrahydroayindanthrene when subjected to the action of a dilute solution of hydrogen sodium sulphide at 100° C.—D. B.

Indanthrene and flavanthrene. V. Reduction products of indanthrene. R. Scholl, W. Steinkopf, and A. Kabacznik. Ber., 1907, **40**, 390—394.

The blue sodium salt of N-dihydro-1.2.2′.1′-anthraquinoneanthraquinolazine is obtained by heating indanthrene with caustic alkali and sodium hydrosulphite solution at 65°—70° C. Benzoylation leads to the formation of a dibenzoyl derivative, whilst the benzoylation of the yellow sodium salt of N-dihydro-1.2.2′.1′-anthraquinolazine prepared by heating indanthrene with zinc dust and alkaline hydrosulphite solution, gives rise to the production of a tetrabenzoyl derivative.—D. B.

Indanthrene and flavanthrene. VI. Action of quinoline and acyl chlorides on indanthrene. R. Scholl and H. Berblinger. Ber., 1907, **40**, 395—400.

When indanthrene is heated with quinoline and benzoyl chloride, tetrabenzoyltetrahydroindanthrene is obtained. It is sparingly soluble in pseudocumene, but dissolves readily in hot nitrobenzene and quinoline with yellow coloration and green fluorescence. It can be oxidised to tetrabenzoylanthraquinolazine by treatment with nitric acid of sp. gr. 1·4, the nitrate of which gives an indigo-blue solution. Prolonged heating at a high temperature leads to the formation of anthraquinoneazine. When tetrabenzoyltetrahydroindanthrene is boiled with quinoline, the yellow solution gradually assumes a magenta red colour with formation of anthranoneazine. The action of acetyl chloride and quinoline on indanthrene in glacial acetic acid solution leads to the formation of tetracetyl-N-dihydroanthraquinolazine. The preceding experiments demonstrate the impossibility of replacing the hydrogen atoms of the imino groups in indanthrene by acid radicals, and further show that by enforcing the introduction of acyl groups, reduction takes place simultaneously with the formation of *O*-acylated reduction products.—D. B.

Dyestuffs; Separation of —— by diffusion. S. Lehmann. Z. physik. Chem., 1907, **57**, 718—720.

The author suggests that the different rates of diffusion of dyestuffs into jellies may be utilised for the spectroscopic detection of individual dyestuffs in mixtures. A piece of glass tubing of about 1 cm. diameter is filled with a 5—10 per cent. solution of gelatin, or a 2 per cent. solution of agar-agar, and after the jelly has set the tube is cut into suitable lengths. A short tube full of jelly thus obtained is suspended in a solution of the dyestuff to be examined, care being taken that no air-bubbles remain adhering to it. With a tube, 10 cm. long, suspended in a mixture of equal parts of equimolecular solutions of Eosine and Tartrazine, it was found that after 2 days the jelly was coloured to a height of 6—7 cm.; at the bottom the colour was the same as that of the solution, but becamo yellower as it extended higher, whilst in the uppermost portion (about 3 cm. deep) of the coloured jelly, the shade was pure yellow, and on spectroscopic examination of this portion, no Eosine could be detected.—A. S.

English Patents.

Colouring matters containing sulphur; Manufacture of —— and of the leuco compounds thereof [Thio-indigo dyestuffs]. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 14,191, June 20, 1906.

See Fr. Pat. 367,431 of 1906; this J., 1906, 1143.—T. F. B.

Sulphurised [sulphide] dyestuffs and their intermediate products; Manufacture of ——. H. H. Lake, London. From The Chemische Fabrik Griesheim-Elektron, Frankfort-on-Maine, Germany. Eng. Pat. 23,864, Oct. 26, 1906.

By the oxidation of naphthylaryl sulphamides (see Ber. 27, 2370) together with *p*-aminophenol or its derivatives, new indophenols are obtained. By treating these indophenols or their reduction products with alkali polysulphides, dyestuffs are obtained of remarkable fastness. Of particular value are the green dyestuffs obtained by melting together the indophenols or their leuco derivatives, and alkali polysulphides in presence of metallic copper or a copper salt. *Manufacture of indophenols.*—109 parts of *p*-aminophenol are dissolved in 1000 parts of water and 140 parts of caustic soda lye of 35° B.; 297 parts of naphthyl-*p*-tolylsulphamide are dissolved in 1000 parts of water and 210 parts of caustic soda lye. The two solutions are mixed cool by means of ice, and an ice-cold solution of sodium hypochlorite, containing 32 parts of active oxygen, is run in. The temperature is kept below 0° C. during the oxidation. The indophenol separates out and may be melted directly with alkali polysulphides. To obtain the leuco derivative, a solution of 360 parts of sodium sulphide is added, and the mixture heated to 75° C., when an almost clear solution results. The phenylnaphthylamine derivative is precipitated as a yellow-brown deposit by the addition of a mineral acid. *Manufacture of the sulphide dyestuff.*—46 parts of the indophenol thus obtained, or the corresponding quantity of its leuco derivative, are melted together with 168 parts of crystallised sodium sulphide and 67 parts of sulphur, a solution of 8 parts of copper sulphate, or 2 parts of metallic copper, being added. The mixture is evaporated till the temperature reaches 120° C., and is kept at that temperature for 20 hours. The resulting green residue is mixed with 1000 parts of water, heated, and the solution filtered from impurities. The dyestuff is precipitated with a current of air. It dyes cotton green tints, very fast to washing, from a sulphide bath. Dyestuffs may also be obtained by using chloraminophenols instead of aminophenols.—A. B. S.

French Patents.

Dyestuffs; Process for producing polyazo ——. L. Cassella und Co. Second Addition, dated Nov. 21, 1905, to Fr. Pat. 361,590, June 28, 1905.

See Eng. Pat. 5245 of 1906; this J., 1907, 15.—T. F. B.

Dyestuffs; Production of [sulphide] ——. E. Vidal. Fr. Pat. 361,939, Nov. 25, 1905.

See Eng. Pat. 23,740 of 1905; this J., 1906, 1037.—T. F. B.

Dyestuffs; Production of sulphide ——. E. Vidal. Fr. Pats. 361,940, Nov. 25, 1905, and 361,982, Dec. 9, 1905.

See Eng. Pat. 23,733 of 1905; this J., 1906, 978.—T. F. B.

Triphenylmethane dyestuffs; Production of new acid ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 369,696, Sept. 12, 1906.

An aryl sulphonic ether of salicyl aldehyde is condensed with an alkyl benzylanilinesulphonic acid, and the leuco-compound obtained in this way is converted into the dyestuff by the use of a suitable oxidising agent. The dyestuffs produced dye wool in an acid bath bright green shades, which are fast to washing. Example I.—*Production of the aryl sulphonic ether*: 25 parts of salicyl aldehyde are dissolved in 250 parts of hot water, with the addition of 24 parts of aqueous caustic soda (40° B.); 50 parts of *p*-toluenesulphonic chloride (80 per cent.) are now added with vigorous stirring, and the mixture kept at 70°—

80° C., until the yellow colour has disappeared. On cooling, the condensation product separates in small, white nodules, m. pt., 59°—60° C. Similar condensation products obtained by using benzenesulphonic chloride and *o*- and *p*-homosalicyl aldehydes are described. II.—*Production of the dyestuff*: 28 parts of the above compound, $CHO.C_6H_4.O.SO_2.C_6H_4.CH_3$, and 58·2 parts of ethylbenzylanilinesulphonic acid are dissolved together in a mixture of 90 parts of water and 100 parts of alcohol, with the addition of 10 parts of concentrated sulphuric acid. The solution is boiled until the aldehyde has disappeared. On distilling off the alcohol and pouring the residue into 500 parts of water, the leuco-disulphonic acid separates as a white resin. For the oxidation, 84 parts of this leuco compound are dissolved in about 1600 parts of water and 11 parts of sodium carbonate; 75 parts of moist lead peroxide (containing 33 per cent. of PbO_2) are now added, together with the necessary quantity of acetic acid, and the whole vigorously shaken. When the oxidation is complete, the lead is removed by sulphuric acid, and sodium sulphate added to the filtrate, when the dyestuff is precipitated as a mass possessing a coppery lustre. It dissolves in water or alcohol with a green colour, and is re-precipitated by the addition of hydrochloric acid or caustic soda. With concentrated sulphuric acid a yellowish-brown solution is produced, which is changed to green by adding ice. Corresponding dyestuffs are obtained by varying the condensation product as indicated in the first example.—J. C. C.

Dyestuff of the oxazine series and its leuco-derivative; Manufacture of a new ——. Farbenfabr. vorm. F. Bayer & Co. Fr. Pat. 369,835, Sept. 18, 1906. Under Int. Conv., May 8 and Aug. 31, 1906.

By heating Gallocyanine (from nitrosodimethylaniline and gallic acid) with alkaline reducing agents for a sufficiently long time, the leuco-compound of a new dyestuff is obtained which is different from the leuco-compound of Gallocyanine previously described. The new dyestuff, obtained by oxidising this leuco-compound, is insoluble in aqueous sodium carbonate, and dissolves with a blue colour in hydrochloric acid (20° B.); it is also more readily soluble in water than Gallocyanine, and the chrome lake is developed more easily than in the case of that colour. It may also be prepared directly from Gallocyanine by heating the base suspended in water. Example I.—33·6 kilos. of Gallocyanine are suspended in 600—700 litres of water, a solution of 30 kilos. of crystallised sodium sulphide and 8 kilos of caustic soda in 200 litres of water added, and the whole heated in absence of air at 95° C. for 1½ hours. When the reaction is finished, hydrochloric acid is added, the precipitated sulphur filtered off, and the leuco-derivative separated by adding salt to the filtrate. The hydrochloride of the leuco-base is a black-green powder, very readily soluble in water, giving a yellowish-green solution, which is oxidised to blue on exposure to the air. II.—25·2 kilos. of sodium acetate are added to a suspension of 33·6 kilos. of Gallocyanine in 650 kilos. of water, and the whole heated to boiling for 4—5 hours. The reaction is complete when a portion no longer dissolves in aqueous sodium carbonate, and gives a blue colour with hydrochloric acid. On cooling, the dyestuff is collected and converted into its hydrochloride, which is a green powder, soluble in water with a violet-red colour. The dyestuff produces redder and brighter shades than does Gallocyanine.—J. C. C.

Indigo products formed by condensation; Method of manufacture of ——. H. Belart. Fr. Pat. 369,907, Sept. 20, 1906. Under Int. Conv., Jan. 12, 1906.

In the manufacture of Indigo by the sodamide process, metallic amides of organic bases such as aniline, naphthylamine, diphenylamine, tolylamine, and xylylamine may be used instead of sodamide as condensing agents. Example:—500 parts of aniline and 36 parts of sodium are warmed together and vigorously agitated; when the sodium has dissolved, 150 parts of the dry disodium salt of phenylglycine-*o*-carboxylic acid are added, and the whole heated in a vessel fitted with a reflux condenser. When the reaction is finished, the excess of aniline is distilled off, and the Indigo isolated by the usual methods. The sodium anilide may also be prepared from sodamide and aniline.—J. C. C.

Dyestuffs of the anthracene series; Production of vat ——. Badische Anilin und Soda Fabrik. Fr. Pat. 370,070, Sept. 27, 1906. Under Int. Conv., June 2, 1906.

See Eng. Pat. 20,633 of 1906; this J., 1906, 1143.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 147.)

Textile fibres; Chemical nature of ——. L. Vignon. Bull. Soc. Ind. Mulhouse, 1906, 76, 359—361.

Pieces of silk, wool, and cotton of known weights were immersed for one hour in solutions of sulphuric acid, barium hydroxide, and sodium chloride of 1·0 per cent. and 0·1 per cent. strengths. The changes in the concentrations of the solutions, due to the chemical action of the fibres, were accurately determined, and from them were calculated the coefficients of distribution of the acid, base, and salt between the fibres and the water. From these experiments the author concludes (1) that animal fibres possess both acid and basic properties, (2) that vegetable fibres have no basic properties, and only very weak acid properties such as would be possessed by alcohols.
—P. F. C.

Cellulose [; *Mercerised* ——]. H. Wichelhaus and W. Vieweg. Ber., 1907, **40**, 441—443.

In studying the affinities which exist between cellulose and certain basic oxides, the authors observed that cellulose absorbed 3·82 per cent of barium hydroxide from a *N*/5 solution of the base at 0° C., and 2·18 per cent. of strontium hydroxide from a *N*/10 solution, also at 0° C. In order to show the chemical modification which cellulose undergoes in the ordinary process of mercerising, the authors prepared nitric esters and benzoic esters under comparative conditions from identical samples of cellulose before and after mercerisation. In the case of the nitrates, products containing substantially the same percentage of nitrogen were obtained from the mercerised and the unmercerised cellulose, but the products from the mercerised cellulose always contained considerably higher proportions of nitrate soluble in ether-alcohol. In the case of the benzoates, the difference between the mercerised and unmercerised celluloses was shown in the yields of ester obtained. For instance, unmercerised cotton yielded 112 per cent. of benzoate, whilst mercerised cotton yielded 139 per cent.; similarly unmercerised linen yielded 121 per cent. and mercerised 137 per cent. of benzoate.—J. F. B.

Tin in mordanted fabrics; Detection of ——. A. Scheurer and V. Silbermann. Bull. Soc. Ind. Mulhouse, 1906, **76**, 357—358.

The cloth is boiled in a solution of 40 parts of commercial hydrochloric acid in 1000 parts of water. The metal is precipitated from solution by pure zinc and redissolved in acid. The solution is made slightly alkaline with sodium hydroxide. Five parts of bismuth nitrate are dissolved in a mixture of 100 parts of commercial nitric acid and 400 parts of water, and one drop of this solution is added to the alkaline solution of the mordant. A very small quantity of tin is instantaneously indicated by a characteristic brown coloration.—P. F. C.

Dyeing of animal fibres; Processes occurring in the ——. W. Suida. Z. Farb.-Ind., 1907, **6**, 41—50.

THE author discusses the numerous experimental results obtained by himself and Gelmo (this J., 1905, 543, 920; 1906, 472; 1907, 89), and concludes from them that in the dyeing of animal fibres by substantive dyestuffs, the first stage of the process consists in a more or less profound hydrolysis of the fibre-substance, resulting in the splitting-off of products possessing new, active, partially salt-forming groups. The extent of this hydrolysis, as also the penetration of the dyestuff, depends upon the physical nature of the fibre, and is greater with wool than with silk. The hydrolysis proceeds rapidly at first, then more slowly; it is greater in presence of free acid than in pure water. As the dyeing operation goes on, the quantity of wool- or silk-substance decomposed and dissolved in the dye-liquor increases; this dissolved substance precipitates the dyestuff, which is deposited on the fibre. At the same time also, the residual fibres gradually lose their property of becoming dyed in the proper sense of the word. The fugitive character of the shades produced during the latter part of the dyeing process is due to these changes, and it is advisable, especially when using an acid bath, to complete the dyeing operation in as short a time as possible. The actual dyeing of the fibres is due to a kind of salt-formation between the fibre and the dyestuff, the basic dyestuffs being fixed by the fibre substance, acting as a polybasic acid, whilst the acid dyestuffs are fixed by the guanidyl- or imidazole-groups of the fibre substance. Experiments on the behaviour of different albuminoids and their decomposition products towards dyestuffs are cited in support of this view. The addition of acid hinders the salt formation with basic dyestuffs, but favours it in the case of acid dyestuffs. —A. S.

Amino-Methylene Blue; Application of ——. J. Heilmann et Cie. and M. Battegay. Bull. Soc. Ind. Mulhouse, 1906, **76**, 362—363.

METHYLENE GREEN, which is obtained by the nitration of Methylene Blue, gives on reduction a blue dyestuff which has recently been shown by Gnehm and Walder to be identical with Amino-Methylene Blue. The authors have produced this colour on the fibre by first dyeing the cloth with Methylene Green, cover-printing with hydrosulphite NF, and after drying, treating with bichromate.—P. F. C.

α-Naphthylamine Claret. Discharge effects on —— D. Riterman and H. Felli. Sealed Note No. 1595 of Jan. 11, 1906. Bull. Soc. Ind. Mulhouse, 1906, **76**, 333—334.

THE discharge of α-Naphthylamine Claret by hydrosulphite formaldehyde (Rongalite C, B.A.S.F.) can be considerably hastened by the addition of certain basic dyestuffs, such as Glacier Blue, to the discharge paste. H. Schmid in a report on this process points out that the most marked effect is obtained by the addition of Induline Scarlet.—P. F. C.

Discharge effects on α-Naphthylamine Claret; Use of sodium nitrite for obtaining ——. C. Sunder. Sealed Note No. 1625 of April 7th, 1906. Bull. Soc. Ind. Mulhouse, 1906, **76**, 335—337.

THE addition of a small quantity of sodium nitrite to the formaldehyde compound of sodium sulphoxylate, accelerates its decomposition on steaming, without weakening its discharging power, and the mixture has therefore been used as a neutral discharge on α-Naphthylamine Claret. If, however, the quantity of nitrite exceed a certain proportion, rapid decomposition of the discharge paste commences, and this fact has been used in the preparation of a resist under hydrosulphite discharge. A strong solution of sodium nitrite is printed on α-Naphthylamine Claret and then cover-printed with the white discharge, which consists of alkaline sodium sulphoxylate-formaldehyde to which ferrous sulphate and glycerin have been added. Where the nitrite is deposited on the fibre, it acts as a resist by decomposing the hydrosulphite. H. Schmid in his report on this note states that the ferrous sulphate and glycerin can be replaced with advantage by a small quantity of Induline Scarlet. —P. F. C.

α-Naphthylamine Claret; Discharge effects on ——. C. Sunder. Sealed Note, No. 1621 of March 26, 1906. Bull. Soc. Ind. Mulhouse, 1906, **76**, 364—365.

α-NAPHTHYLAMINE Claret is only slowly discharged by "rongalite" (sodiumsulphoxylate - formaldehyde) although Paranitraniline Red, which is also derived from β-naphthol, is very easily reduced. The author suggests that this difference is due to acid properties conferred upon the Paranitraniline Red by its "nitro" group and that this acidity induces the decomposition of the rongalite and thus renders it more active. α-Naphthylamine Claret does not contain an acid group and therefore cannot accelerate the decomposition of the rongalite. Many compounds containing the carbonyl group (CO) have the same property as Paranitraniline Red. For example, alizarin considerably hastens the discharge of α-Naphthylamine Claret by rongalite. —P. F. C.

α-Naphthylamine Claret; Discharge effects on ——. C. Sunder and G. Slatoustoffski. Sealed Note, No. 1622 of March 26, 1906, Bull. Soc. Ind. Mulhouse, 1906, **76**, 365—366.

GUIDED by the theoretical considerations outlined in the preceding paper, the authors investigated the effect of a series of compounds on the discharge of α-Naphthylamine Claret by rongalite, and found that anthraquinone, nitroalizarin, Alizarin, Bordeaux, Auramine, and indigo all had a considerable effect. All of these compounds, with the exception of anthraquinone, are useless for practical purposes, because they stain the white of the discharge. In his report on this and the preceding paper, H. Schmid points out that the theory stated above is opposed to the fact that alizarin considerably hastens the discharge of α-Naphthylamine Claret by a strongly alkaline solution of rongalite. Further, anthraquinone exerts a much more marked effect than its sulphonic acid.—P. F. C.

Stannic chloride; Anhydrous ——. P. Heermann. VII., page 200.

Soluble starch; Preparation of —— by means of formic acid. Welwart. XVI., page 216.

ENGLISH PATENTS.

Silk, artificial, and the like filaments; Manufacture of——. W. P. Dreaper, Beckenham. Eng. Pat. 27,222, Dec. 30, 1905.

LUSTROUS textile fibres are obtained by dissolving cellulose or hydrocellulose in a solution of copper carbonate in strong ammonia, filtering, and discharging the solution through suitable jets into a precipitating bath consisting of a neutral or acid salt, alcohol, or other liquid. The threads are then washed and dried.—D. B.

Silk, artificial; Manufacture of ——, *and apparatus therefor.* J. E. Bousfield, London. From Soc. Anon. Fabrique de Soie Artific. de Tubize, Tubize, Belgium. Eng. Pat. 2906, Feb. 6, 1906.

SEE Fr. Pat. 358,987 of 1905; this J., 1906, 372.—T. F. B.

Threads, artificial; Method of washing and drying ——. E. W. Friedrich, Blaton, Belgium. Eng. Pat. 12.842, June 1, 1906.

SEE Fr. Pat. 366,793 of 1906; this J., 1906, 1091.—T. F. B.

Washing and scouring textile piece goods; Machines for ——. J. Bailey, Slaithwaite, Yorks. Eng. Pat. 5836, March 10, 1906.

At the rear of the machine or at the side at which the fabrics pass to the squeezing rollers, a frame is arranged carrying a series of troughs or elongated guide-ways with converging sides, through which the fabrics are delivered directly to the nip of the rollers. By this arrangement the drafts of the fabric are gradually contracted, and being seized in this state by the rollers before they can open out again, the material is more effectively acted upon.—D. B.

Detergent [for wool, fabrics, &c.]. H. Jackson. Eng. Pat. 6712, March 20, 1906. XII., page 211.

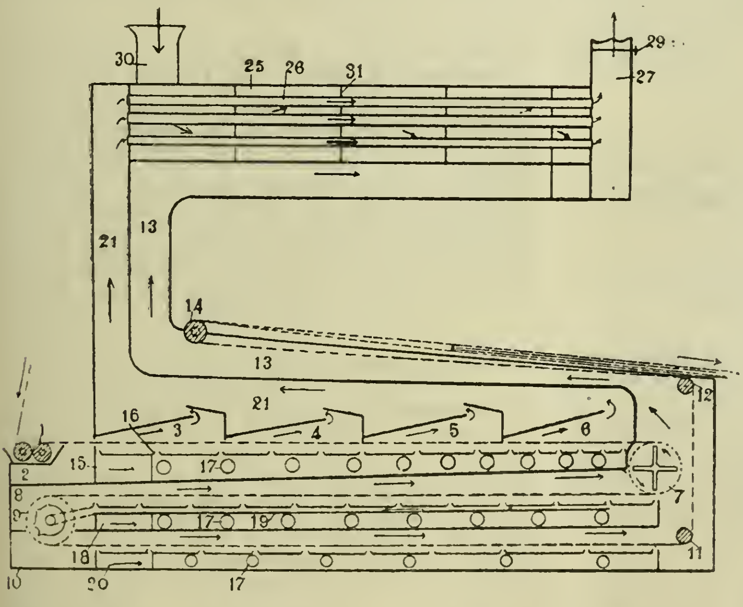
Indigo resist articles; Dyeing of —— in the continuous vat. G. Tagliani, Milan, Italy. Eng. Pat. 11,669, May 18, 1906.

The fabric, after being printed with one of the usual resists, is dried, and then a special protecting film is applied to the printed side by means, for example, of a roller with fine cross lines. It is then dried and dyed. The protecting film consists chiefly of starch, to which various substances may be added, such as sulphide dyestuffs and the necessary additions, so as to obtain a stronger dyed effect. The following is a receipt for use with sulphide dyestuffs:—25 grms. of Italian Green, 25 grms. of Melanogen T., 80 grms. of boiling water, 10 grms. of glycerin, 50 grms. of sodium bisulphite (32° B.), boiled with 900 grms. of starch thickening (1:8), and made up to 1000 c.c. with the latter thickening. An inert dyestuff, such as Congo Red, may be added in order to determine the uniform application of the protecting film.—A. B. S.

Discharge resists under vat dyestuffs upon colours capable of discharge by means of hydrosulphites; Process for the preparation of ——. P. Ribbert, Holthausen, Germany. Eng. Pat. 15,160, July 3, 1906.

See Fr. Pat. 368,335 of 1906; this J., 1907, 92.—T. F. B.

Yarn dressing and drying machines. P. Turlur, Wattrelos, France. Eng. Pat. 18,508, Aug. 17, 1906.



The machine, which is illustrated in the accompanying figure, comprises three main parts, *viz.*, the drying chambers, the heat regenerator, and a centrifugal blast apparatus. The yarn passes from the sizing rollers, 1, into the upper horizontal space, 2, which is divided into compartments, 3, 4, 5, and 6, by means of inclined baffles. It then travels over a perforated drum, 7, into a central space, 8, which it traverses in the opposite direction, after which it passes over a perforated drum, 9, into a lower space, 10. From this chamber it passes upwards over guide rollers, 11 and 12, and then traverses an inclined uptake, 13, and over a roller, 14, into the open air, where it is wound on a drum. Air forced into the distributing box, 15, and heated by pipes, 17, passes through conical nozzles, 16, into the space, 2, in which the yarn in its passage is successively exposed to increasing temperatures. In a similar manner heated air passes from the box, 18, into the space, 8, the box being divided into two parts by a horizontal partition, 19, so that the air must pass the heating pipes, 17, before entering the part above 19, and thence it travels at a high uniform temperature into the chamber, 8. Air passing from a distributing box, 20, into the space, 10, is heated to a less degree than that in the upper boxes. The arrangement of superposing the drying chambers allows, first, of effecting the progressive and systematic drying of the yarn, and secondly, of directly and separately discharging the vapours generated. The inclined baffles forming the roofs of the compartments, 3, 4, 5, and 6, deflect the vapours as they are generated and cause them to flow into the uptake, 21, which leads to a regenerator. The latter consists of an elongated closed chamber, 25, containing metal pipes, 26, through which the vapours flow, the air to be heated being drawn through the funnel, 30, by a fan, and caused by baffles, 31, to flow in an angular direction between the pipes, 26. The vapours from 26 are discharged through the funnel, 27, their flow being regulated by the valve, 29.—D. B.

United States Patents.

Silk, artificial; Apparatus for the manufacture of ——. E. Thiele, Brussels. U.S. Pat. 838,758, Dec. 18, 1906.

See Eng. Pat. 16,078 of 1906; this J., 1906, 924.—T. F. B.

Cellulose threads; Manufacture of lustrous ——. R. Linkmeyer, Brussels. U.S. Pats. 839,013 and 839,014, Dec. 18, 1906.

See Eng. Pat. 4755 of 1905; this J., 1906, 371.—T. F. B.

Warp; Machine for printing ——. A. C. Schoen, Assignor to Stinson Bros., Philadelphia, Pa. U.S. Pat. 839,083, Dec. 18, 1906.

Claim is made for a machine for printing warp, consisting of a drum having a number of movable sections which can be removed by suitable mechanism, so as to decrease the periphery of the drum.—A. B. S.

French Patents.

Cellulose fibres; Production of —— by means of nitrated cotton. Soc. Anon. des Plaques et Papiers Photographiques, A. Lumeìre et ses Fils. Fr. Pat. 361,960, Dec. 4, 1905.

To obtain artificial collodion fibres free from irregularities due to the method of coagulation, a coagulating bath is employed, consisting of one of the usual solvents for nitrated cotton, to which has been added just sufficient water or other substance to prevent it dissolving the nitrated cotton. For example a collodion prepared by dissolving 25 kilos. of guncotton in 1 hectolitre of pure methyl alcohol, is immediately and completely solidified by a coagulating bath of the same methyl alcohol containing 5—8 per cent. of water. The collodion is forced through the usual orifices into a vessel through which the coagulating liquid is kept circulating. When the vessel is filled with the fibres, the stream of collodion is stopped, and the free end of the fibre is placed on a reel, and the fibre wound up. To prevent it carrying the precipitating liquid with it, it is passed through an orifice nearly equal to the section of the fibre. The fibre contains practically all the original solvent, and the latter may be recovered by treating the fibre with water and distilling the water.—A. B. S.

Fibres, artificial ; Process for increasing the strength and especially the resistance to water of ——. E. W. Friedrich. Fr. Pat. 369,957, Sept. 22, 1906. Under Int. Conv., Sept. 23, 1905.

The artificial fibre is submitted to the action of gaseous dehydrating agents, such as the vapour of alcohol, ether, carbon bisulphide, benzene, &c. The effect is more complete the higher the temperature, and the latter can be increased by working under pressure, but care must be taken not to reach the temperature at which the cellulose is decomposed. By using alcohol vapour heated under a pressure of 2000 mm. of mercury, the product obtained has a strength in the wet condition equal to 80 per cent. of its dry strength. The same effect can be obtained by the addition of dehydrating agents to the coagulating bath. For this purpose methyl-sulphuric acid, ethyl-sulphuric acid, or glycerol-sulphuric acid may be employed.—A. B. S.

Carbon [electrode] for electrolytic bleaching. Dr. P. Schoop, Elektrische Bleichanlagen G.m.b.H. Fr. Pat. 370,162, Oct. 2, 1906. XIA., page 209.

Dyeing machine with independent hank reels. C. Corron. Fr. Pat. 370,174, Oct. 3, 1906.

This machine comprises a number of hank reels arranged in pairs along a suitable supporting frame. By means of a system of levers and connecting rods actuated by a helicoidal gear wheel, these hank reels are given an alternating rotary movement. Each pair of reels is supported on a vertical pillar provided with a screw thread, and the latter can be put in gear with a driving shaft, so that the reels can be raised vertically in order to remove the hanks from the dye bath, which is placed beneath them. By a simple adjustment of the connecting arrangements, one or more of the pairs of reels may be used as desired.—A. B. S.

Rubber, wood, leather, textiles, &c. ; Process of rendering —— *impermeable.* A. Bascir and R. de Fazi. Fr. Pat. 370,043, Sept. 26, 1906. XIIIC., page 212.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(Continued from page 151.)

Boric acid ; Improvements in the manufacture of ——. T. Heidlberg. Vegyészeti Lapok, 1907, **2**, 3 ; Chem.-Zeit., 1907, **31**, Rep. 48.

Boric acid is now prepared by treating boracite with sodium bisulphate, a by-product from the nitric acid industry. 500 kilos. of finely powdered boracite are treated with 850 kilos. of crude sodium bisulphate, dissolved in water to a solution of density 15° B., for one hour at 100° C. The solution is filtered, concentrated till the density is 30° B., and on cooling is found to yield 450 kilos. of crude boric acid. The mother-liquor on further concentration yields a quantity of very pure sodium sulphate.—B. J. S.

Perchloric acid ; Sp. gr. and strength of aqueous solutions of ——. K. van Emster. Z. anorg. Chem., 1907, **52**, 270—280.

The perchloric acid was prepared by distilling a mixture of solid potassium perchlorate with sulphuric acid of 96—97·5 per cent. strength under diminished pressure (50—70 mm. of mercury), and then redistilling the perchloric acid under reduced pressure. The specific gravity of the solutions was determined with a Sprengel's pyknometer with a capacity of about 15·9 grms. of water at 15° C., and the acidity was ascertained by titration with $N/5$ barium hydroxide solution. The results are shown in the following table :—

Sp. gr. at 15°/4°.	Per cent. of $HClO_4$.	Sp. gr. at 15°/4°.	Per cent. of $HClO_4$.	Sp. gr. at 15°/4°.	Per cent. of $HClO_4$
1·005	1·00	1·230	32·74	1·455	53·71
1·010	1·90	1·235	33·29	1·460	54·11
1·015	2·77	1·240	33·85	1·465	54·50
1·020	3·61	1·245	34·40	1·470	54·89
1·025	4·43	1·250	34·95	1·475	55·18
1·030	5·25	1·255	35·49	1·480	55·56
1·035	6·07	1·260	36·03	1·485	55·95
1·040	6·88	1·265	36·56	1·490	56·32
1·045	7·68	1·270	37·08	1·495	56·69
1·050	8·48	1·275	37·60	1·500	57·06
1·055	9·28	1·280	38·10	1·505	57·44
1·060	10·06	1·285	38·60	1·510	57·81
1·065	10·83	1·290	39·10	1·515	58·17
1·070	11·58	1·295	39·60	1·520	58·54
1·075	12·33	1·300	40·10	1·525	58·91
1·080	13·08	1·305	40·59	1·530	59·28
1·085	13·83	1·310	41·08	1·535	59·66
1·090	14·56	1·315	41·56	1·540	60·04
1·095	15·28	1·320	42·03	1·545	60·41
1·100	16·00	1·325	42·49	1·550	60·78
1·105	16·72	1·330	42·97	1·555	61·15
1·110	17·45	1·335	43·43	1·560	61·52
1·115	18·16	1·340	43·89	1·565	61·89
1·120	18·88	1·345	44·35	1·570	62·26
1·125	19·57	1·350	44·81	1·575	62·63
1·130	20·26	1·355	45·26	1·580	63·00
1·135	20·95	1·360	45·71	1·585	63·37
1·140	21·64	1·365	46·16	1·590	63·74
1·145	22·32	1·370	46·61	1·595	64·12
1·150	22·99	1·375	47·05	1·600	64·50
1·155	23·65	1·380	47·49	1·605	64·88
1·160	24·30	1·385	47·93	1·610	65·26
1·165	24·94	1·390	48·37	1·615	65·63
1·170	25·57	1·395	48·80	1·620	66·01
1·175	26·20	1·400	49·23	1·625	66·39
1·180	26·82	1·405	49·68	1·630	66·76
1·185	27·44	1·410	50·10	1·635	67·13
1·190	28·05	1·415	50·51	1·640	67·51
1·195	28·66	1·420	50·91	1·645	67·89
1·200	29·26	1·425	51·31	1·650	68·26
1·205	29·86	1·430	51·71	1·655	68·64
1·210	30·45	1·435	52·11	1·660	69·02
1·215	31·04	1·440	52·51	1·665	69·40
1·220	31·61	1·445	52·91	1·670	69·77
1·225	32·18	1·450	53·31	1·675	70·15

—A. S.

Oxides ; Solubility of alkaline-earth —— *in their fused chlorides.* K. Arndt. Ber., 1907, **40**, 427—431.

The fused chlorides of calcium, strontium, and barium dissolve a certain amount of the corresponding oxides. The point of solidification of the fused chloride is not lowered by the dissolved oxide, indicating that the solution continues in the solid state. Approximate determinations showed that 1 mol. of calcium oxide dissolves in about 7 mols. of calcium chloride ; 1 mol. of strontium oxide in about 3 mols. of strontium chloride ; and 1 mol. of barium oxide in about 2 mols. of the corresponding chloride. Calcium fluoride is without influence on the solubility of calcium oxide in fused calcium chloride.
—E. F. A.

Magnesium carbonate ; Effect of boiling solutions of ——. R. Rinne. Chem.-Zeit., 1907, **31**, 125—126.

In the author's experiments to determine to what extent the proportion of magnesia in a solution of magnesium carbonate was reduced by boiling, the solution was prepared by the action of carbon dioxide upon magnesia suspended in distilled water. The liquid was boiled for various periods under a reflux condenser, and determinations made of the amounts of magnesia left in solution. It was found that long-continued boiling did not remove the whole of the magnesium carbonate. Thus a solution containing 0·288 grm. per litre still contained 0·0226 grm. after five hours' boiling, and 0·0184 grm. after seven hours' boiling. Hence in the ordinary method of determining the hardness of water a considerable amount of magnesium carbonate might be included in the permanent hardness. From the ratio of magnesia to carbon dioxide in the residual salt the author concluded that the magnesium was present in the boiled solution in the form of a mixture of carbonate and bicarbonate, in which the latter predominated. The presence of monocarbonate was also indicated by the fact that the water invariably had an alkaline reaction after boiling. (See Davis, this J., 1906, 788.)—C. A. M.

Ammonium salts ; Hydrolysis of —— in presence of iodides and iodates. S. E. Moody. Amer. J. Science, 1906 [4], 22, 379—382 ; Chem. Zentr., 1907, 1, 393.

If a solution containing ammonium sulphate, potassium iodide, and potassium iodate be allowed to stand at the ordinary temperature, only a very small quantity of iodine is liberated in the course of several hours. If the ammonium sulphate solution be boiled for a long time before the addition of iodide and iodate, a somewhat larger quantity of iodine is liberated. On boiling the solution containing the three salts, and carrying away the liberated iodine by a current of hydrogen, it was found that the ammonium sulphate was completely hydrolysed in three hours, the quantity of iodine liberated corresponding exactly to the sulphuric acid from the ammonium sulphate. For the determination of the liberated iodine, it is necessary to collect it in an acid solution of potassium iodide. Under similar conditions ammonium chloride is also completely hydrolysed, and more rapidly than ammonium sulphate.—A. S.

Sulphites ; Detection of —— in presence of thiosulphates and thionates. E. Votoček. Ber., 1907, 40, 414—418.

Dilute solutions of magenta or malachite green are, in contradistinction to the well-known reaction with sulphurous acid or bisulphites, instantaneously decolorised by normal sulphites, whereby the sulphite of the colour base is formed. If an aqueous solution of acetaldehyde be now added, the colour is regenerated. The author finds that thiosulphates, di-, tri-, and tetra-thionates do not produce this decolorisation, so that it is possible to use this reaction to identify sulphites in presence of these salts. Bicarbonates, hydrosulphides, phosphates, &c., do not interfere with the reaction, but mono- and polysulphides have the same action as sulphites, and must, therefore, be first removed before carrying out the test. The most suitable solution was found to be composed of 3 vols. of magenta solution (0·25 grm. in 1 litre of water) mixed with 1 vol. of malachite green solution (0·25 grm. in 1 litre of water). This is added, drop by drop, to 2—3 c.c. of the solution to be tested ; if normal sulphite be present, the dye solution is instantly decolorised, and on adding acetaldehyde solution, the colour reappears. If the solution to be tested contain free alkali, this must first be converted into bicarbonate by a stream of carbon dioxide, and the presence of acids necessitates the addition of a bicarbonate. The test is a very delicate one ; an aqueous solution containing 0·00006 grm. of sulphurous acid (as normal sulphite) in 1 c.c. at once decolorises the dye solution. The following table shows the qualitative analysis of solutions from which sulphur is separated on treatment with acids :—

I.—The solution, (A), decolorises the reagent, and regenerates a violet colour with acetaldehyde, (B) is coloured violet with alkaline sodium nitroprusside, (C) by treatment with cadmium carbonate, filtering, and saturating with carbon dioxide, neither decolorises the reagent nor separates sulphur with acid.	Presence of poly- or normal sulphides, but absence of sulphite.
II.—(A) Does not decolorise the reagent, (B) gives no colour with sodium nitroprusside.	Can contain thiosulphates or di-, tri-, or tetrathionates.
III.—(A) Decolorises the reagent, but (B) gives no colour with sodium nitroprusside.	Presence of sulphite and thiosulphate.
IV.—(A) decolorises the reagent, (B) gives violet colour with sodium nitroprusside, (C) when treated with cadmium carbonate, &c., as in I. (C), decolorises the reagent, but does not separate sulphur with acid.	Presence of monosulphide and sulphite.
V.—(A) Gives violet colour with sodium nitroprusside, (B) decolorises reagent, (C) treated with cadmium carbonate as in I. (C), does not decolorise reagent.	Presence of monosulphide and thiosulphate.
VI.—(A) decolorises reagent, (B) gives violet colour with sodium nitroprusside, (C) treated with cadmium carbonate, as in I. (C), decolorises reagent, and separates sulphur with acid.	Presence of monosulphide, sulphite, and thiosulphate.

Dilute solutions of hydrosulphide and sulphides are distinguished in that the former does not decolorise the reagent, whilst the latter does. The reagent may also be used for the detection of sulphur dioxide in presence of hydrogen sulphide in gas analysis.—J. C. C.

Calcium phosphates ; Contributions to the study of the ——. I.—The hydrates of the calcium hydrogen orthophosphates. II.—The action of ammonia gas on the calcium hydrogen orthophosphates. H. Bassett, jun. Chem. Soc. Proc. 1907, 22, 315—316.

I.—Although numerous hydrates of dicalcium phosphate have been mentioned in chemical literature, the author's experiments show that, in all probability, dicalcium phosphate can only form one hydrate, namely, the dihydrate. The monocalcium phosphate has also been studied, and it has been found possible to prepare the crystallised anhydrous salt. This compound can be obtained in long, bright prisms by crystallisation at 160°C. of a solution of calcium carbonate in orthophosphoric acid if the ratio of P_2O_5/CaO in the solution, be sufficiently large. The best value for this ratio was found to be 4·6. If it is less than 3·0, then, even at 160°, the monocalcium phosphate monohydrate crystallises out.

II.—It was found that under certain conditions when the acid calcium phosphates were treated with ammonia gas, dried by passing over solid sodium hydroxide and sodium wire, absorption of the latter took place. The cause of this and the reactions occurring, have been investigated with the following results :—Anhydrous monocalcium phosphate, $CaHPO_4$, does not absorb ammonia, either at the ordinary temperature or at 100° C. The dihydrate does not absorb ammonia at the ordinary temperature, but if heated in the gas to 100°, vigorous absorption takes place with the formation of a mixture of tricalcium- and ammonium phosphates according to the equation :—

$$3CaHPO_4,2H_2O+2NH_3=$$
$$Ca_3(PO_4)_2+(NH_4)_2HPO_4+6H_2O.$$

When the dihydrate is heated, it would seem that at a temperature of about 80°, one of the quintuple points of the system, $CaO-P_2O_5-H_2O$, is reached. At this temperature the dihydrate breaks up into a mixture of $CaHPO_4,Ca_3(PO_4)_2$ and solution, and it is in this solution that the above reaction with ammonia takes place. $CaH_4(PO_4)_2$ absorbs ammonia very slowly at the ordinary temperature, but rapidly at 100°, with formation of the compound, $Ca(NH_4)_2H_2(PO_4)_2$. This compound is not stable in presence of water, which at once decomposes it into $CaHPO_4$ and $(NH_4)_2HPO_4$. This explains why, when $CaH_4(PO_4)_2H_2O$ reacts with ammonia gas, a mixture of $CaHPO_4.Ca_3(PO_4)_2$, and $(NH_4)_2HPO_4$, is formed. The commencement of the ammonia absorption by the $CaH_4(PO_4)_2,H_2O$, is probably due to formation of the above calcium ammonium phosphate. This, however, liberates water of crystallisation, which at once forms some solution in which the reaction proceeds. Although this reaction first leads to the formation of $CaHPO_4$, this can further react with ammonia as long as any solution is present. It is to this further reaction that the presence of $Ca_3(PO_4)_2$ in the final product is due.

Iron-cyanogen compounds, IV. K. A. Hofmann, H. Arnoldi, and H. Hiendlmaier. Annalen, 1907, 352, 54—72. (See also this J., 1904, 1209 ; 1905, 1221 ; 1906, 806.)

Various attempts have been made by the authors to obtain ferrous cyanide, $Fe(CN)_2$, concerning the existence of which evidence has hitherto been somewhat contradictory. Potassium cyanide added to ferrous sulphate solution in varying proportions gives precipitates containing potassium, of the approximate composition, $KFe_2(CN)_5$, which turn blue in the air. The careful addition of ammonia, hydroxylamine, or pyridine to the mixture makes little difference to the results obtained. All the precipitates, on filtering and treating with neutral oxidising agents (air or hydrogen peroxide), are converted into the deep blue ferric ferrocyanide $Fe'''HFe''(CN)_6 +$ Aq, in which the hydrogen is acid and can be replaced by metals, whereas subsequent oxidation of ferrous cyanide by neutral agents would be expected to yield a basic cyanide. Apparently, the ferrous cyanide formed quickly polymerises, and then takes up hydrogen cyanide, or its salts, forming the compound, $Fe(CN)_2.Fe(CN)_2.2HCN$, which by intramolecular change and oxidation gives the compound, $Fe'''HFe(CN)_6$. An attempt to obtain ferrous cyanide by heating a solution of hydroferrocyanic acid at 100° C. in absence of air, gives a greenish-yellow crystalline substance of the formula, $FeH_2Fe(CN)_6 +$ Aq, which by oxidation with hydrogen peroxide gives a blue compound, $Fe'''HFe(CN)_6$, very similar to Williamson's violet. If the decomposition of hydroferrocyanic acid takes place in acid solutions, there result quite insoluble, difficultly oxidisable, colourless or pale-greenish bodies, crystallising in cubes, of the same type as the residue from the preparation of hydrogen cyanide, $FeK_2\ F(CN)_6$, and similarly by complete oxidation give Williamson's violet, $[FeKFe(CN)_6]_2$, or its ammonium-containing analogue, $[FeNH_4Fe(CN)_6]_2$. In these compounds the potassium or ammonium cannot be replaced by sodium. By using oxalic acid potassium ferrocyanide gives a bright green product, $[FeK_2Fe(CN)_6]n$, probably identical with the residue from the preparation of hydrogen cyanide. Thus, by the decomposition of hydroferrocyanic acid or its salts in aqueous solution, ferrous cyanide itself is never obtained, but the complex polymer, $H_2Fe_2(CN)_6$ (see above). From ammonium ferrocyanide solution an easily oxidisable precipitate is obtained on heating, which finally has the composition, $FeNH_4Fe(CN)_6 + H_2O$, agreeing in every way with the ammoniacal blue of Monthiers. This so closely resembles the "water-soluble stable Prussian blue" before described (this J., 1905, 1221) that their structures are probably identical, and the double formula should, therefore, be given, $[FeNH_4Fe(CN)_6]_2 +$ Aq. The three soluble blues, $Fe'''KFe(CN)_6 +$ Aq, previously described (*loc. cit.*), by reduction with sulphuretted hydrogen give a leuco-compound, $FeKHFe(CN)_6$. The same leuco-compound results by the influence of ammonium oxalate solution in sunlight. But no indication of the formation of ferrous cyanide could be obtained. If the blue colour of these compounds is due to the presence of ferric and ferrous iron in the same molecule (*loc. cit.*), this leuco-body, containing only ferrous iron, should not be blue, but, as is the fact, should develop this colour on oxidation. Ferrous cyanide then must possess an eminent capacity for polymerisation and the formation of stable complexes. It is apparently soluble in water, and very readily hydrolysed by acids. The identity of Prussian blue and Turnbull's blue has been confirmed by further experiments.—F. SODN.

Aluminium hydroxide and free acid in aluminium sulphate and alums; Iodometric determination of ——. S. E. Moody. Amer. J. Science; through Z. anorg. Chem., 1907, **52**, 286—291.

THE method is based upon the hydrolysis of metallic sulphates effected by a mixture of potassium iodide and iodate. In applying the method to the analysis of aluminium sulphate and alums, separate determinations of the ferrous iron by titration with permanganate, of the total iron by reduction with zinc and titration with permanganate, of the zinc by electrolysis with a rotating cathode from a solution containing sodium acetate and acetic acid, and of ammonia are carried out. A portion of the sample is also hydrolysed by the iodide-iodate mixture (this J., 1905, 1033; 1906, 1043), and the amount of iodine liberated titrated with thiosulphate. The hydroxides separated on hydrolysis, are collected, dried, and ignited, and the oxides (Al_2O_3, Fe_2O_3, ZnO) weighed. From the data obtained, the results desired are calculated as follows:—Total oxides—[Fe_2O_3 + FeO (as Fe_2O_3) + ZnO] = total alumina. Next, the quantities of iodine equivalent to the respective amounts of aluminium, ferric, ferrous, zinc, and ammonium sulphates present are calculated according to the equations previously given (*loc. cit.*; see also page 199). If the total quantity of iodine thus obtained be less than the amount determined by titration with thiosulphate, free acid is present in the sample in quantity equivalent to the difference between the two amounts, whilst, if it be more, free alumina is present.

$$\text{Free acid} = \text{iodine difference} \times \left(\frac{98{\cdot}08}{2 \times 126{\cdot}97}\right) (0{\cdot}386)$$

$$\text{Free alumina} = \text{iodine difference} \times \left(\frac{102{\cdot}2}{6 \times 126{\cdot}9}\right) (0{\cdot}134).$$

—A. S.

Chromic sulphate; Molecular changes in —— *when dissolved.* A. Colson. Compt. rend., 1907, **144**, 325—326.

DETERMINATIONS of the depression of the freezing point of water by the green chromium sulphate, obtained by heating the violet salt to a temperature above 90° C., exhibit two states when dissolved: an initial state expressed by the formula $[Cr_2(SO_4)_3]_2$, and a normal state, $Cr_2(SO_4)_3$, resulting from the slow dissociation of the former.—W. P. S.

Plumbic acid; Properties of hydrosols of ——. I. Bellucci and N. Parravano. Atti R. Accad. dei Lincei Roma, 1907, [5], **15**, II., 631—635. Chem. Zentr., 1907, **1**, 528. (See also this J., 1907, 149.)

NEUTRAL hydrosols containing potash and lead peroxide have no influence on the freezing-point of water, but faintly alkaline hydrosols lower it somewhat, the effect being smaller, the more thorough the purification of the hydrosol by dialysis. In experiments on the precipitation of the hydrosol by electrolytes, 5 c.c. of a preparation containing 0·759 grm. of lead peroxide and 0·022 grm. of potassium oxide per litre were treated with 1 c.c. of $N/100$ solutions of different electrolytes. Immediate and complete precipitation was caused by potassium iodide, ferrocyanide, tartrate, and fluoride, and partial precipitation by potassium acetate, chromate, iodate, nitrate, sulphate, thiocyanate, chloride, bromide, bichromate, permanganate, chlorate, perchlorate, and ferricyanide; potassium periodate, oxalate, carbonate, and arsenate were without effect. Of different chlorides, those of aluminium, ferric iron, chromium, strontium, barium, magnesium, cadmium, mercury, manganese, nickel, cobalt, and copper precipitated the hydrosol immediately and completely, whilst those of ammonium, cæsium, lithium, potassium, rubidium, and sodium caused partial precipitation. Potassium arsenite reacts chemically with the hydrosol.
—A. S.

Stannic chloride; Anhydrous ——. P. Heermann. Färber-Zeit., 1907, **18**, 34—37.

TIN-PLATE waste is treated with chlorine under varying pressures. The stannic chloride produced and the excess of chlorine are removed from the chlorinating vessel by the use of an inert gas and by alteration of the pressure. The tin chloride obtained is strongly yellow coloured and contains a considerable amount of free chlorine which is very soluble in anhydrous stannic chloride; the excess of chlorine is removed by the addition of the requisite quantity of stannous chloride or else by passing the distilled stannic chloride over granulated tin. The product obtained is of about 99·9 per cent. purity. It is more than twice as strong as the ordinary 50° B. solution.—A. B. S.

Ozone, nitric oxide, and hydrogen peroxide; Thermic relations of formation of ——. F. Fischer and H. Marx. Ber., 1907, **40**, 443—458.

A CONTINUATION of the work abstracted in this J., 1906 314 and 808. The Nernst filament was used. The results are as follows:—(1) As the temperature of the filament is raised, the ozone-concentration attained increases as theory requires. (2) The same is true of the hydrogen peroxide concentration when moist air is used. (3) The form of the slit from which the air-blast issues exerts a great influence on the results. The best form is a double parallel slit, so that one half of the blast passes over each of the two sides of the filament. (4) The highest ozone-concentration reached was 0·03 per cent. by weight of the air used, or 0·13 per cent. of the contained oxygen. (5) The temperature of the air blown over the filament is of little influence as far as ordinary atmospheric or climatic variations are concerned, but the yield of ozone is very considerably reduced when the air-temperature is raised to 60° C. (7) Moisture in the air reduces the yield of ozone, and produces hydrogen peroxide. (8) When oxygen is used instead of air, a much lower speed of issue is necessary for the maximum ozone-concentration; and at higher speeds the ozone-concentration, expressed as percentage of the oxygen present, is much lower with pure or almost pure oxygen than with air.—J. T. D.

Bromine industry in the United States. K. Petrusky. Chem. Ind., 1907, 30, 85—86.

The chief source of bromine is brine. These brines occur at various geological horizons, chiefly in the upper and lower coal-measures. Bromine was first produced from them in 1846 at Freeport in Pennsylvania. At present the chief districts of production are Michigan—at St. Charles, at Midland and Mount Pleasant, where the Dow Chemical Co. make about half the total output of the States, and at St. Louis; Ohio—at Pomeroy and Syracuse; West Virginia—at Hartford and Mazon, and at Malden, a few miles south-east of Charleston; and Pennsylvania—at Pittsburg. The usual process of manufacture is as follows:—The mother-liquors from the salt-crystallisation are mixed with dilute sulphuric acid, and heated to 49° C., when much of the hydrochloric acid produced escapes. On cooling, sulphates crystallise out, and the liquor is distilled with sulphuric acid and manganese dioxide. The vapours pass through an empty receiver, in which they deposit a certain amount of water, bromine, bromoform, bromine chloride, and carbon tetrabromide, and are then absorbed in sodium hydroxide solution in a second receiver. The liquor is evaporated to dryness, ignited, and the solid bromide produced is again distilled with sulphuric acid and manganese dioxide, yielding a practically pure bromine. In some instances the mother-liquor is concentrated, and distilled in stoneware retorts with sulphuric acid and potassium chlorate, the evolved bromine being condensed in lead tube condensers and redistilled. The Dow Chemical Co. electrolyse the mother-liquors, and expel the bromine thus produced by means of a current of air; this passes through sodium hydroxide solution, which extracts the bromine from it again. The production largely increased during the year 1905, although the lowered price, due to German competition (the price averaged in 1903, 28; in 1904, 30; and in 1905, 15 cents per lb.) brings the total value of the production below that of the previous year. The following statistics are given from the Report of the U.S. Geological Survey:—

Year.	Total production.	Value.
	lb.	$
1896	546,580	144,501
1897	487,149	129,094
1898	486,979	126,614
1899	443,004	108,251
1900	521,444	140,790
1901	552,043	154,572
1902	513,893	128,472
1903	598,500	167,580
1904	897,100	269,130
1905	1,192,758	178,914

—J. T. D.

Potassium chlorate; Dangerous ——. R. Gartenmeister, XXII., page 223.

Iodine; Japanese ——. Chem. and Drug., Feb. 23, 1907. [T.R.]

The high prices which have ruled for several months past in Japan have considerably hampered the export, the demand having been for the home market only. Holders in the interior are willing to sell at a low price in order to dispose of their stock. The market has, therefore, declined to some extent, and transactions are now being made for export at prices ranging from 3·65 yen to 3·60 yen per lb. for iodide of potassium. It seems that unless holders further reduce the price by 5 to 10 per cent. business will be only small. On the other hand, the stock of crude iodine in the interior is not heavy. The exports of potassium iodide during the past four years have been as follows (1 yen = 1 florin):—

	Quantity.	Value.
	lb.	yen
1903	29,753	101,174
1904	69,176	268,800
1905	57,533	266,288
1906	24,779	85,455

Sulphur; Sicilian ——. Chem. and Drug., Feb. 23, 1907. [T.R.]

The shipments of crude and refined sulphur from Sicily during 1906 amounted to 387,432 tons, or 68,728 tons less than in 1905, leaving stocks at all shipping ports in Sicily at the end of December estimated at 523,992 tons. The exports to the United States and Canada were 41,266 tons in 1906, against 71,399 tons in 1905 and 104,729 tons in 1904. The "Consorzio" having since last August declined to sell sulphur for shipment to the United States and Canada, it is probable that the decrease will become greater this year. The remainder of the decline in shipments during 1906 was due to the smaller demand of the wine-growing countries, wherein the consumption depends much upon the weather, and is therefore subject to fluctuations. Excluding exports to U.S.A. the total exports to other countries (comprising only 298,400 tons in 1902) increased in 1906 to 351,300 tons.

Nitrate industry of Iquique, Chile. Eng. and Mining J., Feb. 2, 1907. [T.R.]

The foreign commerce of the consular district of Iquique, Chile, showed a remarkable increase during 1905. The principal exports consisted of borax, valued at $953,142; copper ores, $693,404, and nitrate of soda, $67,314,977. The total amount of nitrate of soda produced in the Iquique district in 1905 was 1,902,578 tons, an increase of 202,909 tons over 1904. The exports amounted to 1,793,707 tons. At the beginning of 1905 there were in operation 113 nitrate plants, with an estimated producing capacity of 2,896,450 tons annually, and there were in process of construction 19 new plants, with a producing capacity of 950,000 tons a year. During the fiscal year ending March 31, 1907, the production and exportation is to be limited to 2,175,000 tons.

English Patents.

Sulphuric acid; Apparatus for the concentration of ——. A. Gaillard, Barcelona, Spain. Eng. Pat. 12,538, May 29, 1906.

See Fr. Pat. 367,376 of 1906; this J., 1906, 1146.—T. F. B.

Phosphate of lime; Converting tribasic —— *into monobasic phosphate of lime and oxide of calcium, and subsequent separation of the two.* M. Walkey, London. Eng. Pat. 13,882, June 18, 1906.

Ground tribasic calcium phosphate is mixed with sawdust and small coal, and the mixture is heated to bright redness. It is stated that by this process two of the three "molecules" of calcium are converted into oxide, leaving the remainder of the calcium as monocalcium metaphosphate (CaP_2O_6). The furnaced product is, when cold, transferred to a centrifugal separator, in which the lighter calcium oxide is blown away.—E. S.

Aluminate of soda; Process for removing silica from —— in the manufacture of alumina. La Cie. des Prod. Chim. d'Alais et de la Camarque, Salindres, France. Eng. Pat. 27,290, Nov. 30, 1906. Under Int. Conv., Aug. 13, 1906.

ALUMINATE of soda liquor, such as is prepared by lixiviating the mass obtained by roasting bauxite with sodium carbonate, is treated with milk of freshly precipitated calcium carbonate, in sufficient proportion to combine with the silica present. The liquor is then boiled, or subjected to steam pressure, with agitation, in an autoclave. The precipitate containing the silica which is carried down by the calcium carbonate is readily separated by subsidence or filtration. It is stated that about nine-tenths of the silica in solution in the crude sodium aluminate liquor is thus eliminated. Eng. Pat. 19,924 of 1904 (this J., 1904, 1088) is referred to.—E. S.

FRENCH PATENTS.

Generator of electricity; Thermo-chemical —— with complete or partial regeneration of the active materials, and, in the latter case, with manufacture of sulphuric acid. L. P. Basset. Fr. Pat. 370,170, Oct. 2, 1906. XIA., page 209.

Oxides in the form of powder; Process and apparatus for treating lead, tin, copper, &c., and easily fusible alloys in order to obtain the ——. C. L. C. Berton. Fr. Pat. 370,869, Oct. 27, 1906.

THE apparatus consists of a cylindrical chamber, the front part of which is formed of a double metallic shell and the rest of refractory material. The metal, in the form of fine powder, is forced by compressed air into the front part of the chamber through a tube surrounded by another tube of larger diameter, the annular space between the two serving as a gas inlet. The mixed jet of air, and metallic powder, is thus surrounded by the burning gas, and the metal is quickly and completely oxidised, the powdered oxide being drawn into the part of the chamber lined with refractory material, and collected. The air supply for the jet is heated by passing between the double metallic walls of the front part of the chamber, and may be ozonised or enriched with oxygen.—O. F. H.

VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 152.)

Frits; Standardisation of ——. F. Wooldridge and W. G. Morley. Trans. Eng. Ceramic Soc., 1905-6, **5**, 152—158.

THE authors point out the advantages likely to arise from the adoption of standard frits, which could be made of a more uniform quality and composition, at a considerably lower cost, by manufacturers who confined their attention to them, and were thus able to work on a large scale. As an example the author gives the composition of five well-known frits and of five glazes prepared therefrom without intermixing any of the frits. By using suitable proportions of one or more frits, it would be possible to prepare many different types of glazes. The five frits were prepared from felspar, sand, red lead, borax, china clay, and whiting, and had the following molecular composition:—

Frit	Basic oxides.				Al_2O_3	Acidic oxides.	
	K_2O.	Na_2O.	CaO.	PbO.		SiO_2.	B_2O_3.
No 1	0·19	0·08	0·15	0·58	0·20	1·61	0·20
No 2	0·18	0·12	0·15	0·56	0·17	1·79	0·26
No 3	0·12	0·25	0·63	—	0·24	3·75	0·62
No 4	[illegible]	0·26	0·41	—	0·25	2·66	0·64
No 5	0·24	0·30	0·47	—	0·26	3·15	0·76

The composition of the mill mixtures for the five glazes is given in the following table:—

Mill mixture.	A.	B.	C.	D.	E.
Frit	90 (1)	82 (2)	58 (3)	65 (4)	65 (5)
White lead	9	8	26	24	13
Sand	—	—	—	—	11
Norwegian felspar ..	—	10	16	11	11

NOTE.—The figures in brackets refer to the frits numbered in the first table.

The glazes had the following molecular composition:—

Glaze.	Basic oxides.				Al_2O_3.	Acidic oxides.	
	K_2O.	Na_2O.	CaO.	PbO.		SiO_2.	B_2O_3.
A	0·27	0·13	0·21	0·39	0·28	2·26	0·26
B	0·27	0·17	0·21	0·35	0·32	2·77	0·36
C	0·14	0·15	0·34	0·37	0·30	2·33	0·35
D	0·29	0·16	0·25	0·30	0·22	2·01	0·40
E	0·28	0·21	0·32	0·19	0·20	2·88	0·45

—A. S.

Pottery for electrical uses. H. Watkin. The Times Engineering Supplements, Jan. 16, p. 18, and Feb. 6, 1907, p. 42.

THE author gives a brief summary of the process of manufacture of pottery, and emphasises the fact that, for electrical purposes, it is essential that all the measurements of the holes, which are often tapped to receive screws, recesses, &c., of the articles, must be accurate. This accuracy is extremely difficult to attain owing to the contraction of the clay body during drying and during burning in the biscuit oven, apart from any inequalities that might arise in the process of glazing. To obtain articles of exact dimensions, the author considers that the most suitable condition in which to employ the clay for moulding is that of nearly dry powder or dust, and to mould the objects in a stamping press. At the same time, for the success of this process the ratio of the amount of water present to that of the clay must be constant, and the clay must always be ground to the same degree of fineness, and the same amount of clay used for each piece pressed. The moulds must be carefully adjusted in size to allow for the contraction on drying of the particular clay body employed, and the contraction due to firing at definite temperatures must also be accurately known. With regard to the firing, instruments must be used to show the progress of the temperature, and to definitely record the temperature attained in each portion of the oven, *e.g.*, by the use of pellets of fusible material placed in recesses in a small block of very refractory material and arranged in each saggar in the oven. Further, the requisite degree of heat required for each article must be attained during the firing, and pieces that have not undergone their maximum contraction should be refired, while those that have been exposed to temperatures higher than necessary should be rejected. Besides accuracy of dimensions, which will allow of the interchange of parts, and renewal of breakages, electrical porcelain should possess density or "vitreosity," tensile strength, and high insulating properties. If made too vitreous the article tends to become brittle, and on the other hand a porous body absorbs moisture and is consequently an imperfect insulator. Any crazing of the glaze also favours the absorption of moisture, besides decreasing the tensile strength of the article, and consequently there must be complete agreement between the body and the glaze. The porosity of a piece of pottery is determined by comparing its weight when dry with its weight after immersion in water for twenty-four hours. Good electrical porcelain will resist electric currents at 30,000 volts, and in some cases even up to 60,000 volts.
—W. C. H.

Fireclay and infusorial earth in Manchuria. Bd. of Trade J., Feb. 14, 1907. [T.R.]

The "Charbinski Wjestnik" reports that large deposits of white fire-clay of very good quality have been found in the western slopes of the Great Chingan. The clay contains 39 per cent. of alumina and very small quantities of iron oxide, magnesia, and potash. A similar clay of good quality is known to exist on the Sjaolin mountain ridge on the Chinese Eastern Railway. Besides these, there is a large number of deposits of plastic clay in Manchuria. Further, the deposits of infusorial earth (kieselguhr) between Imjanpo and Uzeima are of importance.

French Patents.

Glass; Process and apparatus for making window and sheet ——. C. Menzel. Fr. Pat. 369,708, Sept. 14, 1906.

See Eng. Pat. 20,507 of 1906; this J., 1907, 48.—T. F. B.

Glass sheets; Mechanical production of ——. F. Oppermann. Fr. Pat. 369,986, Sept. 24, 1906.

In this process glass sheets are produced from a mass of hot plastic glass in a specially constructed pot or furnace. The pot is provided in one of its walls, which must be straight, with a slit through which a band or sheet of glass can be made to flow by turning the pot into such a position that the slit is lower than the level of the molten glass in the pot. The band of glass escaping from the slit is cooled and stiffened, by radiation, by passing close to a system of metal pipes through which a cooling liquid is circulated, and below this system the sheet is gripped between friction rollers. To prevent very rapid cooling of the sheet, the cooling apparatus, friction rollers, and sheet are surrounded with a suitable casing. The pot is made to turn about some axis, preferably the axis coinciding with the length of the slit through which the glass flows. The pot may form an integral portion of a furnace which turns upon an axis, or a founder's furnace capable of turning on a horizontal axis, may support the pot.—W. C. H.

Glass; Artificial production of volcanic ——. S. J. d'Après and J. Dessane. Fr. Pat. 370,175, Oct. 3, 1906.

Artificial volcanic glass, or obsidian, is produced by the fusion of marls at a high temperature. The fused mass is very slowly cooled in moulds, in which the mass is formed into the required shapes. The articles may be decorated by means of enamels, such as are employed in similar arts.—W. C. H.

Magnesium silicates; Manufacture of ——. H. Herrenschmidt. Fr. Pat. 369,987, Sept. 24, 1906.

The object of this invention is the preparation of homogeneous magnesium silicates for use in the pottery, porcelain, and firebrick industries. The process consists in mixing definite proportions of silica and magnesia, ground to suitable fineness, and completely fusing the mixture in an electric furnace. The percentage of silica must lie between 30 and 65, and the percentage of magnesia between 35 and 70.—O. R.

Magnesium silicates, natural or artificial; Coloration of ——. H. Herrenschmidt. Fr. Pat. 369,988, Sept. 24, 1906.

A metal which forms coloured oxides is reduced to a finely divided condition, mixed with an oxidising agent such as saltpetre, and incorporated with the mixture of silica and magnesia which yields the desired magnesium silicate after fusion in an electric furnace.—O. R.

Ceramic products; Manufacture of light (weight), insulating ——. C. Robin, *née* Mousset. Fr. Pat. 370,159, Oct. 2, 1906.

The light insulating ceramic products described are specially useful for heat-insulation, and are made from a mixture of special clay containing a large amount of silica, about five to seven times as much as the alumina by weight, with about 40 to 60 per cent. by weight of organic materials in small pieces.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 153.)

Firebricks and their employment in chemical industry. C. Schärtler. Chem. Ind., 1907, 30, 57—59.

The value of refractory materials employed in chemical industries depends not only upon the actual power of resisting high temperatures but also upon the power of resisting chemical reagents. An obvious source of chemical influence is to be found in the ash of the fuel used in the furnace, and the author has encountered several examples of the melting down of basic blocks due to acid furnace cinder. Just as the quality of coal from the same area varies, so the composition of the ash also varies; for example, Bischof mentions that the alumina content of coke cinder from one gas-works was 24·41 per cent., whilst that in the ash of bog-head coal amounted to 38·87 per cent., a difference sufficiently great to show that the effect of the ash cannot be overlooked. Again, a case is cited by Otto, in which the melting down of the walls of a coke-oven was traced to an abnormal amount of salt present in the coal. With the density the mechanical strength of a block increases, and this is important, especially in sulphate and pyrites roasters, which have to withstand the abrading action of scrapers besides the action of acid fumes. Consequently, dense, hard burnt acid blocks should be used for the hearth-flags of sulphate kilns; for the rest of the walls, the so-called balling-furnace stone (Schweissofenstein) offers great resistance to hydrochloric acid fumes. With ordinary regular working such flags should last twelve to fifteen months, and the vaults of the furnace in most cases should not need renewal. In the modern mechanical pyrites roasters the movement of the scrapers does not appear to affect the blocks injuriously. The blocks and rings of Glover and Gay-Lussac towers have to resist acids rather than high temperatures; consequently, the material must not have too high a content of alumina, or, in other words, must be rich in silica and rather porous. A highly sintered material is to be avoided on account of the danger of cracking. However, though only highly silicious materials can be used, it must be remembered that such materials possess little resistance to changes of temperature, and that flaws and crevices may occur at relatively low temperatures, and afford advantageous starting points for the destructive work of the acid. For revolving soda furnaces a very hard burnt and highly basic lining is used, which is protected when once a thick crust of soda forms upon it. For lime kilns the blocks must be very strong mechanically, but do not have to resist very high temperatures. Small plates are used for lining the pear-shaped digesters employed in the sulphite process of cellulose (pulp) manufacture. The lining is composed of two layers, with "crossed" joints, which are filled with water-glass cement. The lining has to withstand a temperature of 120° C., and the action of the "sulphite-liquor," for which an acid, hard burnt, but not a sintered, material is the best. The durability of refractory materials, especially in the iron industry, depends upon the mixing of the ores, and it would be a great advantage to manufacturers of such products if observations of the durability of their blocks were accessible to them. In chemical industries most furnaces work continuously, and consequently brittle and highly silicious blocks can be used, since they are not exposed to great variations of temperature. With discontinuous working, Dinas bricks, for example, cannot be used, though very serviceable for furnaces working continuously. In cooling, the inrush of cold air gives rise to cracks, and the blocks fall from the bonding. Cases may occur in which blocks are exposed on one side to acid effects, and on the other to basic effects. Such a case may be met by using a double layer of blocks in the wall, but here it must be remembered that an increased amount of fuel would be needed to maintain the required temperature, owing to the increased thickness of the wall. Blocks, however, can be made with an acid surface on a basic foundation;

it is only necessary that the coefficients of contraction, both on drying and burning, of a basic and an acid mixture should be exactly similar. For building burnt clay blocks into a wall a suitable mortar must be used, composed of refractory binding clay and ground burnt clay. —W. C. H.

Paper bags for cement. W. Herzberg. XIX., page 220.

English Patent

Bricks of calcareous sand or the like ; Method of manufacturing ——. S. W. Berglund, Stockholm. Eng. Pat. 9785, April 26, 1906.

See Fr. Pat. 366,830 of 1906 ; this J., 1906, 1081.—T. F. B.

French Patents.

Wood ; Process for preserving —— and rendering it noninflammable. E. Herre. Fr. Pat. 369,985, Sept. 24, 1906.

This invention has special reference to preserving and making incombustible timber which is employed for mining purposes. The material is heated for one and a half to two and a half hours in a solution consisting of a mixture of earthy and heavy sulphates, usually those of alumina and iron (ferrous), the temperature being between 80 and 100° C. The wood is allowed to cool in the same solution at atmospheric pressure. A suitable impregnating mixture consists of 145 kilos. of ferrous sulphate and 5 kilos. of aluminium sulphate dissolved in 1000 litres of water.—O. R.

Rubber, wood, leather, textiles, &c. ; Process of rendering —— impermeable. A. Baseir and R. de Fazi. Fr. Pat. 370,043, Sept. 26, 1906, XIIIC., page 212.

Natural soft or porous stone, plaster, magnesite, cement and similar materials ; Process of hardening and rendering more resistant, objects, plain or coloured, made of ——. E. E. Hippe. Fr. Pat. 370,105, Sept. 29, 1906.

The process of hardening and protecting plain or coloured objects made of natural stone that is soft or porous, plaster, &c., consists in impregnating the objects with melted resin, the melting point of which is lowered by the admixture of hydrocarbons or similar substances to such an extent that the temperature of the bath does not have any injurious effect upon the water of crystallisation present in the articles. The articles may also be impregnated with the hydrocarbons or similar substances previous to their immersion in the resin bath.—W. C. H.

Insulating and building materials ; Process and apparatus for the manufacture of ——. Vacuum Pressgut-Ges.m.b.H. Fr. Pat. 370,143, Oct. 1, 1906.

This invention consists essentially of subjecting insulating materials to the simultaneous action of heat and compression *in vacuo*. It is stated that in this way, bad conductors of electricity, which are normally hygroscopic, are made available for insulators, for which they would otherwise be unsuitable owing to their attraction for moisture. For this purpose, substances such as asbestos, &c., are incorporated with waterproof materials as copal, wax, shellac, &c., and dried *in vacuo* under the combined action of heat and pressure. The thorough incorporation is best effected by using a solution of the binding material in a suitable solvent, such as alcohol, and removing the solvent by evaporation in the same evacuated vessel in which the final heating and compression takes place.—O. R.

X.—METALLURGY.

(Continued from page 150.)

Gold output of Australasia in 1906. Bd. of Trade J., Feb. 21, 1907. [T.R.]

The "Australian Mining Standard" publishes the following statistics of the output of gold during the year ended December 31, 1906, with comparative figures for the preceding year :—

States.	1905.		1906.	
	Fine oz.	£	Fine oz.	£
Western Australia	1,955,316	8,305,651	1,794,432	7,693,285
Victoria........	747,366	3,173,744	772,290	3,280,478
Queensland.....	578,364	2,517,295	496,924	2,110,800
New South Wales	274,267	1,165,013	253,987	1,078,866
Tasmania	73,540	312,380	60,649*	254,246
New Zealand ..	493,155	2,093,936	533,207	2,264,918
Total	4,122,008	17,568,019	3,911,489	16,682,593

* Approximate.

Martin process ; Metallurgy of the ——. T. Naske. Stahl und Eisen, 1907, 27, 157—161, 191—194, 229—236, 265—269.

The investigation carried out by the author is supplementary to that of Dichmann (this J., 1906, 74). The conclusions arrived at are based mainly upon the results of analyses of charge, slag, and metal at varying periods of the process, and under varying conditions. Manganese acts sometimes as an oxidising agent and sometimes as a reducing agent. In the initial stage of the process the manganese is for the most part oxidised, and goes into the slag, forming a manganese-iron silicate, and the prevailing tendency is to the formation of a singulo-silicate, $(Fe_xMn_y)_2SiO_4$, where $x=y$. Experimental results show that when the quotient, $Q=\frac{\%\ \text{Fe in slag}}{\%\ \text{Mn in slag}}$ is equal to unity, the manganese in the metal and in the slag are in equilibrium. If Q be less than 1, as is usually the case, manganese is reduced from the slag and passes into the metal, whilst if Q be greater than 1, manganese is oxidised and passes from the metal into the slag, in both cases, until equilibrium is attained. If the amount of manganese present be insufficient for equilibrium to be attained, the slag acts as an oxidising agent, and the metal takes up iron oxides, and becomes "red-short."

With respect to the removal of carbon and silicon from the iron, it must be accepted that in the first place the carbon is oxidised to carbon monoxide (carbon dioxide is, for the most part, dissociated at the temperature of the Martin furnace), which is then reduced by the silicon according to the equation, $Si+2CO=SiO_2+2C$, the carbon being re-dissolved by the iron. The reduction of the carbon monoxide, and, consequently, the decarburisation of the iron, proceeds more rapidly the higher the concentration of the silicon. When cold iron ore is added to the molten pig-iron, the period of most rapid decarburisation occurs when about one-half of the carbon has been oxidised. With an increase in the temperature of either or both of the reacting bodies (ore and pig-iron), the period of most rapid decarburisation is displaced from the end towards the beginning of the process, and, if fused ore and superheated molten pig-iron be employed, occurs directly after the materials come into contact. The reaction-velocity, *i.e.*, the quantity of oxygen entering into chemical reaction in unit time, bears a definite relation to the time elapsing before the period of most rapid decarburisation is attained, being greater the more the latter is displaced towards the beginning of the process. It appears evident, therefore, that in practice the most economical method of working is to superheat the pig-iron as it comes from the blast-furnace, and to use fused iron-ore. In the author's opinion, the superheating of the pig-iron would be best accomplished in a large, tilting Martin furnace (with a neutral lining), capable of supplying four ordinary Martin furnaces with superheated pig-iron, and itself fed directly from the blast-furnace, the inlet opening being provided with a bridge or other suitable device for preventing the admission of any separated graphite present in the molten iron.

The removal of phosphorus from the pig-iron is only possible in presence of iron oxides or limestone, the most effective solvent being an iron-calcium silicate slag, in which the iron cannot be replaced by lime, or *vice versâ*, without the solvent power for phosphoric acid being affected ; it is probable, however, that the iron may be partially replaced by manganese. The separation of phosphorus from the pig-iron is favoured by increase of temperature, but manganese does not appear to exert any influence. When the slag is saturated with phosphoric acid, the reverse action may commence, and under the influence of carbon and carbon monoxide, in presence of metallic iron, phosphorus may pass from the slag again into the metal. In conclusion, the author points out that the Martin process is not exclusively an oxidising process, both oxidising and reducing actions playing parts.—A. S.

Chromium in steel; Volumetric determination of ——. G. V. Bianchetti. Rass. Min., 1906, **25**, 189—190; Laboratorio Chimico e Micrografico della Fonderia Milanese di Acciaio. Chem. Abs., Amer. Chem. Soc., 1907, 151.

Either 1·667 or 3·334 grms. of steel turnings are dissolved in 25—30 c.c. of hydrochloric acid (sp. gr. = 1·124) in a 150 c.c. glass beaker. When solution is complete, 20—30 c.c. of an 8 per cent. solution of potassium chlorate are added for the purpose of oxidising the iron. The solution is then boiled until the last trace of free chlorine has disappeared. After the solution has been neutralised in a large Erlenmeyer flask with a 40 per cent. solution of sodium carbonate, the chromium is oxidised with 10—20 c.c. of a 4 per cent. solution of potassium permanganate. The entire solution is boiled for ten to fifteen minutes, with constant stirring. If the liquid is rose-coloured, from 2—5 c.c. of ethyl alcohol are added, and the solution is again boiled for ten minutes. When perfectly cool, the contents of the flask are transferred to a measuring flask, and are diluted to exactly 500 c.c. with cold distilled water, being frequently shaken during the operation. The solution is now poured upon a dry filter. For the determination of chromium, 300 c.c. of the filtrate (corresponding to 1 grm. or to 2 grms., according to the amount of steel originally weighed out) are employed. This sample is divided into six equal parts of 50 c.c. each, which are slightly acidified with dilute hydrochloric acid. To each part is added 5—10 c.c. of a 10 per cent. solution of potassium iodide, then, after shaking, 10—20 c.c. (carefully measured) of *N*/10 sodium thiosulphate solution, and, finally, 5 c.c. of a solution of starch paste. A *N*/10 solution of iodine is now added drop by drop from a burette until the faintest permanent blue colour is obtained. From the number of c.c. of thiosulphate solution taken is subtracted the number of c.c. of iodine solution employed. The percentage of chromium is calculated by multiplying this difference by the factor, 0·17362, and multiplying the product by 6. This result must be divided by 2 in case 3·334 grms. instead of 1·667 grms. of steel were taken at the outset.

Silver bullion; Assay of —— by Volhard's method. E. A. Smith. Inst. Mining and Metall., Jan. 17, 1907. [Advance proof.]

The Volhard method for the assay of silver bullion has been used by the author for several years past for some 200 assays per diem, with entire satisfaction, certain modifications being introduced which add to the accuracy attainable. An ammonium thiocyanate solution is prepared of such strength that 100 c.c. are equivalent to about 1·0003 grms. to 1·0005 grms. of silver. To a solution containing 1 grm. of pure silver, deprived of all traces of nitrous acid, and after addition of the ferric indicator solution (iron alum decolorised by nitric acid), 100 c.c. of the thiocyanate solution are added; when the precipitate that forms has settled, a clear, pale-red coloured solution (due to the presence of ferric thiocyanate) is left, which becomes now the standard of comparison to which all assays are worked. The addition of 0·5 c.c. of *N*/10 silver nitrate solution should render the solution colourless. The standard or check being thus obtained, in assaying silver bullion a solution is formed in like manner from about 1 grm. of silver, and after precipitation (in presence of the ferric indicator), by the normal thiocyanate solution, *N*/10 thiocyanate solution is added until the colour approaches that of the check, and after clearing, the solution is added by drops, until the colour of the check is exactly reached. One drop of the *N*/10 solution (0·05 c.c.) is equivalent to 0·05 mgrm. of silver, and makes a perceptible difference in the colour. Thus, it is the extreme delicacy of the reaction between the thiocyanate and the ferric salt which is taken advantage of in the described modified process, making it possible to see the end of the assay more accurately than when the assay is finished in the usual way. The assays are best compared with the check by placing the bottles so that they catch the reflected light of a white surface. In assaying silver-copper alloys, a pure silver check is used, with addition of copper in proportion approximately equivalent to that in the alloy.—E. S.

Zinc; Analysis of minerals containing ——. J. A. Muller. Bull. Soc. Chim., 1907, [4], **1**, 61—63.

The following process has proved successful for the estimation of arsenic, antimony, lead, copper, cadmium, iron, aluminium, manganese, zinc, calcium, and magnesium in zinc ores, such as blendes and calamines, although not applicable if much phosphorus or fluorine be present. The hydrochloric acid solution is precipitated hot by sulphuretted hydrogen, and the precipitate extracted with sodium sulphide.

Sodium sulphide filtrate.—This is precipitated by dilute hydrochloric acid, and the precipitate washed with water, alcohol, and then a mixture of equal parts of alcohol, ether, and carbon bisulphide to get rid of sulphur. It is washed off the filter with alcohol, evaporated to dryness, and treated with nitric acid (sp. gr., 1·4) in a covered dish. The residue is extracted successively with water and hot *aqua regia*, and then to the whole solution are added tartaric acid and ammonia in excess to precipitate the arsenic as ammonium-magnesium arsenate, which is weighed on a tared filter, after drying over sulphuric acid. The mother-liquor contains about 1 mgrm. of the double arsenate per 20 c.c. The antimony is precipitated in acid solution by sulphuretted hydrogen, and weighed as sulphide, the trace of arsenious sulphide present being allowed for.

Residue.—This may contain lead, copper, and cadmium. It is treated with nitric acid, excess of the acid removed by heat, and the lead separated by a little sulphuric acid and alcohol. The filtrate is evaporated to complete dryness, the residue taken up by a little nitric acid, and diluted so as to contain 3·4 per cent. of free nitric acid; from this solution copper is separated by electrolysis. The liquid is then evaporated to dryness with a little sulphuric acid, and the residual cadmium sulphate, which may contain traces of lead, copper, and zinc, is weighed.

Acid filtrate.—Sulphuretted hydrogen is removed by boiling, and then iron, manganese, and aluminium are precipitated by hydrogen peroxide and ammonia. The precipitate is dissolved in hydrochloric acid, the solution boiled, and iron and aluminium are thrown down with ammonium succinate and sodium acetate from a hot and nearly neutral solution. After twenty hours, the whole is reheated to 90° C., cooled, filtered, and the precipitate washed with water and with dilute ammonia. The precipitate is ignited and weighed, and the aluminium separated by fusion with caustic potash in a silver crucible, or the iron is estimated volumetrically. The manganese is weighed as Mn_3O_4 after precipitation by hydrogen peroxide and ammonia. After separating the three preceding metals, the liquid is boiled to drive off the excess of ammonia and precipitate the last traces of aluminium. After cooling, a little ammonia is added, and the zinc precipitated by sulphuretted hydrogen, and weighed as sulphide. Calcium is then weighed as sulphate, after precipitation as oxalate, and magnesium as the pyrophosphate in the usual way.—F. Sodn.

Ferro-cuprous sulphides [Mattes]; Constitution of ——. H. O. Hofman, W. S. Caypless, and E. E. Harrington. Bull. Amer. Inst. Min. Eng., 1907, 25—36.

A determination of the freezing-point curve of mixtures of cuprous sulphide and ferrous sulphide, together with a microscopical examination of the products, gave results at variance with those of Gibb and Philp (this J., 1906, 24), who concluded that the two sulphides form a chemical compound, $5Cu_2S,FeS$. The freezing-point curve of mixtures of the two sulphides has a V-form characteristic of eutectiferous alloys, and micrographical examination showed that in all of the products containing more than 20 per cent. of ferrous sulphide, a eutectoid constituent is more or less plainly discernible. The eutectic mixture appears to be one containing about 86 per cent. of ferrous sulphide and 14 per cent. of cuprous sulphide, with a solidifying point at about 850° C.; in products containing more ferrous sulphide, the structure of the eutectic becomes merged in that of the pure ferrous sulphide, and cannot be distinguished from it. Products containing more than 80 per cent. of cuprous sulphide consist of solid solutions of ferrous sulphide in cuprous sulphide. Metallic copper was present in all of the products containing more than 30 per cent. of cuprous sulphide.—A. S.

Lime-roasting a galena concentrate; Laboratory experiments in —— with reference to the Savelsberg process. H. O. Hofman, R. P. Reynolds, and A. E. Wells. Bull. Amer. Inst. Min. Eng., 1907, 37—52.

In the Savelsberg process for the treatment of lead sulphide ores (see Fr. Pat. 336,540 of 1903; this J., 1904, 376), the charge of ore, limestone, and, if desirable, some siliceous or ferruginous flux, is crushed to pass a screen with holes of 3 mm. diameter, moistened with 5 per cent. of water, and blown in a converter. The authors have attempted to determine the effects of variations in the amount of limestone added, and of changes in the volume of the blast, upon the degree of desulphurisation, the physical character of the product, and losses of lead and silver. The ore used was a galena concentrate containing:—Sulphur, 10·58; ferrous oxide, 5·95; alumina, 4·80; silica, 18·58; zinc, 2·57; lead, 54·70; lime, 2·20; magnesia, 0·40; and silver (39·5 ozs. per ton), 0·135 per cent. Two sets of tests were made, in one of which sufficient quartzite was added to the charge of ore and limestone for the production of a singulo-silicate slag, whilst in the other, no quartzite was added, sub-silicate slags being produced. The results obtained showed that with the ore in question, charges containing widely-differing proportions of lime and silica could be successfully blown. In working to obtain a singulo-silicate slag, the best results were obtained by using quantities of limestone equal to 20—26 per cent. of the weight of the charge, whilst with mixtures giving sub-silicate slags, the best proportion of limestone was 20 per cent. In all cases more efficient desulphurisation was attained with a low-pressure than with a high-pressure blast, and the losses of lead and silver were also less with the former.—A. S.

Aluminium and copper; Alloys of ——. H. C. H. Carpenter and C. A. Edwards. Appendix to eighth report of Alloys Research Committee, Inst. Mech. Eng. Engineering, 1907, **83**, 253—254. (See this J., 1907, 153.)

The results obtained by the authors as to the structural constituents of aluminium-copper alloys are in agreement, with one or two exceptions, with those of Guillet (this J., 1905, 1019, 1237). Six constituents were identified, *viz.*, α, a solid solution of aluminium (up to about 9 per cent.) in copper; α, the compound, Cu_4Al; β, the compound, Cu_2Al; γ, a solid solution containing between 16 and 27 per cent. of aluminium; δ, the compound, $CuAl_2$; and ϵ, a solid solution of copper in aluminium, containing very little copper. The behaviour of the alloys during solidification and on cooling is discussed in detail. No evidence of the formation of the compound, AlCu, mentioned by Guillet, could be obtained, but the compound Cu_4Al, not mentioned by him, was identified. In conclusion, attention is drawn to the many points of resemblance between copper-aluminium and copper-tin alloys.—A. S.

Palladium and lead; Alloys of ——. R. Ruer. Z. anorg Chem., 1907, **52**, 345—357.

From consideration of the cooling-curve of palladium-lead alloys, together with examination of their microstructure, the author concludes that the two metals form five compounds, of which, however, three undergo decomposition on melting. The compounds which melt without decomposition have the compositions, $PdPb_2$ (m.pt. 454° C.) and Pd_3Pb (m. pt. 1219° C.), respectively. Of the other compounds, one of the probable composition, PdPb, melts at 495° C., with separation of a compound containing between 37·5 and 40·7 per cent. of palladium, which in turn melts at 596° C., with separation of the compound, Pd_2Pb, melting, with decomposition, at 830° C. The hardness of palladium-lead alloys increases from that of lead (about 1·5 on Mohs' scale) to a maximum of about 5 in the alloy containing 65 per cent. of palladium, and then again decreases to that of palladium ("about 3").
—A. S.

Stream pollution by acid iron waste. Stabler. XVIII*B*., page 219.

English Patents.

Air for metallurgical operations; Desiccation of ——. L. Sterne, London. From L. Block, Mamaroneck, New York. Eng. Pat. 24,647, Nov. 28, 1905.

The air is first compressed to a higher pressure than that required in the furnace; the compression is, if desired, performed in two stages, the air being cooled and partially deprived of its moisture in a heat-interchange apparatus through which it is passed between the two compressions. The compressed air is then cooled in a surface- or spray-condenser, or in both, whereby the greater part of the moisture is removed. The cooled dry air is next slightly heated to prevent the deposition of snow, and is allowed to expand, down to the pressure required in the furnace, in the cylinder of a motor. The energy liberated is utilised to assist in the first compression, and the cold produced by the expansion may be used to cool the air in the surface condenser. Finally the air is passed through a heater or stove to the furnace.—W. H. C.

Furnaces; Reverberatory [metallurgical] ——. F. Cotton, Hornsby, N.S.W. Eng. Pat. 1770, Jan. 23, 1906.

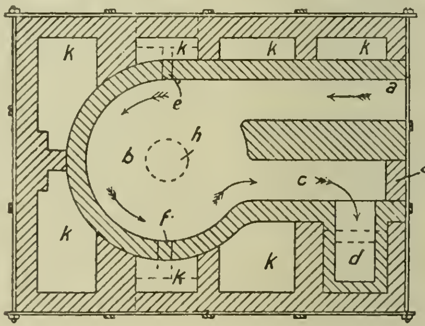


Fig. 1.

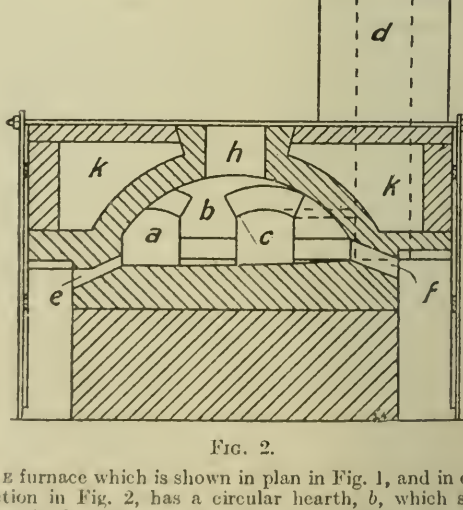


Fig. 2.

The furnace which is shown in plan in Fig. 1, and in cross-section in Fig. 2, has a circular hearth, *b*, which slopes towards the tapping-hole, *c*, from which the molten metal is withdrawn, and is provided with another aperture, *f*, on the opposite side, for the removal of the slag. The gaseous- or liquid-fuel burner is placed at the entrance of the flue, *a*, which is tangential to the hearth, *b*, and the flame and hot gases travel in the direction shown by the arrows. In consequence of the centrifugal motion imparted to the gases, the heavier products of combustion are caused to hug the circular wall of the furnace, and the unburnt lighter gases continue to circulate in the centre of the hearth until they are burnt. The products of combustion escape to the chimney, *d*, by the flue, *c*, which has a direction parallel to the flue, *a*, and almost radial to the furnace hearth, *b*; a removable tile, *g*, allows the dust to be removed. The charge is introduced through the opening, *h*, in the top of the furnace, and the latter is surrounded by a double wall separated by the spaces, *k*, which are filled with sand to prevent radiation and to allow the hearth, *b*, to be easily raised to and maintained at a high temperature.—W. H. C.

Rusting; Treatment of iron or steel for preventing oxidation or ——. T. W. Coslett, Birmingham. Eng. Pat. 8667, April 10, 1906.

The articles of iron or steel are coated with phosphate of iron by treatment with a dilute solution of ordinary phosphoric acid. A suitable substance, such as iron filings, may be used "for the purpose of controlling or regulating the rapidity or strength of the chemical action upon the metal or articles undergoing treatment."
—O. F. H.

Steel and other metals; Melting and converting furnaces for ——. L. Rousseau, Argenteuil, France. Eng. Pat. 12,729, May 31, 1906.

The furnace, which is a portable one and adapted to be tilted on trunnions, consists of a chamber in which the fuel is burnt by air under pressure, and a separate melting chamber into which the flames pass by two sets of ducts, one at an upper and one at a lower level, inclined horizontally. By this arrangement it is claimed that the melted metal is thoroughly mixed by rotary motion set up by the passage through it of the flames from the lower ducts, and that pig iron may be converted into steel by adjusting the air supply so as to give an oxidising flame.—O. F. H.

Gold from auriferous sands; Apparatus for the extraction of —— by amalgamation. B. G. Jayne and C. M. Knight, New York. Eng. Pat. 17,699, Aug. 7, 1906.

The material, after passing a grizzly, is pumped, with clear water, if necessary, through jets in the bottom of a tank containing a series of wings and vanes which direct the flow of pulp upward, outward, and forward to the top of corrugated amalgamated plates which it descends. The bottom of the tank is provided with "sand deflectors," which deflect the sand again into the jets, and prevent its accumulation. The sand is discharged through two pipes at the end near the top of the tank, and is pumped back again for further treatment.—O. F. H.

United States Patent.

Furnace; Porous-hearth ——. J. E. Greenawalt, Denver. U.S. Pat. 839,064, Dec. 18, 1906.

See Fr. Pat. 355,312 of 1905; this J., 1905, 1239.—T. F. B.

French Patents.

Metals, alloys, and definite metallic compounds, such as metallic silicides; Industrial production of ——. L. d'E. Muller and L. H. Baraduc. Fr. Pat. 361,950, Nov. 29, 1905.

The process consists in heating to a high temperature in an electric or other furnace a mixture of one or more metallic oxides with oxycarbide of silicon (siloxicon) or carbide of silicon (carborundum), together with suitable fluxes such as lime, magnesia, borax, cryolite, sodium carbonate, &c.—O. F. H.

Iron ores; Process for briquetting ——. W. Schumacher. Fr. Pat. 361,957, Dec. 2, 1905.

In this invention calcium silicate is used as the binding agent. The finely-divided ore or flue dust is made into briquettes with a small quantity (*e.g.*, 5 per cent.) of a mixture of equal parts of very finely powdered sand and lime, and allowed to harden. Blast-furnace slags, magnesia, Portland cement, &c., may also be used as part of the binding mixture.—O. F. H.

Steel; Quenching baths for ——. J. Churchward. Fr. Pat. 369,684, Aug. 30, 1906.

The claim is for a quenching bath containing mercury, to be used either alone or in conjunction with a bath of phenol. For steel heated to 760°—870°C., good results are obtained by quenching in a vessel containing a mixture of mercury (30—50 per cent.) and lard or other fat (70—50 per cent.), covered by a mixture of phenol (30—50 per cent.) and linseed oil (70—50 per cent.). Glycerin or other fatty matters may be employed instead of the linseed oil, and cresol instead of phenol.—A. S.

Turrets and other armoured shelters; [Treatment of steel for ——]. R. A. Hadfield. Fr. Pat. 370,155, Oct. 2, 1906.

See Eng. Pat. 834,904 of 1906; this J., 1906, 1153.—T. F. B.

Soldering; Process of autogenous ——. A. G. Le Chatelier. Fr. Pat. 361,964, Dec. 5, 1905.

In the autogenous soldering of iron and steel by means of the oxyhydrogen or oxy-coal-gas flame, difficulty is experienced owing to oxidation of the iron by the steam produced in the flame. The inventor proposes to add a suitable proportion of a hydrocarbon rich in carbon (acetylene, vapour of light petroleum, &c.) to the coal-gas or hydrogen, in order to avoid this difficulty. It is stated that by this means the products of combustion contain less steam and more carbon dioxide; also, the latter is partially dissociated with formation of carbon monoxide, which has a reducing action, and this prevents oxidation of the iron.—A. S.

Auriferous sands and gravels; Apparatus for washing ——. P. Holenstein. Fr. Pat. 369,655, Feb. 8, 1906.

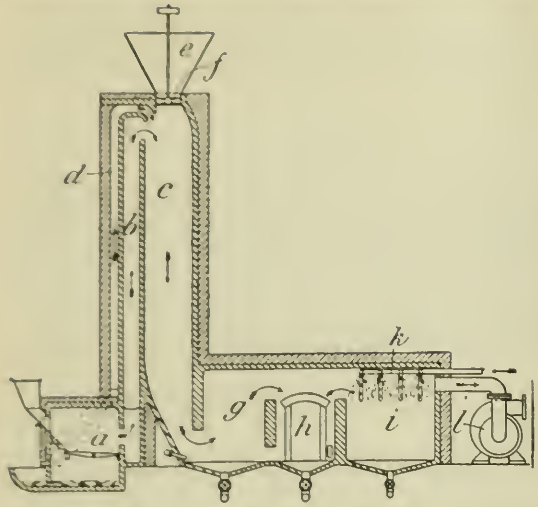
The apparatus consists of a box containing three frames supporting inclined tables and screens. The two lower tables are provided with riffles, and at the end of the last one is a brush for catching very fine or float gold. The auriferous material is fed into the box through a hopper and grizzly, and a shaking movement is given to the box by hydraulic or hand power.—O. F. H.

Gold; Apparatus for the extraction of ——. P. de Boklevsky. Fr. Pat. 369,671, Aug. 11, 1906.

The apparatus is intended for the extraction of gold from slimes by amalgamation, and consists of four concentric bowl-shaped copper vessels attached to a central shaft, which can be revolved at about 60 revs. per min. These bowls are fixed to the shaft and rotate with the latter: they are separated from each other by three fixed copper vessels, the rims of which project above the rims of the others. Both sets of vessels have their interior surfaces amalgamated. The sludge enters the first and smallest of the revolving copper vessels and by the action of the centrifugal force covers the whole of the interior amalgamated surface and flows over the rim into the first of the fixed vessels. From the first fixed vessel the sludge passes by an opening at the bottom into the second revolving vessel, and so on to the last revolving vessel, from which the sludge is discharged over the rim into an annular channel.—O. F. H.

Reduction of metallic oxides; Furnace for ——. J. A. Brown. Fr. Pat. 369,852, March 22, 1906.

The finely crushed and dried ore mixed with a calculated quantity of finely powdered carbon is fed into the hopper, *e*, placed at the top of the vertical cylindrical chamber, *c*, and is evenly distributed into the latter by the fan, *f*. Immediately below the fan are the openings of the hot



air passage, *d*, and the gas passage, *b*, from the producer, *a*. Thus the mixture of ore and carbon as soon as it enters the furnace comes into contact with a hot reducing flame which, with the aid of the carbon in the mixture, reduces the metallic oxides to metals, the silicious gangue remaining unchanged. The products of the furnace pass downwards to the bottom of the shaft, *c*, and into the first condensing chamber, *g*, where the gases expand and consequently are partially cooled, and the heavy metallic particles are deposited. On passing into the second condensing chamber, *h*, the particles of medium density settle, and in the third chamber, *i*, the light silicious gangue is deposited and the gases cooled by water sprays, *k*. The residual gases are withdrawn by means of the fan, *l*, which also serves to produce the necessary downward current in the chamber, *c*.—O. F. H.

Metals and metalloids ; Extraction of —— from ores containing them. H. Herrenschmidt. Fr. Pat. 369,878, Sept. 18, 1906.

THE process described aims at the production of metals and metalloids, *e.g.*, boro-aluminium and ferro-boron, by heating minerals or ores in the electric furnace or other suitable apparatus in the presence of carbon and boric acid, either as such or as a salt. It is claimed that by applying this process to the treatment of bauxite, artificial corundum practically free from iron and silicon can be produced.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Ozone ; Preparation of —— by electrolysis. F. Fischer and K. Massenez. II. Z. anorg. Chem., 1907, **52**, 229—255. (See also this J., 1907, 156.)

THE yield of ozone obtained by electrolysis has been further increased, the conditions necessary being reviewed.

Temperature.—The anode temperature should be kept low to prevent the destruction of ozone. The temperature of the electrolyte as a whole is of secondary importance. Water, on account of its high specific heat, is most suitable for the cooling liquid, and it should be forced through the anode rapidly. For temperatures below 0° C. a solution of calcium chloride is best, and for the same reason. The importance of the anode temperature is seen in the following table :—

Current density, ampères per sq. cm.	Temp. of anode-cooling liquid.	Percentage of ozone.
	° C.	
87	13	20·88
87	0	25·27
87	−14	27·41

The electrode.—Platinum or platinum-iridium are the only materials not readily attacked with the high current densities necessary. A platinum anode, as before described (*loc. cit.*), gives the best results, and in the table below is shown the effect of varying the dimensions of the exposed strip.

Breadth mm.	Length mm.	Current density, amps. per sq. cm.	Percentage of ozone.
0·5	6·0	50	14·4
0·4	6·0	58	17·14
0·16	10·0	63	19·47
0·10	11·5	87	22·87

The electrolyte.—Sulphuric acid gives better results than other electrolytes. Acid of sp. gr. 1·223 has the highest conductivity, but that of sp. gr. 1·085, or, for the higher current densities between 80 and 90 ampères per sq. cm., that of sp. gr. 1·07, give the greatest percentage of ozone. This is probably owing to the fact that the acid becomes more concentrated around the anode, where that of the highest conductivity is required. The anode and cathode spaces are best separated by a diaphragm, so that the solution around the anode may remain saturated with ozone.

Yield.—At 13° C. oxygen containing 23 per cent. of ozone can be prepared continuously, without attacking the electrode material. By cooling the anode with calcium chloride solution at −14° C., and with a current of 1 ampère (87 ampères per sq. cm.), oxygen containing 28 per cent. of ozone has been obtained. The best energy yield, however, 7·18 grms. of ozone per kilowatt-hour, was given by a current density of 65 ampères per sq. cm., producing oxygen with 21·43 per cent. of ozone.—F. SODN.

Electrolytic oxidation in presence of fluorine ions. M. G. Levi and F. Ageno. Atti R. Accad. dei Lincei Roma, 1906 [5], **15** ; II., 615—620. Chem. Zentr., 1907, **1**. 526—527. (See also this J., 1907, 156.)

THE authors electrolysed *N*/1 alkaline solutions of ammonium sulphate and 3*N*-solutions of ammonia, in presence of alkali fluoride, with bright platinum electrodes ; the cathode was immersed in caustic alkali in a Pukall cell. The presence of fluorine ions caused a distinct but not very great increase in the anode potential, and consequently in the yield of nitrate. In all cases there was a loss of about 20 per cent. of the current energy, which could not be accounted for. By the electrolytic oxidation of solutions of manganous sulphate, there were formed manganic sulphate and manganese dioxide in solutions rendered faintly acid with sulphuric acid, manganic sulphate alone in strong sulphuric acid solution, and a considerable quantity of permanganic acid in solutions rendered acid (4*N*) with hydrofluoric acid.—A. S.

Plumbic acid ; Properties of hydrosols of ——. I. Bellucci and N. Parravano. VII., page 200.

ENGLISH PATENT.

Oils and other organic bodies ; Decomposition of ——. J. Harvey and E. T. B. Simpson. Eng. Pat. 26,917, Dec. 23, 1905. XII., page 211.

UNITED STATES PATENTS.

Furnace ; Pyro-electric ——. F. E. Roach, Chicago, Ill. U.S. Pat. 838,647, Dec. 18, 1906.

THE electric furnace is provided with a muffle, comprising a tapering annular shell of refractory and non-conducting material, split longitudinally, and with open ends having closely-arranged notches. Resistance wires are wound continuously and longitudinally around the inner and outer sides of the shell, the turns engaging in the notches, and being "crimped" at each turn in order to afford a number of bends. The ends of the wire extend through apertures in the shell on opposite sides of the slit. A cup of non-conducting and refractory material closes the top and sides of the muffle, and is bound to the latter by the resistance wires. A removable, closely-fitting bottom entirely closes the muffle, and a central insulating refractory tablet is secured to this base, the tablet being provided with a support or carrier for the material to be treated, so that the latter is approximately at the centre of the muffle. Binding posts, connected with the resistance wires, are rigidly fastened to the muffle, and similar binding posts on the furnace-base engage with these and form sliding connections. A thermostat, communicating with the interior of the muffle, is adapted to a wide range of temperatures, and, by means of a lever and a fusible plug, breaks the circuit at the temperature for which the thermostat is set.—B. N.

Bichromates ; [*Electrolytically*] *converting chromates into* ——. R. Suchy, Griesheim, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 838,757, Dec. 18, 1906.

See Fr. Pat. 334,685 of 1903 ; this J., 1904, 119.—T. F. B.

French Patents.

Chemical reactions in gases at the temperature of the arc ; Process and arrangement for the production of ——. A. A. Naville, C. E. Guye, and P. A. Guye. First Addition dated Nov. 21, 1905, to Fr. Pat. 361.827 of Oct. 7, 1905 (this J., 1907, 23).

An alternating current electric arc is brought into movement by the action of a rotating magnetic field, which acts upon it. In the case where the periodicity of the current through the arc and that serving to produce the magnetic field are the same, an oscillatory motion is obtained. When the periodicity differs in the two cases, a rotatory motion is superposed upon the oscillations of the arc.—R. S. H.

Filaments of tungsten or molybdenum for incandescent electric lamps ; Process of manufacturing ——. J. Lux. Fr. Pat. 369,233, Aug. 25, 1906. II., page 192.

Carbon [*electrode*] *for electrolytic bleaching.* Dr. P. Schoop, Elektrische Bleichanlagen G.m.b.H. Fr. Pat. 370,162, Oct. 2, 1906.

For making the terminal connections to the carbon electrodes, the graphite plates are provided with threaded holes, bands of silver or platinum serving to conduct the current to the electrodes, being suitably perforated and pressed against the carbon by graphite screws corresponding to the holes in the graphite plate.—R. S. H.

Generator of electricity ; Thermo-chemical ——, *with complete or partial regeneration of the active materials, and, in the latter case, with manufacture of sulphuric acid.* L. P. Basset. Fr. Pat. 370,170, Oct. 2, 1906.

The inventor varies the cell previously described (this J., 1905, 1312) by employing a solution of sulphurous acid in dilute sulphuric acid as one electrolyte, and a solution of peroxide of nitrogen in dilute sulphuric acid as the other. The reaction occurring during the passage of current through the cell may be expressed by the equation : $SO_2 + NO_2 + H_2O = H_2SO_4 + NO$. The exothermic nature of the reaction is used for the production of electric energy. The nitric oxide may be treated outside the cell for the formation of the peroxide, and in the case where it is not desired to otherwise use the sulphuric acid produced, sulphurous acid may be regenerated from it.—R. S. H.

(*B.*)—ELECTRO-METALLURGY.

Nickel-plated scrap. C. Richter. Elektrochem. Zeits. ; through Electrochem. and Metall. Ind., 1907, **5**, 61.

The author describes a method of recovering electrolytically copper and nickel from strips of sheet iron heavily copper-plated and then nickel-plated, which had been used for making cartridges. The scrap contained 92·49 per cent. of iron, 6·40 per cent. of copper, and 1·11 per cent. of nickel. The strips of metal were used as anodes in an electrolyte of dilute sulphuric acid (240 grms. of H_2SO_4 per litre), the cathodes consisting of sheet lead at a distance of 7·5 cm. from the anodes. The nickel is first dissolved by the aid of a current of 780 ampères per sq. metre, with a P.D. of 0·8 to 1·6 volts, and then a current of 900 ampères per sq. metre is passed at a P.D. of 2·5—3 volts, whereby the copper, together with some iron, is dissolved. Towards the end, the current-density should be so high that gas is freely liberated at the anode ; otherwise copper is reprecipitated from the solution by the exposed surface of the iron. Only copper is deposited on the cathodes, the nickel and iron remaining in solution. The stripped iron is suitable for use in the manufacture of steel. The solution is subsequently electrolysed with insoluble electrodes to deposit the copper, and the dissolved iron and nickel recovered by any of the known methods.—A. S.

Lead-smelting process ; Electrical ——. A. G. Betts and W. Valentine. Elektrochem. Zeits., 1906, **13**, 190—195, 1907, 219—224 ; Chem. Zentr., 1907, **1**, 593.

Fused lead sulphide alone cannot be satisfactorily electrolysed. By using a solution of lead sulphide in fused lead chloride, with a current at 1—1·25 volts, electrolysis proceeds smoothly for some time, but then irregularities are exhibited, probably owing to accumulation of the impurities, especially pyrites, in the bath. To overcome these difficulties, the following method of working is recommended. The ore is first smelted for the removal of lime, alumina, silica, &c., and the production of a lead sulphide matte. This is dissolved in fused sodium chloride, and electrolysed in a cell having a cathode at the bottom.—A. S.

English Patents.

Metals [*nickel and copper*] ; [*Electrolytic*] *process of separating* ——. N. V. Hybinette, Westfield, U.S.A. Eng. Pat. 25,122, Dec. 4, 1905.

See U.S. Pat. 805,969 of 1905 ; this J., 1906, 29.—T. F. B.

Electroplating apparatus. A. Schmitz, Charlottenburg, Germany. Eng. Pats. 1628 and 1628a, Jan. 22, 1906.

See Fr. Pat. 362,185 of 1906 ; this J., 1906, 644.—T. F. B.

Sheet metal ; Process of treating —— *and depositing metallic coatings thereon by electrolysis.* A. E. Edwards, London. From Hille und Müller, Porschdorf, Saxony. Eng. Pat. 9435, April 21, 1906.

See Fr. Pat. 365,456 of 1906 ; this J., 1906, 1054.—T. F. B.

Furnaces ; Electric ——. A. G. Betts, Troy, U.S.A. Eng. Pat. 2552, Feb. 1, 1906.

See U.S. Pat. 816,554 of 1906 ; this J., 1906, 433.—T. F. B.

Furnaces ; Electric ——. A. Hiorth, Christiania. Eng. Pat. 28,370, Dec. 12, 1906.

See Fr. Pat. 365,655 of 1906 ; this J., 1906, 1054.—T. F. B.

Electrical smelting furnaces ; Method of operating ——. A. Hiorth, Christiania, Norway. Eng. Pat. 28,959, Dec. 19, 1906. Under Int. Conv., May 5, 1906.

The patent relates to means whereby an electric furnace can be worked as an induction or an electrode furnace, and thus utilised both for the extraction of metals from ores and for the refining of the metal. When it is desired to work an induction furnace as an electrode furnace, one or more removable partitions are placed in the annular space of the furnace, and one or more removable pairs of connected electrodes are introduced into the slag, one of each pair on either side of the partition. The current then passes through the electrodes and through the slag, intensely heating the latter. This mode of working is especially adapted for the direct production of steel from iron ore. The furnace is first operated as an electrode furnace for the reduction of the iron ore, and then, after removing the partitions and electrodes, is worked as an induction furnace, steel scrap being added to effect the transformation of the molten iron into steel.—A. S.

United States Patents.

Electroplating apparatus. W. S. Hutchinson, Boston, Mass. U.S. Pat. 838,716, Dec. 18, 1906.

This invention relates to the recovery of gold from plating solutions, and comprises a rinsing tank subdivided into a

series of compartments, an inlet being provided for the rinsing fluid at one end of the series, and an enriching vessel connected to the outlet end of the series. Fresh cyanide is supplied to the enriching vessel, the outlet of which communicates with a recovery apparatus comprising a series of zinc boxes. (See following abstract.)
—B. N.

Electroplating; Process of ——. W. S. Hutchinson, Boston, Mass. U.S. Pat. 838,717, Dec. 18, 1906.

THIS invention relates to the method of recovering the valuable ingredients, such as gold, from cyanide plating solutions. The freshly-plated articles are subjected to "successive cumulative rinsings," the rinsing liquid being made to pass continuously in a direction which is the reverse of that of the plated articles. The rinsing solution is afterwards strengthened with a cyanide, and the gold recovered from the solution by chemical deposition with zinc. (See preceding abstract.)—B. N.

FRENCH PATENTS.

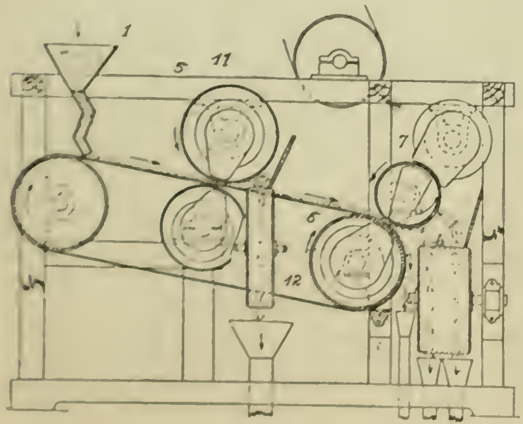
Copper; Process and apparatus for producing homogeneous electrolytic ——. Soc. Jullien and Dessolle. Fr. Pat. 369,746, Sept. 14, 1906. Under Int. Conv., May 31, 1906.

THE copper is electrolytically deposited upon a rotating cylindrical cathode, and is submitted to the action of a burnisher, which is moved longitudinally along the cylinder, and also has an alternating movement in a different plane superposed upon it. In this manner every point of the deposit is submitted to the action of the burnisher.—R. S. H.

[Zinc] minerals; [Electro-thermic] process and apparatus for the treatment of ——. F. T. Snyder. Fr. Pat. 369,756, Sept. 14, 1906.

THE electric furnace employed, is divided into three main compartments, a preheating chamber, heated by the waste gases and by radiation, a fusion and reduction chamber, in which the mineral mixed with carbon is heated by the electrical resistance of the fused slag, and a condensation chamber in which the zinc vapours are condensed. The process is specially intended for the treatment of zinc-lead minerals, which yield slags unsuitable for the ordinary retort processes. A highly basic slag is produced, and the temperature of the reduction chamber is limited, so as to prevent any considerable volatilisation of metals other than zinc. Provision is made for withdrawing the lead, zinc, and slag, and for the admission of fresh charge. The three compartments of the furnace are suitably disposed in proximity to one another, in order to reduce the heat-losses and simplify the inter-connection of the chambers.
—R. S. H.

Magnetic separation; Process and apparatus for ——, *using transverse belt conveyors.* Maschinenbau Anstalt Humboldt and Metallurgische Ges. A.-G. Fr. Pat. 369,799, Sept. 15, 1906. Under Int. Conv., Jan. 26, 1906.



THE powdered ore is fed by the hopper, 1, on to a belt conveyor, and carried beneath the drum, 11, which revolves about the magnet, 5. Magnetic particles are attracted, carried out of the magnetic field by the revolving drum, and deposited on the transverse belt, 12. The main conveyor passes beneath the transverse one, and carries the residual ore between the second system of magnets, 7, 8, where a further separation takes place, the magnetic particles being deposited on a second transverse belt. The different concentrates and the tailings are collected in hoppers as shown.—O. F. H.

Furnace; Electric ——. F. M. Chaplet and Soc. Néo-Métallurgique. Fr. Pat. 370,005, Sept. 25, 1906.

THE furnace is divided into two distinct chambers, which are connected by a channel filled with some conducting material, which may be the metal to be treated. One chamber forms the receptacle in which the electro-thermic process is carried out; it is provided with one or more electrodes connected to one terminal of the current. The second chamber serves only for the connection to the other terminal. It is essential that the size, shape, and arrangement of the channel, and the nature and condition of the material contained in it, be such as to assure continuity of the electrical connection between the two chambers even if the furnace be tilted. The furnace is suitable for the fusion and refining of iron and other metals, and for the reduction of ores.—R. S. H.

Furnace; Electric ——. J. B. Trillon and the Soc. Electro-chimique du Giffre. Fr. Pat. 370,051, Sept. 26, 1906.

THE furnace consists of a hearth divided into two or more heating zones; the heat being generated either by electric arcs maintained between superposed electrodes and the charge on the hearth, or by the resistance offered to the passage of the electric current by the material in the furnace. The intensity of the current in any one heating zone is made independent of that in the others by connecting the hearth of the furnace to a suitable point in the generating circuit.—R. S. H.

Alloys of alkaline-earth metals with aluminium, iron, or copper. Soc. des Etabl. Poulenc Frères and M. Meslans. First Addition, dated Dec. 2, 1905, to Fr. Pat. 316,612, Dec. 6, 1901.

THE process described in the main patent consisted in electrolysing fused salts of alkaline-earth metals, especially the chlorides, using a cathode consisting of molten aluminium, copper, or iron. According to the present addition, the fusing point of the alkaline-earth chloride is lowered by the addition of a suitable quantity of an alkali chloride, for example, 10 per cent. of sodium chloride.
—A. S.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 159.)

Cottonseed oil; Notes on Halphen's reaction for ——. E. Rupp. Z. Untersuch. Nahr. Genussm., 1907, 13, 74—76.

STEINMANN described a method of rendering this reaction more sensitive by heating the mixture of fat, amyl alcohol, and carbon bisulphide containing sulphur in a sealed tube. The author, however, finds that equally good results are obtained by placing the mixture in a flask, the glass stopper of which is secured by means of wire or parchment paper, and immersing the flask in boiling water. In comparative experiments made by this method, and with the usual open test tube, almond oil containing 1 per cent. of cottonseed oil gave a rose coloration within 30 minutes in the flask, whilst in the case of the tube, the colour was unchanged after 30 minutes, and yellow after 45 minutes.—C. A. M.

Zeiss butyro-refractometer; Temperature correction of the ——. H. D. Richmond. XXIII., page 225.

Sesamé oil; Notes on the reactions for ——. E. Gerber. XVIII*A*., page 218.

Soap trade of Italy. Bd. of Trade J., Feb. 21, 1907. [T.R.]

According to the Italian custom house regulations soap is divided under three headings: common soap, scented soap, and glycerin soap. Under the first heading are included all the ordinary soaps for industrial and domestic purposes, provided that they are unscented, and that the bars or tablets are cut or moulded with sharp corners. This point is most important, because the same quality of soap, which, with sharp corners, would pass as common, is dutiable as scented soap, if the corners are rounded; the duty leviable on scented soap is five times larger than that payable on common soap. The following are the duties payable:—Common soap, 2s. 10d. per cwt. (7 lire per 100 kilos.); scented soap, 14s. 2½d. per cwt. (35 lire per 100 kilos.); glycerin soap, £1 4s. 5d. per cwt. (60 lire per 100 kilos.). Duty is leviable on the gross weight of common soap, on the legal net weight of scented soap, and on the real net weight of glycerin soap. The legal net weight is found by deducting from every 100 kilos. of gross weight the tare authorised for different products and packings. In the case of "merchandise not otherwise specified" this reduction is 8 per cent. for goods imported in cases, &c. Business in imported soap is mostly carried on on a small scale, as there are few large buyers but numerous small retailers. There is a demand for a good quality of soap, which must be dry and free from silicates and calcium carbonate. The brand must be clearly marked. For industrial purposes bars of soap weighing about 10 lb. each are preferred. France is the largest exporter of common soap to Italy: England stands second, followed by Germany. Germany heads the imports of scented soap, but the quantity is not great. The importation of glycerin soap is unimportant, not being more than 100 quintals a year

English Patents.

Oils and other organic bodies; Decomposition of ——. J. Harvey, Liverpool, and E. T. B. Simpson, Wakefield. Eng. Pat. 26,917, Dec. 23, 1905.

Fatty oils or other organic bodies are subjected in a closed vessel to the simultaneous action of steam under pressure and an electric current, with the object of effecting, *e.g.*, more rapid hydrolysis of glycerides and of obtaining purer products and a larger yield of glycerin. The process may be further accelerated by the introduction of zinc oxide, lime, or other suitable substance to produce a disintegrating action. The electric current is, as a rule, preferably derived from an exterior source, but a similar result is obtained less rapidly by means of galvanic action produced by coupling together plates of copper or zinc completely or partially immersed in the contents of the vessel.—C. A. M.

Oils; Treatment of vegetable ——. A. J. Boult, London. From A. Van de Kerckhove. Forest-lèz-Bruxelles, Belgium. Eng. Pat. 21,172, Sept. 24, 1906.

This is a process for treating vegetable oils, notably colza and cottonseed oils, in such a way as to give them the physical and chemical characteristics of animal oils. For this purpose, the vegetable oil is first emulsified, preferably with the aid of compressed air, with an equal quantity of a solution of "sea salt," the amount of the salt required for each 1000 parts of water being 10 parts, less 1·13 part for each 0·002 degree of density above or below 0·963, "which is that of colza oil." Free fatty acids, if present in large excess, should be removed before forming the emulsion. Albuminoid matters, &c., are separated by adding to the emulsion, preferably during agitation at a temperature of 100° to 105° C., a small proportion of "a double sulphate of soda and zinc converted into a base by tin chloride." The solid glycerides of the vegetable oil (erucin, &c.) are next transformed into "stearic glycerides approximating those peculiar to animal oil" by adding to the emulsion chlorine peroxide or a solution of potassium chlorate in hydrochloric acid, in sufficient quantity to saturate the glycerides, whilst the liquid glycerides (of the ethylic and allylic series) are transformed by the addition of zinc chloride to the heated mixture, followed by a treatment with an oxide of chlorine. Claim is also made for the addition of formaldehyde solution to the emulsion, whilst agitated at 100° to 130° C., with the object of removing diastase and other enzymes, and thiocyanates. Lastly, the product is clarified by spreading a thin layer of finely powdered alumina or calcined alum and talc over the surface of the cooled oil, reheating the whole to the initial temperature, with agitation, allowing it to settle, and finally filtering the oil.—C. A. M.

Lubricating composition. F. G. Arcéluz, Bilbao, Spain. Eng. Pat. 18,810, Aug. 22, 1906.

Claim is made for a composition consisting of the dried and pulverised pith of rushes, reeds, or reed-mace thoroughly incorporated with a lubricating oil. It is stated that the mixture, to which the name of "greasine" is given, effects a saving of more than 70 per cent. of oil over the quantity of the latter required for lubricating when used alone.—C. A. M.

Detergent [for wool, fabrics, &c.]. H. Jackson, Eng. Pat. 6712, March 20, 1906.

Claim is made for the use of a solution containing about 1 per cent. of ammonium oleate without material excess of ammonia. This solution is preferably made as required by mixing oleic acid and water, and adding ammonia in just sufficient quantity to effect solution of the acid. The goods to be washed are immersed for some time in the solution at the ordinary temperature and subsequently rinsed with water.—C. A. M.

United States Patents.

Oil-waste; Apparatus for cleaning ——. J. I. Orkin, Assignor to J. Isaacs, Boston, Mass. U.S. Pat. 838,640, Dec. 18, 1906.

The apparatus comprises a steam tank having a perforated inner chamber, a steam-supply pipe opening beneath this inner chamber, and a vertical shaft with agitating arms within the inner vessel, which can be made to revolve simultaneously with the arms. There is also a pipe for supplying water to wash the material as the inner vessel is revolved after the treatment with steam. Or there may be a perforated tray supported over a steam pipe or coil within the tank, and provided with means for agitating the material.—C. A. M.

Oils; Apparatus for extracting ——. H. A. Silvera, Assignor to E. H. Fallows, New York. U.S. Pat. 838,658, Dec. 18, 1906.

Claim is made for an apparatus divided by means of a diaphragm into an upper and lower chamber, the latter containing two or more vessels, closed at the bottom, in which the material is digested, whilst a space is provided between them through which the heating agent contained in the upper chamber can circulate. There may also be hollow heating shelves projecting inwards from the sides of the digesting vessels and communicating with the space between them. The liberated oil can rise through openings in the diaphragm into the upper chamber, where means are provided for drawing it off.—C. A. M.

French Patents.

Fats; Method of purifying ——. A. E. Urbain and A. Feige. Fr. Pat. 361,966, Dec. 5, 1905.

Claim is made for a process of treating oils or fats with hot alcohol in a series of vessels so arranged that the oil descends from vessel to vessel whilst the alcohol circulates in the opposite direction, or *vice versa.* In this way, the impure oil comes first into contact with the least pure solvent and meets a continually purer alcohol as it descends. Agitators are provided within the purifying vessels, together with means for heating the contents to about 70° C., and evaporating and condensing the alcohol after the extraction is complete.—C. A. M.

Soap ; Method of pressing cakes of ——. G. Klinger. Fr. Pat. 370,086, Sept. 28, 1906.

The melted soap is conducted directly from the copper into the press beneath, the mould of which is made as long as possible and is not cooled. It is stated that soap thus prepared is less friable than that obtained by the ordinary method, in which it is exposed to changes of temperature.—C. A. M.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*Continued from page* 160.)

(*A.*)—PIGMENTS, PAINTS.

United States Patent.

Lithopone having a sulphite of baryta base ; Method of formation of a ——. L. Brunet, Brioude, France. U.S. Pat. 838,769, Dec. 18, 1906.

See Fr. Pat. 360,517 of 1905 ; this J., 1906, 486.—T. F. B.

French Patent.

Paint ; Manufacture of a composition to be used as ——. J. F. Villard. Fr. Pat. 369,829, Sept. 18, 1906. Under Int. Conv., June 13, 1906.

About 4·5 kilos. of chalk and 1·8 kilos. of flour are boiled with about 9 litres of water and 230 grms. of glue, and the resulting paste is mixed with about 4·5 litres of linseed oil and about 2·225 litres of melted rosin. The hot product is next mixed with about 230 grms. of crude larch resin (*poix de mélèze*) melted in linseed oil, and the whole incorporated with white lead, a siccative, linseed oil, and a colouring matter. For painting frescoes or interiors, a solution of about 450 grms. of beeswax in about 1·4 litres of turpentine oil is added to these ingredients. It is stated that the constituents of this paint do not separate on standing in tins or when dried upon a surface.—C. A. M.

(*B.*)—RESINS, VARNISHES.

French Patent.

Varnish, enamel, and films ; Transparent and impermeable composition, susceptible of utilisation for ——. A. Patat et Cie. Fr. Pat. 361,934, Dec. 1, 1905.

The composition consists of a mixture of amyl acetate, methylated spirit, castor oil, and celluloid or resin, in the following proportions :—Amyl acetate (450 c.c.), methylated spirit (500 c.c.), castor oil (50 c.c.), and celluloid (50 grms.). As a medium for gold and bronze paints, the following mixture is suitable :—Amyl acetate (500 c.c.), methylated spirit (500 c.c.), and gum sandarac (40 grms.).
—G. W. McD.

(*C.*)—INDIA-RUBBER, &c.

Sulphur ; Determination of —— *in vulcanised india-rubber and rubber substitute by Dennstedt's method.* R. Ditmar. Gummi-Zeit., 1907, **21**, 497.

Both sulphur and chlorine can be rapidly and accurately determined in rubber goods and substitutes, provided that inorganic filling materials are absent, by Dennstedt's method of organic analysis by combustion. The substance is burnt in oxygen in a combustion tube in which is a packing of platinised quartz, followed by one or more boats containing lead peroxide. The latter is kept at 300° C. during the operation, and absorbs the sulphur and chlorine, forming lead sulphate and chloride respectively. After combustion, the absorbent is mixed with 200 c.c. of a 4 per cent. solution of sodium carbonate or bicarbonate and is agitated in a shaking machine for 1—2 hours, or allowed to stand for 24 hours with occasional shaking. Aliquot parts of the filtrate are then suitably acidified and precipitated, the one with barium chloride, the other with silver nitrate.—W. A. C.

English Patent.

India-rubber and like compositions ; Manufacture of ——. P. J. Jackson, London. Eng. Pat. 2791, Feb. 5, 1906.

Pulverised slag or scoriæ, to the extent of 10—20 per cent., is added to caoutchouc or india-rubber, and the whole mixture hardened or vulcanised as desired. The object of the addition of slag is to prevent skidding or slipping when the composition is used for tyres. Reference is directed to Eng. Pats. 2121 of 1889, 6830 of 1896, 27,606 of 1898, and 5648 of 1904 (this J., 1898, 340 ; 1900, 43 ; and 1905, 445).—G. W. McD.

United States Patent.

Rubber ; Apparatus for reclaiming waste ——. E. R. Solliday, Trenton, N.J. U.S. Pat. 838,756, Dec. 18, 1906.

The patent relates to an apparatus for washing waste rubber, consisting of a long trough, with a false bottom, and containing water, through which the material is caused to pass by means of a series of revolving paddle-wheels, which are so arranged that spaces are left between adjacent wheels for the deposition of sand, metals, and other foreign substances settling out by gravitation. The blades of one paddle-wheel move in the opposite direction to the blades of the other, " where they describe their arc of rotation adjacent to each other." The sand, &c., is discharged through valve-controlled openings in the false-bottom, consisting of slits, on which rest revolving tubes. The washed rubber is removed by means of an endless conveyor.—A. S.

French Patents.

Plastic and elastic material [*rubber substitute*]. P. P. Orange and L. L. B. Denis. Fr. Pat. 361,944, Nov. 27, 1905.

A plastic and elastic material, suitable for use as a rubber substitute, is prepared by mixing a paste obtained from amylaceous substances with saccharine substances such as molasses or honey, in order to ensure the paste retaining a certain quantity of water, and thus preventing it from becoming hard and brittle. Other substances, such as glycerin, gelatin, paraffin wax, fatty matters, deliquescent metallic salts, and colouring matters, may also be added to the mixture.—A. S.

Ebonite or india-rubber ; Manufacture of substances analogous to —— [*from nitrocellulose*]. C. Claessen. Fr. Pat. 369,797, Sept. 15, 1906.

In Fr. Pat. 364,604 of 1906 (this J., 1906, 906) claim was made for the preparation of substances similar to celluloid from 2 parts of nitrocellulose and 1 part of a tetra-substituted urea. It has now been found that by varying the proportions of the two compounds, substances resembling ebonite or india-rubber can be obtained. *Example.*—83·3 parts of nitrocellulose (" containing 40 per cent. of water ") are mixed with 50 parts of ethylmethyldiphenylurea and sufficient water to give a pasty mass, which is heated to about 60° C. By passing the product between hot rollers, and then subjecting it to the simultaneous action of heat and pressure, a substance resembling ebonite is obtained. If only half the quantity of nitrocellulose mentioned be employed, the resulting product is similar to india-rubber. In place of the tetra-substituted ureas, thio-ureas or chlorinated ureas may be employed.—A. S.

Rubber, wood, leather, textiles, &c. ; Process of rendering —— *impermeable.* A. Baseir and R. de Fazi. Fr. Pat. 370,043, Sept. 26, 1906.

The claim covers the use, for rendering rubber, wood, leather, &c., impermeable, of a solution of organic substances, such as spirit of turpentine, resins or gums, and phenols in suitable solvents, especially in a mixture of alcohol and ether. The process is intended especially for the treatment of pneumatic tyre covers.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 160.)

Chromed hide powder. J. Paessler and W. Appelius. Collegium, 1906, 412—415, 417—424, 425—434.

The authors have made experiments comparing the different methods of tannin analysis. They state that the American shake method gives too high results for the non-tannins as compared with the filter bell method. At the same time, they agree that a chromed hide powder gives better results than the ordinary white hide powder, and state that a somewhat inferior ordinary powder can be improved by chroming. By using a chromed powder, the swelling is greatly decreased and the absorption of tannin is more complete, hence more correct non-tannin values are obtained. Lightly-chromed dry hide powder gave better results in the filter bell than ordinary powder, and also than a heavily-chromed dry powder. Employing lightly-chromed powder in the shake method, non-tannin results agreeing with those given by the American shake method, but higher than by the filter bell method were obtained. A lightly-chromed powder absorbs neither grape sugar, cane sugar, nor dextrin, and much less gallic acid than a heavily-chromed powder. The following two methods are given for the manufacture of a lightly-chromed dry hide powder to be used in the filter bell. (1) 500 grms. of unacidified hide powder are churned with 10 litres of water, and 15 grms. of chrome alum dissolved in 500 c.c. of water are added at intervals, the chroming extending over 3—4 days. The mass is squeezed, and well washed with distilled water until free from sulphate, when it is dried and ground. (2) To 1 kilo. of hide, use 10 grms. of chrome alum and 2½—3 litres of water; the chrome alum solution being added at intervals. After chroming, the hide is twice drummed with sodium silicate solution (10 grms. of sodium silicate and 2·5 litres of water per kilo. of hide) to neutralise acidity, drummed again with fresh water, and then stretched in a frame to dry. After drying, the hide is ground.—H. Br.

Hide powder filter and the American shake or chromed hide powder methods of tannin analysis; The relative value of the ——. H. C. Reed. Collegium, 1906, 437—452.

In the estimation of soluble solid matter present in a tanning material, the official method of the International Association of Leather Trades Chemists differs from that of the American Leather Chemists' Association. That of the former chemists consists of filtering the tanning solution through a specially devised candle filter, under reduced pressure, the insoluble matter in the solution remaining on the exterior of the filter, and an aliquot portion of the filtrate being evaporated for soluble solid matter. The American method calls for filtration through S. and S. 590, single, pleated, filter paper with the aid of kaolin; about 150 c.c. of the filtrate being discarded before collecting the 100 c.c. used for the determination. The I.A.L.T.C. method was exhaustively studied by the American Association, but was proved to be unreliable, owing probably, as Procter points out, "to some variation in the porosity of the candles or to difference in the extracts which come before us." Certain extracts, especially quebracho, pass through the candle, even after filtering considerable quantities, in a very turbid condition, and the analytical results vary in a very marked manner from those obtained by the method of filtration with paper and the use of kaolin. As regards the estimation of non-tannin matters, the divergency between the International method and the American method is very considerable. The former method consists of upward filtration through a filter bell packed with unchromed hide powder, the first 30 c.c. of the filtrate being rejected, and the next 50 c.c. being evaporated for the non-tannin determination. The American shake method specifies that a lightly-chromed wet hide powder, containing 70—75 per cent. of moisture and of an amount equivalent to 12—13 grms. of dry hide powder, shall be shaken in a mechanical shaker with 200 c.c. of the tannin solution for ten minutes, the mass squeezed through linen, the de-tannised solution filtered through filter paper with addition of kaolin, and 100 c.c. of the clear filtrate evaporated for the determination. It has been shown that hide has an affinity for non-tannins as well as tannins, and this is more marked when the hide powder is used in a filter bell than when used in the shake machine. The explanation of this is simple. In the bell method the solution is introduced slowly into the beaker in which the filter tube is placed, so that it may be absorbed and rise in the tube by capillary attraction. The slow filtration, together with the slow addition of the solution previous to filtration, permit of a very thorough tannage of the hide powder at the base of the tube, leaving that in the upper portion almost entirely unacted upon by the tannin, and therefore in a condition to absorb a large amount of non-tannin matter. In the case of the shake method the whole of the powder is added to the whole of the liquor. The tannin present acts on the hide powder much more quickly than the non-tannin, tanning the exterior and thus rendering it incapable of absorbing non-tannins.

The shape of the filter tube, the speed of filtration, the manner in which the tube is packed, and the acidity of the hide powder, together with the character of the solution analysed, are points that lead to the divergent results in the filter tube method, whereas the shake method is not subject to these variations.—H. Br.

Formaldehyde in the testing of tanning materials; Notes on the use of——. F. Jean and C. Frabot. Collegium, 1906, 435—436.

Whilst engaged in a study of the wood and bark of the mangrove tree, the authors noticed that a warm aqueous solution of the bark gave a heavy precipitate with formaldehyde and hydrochloric acid. On filtering, the filtrate no longer contained tannin, as tested with sodium acetate and iron alum. Submitting a number of tanning materials to this reaction, it was found that whilst the catechol tannins were precipitated, those of the pyrogallol group remained unaffected. By this means it is hoped to be able to detect certain adulterants, for example, chestnut in oak extract, lentiscus in sumach. The precipitate formed by the action of the formaldehyde and hydrochloric acid is stated to be a product of condensation, retaining neither of the two reagents, and it is hoped to work out a method to estimate, quantitatively, the tannin in certain tanning materials.—H. Br.

Chrome liquors; Basicity of——. F. K. Kopecky. J. Amer. Leather Chem. Assoc., 1906, 1, 261—267.

The method proposed by the author is based upon the fact that the whole of the chromium is precipitated as hydroxide from a solution of chromium sulphate or chloride by boiling with excess of magnesium carbonate. In a portion of the liquor the iron, aluminium, and chromium are determined together as hydroxides, and from the weight of the combined oxides, expressed in terms of chromic oxide, the "apparent percentage of chromic oxide" is calculated, and is used in estimating the basicity of the liquor, since the iron, aluminium, and chromium are all present in the form of basic salts. A quantity of liquor, corresponding to 15·3 grms. of chromic oxide, is then diluted to 1 litre, and 50 c.c. are heated gradually to boiling with 2 grms. of magnesium carbonate. The boiling is continued until carbon dioxide is no longer evolved, and the liquid is then cooled, made up to 100 c.c., and filtered through a dry filter. In 50 c.c. of the filtrate, the magnesium is precipitated as oxalate, and determined as oxide. The weight (in grms.) obtained multiplied by four gives the "acidity" in terms of magnesia per 10 grms. of chrome alum or 1·53 grms. of chromic oxide. The author proposes that the "acidity" of chrome liquors be expressed in centigrams of magnesia per 10 grms. of chrome alum or 1·53 grms. of chromic oxide, as shown in the following table :—

	A.	B.	C.	D.
		Centigrms. of MgO per 1·53 grms. of Cr_2O_3.		
Normal chrome alum ...	$Cr_2(SO_4)_3$	120·9	—	—
One-third basic chrome liquor	$Cr_2(OH)_2(SO_4)_2$	80·6	40·3	80·6
Procter's basic chrome liquor, 10 of chrome alum and 3·5 of washing soda	—	71·0	49·9	71·0
Two-thirds basic chrome liquor, too basic for practical purposes	$Cr_2(OH)_4SO_4$.	40·3	80·6	40·3

A. = Formula of active component.
B. = Total acidity.
C = Basicity due to neutralisation or deficiency of acid.
D = "Acidity" of basic liquor.

—A. S.

Resinous spew on leather ; Notes on the ——. F. Jean. Collegium, 1906, 363—366.

On examining a black sheep-skin lining which had been sewn up into a garment, it was found to be marked with little yellow transparent resinous drops, spotted over, but not penetrating the skin, and exuding chiefly at the holes made by the needle with which the skin had been sewn. This resinous matter was found to contain a large percentage of oxidised oil, and free fatty acid. A tanned calf skin curried with degras which showed the same defect as that of the sheep skin, on analysis of the resinous matter, showed free fatty acids and oxidised oil, free glycerin being absent in both the calf and sheep skin. Another sheep skin stuffed with linseed oil showed spew in the same places as those on the calf skin, the fats used in both these being oxidisable drying oils. It was therefore concluded that some great change in the fats, used for currying had taken place in the interior of the skin. A probable explanation of the origin of this spew may be that the presence of moisture, heat, diastases, and micro-organisms present in the skin and fat lead to oxidation and saponification, setting glycerin free, which is retained by the moisture of the skin, and results in an increase of fatty matter, with which the skin is saturated, and so exudes as resinous spews at the weakest parts of the grain. To avoid this trouble it seems advisable to dilute degras which have an oxidising tendency (those made with cod oil), with a non-drying oil, whale oil for example, in place of cod oil, and in cases where linseed oil is necessary, to dilute this drying oil with a non-drying oil, or mineral oil ; the oils used being well settled, as the "foots" appear to lead to acidification and spewing. Some experiments, in which cod oil alone, and cod oil in presence of some of the resinous spews, was allowed to stand for several weeks at 22° C., showed on examination that whilst the cod oil in both cases had considerably thickened, only in that containing the spews were micro-organisms found. The author thinks that it is premature to state that the spews were caused by the presence of micro-organisms, but is bound to record their presence.—H. Br.

Leather dyeing, Recent experiences in ——. P. Kauschke. Collegium, 1906, 355—360, 361—363.

In tanning skins which have subsequently to be dyed, a dark-coloured leather is produced where materials such as mimosa and quebracho have been used for a considerable length of time, but the colour can be very much improved if the leather is drummed in sumach. Sulphuric and oxalic acids are often used with the object of lightening the colour of the leather before dyeing, but these are not to be recommended, as any trace of free acid left in the skin will in a short time deleteriously affect the strength of the leather. The author found that a little sodium acetate or formate in the leather acted as a good preservative against the injurious effect of the products of combustion of illuminating gas ; sodium formate acted in the same way as sodium acetate, exerting at the same time a lightening and clearing effect on the leather, without having the evil effects that sulphuric acid had. Stiasny found that formaldehyde had very little tendency to lighten the colour of leather ; this is also the author's experience, but if the formaldehyde contain a little formic acid, then the lightening effect is much improved.—H. Br.

English Patent.

Tanning and depilating hides or skins. C. J. Glasel, South Boston, U.S.A. Eng. Pat. 2230, Jan. 29, 1906.

See Fr. Pat. 362,663 of 1906 ; this J., 1906, 770.—T.F.B.

French Patents.

Leather, skins, hoofs, horn, or bone ; Treatment and utilisation of waste ——. A. G. Inrig and H. E. McKrell. Fr. Pat. 369,887, Sept. 19, 1906.

See Eng. Pat. 25,467 of 1905 ; this J., 1907, 27.—T. F. B.

Rubber, wood, leather, textiles, &c. ; Process of rendering —— *impermeable.* A. Basevi and R. de Fazi. Fr. Pat. 370,043, Sept. 26, 1906. XIIIC., page 212.

Ossein ; Transformation and applications of ——. A. Helbronner and E. A. Vallée. First Addition, dated Sept. 12, 1906, to Fr. Pat. 361,796, Sept. 26, 1905 (this J., 1906, 1227).

The present addition relates to improvements in the process of converting ossein into a coagulable product by digesting it with alkaline solutions at a temperature below 60° C. These consist in washing the alkaline mass thus obtained, after neutralising it if desired, with saline solutions (ammonium sulphate) in which it is insoluble, with the object of removing the excess of alkali and mineral salts. The product is then dissolved in a suitable solvent, and treated, in the form of threads, films, or the like, with a coagulating agent, such as zinc chloride, ammonium sulphate, sodium chloride, alcohol, tannin, &c. The product may also be treated, either before or after coagulation, with formaldehyde. The coagulated material may be mixed with waste hair, or animal, vegetable, or mineral fibres for the production of a kind of artificial leather.—A. S.

XV.—MANURES, &c.

(*Continued from page* 160.)

Syrup ; Experimental work in the production of table —— *at Waycross, Ga.*, 1905. H. W. Wiley. XVI., page 215.

English Patent.

Manures ; Artificial ——, *and processes of manufacturing the same.* W. P. Thompson, London. From J. Schlutius, Karow, Germany. Eng. Pat. 26,887, Dec. 23, 1905.

The manure is a "potassium-phosphorus-saltpetre-nitrogen product," obtained by mixing with phosphates, potassium salts (crude, or their waste lyes), and treating the mixture with compounds of oxygen and nitrogen, especially nitric acid, the proportion of which may be reduced in presence of chlorides. A claim is made for the application to the purposes of the invention of the products of the oxidation of atmospheric nitrogen.—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 161.)

Beetroot ; Objectionable nitrogenous matter in ——. K. Andrlík. Z. Zuckerind. Böhm., 1907, 31, 277—284.

The author has investigated the conditions which influence the storage of objectionable nitrogenous matter (*i.e.*, melassigenic nitrogenous matter ; see this J., 1905, 808) in the beetroot. His conclusions are as follows :—The accumulation of objectionable nitrogenous matter in the root is much increased by a deficiency of rain during the growth of the crop; in the very dry season of 1904, the amount of such nitrogenous matter was 2—3 times that accumulated in normal seasons. The capacity of the root for accumulating objectionable nitrogenous matter varies according to the kind of seed employed. Fertilisation with nitrogenous manure alone (in the form of saltpetre, ammonia, or amino-nitrogen) increases the content of objectionable nitrogen; the harmful effect of an abundant supply of saltpetre may be partially prevented by the simultaneous addition of potash and superphosphate. Stable manure, up to a quantity of 60,000 kilos. per hectare, does not cause an accumulation of objectionable nitrogenous matter in normally-developed roots.—L. E.

Press diffusion process; Hyross-Rak continuous ——. K. Andrlík, V. Staněk, and J. Urban. Z. Zuckerind. Böhm., 1907, **31**, 284—290. (See also this J., 1904, 831.)

The inventors of this process have claimed the following advantages for it:—The loss of sugar in the extracted slices is normal. The diffusion juice may be obtained of any desired density (up to that of the beetroot juice itself), and its coefficient of purity is at least about 0·5 per cent. higher than that of the juice obtained by other processes. The water required for diffusion amounts to only 30—40 per cent. of the weight of the beetroot. The content of dry substance in the slices is at least 20 per cent. No diffusion waste-water is produced, and the labour required is moderate. The authors have investigated the process, and consider that the above claims are justified. The loss of beetroot fibre, which is carried away with the waste waters in other processes, is avoided. Since the slices obtained by this process contain so much dry substance, the process of drying them, for storage purposes, should be relatively cheap.—L. E.

Hydrosulphites; Employment of crystallised —— *in sugar factories and in distilleries.* L. Descamps. Bull. Assoc. Chim. Sucr. et Dist., 1907, **24**, 875—876.

Calcium (or sodium) hydrosulphite is a valuable agent for the decolorisation of sugar juice, syrup, or massecuite; in the presence of lime it decomposes thus: $CaS_2O_4 + Ca(OH)_2 = 2CaSO_3 + H_2$. Both the sulphite and the nascent hydrogen produced in this way exert a decolorising action on the juice or syrup. The hydrosulphite is a more efficacious decolorising agent than sulphite; a smaller quantity of the former may be used, danger of incrustation being thereby avoided. Hydrosulphite treatment does not exclude the use of sulphite, which may be employed either before or after the hydrosulphite for the purpose of economising the latter.—L. E.

Sugar juice; Elimination of potash and soda from —— *by means of aluminium silicate.* R. Gans. Z. Ver. deut. Zuckerind., 1907, 206—217.

Hydrated silicates, both natural and artificial, are capable of withdrawing the bases from alkaline and neutral salt solutions. This action is due to (1) formation of insoluble double silicates; (2) exchange of the base or bases in the silicates with the bases in the solution. Rümpler has proposed the employment of calcium-aluminium silicate for the purpose of removing potash from sugar juice or molasses and thus facilitating the crystallisation of the sugar (since potassium salts are generally considered to exert a very great melassigenic action). The author has found that by filtering a sample of molasses through calcium-aluminium silicate, the greater part of the potash and a considerable part of the soda are removed from the molasses, their places being taken by an equivalent quantity of lime. The calcium-aluminium silicate may be regenerated by washing the exhausted silicate (*i.e.*, the silicate saturated with soda and potash) with calcium chloride solution. It is preferable to subject the thin juice rather than the molasses to this process, since the exchange of potash for lime is effected most readily in dilute solution, and also because the sugar can be more easily extracted from the exhausted silicate. Experiments on thin juice showed that the massecuite obtained from juice which had been subjected to the above treatment was of lighter colour, and crystallised more rapidly and completely than the massecuite obtained from juice which had not been so treated. The alkalinity of the juice is not at all, or only very slightly, affected by the silicate filtration. On the assumption that only 56 per cent. of the double silicate is utilised, and that the silicate is regenerated four times in twenty-four hours, about 2000 kilos. of silicate would be required in a factory in which 650,000 kilos. of thin juice are dealt with daily. A solution of potassium and sodium chlorides is obtained as a by-product of the above process. By filtering this solution through ammonium-aluminium silicate, the ammonia is replaced by potash and to a less extent by soda; the ammonia in the filtrate may be recovered by distillation, and the potash and soda may be obtained from the silicate by treating the latter with ammonium carbonate, whereby potassium and sodium carbonates are formed and ammonium-aluminium silicate is regenerated. The purification of sugar juice on the large scale by the silicate process has given satisfactory results, so far as it has been investigated. The author also points out that filtration through sodium aluminium silicate presents a ready means whereby water may be rendered suitable for steam boiler supply.—L. E.

Syrup; Experimental work in the production of table —— *at Waycross, Ga.*, 1905. H. W. Wiley. U.S. Dep. Agr., Bureau of Chemistry, Bull. No. 103, 1906, 1—38. [T. R.]

The average quantity of syrup per ton (American, of 2000 lb.) of sugar cane, obtained at the experimental syrup factory at Waycross in the season 1905 was 21·87 galls. The average percentage contents of the constituents of the finished syrups were: Total solids, 75·73; sucrose, 46·05; reducing sugar, 24·49. The ratio of the total sugar to the total solids showed that the finished syrups were comparatively free from soluble non-sugar; the average percentage of total sugar, calculated on total solids, was 93·11. The effect of the following fertilisers on the growth of the cane, during the years 1902—1905 was also investigated.

Normal formula for 1 *ton* (2000 *lb.*) *of fertiliser; normal ration,* 1200 *lb. per acre.*

Ingredients.	lb. per ton.	lb. per acre.
Acid phosphate (14 per cent. P_2O_5).	1,200	720
Upland cottonseed meal (8 per cent. NH_3)........................	400	240
Nitrate of soda (19 per cent. NH_3)	200	120
Muriate of potash (50 per cent. K_2O)	200	120

Revised formula for 1 *ton of fertiliser; normal ration,* 1200 *lb. per acre.*

Ingredients.	lb. per ton.	lb. per acre
Acid phosphate (14 per cent. P_2O_5).	1,400	840
Upland cottonseed meal (8 per cent. NH_3)	300	180
Nitrate of soda (19 per cent. NH_3)	100	60
Muriate of potash (50 per cent. K_2O)	200	120

The above fertilisers were found to give very good results; the average results of the experiments indicated that the amount of the crop of sugar cane may be approximately doubled by the application of an amount of plant food represented by the normal formula.—L. E.

Carbohydrates; Separation of —— *by means of pure yeasts.* J. König and P. Hörmann. Z. Untersuch. Nahr. u. Genussm., 1907, **13**, 113—132.

The authors have investigated the fermentation of a number of carbohydrates, *viz.*, dextrose, lævulose, maltose, sucrose, and dextrin, by various pure yeast varieties, with a view to elaborating methods whereby mixtures of these carbohydrates may be analysed. The dextrin employed was obtained from three sources, *viz.*, commercial acid dextrin, malt dextrin, and honey dextrin; the acid and malt dextrins were each separated into two groups by fractional alcoholic precipitation, each group being examined separately. Experiments were first made on the individual carbohydrates (with the exception of dextrose and lævulose, which were investigated together). The separation of the following mixtures was then examined:—Dextrose and lævulose from sucrose; from maltose; and from dextrin. Dextrose, lævulose, and sucrose from dextrin. Dextrose, lævulose, sucrose, and maltose from dextrin. Finally, some commercial sugar products were investigated. The chief conclusions drawn from the experiments were as follows:—In the analysis of mixtures of sugars, the fermentation method is only applicable in cases where the constituent to be determined is alone left unfermented by the yeast or yeasts employed; the determination of the fermented sugar from the loss in weight due to evolution of carbon dioxide, does not always give accurate results. The separation of dextrin from sugars by means of yeast fermentation furnishes a more accurate method of estimating dextrin than does the alcoholic precipitation process; the former method requires more time however. A quantitative fermentation of pure sugars requires an average time of five to six days, and maltose, in presence of dextrin, requires two to three days longer. The fermentation is considerably quicker in the case of sugar products which already contain the necessary nutrient salts. The fermentation method is specially useful for the separation of dextrose from maltose, since no other trustworthy method is known; it is indispensable, for instance, in the examination of starch syrup and starch sugar. For the determination of a mixture of dextrose, lævulose, sucrose, and maltose, as well as for the complete analysis of starch sugar and syrup, the yeasts *Torula pulcherrima*, *S. marxianus*, and the bottom yeast from Dantzig Jopen beer are most suitable; the first of these yeasts ferments dextrose and lævulose, the second ferments dextrose, lævulose, and sucrose, and the last ferments dextrose, lævulose, sucrose, and maltose.—L. E.

Methyl pentoses; Quantitative determination of —— A. Jolles. XXIII., page 226.

Soluble starch; Preparation of —— by means of formic acid. Welwart. Chem.-Zeit., 1907, **31**, 126.

The simplest means of converting starch into the soluble modification is to boil the thin paste with a little formic acid, which is subsequently completely expelled by a single boiling. Owing to this action upon starch, formic acid is unsuitable for the preparation of stiffening agents, the starch becoming much thinner than when acetic acid is used.—C. A. M.

English Patent.

Sugar; Centrifugal machines used in the manufacture of ——. A. Ahrberg, Halle a S., Germany. Eng. Pat. 2859, Feb. 6, 1906.

In making plates or bars of sugar in moulds carried in liners placed in the centrifugal machines, it is necessary, in order that the moulds shall be full after the removal of the syrup, to add a certain excess of the massecuite to the machine, and to cut out the excess after the sugar has hardened. For this purpose, in the present invention, an annular saw is employed, which fits exactly in the cylindrical free space inside the liner. By the rotation of the saw, the excess of sugar in this free space is cut away, and the bars of sugar can be ejected from the moulds by a mechanical ejecting device. If the layers of sugar which have to be cut away are not very thick, a ring-shaped scraper can be used instead of the saw.
—J. F. B.

United States Patent.

Sugar cane; Method of extracting saccharine matter from ——. M. B. Spelman, New York. U.S. Pat. 838,818, Dec. 18, 1906.

The sugar cane is first flattened by crushing; its weight and volume are thus reduced by 40—50 per cent., owing to expression of juice. It is then cut, at right angles to the length of the cane, into chips less than 1 inch long. The chips are repeatedly immersed in water, whereby they expand and become filled with water. The liquid contents of the chips are expressed and collected after each immersion.—L. E.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 163.)

Barley corns; Kiln-drying the "swimmer" ——. K. Michel. Woch. f. Brau., 1907, **24**, 90—91.

It is pointed out that the "swimmer" corns floated off from the steeping cisterns, which ought to be dried in a kiln and sold as fodder, are frequently allowed to putrefy, or are otherwise wasted. No special kiln is required for drying these corns, but a corner of the upper floor of the ordinary malt kiln can be partitioned off for the purpose. The "swimmer" barley is distributed on the ordinary perforated trays, and is dried by hot air from the lower kilning floor. After drying, it should be sifted to remove particles of straw and foreign matters; the yield amounts to 1·5—2 per cent. of the total barley steeped.—J. F. B.

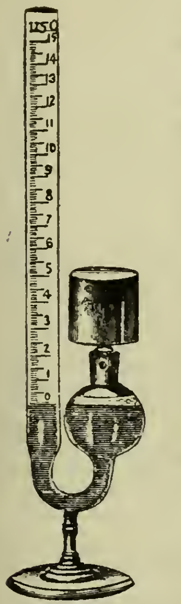
Hops; Valuation of ——. G. Coez. Bull. Soc. Chim. Nord, France, 1906, 152; Analyst, 1907, **32**, 51.

The amount of substances that can be extracted from hops by crystallisable benzene is stated to vary with the quality of the sample. Thus, in the case of 28 different kinds examined by the author, the quantity of extract obtained by extracting 10 grms. of the powdered hops in a Soxhlet extractor ranged from 12·85 per cent. to 19·05 per cent., the best qualities giving the most; and classification of the hops in accordance with these results agreed with the selection of specialists. Untreated hops yielded a green extract, whilst that from sulphured hops was yellowish-brown in colour. On extracting the residual hops with ether, only an additional 0·16 per cent. to 0·30 per cent. of substances was removed, whilst a third extraction, with alcohol as solvent, yielded 8 per cent. to 11·5 per cent. of dark astringent substances, and a final extraction with water removed from 8·1 per cent. to 9·25 per cent. of soluble substances. The proportion of tannin in the samples, determined by Loewenthal's method, varied from 3·4 per cent. to 4·8 per cent.; but in the author's opinion, no conclusion as to the quality of hops can be based on this factor.—C. A. M.

Wildier's "bios"; Preparation of —— in the pure state. R. Devloo. La Cellule, 1906, **23**, 361; Woch. f. Brau., 1907, **24**, 68—71.

The existence of Wildier's "bios" has been a subject of dispute ever since the hypothesis was first formulated in 1901. The author now claims to have isolated this active principle in an approximately pure form. *Biosine* is a mono-amino organic base, similar to, but not identical with, choline. It occurs together with about an equal proportion of choline as one of the bases of ordinary lecithin. The amino group still contains one unsubstituted hydrogen atom, since the base is precipitated by a mixture of mercuric chloride and barium hydroxide, and is soluble in phosphomolybdic acid. Biosine is readily soluble in water, and is non-volatile; its hydrochloride, sulphate, and oxalate are soluble in water, and in 75 per cent. alcohol. It is incompletely precipitated by alcohol of above 80 per cent. strength, and by mixtures of 80 per cent. alcohol with ether, acetone, or chloroform. Choline and its decomposition products have none of the physiological properties of biosine, which has not been identified with any of the known bases. Biosine is widely distributed in nature, and can be prepared from commercial lecithin, or more cheaply from dried yeast. According to quantitative measurements with purified biosine in mineral nutrient media, biosine is completely assimilated by yeast.—J. F. B.

Fermentable sugar ; Lohnstein's saccharometer for the determination of ——. F. Schönfeld. Woch. f. Brau., 1907, **24**, 45—50.



Lohnstein's fermentation saccharometer (see Fig.) is described in Eng. Pat. 26,264 of 1905 (this J., 1907, 115). The graduations of the vertical graduated tube show directly the proportion of fermentable sugar in terms of grms. of maltose per 100 c.c. in the wort. The ratio of yeast (0·2 c.c. of a concentrated suspension) to beer wort (0·5 c.c.) used is very high, but in spite of this the author found that it was necessary to allow the fermentation to proceed for 24 hours at 27° C. before the evolution of carbon dioxide was complete. Duplicate determinations were found to agree in a satisfactory manner, but the results obtained with this apparatus could not be made to coincide sufficiently well with those recorded by the ordinary attenuation method. The results depend very largely on the physiological condition of the yeast, being very much too high when a fresh vigorous culture is employed. This error is to some extent caused by the autofermentation of the glycogen in the yeast itself, but it cannot be corrected in any reliable manner either by blank fermentations or by storage of the yeast. When old cultures of yeast are employed, top fermentation beer yeast yields results of a fair degree of approximation, but with bottom fermentation and distillery yeasts the numbers are still unreliable.—J. F. B.

Whey and skim milk for diluting molasses in the manufacture of alcohol ; Use of ——. Von Bohle. Centr. Zuckerind., **15**, 68—70 ; Chem. Abstr., Amer. Chem. Soc., 1907, 218.

The author calls attention to the numerous difficulties in connection with the utilisation of skim-milk and whey from creameries and cheese factories, and suggests that these by-products be used in diluting molasses for fermentation. In this manner the milk sugar, which makes up about 5 per cent. of whey and skim milk, could be worked up into alcohol with considerable profit.

Fermentation ; Intermediate products of alcoholic ——. A. Slator. Ber., 1907, **40**, 123—126 (see also this J., 1906, 227).

Buchner and Meisenheimer consider (this J., 1904, 262 ; 1905, 246) that lactic acid is an intermediate product of alcoholic fermentation. Continuing his previous work, the author has obtained the following results :—Lactic acid is either not fermented at all by yeast, or only to a very slight degree. Very dilute solutions of lactic acid (below $N/500$) are without toxic effect on the activity of yeast; stronger concentrations are only slightly inhibitive. The action is practically the same as that of acetic acid of like concentration. When relatively considerable quantities of lactic acid were added to dextrose solution undergoing active fermentation, not more than about 8 per cent. of the lactic acid was destroyed. If lactic acid were an intermediate product of alcoholic fermentation, much larger proportions of the lactic acid must have been destroyed, and its disappearance must have been rapid. The lactic acid formed during alcoholic fermentation must, therefore, be a by-product, and not an intermediate product.—L. E.

Carbohydrates ; Separation of —— *by means of pure yeasts.* J. König and P. Hörmann, XVI., page 215.

Hydrosulphites ; Employment of crystallised —— *in sugar factories and in distilleries.* L. Descamps, XVI., page 215.

English Patents.

Beer and the like ; Apparatus for cooling and carbonating ——. L. Chew and H. J. West and Co., Surrey. Eng. Pat. 1326, Jan. 17, 1906.

The beer enters a vertical cylindrical vessel by a pipe which terminates in a perforated tubular ring above the uppermost convolution of a cooling coil. The beer trickles over the surface of the coil and accumulates at the bottom of the vessel. Carbon dioxide enters by a nozzle projecting through the bottom of the vessel to a point somewhat below the normal level of the beer ; the nozzle is provided with a short fitting with trumpet-shaped ends, the level of the beer in the fitting coinciding with that in the vessel. The gas issuing from the nozzle causes a flow of beer through the fitting and sprays it out of the upper end of the latter. A floating valve in the beer outlet pipe prevents escape of gas from the vessel ; a second floating valve, controlling the beer inlet pipe, prevents too great an accumulation of beer in the vessel. A by-pass pipe and loaded valve control the pressure in the beer inlet pipe. A three-way cock permits of the beer being pumped through the inlet pipe, either from the beer supply, or from the bottom of the vessel.—L. E.

Spirituous liquors ; Processes for treating ——. H. H. Cousins, Kingston, Jamaica. Eng. Pat. 16,741, July 24, 1906.

Liquors containing volatile organic acids, such as lees and other waste distillery liquors, are neutralised with lime and evaporated to dryness. The mixture of dry organic salts is introduced into the liquid to be distilled (such as so-called high wines, low wines, spirit, &c.), a slight excess of sulphuric acid is added, and the whole gently stirred for 12—24 hours in order to promote etherification. The spirit thus treated is filtered, if necessary, and then distilled. By this process, the ether content of spirituous liquors may be largely increased. —L. E.

Brewers' refuse, grains, and the like ; Apparatus for drying ——. E. Makin, jun., Ainsworth, Lancs. Eng. Pat. 5223, March 3, 1906.

This is a modification of the process described in Eng. Pat. 9835 of 1895 (this J., 1896, 367), in which the rotating drum there specified is replaced by a long pipe or flue, in connection with a fan. The material to be dried is introduced by a hopper at one end of the flue, where it is broken up, if necessary, by a centrifugal agitator. A supply of hot, dry air is also introduced into the pipe at the same end as the feed-hopper. The materials are drawn through the pipe by the action of the "fan" at the other end, and are dried during their passage by the hot air in which they are suspended, being discharged through the fan in the dry state.—J. F. B.

United States Patents.

Wort ; Apparatus for fermenting ——. H. A. Schalk, New York. U.S. Pat. 838,812, Dec. 18, 1906.

The apparatus includes a cycle of cylindrical tubs placed with their axes substantially horizontal, valve-controlled means for connecting adjoining tubs below the liquid level, an inclined open pipe extending along the bottom of each tub, and an air-injector communicating with the lower end of the pipe.—L. E.

Fermentation of liquids. G. Johnson and P. R. Hare, Bromley. U.S. Pat. 839,067, Dec. 18, 1906.

See Eng. Pat. 10,093 of 1903 ; this J., 1904, 499.—T. F. B.

Pasteurising beer and other liquids having a gas dissolved therein ; Process of ——. F. Knipping, Berlin. U.S. Pat. 838,721, Dec. 18, 1906.

The liquid to be pasteurised is placed in an open receptacle, and the latter within a closed container ; the whole is heated, sufficient pressure of a permanent gas, or of a gas similar to that dissolved in the liquid, being produced to prevent escape of gas from the liquid.—L. E.

French Patents.

Fermentation; Apparatus for ——. A. A. Colas. Fr. Pat. 369,976, Sept. 24, 1906.

The apparatus consists of a series of galvanised-iron vats or of one vat divided into compartments, the interior surfaces being coated with varnish. Each vat or compartment is provided with one or more metal cooling coils; by regulating the flow of cooling water, the temperature of the fermenting liquid may be maintained at any desired degree. The apparatus is designed more especially for the secondary fermentation of beer of high attenuation; it would also be applicable in the case of fermentation processes of an analogous character.—L. E.

Fermented beverages; Apparatus for the concentration of ——. L. Riby. Fr. Pat. 361,972, Dec. 7, 1905.

The apparatus consists of a double-walled metal vessel containing a number of tinned metal basins supported on shelves. The basins, which contain the liquor to be concentrated, are closed with membranes, the latter being supported by covers of cotton-canvas. The membrane is prepared by repeatedly steeping cleaned horse's bladder (or bullock's, calf's, or pig's bladder) in a bath consisting of 100 parts of water and 1 part of glue prepared from the bladders, and drying after each steeping. This treatment is applied both to the interior and exterior of the bladder, and has the effect of rendering the bladder impervious to alcohol vapour, but not to water vapour. The vessel is heated to 60°—65° C. by introducing steam or hot air into the space between the double walls. The basins are provided with gauges to indicate the amount of liquid in them.—L. E.

Alcohol from alcoholic liquors; Apparatus for separating ——. A. Linzel. Fr. Pat. 369,841, Sept. 19, 1906. Under Int. Conv., May 23, 1906.

The liquor enters at the bottom of a cylindrical vessel which is divided into compartments by a number of perpendicular partitions. The partitions are provided with apertures, so arranged that in flowing to the exit pipe, the liquor pursues a zig-zag course. The vessel and contents may be heated by hot water. Each compartment is roofed in by a cover consisting of two sections which slope upwards towards each other from the edge of the vessel, a space being left between their adjacent ends to allow of the escape of alcohol vapour. Any portion of the vapour which condenses before reaching the cooling apparatus, falls on the cover, and is thence conducted to the first compartment of the vessel to undergo the heating process afresh.—L. E.

Disinfectant for the brewery; Special ——. E. H. Macron. Fr. Pat. 370,090, Sept. 28, 1906.

The disinfectant consists of a mixture of formaldehyde and extract of chestnut wood in suitable proportions; a mixture of 320 grms. of formaldehyde and 180 grms. of the extract is quite sufficient to disinfect a tun of 160 litres capacity. The tannic acid in the chestnut wood extract prevents putrefaction, and destroys the odour of the formaldehyde.—L. E.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS

(Continued from page 164.)

(*A.*)—FOODS.

Sesame oil; Notes on the reactions for ——. E. Gerber. Z. Untersuch. Nahr. Genussm., 1907, **13**, 65—68.

It has been shown that "cocoa red" gives a coloration in the colour tests for sesame oil, but according to the author's experience this is not invariably the case, for certain cacao preparations gave negative results. Moreover, any reaction due to the presence of "cocoa red" in cacao butter can only be attributed to the mechanical admixture of particles of cocoa in the ethereal extract of the fat, for the author shows that "cocoa red" is insoluble in hot cacao butter. On the other hand, the fat from a chocolate varnished over with gum benzoin tincture gives a red coloration with both Soltsien's tin reagent and Baudouin's furfural reagent. Different kinds of gum benzoin differ in their behaviour with the two reagents when tested in alcoholic solution. Thus Siamese benzoin gave a red coloration with the furfural reagent, Sumatra benzoin a grey coloration, and purified benzoin a lilac coloration, whilst Sumatra benzoin gave a reddish-brown coloration and the others a red coloration with the tin reagent. Red or brown colorations were also obtained with cacao butter containing ethereal extracts of vanillin, vanilla, cloves, and cinnamon, all of which are used in the manufacture of chocolates of various kinds.—C. A. M.

Cheese; The presence of aldehydes in ——, *and their influence on the flavour of the same.* A. Trillat and Sauton. Compt. rend., 1907, **144**, 333—335.

It is shown that aldehydes are present in cheeses, the quantity varying from mere traces in the case of Camembert, Gruyère, and Dutch cheeses, to 0·0027 per cent. in Roquefort, and 0·0029 per cent. in Gorgonzola. Cheeses, therefore, having a pronounced bitter flavour contain the largest quantity of aldehydes, and the authors find that formation of the aldehydes during the ripening of the cheese coincides with the appearance of the bitter flavour. The aldehydes may exist as acetals in the cheeses.
—W. P. S.

Zeiss butyro-refractometer; Temperature correction of the ——. H. D. Richmond. XXIII., page 225.

Whey and skim milk for diluting molasses in the manufacture of alcohol. Von Bohle. XVII., page 217.

English Patents.

Desiccating [milk, &c.]; Apparatus for ——, *and product thereof.* C. K. Mills, London. From D. R. Hendricks, New York. Eng. Pat. 4473, Feb. 23, 1906.

The material to be treated is projected downwards in the form of spray, by atomising jets, into a desiccating chamber, into the lower part of which an upward current of air is blown by a fan or other suitable device. The proportions are so adjusted that the whole of the moisture is vaporised and carried forward by the air, along with the dried material in the form of a powder, through an opening in the upper part of the chamber. It then passes through a depositing chamber provided with baffles, where the product, which is claimed as such, is collected. No claim is made for anything protected by Eng. Pats. 14,724 of 1900; 28,594-5 of 1903; and 13,186 and 29,367 of 1904 (this J., 1901, 59; 1905, 77; 1904, 814).—W. H. C.

Milk; Improved antiseptic compound for the preservation of ——. W. Bath and W. E. Allard, London. Eng. Pat. 10,767, May 8, 1906.

The antiseptic preparation consists of the peroxides of sodium and potassium, used either separately or mixed with sodium or potassium bicarbonates or with magnesium carbonate. A preparation of equal parts of the mixture of peroxides and a bicarbonate is suitable for the preservation of milk for a comparatively short time, 1 part of this preparation being sufficient for 1280 parts of milk. The milk should be strained through a dairy cloth about 15 minutes after the addition of the preparation. Reference is directed to Eng. Pat. 12,113 of 1904 (this J., 1904, 1108).—L. E.

French Patents.

Meat extract; Process of preparing a concentrated fluid ——. A. Mouneyrat. Fr. Pat. 361,958, Dec. 2, 1905.

Finely-ground lean meat is mixed with its own weight of dilute sodium chloride solution rendered slightly alkaline with sodium hydroxide (artificial serum). The mixture is cooled for one hour to a low temperature by the aid of solid carbon dioxide or liquid air, and is then gradually warmed to a temperature of 25° to 30° C., at which temperature it is kept for about four hours. The liquid portion is now pressed out and clarified, whilst the solid portion is converted into albumoses by any suitable process. The two portions are united and concentrated to any desired consistency.—W. P. S.

Water used for washing cereals; Process and apparatus for clarifying ——, *and for recovering solid matters from the same.* P. Piepenbring and Co. Fr. Pat. 369,759, Sept. 14, 1906. Under Int. Conv., Nov. 14, 1905.

In order to recover husks, &c., from water which has been used for washing cereals, the water is passed through a series of sieves. The solid matters collecting on the sieves are carried by a conveyor to a press or centrifugal apparatus, whence they pass to a drying chamber. The dry substances are then ground and used for fodder, with or without the addition of other materials.—W. P. S.

Eggs; Process for preserving the white and yolk of ——. F. Foschi. Fr. Pat. 369,967, Sept. 22, 1906. Under Int. Conv., Nov. 1, 1905.

The whites and yolks of eggs are thoroughly mixed together, and the mass is dried in a current of air heated to a temperature of 37° to 40° C. The drying process takes about 18 hours; if the yolks be dried separately, only about 6 hours' drying is necessary, and in the case of whites alone, 12 hours. The dry mass is next exposed to the atmosphere for 24 hours, then ground, again exposed to the air for a further 24 hours, and the powder finally packed in boxes, tins, &c., or pressed into tablets. The egg powder thus prepared is quite soluble in water.—W. P. S.

German Patent.

Fat-content of cheese; Process for the approximate determination of the ——. Milchwirtschaftlicher Verein im Allgäu e. V. Ger. Pat. 175,147, Dec. 28, 1905.

The method is based upon the use of a liquid (brine or the like) of which the specific gravity can be altered. Pieces of the cheese free from air bubbles are introduced into a liquid having a specific gravity corresponding to a cheese with a known percentage of fat, or into a liquid of which the specific gravity is subsequently altered so that the cheese just floats.—A. S.

(*B*).—SANITATION; WATER PURIFICATION.

Stream pollution by acid iron waste. Stabler. Water-Supply and Irrigation Paper No. **186**, U. S. Geol. Sur.; Chem. Abstr., Amer. Chem. Soc., 1907, 214.

The waste liquors from the Shelby Steel Tube Co.'s works at Shelby, O., have caused serious trouble in the small stream into which they discharge. Their deleterious ingredients are derived from the "pickling process" in which metal surfaces are cleaned by immersion in sulphuric acid. The spent liquor as discharged contains a considerable quantity of ferrous sulphate with some free acid. In the stream a precipitate of iron oxide is formed, and dissolved oxygen is exhausted, rendering the water unsuitable for fish life. The permanent hardness of the water is increased, and riparian owners have secured damages against the company. The diversion of a portion of the water to the city sewers improved conditions in the stream; but at the purification works, which consist of settling basins and cinder filters, the sewage, containing 5—10 per cent. of acid iron waste, proved difficult to handle. The settling tanks filled up rapidly, and the filters became clogged. A process for recovering acid from the spent liquor has been used at Shelby since 1904. It consists in the concentration of the waste in the presence of iron turnings to about 45° B., and the crystallisation of ferrous sulphate. This process works well, and the cost of production is $6·29 a ton for a product worth $9·64. Only about one-fifth of the acid used is at present recovered at Shelby, but by arranging to utilise it, all "stream pollution can be practically obviated and the economic value of the plant greatly enhanced."

French Patents.

Air; Product and apparatus for purifying vitiated ——. British Submarine Boat Co., Ltd. Fr. Pat. 369,846, Sept. 19, 1906. Under Int. Conv., Sept. 20, 1905.

See Eng. Pat. 19,012 of 1905; this J., 1906, 1062.—T. F. B.

Effluents; Method of sterilising —— *and utilising their constituents.* J. C. Butterfield and G. Watson. Fr. Pat. 370,012, Sept. 25, 1906.

See Eng. Pat. 19,502 of 1905; this J., 1906, 1035.—T. F. B.

German Patents.

Ferric hydroxide solution suitable for the purification of water; Process for the preparation, without dialysis, of a ——. H. Schweikert. Ger. Pat. 173,773, July 8, 1904.

Sodium carbonate solution, free from sulphate, is added gradually to a solution of ferric chloride free from sulphuric acid, so long as the precipitate formed redissolves, and until the solution no longer gives a red coloration with thiocyanate, but yet appears clear by transmitted light. A solution of sodium bicarbonate or a very dilute solution of sodium carbonate is next added in quantity sufficient to precipitate the iron as ferric hydroxide containing some chloride, but to still leave the solution faintly acid. The precipitate is collected, washed with a small quantity of water, freed from liquid, as far as possible, by the aid of the pump, and finally dissolved in a suitable quantity of water with, if necessary, the addition of a trace of ferric chloride.—A. S.

Sewage; Process for the purification of —— *by treatment with a current of air under pressure.* B. R. Tralls. Ger. Pat. 171,480, July 26, 1904.

The sewage is introduced into a vessel provided in its lower part with a perforated partition or the like, on which rests a thick layer of fine, sharp-edged sand or similar material, and is subjected therein to the action of a current of air, forced up through the sand from below. It is stated that the intimate contact thus effected between the sand and the sewage leads to a rapid disintegration and decomposition of the solid impurities.—A. S.

(*C*.)—DISINFECTANTS.

Antiseptic action of essential oils and their constituents. K. Kobert. Schimmel's Report; through Chem. Zentr., 1907, **1**, 419—420.

In his experiments the author made use of the fact, recorded by Brüning, that so-called normal lactic bacteria produce sulphuretted hydrogen from raw milk to which powdered sulphur has been added. Into each of a series of test-tubes were introduced 10 c.c. of raw milk and a small quantity of finely-powdered sulphur, and then different quantities (from 1 drop to 1 c.c.) of the essential oil was added, and sulphuretted hydrogen tested for by means of lead-paper. The most active essential oils (preventing formation of hydrogen sulphide at a dilution of more than 1:100) were: bitter almond oil (natural and artificial), cassia oil, cherry-laurel oil, clove oil, mustard oil (natural and artificial), spike oil, and cinnamon oil. Of the individual constituents of essential oils, the most active (at a dilution of more than 1:100) were: benzyl alcohol, anisaldehyde, benzaldehyde, cinnamic aldehyde, iso-eugenol, and the compound, $C_{10}H_{16}O_2$, from wormseed oil. The terpenes have, in general, only a weak antiseptic action, with the exception of limonene. Oil of turpentine is rendered much more active by exposure to light and air. Walbaum's muskone (this J., 1906, 607) and *Tinctura Moschi* prevent the development of hydrogen sulphide from milk and sulphur, as also do benzoic acid (0·1 grm. per 10 c.c. of milk), salicylic acid (0·2 grm.), and skatole (0·5 grm.).—A. S.

French Patent.

Disinfectant for the brewery; Special ——. E. H. Macron. Fr. Pat. 370,090, Sept. 28, 1906. XVII., page 218.

XIX.—PAPER, PASTEBOARD, &c.

(Continued from page 165.)

Paper bags for cement. W. Herzberg. Wochenbl. Papierfab., 1907, 38, 477—479.

PAPER bags are now being used in America for packing Portland cement. This paper possesses the properties of toughness and flexibility in a remarkably high degree, and considerable difficulty has been met with by German paper makers in their attempts to imitate it. The American paper examined by the author was composed of 70 per cent. of manila rope fibre and 30 per cent. of sulphite wood pulp. The mechanical tests gave the following results :—Breaking length, machine direction 7850 m., cross direction 4250 m., mean 6050 m. Elongation, machine direction 2·7 per cent., cross direction 7·0 per cent., mean 4·9 per cent. Number of double folds (Schopper's machine), machine direction 35,000, cross direction 15,000, mean 25,000. The paper had a weight of 145 grms. per sq. m., and had been made by couching together two webs of 80 and 65 grms. per sq. m. respectively. The preparation of the paper in two layers improves the uniformity and gives a softer, more flexible and more elastic product than if it were made in a single sheet of the same weight. This is therefore regarded as an essential point of the manufacture. Under the microscope it was observed that the full natural length of the fibres of the manila and the wood pulp had been preserved as far as possible, and that unresolved bundles of lignified manila fibres were fairly frequent, indicating very mild chemical and mechanical treatments. The paper was "hard sized," although it contained no rosin, starch, or gelatin. This property was apparently due to the presence in fairly large quantities of a yellowish oil, which, in the author's opinion, was probably derived from the ropes, and which might contribute to the softness and elasticity of the paper.—J. F. B.

Cellulose [: Mercerised ——]. H. Wichelhaus and W. Viewig. V., page 195.

ENGLISH PATENTS.

Paper ; Process for removing glaze from printed ——. A. and H. Scheufelen, Oberleuningen-Teck, Germany. Eng. Pat. 23,684, Oct. 24, 1906. Under Int. Conv., Feb. 28, 1906.

COATED papers employed for printing half-tone illustrations possess a very high glaze, necessary for receiving the impression, but very objectionable in subsequent use. According to this process the impression is made on the highly-glazed surface in the ordinary way, and the glaze is then destroyed by treatment with a liquid. The printed paper is suspended in a chamber, the atmosphere of which contains moisture equivalent to about 95 per cent. of saturation at a temperature of 25° C. After some hours in this chamber the glaze disappears, and the paper is dried and pressed.—J. F. B.

Pulp ; Process of reclaiming —— from waste water. G. Harrison, London. From H. Parker, Nashua, U.S.A., Eng. Pat. 5219, March 3, 1906.

SEE Fr. Pat. 365,866 of 1906 ; this J., 1906, 1001.—T. F. B.

Water used in [cellulose and paper] factories ; Process and apparatus for purifying ——. J. E. Evans-Jackson, London. From Oesterreichischer Verein f. Cellulosefabrik., Vienna. Eng. Pat. 17,997, Aug. 10, 1906.

SEE Fr. Pat. 368,868 of 1906 ; this J., 1907, 65.—T. F. B.

Silk, artificial, and the like filaments ; Manufacture of ——. W. P. Dreaper. Eng. Pat. 27,222, Dec. 30, 1905. V., page 196.

Cellulose esters of fatty acids ; Manufacture of ——. C. D. Abel, London. From Act. Ges. f. Anilinfabr., Berlin. Eng. Pat. 14,255, June 21, 1906.

SEE Fr. Pat. 368,738 of 1906 ; this J., 1907, 30.—T. F. B.

Cellulose compounds and their application for the manufacture of filaments, films, ribbons, and other products. L. Lederer, Sulzbach, Bavaria. Eng. Pat. 19,107, Aug. 27, 1906.

SEE Fr. Pat. 368,766 of 1906 ; this J., 1907, 30.—T. F. B.

FRENCH PATENTS.

Wood and bark of the baobab tree ; Method of preparation of the —— [for paper manufacture, &c.]. A. Barthólemy. Fr. Pat. 369,657, March 29, 1906.

THE wood is first crushed to get rid of sap, and then immersed in a 10 per cent. benzene solution (" dans un bain à base de benzine : 10 p. 100 environ "). This treatment is said to preserve the natural colour of the fibre and render it particularly suitable for paper manufacture, &c., as regards durability.—G. W. McD.

Cellulose fibres ; Production of —— by means of nitrated cotton. Soc. Anon. des Plaques et Papiers Phot. A. Lumière et ses fils. Fr. Pat. 361,960, Dec. 4, 1905. V., page 197.

Ebonite or india-rubber ; Manufacture of substances analogous to —— [from nitrocellulose]. C. Claessen. Fr. Pat. 369,797, Sept. 15, 1906. XIIIC., page 212.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(Continued from page 167.)

Morphine ; Assay of ——. A method of extraction. T. Tickle. Pharm. J., 1907, 78, 162—164.

As a satisfactory solvent for the extraction of morphine, the author recommends cresol or crude carbolic acid, purified by re-distillation. The cresol is mixed with amyl alcohol to diminish its miscibility with water, and with chloroform or benzene to promote separation from the aqueous solution, if the latter contain much glycerol. 100 c.c. of the solution containing morphine are treated with sodium bicarbonate to liberate the alkaloid, and well shaken with a mixture of 2 parts of recently-distilled cresol and 1 part of amyl alcohol. The solvent is used in four fractions of 10 c.c., 10 c.c., 5 c.c., and 5 c.c., respectively. The different fractions are united, mixed with 15 c.c. of ether, and filtered through thick dry paper, the loss being noted and allowed for later. The filtrate is mixed with 30 c.c. of petroleum ether, and the morphine extracted by shaking first with 10 c.c. and then with successive quantities of 5 c.c. of 1 per cent. acetic acid solution. The acetic acid solution is evaporated to dryness, and the residue converted into crystallised morphine in the usual way. In the preliminary experiments made to ascertain the best solvent for morhpine, the following are some of the results obtained :—

Percentage of morphine extracted on shaking a solution containing 5 grms. per litre with an equal volume of the solvent :—

Ethyl acetate	32·0	Creosote	91·0
Amyl alcohol	37·2	Eugenol............	32·0
Phenol	69·2	Clove oil	71·0
o-Cresol	66·8	Cassia oil	33·0
p-Cresol............	68·8	Phenol, 1 ...... Benzene, 1	68·0
m-Cresol	84·8	Phenol, 1 .... Chloroform, 1	65·0
Phenol, 1 ...... Amyl alcohol, 2 ..	88·0	Cresol, 1 .... Ether, 1	49·0
Phenol, 2 ...... Amyl alcohol, 1 ..	99·0		
Phenol, 1 ...... Camphor, 1	89·0		

Under similar conditions, 20 c.c. of chloroform containing a small proportion of alcohol extracted 0·0075 grm. of morphine ; carbon tetrachloride, 0·0006 grm. ; benzene, traces ; nitrobenzene, 0·003 grm. ; and benzaldehyde, 0·006 grm. of morphine.—A. S.

Camphor and camphor trees in Algeria. J. A. Battandier. J. Pharm. Chim., 1907, **25**, 182—183.

Camphor trees yield camphor in the Mediterranean region as well as in those countries to which they are indigenous. The leaves, with twigs, of trees raised from seeds imported from Formosa and grown in Algeria, have given from 1·05 to 1·4 per cent., on distillation. Camphor trees previously introduced into Algeria have been found to produce no camphor. The same variability in the yield of camphor has been observed in its native countries. It is suggested that the yield might be increased by methods of selecting seedlings and grafting.—J. O. B.

Terpene alcohols such as linalool ; Determination of —— in essential oils. M. V. Boulez. Les corps gras., 1907, 178. Chem.-Zeit., 1907, **31**, Rep. 58.

For the determination of terpene alcohols, such as linalool, for example, the author has used the following method :— 5 grms. of the essential oil and 25 grms. of turpentine oil are weighed out into a long-necked flask, and the mixture boiled for three hours with 40 grms. of acetic anhydride and 3—4 grms. of sodium acetate. The amount of acetic acid consumed by the turpentine oil must be determined by a separate experiment ; the amount required was not more than the equivalent of 1·05 per cent. of potassium hydroxide. The acetylated mixture is shaken with water, dried, and 1 grm. boiled with standard alcoholic potassium hydroxide solution, and titrated. After allowing for the turpentine oil, the amount of alcohol present in the original oil can be calculated. The author found that pure linalool gave 98—100 per cent. of linalool by this method, as against 50 per cent. by the ordinary method ; also an essential oil found to contain 40—50 per cent. by the old method gave 80—90 per cent. by the new method.—F. Shdn.

Terpinene. O. Wallach. Ber., 1907, **40**, 575—584.

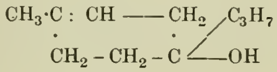
In this communication the author criticises the work of Semmler (see this J., 1907, 66), and refers largely to his own recent work on terpinene (see this J., 1906, 1171). The halogen and hydroxyl derivatives of terpinene are again described. Terpinene bihydrochloride, when treated with caustic alkali, gave, amongst other substances, a new terpine melting at 137° C. This boils at 250° C., and can be crystallised from water or methyl alcohol. On treatment with hydrochloric acid, it passes back into terpinene bihydrochloride, m. pt. 52° C. This terpine can be obtained from the terpinenol (terpineol) of cardamom or marjoram oils, and from thujene. Terpinene nitrosite can be readily reduced in glacial acetic acid to carvenone. The substance, m. pt. 163° C., produced by the action of alcoholic alkali on terpinene nitrosite, or terpinene nitrolpiperidide, also give carvenone on reduction. The constitution of these substances is discussed, and comparisons made with Semmler's conclusions.—F. Shdn.

Sabinene and its relation to terpinene. O. Wallach. Ber., 1907, **40**, 585—595.

This paper is largely taken up with criticism of Semmler's results (this J., 1907, 66). The author discusses the molecular refraction of sabinene. In addition to what has been already published (this J., 1906, 712), he states that sabinene monohydrochloride, $C_{10}H_{17}Cl$, can be readily produced by passing dry hydrochloric acid gas into a dry solution of sabinene in carbon bisulphide. The hydrochloride is a non-crystallisable oil, boiling at 87°—92° C. at 12 mm., with sp. gr., 0·982, and $n_D = 1{\cdot}4824$ at 20° C. When sabinene is shaken with sulphuric acid, terpine, m. pt. 137° C., and terpinenol, $C_{10}H_{17}OH$, are produced. Terpinenol (terpineol) boils at 209°—212°C. with sp. gr., 0·9265, $n_D = 1{\cdot}4785$ at 19° C., and $\alpha = +25° 4'$. On oxidation with permanganate, it yields a glycerol, $C_{10}H_{17}(OH)_3$, m. pt., 114°—115° C., and with $[\alpha]_D = +21{\cdot}21°$. This alcohol is chemically and physically identical with the alcohol of cardamom and marjoram oils ; it is, moreover, the active modification of the inactive terpinenol produced by shaking terpinene bihydrochloride with potassium hydroxide.—F. Shdn.

Terpinenol of oil of marjoram ; The ——. O. Wallach and F. Bödecker. Ber., 1907, **40**, 596—600.

The author has previously shown that oil of marjoram contains principally *d* α-terpineol, m. pt. 35° C., and a second alcohol, giving rise to terpinene derivatives. This latter, Semmler has described under the name of "origanol" (this J., 1907, 66). The author describes this substance under the name of terpinenol, in place of terpineol (see preceding abstract). If the glycerol, $C_{10}H_{17}(OH)_3$, obtained from terpinenol be further oxidised, an acid, $C_{10}H_{18}O_6$, is produced ; this occurs in two modifications melting at 205°—206° C., and 188°—189° C., respectively. Both acids yield lactones, $C_{10}H_{14}O_4$, volatile with steam, and melting at 63°—64° C. and 72°—73° C. respectively. The lactone melting at 63° C. is not to be confused with that obtained by an analogous process from α-terpineol and with almost the same melting-point. If the terpinenol-containing fraction of marjoram oil be shaken with sulphuric acid, *cis*-terpine hydrate, m. pt. 117° and terpinene-terpine, m. pt. 137° are obtained. It would appear that oil of marjoram contains one of the ordinary terpineols. The glycerol from terpinenol on distillation with hydrochloric acid yields carvenone. The following formula represents the constitution of terpinenol :—



—F. Shdn.

Dipentene ; The nature and boiling point of ——. O. Wallach. Ber., 1907, **40**, 600—606.

In consequence of Semmler's observations on the boiling-point of dipentene (this J., 1907, 66), the author has made a comparison between dipentene and *i*-limonene. The dipentene was prepared by the action of aniline on dipentene dihydrochloride. On fractionation, it nearly all boiled between 177° and 178° C. The *i*-limonene was prepared by mixing equal quantities of *d*- and *l*-limonene ; it boiled at 175°—176°. Ten grms. of dipentene gave 8·5 grms. of a tetrabromide, melting at 125° C., after crystallisation ; 10 grms. of *i*-limonene gave 10 grms. of tetrabromide, melting at the same temperature. The slightly-higher boiling-point of dipentene is due to some impurity, the nature of which has not been determined. —F. Shdn.

Tropeïnes ; Relation between chemical constitution and physiological action in the ——. H. A. D. Jowett and F. L. Pyman. Chem. Soc. Proc., 1907, 22, 317.

Reference was made to Ladenburg's generalisation, according to which a tropeïne in order to possess mydriatic action, must contain a benzene nucleus and a fatty hydroxyl in the side chain containing the carboxyl group, and also to a recent paper by Jowett and Hann (this J., 1906, 391), in which it was stated that terebyl- and phthalidecarboxyl-tropeïnes, which are lactones, and do not contain fatty hydroxyl groups, produce, nevertheless, marked dilation of the pupil, and lose their physiological activity when converted into the corresponding hydroxy-acids. The authors have prepared the *lactone* of *o-carboxyphenylglycerylt ropeïne*, expecting to find it very active physiologically, since it is not only a lactone, but also conforms to Ladenburg's generalisation, *isocoumarincarboxyltropeïne*, which results on heating the above, and certain alkyl bromides of these tropeïnes and of homatropine. The physiological examination showed that these tropeïnes are only slightly mydriatic, and that their physiological activity is lost when they are converted into the corresponding hydroxy-acids. The authors conclude that Ladenburg's generalisation cannot be maintained since it does not hold good either in the case of terebyltropeine or of the lactone of *o*-carboxyphenylglyceryltropeine, but that the difference in activity between a lactone and its corresponding hydroxy-acid possesses important physiological significance.

Salicylic acid; Some derivatives of ——. H. A. D. Jowett and F. L. Pyman. Chem. Soc. Proc., 1907, **22**, 317—318.

In the course of the production of some derivatives of salicylic acid which might possibly find application in medicine, *cinnamoylsalicylic acid*, its *methyl* and *ethyl esters*, and *quinine salt*, and also 3 : 5-*dichloroacetylsalicylic acid* were prepared and characterised. *Cinnamoylsalicylic acid*, $CO_2H\cdot C_6H_4\cdot O\cdot CO\cdot CH:CHC_6H_5$.—Ten grams of salicylic acid and 12 grams of cinnamoyl chloride were heated together on a water-bath during three and a half hours. The end of the reaction was indicated by the mixture becoming quite solid. After two recrystallisations from benzene, *cinnamoylsalicylic acid* was obtained in a pure state, and in quantity amounting to 48 per cent. of the theoretical yield; it crystallises from benzene in needles melting at 155° C.; is very readily soluble in alcohol or ether, sparingly so in chloroform or benzene, and almost insoluble in water. The *quinine salt*, $C_{16}H_{12}O_4.C_{20}H_{24}O_2N_2$, crystallises from alcohol in needles which melt at 169° C. It is almost insoluble in water or cold alcohol. The *methyl ester* was prepared by the condensation of molecular quantities of cinnamoyl chloride and methyl salicylate by means of anhydrous potassium carbonate. The product was purified by first treating with hot water, dissolving in chloroform, drying this solution, and mixing the oil which resulted after the removal of the solvent with light petroleum. On then recrystallising from alcohol, the pure ester was obtained in large, tabular crystals melting at 71°, and in an amount equal to 63 per cent. of the theoretical yield. The *ethyl ester*, obtained in an analogous manner, crystallises from alcohol in fine needles melting at 66°—67°. 3 : 5-*Dichloroacetylsalicylic acid*, $C_9H_6O_4Cl_2$.—This substance was prepared by the acetylation of 3 : 5-dichlorosalicylic acid with acetic anhydride and sodium acetate. It crystallises from benzene in needles, melting at 159°.

Resorcinol; A reaction of ——. A. Carrobbio. Boll. Chim. Farm., 1906, 365; Analyst, 1907, **32**, 61—62.

When 1 c.c. to 2 c.c. of a solution of resorcinol in ether is poured upon the surface of 1 c.c. of a solution of zinc chloride, to which ammonia has been added in sufficient quantity to render the liquid clear again, there is formed at the contact zone a yellow ring which rapidly changes to bluish-green, and then to bright blue. On now shaking the contents of the tube with a little alcoholic hydrochloric acid, the ethereal layer is changed to red, whilst the reagent becomes azure blue. It is stated that the zinc reagent is capable of detecting 1 part of resorcinol in 100,000.—C. A. M.

Sodium phenylate; Hydrolysis of ——. A. Naumann, W. Muller, and E. Lantelme. J. prakt. Chem., 1907, **75**, 65—87.

For the determination of the degree of hydrolysis of sodium phenylate solutions at their boiling points, two series of experiments were carried out. In the first, solutions of sodium phenylate of different concentrations were distilled, the volume of the distilling liquid being kept constant at 500 c.c. by the continuous addition of water. The distillate was collected in 100 c.c. fractions, and the amount of phenol passing over determined. In the second set of experiments, the conditions were the same, except that the volume of the distilling liquid was kept constant at 1000 c.c., and the distillate was collected in 25 c.c. fractions. In both cases solutions of pure phenol were distilled under exactly similar conditions. The authors show that from the data thus obtained, the degree of hydrolysis of the phenylate solutions can be estimated, inasmuch as the amount of free phenol formed by hydrolysis in a given phenylate solution is equal to the amount contained in a solution of pure phenol, which yields in the distillate a quantity of phenol equal to that obtained under similar conditions from the phenylate solutions. Some of the results obtained are given in the following table:—

Percentage hydrolysis of sodium phenylate solutions.

Concentration of solution in grm.-mols. per litre.	Distilling liquid, 500 c.c. distillate, 100 c.c.	Distilling liquid, 1000 c.c. distillate, 25 c.c.
1·0	4·39	—
0·5	5·83	—
0·4	6·19	—
0·2	8·61	8·86
0·1	12·24	11·02
0·05	16·52	15·35
0·025	22·50	—
0·02	—	23·97
0·01	29·28	30·14
0·008	31·66	—
0·005	—	40·04
0·004	43·08	—
0·002	56·45	—

Addition of excess of sodium hydroxide considerably diminishes the hydrolysis of sodium phenylate, the amount of phenol in the first 100 c.c. of distillate from 500 c.c. of a 0·2*N*-solution being reduced from 0·3882 grm. to 0·0310 grm. by addition of an equimolecular proportion of sodium hydroxide. Further additions of sodium hydroxide had much less influence. The effect of sodium hydroxide diminishes rapidly, as the concentration of the phenylate solution is reduced.—A. S.

Aldehydes; Conversion of —— *into ketones by means of diazomethane.* F. Schlotterbeck. Ber., 1907, **40**, 479—483.

Aldehydes when left at the ordinary temperature with an ethereal solution of diazomethane, prepared from nitrosomethylurethane, are slowly converted into ketones with one carbon atom more. Probably an unstable furodiazole is formed as an intermediate compound which at once decomposes, liberating nitrogen, to form a ketone. In this way methyl-hexylketone was obtained from oenanthol, acetophenone from benzaldehyde, and methyl-isobutylketone from isovaleraldehyde, the ketones being in each case identified by means of their semi-carbazones.—E. F. A.

β-Mercury-dipropionic acid. F. Fischer. Ber., 1907, **40**, 386—389.

When the ethyl ester of β-iodopropionic acid dissolved in dry ether is treated with sodium amalgam, the corresponding ester of β-mercury-dipropionic acid is formed. If the mixture be treated with water, and the ethereal solution evaporated, the ester is obtained as a yellowish uncrystallisable oil with a very unpleasant smell. On saponification, β-mercury-dipropionic acid, $Hg(CH_2.CH_2.COOH)_2$, is produced. This melts and turns grey at 148·5°—149·5° C. (corr.), and crystallises from water in fine, colourless, and odourless prisms. When neutralised with sodium hydroxide, it gives precipitates with salts of lead, copper, and silver. It is decomposed by halogens and strong acids. Its toxic action is slight. It is decomposed by boiling with water into a substance which is probably oxymercuric propionic anhydride, $\overset{|}{O}Hg.CH_2.CH_2.\overset{|}{C}O$. This substance is insoluble in water, but soluble in alkalis and dilute acids, and turns grey when heated to 190° C.—F. Shdn.

Lead and calcium arsenates; Note on ——. Spencer Pickering. Chem. Soc. Proc. 1907, **23**, 35.

Crystallised sodium arsenate of commerce consists of the disodium salt, generally united with seven, but sometimes with twelve mols. of water of crystallisation. In either case, this water may all be expelled at 100° C., and decomposition into the pyro-arsenate commences at 150° C. The preparations dried at 300° F. (148·9° C.) in accordance with the Pharmacopœia are, therefore, overheated. With lead acetate, all commercially pure samples give a precipitate of triplumbic arsenate; but with lead nitrate, the precipitate consists of the diplumbic salt, mixed, occasionally, with a certain amount of the tri- or monoplumbic arsenates. With preparations of crude sodium arsenate, the amount of lead salt required for precipitation varies considerably, and there is an indication that a compound of the di- and tri-plumbic salts may sometimes be formed.

With calcium chloride or nitrate, sodium arsenate forms the tricalcium arsenate; but, when thus prepared, it is not very insoluble, and is, therefore, unsuitable as an insecticide. But it may be completely precipitated by calcium hydroxide; and thus a mixture of lime and sodium arsenate may be used as a substitute for lead arsenate.

Chromyl dichloride; Preparation of ——. H. D. Law and F. Mollwo Perkin. Chem. Soc. Proc., 1907, **23**, 11.

The authors find that the best method for preparing chromyl dichloride is to dissolve chromic acid in rather more than the equivalent quantity of concentrated aqueous hydrochloric acid and to add to this solution concentrated sulphuric acid in small quantities at a time, the mixture being cooled between each addition. After standing for about twenty minutes in a tap funnel, the heavy under layer of chromyl dichloride is drawn off. It can be purified by aspirating dry air through it and subsequent distillation. The yield is almost theoretical.

Praseodymium compounds; Method for preparing pure ——. N. A. Orlow. Chem.-Zeit., 1907, **31**, 115.

The known methods of separating praseodymium from lanthanum compounds, comprising several successive recrystallisations, are unsatisfactory. In repeating some of the work of C. Winkler, the author found that in presence of cerium salts, praseodymium can be precipitated as oxide whilst lanthanum remains in solution. The solution of praseodymium salt containing lanthanum is mixed with a slight excess of cerium chloride, and the mixed oxides of cerium and praseodymium are precipitated by addition of mercuric oxide and potassium permanganate, and filtered. The precipitate is dissolved in dilute acid, and the metals again precipitated as oxalates, which are converted successively into oxides and nitrates. The latter are fused with potassium nitrate at 300°—350° C., and the praseodymium compound extracted with water from the cold mass.
—B. J. S.

Hydrocarbons of the benzene series; Oxidation of ——. H. D. Law and F. M. Perkin. III., page 192.

English Patents.

Iso-bornyl esters; Manufacture of ——. C. Weizmann and the Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 8266, April 5, 1906.

Isobornyl esters can be made in one operation by heating pinene hydrochloride with a suitable organic acid (*e.g.*, glacial acetic acid) in the presence of a small quantity of zinc chloride.—F. Shdn.

Tinctures; Production of permanently clear ——. Wilh. Anhalt Ges. m.b. H., Colberg, Prussia. Eng. Pat. 15,064, July 2, 1906. Under Int. Conv., Aug. 3, 1905.

Permanently clear tinctures from alcoholic extracts of vegetable substances can be produced by diluting the extract with water and adding a hot solution of an inorganic salt of boric acid, such as sodium tetraborate.—F. Shdn.

Antiseptic compounds [Benzoyl-succinyl peroxide]. A. C. Houghton, Syracuse, U.S.A. Eng. Pat. 20,680, Sept. 18, 1906. Under Int. Conv., Sept. 25, 1905.

See U.S. Pat. 821,291 of 1906; this J., 1906, 608.—T.F.B.

French Patents.

Glycidic esters and ketones; Preparation of α-β-substituted ——. G. Darzens. First Addition, dated Dec. 6, 1905, to Fr. Pat. 360,513, Feb. 25, 1905 (this J., 1906, 496).

Claim is made for several α-β-substituted glycidic esters and the corresponding ketones, and for their use in confectionery and perfumery.—F. Shdn.

Liquid residues arising from the preparation of pinene hydrochloride from oil of turpentine by the action of hydrochloric acid; Utilisation of ——. A. Béhal. Fr. Pat. 361,978, Dec. 8, 1905.

The chlorine contained in the liquid residues from the preparation of pinene hydrochloride from oil of turpentine by means of hydrochloric acid can be removed by heating with anhydrous lead acetate dissolved in acetic acid. After separating the lead chloride, the liquid is distilled. The low boiling hydrocarbons can be used industrially, the bornyl acetate can be saponified, and the higher boiling hydrocarbons can be converted into bornyl acetate.
—F. Shdn.

Esters of terpenic alcohols; Preparation of —— from terpenes. A. A. Shukoff. Fr. Pat. 369,794, Sept. 15, 1906.

The acetic esters of terpenic alcohols can be prepared by heating terpenes with a mixture of glacial acetic and sulphuric acids and saponifying the product. In this invention the acetic acid is partially or entirely replaced by an unsaturated organic acid such as linoleic acid. The sulphuric acid can be replaced by other mineral acids.
—F. Shdn.

Alcohols, especially ethyl alcohol; Process for dehydrating ——. Elektrochem. Werke. Fr. Pat. 370,093, Sept. 28, 1906. Under Int. Conv., Sept. 29, 1905.

See Eng. Pat. 21,567 of 1906; this J., 1906, 1231.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(Continued from page 167.)

Potassium chlorate [containing hypochlorite]; Dangerous ——. R. Gartenmeister. Chem.-Zeit., 1907, **31**, 174.

A series of explosions recently occurred one after the other, with tubes containing a dry mixture of potassium chlorate, sulphur, and sugar. As the workman in charge of the chlorate mill stated that an odour of chlorine was frequently noticeable on opening the mill, the author tested the chlorate in question, (*a*), and also samples of another lot of chlorate, (*b*), in the use of which no explosions had occurred. It was found that the chlorate, (*a*), gave in the cold an immediate, intense blue colour on addition of potassium iodide, starch, and sulphuric acid, whilst the chlorate, (*b*), gave a negative result. It is concluded that the explosions were due to the contamination of the chlorate with chlorine monoxide (potassium hypochlorite).
—A. S.

Explosives and dangerous goods; Sea-carriage of ——. New Books, page 226.

English Patent.

Matches; Manufacture of ——. G. A. Haffner, Paris. Eng. Pat. 1354, Jan. 18, 1907. Under Int. Conv., Jan. 18, 1906.

The invention relates to matches without heads rendered inflammable at one or both ends. The inflammable composition consists of potassium chlorate (50 parts), zinc salt of naphthalene-β-sulphonic acid (5 parts), and water (110 parts). Before the application of the inflammable substance, the end portions of the matches are rubbed near their ends with pulverised sulphur, leaving the extreme ends as free as possible, and the sulphur is caused to penetrate into the wood by dry heat or steam. A supplementary impregnation [coating] can also be given with a mixture of lead thiosulphate, potassium chlorate, and an adhesive substance.—G. W. McD.

French Patent.

Explosive; Manufacture of a plastic —— with the aid of trinitrotoluene. C. E. Bichel. Fr. Pat. 369,661, July 18, 1906.

The patent relates to an explosive for shells and torpedoes consisting essentially of trinitrotoluene, which is mixed with solid or liquid resins, with or without addition of dinitrotoluene and collodion-cotton. The following are given as examples :—(A) Trinitrotoluene (87 parts) and copaiba balsam (13 parts). (B) Trinitrotoluene (87 parts), copaiba balsam (12), and collodion-cotton (1 part). (C) Trinitrotoluene (85 parts), resin (14), and collodion-cotton (1 part). (D) "Trinitrotoluene (85 parts), liquid storax (4·5), collodion-cotton (5·0), and dinitrotoluene (10 parts)."—G. W. McD.

German Patents.

Wood; Process for the impregnation of —— with paraffin wax, wax, and the like, in order to make it suitable for the manufacture of safety-matches. Holzwarenfabr. Rexroth-Lynen. Ger. Pat. 173,428, Jan. 6, 1904.

The wood is boiled with "an aqueous solution" of the emulsion formed by treating the impregnating material (paraffin-wax, wax, oil of turpentine, rosin, or the like) with an oil soluble in water, such as Turkey-red oil, or with soaps. For example, 100 kilos. of paraffin wax are melted, and intimately mixed with 100 kilos. of Turkey-red oil, and the emulsion thus produced is run into 1000 litres of boiling water, and the whole well stirred. The wood is introduced into this liquid, which is kept boiling for some time, after which the wood is withdrawn and dried.—A. S.

Explosives; Process for the manufacture of [safety] ——. H. Hermann. Ger. Pat. 176,072, April 27, 1905.

The patent relates to a method of preparing nitroglycerin and chlorate explosives in plastic or granular form, which are safe to handle, and not sensitive to blows or shock. It consists in adding condensation products of formaldehyde with aromatic amines or aminophenols to the nitroglycerin or chlorate, or to mixtures of these with oxygen-yielding or carbonaceous substances. In applying the method to nitroglycerin explosives, the condensation of the formaldehyde with amines or aminophenols may be effected in presence of nitroglycerin and oxygen-yielding compounds. In the case of chlorate explosives, the anhydroformaldehyde compound is fused with substances of an acid character, such as rosin, picric acid, &c., and the product dissolved in a suitable solvent, oil of turpentine, for example, and mixed with the chlorate. The following examples are given :—(1) *Powder.*—Nitroglycerin, 5; anhydroformaldehyde-aniline, 10; and ammonium nitrate, 85 parts. (2) *Plastic explosive.*—Anhydroformaldehyde-aniline, 12; nitroglycerin, 26; and ammonium nitrate, 62 parts.—A.S.

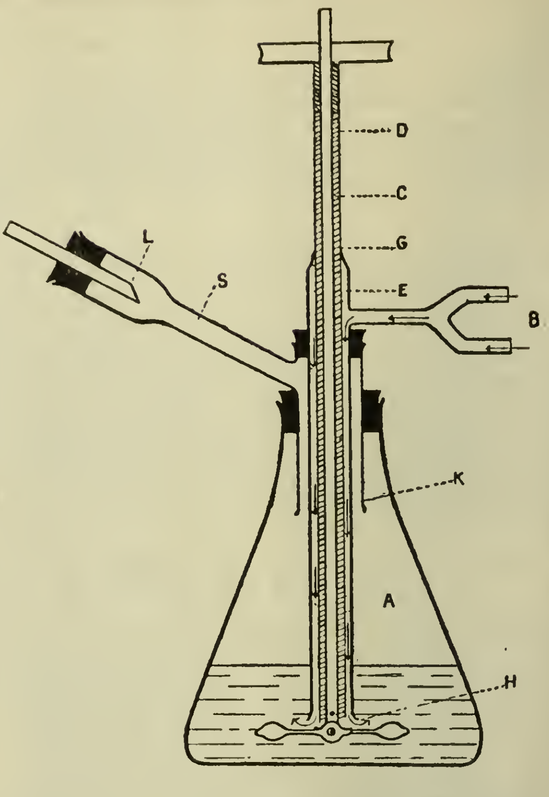
XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 168.)

APPARATUS.

Treating a liquid at its boiling point with two or more gases; Simple apparatus, with stirrer, for ——. N. L. Gebhard. Chem. Soc. Proc., 1907, 23, 34.

Whilst studying the action of certain gases on liquids at their boiling points, the apparatus represented in the figure was devised and found to work satisfactorily. The liquid is placed in an Erlenmeyer flask, A, of capacity appropriate to the volume of liquid under treatment. The rest of the apparatus includes a centrifugal stirrer in the liquid, driven by a water turbine through a horizontal pulley, the rod, C, carrying the stirrer rotating in an outer tube, D. At G, D is sealed into a tube, E, of slightly wider bore. The tube, E, reaches almost to the stirrer, and dips well below the surface of the liquid. The gases enter at the tubes, B, pass along the annular space between D and E, as indicated by the arrows, and encounter the liquid at H, just above the stirrer. The upper part of E is surrounded for part of its length by a wider tube, K, with a side tube, S, through which the vapour of the boiling liquid passes, to be condensed in the reflux condenser, L. E is fitted to K, and the latter to the flask, by means of suitable corks. The apparatus enables a liquid, in vigorous ebullition, to be subjected to the action of gases, with constant stirring.



Hydrogen sulphide; New laboratory method for the preparation of ——. F. R. L. Wilson. Chem. Soc. Proc., 1907, 22, 312.

The common method for the preparation of hydrogen sulphide by the interaction of hydrochloric acid and ferrous sulphide is open to several objections, the most serious of which is the liability of the gas to contain the hydrides of arsenic and phosphorus, due to the contamination of the iron sulphide with phosphide and arsenide. The method described, ensures freedom from these impurities, as well as the absence of most of the unpleasant accompaniments of the ordinary process of preparation. If a current of hydrogen sulphide is passed over an alkali hydroxide, for example, sodium or calcium hydroxides, a hydrosulphide is formed, heat being evolved and a change in colour from white to yellow taking place. If a current of carbon dioxide be now passed over the hydrosulphide, the compound is at once decomposed, a carbonate being formed and hydrogen sulphide set free. In the case of calcium hydroxide, the yellow substance has the composition $Ca(HS)(OH)$, and the action of carbon dioxide is given by the equation : $Ca(HS)(OH) + CO_2 = CaCO_3 + H_2S$. A drying tower is filled either with granular soda-lime or an intimate mixture of calcium hydroxide and moist sawdust. A stream of hydrogen sulphide is passed into the tower until the contents are saturated with the gas, the course of the action being easily determined by the change in colour and by the movement of a heated zone upwards through the tower. After the action has proceeded for some time the gas which escapes from the exit tube smells strongly of hydrogen phosphide, and is inflammable, doubtless consisting of hydrogen mixed with all the other gaseous impurities evolved by the action of acid on the ferrous sulphide. When the hydroxide has reacted with as much hydrogen sulphide as possible, a carbon dioxide generator is substituted for that supplying hydrogen sulphide, and the apparatus is ready to yield as slow or rapid a supply of the latter gas as may be desired. The supply of hydrogen sulphide ceases at once when the stream of carbon dioxide is cut off, and if the exit tube from the tower be closed, a partial vacuum will soon be produced owing to combination of the gases in the tower with unaltered hydroxide. Owing to this absorption of the gas in the tower, it is only necessary to cut off the supply of carbon dioxide in order to prevent further escape of hydrogen sulphide. The rate of supply of the gas may be nicely regulated by introducing a short length of capillary glass tubing between the carbon dioxide apparatus and the generating tower. The danger of contamination of the hydrogen sulphide with carbon dioxide is very small, and may be entirely eliminated by using two towers. As soon as the first shows signs of exhaustion (indicated when calcium hydroxide is used, by the change in colour) it is replaced by the second tower; a new one is put in in place of the latter, and the supply of gas taken from this. R. Meldola referred to the known laboratory process of preparing hydrogen sulphide by heating sulphur with certain hydrocarbons, such as solid paraffin.

Zeiss butyro-refractometer; Temperature correction of the ——. H. D. Richmond. Analyst, 1907, **32**, 44—46.

It was found by Tolman and Munson (this J., 1902, 1238) that the average correction factor to be applied to the refractive indices, calculated from the readings on this instrument, corresponded to 0·000365 for each 1° C., and Leach and Lythgoe (this J., 1905, 943) constructed a temperature scale based upon this factor. The author, however, finds that the errors in the results obtained by the use of this scale are greater than are to be accounted for by the errors of working. The factor varies with each part of the refractometer scale, and the author gives a table of the corrections found necessary in the case of a number of fats and oils. He has also made determinations with the standard fluid supplied with the instrument, and finds the most probable corrections to be as follows:—

Temp. °C.	Correction for scale reading.	Correction for refractive index.
15—20	0·62	0·000372
20—25	0·60	0·000372
25—30	0·608	0·000380
30—35	0·615	0·000393
35—40	0·594	0·000386
40—45	0·585	0·000383
45—50	0·583	0·000385

In the author's opinion it would be preferable to correct the scale readings rather than the refractive indices; but theoretically this is incorrect, since the expansion of fats is very nearly linear, whereas the refractive indices are not so. In practice, however, approximately correct results can be obtained by the use of the factor 0·00038, and the substitution of this factor for 0·000365 in Leach and Lythgoe's scale would give results in which the error would not exceed the limits of experimental error. The tendency of the correction (in the case of butter) to increase with the rise of temperature is due to no correction being made in the thermometer readings for the cooling of the exposed portion of the mercury. In conclusion the author gives directions for plotting a chart of corrections to obtain accurate readings at all temperatures.—C. A. M.

INORGANIC—QUALITATIVE.

Tin in mordanted fabrics; Detection of ——. A. Scheurer and V. Silbermann. V., page 195.

Sulphites; Detection of —— *in presence of thiosulphates and thionates.* E. Votocek. VII., page 199.

INORGANIC—QUANTITATIVE.

Zinc; Determination of traces of ——. G. Bertrand and M. Javillier. Bull. Soc. Chim., 1907 [4], **1**, 63—66.

When an excess of ammonia is added to a solution containing zinc and a sufficiency of calcium, there is deposited slowly on boiling a microcrystalline precipitate of calcium zincate, $CaH_2Zn_2O_4 + 4H_2O$. The authors have devised a method for the detection and estimation of traces of zinc, based on the insolubility of this compound. As an example, a solution containing 0·001 grm. of zinc in 500 c.c. is considered. A few c.c. of milk of lime or at least 50 c.c. of lime-water are added to the solution, and then 10—15 per cent. of concentrated ammonia. The liquid is filtered, if necessary, and boiled as long as ammonia is evolved, and after allowing to cool, the precipitate of zincate and calcium carbonate is collected on a small filter. It is then dissolved in hydrochloric acid, evaporated to dryness, taken up in a little water, and the calcium precipitated by ammonium oxalate in the presence of much ammonia. The filtrate from this is evaporated, heated with sulphuric acid, and the residual sulphate weighed. The reagents used must of course be quite free from zinc, but a blank experiment is advisable to allow for traces of calcium which escape precipitation, or may be dissolved from the vessels employed.—F. Sodn.

Arsenic; Separation of —— *from copper as ammonium-magnesium arsenate.* F. A. Gooch and M. A. Phelps. Amer. J. Science; through Z. anorg. Chem., 1907, **52**, 292—298.

The method is based upon the fact that whilst many copper salts are soluble in ammonia, small quantities of arsenic can be precipitated as ammonium-magnesium arsenate, even in presence of ammonium salts, such as the chloride, if a sufficient excess of magnesia mixture be added. The precipitated ammonium-magnesium arsenate is collected on a layer of compressed fine asbestos, in a platinum filter-crucible. If more than a few mgrms. of arsenic be present, it is necessary to dissolve the washed precipitate, and re-precipitate, whilst if more than 0·2 grm. of arsenic be present, three precipitations are necessary. If the quantity of arsenic amount to only 5 mgrms. or less, precipitation is very slow, and it is advantageous (with very small quantities, even necessary) to freeze the mixture after adding the precipitant in order to induce separation of the magnesium-ammonium arsenate, which remains undissolved on thawing.—A. S.

Aluminium hydroxide and free acid in aluminium sulphate and alums; Iodometric determination of ——. S. E. Moody. VII., page 200.

Silver bullion; Assay of —— *by Volhard's method.* E. A. Smith. X., page 205.

Zinc; Analysis of minerals containing ——. J. A. Muller. X., page 205.

Chromium in steel; Volumetric determination of ——. G. V. Bianchetti. X., page 205.

ORGANIC—QUALITATIVE.

Dyestuffs; Separation of —— *by diffusion.* E. Lehmann. IV., page 194.

Cottonseed oil; Notes on Halphen's reaction for ——. E. Rupp. XII., page 210.

Sesamé oil; Notes on the reactions for ——. E. Gerber. XVIIIA., page 218.

Formaldehyde in the testing of tanning materials. F. Jean and C. Frabot. XIV., page 213.

Resorcinol; A reaction of ——. A. Carrobbio. XX., page 222.

ORGANIC—QUANTITATIVE.

Methylpentoses; Quantitative determination of ——. A. Jolles. Annalen, 1907, **351**, 38—43.

The method previously described for the determination of pentoses (this J., 1906, 201, 500) can be also used for the determination of methylpentoses. When methylpentoses and pentoses are present together, the author separates them by a method first proposed by Suleiman Bey (Z. klin. Med., **39** [3 and 4]). A solution containing from 0·3 to 1 grm. of pentoses is cooled to 0° C., treated with a saturated solution of barium hydroxide also at 0° C., and precipitated with a large excess of pure alcohol previously cooled to 0° C., the mixture being continually stirred. After one and a half to two hours, the solution is decanted through a double filter, and the precipitate washed several times, by decantation, with cooled alcohol, and afterwards collected on the filter, with the aid of the pump. The precipitate is then distilled with hydrochloric acid for the determination of the pentoses in the manner previously described (*loc. cit.*). In a separate portion of the original substance, the pentoses and methyl-pentoses are determined together. Then, if A c.c. of $N/1$ bisulphite solution be consumed in the determination of the pentoses and methylpentoses, and B c.c. in that of the pentoses alone, the weight of pentoses in the substance taken is $B \times 75$ mgrms., and that of methylpentoses, $(A - B) \times 82$ mgrms.—A. S.

Sulphur; Determination of —— *in vulcanised india-rubber and rubber substitute, by Dennstedt's method.* R. Ditmar. XIIIC., page 212.

Chromed hide powder. J. Paessler and W. Appelius XIV., page 213.

Hide powder filter and the American shake or chromed hide powder methods of tannin analysis; The value of the ——. H. C. Reed. XIV., page 213.

Chrome liquors; Basicity of ——. F. K. Kopecky XIV., page 213.

Carbohydrates; Separation of —— *by means of pure yeasts.* J. König and P. Hörmann. XVI., page 215.

Hops; Valuation of ——. G. Cocz. XVII., page 216.

Fermentable sugar; Lohnstein's saccharometer for the determination of ——. F. Schönfeld. XVII., page 217.

Fat-content of cheese; Process for the approximate determination of the ——. Milchwirtschaftlicher Verein im Allgau e. V. Ger. Pat. 175,147, Dec. 28, 1905. XVIIIA., page 219.

Morphine; Assay of ——. *A method of extraction.* T. Tickle. XX., page 220.

Terpene alcohols, such as linalool; Determination of —— *in essential oils.* M. V. Boulez. XX., page 221.

New Books.

Practical Paper Making. A Manual for Paper-Makers, and Owners and Managers of Paper Mills; to which are appended Useful Tables, Calculations, Data, &c. By George Clapperton. 2nd Edition. Crosby Lockwood and Son. 7, Stationers' Hall Court, Ludgate Hill, London. 1907. Price 5s. net.

8vo volume, containing frontispiece, 216 pages of subject matter, with 16 illustrations, and an alphabetical index. The subdivision of the matter into chapters is effected according to the following plan:—I. Chemical and Physical Characteristics of Various Fibres. II. Cutting and Boiling of Rags. Jute Boiling and Bleaching. III. Web Picking. Washing, Breaking, and Bleaching. Electrolytic Bleaching. IV. Cellulose from Wood, &c. V. Esparto and Straw. VI. Beating. VII. Loading. Starch. Colouring Matter. VIII. Resin, Size, and Sizing. IX. The Fourdrinier Machine and its Management. X. Animal Sizing. Drying. XI. Glazing and Burnishing. XII. Cutting. Finishing. XIII. Microscopical Examination of Paper. XIV. Tests for Ingredients of Paper. XV. Recovery of Soda. XVI. Testing of Chemicals and Water for Impurities.

The Gas Engineer's Pocket Book. Comprising Tables, Notes, and Memoranda relating to the Manufacture, Distribution, and Use of Coal Gas, and the Construction of Gas Works. By Henry O'Connor, Past President of the Society of Engineers, &c. 3rd Edition. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London. 1907. Price 10s. 6d. net.

Small volume of pocket-book size, containing 438 pages of subject matter, with numerous diagrams and illustrations, &c. The tables, notes, and data given, are classified and arranged under the following heads:—General Constructive Memoranda.—I. General Mathematical Tables. II. Unloading Materials, and Storage. III. Retort House. IV. Condensers. V. Boilers, Engines, Pumps, and Exhausters. VI. Scrubbers and Washers. VII. Purifiers. VIII. Gasholder Tanks. IX. Gasholders. X. Workshop Notes. Manufacturing.—I. Storing Materials. II. Retort House. III. Condensing Gas. IV. Exhausters, &c. V. Washing and Scrubbing. VI. Purification. VII. Gasholders. VIII. Distributing Gas. IX. Testing. X. Enriching Processes. XI. Products Works. XII. Supplementary.

Explosives and Dangerous Goods: Sea-carriage of ——. Board of Trade. Messrs. Wyman and Son, Limited, Fetter Lane, London, E.C. Price 6d. each, postage.

A memorandum has been issued relating to the carriage of dangerous goods and explosives in ships. The memorandum is issued for the guidance of surveyors who have to deal with the shipment of dangerous goods on vessels leaving the United Kingdom, and supersedes the printed instructions on this matter which were issued in 1904. It contains the principal legal provisions bearing on the subject, together with notes on various substances which have from time to time been specially brought to the notice of the Department, and in the appendix are printed the model codes of harbour by-laws under the Explosives and Petroleum Acts, the Admiralty rules as to the conveyance of Government stores, and the recommendations of the Home Office Committee of 1895, on compressed gas cylinders.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application. and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

4047. Craven. Kilns of the continuous or Hoffmann type. Feb. 18.

4124. Rehue. Apparatus for heating, refrigerating, and evaporating liquids.* Feb. 19.

4306. Schilde. Drying, cooling, and moistening material.* Feb. 21.

4366. Scherfenberg. Bricks and inside structure for reaction towers. [Ger. Appl., Feb. 21, 1906.]* Feb. 21.

4407. Guttmann. Apparatus for mixing, attemperating, condensing, or effecting reactions between liquids and (or) gases.* Feb. 22.

4513. Knudsen. Separation of the constituents of air and other gases. Feb. 23.

4553. Neilson (Iffland). Cooling towers. Feb. 25.

4589. Martini and Hüneke. Storage and transference of inflammable liquids.* Feb. 25.

5019. Diamanti and Lambert. Recovery of vapours given off by volatile liquids. [Fr. Appl., March 3, 1906.]* March 1.

5131. Lake (Maschinenbauanst. Eisengiesserei u. Dampfkesselfabr. H. Paucksch). Drying machines. March 2.

Complete Specifications Accepted.

12,700 (1906). Shears. Apparatus for homogenising liquids and semi-liquids. March 6.

17,832 (1906). Mackenzie and Gibson. Packings for Glover and other towers, tunnels, &c., for concentrating liquids, absorbing gases, &c. March 6.

19,193 (1906). Merrell, Gere, and Merrell-Soule Co. Recovering in the form of dry powder the solids in liquids or semi-liquids. March 6.

22,512 (1906). Carpenter. Distilling apparatus. March 6.

23,049 (1906). Mackenzie and McLauchlan. Filters for filtering by percolation. Feb. 27.

24,942 (1906). Siemens Bros. and Co. (Havard). Water pyrometers. Feb. 27.

27,592 (1906). Crush. Filter frame and process of filtration. Feb. 27.

II.—FUEL, GAS, AND LIGHT.

Applications.

4067. Parker. Retorts for distilling coal and other carbonaceous substances. Feb. 19.

4094. Read and Spencer. Regenerative furnaces for gas retorts. Feb. 19.

4115. Epstein. Production of liquid or solid fuel. Feb. 19.

4400. Keller-Kurz. Apparatus for carbonising air by liquid hydrocarbon.* Feb. 22.

4489. Parker, and Automobile Gas Producer Synd. Gas producer plant. Feb. 23.

4641. Lynde. Apparatus for producing gas from petrol, &c. Feb. 26.

4814. Siemens und Halske, A.-G. Manufacture of electric incandescence filaments of tungsten or mixtures thereof with other metals. [Ger. Appl., March 10, 1906.]* Feb. 27.

4873. Fearnhead. Suction gas producers. Feb. 28.

4911. De Vilar. Gas generators. Feb. 28.

4945. Torda. Photometers using selenium cells. March 1.

Complete Specifications Accepted.

4949 (1906). Hubert. Gasification of liquid fuel. March 6.

5435. (1906). Marriott. Application of pitch as waterproof agglomerant for artificial fuel. March 6.

6432 (1906). Sensenschmidt. Apparatus for hardening incandescent bodies. Feb. 27.

6814 (1906). Terrell. Manufacture of incandescent mantles. Feb. 27.

8067 (1906). A.-G. f. Selasbeleuchtung. Apparatus for mixing gas and air. March 6.

9327 (1906). Seymour. Coke ovens. Feb. 27.

11,639 (1906). Bloxam (Lux). Incandescence filaments for electric lamps. March 6.

13,181 (1906). Thorpe and Dougan. Incandescence gas mantles. March 6.

15,021 (1906). Cons. f. Elektrochem. Ind. Incandescence bodies of tungsten. Feb. 27.

18,131 (1906). Mehta. Manufacture of fuel briquettes. March 6.

24,192 (1906). Kridlo. *See under* III.

26,928 (1906). Frank. Production of pure hydrogen from water-gas. March 6.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specifications Accepted.

24,192 (1906). Kridlo. Utilising petroleum residues for combustion and for producing coke or carbon. March 6.

24,344 (1906). Wirth. Rendering heavy coal tar oils odourless. Feb. 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

4159. Ges. f. Chem. Ind. in Basle. Manufacture of yellow sulphine dyestuffs of the quinophthalone series. [Ger. Appl., Dec. 24, 1906.]* Feb. 19.

4235. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Feb. 20.

4413. Newton (Bayer und Co.). Manufacture of azo colouring matters. Feb. 22.

4592. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Feb. 25.

4976. Newton (Bayer und Co.). Manufacture of a new chloroaminophenolsulphonic acid. March 1.

5122. Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of indigo and leuco-compounds thereof. March 1.

Complete Specifications Accepted.

16,012 (1905). Deuts. Gold. und Silber Scheide Anstalt. Manufacture of indigo leuco-bodies. Feb. 27

5959 (1906). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Feb. 27.

20,132 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. March 6.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

4015. Müller. Manufacture of artificial threads.* Feb. 18.

4251. Silverwood and Taylor. Mercerising and bleaching cotton yarns or fabrics. Feb. 20.

4528. Bousfield (Heberlein & Co.). Mercerising vegetable fibres or textiles materials. Feb. 23.

4547. Calico Printers' Assoc., and Fourneaux. Printing or dyeing textile fibres. Feb. 25.

4614. Bloxam (Act.-Ges. f. Anilinfabr.). Dyeing furs, feathers, or the like. Feb. 25.

4902. Ransford (Calico-Printing Works Co. E. Zundel). Production of silk-like or velvet effects. Feb. 28.

4910. Dassonville. Electrolytic bleaching and scouring apparatus. Feb. 28.

4963. Hall and Brandt. Machines for scouring, bleaching, and dyeing spun or manufactured fibrous materials.* March 1.

5020. Diamanti and Lambert. Recovery of volatile solvents in the manufacture of artificial silk. [Fr. Appl., March 3, 1906.]* March 1.

Complete Specifications Accepted.

4981 (1906). Rhodes. Apparatus for preparing, dyeing, or otherwise treating with liquids pieces, warps, or other material. Feb. 27.

5284 (1906). Petrie and Petrie. Machines for washing wool and other fibrous materials. Feb. 27.

5845 (1906). Whiteley. Machines for drying, shrinking, or ageing fabrics. March 6.

8435 (1906). Ringenbac. Bleaching textile fabrics. March 6.

10,693 (1906). Ransford (Cassella und Co.). Dyeing animal fibres with sulphide colours. Feb. 27.

11,758 (1906). Imray (Meister, Lucius und Brüning). Machines for dyeing or printing in shaded colours or tints. March 6.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

4193. Liverpool Borax Co., and Fry. Utilisation of by-products obtained in the manufacture of borax. Feb. 20.

4254. Gontard and Valentiner. Process for obtaining highly concentrated nitric acid.* Feb. 20.

4861. Fromont. Lead chambers for the manufacture of sulphuric acid. Feb. 28.

5032. Meyer. Manufacture of zinc sulphide.* March 1.

Complete Specifications Accepted.

4409 (1906). Lance and Elworthy. Synthetic production of cyanides. March 6.

5151 (1906). Raschen, Wareing, and United Alkali Co. Purification of arsenical sulphuric acid and the obtainment of arsenic therefrom. March 6.

17,832 (1906). Mackenzie and Gibson. *See under* I.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

5119. Pilkington. Apparatus for making glass sheets or plates. March 2.

5123. Bloxam (Riesler und Co.). Manufacture of a ceramic mass and of ware therefrom. March 2.

Complete Specifications Accepted.

12,915 (1906). Boult (Lecomte-Falleur et Cie.). Glass-melting furnaces. March 6.

14,674 (1906). Bottomley and Paget. Manufacture of fused silica ware. Feb. 27.

19,045 (1906). Méran and Méran. Ceramic products. Feb. 27.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

4478. Schmatolla. Vertical kilns for burning limestone and other substances. Feb. 23.

4530. Cowper-Coles. Processes for making cement from blast-furnace slag.* Feb. 23.

4598. Stanley. Manufacture of colour-faced bricks. Feb. 25.

4763. Baxter. Impregnating wood. Feb. 27.

5110. Roman Brick Co., Ltd., and Schauermann. Manufacture of bricks, pottery, &c. March 2.

Complete Specifications Accepted.

5368 (1906). Touya. Manufacture of artificial stone for grinding or abrasive purposes. March 6.

6034 (1906). Neal. Distemper or composition for producing a stone-like surface. Feb. 27.

23,124 (1906). Frollo. Cement. March 6.

24,823 (1906). Assoc. Portland Cement Manufacturers, Ltd., and Gibbs. Burning lime and other substances. Feb. 27.

X.—METALLURGY.

Applications.

3981. Cowper-Coles. Zinc alloys. Feb. 18.

3984. Syms. Amalgam. Feb. 18.

4225. Wetter (Holenstein). Appliances for obtaining gold dust from auriferous sand or earth. Feb. 20.

4313. Cowper-Coles. Removing scale and oxide from metallic surfaces. Feb. 21.

4336. Levy. Preparation of metallic objects to receive metallic coatings. [Fr. Appl., March 1, 1906.]* Feb. 21.

4358. Pratt. Extraction, refining, and manufacture of metals, alloys, and other substances. Feb. 21.

4428. Deuts. Wachwitzmetall A.-G. Plating iron and steel with aluminium alloys. [Ger. Appl., Nov. 22, 1906.]* Feb. 22.

4541. McCowan and MacIvor. Treatment of antimonial and other complex sulphide ores containing gold. Feb. 25.

4912. Mallmann. Crucible furnaces. Feb. 28.

5100. Côte and Pierron. *See under* XI.

5127. Kjellin. Method and furnace for producing metals or metalloids from their combinations.* March 2.

Complete Specifications Accepted.

1102 (1906). Benjamin. Process for obtaining a slag. Feb. 27.

4796 (1906). Walker (Just). Recovery of precious metals from ores and other material. March 6.

5031 (1906). Annable, and Ferro-Alloys Synd. Manufacture of ferro-molybdenum. March 6.

5655 (1906). Leaver and Von Buch. Treatment of flux skimmings of zinc. March 6.

8683 (1906). Kimber. Steel for bits or drills. Feb. 27.

16,322 (1906). Charles and Heinze. Method of lining converters. March 6.

18,742 (1906). Bontempi. Production of articles of an alloy of iron and hydrogen. March 6.

20,545 (1906). Maschinenbauanstalt Humboldt, and Metallurgische Ges. Separation of substances having different magnetic excitabilities. Feb. 27.

22,491 (1906). Bloxam (Siemens und Halske A.-G.). Producing homogeneous masses of tantalum or other difficultly-fusible metal. March 6.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

3982. Cowper-Coles. Vessels for containing fused salts during electrolysis. Feb. 18.

4051. Cowper-Coles. Production of electrotypes.* Feb. 18.

4352. Boult (Lessing). Carbon electrodes. Feb. 21.

4910. Dassonville. *See under* V.

4927. Chaplet, and Soc. La Neo-Métallurgie. Electric furnaces. [Fr. Appl., Sept. 25, 1906.] Feb. 28.

4937. Gillon. Insulating composition. March 1.

5100. Côte and Pierron. Electric furnace for the continuous extraction of zinc from its ores. March 2.

Complete Specifications Accepted.

16,269 (1906). Gröndal Kjellin Co., and Harden. Electric induction furnaces. Feb. 27.

28,960 (1906). Hiorth. Electric induction furnace. Feb. 27.

28,961 (1906). Hiorth. Operating electrical smelting furnaces. Feb. 27.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

4762. Lennox. Purification of soap solutions. Feb. 27.

Complete Specification Accepted.

17,656 (1906). Breda. Process for extracting fats. Feb. 27.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—Pigments, Paints.

Application.

4379. Simpson. Waterproof writing ink. Feb. 22.

(*B*.)—Resins, Varnishes.

Complete Specification Accepted.

4678 (1906). Poppe. Manufacture of linoleum or like material. March 6.

(*C*.)—India-rubber.

Applications.

4268. West. Treatment of vulcanised india-rubber. Feb. 20.

4410. Turner and Willoughby. Apparatus for vulcanising raw rubber, &c. Feb. 22.

4510. Norzagaray. Apparatus for treating rubber. Feb. 23.

4511. Norzagaray. Apparatus for extracting rubber. Feb. 23.

4717. Bloxam (Raffineries Réunies de Caoutchouc Soc. Anon.). Process for refining crude caoutchouc.* Feb. 26.

5117. Thompson. Manufacture of elastic substances. March 2.

Complete Specification Accepted.

12,525 (1906). Boult (Köneman). Recovery of rubber from rubber waste. March 6.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

4049. Johnson (Badische Anilin und Soda Fabrik). Bleaching glue. Feb. 18.

4102. Babert. Rubbered or vulcanised leather. Feb. 19.

4605. Weinschenk. Tanning hides and skins. Feb. 25.

XV.—MANURES, &c.

Application.

4109. Makin. Utilisation of certain waste material in making fertilisers and foodstuffs. Feb. 19.

Complete Specifications Accepted.

24,647 (1906). MacDonald. Manufacture of manure. March 6.

26,635 (1906). Bazin. Increasing the nitrogen content of peat for manure. March 6.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

4623. Altolaguirre and Zubilaga. Apparatus for defecating cane juice.* Feb. 25.

XVII.—BREWING, WINES, SPIRITS &c.

Applications.

2591a. Reynaud and Frestadius. Treatment of pot ale. Feb. 23.

4009. Davidson and Burra. Extracts of hops. Feb. 18.

4174. Hellwig. Preparing and filtering beer wort.* Feb. 19.

Complete Specification Accepted.

4552 (1906). Hellwig. Preparing and filtering beer wort. Feb. 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A*.)—Foods.

Applications.

4109. Makin. *See under* XV.

4289. Finan. Composition for preventing deterioration of food stuffs. Feb. 21.

4919. Newlands and Eastick. Manufacture of food for cattle and other animals. Feb. 28.

Complete Specifications Accepted.

4365 (1906). Makin. Preparation of foods from yeast. Feb. 27.

14,067 (1906). Temple. Treatment of yeast for bread making. Feb. 27.

16,628 (1906). Burckhardt. Manufacture of cocoa products. Feb. 27.

27,514 (1906). Sefton-Jones (Meyer). Food products. Feb. 27.

(*B*.)—Sanitation; Water Purification.

Applications.

4118. Guy. Sewage filtration beds. Feb. 19.

5095. Adams. Apparatus for sewage purification. March 2.

(*C*.)—Disinfectants.

Application.

5079. Smith. Sheep-wash fluid. March 2.

XIX.—PAPER, PASTEBOARD, &c.

Application.

4590. Newton (Dresdner Chromo- und Kunstdruckpapierfabr. Krause und Baumann). Coating paper in continuous lengths, especially with heavy colours.* Feb. 25.

Complete Specifications Accepted.

22,887 (1906). Robeson. Treatment of waste sulphite liquor. Feb. 27.

26,501 (1906). Lederer. Process for obtaining cellulose esters from solutions. March 6.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

4248. Newton (Bayer und Co.). Production of isoborneol acetate. Feb. 20.

4250. Newton (Bayer und Co.). Production of new pharmaceutical compounds. Feb. 20.

4613. McDougall and McDougall. Manufacture of certain organic acids. Feb. 25.

5013. Imbert. Production of chloracetic ether and chloracetic acid.* March 1.

5014. Imbert. Production of dichlorethoxyethylene.* March 1.

Complete Specifications Accepted.

5066 (1906). Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of alkylaminomethylpentyl benzoates. March 6.

7487 (1906). Newton (Bayer und Co.). Generation of formaldehyde. March 6.

10,798 (1906). Weizmann, and Clatyon Aniline Co. Manufacture of isobornyl esters. March 6.

16,258 (1906). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Feb. 27.

17,169 (1906). Busch. Manufacture of compounds of albuminoids and proteids with bismuth iodide or mercuric iodide. March 6.

22,810 (1906). Koch. Manufacture of camphene. March 6.

29,093 (1906). Bergell and Wülfing. Manufacture of hexamethylenetetramine derivatives. Feb. 27.

1948 (1906). Imray (Basle Chemical Works). Manufacture of camphene. March 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

4932. Brasseur. Production of photographs in natural colours. [Fr. Appl., March 1, 1906.]* Feb. 28.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

4439. Himalaya. Manufacture of explosives. [U.S. Appl., Feb. 24, 1906.]* Feb. 22.

Journal of the Society of Chemical Industry.

No. 6, Vol. XXVI. MARCH 30, 1907. No. 6, Vol. XXVI.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. Full particulars will appear later.

Birmingham and Midland Section.

Meeting held at Birmingham on Thursday, Feb. 14, 1907.

MR. FRANK E. LOTT IN THE CHAIR.

THE BACTERIAL PURIFICATION OF SEWAGE CONTAINING A LARGE PROPORTION OF SPENT GAS LIQUOR.

BY PERCY F. FRANKLAND, F.R.S., AND H. SILVESTER, B.SC., F.I.C.

Amongst the numerous refuse liquids arising in the course of manufacturing operations, there is, perhaps, none which enjoys a worse reputation, as far as purification by bacterial agencies is concerned, than the waste from the stills employed in the ammonia recovery from gas liquor. Fortunately, there are comparatively few places where this particular form of waste bulks largely in the total volume of sewage having to be treated. In the ordinary course of events, if the gas liquor is distilled for ammonia in the places where it is produced, the proportion which the waste bears to the total volume of sewage will be automatically restricted, a large quantity only being possible in a large town where the volume of sewage will be correspondingly great also. Thus, in the evidence given before the present Royal Commission on Sewage Disposal, the only important reference to this particular form of waste is given by Mr. Brotherton (Vol. 11, Evidence, p. 82), the Managing Director of Messrs. Brotherton & Co., the well-known ammonia distillers. Mr. Brotherton states that at Leeds 51,000 gallons per 24 hours are discharged during 180 days in the year from their works, but that this large quantity of highly polluting material does not amount to more than 0·35 per cent., even of the dry weather flow (16,000,000 galls.), when the process is at work. At Wakefield, again, where the same firm has works, the proportion is somewhat greater, viz., 29,000 galls. of waste to 2,250,000 galls. of sewage, or 1·3 per cent. of the total. Mr. Brotherton, however, points out that the actual pollution by this waste is much smaller than is represented by these figures, because the lime is caused to settle in lagoons and channels constructed in a large field, and in its passage through these the liquid percolates into the ground to such an extent that practically none finds its way into the sewers. Indeed, we are acquainted with only one place, Oldbury, where this particular waste-liquor forms a really substantial part of the total sewage flow. The cause of this being what may perhaps be described as the unnatural system of treating a large part of the gas-liquor produced in Birmingham and district outside the area of the Birmingham drainage area. Thus, the population of Oldbury is only 25,000, the total dry weather sewage flow, 791,000 galls., of which as much as 70,000 galls., or in round numbers, 9 per cent., may at times consist of the waste from the distillation of gas-liquor. It is obvious that in the attempt to purify this sewage on bacterial lines, difficulties of a very exceptional character would be experienced.

At the time when our attention was first directed to this matter, the sewage of Oldbury was being dealt with at works having the dimensions, and employing the processes indicated below:—The capacity of the eight lime-precipitation tanks was 483,000 galls., and that of the tanks used as septic tanks was 302,000 galls. The primary contact bacteria beds, which were 3 ft. 3 in. deep, covered 5615 sq. yds. (1·16 acres). The secondary contact bacteria beds, also 3 ft. 3 in. deep, extended over 3327 sq. yds. (0·68 acre), and the land for irrigation (clay) covered 3·5 acres. With these resources we found that, although in general the effluent produced (see analyses below) was highly unsatisfactory, yet on those occasions when the spent gas liquor was either not present at all, or present only in small quantity, the effluent contained nitrates, was non-putrescible, and in every respect of fairly good quality.

Analyses of sewage.—(1) *Containing waste*; (2) *Containing practically no waste.*

	Parts per 100,000.	
	1.	2.
Total solids	365·2	183·6
Solids in suspension	69·2	41·6
Solids in solution	296·0	142·0
Matters in solution—		
Free and saline ammonia	5·18	5·2
Albuminoid ammonia	0·92	0·54
Oxygen consumed in four hours at 80° F.	45·1	9·60
Do., in three minutes	30·2	Not determined
Nitric nitrogen	nil.	nil.
Sulphocyanide (CNS)	9·3	Trace
Combined chlorine (total silver p.pt.)	84·8	30·6

Average analysis of double contact effluents derived from sewage.—(1) *Containing practically no waste (three samples)*; (2) *Containing a considerable proportion of waste (three samples).*

	Parts per 100,000.	
	1.	2.
Total solids	165·6	288·0
Free and saline ammonia	0·95	2·18
Albuminoid ammonia	0·142	0·504
Oxygen absorbed in four hours at 80° F.	1·65	18·44
Do., in three minutes	0·78	11·76
Do., after incubating for five days at 80° F.	0·51	11·40
Nitric nitrogen	1·157	0·30
Sulphocyanide (CNS)	0·06	4·37
Combined chlorine	30·0	84·80
Incubator test	Non-putrescible	Non-putrescible

Analysis of Waste Gas liquor; average of five analyses, With maximum and minimum figures.

	Parts per 100,000.		
	Average.	Maximum.	Minimum.
Solids in suspension	175·1	845·2	nil.
Solids in solution	2765·2	4888·0	2000·0
Matters in solution—			
Free and saline ammonia.	12·8	17·2	9·6
Albuminoid ammonia	14·16	20·8	11·4
Total nitrogen other than free and saline (Kjeldahl)	56·75	60·8	52·7
Tar bases as nitrogen	4·0	5·0	3·0
Oxygen consumed in four hours at 80° F.	499·4	564·0	401·2
Oxygen consumed in three minutes	333·9	391·7	300·0
Sulphocyanide (CNS)	153·8	171·7	143·0
Thiosulphate as sulphur	46·8	52·5	41·1
Phenol	140·1	172·3	108·0
Combined chlorine	875·4	1835·0	560·0
Reaction—Alkaline	341·0*	400·0*	300·0*

* Parts of calcium carbonate per 100,000.

The fact that fairly good results could thus be obtained indicated that the ingredients of the gas liquor waste did not actually sterilise the bacteria beds, although they doubtless retarded their work of purification. It appeared, therefore, probable that satisfactory purification might be realised even in the presence of the larger proportions of the waste, by providing more extended opportunities of bacterial action.*

In the first instance we endeavoured to realise these conditions by giving the existing double contact beds only one filling of septicised sewage per 24 hours, as against three fillings hitherto employed. This mode of using the beds did not, however, yield a sufficiently favourable result to warrant recommendation, although it showed that even by this means a non-putrescible effluent, containing a large proportion of nitrates, could be obtained thus.

Average of four analyses.—Double contact beds. One filling per 24 hours.

	Parts per 100,000.	
	Septicised sewage.	Second contact-bed effluent.
Matters in solution—		
Total solids	257·0	240·0
Free and saline ammonia	3·87	1·91
Albuminoid ammonia	1·01	0·42
Oxygen consumed in four hours at 80° F.	37·9	13·4
Oxygen consumed in three minutes	23·9	8·91
Do., after incubating for five days at 80° F.	—	8·21
Nitric nitrogen	nil.	1·09
Sulphocyanide (CNS)	7·6	2·15
Combined chlorine (total silver ppt.)	79·7	70·5
Incubator test	Putrescible.	Non-Putrescible.

We next proceeded to experiment on the effect of giving triple contact.

First experiment.—Triple contact beds (small).—In the first instance we will describe an experiment which was carried on over a period of more than two years.

The triple contact beds were all 3 ft. in depth, and of practically equal area (primary, 11·5 sq. yds.; secondary, 10·57 sq. yds.; tertiary, 10·46 sq. yds.). The material used on all three beds was clinker graded so as to pass a sieve of 1¼ ins., and to be retained by one of ⅛-in. mesh. The beds were started with one filling per 24 hours, after one month this was increased to two fillings, and after a further five weeks to five fillings in 48 hours, and continued at this rate for two months, when the number of fillings was further increased to three fillings per 24 hours. The three fillings per 24 hours were continued for three months, when, in consequence of loss of capacity, through overwork, they were allowed to rest for one month. They were restarted with one filling per 24 hours, and worked at this rate for a period of 18 months.

Even with this diminished rate of one filling in 24 hours, the capacity of the primary bed was very materially reduced (51·6 galls. to 39·2 galls.) during the 18 months that the beds were continuously worked. The secondary and tertiary beds were not affected to anything like the same extent, but we have, unfortunately, not got separate gaugings of their capacity.

From the accompanying analytical figures it will be apparent how successful this installation of triple contact beds was in purifying a sewage of such exceptional composition. Thus, on the average, the following reductions were effected :—

	Parts per 100,000.			
	Septicised sewage.		Final effluent.	
	1.	2.	1.	2.
Albuminoid ammonia ...	0·92	1·03	0·118	0·128
Oxygen absorbed in 4 hours	27·88	38·03	1·1	1·13
Sulphocyanide (CNS) ...	6·2	10·2	nil.	0·11
Nitric nitrogen	nil.	nil.	1·61	1·86

Moreover, in all cases, the final effluent passed the "incubator test," and supported fish life (gold fish).

In the first series of experiments with this installation the quantity of sewage applied varied from 343,339 to 158,313 galls. per acre, whilst in the second series the variation was from 83,114 to 34,301 galls. per acre, the final volume, after continuous use of the beds for many months, being 63,325 galls. per acre.

The greatly reduced rate employed in the second series of experiments was necessitated by the loss of capacity of the primary bed when dealing with very strong sewage. This loss of capacity points to the desirability of having a considerable reserve of primary beds, so that the latter may be rested at frequent intervals. In other words, a larger area should be devoted to the primary beds than to either the secondary or the tertiary respectively. Similar considerations, in a lesser degree, apply to the areas to be used for the secondary and tertiary beds respectively.

Second Experiment.—Triple trickling beds.—At the same time we instituted a comparison between the efficiency of triple contact and triple trickling beds respectively. The construction of these beds will be apparent from the following particulars :—Primary bed, 6 ft. deep, 27 ft. diameter, composed of blast furnace slag, graded so that the material of the upper 3 ft. passed a sieve of 1¼ in., and was retained by one of ⅛-in. mesh, whilst the material of the lower 3 ft. passed a sieve of 2½ ins., and was retained by one of 1¼-in. mesh. Secondary and tertiary beds were each 3 ft. deep, 28 ft. diameter, composed of clinker graded between 1¼ in. and ⅛-in., as in the case of the upper 3 ft. of the primary bed. The distribution was effected by means of revolving arms. From the accompanying analytical figures it will be seen that although the purification effected was very striking in its amount, it was distinctly different in character from that realised by the triple contact beds. Thus, whilst the nitrification was in most cases greater with the trickling beds, the removal of albuminoid ammonia and of oxidisable matter was almost invariably and generally very considerably less. The sulphocyanide, also, was hardly ever abolished, although greatly reduced. The defective purification was particularly noticeable when the septicised sewage was exceptionally strong, whilst the same sewage was successfully dealt with by the triple contact beds. Thus :—

	Parts per 100,000.		
	Septicised sewage.	Third contact effluent.	Third trickling bed effluent.
Albuminoid ammonia	1·5	0·08	0·712
Oxygen consumed in four hours at 80° F.	57·7	1·1	9·16
Sulphocyanide (CNS) .	14·6	nil.	2·67
Nitric nitrogen	nil.	1·29	3·75

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* The possibility of purifying gas-liquor waste by bacterial treatment has been indicated by Dr. Gilbert Fowler in his evidence before the Royal Commission on Sewage Disposal (Vol. II, Evidence, p. 196):—"On Dec. 2, 1899, an accidental discharge of ammonia-recovery liquor into the sewer, raised the oxygen-absorption figure of the closed septic tank effluent to upwards of 24 grs. per gallon; this was reduced by the filters dealing with the tank effluent to 2·56, and no subsequent ill effects were noted." Of course, in this case, the proportion of gas-liquor waste was only temporarily of the order in which it is almost constantly present in the Oldbury sewage.

It is, however, particularly noteworthy that notwithstanding the high proportions of albuminoid ammonia and oxidisable organic matter in some of the samples, none were found to be putrescible by the incubator test, pointing to these residual impurities being derived from the trade waste, and not from unpurified domestic sewage.

On the other hand, the average performance of these triple trickling beds may be gathered from the following summary :—

	Parts per 100,000.	
	Septicised sewage.	Final effluent.
Albuminoid ammonia	0·95	0·31
Oxygen absorbed in four hours	26·39	3·33
Sulphocyanide (CNS)	5·83	0·84
Nitric nitrogen	nil.	2·27

The volume of sewage applied to these triple trickling beds varied from 425,000 to 189,707 galls. per acre per 24 hours. The smaller volume being applied when the sewage was exceptionally strong, *i.e.*, when the above comparison with the triple contact beds was made.

Having regard to the frequent presence of large proportions of chemical impurity in the effluent from the trickling beds, and the constant difficulties encountered in connection with the distributing appliances, we determined to concentrate our further efforts on developing the treatment by contact beds.

Experiment III. Triple contact beds (large).—From February, 1905, to July, 1906, we experimented with an installation of large triple contact beds, in which we had to make use of the existing beds of the sewage works. These beds had, however, not been filled with material of the grade approved by ourselves, the most defective in this respect being the primary bed, whilst the other two were fairly in accord with our recommendations. We naturally did not expect that these improperly filled beds would give such satisfactory results as the small beds which had been filled according to our instructions. As a matter of fact we soon discovered that the large primary bed failed to lead to anything like the degree of purification which we had obtained by means of the small primary bed in Experiment I. The principal defect in this large primary bed was that the bottom six inches were composed of such coarse material (passed a sieve of 3-in. mesh and retained by one of 2½ in.) that this layer would be practically inoperative for purification purposes.

Notwithstanding this defect, the installation gave fairly satisfactory results as far as the final effluent was concerned, for the latter invariably supported fish life, was non-putrescible, and contained a high proportion of nitrate, but exhibited occasional traces of sulphocyanide and not unfrequently rather large figures for oxygen absorbed. The results obtained are exhibited in the following analytical table :—

TABLE 3.—*Septic tank effluent. May* 17, 1905, *to July* 12, 1906.

	Parts per 100,000.		
	Average.	Maximum.	Minimum.
Number of samples—10.			
Free and saline ammonia ..	3·95	5·598	2·9
Albuminoid ammonia	1·08	1·757	0·72
Oxygen consumed in four hours at 80° F.	37·0	54·2	16·16
Sulphocyanide (CNS)	9·47	14·14	3·00
Combined chlorine (total silver precipitate)	75·3	107·0	44·0

Effluent from Tertiary Bed. May 17, 1905, *to July* 12, 1906.

	Parts per 100,000.		
	Average.	Maximum.	Minimum.
Number of samples—11.			
Free and saline ammonia ..	0·403	0·85	0·24
Albuminoid ammonia	0·224	0·322	0·17
Oxygen consumed in four hours at 80° F.	3·746	7·82	1·61
Sulphocyanide (CNS)	0·390	1·50	nil.
Nitrogen as nitrate and nitrite	1·20	2·56	0·79
Combined chlorine (total silver precipitate)	65·9	85·0	57·6
Number of samples—36.*			
Oxygen consumed in four hours at 80° F.	2·74	7·82	0·98
Sulphocyanide (CNS)	0·27	2·20	nil.
Nitrogen as nitrate and nitrite	1·56	3·60	0·53
Combined chlorine (total silver precipitate)	61·2	110·8	35·2

The dimensious of this large installation of triple contact beds were as follows :—Primary bed, 1174 sq. yards (0·242 acre), 2 ft. 9 in. deep ; secondary and tertiary beds, each, 243 sq. yards (0·05 acre), 3 ft. deep. The primary bed was filled with new material (slag graded between 1¼ in. and ⅛ in., the bottom 6 ins. being between 3 in. and 2½ in.) when the experiment was begun, but the secondary and tertiary beds had been in use for some years (clinker, graded between 1⅛ in. and ⅛ in. throughout). The original water capacity of the two latter could not, therefore, be then ascertained, but their capacity when this experiment commenced, and which was maintained until the end, was about 33 per cent. of their tank capacity. The primary bed, charged with new material when it began work, had a water capacity of 44·7 per cent. of its tank capacity. This was reduced during its period of operation (one year nine months) to 29·5 per cent.

The capacity of the beds during the progress of the experiment is shown in the following table :—

Table of capacities.

Date of gauging.	Rate of application per cubic yard per 24 hours.		
	Primary bed.	Secondary bed.	Tertiary bed.
	galls.	galls.	galls.
October 28, 1904 ..	80·7	—	—
December 14, 1904 ...	72·4	—	—
January 2, 1905	68·9	—	—
January 23, 1905 ..	61·7	—	—
February 5, 1905 ..	59·2	—	—
February 19, 1905 ..	59·9	—	—
May 24, 1905	—	57·6	57·6
May 29, 1905	62·6	—	—
January 5, 1906 ...	54·6	—	—
January 10, 1906 ..	—	61·7	61·7
July 25, 1906	—	59·6	59·6
July 26, 1906	53·1	—	—

Average rate of application to total area in gallons per acre per 24 hours = 96,800 galls.

Thus even during a working period of nearly two years, the primary bed had only lost about 30 per cent. of its capacity. The rate at which the septicised sewage was applied in this experiment was in round numbers 100,000 galls. per acre, the beds receiving one filling per twenty-four hours.

General considerations.—The experimental results which we have detailed above reveal in the most striking manner the extraordinary power possessed by bacteria beds of breaking down the great variety of chemical compounds which are present in spent gas liquor. From the analysis of the waste liquor which we have given above, it will be seen that it contains sulphocyanides, phenols, thiosulphates, and tar-bases in approximately the following proportions :—

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* The 36 samples include the 11 samples for which separate figures are given above.

Matters in solution.	Parts per 100,000.
Sulphocyanides (calculated as CNS) ..	153·8 (=206·8 $Ca(CNS)_2$
Thiosulphates (calculated as S)	46·8 (=111·5 CaS_2O_3)
Phenols (calculated as C_6H_5OH)	140·1
Tar-bases (calculated as nitrogen from the Kjeldahl result, after deducting free and saline ammonia, and the nitrogen in sulphocyanide)	4·0
Albuminoid ammonia	14·2
Oxygen consumed in four hours at 80° F.	500·0

But, as we have pointed out above, the waste amounts at the maximum, to about 9 per cent. of the dry weather flow of the Oldbury sewage, and these chemical ingredients will, therefore, be present in the mixed sewage received at the Outfall Works in approximately the following proportions :—

Matters in solution.	Parts per 100,000.
Sulphocyanides (calculated as CNS)	14·0
Thiosulphates (calculated as S)	4·2
Phenols (calculated as C_6H_5OH)	12·7
Tar-bases (calculated as nitrogen from the Kjeldahl figure, after deducting free and saline ammonia, and the nitrogen in sulphocyanide)..................................	0·36
Albuminoid ammonia	1·3
Oxygen consumed in four hours at 80° F.	45·4

These calculations are borne out by the actual analyses of the septicised sewage, which when at its strongest, yielded, as already recorded in the analytical tables (p.233), the following figures :—

Matters in solution.	Parts per 100,000.
Sulphocyanide (CNS)	14·14
Albuminoid ammonia	1·75
Oxygen consumed in four hours at 80° F. ..	54·2

These figures are of further interest, inasmuch as they show that the sulphocyanide is not destroyed in the septic tank, and that the oxygen absorbed is, apparently, not reduced there either.

In connection with the extraordinary oxidising powers displayed by the bacteria-beds, we may give the following results of experiments which we have made in order to determine the amount of oxygen required for the oxidation of the chief ingredients of the waste gas liquor.

These determinations were made on exactly the same lines as in estimating the amount of oxygen absorbed in four hours at 80° F. in the ordinary method of sewage analysis, thus :—

100 parts of ingredient.	Amount of oxygen required (theoretical)	Oxygen absorbed in four hours at 80° F. (experimental).	Percentage of theoretical obtained in experiment.
Sulphocyanide (CNS) .	82·7*	82·7	100·0
Thiosulphate (S_2O_3) .	100·0†	85·6	85·6
Phenol (C_6H_5OH)	238·0‡	178·0	74·8

It appeared to us of interest to ascertain what the effect of the cheapest chemical oxidising agent, bleaching powder, would be on the gas liquor waste. For this purpose the following experiments were made :—

Effect of treating gas liquor waste with bleaching powder and sulphuric acid.

	Parts per 100,000.			
	Oxygen consumed in 3 mins.		Albuminoid ammonia.	
	Before treatment.	After treatment.	Before treatment.	After treatment.
Experiment 1— 100 c.c. of waste liquor and 100 c.c. of 3 per cent. bleaching powder solution + 8 c.c. of normal sulphuric acid allowed to stand 48 hours.	300·0	164·7	14·4	8·3
Experiment 2— 100 c.c. of waste liquor + 50 c.c. of bleaching powder solution (3 per cent.) + 4 c.c. of normal sulphuric acid.	300·0	214·0	14·4	8·0
Experiment 3— 100 c.c. of waste liquor +20 c.c. of bleaching powder solution (3 per cent.) + 4 c.c. of normal sulphuric acid.	300·0	246·8	14·4	12·0

NOTE.—In all cases the results of analysis after treatment are calculated on the original liquid.

It is obvious from the above that the idea of oxidation by chemical means could not be entertained. Thus, even such inadequate purification as took place in Experiment 1 required the use of 3/10 lb. of bleaching powder (35 per cent. strength) per gallon of waste liquor.

Inasmuch as so little is known of the behaviour of sulphocyanides in solution under the conditions met with in nature, we thought it would be of interest to ascertain whether it is permanent or not in a well-oxidised effluent. For this purpose we added different proportions of potassium sulphocyanide to effluents containing a considerable quantity of nitrates, and allowed the mixtures to stand for four days in a closed bottle at room temperature, thus :—

Effect of adding potassium-sulphocyanide to an effluent containing nitrates.

	Parts per 100.000.		
	Nitric nitrogen.		
	Before addition.	Four days after addition.	CNS present in mixture.
Experiment 1	1·7	1·61	29·0
Experiment 2	2·55	2·6	14·5
Experiment 3	0·52	0·52	6·8*

Thus the sulphocyanide appears to undergo no change in an effluent containing an abundance of nitric nitrogen, even in the course of four days at about 20° C.

The work of oxidation which will have to be carried out by the bacteria beds at Oldbury is, perhaps, best indicated by the following table, in which are given the total weights of the several chemical polluting ingredients in 24 hours maximum flow of the waste, and the weights and volumes

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* $CNS + 3O = SO_3 + CN$.
† $S_2O_3 + 2O_2 = 2SO_3$.
‡ $C_6H_5OH + 7O_2 = 6CO_2 + 3H_2O$.

* The amount of CNS in the mixture (Experiment 3) was found to be quite unaltered after four days.

TABLE I.

To give the Septicised Sewage Triple Contact in Beds 3 ft. deep.

Area of Beds:—No. 1 Bed, 11·5 sq. yds. No. 2 Bed, 10·57 sq. yds. No. 3 Bed, 10·46 sq. yds. Total Area, 32·58 sq. yds.

Nature and size of Material:—Clinker passed 1⅛ in. mesh sieve, retained by ⅛ in. mesh sieve.

Date of gaugings.	Number of fillings per 24 hours.	Capacity of primary bed.	Rate of application to each bed per cb. yd. per 24 hours.	Rate of application to total area in galls. per cb. yd. per 24 hours.	Rate of application to total area in galls. per acre per 24 hours.
1904.					
April to May 10	One	—	—	—	—
May 10 to June 23	Two	—	—	—	—
June 23	Five in 48 hours	71·9 galls.	179·7 galls.	59·9 galls.	290,252 galls.
July 24	,, ,,	,, ,,	,, ,,	,, ,,	,, ,,
August 19	Three in 24 hours	70·9 ,,	202·7 ,,	70·9 ,,	343,339 ,,
September 20	,, ,,	60·5 ,,	181·5 ,,	60·5 ,,	292,860 ,,
October 23	,, ,,	51·9 ,,	155·7 ,,	51·9 ,,	251,326 ,,
November 3	,, ,,	40·8 ,,	122·4 ,,	40·8 ,,	197,872 ,,
November 12	,, ,,	32·7 ,,	98·1 ,,	32·7 ,,	158,313 ,,
	Beds under rest for a month, three gaugings taken during that time.				
November 22	—	37·2 galls.	—	—	—
November 30	—	42·1 ,,	—	—	—
December 12	—	50·2 ,,	—	—	—
December 19	One	Beds restarted work, three hours' contact.			
December 20	,,	51·6 galls.	51·6 galls.	17·2 galls.	83,114 galls.
1905.					
January 31	,,	40·8 ,,	40·8 ,,	13·6 ,,	65,963 ,,
February 26	,,	31·2 ,,	31·2 ,,	10·4 ,,	50,792 ,,
March 26	,,	24·0 ,,	24·0 ,,	8·0 ,,	38,918 ,,
June 23		Period of contact decreased from 3 to 2 hours.			
July 26 1906.	,,	39·2 galls.	39·2 galls.	13·0 galls.	63,325 ,,

RESULTS IN PARTS PER 100,000.

Period.	Septic tank effluent.					First contact bed effluent					Second contact bed effluent.						Third contact bed effluent.					
	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Combined chlorine.	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Combined chlorine.	Ammonia.		Oxygen consumed. 4 hrs.	Sulpho-cyanide.	Nitrogen as nitrate and nitrite.	Combined chlorine.	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Nitrogen as nitrate and nitrite.	Combined chlorine.
	Free and saline.	Albuminoid				Free and saline.	Albuminoid				Free and saline.	Albuminoid					Free and saline.	Albuminoid				
Apr. 21st, 1904, to Jan. 4th, 1905.						First Series of Analyses, April 21st, 1904, to January 4th, 1905.																
Aver. ...	4·2	0·918	27·88	6·21	71·8	3·07	0·465	12·14	2·23	92·3	2·29	0·255	4·15	0·17	0·066	85·9	0·324	0·118	1·10	Nil	1·61	73·0
Max	5·19	1·50	57·70	14·60	130·0	4·39	0·64	20·48	4·40	118·0	4·80	0·392	6·80	0·58	0·40	114·4	0·96	0·183	1·36	,,	2·52	113·2
Min.	3·28	0·65	16·96	3·94	48·8	1·75	0·35	7·20	0·46	61·2	0·76	0·172	1·54	Nil	Nil	60·4	0·080	0·080	0·63	,,	0·58	45·6
						Second Series of Analyses, December 21st, 1905, to July 12th, 1906.																
Aver. ...	3·82	1·02	38·03	10·2	79·8	No analyses made.					No analyses made.						0·148	0·128	1·13	0·11	1·862	69·8
Max.	4·8	1·32	54·54	14·84	107·2												0·72	0·259	1·70	0·58	2·40	89·6
Min.	2·90	0·72	25·0	7·0	52·0												0·23	0·080	0·88	Nil	1·31	45·2

The effluent from the third contact bed supported fish life (Gold fish).

TABLE II.

Treatment of the Septicised Sewage by Triple Continuous Filtration.

Area and depth of each bed:—Primary, 27 ft. diameter, 6 ft. deep.   Secondary and Tertiary, 28 ft. diameter, 3 ft. deep.

Material used:—Slag and Clinker.   Size of Material:—In No. 1 Filter, the top 3 ft. graded between 1⅛ in. and ⅛ in.

The bottom 3 ft. from 1½ in. to 2½ in.   In Filters Nos. 2 and 3, graded between 1⅛ in. and ⅛ in.

Duration of experiment:—February, 1904, to December, 1904.

Date.	Period of working per day.		Rate of application per cb. yd. per 24 hours.			Rate of application to total area in galls. per acre per 24 hours.
			Primary bed.	Secondary bed.	Tertiary bed.	
	Work.	Rest.	Galls.	Galls.	Galls.	
1904.						
February 13 to May 10	2 hours	2 hours	141·46	259·92	259·92	425,000
May 10 to June 23	1¼ ,,	2¾ ,,	105·25	193·4	193·4	316,536
June 23 to August 23	1 h. 25 min.	2 h. 35 min.	119·29	219·19	219·19	358,483
August 23 to November 12	¾ hour	3¼ hours	63·15	116·04	116·04	189,707

RESULTS IN PARTS PER 100,000.

	Septic tank effluent.					Effluent from primary filter.					Effluent from secondary filter.*						Effluent from tertiary bed.					
	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Com-bined chlorine.	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Com-bined chlorine.	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Nitrogen as nitrate and nitrite.	Com-bined chlorine.	Ammonia.		Oxygen consumed 4 hrs.	Sulpho-cyanide.	Nitrogen as nitrate and nitrite.	Com-bined chlorine.
	Free and saline.	Albu-minoid				Free and saline.	Albu-minoid				Free and saline.	Albu-minoid					Free and saline.	Albu-minoid				
						1st Analysis made April 21st, 1904.					Last Analysis made Nov. 2nd, 1904.											
Av'age...	4·09	0·95	26·39	5·83	72·3	4·31	0·876	15·29	3·55	95·2	2·304	0·494	6·00	1·8	1·72	85·00	1·77	0·309	3·33	0·84	2·27	70·4
Max.	5·19	1·5	57·70	14·60	130·0	5·2	1·430	28·80	6·26	125·0	3·64	0·811	12·48	4·99	3·48	121·0	2·48	0·711	9·16	2·67	5·20	121·0
Min......	3·28	0·65	16·96	3·94	48·8	3·52	0·527	8·27	2·08	62·8	0·255	0·183	1·30	Nil	0·85	63·6	0·017	0·124	1·08	Nil	0·98	47·2

* Incubator test:—Two samples doubtful, two putrescible.

of oxygen required for their complete oxidation respectively :—

Ingredients in 24 hours' flow (maximum).	Weight.	Weight of oxygen required for complete oxidation.	Volume of oxygen required.
	cwt.	cwt.	cub. ft.
Sulphocyanide (CNS)	9·6	8·0	10,000
Phenol (C_6H_5OH) ...	8·75	20·8	26,065
Thiosulphate (S)	2·9	2·9	3,665
Total	21·25	31·7	39,730

Toxicity of sulphocyanides.—Although many experiments appear to have been made on the physiological and toxic actions of sulphocyanides, we have been unable to obtain any precise information as to the doses in which it is poisonous. Arthur Mayer (Deuts. Archiv. f. Klin. Medizin, **79**, 1904, 195) states that he had administered 0·5 grm. per diem to a patient over a period of four days, and on one day as much as 1 grm., without evil consequences. From this statement it is evident that sulphocyanides are generally regarded as highly toxic to man. Benedict ("Abwässer der Fabriken," p. 392 ; Sammlung chem. und chem. Techn. Vorträge, 1896) states that ammonium sulphocyanide in the proportion of 0·1 grm. per litre (or 7·6 parts of CNS per 100,000) had no effect on trout in the course of one hour, but also quotes from König to the effect that ammonium sulphocyanide had been found to be extremely poisonous to plants.

Under these circumstances, we thought that more definite information as to the effect of sulphocyanides on fish life was called for, and we, therefore, made the following series of experiments on gold fish :—

Experiments on the toxic action of sulphocyanides on gold fish.

Concentration of potassium-thiocyanate solution expressed as CNS in parts per 100,000.	Remarks.
16	Fish alive and vigorous.
32	Ditto.
60	Ditto.
125	Ditto.
260	Ditto.
450	Showed signs of distress.
500	Dead.

NOTE.—The solution of KCNS was in every case made with Birmingham tap water, and the fish remained in the solution for 24 hours in each experiment.

It thus appears that gold fish are practically unaffected by sulphocyanide up to the proportion of 260 parts (CNS) per 100,000.

Toxic action of CNS on Bacillus coli communis.—A 48-hours' cultivation of *B. coli* in broth was inoculated into each of the following solutions in such proportions that in each case the broth was diluted with 50 volumes of the solution. Thus each solution contained initially the same number of bacilli.

	Parts of CNS per 100,000.				
	1000.	250.	50.	10.	Control containing no CNS.
	Number of bacteria per c.c.				
3 hours after inoculation	91	96	436	863	1,810
24 ,, ,, ,,	0	14	17	113	16,900
72 ,, ,, ,,	0	0	2	58	450,000
96 ,, ,, ,,	0	0	0	30	450,000

(CNS used in the form of ammonium sulphocyanide.)

The above table shows that even in three hours the presence of sulphocyanide in all the proportions employed exercised a prejudicial effect on the vitality of the *B. coli.* Further, that in the control liquid (sterilised Birmingham tap-water, to which the same proportion of *B. coli* broth culture had been added) containing no sulphocyanide, the introduced bacilli underwent extensive multiplication, whilst in all the solutions containing sulphocyanide, more or less rapid diminution in the number of bacilli occurred, according to the proportion of sulphocyanide present.

Summary.—The experiments which we have made show that the presence of a large proportion of gas liquor waste in sewage occasions considerable but not insuperable difficulties in the purification of the latter by bacterial means; on the other hand, the oxidation of the waste by chemical means can only be effected at a prohibitive cost, even with bleaching powder.

By providing a larger area of beds, giving triple contact, and permitting only a diminished flow of sewage on to the beds, we have found that satisfactory purification can be effected of any proportions of gas liquor waste occurring in the Oldbury sewage—*i.e.*, as far as our experience goes, up to 9 per cent. of the total flow.

The effluents obtained were non-putrefactive, supported fish life, and gave only reasonable figures for albuminoid ammonia and oxygen absorbed, whilst they were also almost invariably free from sulphocyanides, and contained an abundance of nitrates.

The results obtained by triple trickling filters were less satisfactory as regards the figures for albuminoid ammonia and oxygen absorbed, and the sulphocyanides were less completely removed, although the proportion of nitrates was higher. If, however, the rate at which the liquid passes through the beds could be suitably retarded, there is every reason to believe that results of a similar character to those yielded by the contact beds could be obtained.

The experiments we have made on gold fish indicate that the latter can live for a period of at least 24 hours, without apparent discomfort, in solutions containing up to 250 parts of sulphocyanide (CNS) per 100,000.

On the other hand, the experiments made on *Bacillus coli communis* show that these micro-organisms are prejudicially affected even by 10 parts of sulphocyanide (CNS) per 100,000.

In conclusion, we should like to express our thanks to Mr. Crowther, F.I.C., for valuable information and suggestions with regard to the composition of the waste and its influence on the problem of oxidation by the beds. We are also indebted to Mr. Shipton, the Surveyor to the Oldbury District Council, for the able manner in which he has carried out the engineering part of the work.

DISCUSSION.

The CHAIRMAN said that as a rule they had to consider waste liquids having a marked putrescible nature. On the other hand, the author had to deal with waste liquors with a more or less antiseptic action. None the less the chemist was bound by certain Acts of Parliament and certain rulings to bring his effluent to a particular standard. The decision of the Royal Commission in its interim report, making it a necessary condition of a good effluent that it should be non-putrescible as well as of a particular chemical composition, was a wise decision. The question of putrescibility was more important than apparent chemical composition. Certain substances yielding albuminoid ammonia when mixed with ordinary town sewage, aggravated its chemical composition, but they did not aggravate the putrescibility of the effluent to be obtained from such sewage ; on the contrary they rather assisted it. There was a great deal of work to be done in elaborating the conditions under which chemical industries were carried on. The author had shown how one particular branch of sewage disposal might be worked out in a thoroughly scientific and valuable manner. The figures put before them enabled them to see clearly what took place with this method of treatment, and he thought it had been proved in a very practical manner that the method of treatment was a thoroughly satisfactory one. There would be questions as to how far it was continuously so, and how far it might be satisfactory in dealing with other waste products. He gathered from the fact that after a rest the capacity of the tanks was increased, that the major cause of the reduction was an organic deposition, but he should like to know how far there was a mineral deposition at the same time. Thiocyanates to a certain extent restricted decomposition, as shown by the last figures, but the action of phenol, he took it, would be very much more marked, both on the bacteria and on the gold fish. The question of the trickling beds as compared with the continuous contact beds raised the point whether the former favoured aerobic organisms more than the latter, or were they both to a considerable extent a continuation of the septic tank changes?

Mr. W. Clifford said that in the comparison between the contact bed and the trickling bed, the rate in the contact bed was about 63,000 galls. per acre, and in the trickling bed about 300,000 galls. per acre. The comparison was therefore unfair, as the one was dealing with four or five times as much liquor as the other. Was the distribution on the trickling bed carried over the twenty-four hours, or was it merely sprinkled on intermittently? He found great difficulty in getting an even distribution at anything like low rates of working. Was the waste liquor in the sewage coming down in regular quantities or in flushes? At Wolverhampton they had some difficulty with this liquor in the past, and they found that by regulating the quantity so that the flow was equally distributed during the twenty-four hours they overcame the difficulty. It was just possible that with large flushes it would pass through the bed under the method which had been described. There was no doubt it would pass through land under such conditions. The material used in the trickling bed was exceedingly coarse; it passed through a 1⅛ in. mesh, and was retained by a ⅓ in. mesh. It would be helpful to know the percentages of the various grades contained in the material. In the course of some experiments on the capacity of trickling beds, a great difference was found in the amount of oxidation which took place in coarse material as compared with fine. In the tabulated results of Experiment 3, the rate of application per cubic yard, 80·7, was given as capacity of bed. Was that an error? The data regarding thiocyanates were exceedingly interesting, and, so far as works chemists were concerned, it was important for them to know that liquor was inimical to fish life when it reached 70 per cent., and under that amount it was not inimical. It would also be interesting to know the effect on trout.

Mr. Thos. Lawton said that in giving the proportions of waste liquor for different towns, the author had cited Leeds with 51,000 galls. in twenty-four hours, Wakefield 80,000, and Oldbury 70,000. He thought those figures did not actually refer to waste liquor, but to the amount of gas liquor distilled. It was very usual to measure very accurately the amount of gas liquor distilled, but he did not know of any works where the waste liquor was measured. Of course, if he was right in his assumption the figures would be considerably increased, because in the process of distillation the gas liquor was treated with a quantity of milk of lime, open steam, &c. The actual amount treated at Brotherton's works in Birmingham at the present time was between 100,000 and 120,000 galls. in twenty-four hours, and he should like to know how the percentage on the quantity of sewage compared with other towns.

Mr. F. R. O'Shaughnessy said the relative merits of contact beds and trickling beds had long been a subject of considerable discussion, and among the things which stood out most prominently in the case of the contact beds was the choking, owing to the loss in capacity, which led to considerable dislocation of existing works. At present there were not many such works in this country constructed on a large scale from which reliable figures could be got. Had Prof. Frankland specifically examined the nature of the choking material? From his own observations he could quite understand the first contact bed choking and the other not doing so. The choking seemed to be very largely due to colloidal matters of various kinds, which naturally were for the most part taken out in the first contact bed. There was the same problem in working trickling filters, only the choking in that case took place on the surface. It was one of the most serious problems with which sewage experts had to deal. At Minworth they had tried fine-medium percolation beds as against relatively coarse medium. The fine medium consisted of matter which was of ¼ in. to ⅛ in. gauge. The larger material was 1¼ in. gauge. The large medium would keep relatively clear, whereas within a fortnight after beginning the work in the fine medium the whole bed pooled over and refused to allow any but the smallest trickle of water to pass through it. In fact, after a very long experiment they were quite convinced that a fine medium such as was recommended by experts like Dr. Reid, of Stafford, was, unless in exceptional cases, altogether unworkable. Necessarily, the most salient feature of the paper related to the presence of chemical trade waste in the sewage, and its effects on the working of the beds. It was obvious from the results that for that particular sewage the contact beds were the best. Here again the size of medium came in. If that sewage could be treated on percolation beds of sufficiently fine material, and a sufficiently small quantity were put through them, the trickling filters would give as efficient results as the contact beds. The destruction of the thiocyanates and other chemical wastes seemed to be very largely a question of a time function.

Mr. Silvester, in reply, said he was glad to hear the Chairman emphasise the importance of sewage works producing a non-putrescible effluent containing a reserve of oxygen in the form of nitrates, and he agreed that on these lines a fairer and broader standard could be worked out than on the oxygen consumed and on the albuminoid ammonia figures that had hitherto been generally applied. A portion of the reduction in the capacity of the primary beds would certainly be due to arrested mineral matter, because the effluent from the septic tank contained a small amount of suspended solids, and probably some 40 or 50 per cent. of these solids were of a mineral character. No experiments were made as to the toxic action of phenol on fish, but 14 parts per 100,000 of phenol were said to kill gold fish in twenty-four hours. The organisms in the trickling bed would be aërobic rather than anaërobic. Replying to Mr. Clifford, it was quite true that at the commencement of the experiments a larger volume of sewage was applied to the triple trickling beds than to the triple contact, but a reference to the tables would show that after a short time the number of gallons per twenty-four hours was, as far as possible, very similar in the two systems. If anything, the trickling beds were favoured, and in this connection it was to be observed that the total depth of these beds was 12 ft. as against 9 ft. for the contact beds.

The sewage was applied intermittently to the trickling beds, as shown in the table.

It was certainly very undesirable that the spent liquor should be sent into the sewers in rushes, and the manufacturers, on representations being made to them, had co-operated with the authority by distributing the flow of the waste fairly evenly over the twenty-four hours. He was unable to give the proportions of the various grades of material of which the trickling beds were composed. In the large experiment, the average rate of application of the sewage was 96,800 galls. per acre per twenty-four hours, and, as the beds were only filled once a day, the gauging of each bed represented the rate of working that bed. No experiments were made as to the poisonous effect of thiocyanates on other fish, though it was well known that trout were more susceptible to unfavourable conditions than gold fish.

In reply to Mr. Lawton, the figures quoted as to the volumes of spent gas liquor at Leeds and Wakefield were taken from Mr. Brotherton's evidence given in the Blue-book quoted in the paper. The figures for the Oldbury works were supplied by the manufacturers at a Local Government Board inquiry held at that place in July of last year.

Mr. O'Shaughnessy mentioned that the figure given by Mr. Lawton for Birmingham waste gas liquor worked out at 0·6 per cent. of the dry weather flow of sewage.

Mr. Silvester said he had been much interested in the comparison of the purification effected by contact beds and trickling beds given by Mr. O'Shaughnessy. They held no brief for contact beds, but with the particular sewage dealt with in the paper, the results obtained by their use were superior to those given by the trickling system. No doubt Mr. O'Shaughnessy gave the correct explanation of the superiority when he stated that in this case purification was a time function.

Mr. O'Shaughnessy mentioned the question of standards, on which, he pointed out, the paper had a very distinct and important bearing. The figures adduced had brought out very forcibly the absurdity of the conventional and arbitrary standards adopted in some parts of the country. He had some figures with regard to the nature of effluents, some of which were passed as good, while others were not. For instance—four hours, oxygen absorbed, 70 grains per gall.; albuminoid ammonia, 0·092 grains per gall.; nitric nitrogen, 0·37 grains per gall. That was only classed as a fair effluent. He might quote, by way of contrast, some results which he obtained under very special circumstances with domestic sewage on a small sewage installation:—Suspended solids, 11·0 parts per 100,000; albuminoid ammonia, 0·56; chlorine, 14·6; nitric nitrogen, 3·50; oxygen absorbed in four hours at 80° F., 9·51. The sample was non-putrescible on incubation. The above condition was maintained in the small installation for a prolonged period. It was an extreme case, but helped to show the futility of a fixed figure standard.

Canadian Section.

Meeting held at Toronto on Thursday, November 23, 1905.

DR. F. J. SMALE IN THE CHAIR.

CHEMICAL INDUSTRY IN BRITISH COLUMBIA.

BY PROF. W. R. LANG.

To consider fully all the industries visited last summer would occupy more time than can be allowed at this sitting. Much less would it be possible to do justice to the whole subject of the chemical industries in active operation in British Columbia on the strength of a comparatively short acquaintance with that province. An account of the mineral industries alone would occupy volumes, but it must be remembered that these are not the only ones: chemical works, sugar refineries, vinegar-making, and a host of other smaller industries are flourishing in the West, and a short and imperfect account of those visited will be found in the sequel.

In Victoria, Vancouver Island—the natural limit of one's Western travels—there is an excellent plant for the preparation of sulphuric acid. The lead-chamber process was in full swing, and a large experimental plant for preparing sulphur trioxide by the "contact" process was just in progress of demolition, to be set up again on the large scale. The manager expressed himself as perfectly satisfied with the results of their experiments, extending over a number of months, and looked forward to a successful working of the new process commercially. To hear that Canadian sulphur was not used in making the acid was somewhat of a surprise, but the inspection of a few figures relative to the comparative cost of native sulphur imported by sailing ships from islands in the Pacific and the expense alone of bringing the sulphur—even if recovered from the sulphide ores there—from the Kootenay district, served to shatter at once the idea that all the materials necessary for the production of even this one substance could be obtained readily in the Dominion. In time, no doubt, importation of sulphur will be unnecessary, but at present the 500 odd miles of rail and water between Victoria and the Kootenay mines effectually prevent any use being made on the coast of the sulphur they might produce.

At the Parliament Buildings in Victoria, Mr. R. E. Gosnell kindly supplied literature and much information regarding the mineral industries of the province, an account of which will be given later on. Vancouver City contains two large breweries, a distillery, vinegar works, and a sugar refinery. This last is a very fine one, replete with all the most modern machinery, and producing both syrup and fine sugars, the raw materials from which are imported from Peru, Java, Fiji, and Central America. The vinegar works close at hand convert weak alcohol, obtained from the distillery, into vinegar by the "quick vinegar" process. The spirit is allowed to trickle through a series of large vats placed on three floors, one above the other, over suitably arranged shelves in the vats, to which a properly regulated air supply is admitted. The resulting vinegar is of a very good quality. Both distillery and vinegar works are the property of the same company. There are breweries also in Rossland and Nelson.

A couple of establishments in Victoria are engaged in the preparation of coffee and spices for the market, both of which are doing a fairly good business.

In Victoria is an extensive factory for laundry and toilet soaps, also paints, varnishes, and colours, and in Vancouver there are also soap works.

About the beginning of the present year, a Portland cement plant was erected, and put in operation on Vancouver Island, some distance from the city of Victoria. They have two rotary kilns in operation, though they expect to enlarge their plant in the near future. Fire bricks, drain-pipes, and tiles are also manufactured on Vancouver Island, and supply local demands; indeed, lime and brick are produced in almost every district. Fish canning might also be mentioned as a staple industry of the province.

British Columbia claims to be the "Mineral Province" of the Dominion: iron, gold, silver, lead, copper, zinc, mercury, and even platinum are being worked, while the coal deposits are a most valuable asset. The iron ores of British Columbia are practically the only ones of any importance along the northern coast of the Pacific, consequently iron manufactured there would have as a market all this territory. At present much of the iron used there comes by sea from Great Britain. Vancouver Island, the mainland, Kamloops, and, to some extent, East Kootenay are possessed of iron deposits. As cheap transportation of ores, coke, and fluxes are essential for the success of the iron industry, British Columbia is eminently fitted, with its coast and other waterways, to become a large producer. Vancouver Island has an abundant supply of coal of a good coking quality, while as to fluxes, the limestone found associated with the iron is exceptionally pure.

Circumstances have so far militated against the progress of this industry owing to the possible iron-master being unwilling to build blast-furnaces without a direct assurance from the mine-owners that they can supply his needs, and the mine-owners will not exploit their ores unless means of reducing them are promised. These difficulties seem now in a fair way of being removed.

A recent article in a Toronto newspaper, however, on the position and prospects of zinc in the province, states ". . . large shipments were made this year, but the producers are at a great loss through having to ship the ore to the United States or to Europe for treatment." This news must be encouraging to the province, as hitherto the occurrence of zinc in silver-lead deposits has been looked upon—and indeed penalised—by smelters as detracting from the value of the ore as a source of these two metals. In many cases, zinc was present in quantities necessitating separate treatment of the ore; this has evidently shown that zinc ores might with advantage be worked for that metal itself, as the market for spelter is increasing year by year.

The following is a short account of the working of the magnetic separator as applied to zinc ores as set forth in the official bulletin on mining, published by the British Columbia Government:—

"An important addition made last year to the concentrating plant of the Payne Mine, near Sandon, Slocan, was the magnetic separating plant for zinc ores. In the first instance, a 42 per cent. blende concentrate is produced in the usual way by means of jigs and Wilfley tables. This is dried and then exposed to a moderate heat in a furnace of the revolving cylinder type, whereby the spathic iron (siderite) associated with the zinc is changed into a magnetic product. After cooling, the roasted product is sized in a set of vibrating screens and charged into magnetic separating machines of the Knowles type, thereby eliminating the magnetic iron and leaving the zinc blende as a 55 to 57 per cent. finished product. Some silver is contained in the blende, but after separation only a small percentage of iron and lead remains in the ore, thus making it a very desirable smelting material. The entire plant is automatic, and the cost of handling is therefore very small per ton. The Payne concentrator, in conjunction with which the separator is operated, produces a high-grade silver-lead product of an average value of about $100 per ton. It also possesses the material advantage of making a zinc product in the fourth compartment of the jigs."

The same writer also describes the use of oil—the Elmore oil process—for the treatment of the tailings remaining after the crushed ore has been subjected to the ordinary process of water concentration. The tailings are run on to two units of an Elmore oil plant. (One unit equals an estimated capacity of 25 tons per day.) These tailings are fed into mixing cylinders with water and oil from the storage tanks. These, of which there are three, are long iron cylinders, placed horizontally, and provided with inside baffle plates, which, as the cylinder is revolved at a low rate of speed by power, thoroughly mix the charge, bringing the oil into contact with every particle of material in the tailings. The oil has the property of catching up and retaining fine particles of sulphides and of free gold. From the mixers, the charge is flushed with water into settling tanks. Here the gangue matter settles to the bottom, while the oil, being lighter than the water, floats on the surface, retaining with it the metallic sulphides &c. The oil can, of course, only carry a limited amount of sulphides to an extent such as will not render the oil-mineral compound heavier than the water.

The tailings from the first mixer are passed through a second and a third mixer to catch any sulphides that have not been taken up by the oil in the earlier process. The mineral-charged oil is next run into a centrifugal oil extractor, a machine 4 ft. in diameter, revolving at a speed of 1,000 revolutions per minute, and the oil concentrate that remains is carried to a second extractor, into which a steam jet is introduced, this removing more oil and to some extent drying the concentrate, which is thereafter sent to the smelter for final treatment.

Platinum and osmiridium have been found in small quantities in the black sands of the Cariboo district, but little has yet been done to save these metals. Mercury, in the form of cinnabar, has been found in the neighbourhood of Kamloops Lake, and the deposits were treated for the extraction of quicksilver for a number of years. Though in the meantime unsuccessful, there is a strong probability of these mercury ores being profitably treated at no distant date.

Attracted by the reputation that West Kootenay has for its smelting and reduction works, an eastward trip was made as far as Revelstoke, and thence by C.P.R. steamer down the Arrow Lakes to Trail and Rossland. At Trail are situated the largest lead-copper reduction works in Canada, now known as the Canadian Smelting Works, and owned by the C.P.R. The buildings and appliances of different kinds cover some 45 acres, and electric power is obtained from the Kootenay Power Company's Station at Bonnington Falls; there is a total of 1,000 horse power in motors. The ores treated are varied in character, and are custom ores entirely. The Rossland mines supply most of the copper-gold ores, which, after crushing and sampling, are carefully assayed. Most of the ore is roasted in heaps of from two to three thousand tons each, which process occupies from four to six weeks. No attempt is made to save the sulphur, which is allowed to burn off. This is due to the lack of a convenient market and to other causes. With more branch lines of railway, systems of water transport, and demands for sulphur, consequent on the increase of population, and the resulting building of towns and cities throughout the West, will come the utilisation of this valuable element for the numerous industries that this and the next generation will see being carried on in the province. In the meantime, the sulphur content of the ores must continue to be waste material. The roasted ores are fed mechanically to the furnaces, and the first matte produced contains 14 to 15 per cent. of copper. It is roasted, granulated, and briquetted, and re-smelted with some raw ore, yielding a high grade matte of about 55 per cent. copper. This last is treated elsewhere, and brought up to 98 per cent. of copper, when it is sent to Eastern refineries, where the gold and silver are extracted by electrolytic methods.

An interesting feature of the Trail Works is the production of electrolytic lead by the Betts process; this is the first instance of this process being carried out on the commercial scale. A plant for making lead pipe up to 4 in. in diameter is included in the company's equipment, the first of its kind in Canada for producing lead pipe from Canadian lead. It should also be added that this is the first company to make silver bullion in quantity from Canadian ores smelted on the spot. The establishment of works in Eastern Canada for the corrosion of lead, and the manufacture therefrom of white-lead and other pigments, should open up a large market for the output of this metal from British Columbia. As an example of a really fine chemical industry, the works at Trail holds a high position. Large roomy laboratories, store-rooms, and assay furnaces—not to mention the works proper—are a fitting preparation for a visit to villa residences and tennis courts on the high banks of the river, which the Company has erected for its officers.

Lack of time prevented a visit being made to Grand Forks, where are installed Bessemer converters, having a capacity for treating about a hundred tons of copper matte daily—an exceedingly large amount. There blister copper of about 99 per cent. purity is turned out in cakes of about 100 lb. each.

A short railway journey from Trail brings one to the picturesque town of Nelson, situated on the hill-side above the west arm of Kootenay Lake. Here the Hall Mining and Smelting Company erected their works on the high ground above the town about 10 years ago, principally for the treatment of ores from the Silver King Mine on Toad Mountain, which is connected with the works by an aerial line. Since 1900, the Company has smelted custom ores as well, mainly lead ores, very little being done with the copper-silver ore from the Silver King Mine. The blast furnaces have a capacity of from 180 to 200 tons of lead charge per day; the slag is automatically removed by water granulation, the matte crushed, rolled, screened, and roasted. The roasted matte is briquetted and conveyed to the blast furnaces.

Fifty-five miles by water from Nelson is Kootenay Landing, the present western terminus of the Crow's Nest Pass Route, the construction of which through the mountains of East Kootenay and across the plains of Southern Alberta to Lethbridge—a distance of 289 miles—occupied less than fifteen months! Truly, a magnificent piece of work. In six hours or so from this terminus, the great coal belt of East Kootenay is first encountered, which is supposed to be the largest undeveloped coal measures in the world.

It would be beyond the scope of this short account of a chemist's wanderings in British Columbia to enter into any historical or statistical particulars of the opening up and development of these coalfields: the chemist is more interested in the proper utilisation of the coal, of the products of its distillation and of the coke resulting therefrom. The physical conditions at Coal Creek and Morrissey are such that a departure from methods prevailing at most collieries where coke is made has been necessary, for owing to there not being room in the valleys near the mines for a sufficient number of coke ovens, these have had to be built away from the mines. The ovens of the Coal Creek Colliery are at Fernie, between four and five miles from the mines; the Morrissey ovens are nearly two miles from the mines. The slack coal for coking in these ovens is loaded directly on to railway dump cars, and hauled to storage bins built near the ovens. At Michel, the slack is collected from the screens in pockets, conveyed to an elevator, discharged on a second conveyor, and distributed to bunkers as required.

The coke ovens are of beehive shape, diameter 12 ft., and have a circular "eye-hole" or chimney at the top. They are built in double rows, of fire-brick, with supporting walls and piers of stone masonry, filled in between with fireclay. A single standard-gauge railway track runs along the top of each battery, and on this are hauled, by light steam locomotives, the side-discharge steel lorry cars, which charge the ovens with 6½ tons of slack each. The production of coke per charge is from 3·90 to 4·22 tons, the average being 1 ton of coke from 1·6 tons of coal. The time for burning is 60 to 72 hours, which gives a daily production per oven at the rate of 1·3 to 1·6 tons. No provision is made to recover the by-products. The coke is "quenched" or cooled, and the dirt washed off by hose-watering inside the ovens. The coke is generally long, lustrous, and firm, containing up to 94 per cent. fixed carbon, 4·50 per cent. ash, and 0·75 per cent. sulphur.* The ovens at Fernie, Morrissey, and Michel number well over 1000.

The Government Bulletin on Mining, 1904, also gives the following particulars regarding cost, &c.:—Coke is supplied at $4.25 to $4.50, f.o.b., and freight to boundary points is $2 to $2.25, so about $6.50 per ton is the cost delivered at the boundary smelters. Coal from Vancouver Island Collieries used to cost $10, and coke $11, delivered at Nelson; now coal from the Crow's Nest Pass Collieries is delivered there at about $5, and coke at about $6; so the beneficial influence of the Crow's Nest Pass Coalfields has here been unmistakably demonstrated by a reduction in cost of fuel of nearly 50 per cent.

Two railways give the Crow's Nest Pass Coalfields access to markets for their coal and coke. The Canadian Pacific Railway Company's Crow's Nest line leaves its present main line at Dunmore Junction, Assiniboia, reaches Michel at 224 miles, Fernie at 247 miles, Morrissey Junction at 256 miles, and Kootenay Landing at 394 miles. From Kootenay Landing to Nelson the distance is 52 miles, of which distance 32 miles, to Proctor, is by water, the freight cars being transferred on large scows or barges, each carrying 10 cars. Smelting points in British Columbia reached by Canadian Pacific Railway are distant from Fernie as follows:—Nelson, West Kootenay, 199 miles; Trail, West Kootenay, 251 miles; Grand Forks, Boundary, 299 miles; Greenwood, Boundary, 318 miles; Boundary Falls, Boundary, 321 miles.

At the coke-ovens here the volatile products of the distillation of the coal share the same fate as the sulphur at the smelters, and possibly for the reasons suggested when considering that question. The following figures, calculated from the *data* regarding output of coke during 1903, proportional yield of coke to coal used, and average analyses of coals (to be found in Official Bulletin, No. 19, of the British Columbia Government, 1904, pp. 117 and 119), give some idea of the amount of useful material in the form of coal-tar and ammonia that was lost that year:—167,700 short tons of coke were produced from 268,320 tons of coal (1 ton of coke from 1·6 tons of coal). The difference, 100,620 tons, represents gas, tar, and liquor; the amount of coal-tar obtained would be, approximately, 10,000 tons, or 1,780,000 galls., worth $53,400 (at 3c. per gall.), and the ammoniacal liquor, 21,000 tons (4,200,000 galls.), worth $42,000 if its value were 1c. per gall. This gives a total value of $95,400.

These figures speak for themselves. The present demand for the distillation products of coal-tar and for ammonia has not as yet justified the saving of these substances. No doubt when the Canadian Pacific Railway continues its Crow's Nest line to the coast, and as other industries spring up in British Columbia and in Alberta, a market will be found for their disposal. As was stated in an article on the Chemical Industries of the Dominion, published in the "Transactions of the Canadian Mining Institute," 1904, the Dominion Iron and Steel Company at Sydney, C.B., now utilises all the coal-tar produced from their coke-ovens for making benzol, creosote oil, and carbolic acid. The demands for their products in Canada are not sufficient, however, so a considerable amount is exported to Europe and the United States. The positions of Fernie and Sydney are, perhaps, hardly comparable as regard transport facilities, but no doubt a day will come when the ninety-five thousand odd dollars at present being dissipated at the former place will be saved, and advantageously treated or disposed of.

Meeting held at Toronto, on January 18, 1906.

DR. F. J. SMALE IN THE CHAIR.

THE COBALT-NICKEL ARSENIDES AND SILVER DEPOSITS AT TEMISKAMING, ONTARIO.

(Abstract.)

BY WILLET G. MILLER, B.A., M.A.SC.

In November, 1903, the writer reported the occurrence of veins carrying a somewhat unique group of minerals, on the line of the Temiskaming and Northern Ontario Railway, then under construction a few miles from Lake Temiskaming. It was shown that the four veins then known occupied narrow fissures in the slate and conglomerate of the Huronian, one of the members of the pre-Cambrian system. The rather massive ore of the veins contained a high percentage of the diarsenide of cobalt, smaltite, the arsenide of nickel, niccolite, together with much native silver and various compounds of this metal, notably the sulphantimonide, pyrargyrite, and the sulphide, argentite. Near the surface, the smaltite was found to be altered to some extent to the delicate pink arsenate of cobalt, known as cobalt bloom, and the niccolite was more or less changed to the green arsenate of nickel, annabergite. On some parts of the surface of the veins the pink bloom was mixed with the green annabergite in such proportions as to produce a white clayey material, the pink evidently acting as a complimentary colour to the green. Native bismuth and other minerals also occur in the veins. The following table shows the chief minerals thus far recognised in the veins:—

1. *Native elements*:—Silver, bismuth, graphite.
2. *Arsenides*:—Niccolite, $NiAs$; chloanthite, or diarsenide of nickel, $NiAs_2$; smaltite, $CoAs_2$.
3. *Arsenates*:—Erythrite, or cobalt bloom, $Co_3As_2O_8 + 8H_2O$; and annabergite, or nickel bloom, $Ni_3As_2O_8 + 8H_2O$.
4. *Sulphides*:—Argentite, or silver sulphide, Ag_2S; millerite, or nickel sulphide, NiS.
5. *Sulpharsenides*:—Mispickel, or sulpharsenide of iron, $FeAsS$; cobaltite, or sulpharsenide of cobalt, $CoAsS$.
6. *Antimonide*:—Dyscrasite, or silver antimonide, Ag_6Sb.
7. *Sulphantimonides*:—Pyrargyrite, or dark red silver ore, Ag_3SbS_3; tetrahedrite, or sulphantimonide of copper, $Cu_8Sb_2S_7$.

Small quantities of pyrite and galena, zinc blende and copper pyrites are found, especially in the wall rock of the veins.

For over a year after the report of the discovery of the veins, the public evinced little interest in them. By the end of 1906, however, the district was the scene of the greatest mining boom that Canada has witnessed. The name Cobalt, after one of the chief metallic constituents of the ores, has been given to the railway station. This name is now commonly used to designate the whole mineral-bearing area. Numerous veins, probably about one hundred of which are, or will be, producers, have been discovered. They are similar in character to those first found, occupying narrow fissures or joint planes in the pre-Cambrian rocks. While most of the veins, like the four first found, occur in the Huronian conglomerate and slate, a few are found in an older series, greenstone, known as the Keewatin, and the later diabase series, which cuts both the Huronian and Keewatin, also contains some veins. The veins carrying high values in silver are practically all confined to an area five or six miles in extent. Similar veins carrying cobalt have been found over a large area, stretching 30 miles to the north of Cobalt Station and about the same distance to the south and west of it, but the silver values are lacking. Up to the present time most of the veins have been worked as open cuts. Now, however, more underground work, in the nature of shaft sinking and the driving of levels, is being carried on. In spite of the unsystematic working of the veins, and the comparatively small number of men employed, the production of silver in 1906 has been between $3,500,000 and $4,000,000. Little has been received for the cobalt, nickel, or arsenic contained in the ores, owing to the fact that the reduction works in America are not adapted to the extraction of these substances.

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* Official Bulletin, No. 19, Mining in British Columbia, 1904, p. 117.

In 1905, the 2144 tons of ore shipped had the following percentage composition:—Silver, 3·90; cobalt, 5·50; nickel, 3·49; arsenic, 25·60. This percentage of silver represents a value of about $800 a ton. Car-loads have been frequently shipped which averaged over $2000 a ton in silver. A few car-loads have averaged between $3000 and $4000 a ton. These ores at Cobalt are unique so far as is known in America. Similar silver-cobalt-nickel-arsenic ores have been worked for many years in Saxony and Bohemia.

Details concerning the mines and mining at Cobalt are to be found in the writer's report on "The cobalt-nickel-arsenides and silver deposits of Temiskaming," published by the Bureau of Mines, Toronto.

Meeting held at Toronto, on Thursday, May 10, 1906.

PROF. W. H. ELLIS IN THE CHAIR.

BREAKFAST FOODS: THEIR CHEMICAL COMPOSITION, DIGESTIBILITY, AND COST.

BY PROF. ROBERT HARCOURT, B.S.A.

The cereal grains and the preparations made therefrom occupy a very prominent place in human dietary. This is doubtless due to the fact that these foods are, as a rule, cheap; that, when properly prepared, they are comparatively easily and completely digested; and that they contain all the constituents required to nourish the body. Wheat bread has long been known as the "staff of life," and many of the grains have been used in the cracked or ground condition for ages; but within recent years an almost endless variety of wheat and oat products have been placed on the market under the name of "breakfast cereals" or "breakfast foods." According to the claims made for some of these new foods, they are not only a perfect food in a condensed form, but they are also brain tonics, and have a variety of wonderful virtues.

The various types of breakfast foods may be roughly divided into the following classes:—First, the uncooked, as the old forms of granulated oatmeal and the wheat farinas. The foods of this class are served either after cooking for a short time, or after cooking for several hours. The latter method of preparation renders them more palatable and more easily digested. Second, the partially cooked, to which the rolled and flaked grains belong. In the preparation of these foods the grain is softened by steaming, and then rolled and dried. During the process they are slightly cooked, and the cell walls ruptured; consequently, this class of food may be prepared for the table in less time than those of the previous class. A third class is the cooked foods, such as Shredded Wheat, which may be served at once without any special treatment. A fourth class is the malted foods; these are supposed to be both cooked and partially digested. Force, Orange Meat, Norka, Grape Nuts, &c., are types of this class.

In determining the relative value of foods, at least three points must be taken into consideration. These are chemical composition, digestibility, and cost.

In our study of the composition of the breakfast foods, a large number of analyses were made according to the method suggested by the Association of Official Agricultural Chemists (Bulletin No. 46, Bureau of Chemistry, Department of Agriculture, Washington). The results are incorporated in the following table:—

Percentage composition of some breakfast foods.

	No. of samples analysed.	Water.	Crude protein.	Crude fat.	Carbohydrates.*	Crude fibre.	Ash.	Energy per grm. calories.
Granulated oats	12	7·75	12·29	6·65	71·71	(1·59)	1·60	4·283
Rolled oats	19	8·55	11·83	6·61	71·35	(1·25)	1·66	4·238
Wheat farina	8	10·63	9·70	1·05	78·23	(0·62)	0·57	3·876
Wheat germ	1	8·39	10·97	2·79	76·77	(1·15)	1·08	4·034
Rolled wheat	2	10·41	8·77	1·90	77·22	(2·05)	1·70	3·860
Flaked barley	4	10·58	9·71	1·43	76·81	(2·07)	1·47	3·854
Cornmeal	2	9·76	6·99	1·26	81·49	(0·52)	0·50	3·870
Orange Meat	3	8·66	9·70	1·31	78·43	†(1·95)	1·90	3·909
Force	3	9·06	10·14	1·51	76·88	†(1·85)	2·41	3·886
Norka	3	7·38	14·33	5·55	69·91	†(1·84)	2·83	4·229
Malta Vita	3	8·23	9·88	1·39	78·27	—	2·23	3·915
Grape Nuts	3	7·03	11·49	0·94	78·78	—	1·71	3·995
Canada Flakes	2	8·97	10·84	1·18	76·22	—	2·79	3·874
Shredded Wheat	2	9·41	11·53	0·85	76·51	—	1·70	3·916
Rice Flakes	1	12·29	7·24	0·08	80·04	†(0·55)	0·35	3·716

* Including fibre. † One result only.

The main functions of food are: First, to form the materials of the body and to repair waste; and, second, to yield heat to keep the body warm, and to furnish power for the work it has to do. In the first case, the food serves for growth and repair; in the second, it serves as a fuel. The protein compounds are the principal tissue formers. They build up and repair the muscles and tendons and supply the albuminoids of the blood and other fluids. They may also be burned in the body, and thus may serve as a fuel. Protein, or, more correctly speaking, a certain part of the protein, is the only constituent of the food capable of forming flesh or muscle, hence it is the most expensive. Fat and carbohydrates, on the other hand, are the chief fuel ingredients of the food. The fat, however, is capable of producing 2·25 times as much heat as the same weight of carbohydrates. They may both be transformed into body fat when taken into the system in excess of what is required for heat and energy. The crude fibre is practically indigestible, and, while it has a limited physological value, much of it in a food detracts from its nutritive value. The ash is used in the formation of bone, and to supply the inorganic materials in the fluids of the body.

If, then, with the above facts in mind, we study the composition of the breakfast foods, it will be found that the oatmeals and Norka, which is an oat product, contain the most proteids and fat, while all the other foods are richer in carbohydrates. The cornmeals are the lowest in crude protein and highest in carbohydrates, and the wheat farinas and cornmeal contain the least fibre. The germ of a seed is rich in protein and fat, consequently, we are not surprised to find wheat germ richer in these constituents than the other wheat products. Taking all the facts into consideration, we would naturally be led to conclude that as the oat products contain the most muscle-forming substances and the largest percentage of fat, they are the most nutritious foods.

However, it is very difficult to form a correct estimate of the nutritive value of foods, differing in composition as these do, by balancing a high protein and low carbohydrate content against a low protein and a high carbohydrate. Possibly the best method of making a comparison, and the one usually followed, is to compare them on the basis of the number of heat calories they will produce when burned. No actual determination of the fuel value of these foods was made; but, calculating on the basis proposed by Dr. Wiley,[*] we obtain the figures placed in the last column of the table of composition. Reference to these figures shows that, upon this basis of comparison, the oat products stand highest, and that the much-advertised prepared breakfast foods have a very slight advantage over the ordinary wheat farinas. But the above list of foods represents the four classes of breakfast foods previously mentioned, and, consequently, we would expect to find wide differences in the make-up of the various constituents, more especially in carbohydrates. The changes effected by cooking and malting would, doubtless, increase the amount soluble in water. It was, therefore, decided to determine the amount and the composition of the water-soluble extract of the various foods. The method used in making the extract was as follows:—100 grms. of the material in its natural condition and 1000 c.c. of distilled water at room temperature were placed in a 2-litre bottle, and fastened on a machine in which the bottles were turned end over end, at the rate of forty revolutions per minute, for 24 hours. Previous experiments demonstrated that up to this length of time there was a sensible increase in the amount of material brought into solution. The contents of the bottles were then placed in the cups of a large centrifuge, and the insoluble matter separated by centrifugal force. After filtering through close paper to insure a clear solution, the total solids—dextrin, sugar, and nitrogen—were determined in the filtrate. The methods followed in making these determinations were practically those outlined by A. McGill in Bulletin No. 84, Inland Revenue Department, Ottawa. Because the alcohol precipitate is not all dextrin, it has been simply called alcohol precipitate, and as the sugar may, in some cases, be dextrose, and in others maltose, and no separation of these was made, the results are reported as cuprous oxide precipitated. The results are embodied in the following table:—

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[*] Bureau of Chemistry, Bulletin No. 13, Part IX.

Percentage of water-soluble material in foods examined.

Name of food.	No. of samples analysed.	Solids.	Alcohol precipitate.	Cuprous oxide precipitated.	Soluble nitrogen.
Wheat products (farinas)	7	7·33	0·257	1·336	0·431
Oatmeals (granulated)........	4	6·55	—	—	—
Rolled oats	12	6·56	1·64	—	0·147
Shredded Wheat	1	8·76	4·11	0·26	—
Orange Meat ...	1	20·53	8·66	7·43	—
Malta Vita	5	25·45	9·97	8·01	0·242
Grape Nuts	5	44·20	12·96	21·02	0·304
Canada Flakes..	1	26·43	10·16	12·53	—
Force	1	14·08	5·30	0·61	—
Norka	2	28·17	11·08	10·78	—

In carrying out the above work a considerable variation was noticed in the composition of the water extract of the foods of the same nature put up by different manufacturers. A further examination was therefore made to ascertain if the same brands always contained the same amount of soluble matter. To study this point, a number of samples of two brands of oatmeal, Malta Vita, and Grape Nuts were collected and examined. The results will be found in the following table:—

Analyses of different samples of the same brands of breakfast food.

	Solids.	Alcohol precipitate.	Cuprous oxide precipitated.	Soluble nitrogen.
Tillson's pan-dried oats, No. 1	8·43	2·36	none	—
,, ,, ,, ,, ,, 2	7·8	3·03	,,	0·118
,, ,, ,, ,, ,, 3	6·7	1·68	,,	0·201
,, ,, ,, ,, ,, 4	8·0	2·99	,,	0·230
Quaker Oats, No. 1.......	5·42	—	,,	—
,, ,, ,, 2.......	5·2	0·80	,,	0·134
,, ,, ,, 3.......	5·6	0·72	,,	0·118
,, ,, ,, 4.......	5·6	0·54	,,	0·118
,, ,, ,, 5.......	6·8	1·45	,,	0·139
,, ,, ,, 6.......	5·3	1·16	,,	0·118
Malta Vita, No. 1..........	29·01	13·72	9·02	—
,, ,, ,, 2..........	30·81	10·19	13·78	0·210
,, ,, ,, 3..........	25·09	9·35	7·91	0·266
,, ,, ,, 4..........	22·37	7·72	6·76	0·238
,, ,, ,, 5..........	19·97	8·86	2·58	0·252
Grape Nuts, No. 1........	41·84	12·67	19·14	0·288
,, ,, ,, 2........	44·51	13·00	19·90	0·322
,, ,, ,, 3........	44·83	13·36	22·74	0·308
,, ,, ,, 4........	43·78	12·80	20·89	0·308
,, ,, ,, 5........	46·14	12·97	22·41	0·294

The above results show that, with the exception of Malta Vita, the amount of soluble matter and its composition are fairly constant in the different foods examined. There is quite a similarity in the amount of soluble matter in the different samples examined of Quaker Oats and the various samples of Tillson's Oats. The Grape Nuts, for malted samples, are very uniform.

But the above figures refer only to the composition and heat-producing power of the foods, and do not take into account the differences in digestibility, or the amount that would be absorbed by the body when they are eaten. It is only that part of the food which is digested and absorbed that has any nutritive value. Therefore, to carry the comparison further, we must determine the digestibility or the availability of the constituents of the various classes of foods. Owing to the many difficulties surrounding this part of the work, it is impossible to arrive at absolutely correct figures. The method generally followed is to determine the difference between the quantity of each constituent—*i.e.*, protein, fat, and carbohydrates—in the total food eaten and the amount of the corresponding ingredients in the fæces. The difference is taken as the amount digested. This is calculated to percentage of the given nutrient digested, or, as it is generally called, the coefficient of digestibility. Strictly speaking, the results thus obtained do not represent actual or true digestibility, because the fæces contain not only the portions of the food that are not digested, but also other materials, such as digestive juices and excretory products. On the other hand, these waste materials, or metabolic products, may be considered as representing the cost of digestion in terms of food ingredients. Consequently, while the figures arrived at may be a little below the true digestibility of the food, they do represent the amount of food that will be available to the body.

Each of our digestion experiments extended over a period of four days, and healthy young men were used as subjects. They were all interested in the work, and cooperated in every way to make the work as accurate as possible. Each subject was allowed to use sugar and cream of known composition to suit his taste, but an accurate account was kept of the amount consumed. As the food under experiment was also carefully weighed and analysed, it was possible to calculate the total amount of each constituent eaten. From this was deducted the amount of the various constituents found in the fæces obtained from the food eaten during the experiment. The results got in this way must of necessity show the digestibility of the whole diet, and not of the breakfast food only. But as both the sugar and cream would be almost wholly digested, and were used in very nearly equal quantities throughout all the experiments, the results must be, at least, comparative. Naturally, however, with such materials as the farinas, where the percentage of fat is very low, the digestion coefficients for the fat cannot be considered very accurate. The first part of the following table gives the percentage amount of each constituent of the full diet digested. Dr. Atwater states that 97 per cent. of protein, 95 per cent. of the fat, and 98 per cent. of the carbohydrates of cream and sugar are digested.[*] Assuming the correctness of these figures, we have calculated the percentage amount of each of the constituents of the breakfast foods digested, and have placed these figures in the second part of the table.

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[*] Storrs' Agricultural Experiment Station Report, 1904, p. 191

Percentage amount of each constituent of the full diet digested, calculated to food alone.

Name of food.	No. of digestion experiments.	Organic matter.	Crude protein.	Crude fat.	Carbo-hydrates.	Calculated to food alone.	
Granulated oats	6	94·5	83·4	92·2	97·6	80·8	98·1
Rolled oats	10	94·7	82·8	93·5	98·2	80·0	98·4
Wheat farinas	11	95·6	79·8	95·3	98·2	72·5	98·8
Wheat germ	3	96·9	89·7	96·1	98·5	88·0	98·8
Rolled wheat	3	93·8	79·2	95·6	95·2	74·1	94·8
Flaked barley	5	95·4	76·2	94·8	97·0	69·1	97·1
Cornmeal	3	96·2	81·7	95·3	98·6	73·7	98·9
Orange Meat	2	93·4	84·4	94·9	95·5	75·7	94·6
Force	2	91·1	69·4	93·3	95·3	58·7	94·4
Norka	2	94·3	83·3	92·0	97·6	81·0	97·7

According to these results, the wheat germ was more fully digested and absorbed than other food. It stands highest in the amount of organic matter, and in each of the various constituents absorbed both from the full diet and from the wheat germ alone. The protein of all the foods is less completely absorbed than the other constituents. This is particularly true of that in Force. It is also worthy of note that the carbohydrates of Orange Meat, Force, and Norka were not so fully absorbed as they were from the other foods. Certainly there is nothing in these results to indicate that the high-priced prepared breakfast foods are any more completely digested and absorbed than the wheat farinas and rolled oats, or even than the old forms of granulated oatmeals.

So far, we have compared the foods on the basis of composition, fuel value, and digestibility, but to find the relative economy of these goods, their cost must be considered. From the data given in the preceding tables, and the retail price of the foods, it is easy to calculate the fuel value of the digestible matter obtained from the quantity of each of the foods that can be bought for a certain sum of money. For the purpose of comparison, we have calculated the number of calories of heat that the digestible matter in 10 cents' worth of each of the foods is capable of producing. The retail price of the foods in Guelph was used in the calculation.

Number of calories of heat obtained from the digestible matter contained in 10 cents' worth of the foods.

Food		Price.	Calories.
		cents.	
Granulated oats	In bulk	7 lb. for 25	5128
Rolled oats	,, ,,	7 ,, 25	5088
,, ,,	,, package	2 ,, 10	3635
Farinas	,, bulk	7 ,, 25	4698
,,	,, package	2 ,, 15	2232
Wheat germ	,, bulk	7 ,, 25	4956
Rolled wheat	,, ,,	6 ,, 25	3934
Flaked barley	,, ,,	2 ,, 10	3330
Cornmeal	,, ,,	8 ,, 25	5397
Orange meat	,, package	20 oz. 15	1368
Force	,, ,,	16 ,, 15	1136
Norka	,, ,,	22 ,, 15	1639

The above figures show that upon this basis of comparison, cornmeal is the most economical, the oatmeals second, and wheat germ third. It is also plain that oatmeal and wheat farina are very much more expensive in package than in bulk. In the case of the latter substances, less than half the number of calories are obtained for the same money. The meal in the package may be cleaned and more conveniently handled, but if fairly fresh meal can be procured, it is very doubtful if anything is gained by purchasing in package.

Among the goods put up in package, the pre-digested foods are the most expensive. This is to be expected, as these foods have been mixed with malt and are cooked ready for use. How much they are improved by this treatment is difficult to say. They may be more easily digested, but certainly they do not appear to be any more fully absorbed in the system.

The thoroughness of cooking has an influence on the actual food value of all the breakfast foods, for if the cereal preparations are not well cooked, some of the nutritive material will escape the digestive juices. To gather some information on the changes effected by cooking oat and wheat meals for short and long periods, some of these foods were cooked for periods of 20 minutes, two hours, five hours, and eight hours, and extracted with water, as previously explained, and analysed.* The results are given in the following table:—

Influence of cooking on the composition of foods.

Name of food.	Time cooked.	Solids.	Alcohol preci-pitate.	Cuprous oxide preci-pitated.	Soluble nitrogen.
Rolled oats	—	8·43	2·36	—	—
,, ,,	20 mins.	14·95	3·36	—	0·156
,, ,,	2 hrs.	18·79	4·49	—	0·276
,, ,,	5 ,,	29·93	6·92	—	0·400
,, ,,	8 ,,	34·3	8·77	—	0·596
Wheat farina	—	6·97	trace	—	0·383
,, ,,	20 mins.	27·4	6·87	trace	0·045
,, ,,	2 hrs.	37·19	12·8	,,	0·073
,, ,,	5 ,,	38·37	—	,,	0·061
,, ,,	8 ,,	39·99	15·1	,,	0·114

It is evident that the wheatmeals are more readily broken down through the action of heat than the oatmeals. With the latter, there was only 14·95 per cent. solids in the extract at the end of 20 minutes' cooking, whereas with farina, 27·4 per cent. was soluble. A portion of the extract obtained from the wheat boiled for 20 minutes was hydrolysed, when it reduced copper equivalent to 23·85 per cent. of dextrose or 21·46 per cent. of starch. After hydrolysis, a portion of the extract taken from the meal boiled for eight hours reduced copper equivalent to 37·65 per cent. of dextrose, or 33·88 per cent. of starch.

To ascertain the influence of cooking on the digestibility of the foods, we cooked these foods for 20 minutes, the time commonly employed, and for eight hours, and then determined the digestibility in the ordinary way. In the case of the short cooking, the 20 minutes was taken from the time the mass began to bubble, and it was kept boiling hard throughout the whole time. In the long cooking experiment, the mass was brought to the boil and then placed in a double boiler and kept at the boiling point of water for eight hours.

In determining the digestibility, triplicate experiments were conducted with two samples of rolled oats and two of wheat farina. In order that the results might be strictly comparable, the same subjects were used in determining the digestibility of the meal cooked for the short and long period. Different subjects, however, were used with each sample of meal. This was done to bring in as many conditions as possible. The results of two experiments with the oatmeal and one with the wheat farina were discarded. The digestion coefficients were all very close, and only the averages are given below.

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* The meal was cooked by first bringing to boiling over the flame, and then boiling in a double boiler for the eight hours. At the times stated a portion of the material was removed and used in determining the soluble matter. The percentage soluble was calculated from the dry matter in the material extracted.

Digestion coefficients of rolled oats and wheat farina as influenced by short and long periods of cooking.

	No. of digestion experiment.	Organic matter.	Crude protein.	Crude fat.	Carbohydrates.
Rolled oats (short cooking)	4	94·2	81·5	92·5	98·0
Rolled oats (long cooking)	6	95·4	84·3	94·6	98·3
Wheat farina (short cooking)	5	95·5	79·3	94·9	98·3
Wheat farina (long cooking)	6	95·3	79·4	95·6	98·5

From the above results, it is evident that the length of time the meal was cooked did not very materially influence the percentage amount digested. It is, of course, possible that less energy may have been expended in digesting that which was cooked the longer time; but no figures could be procured on this point.

From all the data presented, it is evident that cornmeal, rolled oats, and the farinas, especially if bought in bulk, are the most economic "breakfast foods." It is, however, true that these foods do not agree with everyone, and that the pre-digested foods may be useful for those people who have difficulty in digesting starch. They may also have a place in a hurry-up breakfast; but the intelligent buyer who has to consider economy will hardly pass by the old forms of breakfast foods, unless his own experience has actually demonstrated that these newer foods have a superior value.

Meeting held at Toronto, on Thursday, February 7, 1907.

PROF. W. HODGSON ELLIS IN THE CHAIR.

WOOD SPIRIT IN ACETONE.

BY FRED W. BABINGTON.

During the analysis of varnish removers, which are generally composed of a solution of paraffin wax in benzol, mixed with either acetone or wood spirit rich in acetone, the question arose whether acetone or wood spirit, or wood spirit so rich in acetone that it might be termed acetone, had been used. The so-called pure acetone contains little or no methyl alcohol, but commercial acetone, being often obtained by fractioning wood spirit, may contain fairly large proportions of wood spirit, and still be commercially known as acetone.

I attempted to make the various qualitative tests for methyl alcohol quantitative, but the results in the main were negative. I first attempted to fix the acetone and free the alcohol for determination as follows:—

(1) By salting out by calcium chloride, and ultimately saturating the solution with powdered calcium chloride, the bulk of the acetone separated, but enough remained in solution to nullify the test for alcohol.

(2) Evaporation with calcium chloride failed, since the acetone and alcohol both evaporated.

(3) Separation of the acetone by alkali sulphite failed as in (1).

(4) Separating the alcohol as methyl oxalate failed as in (1) and (3).

(5) Reynolds' test with mercuric chloride failed, not being quantitative.

(6) Oxidation by chromic acid solution, which gives qualitative results, is useless quantitatively, since the formic acid produced was further oxidised.

(7) Oxidation to formaldehyde by platinum black, which is an excellent method of distinguishing between acetone, ethyl alcohol, and methyl alcohol, fails quantitatively as (6).

The qualitative test is as follows:—A pledget of platinised asbestos is prepared by soaking the asbestos in solution of platinic chloride and igniting until sufficient platinum is deposited. If a few drops of the liquid be dropped on the recently ignited platinum, there is no particular odour with acetone, with ethyl alcohol only the odour of aldehyde, but with methyl alcohol or with acetone rich in wood spirit, the odour of formaldehyde is characteristic. I suggest this test as a qualitative test, together with the chromic acid test; the platinum will show methyl alcohol, the chromic acid will show methyl and ethyl alcohols; pure acetone reduces chromic acid very slowly.

Rich and Bardy's method was tried, but abandoned on account of the time occupied.*

I found the iodoform method for determining the acetone fairly satisfactory when the acetone content was high; but I found also that the gravimetric method was inaccurate when the acetone was low, as the ether-iodoform layer undergoes spontaneous decomposition, with liberation of iodine, and washing with soda solution only temporarily removes it, as it forms again on evaporation. I did not continue, as alcohol was the objective point, but I consider the volumetric process preferable (Allen, page 77).

I then tried to obtain a volatile ester of methyl alcohol which could be titrated, and would yield a number analogous to the Reichert number in butter analysis. After some experiments I found the boric ester to give fairly good results; at all events, it gave a figure for methyl alcohol, and I am of the opinion that if the analysis were conducted with care, the results would be of practical application.

The test is conducted as follows:—25 c.c. of the spirit and 2 grms. of boric acid are placed in a 100 c.c. fractional distillation flask (with pieces of pumice or platinum spirals to stop bumping), provided with a long-stemmed separating funnel, and connected with a condenser and a trapped flask receiver. When all connections are tight, 20 c.c. of glycerin and 20 c.c. of water are placed in the receiver, and the spirit is distilled to dryness by gentle heat. When cool, 25 c.c. of water is added to the contents of the receiver by the separating funnel, the condenser is washed with 10 c.c. to 15 c.c. of the water condensed, and the glycerin solution is titrated by $N/2$ sodium hydroxide solution, using phenolphthalein as indicator, the methyl alcohol being calculated from the table given below; 25 c.c. spirit is used, as that is the usual amount obtained from 100 c.c. of a varnisher remover.

If the esterification were carried out in a pressure flask and distillation performed more carefully, the results would be much more accurate, but the above method has the advantage, in technical work, that four distillations can be done in one hour.

Examination of varnish removers.—100 c.c. is shaken with three successive portions of 50 c.c. water; the contraction represents, roughly, the amount of acetone or wood alcohol used; the supernatant layer, the benzol and paraffin. The latter is divided into two portions, one of which is evaporated for the identification of the paraffin, the other being distilled to identify the solvent.

The united aqueous extracts are distilled to the volume of the contraction observed (which will be, roughly, the amount of alcohol or acetone used). If a blue flame is obtained by the flame test, probably only alcohol is present. The chromic acid test and formaldehyde test are also then applied.

If alcohol is detected, 25 c.c. is distilled with boric acid as described.

The following figures were obtained by analysis of samples of "chemically pure" acetone and a good commercial acetone:—

	"Pure."	"Commercial."
Sp. gr. (15° C.) ..	0.7971	0.8338
B. pt.	54° to 55° C.	54° to 55° C.
Fract. distillation	75 per cent. (57° to 58° C.)	25 per cent. (60° to 70° C.)
Calcium chloride test (separation)	48 to 50 per cent.	40 to 45 per cent.
Chromic acid test	slight reduction	reduction
Platinised asbestos test	trace of formaldehyde	formaldehyde (strong)
Iodoform test.....	31 per cent.	26 per cent.
Boric acid test ...	0·3 c.c.	1·0 c.c $N/2$ NaOH.

A sample of "chemically pure" methyl alcohol gave the following figures:—Iodoform test, trace; boric acid test, 46·5 c.c. $N/2$ alkali.

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* These tests, with the exception of the formaldehyde test, will be found in Allen's "Organic Analysis," page 70 *et seq.*

From the following table a fair approximation of the amount of methyl alcohol present can be ascertained; I do not claim it accurate, but it is rapid and sufficiently accurate for technical purposes:—

Acetone per cent.	Methyl alcohol per cent.	c.c. of $N/2$ sodium hydroxide solution used.
0	100	46·5
20	80	38·0
40	60	24·5
60	40	13·0
80	20	6·0

Wood spirit usually requires about 34 c.c. of sodium hydroxide solution.

New York Section.

Meeting held at the Chemists' Club, on Friday, Jan. 25, 1907.

MR. GEORGE C. STONE IN THE CHAIR.

DANGEROUS DUSTS AND THEIR EXPLOSIONS.

BY S. F. PECKHAM.

In the Journal of this Society, January 31, 1906 (pp. 54—57), will be found a paper by Mr. Watson Smith, on "Flour Mill Explosions and Dangerous Dusts," in which the following passage occurs (p. 55):—"The cause of the explosion (at Minneapolis in 1878) was then traced by Prof. Lawrence Smith to the same cause as that already given"; that is, the ignition of dry flour from the friction of dry mill-stones.

Prof. J. Lawrence Smith was in Europe at the time the explosion occurred, and did not visit Minneapolis until the October following. I sent him, at Geneva, Switzerland, in the early autumn of 1878, all the articles that had appeared in the daily papers at Minneapolis and St. Paul, including the reports made to the coroner's jury by myself and Prof. Peck. When Dr. Smith came to Minneapolis, he told me that he had read my report before the French Academy.

The explosion in Minneapolis led the authorities of that city to empanel a coroner's jury, to hold an inquest. This jury invited Prof. Peck and myself to sit with them and question witnesses as we saw fit. This we did, and we were present at all the sittings.* Prof. Peck undertook the mechanical and physical problems, while I confined myself wholly to the chemical problems.

The largest of the three mills that exploded was the Washburn A Mill. In this mill the initial explosion threw the walls outward in all directions, and the roof into the air to a great height. The shock and flame communicated with two other mills then in operation, which exploded; the walls of the nearest one falling upon the prostrate walls of the Washburn A Mill; the walls of the third mill falling upon the prostrate walls of the second mill. The elevator exploded, the roof being thrown into the air, and the entire wooden structure was immediately wrapped in flames. The other three mills were set on fire, and burned quietly.

Prof. Peck contrived, for the purpose of illustrating his address to the jury, a very simple apparatus. This showed that 2 oz. of any material found in a flour mill, except wheat and coarse bran, together with 2 cb. ft. of air, would produce, when ignited in a box with *flame*, an explosion that would lift two men standing on the cover. It was found impossible to ignite mixtures of dust and air with red-hot coal or white-hot platinum wires. A sack of flour and 4000 cb. ft. of air would thus generate sufficient force to throw 2500 tons 100 ft. high.

Prof. Peck and myself were asked to give opinions as to the cause of the explosion, based wholly on the evidence given at the inquest, as if this explosion were the first and only one of the kind that had ever occurred.

Prof. Peck had visited the elevator only a few days before the explosion occurred, and both of us had been in the Washburn A Mill during the previous winter. The quantity of dust that had accumulated upon every object in both buildings had impressed us as enormously increasing the danger of the rapid extension of fire. It covered most of the beams at a sliding angle until they could hold no more. In that mill there must have been several tons of this fine flour-dust.

The evidence showed:—There had never been any explosives of any kind nor any peculiar gas or vapour observed in or about the mill other than are produced in manufacturing flour. None of the materials were sufficiently heated to generate gas of any kind; to do this the wheat would have become charred or cooked, and consequently ruined as flour. A careful examination of the different products of grinding as they left the stones showed only a maximum temperature of 150° F.

It is true that a strong draught was maintained through the eye of the millstones; it served to keep the stones cool, and also to evaporate the water, and at the same time to mechanically convey the dust produced by the grinding to a room where the dust was settled out.

In the normal action of the stones this movement proceeded continuously and safely; but it was shown experimentally that this extremely fine material was easily suspended in air, and that flame would flash through it almost as readily as through a mixture of gas and air, and with precisely the same effect; that is to say, the combustion was instantaneous throughout large areas, the heat developed was very intense, and consequently the volume of gas produced was not only greater than that of the original mixture, but it was enormously expanded by heat, hence the explosive force became practically irresistible.

It was found by experiment that coarse bran was the only product in the manufacture of wheat flour that could not be suspended in air and burned with explosive violence, while six of the materials representing different steps in the process were found to be especially liable to explosions. The general dusts that pervaded the mill and settled everywhere were flour, purified middlings, dust from middlings' purifiers, dust exhausted from the stones, and dust from cleaning the wheat. The finer, dryer, and hotter they were the more readily they exploded, and any of them was liable to burn with explosive violence when mixed with air in the proper proportions and brought into contact with flame. Precisely like gas, if there is too much or too little dust in the mixture the flame would not run through the mass.

Apart from ignition caused by the accidental and careless use of illuminating gas or oils, there was but one process in the manufacture wherein any of these six materials were exposed to the conditions suitable for explosive ignition.

The evidence showed that friction between mill stones was of frequent occurrence. The grist steadies the upper stone as it rapidly revolves; but when it is not well balanced and a change of grist is being made, when the feed is stopped, or when nails or gravel pass between the stones, the friction gives rise to streams of sparks. Under such conditions, as the grist runs out, the last portion will be heated so hot as to char it, producing a substance closely resembling tinder; this will readily ignite from a train of sparks.

The initial fire in the Washburn A Mill occurred on the east side of the mill where six run of stone grinding middlings were exhausted into a spout leading to the dust room. The conclusion was that one of these six sets of stones ran dry; that a train of sparks ignited the tinder-like residue resulting from the friction; that the strong draught through the eye of the stone fanned the smouldering pellets into a flame that flashed through the mixture of dry dust and air, producing an explosion that blew out one end of the conductor through a window to the external air, and at the other end flashed into the dust room igniting the mixture of dust and air there, producing a flame and expansion that burst that room, jarring the dust of the basement into the air, which was on the instant ignited. This phenomenon was successively repeated in each story of the building, until the accumulated expansive force levelled the walls to the ground and threw the roof to an estimated height of 400 ft. The shock jarred the dust into the air in the other mills and the elevator, while a strong wind carried a sheet of flame into contact with the mixture of dust and air, and the two mills and elevator exploded as a result. The three other mills that burned were on the opposite side of the street in a direction against a heavy wind. For this reason flame did not reach them, but the windows were broken and a vast quantity of burning flour and middlings were thrown all over these mills, setting their contents on fire from basement to attic; they burned quietly. The verdict of the jury was in accordance with these conclusions.

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* American Jour. of Science, 1879; Popular Science Monthly, xiv, 159; London Jour. of Science, xvi, 668.

Immediately following this inquest there was a very general house cleaning by the millers of Minneapolis, and no dust has since been allowed to accumulate about their mills. Nor have there been any explosions since 1878. There have been, however, explosions of combustible dusts other than flour dust. One of these. quite notable at the time, occurred in a confectionery establishment here in lower New York, where a mixture of sugar dust and air was ignited with explosive violence.

Prof. Peck discovered that the dust that accumulated in planing mills and furniture factories could be exploded under the same conditions and with a violence equal to that of any product of a flour mill.

The most unexpected explosion of combustible dust that I have investigated occurred in Providence, Rhode Island, on August 14, 1890, in the soap factory of the Kendall Manufacturing Company; two men were killed and nine seriously injured, while the building was badly shattered.

The evidence showed that for a number of years the company had been engaged in the manufacture of a product made by mixing sodium carbonate and soap in certain proportions and drying and grinding the mixture. The grinding had been carried on in a closed room lighted by an open gas jet, amid a cloud of dust, under the supposition that neither of the ingredients nor the mixture would burn, until on the morning in question the factory was shattered by an explosion and the employés injured and killed. I advised the Fire Marshal to have one of Prof. Peck's boxes constructed; this was done, and we found on experiment that neither the manufactured article nor any of its ingredients could be made to explode under ordinary conditions, but that in grinding the mixture a mechanical separation resulted in the accumulation of very large quantities of dust that was nearly pure soap, very fine and very dry.

The idea that soap would burn or explode was scouted, but we had no difficulty in securing a sample of the dust from the room in which the grinding was carried on and in which the explosion occurred. This sample when treated in Prof. Peck's box produced an explosion, the practical effects of which were identical with those produced with powdered sugar, flour, starch, planing-mill dust, or, in fact, any other substance that could be burned in oxygen or air. It made no difference what the ordinary physical condition might be, so long as it was combustible. Make it fine enough and dry enough to be diffused throughout a space filled with the proper amount of air, flame would run through the space instantly and an explosion would follow.

The final conclusion is this, that *all* combustible dusts are dangerous. Coal dust, wood dust, wheat dust, sugar dust, soap dust, *any dust* that under any conditions can be made to burn is, in the long run, dangerous. No open flame should ever be allowed in a dusty place of this kind, and no dust from anything that can be burned should ever be tolerated where its presence can be avoided.

Obituary.

SIR DAVID GAMBLE, Bart., K.C.B.

Sir David Gamble was born in Dublin on Feb. 3, 1823, the year when the salt tax was repealed. He was the only son of Josias Christopher Gamble, a manufacturer of bleaching powder in Dublin. In 1827, the business was broken up, and the following year the Gambles built their first works in St. Helens, and founded the chemical industry of that town.

David Gamble was educated first at a school near St. Helens, then at University College, London, and subsequently at the Andersonian College, Glasgow. In this educational training, engineering received an amount of attention equal to that bestowed on chemical science. In 1842, Sir David became manager of the Gerard's Bridge Works in St. Helens, which belonged to his father, and to which he (Sir David) subsequently added the Hardshaw Brook Works. His father dying in 1848, Sir David succeeded him as head of the business of Josiah C. Gamble and Son, and in 1900 the firm was amalgamated with the United Alkali Company, Ltd., of which he then became a director. He was also one of the first directors of the Tharsis Company. Sir David Gamble was the first (1867–8) to throw open his works to the late Walter Weldon, so that his chlorine process might receive a fair trial. Here at the Gerard's Bridge Works, under Sir David's guidance, and with the able support of the manager, Mr. Edward Bramwell, the necessary plant and machinery were erected for carrying out the process on a working scale, (see also this J., 1885, 578).

Of Sir David Gamble's inventions, the "boat pan" for evaporating and concentrating soda solutions, and a "plus-pressure furnace," are best known. He also greatly improved the construction of the salt cake furnace. He was one of the first to manufacture potassium chlorate on the large scale. At that period it was sold at 4s. 6d. per lb. He was also one of the earliest makers of Epsom salts, first from magnesium carbonate imported from Eubœa, and more recently from *Kieserite*. Gamble was the first, in 1880, to manufacture sodium chlorate on a large scale, the process for this, as well as for barium chlorate, being carried on in the Gerard's Bridge Works (1881). Here also, about 1890, he commenced the manufacture of "Pearl hardening" (precipitated calcium sulphate), wherein he utilised the calcium sulphate produced in the manufacture of sodium chlorate. Sir David Gamble may be regarded as one of the leading pioneers of the second generation of chemical manufacturers, when apparatus on an extended laboratory scale began to be replaced by the machinery and plant of the modern chemical factory. He may be defined as one of the originators of modern chemical engineering. As an example of his early capacity in the application of machinery in chemical operations, Gamble was the first to make use of a hydro-extractor for freeing "soda crystals" from mother-liquor. As a model of the application of modern chemical engineering in the solution of such a problem as that of the Weldon-Pechiney process, for the production of chlorine and hydrochloric acid, see Gamble, this J., 1889, 776—777. Sir David Gamble took a prominent part in the local affairs of St. Helens. In 1897 he was created a baronet, thus becoming the first baronet of Windlehurst, and in 1904, he became a Knight Commander of the Bath. He was the first honorary freeman of St. Helens. In 1894, he made provision for the establishment of a pupil teachers' centre and evening technical classes in St. Helens, by erecting, at a cost of £36,000, and presenting to the town, the "Gamble Institute."

He was an original member of the Society of Chemical Industry, and served as a vice-president from the year 1884 to 1886.

Sir David Gamble died on Monday, Feb. 4, at his residence, Windlehurst, St. Helens, Lancashire.

Journal and Patent Literature.

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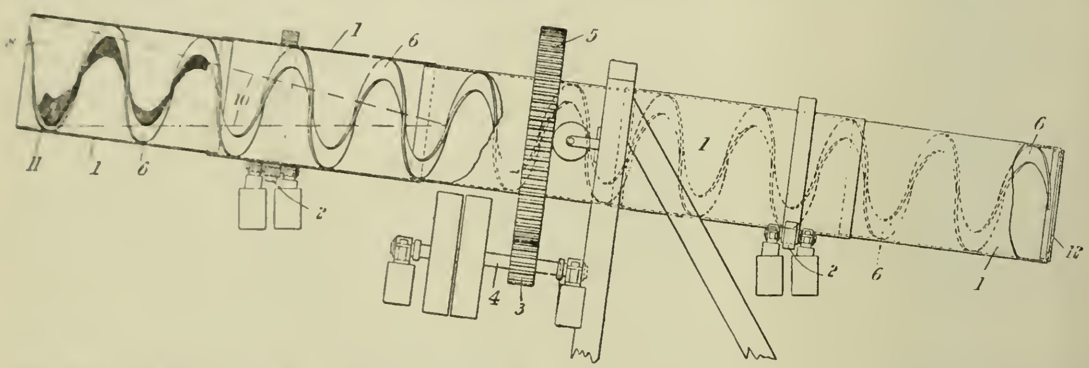
I.—PLANT, APPARATUS, & MACHINERY.

(*Continued from page* 190.)

ENGLISH PATENTS.

Air or gas filters; Method of and apparatus for cleaning ——. P. Kestner, Lille, France. Eng. Pat. 2870, Feb. 6, 1906.

THE flannelette or other fabric through which the gas is passed, is cleaned by applying suction in the opposite direction through that in which the gas flows. The suction is applied through an exhaust nozzle, which only covers a small portion of the area of the filtering surface. Two motions are imparted to the nozzle to cause it to travel over the whole of the surface to be cleaned. As only a small fraction of the surface is covered by the nozzle at once, the process of filtering the gas is not impeded.—W. H. C.



Filtering process, and apparatus therefor. H. Bolze, Worms a/Rh., Germany. Eng. Pat. 5256, March 3, 1906.

THE invention relates to the cleaning of filters formed by porous tubes, closed at the upper end and imbedded in sand. The cleaning is performed by rapidly running off the water and allowing the tubes to fill with air, then causing a portion of the filtered water to flow in a reverse direction through the tubes, and drive the air through the pores into the sand. The water follows the air, and completes the cleansing operation. At the same time the upper surface of the sand is stirred up by rakes, and a wave formed in the water above the sand by the movement of a blade or paddle carries the water containing the impurities into troughs at the side of the filter.—W.H.C.

Filtering media; Process and apparatus for washing loose ——. H. Reisert, Cologne, Germany. Eng. Pat. 18,269, Aug. 14, 1906.

SEE Fr. Pat. 369,656 of 1906; this J., 1907, 40.—T. F. B.

Steam; Apparatus for determining the percentage dryness of ——. P. M. Pritchard and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 12,615, May 30, 1906.

THE steam is passed through the innermost of two concentric tubes, which may be bent into a coil, and the condensing water is caused to flow in an opposite direction through the annular space between the tubes. The coil may be covered with heat insulating composition, and be surrounded by an outer removable casing. The temperatures of the incoming and outflowing cooling water, and of the incoming steam and escaping condensed water, are measured by thermometers placed in sockets at the ends of the coil. The amounts of cooling water and of condensed steam are measured, and the percentage dryness of the steam can then be calculated by the use of tables showing the total heat in a given weight of dry steam at various temperatures.—W. H. C.

Liquids, or solutions, and solids; Apparatus for use in bringing into contact with each other ——. P. M. Pritchard and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 12,616, May 30, 1906.

THE apparatus consists of an inclined cylinder, 1, supported on friction-wheels, 2, and rotated by the mechanism, 3, 4, 5. A helical blade, 6, is fastened at one side to the interior wall of the cylinder, and is of greatest width at the lower end, but tapers off in width towards the upper end, so that its inner edge corresponds with the side of an imaginary cone indicated by the dotted lines, 10. At the upper end, the blade is provided with an extension of wire gauze, 11, which will allow liquids and suspended solids to pass through, but will retain the larger solid pieces. The solid material to be lixiviated, is fed into the lower end of the cylinder, and is carried upwards by the screw, the insoluble portion being discharged from the upper end, 8. The liquid is fed in at the upper end, where it meets the nearly exhausted solid material, and flows downwards, meeting less and less exhausted material, and becoming progressively more concentrated. It is finally discharged through the open lower end, 12, of the cylinder.—W. H. C.

FRENCH PATENTS.

Evaporation or absorption vat for the treatment of liquids. A. Montoy. Fr. Pat. 361,998, Dec. 16, 1905.

A FRAME is covered on both sides with a porous membrane, the joints being made with india-rubber, and the membrane is prevented from breaking by a support formed of large-mesh wire trellis. The liquid is admitted to the interior of the chamber so formed, and, owing to the large surface exposed, is readily evaporated, or saturated with any gas or vapour to which it may be exposed. Several of such frames may be combined together to increase the capacity of the apparatus.—W. H. C.

Evaporator with lateral heaters for separating liquids from saline matters in solution. Soc. G. Sauerbrey. Fr. Pat. 370,691, Oct. 23, 1906.

To prevent the deposited saline matters from coming into contact with the tubes of the heaters and incrusting them, the latter are arranged outside the main chamber of the evaporator. The upper part of this chamber is divided into two concentric compartments by a partition of cylindrical or other suitable shape, so disposed that the solution to be evaporated ascends the outer annular space between the partition and the outer wall, and circulates through the heaters, re-entering the main chamber at the top of the central space, where the vaporised portion escapes, leaving the crystals to fall down into the conical

bottom of the chamber. This arrangement maintains the circulation of the liquid, whilst the crystals are deposited and left undisturbed by the flow of the liquid.
—C. S.

Liquefaction of gases. "Soc. L'Air Liquide." Fr. Pat. 370,850, Jan. 4, 1906.

The claims are for feeding the liquefaction chambers with compressed gas different from that which is allowed to expand, and which has a higher critical temperature; for the use of previously cooled and compressed oxygen for feeding the liquefaction chambers when the gas which is allowed to expand has to perform external work, and for feeding the expansion chambers also when there is no external work to be done; for the use of previously cooled and compressed nitrogen instead of air, to be expanded in the apparatus when external work has to be done.
—W. H. C.

Filter; Centrifugal ——. P. Cazenave. Fr. Pat. 370,311, Oct. 8, 1906.

A concentric cylinder of pervious material is placed within the drum of a centrifugal machine in order to retain the solid particles. The liquid passes through the filter, and the solids collect on the surface. If the solid particles are heavier than the liquid, the mixture is introduced into the bottom of the annular space between the filter and the drum. The liquid passes through, and the solids collect on the outer surface of the filter, from which they are continuously removed by the action of the centrifugal force, so that the filtering surface remains clean, and the solids collect on the interior wall of the drum, from which they are from time to time removed. If the solids are lighter than the liquid, the mixture is introduced into the interior of the filter, the denser liquid passes through, and the solids remain on the interior surface of the filter, from which they are also continuously removed. owing to the tendency of the lighter liquid to displace them backwards towards the axis of the machine.
—W. H. C.

Pressure filters. W. H. Dopp. Fr. Pat. 370,934, Oct. 29, 1906.

The claim is for a form of rotary pressure filter in which the filtering elements are disposed between filling and discharging chambers. The filtering surface extends beyond these chambers, so that whilst the part between them is acting as a filter, the part without is undergoing the operations of cleaning, sterilisation, and aëration. The joints are made with rubber bands, which are kept tight by the outward pressure of the water.—W. H. C.

Agitating and mixing apparatus; Centrifugal ——. M. Horrowitz. Fr. Pat. 370,438, Oct. 12, 1906.

One or more tubes of different lengths are mounted concentrically on a vertical shaft, which is supported by bearings in a tank, and rotated by suitable mechanism from above. The tubes have a funnel shape above and communicate below with a shallow chamber formed by two parallel horizontal discs fastened to the shaft near the bottom and divided into compartments by radial partitions. The liquids are drawn into the top of the tubes and are thrown out, and thoroughly mixed, from the open space between the edges of the discs.—W. H. C.

Distilling apparatus; Still-head and collector-head for ——. J. Fourré. Fr. Pat. 370,537, Oct. 17, 1906.

The heads of the still and collector are each hollow, enclosing a space to be traversed by vapours. The upper surface of each head is corrugated in the shape of a spiral, forming a channel for the cooling water, by means of which the less volatile distillation products are condensed. In the case of the still-head the condensed products run down into a liquid seal and on reaching a certain level, overflow into the still. In the case of the collector, the condensed products flow from the interior of the vessel, through a siphon leading back to the still, whilst the uncondensed vapour escapes to the condenser.—C. S.

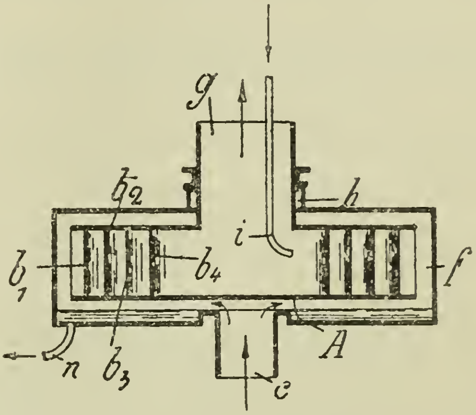
Centrifugal apparatus for separating liquids; Column for ——. Soc. Massey-Harris. Fr. Pat. 370,577, Oct. 18, 1906.

The column or liner consists of two concentric piles or series of conical discs inclined in opposite directions, and mounted on the shaft within the bowl or drum of the machine. The outer series contains a smaller number of discs than the inner, to cause the formation of fresh layers or strata as the liquids pass from the inner to the outer series of discs.—W. H. C.

Drying stove. G. A. Mower and W. J. Bassett. Fr. Pat. 370,968, Oct. 30, 1906. Under Int. Conv., Feb. 12, 1906.

See Eng. Pat. 3458 of 1906; this J., 1907, 11.—T. F. B.

Gases and liquids; Process for mixing intimately ——. P. Winand. Fr. Pat. 371,147, Nov. 6, 1906. Under Int. Conv., Nov. 7, 1905.



A hollow cylinder, or drum, A, having several concentric perforated walls, b_1, b_2, b_3, b_4, is rotated in the casing, *f*, by a hollow shaft, *g*, which passes through the stuffing-box, *h*. The liquid is fed into the interior of the cylinder, A, by the pipe, *i*, and is thrown by centrifugal force against the concentric walls, upon the surface of which it forms a film, and passes through the perforations from plate to plate, finally escaping by the pipe, *n*. The gas enters by the pipe, *c*, and passes from the periphery to the axis of the drum, through the perforated walls, where it comes into intimate contact with the films of liquid, and leaves by the hollow shaft, *g*.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 192.)

English Patents.

Coal and other materials; Apparatus for washing ——. The Hardy Patent Pick Co., Ltd., and G. Smith, Sheffield. Eng. Pat. 8037, April 3, 1906.

This invention relates to the type of coal washing apparatus in which the material to be washed is drawn up an inclined trough, by a suitable conveyor, against a downward current of water, and consists in the use of scrapers, blades, &c., on the conveyor, formed with convex, concave, corrugated or analogous surfaces, with or without more or less irregular or uneven top edges, for the purpose of setting up a number of cross currents, so that the volume of water becomes evenly distributed over the washing trough.—W. C. H.

Fuel briquettes. S. Suski, Kiew, Russia. Eng. Pat. 13,355, June 9, 1906.

The briquettes are composed of a basis of ground anthracite or brown coal and a binding agent consisting of either coal tar, "earth pitch," bitumen, asphaltum, or petroleum waste, together with manganese dioxide. The briquettes are of great hardness and durability.—A. T. L.

Coke ovens ; Vertical flue ——. C. Wilke, Sheffield, and Simon-Carves Bye-Product and Coke Oven Construction and Working Co., Ltd., Manchester. Eng. Pat. 14,281, June 22, 1906.

See Fr. Pat. 370,599 of 1906 ; following these.—T. F. B.

Gas retorts or coke-ovens ; Withdrawal of gases from ——. W. Beimann, Bishop Auckland. Eng. Pat. 4001, Feb. 17 1906.

A water-jet pump or injector, placed in a convenient position in the gas main between the condenser and scrubber, is used to withdraw the gases instead of an exhauster. The jet is fed with weak ammoniacal liquor under pressure, which is withdrawn from the gas main further on, and returned by a circulating pump to the jet to be used over again until it becomes so saturated that it ceases to absorb ammonia. The spray of liquor issuing from the jet is said to remove the particles of tar as well as the ammonia from the gas.—W. H. C.

Generator or producer gas : Manufacture of ——. F. Bauke, Berlin. Eng. Pat. 8670, April 10, 1906

See Fr. Pat. 365 334 of 1906 ; this J., 1906, 920.—T. F. B.

Gas ; Process of and apparatus for manufacturing ——. P. I. Cohen, New York. Eng. Pat. 16,600, July 23, 1906.

See U.S. Pat. 827,081 of 1906 ; this J., 1906, 842.—T. F. B.

Gas purifying devices of suction and other gas plant. R. V. Farnham, Wemyss Bay, Renfrewshire. Eng. Pat. 11,213, May 14, 1906.

This invention relates to gas purifying or scrubbing apparatus, in which a cylinder is provided near the top with a lateral gas-inlet, and contains coke, over which water flows from a water tank, arranged in the upper portion of the cylinder, and provided with a perforated bottom. The improvements consist in the provision of a perforated ring, arranged round the outside of the water tank, just below the cover of the cylinder, by which a ring or band of water can be produced on the outside of the water tank, in order to prevent the deposition of tarry and other matters upon it.—W. C. H.

Carbonic acid in flue and other gases ; Apparatus for indicating and recording the percentage of ——. W. H. Porter. Eng. Pat. 9540, April 24, 1906. XXIII., page 280.

Incandescing bodies for electric incandescent lamps ; Manufacture of ——. A. Just and F. Hanaman, Budapest ; H. Landesberger and I. Salzmann, Vienna ; and Verein. Elektricitäts A.-G., Ujpest, Hungary. Eng. Pats. 3213, Feb. 9 ; 3684, Feb. 14 ; and 4081, Feb. 19, 1906.

See Third, Fifth, and Fourth Additions respectively, to Fr. Pat. 347,661 of 1904 ; this J., 1906, 976, 877, and 976.—T. F. B.

Filaments for incandescent electric lamps. A. Bourdos, R. Rothschild, and J. W. Sutcliffe, London. Eng. Pat. 11,279, May 14, 1906.

A durable and efficient filament, which conducts electricity without preliminary heating, is made from pitchblende by the following process. The pitchblende is subjected to the action of a chlorine-yielding liquid, such as a solution containing 20 per cent. of commercial hydrochloric acid, for two or three days, till no more gas is evolved. A pumice-like mass and a pulverulent precipitate are formed. These are thoroughly washed with water, formed into a mass with the addition of an oxygen-free oil and metallic sodium (1 part of sodium to 3 of the pitchblende product), and heated in a closed vessel—for example, by an arc just above the surface of the mass—until the mass is melted. The product is powdered, mixed with a binding substance such as caoutchouc, and formed into or used for coating filaments. These filaments are strongly heated in a closed crucible containing powdered charcoal and graphite, and finally they are heated electrically in a current of hydrogen or other inert gas.—A. T. L.

United States Patents.

Gas ; Process of making ——. H. Dicke, Assignor to J. E. Goldschmid, Frankfort-on-Maine, Germany. U.S. Pat. 839,459, Dec. 25, 1906.

See Eng. Pat. 14,759 of 1901 ; this J., 1902, 961.—T. F. B.

Gas for power purposes ; Process of producing ——. F. W. Barker, Nyack, and T. L. White, New York, Assignors to J. F. Coffin, New York. U.S. Pat. 839,798, Dec. 25, 1906.

This process for producing gas for power purposes consists in bringing a spray of dilute alcohol into contact with calcium carbide, and in simultaneously passing air through the carbide.—W. C. H.

French Patents.

Sewage ; Treatment of —— *[for fuel].* A. M. Muguet. Fr. Pat. 361,994, Dec. 14, 1905. XVIII*B.*, page 273.

[Briquettes] Agglomerated combustibles ; Process of manufacture of ——. V. Conti. Fr. Pat. 370,804, Dec. 30, 1905.

By this process briquettes are made of combustible material bound together with a special binding agent. This agglutinant consists of a mixture of tar and resin with an oxide or chlorine, to which may be added, individually or collectively, in twos, threes, or fours, salts of ammonium, potassium, or sodium.—W. C. H.

[Briquettes] Agglomerated combustible. L. Bouland. First Addition, dated Oct. 16, 1906, to Fr. Pat. 364,497, March 22, 1906.

According to this invention, about 50 kilos. of carbon, derived from the combustion of waste paper, are mixed with 25 kilos. of rich shale or other oil into a paste. About 40 kilos. of waste fish or meat are digested with 10 kilos. of sodium nitrate, or about 50 kilos. of petroleum coke may be used instead of the fish or meat. These two mixtures are worked up into a pasty mass, weighing about 125 kilos., to which 1000 kilos. of dried, ground sewage are added, together with about 25 kilos. of soft petroleum resin. From this composition the briquettes are made. —W. C. H.

Briquettes made with any kind of charcoal, and agglomerated with a gum and residual denatured molasses ; Process of manufacture of ——. F. G. Monges. Fr. Pat. 370,725, Oct. 24, 1906.

By the process described, briquettes are made from any kind of charcoal or coke, which is first ground, and then purified by means of dry vapour " from lime, either alkaline or acid," or of steam. The ground carbonaceous material is agglutinated by a binding material composed of any gum and residual denatured molasses, and the mass is pressed into the form of briquettes, which are dried in a furnace.—W. C. H.

Fuel ; Artificial ——, *and its manufacture.* J. J. Shedlock. Fr. Pat. 371,111, Nov. 5, 1906. Under Int. Conv., Nov. 6, 1905.

See Eng. Pat. 22,677 of 1905 ; this J., 1906, 1210.—T. F. B.

Coke-oven. Simon-Carves Bye-product Coke Oven Construction and Working Co., Ltd. Fr. Pat. 370,599, Oct. 19, 1906. Under Int. Conv., June 22, 1906.

This invention relates to coke-ovens with vertical flues, and to an arrangement by which the operator can control the admission of air and gas to each flue or system of flues, from a point at some distance from that at which combustion occurs. This object is attained by having the conduits which connect the air chambers with the flues, arranged so that they can be controlled from the outside of the oven or battery of ovens, and a similar arrangement for the control of the conduits connecting the gas chambers with the flues. Each group of flues is provided with an air or gas chamber, from the back wall of which the flues start, and which is arranged to allow of the easy control of the conduits from the outside. The chambers can be arranged separately, and made use of together.—W. C. H.

Gas ; Manufacture of permanent illuminating and heating ——. W. J. Dibdin and H. C. Woltereck. Fr. Pat. 371,192, Oct. 18, 1906.

See Eng. Pat. 26,666 of 1905 ; this J., 1906, 1130.—T. F. B.

Carburetted air ; Manufacture of ——. R. Busch and T. Lampe. Fr. Pat. 371,002, Oct. 23, 1906.

The important features of the invention are the construction of the air-blower and carburetter, a device for supplying the carburetting liquid continuously in proportion to the amount of air carburetted, and means for driving and controlling the various parts of the apparatus. The blower is of similar construction to a wet-meter for gas, and the drum is so designed, that by varying the inclination of the straight passages leading from the inlet compartments to the delivery, blowers of the same size may be constructed to deliver air at different pressures. The carburetter is a vertical cylindrical casing containing horizontal plates, which are alternately circular and annular, leaving alternately annular and circular passages for the air. Air from the blower enters at the top of the carburetter through a central rose, having a number of nozzles arranged to impart a whirling motion to the air. A continuous stream of the carburetting liquid enters from a vertical pipe in the centre of this rose, and passes downwards through the carburetter with the air. The whirling motion of the air spreads the liquid outward over the discs and inward over the annular plates, keeping them wetted over the whole surface. The carburetted air passes to one or more gas-holders. The fuel-supply tank contains a plunger which is lowered by worm and wheel, and rack and pinion gearing, driven from the driving gear of the air compressor. The air compressor is driven by a falling weight or by a hot-air engine. If the air pressure rise too high, it depresses liquid in a vessel and raises the liquid in a vessel connected thereto, thus raising a float, which by suitable mechanism, brakes the air compressor. A similar device throws the hot-air engine out of gear and applies a brake to it. The rise and fall of the gas-holder actuates levers connected to the inlet and outlet valves and to the driving gear of the compressor in such a way that when the output is low, or no gas at all is required, the apparatus is stopped when the gas-holder is full, the inlet valve to the holder being closed suddenly, and at normal output the production of gas is controlled by gradually closing this valve. A compressed-air reservoir may supply air to the carburetter in case of need.—A. T. L.

Carburetted air ; Apparatus for the production of ——. W. von Dulong. Fr. Pat. 371,005, Oct. 31, 1906.

Air is caused to pass through straight narrow passages, the walls of which are kept wetted with the liquid hydrocarbon. Several forms of apparatus are described. In one form, a cylindrical casing contains a number of close-fitting perforated circular plates mounted on a revolving horizontal shaft and dipping into the liquid, and the air passes through the perforations in successive plates. The perforations are not too small to be filled with the liquid, and 2·5 mm. is given as a minimum diameter. The total area of the perforations in each plate should not be much greater than that of the suction pipe of the engine. Instead of being perforated, the plates may consist of concentric rings leaving narrow annular passages, staggered in adjacent plates, or each plate may be replaced by a strip of metal bent into a helix. In every case, the plates may be stationary, and wetted by sprinkling the liquid from the top of the casing between adjacent plates, and the plates may then with advantage be inclined instead of vertical. In a further modification there are two sets of vertical rectangular plates alternately dipped into the liquid and raised into the carburetting space by cam-actuated links and levers driven from the engine.—A. T. L.

Gas generator. C. L. Armstrong. Fr. Pat. 371,051, Nov. 3, 1906.

See U.S. Pat. 837,026 of 1906 ; this J., 1907, 144.—T. F. B.

Suction gas-producer. Les Fils de A. Piat et Cie. Fr. Pat. 371,078, Nov. 3, 1906.

The improvements claimed relate chiefly to regulating automatically the quantity of steam admitted to the producer, superheating the mixed air and steam for the producer, and to a special construction of fuel container. The steam is generated in a vaporiser consisting of a depending tube with radial wings placed in the gas outlet pipe. The steam-space is open to the air through a pipe of a certain length and cross-section, and the suction of the engine draws steam and air from the vaporiser into a superheater consisting of an annular cast-iron vessel surrounding the lower part of the fire, and containing a small quantity of water. The inner and outer walls of the superheater are of inverted conical shape. The ash-pit is below the superheater, and there is no grate, the fuel resting on the ashes, &c., in the ash-pit. Clinkers do not adhere to the metal wall of the superheater in contact with the fire. A further supply of air is admitted to the superheater through a balanced vertical flap-valve, the movement of which is limited by an adjustable stop. The superheated air and steam pass by a pipe to the ash-pit. The fuel container is formed of two castings bolted together by an external flange at a lower level than the gas outlet, the annular space between this flange and the lining of the producer being not greater in area than the gas-outlet pipe. The upper casting is approximately cylindrical, and the lower one sharply conical. The whole arrangement prevents the gas from taking a direct path through the fuel towards the gas-outlet, and from passing up mainly near the walls. A second producer is described in which the vaporiser is an annular vessel which forms the upper part of the shell of the producer above the level of the fire, and the superheater is replaced by a "saturator" differing from the former in having its outer wall cylindrical and containing a considerable body of water. The steam and air space of the saturator is connected with the ash-pit below by a number of vertical tubes. The steam and air pipe from the vaporiser is connected to the vertical branch of a ⊥-piece, which is placed between the starting fan and the "saturator." A hinged flap-valve closes either the vertical branch of the ⊥-piece or the horizontal branch leading from the starting fan, so that it is only necessary to turn this one valve in order to connect the fan to the saturator, and shut off the vaporiser for starting, or *vice versa*, for normal working.—A. T. L.

Suction gas producer for the simultaneous production of producer gas and steam. A. L. E. Guiot. Fr. Pat. 370,851, Oct. 26. 1906.

The gas producer is a cylindrical iron chamber, without the usual refractory lining, having at the base a grate and ash-pit, and at the top a central outlet for the gas, the whole being surrounded by water in a cylindrical vessel having a steam-space at the top and the usual boiler fittings. Depending tubes from the top-plate of the producer increase the heating surface for steam-raising. The outlet for producer gas consists of a vertical tube extending through the steam-space of the boiler. This tube has a horizontal branch, outside the boiler, connected to the gas main. The feeding hopper is placed above the vertical gas outlet. A fire door at the lower part of the boiler gives access to the interior of the producer. The producer is started by forcing in air below the grate from a hand-driven fan, and is subsequently worked by a steam-jet air-injector connected with the steam-space of the boiler. The upper layers of fuel are relatively cool owing to radiation to the surrounding water-cooled surfaces, and in consequence bituminous coal as well as anthracite can be used in the producer. A special device for breaking up the clinker whilst the producer is in operation, consists of a frame in the ash-pit carrying four vertical rods, which project through the grate when a lever or pedal pivoted on the fire-door casting is depressed.—A. T. L.

Gases ; Process and apparatus for determining and registering the quality of——. C. V. Burton and The Cambridge Scientific Instrument Co., Ltd. Fr. Pat. 371,123, Nov. 6, 1906. Under Int. Conv., Nov. 8, 1905.

See Eng. Pat. 22,919 of 1905 ; this J., 1906, 1210.—T. F. B.

Jute fibres ; Process for the disaggregation of ——. T. E. Schiefner. Fr. Pat. 371,033, Nov. 2, 1906. V., page 253.

Filaments of tungsten, molybdenum, or their alloys for incandescence lamps; Manufacture of ——. J. Lux. Fr. Pat. 370,790, Dec. 28, 1905.

See Eng. Pat. 27,002 of 1905; this J., 1907, 42.—T. F. B.

Tungsten or molybdenum incandescence filaments; Process for making uniform ——. J. Lux. Fr. Pat. 371,148, Nov. 6, 1906.

This process for producing incandescent filaments of tungsten and molybdenum of uniform cross-section consists in bringing the finished metallic filaments to incandescence, and then exposing them to the attenuated vapours of halogens or of compounds of them, whereby volatile halogen compounds of the metals are formed, which are immediately dissociated by the incandescent filament, and chiefly so at the hottest—*i.e.*, the thinnest parts of the filament, which then become thickened by the deposition of the metal at those points. One method of carrying out the process consists in admitting highly attenuated halogen vapours into the exhausted lamp bulb containing the tungsten or molybdenum filaments, so that during the working of the lamp a continuous process of making the filament uniform goes on.—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 193.)

French Patents.

Tar oil emulsions for impregnating wood. W. Wildenhayn. Fr. Pat. 370,682, Oct. 22, 1906. IX., page 257.

Paraffin; Process for refining ——. J. Mijs Az. Fr. Pat. 370,796, Dec. 29, 1905.

See Eng. Pat. 495 of 1906; this J., 1907, 86.—T. F. B.

Hydrocarbons; Process for oxidising ——. Soc. Anon. des Combustibles Industriels. First Addition, dated Dec. 30, 1905, to Fr. Pat. 349,214, Dec. 19, 1904 (this J., 1905, 668).

The addition relates to the use of purified and heated air, with or without oxidising agents, for the attainment of a partial oxidation of the hydrocarbons. The dehydrogenised bodies thus formed, re-combine, or condense, into products of more condensed molecular arrangement.
—W. H. C.

Mineral oils; Method of refining ——. J. Noad and E. J. Townsend. Fr. Pat. 370,693, Oct. 19, 1906.

The oil is heated in a still to a temperature below distillation point, and air is blown through the oil, when the more volatile portions are vaporised. The mixture of air and oil vapour is then passed through one or more separators, in which the more readily condensable fractions are condensed and collected, whilst the more volatile portions are led through a condenser.—C. S.

German Patent.

Pitch from tar and heavy tar oils; Process for producing ——. Chem. Fabr. Flörsheim, Dr. H. Noerdlinger. Ger. Pat. 171,380, Jan. 26, 1904. Addition to Ger. Pat. 163,446, June 18, 1903.

Tar, other than beech- or birch-wood tar (see this J., 1906, 367 and 529), is heated, and a strong current of air, oxygen, or ozonised air passed through it until the residue has attained the desired consistency; the volatile products are condensed and separated. The process is also applicable to the production of pitch from heavy tar oils.
—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 195.)

α-Naphthoquinone, β-naphthoquinone, phthalonic acid, and phthalic acid; Detection and determination of ——, [*and the fluorescein reaction*]. M. C. Boswell. XXIII., page 282.

Cellulose and dextrose; Condensation of aromatic hydrocarbons with ——. A. Nastukoff. XXIV., page 282.

English Patent.

Condensing agents for use in the manufacture of synthetic indigo and other products formed by condensation. H. Belart, Brugg, Switzerland. Eng. Pat. 2927, Feb. 7, 1906.

See Fr. Pat. 369,907 of 1906; this J., 1907, 195.—T. F. B.

United States Patents.

Indoxyl, &c.; Process of making ——. A. Bischler, Assignor to Basle Chemical Works, Basle. U.S. Pat. 839,099, Dec. 25, 1906.

See Eng. Pat. 15,223 of 1904; this J., 1905, 614.—T. F. B.

Dyestuff; Red disazo ——. W. Bauer, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 839,360, Dec. 25, 1906.

See Fr. Pat. 365,582 of 1906; this J., 1906, 979.—T. F. B.

Dyestuff; Red azo ——. O. Günther, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 839,382, Dec. 25, 1906.

See Fr. Pat. 364,406 of 1906; this J., 1906, 923.—T. F. B.

Dye; Black mordant ——, *and process of making same.* A. L. Laska, Offenbach-on-the-Maine, Assignor to Chem. Fabr. Griesheim - Elektron, Frankfort-on-the-Maine, Germany. U.S. Pat. 839,489, Dec. 25, 1906.

Mordant azo dyestuffs are prepared by combining, in concentrated solutions, 1·2-diazonaphthol-4-sulphonic acid with hydroxydiphenylamine derivatives of the type, $(3)OH.C_6H_4.NH.C_6H_4X$, where X represents hydrogen or a methyl group. The dyestuff obtained when the methyl derivative is used, is a black-brown powder, soluble in concentrated sulphuric acid, with a violet to bluish-violet colour, and in water with a violet colour, which is rendered more bluish by addition of sodium carbonate, and more reddish by addition of sodium hydroxide. In an acid bath it dyes wool in black-violet tints, changed to reddish-black on subsequent treatment with a bichromate.—A. S.

Dyestuff; Yellow azo ——. A. Kuchenbecker, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 839,605, Dec. 25, 1906.

See Eng. Pat. 2622 of 1906; this J., 1906, 922.—T. F. B.

French Patents.

Dyestuffs of the triphenylmethane series; Manufacture of blue to violet ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 361,989, Dec. 13, 1905.

See Eng. Pat. 25,498 of 1905; this J., 1906, 844.—T. F. B.

Indophenol derived from the simultaneous oxidation of p-phenylenediamine and phenol; Manufacture of the ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 370,787, Dec. 27, 1905.

See Eng. Pat. 27,000 of 1905; this J., 1906, 922.—T. F. B.

Dyestuffs; Process of making o-oxymonoazo ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Dec. 21, 1905, to Fr. Pat. 361,649, July 26, 1905.

See U.S. Pat. 827,468 of 1906; this J., 1906, 922.—T. F. B

Anthracene; Production of a series of new derivatives and dyestuffs from ——. Badische Anilin und Soda Fabrik. Ninth Addition, dated Oct. 1, 1906, to Fr. Pat. 349,531 of Dec. 21, 1904.

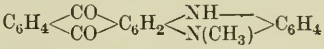
When benzanthrone or benzanthronequinoleine or their derivatives are subjected to the action of chlorine or bromine, mono- and di-substitution products are obtained, which by treatment with caustic alkalis, yield vat dyestuffs dyeing cotton red-violet to blue. Monochlorobenzanthrone is obtained by passing a stream of chlorine through finely-divided benzanthrone suspended in fifty times its weight of water, until the colour of the paste, originally green, becomes yellow. It is also prepared by warming a mixture of 10 kilos. of benzanthrone, 200 kilos. of acetic acid (50 per cent.), and 6 kilos. of potassium chlorate to 90°—95° C., and then slowly adding during one hour 12 kilos. of concentrated hydrochloric acid. The product is a brownish-yellow powder soluble in most organic solvents. When crystallised from glacial acetic acid, it forms yellow needles, melting at 176° C. By taking 10 kilos. of potassium chlorate and 24 kilos. of concentrated hydrochloric acid, and heating the product for three hours on the water-bath, the dichloro-derivatives are obtained. Dichlorobenzanthrones are also prepared by passing a current of chlorine at 60°—70° C. through a solution of benzanthrone in 20 times its weight of glacial acetic acid. The product contains two isomeric dichloro-derivatives, which can be separated by fractional crystallisation from nitrobenzene or glacial acetic acid. The less soluble isomeride crystallises in long yellow needles, melting at 269° C., whilst the more soluble compound crystallises in long yellow needles, melting at 218° C. The chlorination may also be effected by means of sulphuryl chloride in presence of nitrobenzene, the mixture being finally heated to 140°—150° C. Monobromobenzanthrone is obtained as follows:—25 kilos. of benzanthrone are dissolved in 500 kilos. of glacial acetic acid, and 80 kilos. of a 25 per cent. solution of bromine in glacial acetic acid added at 80° C. The mixture is heated to 90°—100° C., until the evolution of hydrobromic acid has ceased. The product is washed with glacial acetic acid, and then with water, and finally dried. In this way a green powder is obtained, which gives a yellow solution with most organic solvents. It crystallises from alcohol or glacial acetic acid in brilliant yellow needles, melting at 170° C. Dibromobenzanthrone is obtained by gradually adding 10 kilos. of benzanthrone to 50 kilos. of bromine, and allowing the mixture to remain for 24 hours. The excess of bromine is removed by glacial acetic acid, and a yellowish-green powder results, which is readily soluble in organic solvents and crystallises from nitrobenzene or glacial acetic acid in small yellow needles, melting at 257° C. The same substance is formed by adding the calculated quantity of bromine to benzanthrone suspended in 25 times its weight of water, and warming for four hours to 90°—95° C. By using half this quantity of bromine, the monobromo-derivative is obtained. In a similar manner monobromobenzanthrone-α-sulphonic acid, monobromobenzanthronequinoleine, m. pt., 298° C., and chlorobenzanthronequinoleine are prepared. *Preparation of the dyestuffs.*—Example: 20 kilos. of caustic potash are heated with 20—25 kilos. of absolute alcohol, until a clear solution is obtained and the temperature is 140° C.; 5 kilos. of monochlorobenzanthrone are now added, and the mixture heated for half-hour to 150° C. The chloro-derivative dissolves at once with a blue coloration, which changes to violet-red. Water is now added, and the solution boiled, or air passed through, whereby the dyestuff is precipitated. This is free from chlorine, and consists of a violet-black powder, insoluble in water, acids, or alkalis. When reduced in alkaline solution, a blue vat is obtained, which produces a reddish-violet colour on cotton. The other halogen derivatives already described yield similar dyestuffs.—J. C. C.

Dyestuffs; Production of new azo ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 370,265, Oct. 5, 1906. Under Int. Conv., June 5 and 29, 1906.

A new azo-dyestuff, dyeing cotton bright bluish-red shades fast to acids and light, is obtained as follows:—18·4 kilos. of benzidine are tetrazotised, and the solution poured into a cold solution of 31 kilos. of 2-naphthylamine-3 : 6-disulphonic acid and excess of sodium acetate. When the formation of the intermediate product is complete, a neutral solution of 24 kilos. of 2-amino-8-naphthol-6-sulphonic acid is added. After warming to 30° C. to complete the combination, the mixture is rendered alkaline by adding sodium carbonate, and the dyestuff is salted out. Other diamines may be used, and the γ-acid can also be combined first instead of last.—J. C. C.

Anthracene derivatives [dyestuffs]; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 371,219, Oct. 30, 1906. Under Int. Conv., Dec. 20, 1905.

o-Aminoarylaminoanthraquinones condense with aldehydes in the presence of acetic acid to form new anthraquinone derivatives. Thus, β-amino-α-anilido-anthraquinone and formaldehyde yield the compound:—



$$C_6H_4{<}\begin{matrix}CO\\CO\end{matrix}{>}C_6H_2{<}\begin{matrix}NH\text{——}\\N(CH_3)\end{matrix}{>}C_6H_4$$

The sulphonic acids of these new compounds dye wool in solid shades, varying from blue to green. Examples are given, of which the following is typical:—10 kilos. of 1-paratolylamino-2-aminoanthraquinone (obtained by the action of p-toluidine on 1-nitro-2-aminoanthraquinone), are heated to about 100° C. with 100 kilos. of glacial acetic acid, and 10 kilos. of a 40 per cent. aqueous solution of formaldehyde are added to the mixture. The colour immediately changes from a violet-red to a deep blue, and the condensation product separates on cooling as a blue crystalline precipitate, which can be recrystallised from glacial acetic acid or from pyridine. The sulphonic acid of this compound is obtained by treating it with fuming sulphuric acid containing 3 per cent. of sulphur trioxide. It dyes wool a greenish-blue shade.—P. F. C.

Alkyldiaminoarylthiosulphonic acids and gallic acid and its derivatives: Production of condensation products of —— and their conversion into gallothionines. Manuf. Mat. Col., ancien. Durand, Huguenin et Cie. Fr. Pat. 370,294, Oct. 6, 1906. Under Int. Conv., July 9, 1906.

See Eng. Pat. 20,397 of 1906; this J., 1907, 44.—T. F. B.

Dyestuffs; Production of new black [sulphide] ——. G. E. Junius. Fr. Pat. 371,119, Nov. 6, 1906. Under Int. Conv., Nov. 7 and Dec. 7, 1905.

If nitroso-o-cresol be heated with sodium sulphide and sulphur in the presence of water, a black sulphide dyestuff is formed. The shade of the black depends on the proportions of the constituents of the mixture. A product having good tinctorial properties is only obtained by this reaction when the methyl group of the nitrosocresol is in the ortho position. *Example*: 7 parts of nitroso-o-cresol are mixed with 10 parts of crystallised sodium sulphide, 3 parts of sulphur, and 25 parts of cold water. The mixture is very slowly heated to the boiling point, and is kept at that temperature until it assumes a greenish-blue colour. The bulk of the mixture is kept constant during the boiling process by adding water to compensate for the loss by evaporation. The reaction is usually complete after about 24 hours. The solution obtained can be used at once for dyeing purposes. The dyestuff can also be obtained in the solid form, either by evaporating the solution to dryness, or by precipitating it from solution by the addition of acid. The final product is soluble in water, but in dyeing cotton it is advisable to add a little sodium sulphide to the bath. This dyestuff also dyes wool in a neutral or feebly acid bath, and the shades obtained are considerably deepened by oxidation.
—P. F. C.

German Patents.

Monoalphyl-α_1-naphthylamine-α_4-sulphonic acid; Preparation of ——. Kalle und Co. Ger. Pat. 170,630, Aug. 11, 1900.

α_1-Alphylnaphthylamine-α_4-sulphonic acids are obtained by heating a solution in dilute hydrochloric acid of an aromatic amine and α_1-naphthylamine-α_4-sulphonic acid to a high temperature, preferably under pressure.

The process is especially adapted to the production of 1·8-phenylamino- or tolylaminonaphthalenesulphonic acid.—T. F. B.

Azobenzene or its homologues or derivatives ; Reduction of ——. M. Bodenstein. Ger. Pat. 172,569, July 30, 1905.

Azobenzene or its homologues or derivatives may be reduced to the corresponding benzidine derivatives by passing sulphur dioxide through a suspension of the azo compound in dilute hydrochloric acid or sulphuric acid, to which a small quantity of iodine, hydriodic acid, or potassium iodide has been added. Only a small quantity of the iodine compound is required, as its oxidation product, formed during the reduction of the azo benzene, is continually reduced by the sulphur dioxide. Any iodine remaining mixed with the benzidine derivative may be recovered by washing, followed by precipitation from the wash-liquid.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 198.)

Weighted silks ; Determination of the charge in ——. G. Gianoli. Rev. Gen. Mat. Col., 1907, **11**, 66—67.

A series of experiments was performed to determine the extent to which the charge of silks, weighted with tin salts, could be removed by the use of hydrofluoric acid as a solvent. It was found that the results depended very largely upon the conditions under which the tin was fixed on the fibre. For example, if the tin-mordant be fixed with water, sodium carbonate solution, or even with a strongly alkaline solution of sodium phosphate, treatment with 1 per cent. hydrofluoric acid at a temperature of 50°—60° C. for 20 minutes proves quite insufficient to completely remove the tin oxide fixed on the silk. If, however, the weighting process takes place under conditions which ensure the conversion of the tin into silicate or phosphate, or a mixture of the two, the whole of the tin can subsequently be removed with hydrofluoric acid. Since the previous history of weighted silks is very rarely known, the author recommends the determination of the amount of nitrogen in the silk as being the best method of finding the weighting-charge.—P. F. C.

Discharges on tannin-antimony mordant ; Production of coloured ——. L. Caberti, P. Roggieri, and C. Barzaghi. Rev. Gen. Mat. Col., 1907, **11**, 65—66.

The authors find that Indanthrene S, Flavanthrene R, and Thio-indigo Red, associated with an alkaline discharge, can be used to obtain coloured discharges on a tannin-antimony mordant. In order to obtain a good fixation of the printed colour, it is necessary to add a reducing agent to the discharge-paste. All ordinary reducing agents can be used for this purpose, but the best results are obtained with stannous salts, glucose, and the various stable hyposulphites (hydrosulphites). The last-mentioned agents were chiefly used by the authors. The following recipe for a violet discharge colour is typical :—80 grms. of Thio-indigo Red paste, 50 grms. of Indanthrene S, 50 grms. of Hydrosulphite NF conc., 150 grms. of British gum, 550 grms. of caustic soda solution (40° B.), and 120 c.c. of water. The cloth, prepared with tannin and antimony, is printed with the discharge paste and steamed for one to one and a half minutes in the Mather-Platt. It is then worked for 10 minutes at 60° C. in a bath containing 5 grms. of tartar-emetic and 5 grms. of ammonium chloride per litre, and washed. The cloth is next passed through a cold bath of dilute sulphuric acid (2 per cent.), washed, well soaped, and then again washed. It is then dyed in the presence of alum and tartar-emetic, again soaped, and finally slightly chlored to brighten the effect of the coloured discharges.—P. F. C.

Fibres and fibrous substances for paper-making ; Philippine ——. G. F. Richmond. XIX., page 274.

Cellulose ; [Mixed] Esters of ——. E. Berl and Watson Smith, jun. XIX., page 273.

English Patents.

Copper oxide in the manufacture of artificial silk ; Process for the recuperation of ——. R. Linkmeyer, Brussels. Eng. Pat. 3566, Feb. 13, 1906. Under Int. Conv., April 5, 1905.

See Fr. Pat. 353,187 of 1905 ; this J., 1905, 1011.—T. F. B.

Textile fibres or artificial silk ; Manufacture of ——. J. A. M. J. Vermeesch, Schaerbeek, Belgium. Eng. Pat. 9254, April 19, 1906.

See U.S. Pat. 836,620 of 1906 ; this J., 1907, 91.—T. F. B.

United States Patent.

Hydrosulphite preparation. R. Müller, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 839,500. Dec. 25, 1906.

See Eng. Pat. 26,173 of 1905 ; this J., 1906, 177.—T. F. B.

French Patents.

Silk ; Method of strengthening and consolidating natural ——. Schmid Frères. Fr. Pat. 370,809, Dec. 27, 1905.

Either of the two following methods of treatment can be used :—(1) The raw silk is first treated with formaldehyde, which toughens the fibre by forming a condensation product with the sericin of the silk. It is then soaped in the presence of steam and air, in order to soften and dissolve the superficial layers of the toughened sericin. Care must be taken that the soaping is not carried too far, lest the interior layers of the altered sericin should be affected. The silk is finally well washed. (2) The raw silk is partially degummed, by soaping in the presence of air and steam, and the sericin remaining on the fibre is then toughened by treatment with formaldehyde. The silk is next soaped as before and finally washed. By either of these two processes it is stated that one can obtain silk which is sufficiently supple to take the place of completely degummed silk, whilst the condensation product of the sericin and the formaldehyde is said to impart a brilliant gloss to the fibre.—P. F. C.

Yarn for laces, hat-shapes, &c. ; Process for the manufacture of ——. L. Guérillot. Fr. Pat. 370,952, Jan. 6, 1906.

Cotton-yarn is first dyed and then passed through a bath composed of 65 parts of gelatin, 10 of formol (formaldehyde), 5 of ammonia, and 20 of water. This bath is maintained at a temperature of 40°—45° C. The yarn next passes through a fine nozzle or spinneret, and into a second bath composed of 15 parts of formol (formaldehyde), 10 of glycerin, and 75 of water, after which it is dried. The compositions of the baths may be varied.
—A. S.

Textile fibres and paper pulp ; Utilisation of a plant for the production of ——. V. A. de Perini. Fr. Pat. 370,547, Sept. 17, 1906. Under Int. Conv., Nov. 16, 1905.

See U.S. Pat. 831,521 of 1906 ; this J., 1906, 1040.—T. F. B.

Plastic mass [substitute for linoleum and rubber] from fibrous material ; Manufacture of a ——. N. Reif and H. Gonnermann. Fr. Pat. 370,490, Oct. 15, 1906. XIIIC., page 265.

Osier bark and other vegetable matters containing liber ; Preparation of long fibres, capable of being spun, from ——. L. v. Ordody and Westdeutsche Thomasphosphat-Werke, G.m.b.H. Fr. Pat. 370,511, Oct. 16, 1906.

The osier bark is steamed in a boiler until it is thoroughly moistened. A boiling solution of ammonium carbonate (3°—4° B.) is then run in, and kept at the boil for between one and two hours. If the liber is very resistant, a small quantity of lime is added to the ammonium carbonate solution. As soon as the liber is sufficiently disintegrated, the lye is run out, and the residual fibrous matter is boiled with water, which is being constantly changed, so that the fibres are never in contact with dirty water. The filaments thus obtained are submitted to the usual methods of after-treatment.—P. F. C.

Osier bark and other vegetable matters containing liber ; Preparation of long fibres, capable of being spun, from ——. L. v. Ordody and Westdeutsche Thomasphosphat-Werke G.m.b.H. Fr. Pat. 370,512, Oct. 16, 1906.

The liber [inner bark] is boiled with an ammonium carbonate lye in a horizontal boiler at between three and four atmospheres pressure. One end of the boiler can be raised to admit two trucks, the upper parts of which are constructed of strong wire-netting. The lye is distributed over the osier bark contained in the trucks, by means of two sprinklers. The lye can be heated either by direct steam, or by steam pipes laid along the bottom of the boiler.—P. F. C.

Tissue impenetrable to Röntgen rays ; Preparation of a ——. W. Meisel. Fr. Pat. 370,635, Oct. 20, 1906.

A finely-powdered metal or metallic oxide, such as lead or minium, is added to rubber solution in sufficient quantity to produce a thick paste. This paste is then rolled out in frames of suitable dimensions and vulcanised. The tissue thus prepared can be intercalated between other fabrics, by fixing it with an adhesive mixture.—P. F. C.

Silk, artificial ; Reel for use in treating ——. Fabr. de Soie Artificielle de Tubize. Fr. Pat. 370,717, Oct. 23, 1906. Under Int. Conv., Oct. 28, 1905.

See Eng. Pat. 3025 of 1906 ; this J., 1906, 1144.—T. F. B.

Elastic threads [artificial fibres] ; Manufacture of ——. Soc. Fürst Guido Donnersmarck'sche Kunstseiden und Acetatwerke. Fr. Pat. 370,741, Oct. 24, 1906. Under Int. Conv., Oct. 25, 1905.

To obtain elastic threads from ordinary artificial silk fibres, a number of the latter are formed into a single homogeneous thread by passing through a solution of some cellulose derivative, such as viscose. The mass of threads is, *e.g.*, allowed to glide over the surface of rollers, which are kept moist by revolving in a solution of viscose of about 8 per cent. strength. The compound thread is then passed through warm air or through a liquid containing a substance which precipitates the viscose solution, and so binds the individual fibres into one thread.—A. B. S.

Jute fibres ; Process for the disaggregation of ——. T. E. Schiefner. Fr. Pat. 371,033, Nov. 2, 1906.

Jute fibres are treated for five to six hours with a boiling, 2—4 per cent. solution of potassium carbonate, under a pressure of 2—8 atmospheres, and then steeped for a similar period in an emulsion of palm-oil or cocoanut-oil, containing 0·25—0·75 kilo. of the oil and 0·25—0·5 kilo. of alcohol or ether per 100 litres of water. It is stated that from jute which has been treated in this manner, threads sufficiently fine to be used in the manufacture of incandescent mantles can be prepared ; for instance, from 1 kilo. of jute, 50,000 m. of thread can be spun.—A. S.

Yarn in bobbins or cops ; Filling of frames for dyeing ——. H. L'Huillier. Fr. Pat. 361,999, Dec. 16, 1905.

In machines for dyeing bobbins which are packed between two perforated plates, the spaces between the individual bobbins are filled with cork chips. These do not adhere to the bobbins, and are easily removed by water, from which they are afterwards recovered.—A. B. S.

Stannic chloride ; Apparatus and process for the manufacture of ——. Soc. Savigny père et fils. Fr. Pat. 371,067, Jan. 10, 1906. VII., page 255.

Sulphide dyestuffs ; Process of dyeing with ——. Farbenfabr. vorm F. Bayer und Co. First Addition, dated Oct. 19, 1906 (Under Int. Conv., July 24, 1906), to Fr. Pat. 367,921, July 9, 1906 (this J., 1906, 1218).

According to the chief patent, more uniform, deeper, and faster tints are obtained in dyeing with sulphide dyestuffs, if ammonium salts be added to the dye-bath, in addition to sodium sulphide. It is found that the favourable effect of ammonium salts is due to the fact that they combine with the free alkali always present in alkali sulphide dye-liquors, and according to the present additional patent, other salts, such as sodium bicarbonate, aluminium acetate, alum, sodium bisulphate, and cream of tartar, or acids such as sulphuric or acetic acid, may be used instead of ammonium salts. The salt or acid is added to the dye-bath in quantity sufficient to produce a distinct odour of hydrogen sulphide, but insufficient to precipitate the dyestuff or its leuco-compound.—A. S.

Spraying a liquid on the surface of paper, textile, or other article ; Apparatus for ——. C. A. Hanitzsch. Fr. Pat. 370,241, Oct. 4, 1906. Under Int. Conv., Oct. 6, 1905.

See Eng. Pat. 20,220 of 1905 ; this J., 1906, 691.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 147.)

United States Patent.

Dyeing leather. R. Rieder, Osterwieck-on-the-Harz, Germany. U.S. Pat. 839,645, Dec. 25, 1906.

See Addition of March 13, 1905, to Fr. Pat. 291,355 of 1899 this J., 1905, 968.—T. F. B.

French Patent.

Paper ; Process of dyeing —— *in shades fast to light and water.* C. G. Schwalbe. Fr. Pat. 370,544, Sept. 11, 1906.

The paper is passed through a hot solution of a sulphide dyestuff in sodium sulphide. It is then passed between squeezing rollers, and finally dried on drying cylinders. If necessary, after passing between the squeezing cylinders, the paper may be rinsed with water from a perforated pipe, squeezed again, and dried.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 202.)

Sodium carbonate ; Causticising of ——. R. Wegscheider. Annalen, 1907, **351**, 87—99. (See also this J., 1905, 440, 843.)

The investigation was chiefly concerned with the conditions under which an insoluble sodium-calcium carbonate can be formed, with a view to explain the loss of soda in the manufacture of sodium hydroxide. In the system of three components—H_2O, $CaCO_3$, Na_2CO_3—if three phases be present, *viz.*, solution, calcium carbonate, and sodium-calcium carbonate, there are two degrees of freedom, so that by keeping the pressure and temperature constant, the system becomes invariant, and a definite concentration of sodium carbonate is required for equilibrium. If the concentration of the sodium carbonate solution be greater than is required for equilibrium, calcium carbonate is converted into the double salt, whilst if it be less, the double salt is decomposed. Experiments with Gaylussite, $Na_2Ca(CO_3)_2$, $5H_2O$, and dilute solutions of sodium carbonate, showed, however, that decomposition of the double salt ceases before the concentration of the sodium carbonate solution increases to that necessary for equilibrium. This is probably due to the particles of double salt becoming coated with calcium carbonate, which prevents further action. At 40° C. and higher temperatures, the double salt deposited is not gaylussite, but pirssonite, $Na_2Ca(CO_3)_2$, $2H_2O$, and it is probable that with very concentrated solutions of sodium carbonate, pirssonite is converted into the anhydrous compound. For equilibrium between sodium carbonate solution, calcium carbonate, and gaylussite at 11° C., a 0·86N solution of sodium carbonate is necessary, whilst for equilibrium between sodium carbonate solution, calcium carbonate, and pirssonite, the concentration of the sodium carbonate solution must be 2·14N at 40° C., 3·77N at 60° C., and 4·34N at 80° C. In presence of sodium hydroxide (or calcium hydroxide), the system becomes univariant even if the temperature and pressure be kept constant, *i.e.*, for a given concentration of sodium hydroxide, equilibrium is attained only with a definite concentration of sodium carbonate. Since the separation of an insoluble sodium-calcium carbonate depends upon the concentration of undissociated sodium carbonate, the total concentration of sodium carbonate required for the attainment of equilibrium is less, the greater the amount of sodium hydroxide present since the latter diminishes the degree of dissociation and hydrolysis of sodium carbonate. Further, it follows from the law of mass action that the total sodium-content of a solution in equilibrium at a given temperature with insoluble sodium-calcium carbonate, is greater the smaller the proportion of sodium present as carbonate. Direct experiments on the causticising process showed that the reaction proceeds somewhat further at 108° C. than at 80° C. The experimental results indicated that the isotherm representing the relation between the composition of the solution in a condition of equilibrium, and its total alkalinity, is not a smooth curve, but has a break at T (alkalinity in grm.-equivalents per litre) = 4·08 at 80° C., and T = 4·4 – 4·7 at 108° C. Evidence is cited in favour of the view that this break is caused by the conversion of calcium carbonate into sodium-calcium carbonate. It appears, therefore, that in the technical causticising process, pirssonite may be formed at 108° C. in solutions of high concentration (from 4·4*N* to 4·7*N*). During settling and filtering, the temperature falls, and the formation of pirssonite may then take place at lower concentrations (about 4*N* at 80° C., 2·5 *N* at 40° C.). Contamination of the sodium carbonate solution with other sodium salts lowers the concentration at which the double salt can be formed. The formation of pirssonite is also favoured by the presence of calcium hydroxide (see also Watson Smith and W. T. Liddle, "Chem. News," 1880, **42**, 244; 1881, **43**, 8).—A. S.

Calcium borates; Crystallised ——. W. Meyerhoffer and J. H. van't Hoff. Annalen, 1907, **351**, 100—107.

The authors describe the methods of preparation of some crystallised calcium borates. *Monoborates.*—For the preparation of $B_2O_4Ca.6H_2O$ (calcium monoborate hexahydrate), 12·4 grms. of boric acid, 11·4 grms. of potassium hydroxide, and 11 grms. of anhydrous calcium chloride are each dissolved in 100 c.c. of water. 10 c.c. of the calcium chloride solution are added to the potassium hydroxide solution, any calcium carbonate formed is separated, and the remainder of the calcium chloride solution is added to the filtrate. Sufficient of the milk of lime thus obtained is added to the warm boric acid solution to just produce a turbidity, and the solution is filtered. The remainder of the milk of lime is sown with a crystal of the hexahydrate, and the partially neutralised boric acid solution added at the rate of 10 c.c. per minute, with agitation. It is essential to leave a slight excess of free lime, which can be removed by washing the separated crystals. The crystals belong to the hexagonal system. If the hexahydrate be warmed with water, it is converted gradually into a tetrahydrate; by sowing with a crystal of the tetrahydrate, the change is accelerated, being completed in two hours. The transformation is reversible, the transition point being at about 24° C. The crystals of the *a*-tetrahydrate thus obtained belong to the tetragonal system. When warmed with a 10 per cent. sodium chloride solution, the *a*-tetrahydrate is transformed at 40° C. into another modification which separates as crystals somewhat similar to those of augite. This β-tetrahydrate is the stable form of calcium monoborate at the ordinary temperature, and forms slowly from the hexahydrate. *Triborates.*—Calcium triborate dodecahydrate, $B_6O_{10}Ca, 12H_2O$, was obtained from 10 grms. of calcium monoborate hexahydrate, 20 grms. of boric acid, and 300 c.c. of water, the crystals being separated after 24 hours, washed with water and alcohol, and dried at the ordinary temperature. On standing, the dodecahydrate is converted into the octahydrate, $B_6O_{10}.Ca.8H_2O$, which forms ill-defined, doubly-refracting leaflets. The octahydrate, also, is not stable, but is transformed gradually into a tetrahydrate. *Borates of the colemanite series.*—Dicalciumtriborate nonohydrate, $B_6O_{11}Ca_2.9H_2O$, which forms crystals similar to those of augite, can be prepared by heating together boric acid solution and calcium monoborate hexahydrate, or by the action of water on the triborate octahydrate. On heating the nonohydrate just mentioned, with 3 per cent. boric acid solution at 100° C., a heptahydrate, $B_6O_{11}Ca_2.7H_2O$, was obtained.—A. S.

Carbon and nitrogen; Combination between ——. M. Berthelot. Compt. rend., 1907, **144**, 354—357.

Pure carbon and nitrogen do not combine at any attainable temperature. The cyanides formed in the electric arc, and when carbon and nitrogen are otherwise exposed to a high temperature, owe their formation to the presence of impurities in the carbon or nitrogen. This is confirmed by the fact that pure dry cyanogen, exposed for a sufficient period of time to the Ruhmkorff discharge, is completely decomposed into carbon and nitrogen. No state of equilibrium is ever reached.—J. T. D.

Sulphur in insoluble sulphides; Determination of ——. De Paepe. XXIII., page 281.

Seaweed industry in Japan. K. Pietrusky. XVIIIA., page 272.

Phosphorus; Extraction of —— *from mineral deposits in the United States.* U.S. Geol. Survey. Oil, Paint, and Drug Rep., Feb. 18, 1907. [T.R.]

In the vicinity of Mount Holly Springs, about 10 miles south-west of Harrisburg, Pa., a deposit of *wavellite* occurs in the white clay, associated with manganese and iron ores. Small quantities of phosphorus had previously been obtained from phosphorite and from apatite, but *wavellite* (aluminium phosphate) has never before been used commercially in the manufacture of phosphorus, as the mineral generally occurs in very limited quantities. The clay in this region has been extensively mined and prospected, and it was in one of the prospect pits that *wavellite* was found. A mill for the extraction of the phosphorus from the ore was built near the mine. The mine was opened in 1900, the first years being devoted to prospecting and experimenting with the reduction of the ore. During the past year the mine was in active operation, and 400 tons of ore were reported to have been extracted and reduced. The world's production of phosphorus has been variously estimated to be from 1000 to 3000 tons a year. The greater part is made at Oldbury, where the Readman process originated. Other large factories are located at Lyons, Griesheim, and Frankfort. There is also a plant in Sweden, and there are numerous smaller ones in Russia.

The census of 1900 in the United States reported three phosphorus establishments in operation, but the census of 1904–5 reported only the Oldbury Electro-Chemical Company, of Niagara Falls. It was impossible to learn the production of these companies.

Sulphur; U.S. Customs decision on——. Oil, Paint, and Drug Rep., Feb. 18, 1907. [T.R.]

The U.S. Circuit Court has confirmed a decision of the Board of Appraisers, declaring sulphur, which has been partially refined, but still contains a small percentage of impurity, to be dutiable at $8 per ton, as "refined sulphur," under par. 84 of the Tariff.

English Patents.

Sulphuric acid; Manufacture of ——. O. Guttmann. London. Eng. Pat. 18,927, Aug. 24, 1906.

The claim is for the injection of sulphuric acid containing water, instead of steam or water, in a fine state of division, into the chambers in the manufacture of sulphuric acid by the chamber process. For example, the weak acid from the last of a set of sulphuric acid chambers is injected or sprayed into the first and second chambers, or the acid from the bottom of a chamber may be introduced again at the top of the chamber in the form of spray. Among the advantages claimed for the process are that a slight defect in the spraying apparatus is not attended with such injurious effects as formerly; stronger chamber acid is obtained; and the productive capacity of a set of chambers is increased, since, as it is not necessary to limit the quantity of acid sprayed into the chambers, the amount of acid gases may also be increased within certain limits. —A. S.

Bicarbonates; Process of manufacturing alkali ——, *and carbonic acid therefrom.* J. G. Behrens, Bremen, Germany. Eng. Pat. 10,008, April 28, 1906.

See Fr. Pat. 365,059 of 1906; this J., 1906, 928.—T. F. B.

Reducing organic or inorganic compounds ; Method of ——. S. Kapff, Aix-la-Chapelle, Germany. Eng. Pat. 3135, Feb. 8, 1906.

See Fr. Pat. 362,985 of 1905 ; this J., 1906, 811.—T. F. B.

Aluminium and nitrogen ; Process of producing compounds of ——. O. Serpek, Luterbach, Switzerland. Eng. Pat. 13,579, June 13, 1906.

See Fr. Pat. 367,124 of 1906 ; this J., 1906, 1096.—T. F. B.

Peroxides ; Manufacture of metal and organic ——. A. G. Bloxam, London. From Kirchhoff und Neirath, Berlin. Eng. Pat. 14,489, June 25, 1906.

See Fr. Pat. 364,249 of 1906 ; this J., 1906, 884.—T. F. B.

United States Patents.

Barytes ; Apparatus for washing ——. W. R. Macklind, Mineral Point, Mo. U.S. Pat. 839,493, Dec. 25, 1906.

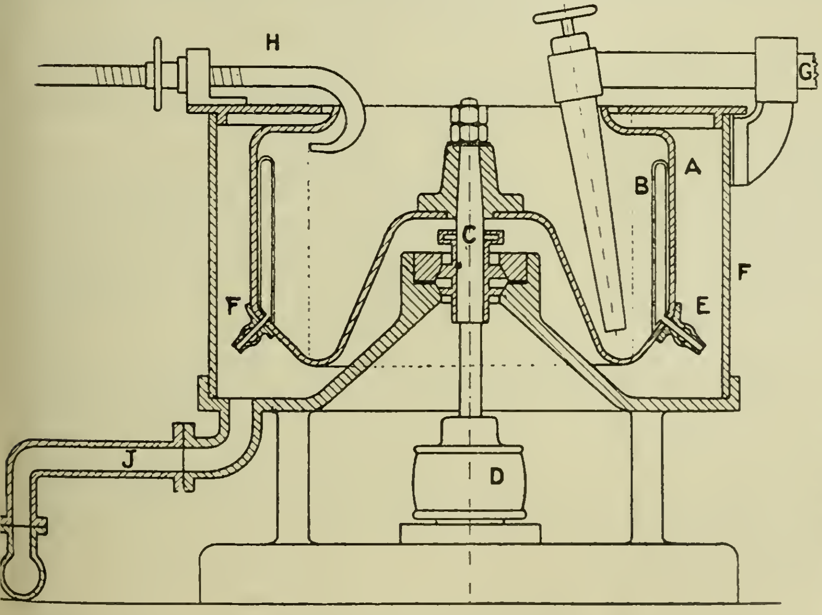
The apparatus described consists of a tank, the bottom of which is conical and provided with a discharge opening. Within the tank, there is an open-ended tube spaced away from the walls of the tank. Above the tank there is a receptacle, with an approximately conical bottom, and a cup at the centre. Barytes and water are introduced into the cup by means of separate conduits, and are carried from the receptacle by pipes, provided with distributing nozzles, into the space between the walls of the tank and the wall of the tube within it. Means are provided for causing the barytes that enters the tank to collect at the bottom, and for conducting the waste water from the tank. A number of these tanks may be arranged in series, and connected, so that the barytes may pass from one tank into the receptacle placed above the next adjacent tank, and means are provided for controlling the quantity of barytes which enters the receptacles.—W. C. H.

Ammonium nitrate ; Production of ——. W. Feld, Hönningen-on-Rhine. U.S. Pat. 839,741, Dec. 25, 1906.

See Fr. Pat. 365,409 of 1906 ; this J., 1906, 928.—T. F. B.

French Patents

Separator ; Centrifugal ——. L. F. A. Devaucelle. Fr. Pat. 370,887, Jan. 5, 1906.



The claim is for the separation of a salt solution, brine, for example, into two portions of different densities by centrifugal force. A drum or cylinder, A, provided with a perforated lining, B, covered with filter cloth, is rotated by the shaft, C, and the pulley, D, within a casing, E. The liquid is fed into the drum through the valved pipe, G, and is separated by the centrifugal force into concentric layers of different densities. The densest layer forms next to the filter cloth, through which it passes and flows away from the drum through the taps, F, by which the rate of flow can be regulated. The liquid collects in the casing, E, and is run off by the pipe, J. The lightest film of liquid forms the innermost layer in about the position indicated by the dotted line, and is removed by the bent tube, H, which acts as a siphon.—W. H. C.

Stannic chloride ; Apparatus and process for the manufacture of ——. Soc. Savigny père et fils. Fr. Pat. 371,067, Jan. 10, 1906.

The furnace, the gases from the fireplace of which are led through two or more horizontal chambers, is intended to be used alternately for the concentration of weak stannic chloride solutions, and for their distillation after they have attained a certain strength. The bottoms of the chambers are occupied by open pans, containing the weak solution to be concentrated. The effluent vapours are conducted to the bottom of a condensing tower, below which a reservoir is provided, which in the first stage of the process becomes charged with acid solution free from tin. A slight diminution of pressure is induced throughout the apparatus by an aspirator. The evaporation is continued until the concentration of the solution attains about 50° B. In the second stage of the process stannic chloride is distilled over, and accumulates in the reservoir below the condensing tower, as a hydrated stannic chloride of about 60° B. The purification of crude stannic chloride may thus be effected by the second stage of the working of the furnace. The "tin cakes" recovered in the dyeing industry may be treated directly by gaseous hydrochloric acid to obtain stannic chloride for subsequent concentration and distillation.—E. S.

Sulphitometer, or tube for measuring [liquid] sulphur dioxide. P. V Pacottet. Second Addition, dated Oct. 5, 1906, to Fr. Pat. 365,224, April 13, 1906 (this J., 1906, 928 ; 1907, 48).

The present addition to the main patent relates to improvements whereby the desired quantity of liquid sulphur dioxide is measured in successive small quantities. For this purpose, an enclosed space of definite volume (which can be altered at will) is provided between the supply and delivery tubes for the liquid sulphur dioxide, communication between the enclosed space and the respective tubes being controlled by valves, which are alternately opened and closed by a suitable arrangement of levers or by other mechanical means.—A. S.

Barium cyanide ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 370,420, Oct. 11, 1906. Under Int. Conv., April 28, 1906.

Crude barium cyanide, containing much cyanamide, is heated to a temperature below 1200° C., in an iron crucible, in which it is subjected to the action of a current of acetylene. The cyanamide is completely converted into cyanide in a few hours. Or, briquettes may be formed of a mixture of three parts of barium carbonate with one part of wood charcoal, which are heated to about 1500° C. in a vessel of refractory material, whilst a current of nitrogen is passed through. The process is continued at a lower temperature with passage of hydrocarbon gases, previously freed from carbon dioxide, until the formation of barium cyanide is complete.—E. S.

Lime, plaster, borax, and other similar products; Process and plant for the economical and continuous manufacture of ——. E. Borias. Fr. Pat. 370,538, Oct. 17, 1906.

THE process described is applicable to the manufacture of lime, plaster, borax, &c., in which carbon dioxide and water vapour are disengaged by the action of heat, either together or separately. The essential characteristic of the process is, that the products of combustion from all the furnaces used in treating the raw materials concerned, together with the gases evolved from these latter during the burning, are collected and stored in a gas-holder, after they have been passed through a reducing chamber, in which all the gaseous components susceptible of reduction are converted into combustible gases. The combustible gases thus produced are used, wholly or in part, to supply the heat required for the different operations comprised in the cycle, and any unused part forms a cheap source of energy. The apparatus for carrying out the process comprises a suitable furnace for the material to be treated, which is heated by gas; the products of combustion, mixed with the gaseous products from the raw materials, are drawn from the furnace, and forced into the reducing column of a producer, also heated by gas, the products of combustion of which are withdrawn by an exhaust fan, and forced into the reducing column. The gases coming from the reducing column of the producer are combustible, and are stored in a gas-holder, from which they can be withdrawn to supply the gas required for heating the furnace, the reducing column of the producer, and for any other supplementary work.—W. C. H.

Oxides [tin oxide]; Preparation of metallic ——. H. Jaeger. Fr. Pat. 370,640, Oct. 20, 1906. Under Int. Conv., Oct. 21, 1905.

THE process is specially adapted to the preparation of tin oxide. The metal is first pulverised by acting on it in a fused condition with dry steam, and the powder is caused to pass through heated retorts by aid of a fan working at 1600 revolutions per minute, so that no metal may adhere to the inner sides of the vessel, oxidation of the pulverised metal being effected by a stream of highly heated air driven through the containing vessel.—E. S.

Bleaching powder [calcium hypochlorite]; Preparation of dry and rich ——. Chem. Fab. Griesheim-Elektron. Fr. Pat. 370,863, Oct. 27, 1906.

CHLORINE is introduced continuously, with agitation, into milk of lime, until the latter is nearly saturated. The solution is concentrated at a low temperature *in vacuo*; or with great rapidity at a relatively high temperature, in suitable apparatus. Calcium hypochlorite then crystallises out, and may be separated by ordinary means from the solution of calcium chloride, and dried rapidly at a low temperature, preferably *in vacuo*. It is stated that the calcium hypochlorite thus obtained is more stable than ordinary bleaching powder, and that it yields 80—90 per cent. of its weight of available chlorine.—E. S.

Sulphur contained in solutions of carbon bisulphide or other similar solutions; Process of extracting ——. Chem. Fabr. Phœnix Rohleder und Co. Fr. Pat. 370,893, Oct. 27, 1906. Under Int. Conv., Nov. 15, 1905.

CARBON bisulphide having sulphur in solution is admitted to a closed boiler containing water heated to about 70° C. through a distributing apparatus discharging the liquid in fine streams or drops. As these drops mingle with the body of the water, the carbon bisulphide distils off, and is conducted to a condenser, whilst the separated sulphur adheres to the sides of the boiler, from which it is subsequently removed by increasing the volume of the water, and raising its temperature to about 85° C. The process here described is given as an example only of one method of carrying out the invention.—E. S.

Chromic acid; Process for making ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 370,907, Oct. 29, 1906. Under Int. Conv., Oct. 31, 1905.

SEE Eng. Pat. 12,618 of 1906; this J., 1907, 150.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 203.)

Aventurine glass; Theory of the formation of copper ——. V. Auger. Compt. rend., 1907, **144**, 422—424.

COPPER aventurine glass consists of a transparent greenish matrix in which are embedded innumerable small red crystals, which impart to the glass a golden-yellow tint. Two views have been held as to the nature of these crystals, the first, assuming that they consist of cuprous oxide or silicate, whilst the second, adopted by the majority of chemists, regards them as crystals of metallic copper. The chief difficulty in the latter theory is to account for the presence of copper in solution before crystallisation takes place, since metallic copper does not dissolve when added to the fused glass. The difficulty is overcome by the view now put forward, which is based in the first place upon the results of a study of the behaviour of cuprous phosphate when fused and cooled. According to this view, fused aventurine glass contains a cuprous silicate, which is stable at a red heat, but splits up on slow cooling into blue cupric silicate and metallic copper. If the fused glass be rapidly cooled, the cuprous silicate remains unchanged and the separation into metal and cupric silicate only occurs on re-heating. This view of the process affords a simple explanation of all the essential points connected with the peculiar nature and chemical behaviour of the glass, and is further supported by analytical results. A small quantity of metallic copper was isolated by treating the powdered glass with dilute hydrofluoric acid in the cold, and the amount present in 4 grms. of the sample was found to be 0·052 grm., of which 0·034 grm. was removed by means of alcoholic silver nitrate, and 0·018 grm. by subsequent treatment with dilute nitric acid. In addition, 0·08 grm. of copper was found to be present in the residue as cupric silicate. The author's theory necessitates the presence of cupric silicate in quantity at least equivalent to the amount of free copper. The question is raised as to whether the theory is applicable to gold glasses.—E. W. L.

ENGLISH PATENT.

Plate or sheet glass; Manufacture of ——, *and apparatus therefor.* W. W. Pilkington, Prescot, Lancs. Eng. Pat. 22,520, Nov. 3, 1905.

IN the apparatus described, the sheets of glass are drawn vertically upwards from a tank by lowering into it a "bait" or metal-gathering plate, and drawing the sheet up through a slot, and between guiding irons at the edges of the sheet. A pair of rollers may be arranged just above the float, in which is the slot. The surfaces of the sheet of glass are gripped by means of belts of driving grips or buffing bars, covered with soft material, such as asbestos. These grips or buffing bars extend across the breadth of the sheet, and travel with the glass, and are arranged upon sprocket chains to be pressed against the glass by weighted levers, or some other mechanical equivalent such as springs, and to be periodically withdrawn from contact with the surfaces of the glass, to allow the surfaces to cool at such points. This arrangement of the buffing bars also serves to shield the glass from direct currents of air, and at the same time to allow access of sufficient air to cool and stiffen the sheet. A line of burners or other heating device may be arranged on one or both sides of the sheet, to soften the surfaces sufficiently to obliterate any marks made by the buffing bars.—W. C. H.

FRENCH PATENTS.

Glass sheets; Method of drawing ——. I. W. Colburn. Fr. Pat. 370,386, Aug. 27, 1906.

SEE Eng. Pat. 18,663 of 1906; this J., 1907, 18.—T. F. B.

Furnace system [*Continuous —— for ceramic products*] *composed of any number of furnaces, that are periodically isolated, and of a regenerator.* M. Kammüller. Fr. Pat. 370,454, Oct. 13, 1906.

This invention relates to a furnace system, for burning ceramic products, in which there are several kilns which are periodically isolated from the system, and a regenerator for pre-heating the air required for combustion. The special feature of the invention is that each regenerator chamber is subdivided into several compartments, which can be introduced into the current of the gas, by suitable means, during the working of the furnace, and according to the rise in temperature of the escaping gases. The size of the regenerator can thus be regulated proportionally to the temperature of the escaping gases. The space used to bring the gases into the different compartments of the regenerator is itself divided into a corresponding number of compartments, which can be put in communication with those of the regenerator by means of valves, and as required by the rise of temperature of the gases. By this system the serious losses of heat, due to the high temperature of the escaping gas, can be avoided, and without detriment to the chimney draught.—W. C. H.

Enamel from enamelled objects ; Process of detaching ——. G. Spitz. Fr. Pat. 370,986, Oct. 31, 1906.

This process for detaching enamel from enamelled objects consists in treating the objects at a temperature of above 100° C., and under a pressure of 7 to 15 atmospheres, with aqueous solutions of, say, caustic soda, or oxalic acid, which attack only the enamel, and not the metal.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 204.)

English Patents.

Stones, bricks, or like articles ; Manufacture of artificial ——. A. Deidesheimer and F. Jurschina, Wurzburg, Bavaria. Eng. Pat. 16,104, July 16, 1906.

See Fr. Pat. 368,096 of 1906 ; this J., 1906, 1221.—T. F. B.

Buildings, building blocks, pavements, and the like ; Rendering the surfaces of —— waterproof. J. M. Rauhoff, Tinley Park, U.S.A. Eng. Pat. 19,186, Aug. 28, 1906.

See U.S. Pat. 830,003 of 1906 ; this J., 1906, 930.—T. F. B.

United States Patent.

Wood ; Treated ——, and process of producing the same. S. B. Chapman, Skyland, N.C. U.S. Pat. 839,551, Dec. 25, 1906.

The process consists in impregnating green wood with sulphuric acid. The product is also claimed as an article of manufacture.—W. C. H.

French Patents.

Lime, plaster, borax, and other similar products ; Process and plant for the economical and continuous manufacture of ——. E. Borias. Fr. Pat. 370,538, Oct. 17, 1906. VII., page 256.

Tar-oil emulsions for impregnating wood. W. Wildenhayn, Fr. Pat. 370,682, Oct. 22, 1906.

Tar-oil is mixed with the acid tar resulting from the refining of benzene or other hydrocarbons, and emulsified with water.—C. S.

Cement made from blast-furnace slag and other similar materials ; Process for accelerating the setting of hydraulic ——. Königshofer Cement-Fabrik Akt.-Ges. Fr. Pat. 370,939, Oct. 29, 1906.

According to this invention, precipitated barium carbonate is added to cement made from blast-furnace slag, and other hydraulic cements, with the object of accelerating the setting and hardening of the cement, by the formation of salts insoluble in water, without the formation of salts soluble in water, which would cause disintegration of the structures. The addition may be made either before or after the reduction of the slag to powder.—W. C. H.

X.—METALLURGY.

(*Continued from page* 208.)

Iron ; Influence of chromium on the solubility of carbon in ——. P. Goerens and A. Stadeler. Metallurgie, 1907, **4**, 18—24 ; Science Abstracts, 1907, **10A**, 115.

The authors find that the solidification temperature of iron saturated with carbon remains practically constant at about 1130° C. upon addition of chromium up to about 10·4 per cent. Beyond this amount, however, it rises rapidly, reaching 1535° with 62 per cent. of chromium. The percentage of carbon required for saturation gradually increases from about 4 with no chromium to 9·2 with 62 per cent. of chromium. The change at 710° C. is not altered in position, but its duration is diminished with addition of chromium until with 29·6 per cent. of chromium (6·4 per cent. of carbon) and upwards it is absent. The results are plotted as a portion of the triangular diagram for the ternary system, iron-carbon-chromium, the curve being the projection of the eutectic line.

Cast iron ; A case of malleability of grey ——. Metallurgie, 1906, **3**, 786—787 ; Science Abstracts, 1907, **10A**, 115.

A piece of cast iron of the following percentage composition was malleable at a red heat : Total carbon, 3·21 ; graphite, 2·34 ; carbide carbon, 0·68 ; hardening carbon, 0·19 ; silicon, 0·80. After forging a cylinder 36 mm. high and 60 mm. diameter down to 15 mm. high, the composition was : Total carbon, 2·89 ; graphite, 1·98 ; carbide carbon, 0·63 ; hardening carbon, 0·28 ; silicon, 0·80. It is found that the most favourable condition of the material occurs when the graphite amounts to about 70 per cent. of the total carbon, as then the continuity of the metal is not too much destroyed, as with higher proportions of graphite, nor is the metal too hard, as with less graphite.

Gold in auriferous sands ; Determination of —— by the wet method. A. Fournier. Compt. rend., 1907, **144**, 378—381.

The sand is intimately mixed with 5—10 per cent. of manganese dioxide, treated with hydrochloric acid in the cold for 24 hours, then heated on the water-bath till the liquid has completely cleared. The liquid is then decanted, and the residue washed with acidulated water ; the liquid and washings are concentrated till their consistence is pasty while the mass is still hot, and the pasty material is dropped into a sufficiency of 95 per cent. alcohol, thoroughly shaken, allowed to stand for 48 hours, and decanted. The alcoholic solution is heated on the water-bath and saturated with hydrogen sulphide, which may take 6—12 hours, or even more if quantities of more than a kilogramme are being treated. The alcohol has the advantages of : (1) Separating as insoluble a number of substances soluble in water ; (2) favouring the agglomeration and settling out of the precipitated sulphides ; (3) reducing considerably the precipitation of sulphur by ferric iron ; (4) preventing the co-precipitation of ferrous sulphide, or facilitating its removal by washing. The sulphides are washed with boiling water, containing a little hydrochloric acid, finally with pure water. They are then extracted with hydrochloric acid free from nitric acid, and afterwards dissolved in nitrohydrochloric acid, and treated to separate the gold. The advantage of this over the dry method is that much larger quantities can be treated.—J. T. D.

Zinc ; Determination of the proportions of —— present as carbonate and silicate in ores. P. H. Walker and H. Schreiber. J. Amer. Chem. Soc., 1907, **29**, 211—214.

The method here suggested for determining the relative amounts of zinc present as carbonate and silicate in an ore gives results which, although only approximate, are more accurate than those given by existing processes. 0·5 grm. of the ore is heated with 5 c.c. of water and 10 c.c. of hydrochloric acid, and filtered at once and washed. The insoluble matter subtracted from the total silica gives the amount of silica in combination as zinc silicate, $H_2Zn_2SiO_5$, and hence the weight of zinc as silicate (A grms.). A portion of the ore is heated in a porcelain boat for 45 minutes at 350°—400° C., and the carbon dioxide evolved is absorbed and weighed. This gives the amount of zinc present as carbonate, $ZnCO_3$ (B grms.). The total zinc is then determined (C grms.). The true weight of zinc present as silicate is then taken as $(A+C-B)/_2$ grms., and of that present in the form of carbonate as $(B+C-A)/_2$ grms.—F. SODN.

Zinc [in ores]; Determination of —— by the ferrocyanide method. W. H. Seaman, J. Amer. Chem. Soc., 1907, **29**, 205—211.

TITRATION with ferrocyanide, under suitable conditions, gives higher and more accurate results than the gravimetric method for the determination of zinc. The presence of potassium chlorate or a large excess of hydrochloric acid during titration vitiates the results, and such metals as iron, manganese, copper, cadmium, and lead should also be absent. Aluminium is recommended instead of lead for the removal of copper, the process being carried out as follows: 0·5 grm. of the ore is covered with 7 c.c. of concentrated nitric acid, and an equal volume of hydrochloric acid is then added. The mixture is allowed to act for 15 minutes at a temperature not exceeding 60° C., 7 grms. of ammonium chloride are now introduced, and the whole evaporated to dryness. After making alkaline with 5 c.c. of ammonia, 15 c.c. of bromine water are added, and the mixture is boiled for three minutes, filtered hot, and the precipitate washed with a mixture of ammonium chloride and ammonia. The filtrate, faintly acidified with hydrochloric acid, is boiled for three minutes with aluminium foil, which precipitates all the copper, lead, and cadmium. The foil is then removed, and the liquid titrated hot, the precipitated metals in no way interfering. In standardising the ferrocyanide solution, the amount of zinc used should correspond as closely as possible to that in the ore, and a correction must always be made for the amount of ferrocyanide required to produce the coloration of the indicator in a blank experiment.—F. SODN.

Tin exports from the Federated Malay States. Bd. of Trade J., March 7, 1907. [T.R.]

THE following statement shows the weight of tin and tin ore (tin exported as ore being taken at 70 per cent. of the gross weight of the ore) exported from the Federated Malay States during the last two years:—

State	1905.			1906.		
	Tin.	Tin exported in the form of ore.	Total.	Tin.	Tin exported in the form of ore.	Total.
	pikuls	pikuls.	pikuls.	pikuls.	pikuls.	pikuls.
Perak ..	139,005	307,776	446,781	132,870	303,039	435,909
Selangor	114,686	175,181	289,867	116,968	151,655	268,623
Negri Sembilan	48,998	36,135	85,133	47,490	30,276	77,766
Pahang .	5,600	29,279	34,879	9,420	25,068	34,488
Total	308,289	548,371	856,660	306,748	510,038	816,786

NOTE.—1 pikul = 133⅓ lb.

Mineral production of the United Kingdom in 1906. Bd. of Trade J., March 7, 1907. [T.R.]

THE following tables show the output of coal and other minerals in the United Kingdom at mines worked under the Coal and Metalliferous Mines Regulations Acts during 1906, with comparative figures for the preceding year:—

I.—*Output of minerals under the Coal Mines Regulations Acts.*

——	1905.	1906.
	tons.	tons.
Barytes	4,034	7,199
Coal	236,111,150	251,050,809
Clay and shale other than fire-clay and oil shale	306,561	252,275
Fire-clay	2,847,122	2,971,173
Igneous rock	900	424
Iron pyrites	8,573	7,342
Ironstone	7,860,969	8,209,880
Limestone	33,167	32,816
Oil shale	2,496,567	2,546,113
Sandstone (including "ganister")	113,505*	126,675*
Petroleum	46	10
Total	249,782,594	265,204,716

* The quantity of ganister obtained was 107,337 tons in 1905 and 119,803 tons in 1906.

II.—*Output of minerals under Metalliferous Mines Regulation Act.*

——	1905.	1906.
	tons.	tons.
Barytes	24,323	27,827
Clay and shale	114,699	118,521
Gold ore	15,981	17,384
Gypsum	216,945	196,143
Igneous rocks	84,977	72,722
Iron ore	1,768,279	1,824,415
Lead ore	27,246	30,226
Limestone	498,633	767,421
Rock salt	231,546	230,558
Sandstone	175,776†	116,579†
Slate	148,602	126,699
Zinc ore	23,909	22,824
Other minerals	113,562	263,178
Total	3,444,478	3,814,497

† Including 2,782 tons of ganister in 1905 and 3,040 tons in 1906.

The above figures do not in all cases represent the total production of minerals. Large quantities of several minerals such as iron ore, limestone, sandstone, slate, clay, &c., are obtained from quarries under the Quarries Act, and from other open workings, the returns from which are not yet available. The totals for coal and the ores of copper, lead, and zinc are, however, substantially complete.

ENGLISH PATENTS.

Iron and steel; Direct process of manufacturing ——. M. Moore, Melbourne, and T. J. Heskett, Brunswick, Vic. Eng. Pat. 17,131, July 30, 1906.

SEE Fr. Pat. 368,598 of 1906; this J., 1907, 53.—T. F. B.

Ferro-chromium; Manufacture of ——. H. W. C. Annable and The Ferro-Alloys Synd., Ltd., London. Eng. Pat. 5030, March 1, 1906.

SEE Fr. Pat. 370,644 of 1906; following these.—T. F. B.

Gold, platinum, silver, nickel, copper, and other metals; Process for the extraction of ——. C. K. Mills, London. From A. Seigle, Lyons, France. Eng. Pat. 3575, Feb. 13, 1906.

SEE Fr. Pat. 363,039 of 1906; this J., 1906, 816. Reference is directed, under Section 1, subsection 6, of the Patents Act, 1902, to Eng. Pats. 883 of 1859, and 8332 of 1888.—T. F. B.

Brass, copper, and any white metal; Method of and means for treating the surfaces of —— for the purpose of joining together these metals or otherwise using them. R. J. Crowley and F. Fitz Payne, London. Eng. Pat. 3310, Feb. 10, 1906.

THE surfaces of the metals to be joined together are first coated with a layer of a suitable flux and then soldered with an alloy of tin, lead, and zinc (see following abstract)

A suitable flux recommended consists of zinc and aluminium in the proportion of about three parts of zinc to one of aluminium, dissolved in just sufficient hydrochloric acid. For aluminium, olive oil is used as flux. It is also claimed that this method may be used to give a protective coating to metals.—O. F. H.

Brass, copper, and any white metal; A metallic alloy for use in surfacing ——, to facilitate the joining together of such metals by soldering, as well as for other purposes. R. J. Crowley and F. Fitz Payne, London. Eng. Pat. 3310A, Feb. 10, 1906.

A MIXTURE of three parts of tin, one part of lead, and one part of zinc is slowly melted in a tinned iron vessel having perforations to allow of the passage of oxygen through and over the melting metal, in order to purify it. The purified molten metal is then allowed to run through or is poured out into an enamelled iron pan, and obtained in a powdery condition by continual stirring during cooling. (See preceding abstract.)—O. F. H.

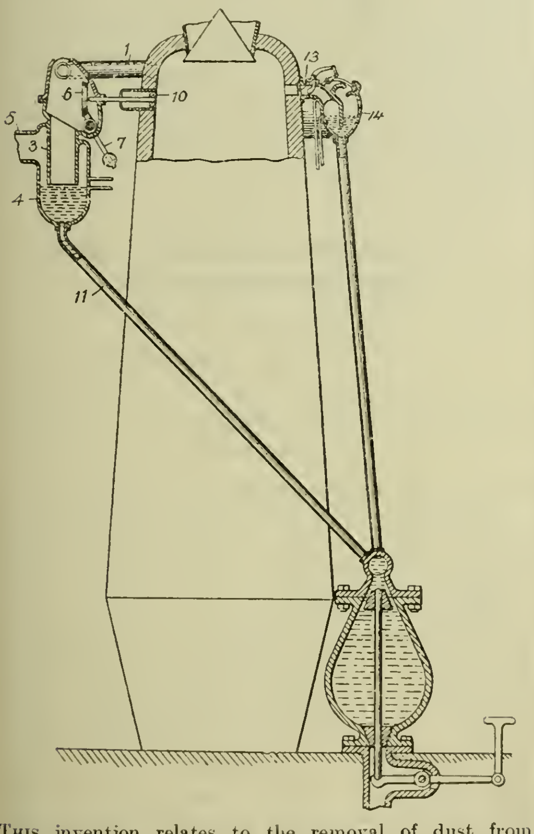
Ores; Treatment of pyritic ——. W. Blackmore and A. Howard, Assignors to The T. R. Refractory Ore Synd., Ltd., London. U.S. Pat. 839,451, Dec. 25, 1906.

SEE Eng. Pat. 17,839 of 1905; this J., 1906, 988.—T. F. B.

Iron ores; Process of smelting ——. C. Ellis, White Plains, N.Y. U.S. Pat. 839,126, Dec. 25, 1906.

THE iron ore, such as magnetic concentrates, is dried and heated by waste gases, mixed with carbonaceous material and fluxes, and heated in thin layers to a high temperature in a reducing flame, the metal and slag being removed from the furnace in a molten condition. The furnace used consists of an inclined revolving cylinder, for the preliminary heating of the ore, connected to an inclined reduction hearth, and a well or crucible for the molten products of the furnace.—O. F. H.

Blast-furnace. J. Coyne, Wilkinsburg, Pa. U.S. Pat. 836,801, Nov. 27, 1907.



THIS invention relates to the removal of dust from the furnace gases. Under normal conditions of working, the gases from the furnace are drawn off by the pipe, 1, and pass by the pipe, 3, into the chamber, 4, which is filled with water nearly to the level of the pipe, 3. The gases are thus forced to abruptly change their direction, pass over the surface of the water, and deposit their dust. The gases pass by the pipe, 5, to the "downcomer pipe," 11, leading to a collector for the dust. In the event of an explosion in the furnace, the piston, 10, is forced out and closes the valve, 6, normally held open by the weight, 7; the gases then pass through the valve, 13, forced open by the increased pressure, into the explosion chamber, 14, where provision is made for the separation of the solid particles and the free escape of the gases.—O. F. H.

Furnace; Mechanically rabbled ore roasting ——. T. Edwards, Ballarat, Australia. U.S. Pat. 836,871, Nov. 27, 1907.

THE furnace is a double-bedded one, with two series of rabbles rotated at equal speeds by overhead shafting, the rabble arms describing circles whose circumferences intersect longitudinally and laterally on each hearth. The rabble arms on each stem are in the same vertical plane to permit of removal through openings in the roof of each hearth, and both stems and arms are hollow and partitioned to allow for water cooling. The two hearths slope in opposite directions, and in the thick part of the tapering portion between them is built an air chamber with openings for the admission of cold air. The object of this air chamber is to cool the upper hearth when necessary (*e.g.*, when roasting very sulphurous ores) by drawing cold air through the chamber. The air thus heated, may either be used in the fireplace attached to the lower hearth, or be allowed to pass through a flue beneath the lower hearth, or direct to the chimney. There is also an auxiliary fireplace attached to the upper hearth, and the furnace is provided with side air and sight holes for each hearth, and suitable openings for the passage of ore from the upper to the lower hearth.—O. F. H.

Zinc smelting furnace. W. Lanyon, Iola, Kan. U.S. Pat. 839,160, Dec. 25, 1906.

THE retort chamber is built with a central wall containing the outlet flue, and gas and air passages. The gaseous fuel and air are admitted to the retort chamber by openings at the base of the central wall at the ends of the furnace, and during combustion are made to pass upwards around the end retorts and downwards around central retorts to the outlet flue by openings at the base of the central wall. Inlet passages from the exterior are provided at the top of the central wall at the ends of the furnace and through the end walls.—O. F. H.

Ores; Apparatus for separating metals from ——. W. Snee, Assignor to J. A. Snee, West Elizabeth, Pa. U.S. Pat. 839,329, Dec. 25, 1906.

THE apparatus consists of an upper shoot provided with screens and having an oscillating lateral movement, and a lower separating shoot, also having an oscillating lateral motion, which receives the screened material. An air blast passes through transverse openings in the bottom of the separating shoot, below which suitable receptacles are arranged, these openings being opened or closed by slide valves.—O. F. H.

Drying air for metallurgical purposes; Apparatus for ——. G. Cattaneo, Charlottenburg, and J. Schlesinger, Berlin, Germany. U.S. Pat. 839,362, Dec. 25, 1906.

THE air to be dried passes through a shower of cooled hygroscopic liquid in a chamber containing a number of shallow trickling-trays. The apparatus also includes a concentrator, a refrigerator, and a "heat equaliser" in which the warm liquid from the concentrator is cooled by the cold liquid from the refrigerator.—O. F. H.

FRENCH PATENTS.

Armour plates; Process of making ——. Marrel Frères. First Addition, dated Oct. 4, 1906, to Fr. Pat. 366,532, May 23, 1906 (this J., 1906, 1051).

THE plates are tempered on one side only, permitting of the use of harder steels containing up to 5 per cent. of nickel.—O. F. H.

Metal [iron or steel]; Treatment [carburisation] of ——. W. S. Simpson. Fr. Pat. 371,098, Nov. 5, 1906.

The article to be treated is covered with carbonaceous material (made into a paste with treacle or sugar) in places where a carburised surface is desired, and with fireclay or other non-carbonaceous material in the other parts, and the whole is then dried. The article so prepared is now heated for a sufficient length of time at the required temperature by wholly or partially submerging it in a bath of molten metal or alloy of high melting point, preferably cast iron. When the carburisation is considered to have proceeded far enough, the article is taken out of the bath, and, after removal of the covering, cooled quickly by quenching in oil or water. It is claimed that by this process, carburisation, hardening, tempering, or annealing may be done uniformly and rapidly without surface oxidation.—O. F. H.

Ferro-chrome; Manufacture of ——. H. W. C. Annable and The Ferro Alloys Syndicate, Ltd. Fr. Pat. 370,644, Oct. 20, 1906. Under Int. Conv., March 1, 1906.

Chromiferous iron ore (chromite) is smelted with carbonaceous material, preferably anthracite, and the crude ferro-chrome thus obtained is mixed with iron oxide in sufficient quantity to obtain a product containing the desired percentage of chromium, and with fluxes (cryolite, fluorspar, &c.). The mixture is then smelted in a closed vessel above a layer of iron oxide, through which the fused ferro-chrome has to pass. In this way, ferro-chrome practically free from carbon is obtained. The process may be carried out in a single operation, the ore being mixed with carbonaceous material, iron oxide, and fluxes, and the mixture smelted above a layer of iron oxide.—A. S.

Ferro-molybdenum; Process for the manufacture of ——. H. W. C. Annable and The Ferro Alloys Syndicate, Ltd. Fr. Pat. 370,645, Oct. 20, 1906. Under Int. Conv., March 1, 1906.

A mixture of finely-ground molybdenite with an alkali carbonate or alkali hydroxide or both, is heated in a reverberatory furnace to just below its melting point, in an oxidising atmosphere. The resulting product, consisting of a mixture of alkali sulphate and molybdate, together with excess of alkali, is lixiviated with water, the solution is heated, and molybdate of iron precipitated by the addition of an iron salt. This is removed from the solution, dried, and reduced to ferro-molybdenum by heating to dull redness in a current of producer-gas or water-gas. —A. S.

Auriferous arsenic or antimony ores; Treatment of ——. Soc. Savigny père et fils. Fr. Pat. 370,783, Dec. 27, 1905.

The finely-ground ore is mixed with 8—20 per cent. of pitch or tar, and the mixture formed into briquettes, which are dried in the air. These briquettes are worked up in cupola furnaces in the manner usual for arsenic and antimony ores, when, it is stated, the precious metals become concentrated in the residue in a condition very suitable for further treatment.—A. S.

Tin; Process for the extraction of —— *from ores, dross, residues, and other stanniferous materials.* H. Brandenburg. Fr. Pat. 370,355, Oct. 10, 1906.

The finely powdered material, preferably subjected to some previous treatment, such as magnetic separation, is mixed with a reducing agent also in a fine state of division, and heated in a furnace to such a temperature that precludes the formation of any slag, thereby avoiding the heavy loss of tin usually contained in the slags of ordinary tin smelting operations. The finely powdered crude tin thus obtained may then be refined by chemical, electro-chemical, or other means.—O. F. H.

Tin ores; Process for separating the iron contained in the intermediate products of the treatment of —— *and in residues, slags, hardhead, putty powder, dross, and flue dust.* H. Brandenburg. Fr. Pat. 370,356, Oct. 10, 1906.

The materials are smelted with silicate of tin, or slag containing silicate or oxides of tin. The tin in the residues, &c., and the tin in the slag added is obtained as metal, and the iron remains as silicate in the slag.—O. F. H.

Zinc ores or zinc sulphide; Direct transformation of sulphurised —— *into metallic zinc, with utilisation of the sulphur and recovery of the flux used for the desulphurisation.* Rheinisch-Nassauische Bergwerks und Hütten Akt.-Ges. Fr. Pat. 370,503, Oct. 15, 1906.

See Eng. Pat. 24,096 of 1906; this J., 1907, 98.—T. F. B.

Soldering; Composition for ——. J. W. Bagger. Fr. Pat. 370,706, Oct. 23, 1906.

An alloy of tin and lead, to which may be added antimony, bismuth, or cadmium (for raising or lowering the melting point of the resulting product) is ground to a fine powder under the action of heat and a vacuum, and then mixed with lactic acid and glycerin to obtain a plastic mass suitable for soldering.—A. S.

Cement made from blast-furnace slag and other similar materials; Process for accelerating the setting of hydraulic ——. Königshofer Cement-Fabrik Act.-Ges. Fr. Pat. 370,939, Oct. 29, 1906. IX., page 257.

Slags of required character and composition; Process for the formation of —— *in the treatment of ores and other materials in the presence of carbon and boric acid.* H. Herrenschmidt. Fr. Pat. 371,019, Nov. 2, 1906.

This invention is a modification of the process called the "boro-carbon process," described in Fr. Pat. 369,878 of 1906 (this J., 1907), with the object of altering the composition of the slag as required in order to give a readily saleable by-product. Thus, in the treatment of bauxite by the boro-carbon process, artificial corundum is obtained as slag; but by adding magnesia or a salt of magnesium to the charge, the slag is altered to an easily utilisable aluminate of magnesium, without interfering with the production of metal. In a similar way, by adding lime to a charge containing phosphoric iron ores, phosphates of lime for agricultural purposes may be obtained. It is also claimed that very poor ores may be profitably treated by this process. Thus, clays containing small quantities of iron may be treated in the electric furnace by the boro-carbon process, modified by the addition of iron in sufficient quantity to collect all the iron reduced from the clay and to alloy with all the silicon, the alumina being left in a state of purity as corundum.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 210.)

(*A.*)—ELECTRO CHEMISTRY.

Lead; Electrolytic determination of ——. G. Vortmann. XXIII., page 281.

English Patents.

Filaments for incandescent electric lamps. A. Bourdos, R. Rothschild, and J. W. Sutcliffe. Eng. Pat. 11,279, May 14, 1906. II., page 248.

Galvanic elements [batteries]; Primary ——. E. W. Jungner. Eng. Pat. 15,727, July 11, 1906. Under Int. Conv., July 12, 1905.

This invention relates to a primary battery, the anode of which consists of pieces of amorphous carbon placed on the bottom of a suitable vessel, a perforated disc of lead or other heavy conductive material, indifferent to the electrolyte, being placed over and kept pressed against the surface of the anode. The inactive conductive portion of the cathode consists of porous, preferably crystalline, graphite, which may be mixed with other substances, the mass being "bricked" in a suitable manner and perforated. The cathode is depolarised by means of the oxygen in the air, the latter being introduced in a mechanical way into the cathode. The electrolyte consists of highly concentrated sulphuric acid (containing at least over 50 per cent. of H_2SO_4), and the acid is heated by steam to a temperature above that of the surrounding atmosphere. Other substances, which have the property of taking up and delivering oxygen during electrolysis, may be mixed with the electrolyte surrounding the cathode, a partition of porous conductive material, such as "bricked" graphite, being interposed between the electrodes. The partition is in conductive communication with the cathode, for the purpose of depriving the oxidising substances of the electrolyte of their depolarising property by the diffusion through the partition, thereby avoiding local reactions at the anode. The latter may consist of a mixture of pulverised amorphous carbon and finely divided crystalline graphite, the mixture being formed in a suitable manner into bricks.—B. N.

Electrodes for electrolytic purposes. P. Ferchland, Berlin. Eng. Pat. 24,806, Nov. 5, 1906. Under Int. Conv., Nov. 9, 1905.

Lead peroxide is deposited electrolytically in a compact form from solutions of lead salts on all sides of suitable conductors, the latter being rotated around their own axes during deposition; the conductors are afterwards removed. —B. N.

Nitric oxide; Apparatus for producing —— by electricity. I. Moscicki, Fribourg, Switzerland. Eng. Pat. 3583, Feb. 13, 1906.

See Fr. Pat. 369,387 of 1906; this J., 1907, 157.—T. F. B.

French Patents.

Wood for use in electrochemical apparatus; Method of preparing ——. Q. Marino and E. W. Barton-Wright. Fr. Pat. 370,457, Oct. 13, 1906.

See Eng. Pat. 20,143 of 1905; this J., 1906, 1052.—T. F. B.

Furnaces; Electric —— with transformers. A. R. Lindblad and O. Stalhane, Sweden. Fr. Pat. 370,583, Oct. 18, 1906. Under Int. Conv., May 8, 1906.

Electric furnaces, with transformers, are provided with a core of laminated iron, the laminæ being arranged in such a manner that the lines of force pass through a great number of the laminæ. The core may be constructed of laminæ with a transverse triangular section, the plane of which is parallel to the plane of the external surface of the core. Each lamina is of such a section that, when the parts are assembled, channels are formed at the interior of the core for the circulation of a cooling agent.—B. N.

Tissue impenetrable to Röntgen rays; Preparation of a ——. W. Meisel. Fr. Pat. 370,635, Oct. 20, 1906. V., page 253.

Tungsten or molybdenum incandescence filaments; Process for making uniform ——. J. Lux. Fr. Pat. 371,148, Nov. 6, 1906. II., page 250.

Purification of liquids [water]; Electrolytic apparatus for the ——. Hinkson Electric Liquid Purifying Co. Fr. Pat. 370,281, Oct. 6, 1906. XVIII*B*., page 273.

Electrolysis of liquids; Apparatus for the ——. E. Weichert. Fr. Pat. 370,718, Oct. 23, 1906.

This invention relates to a method of circulating the liquid to be electrolysed through a winding pipe placed horizontally in a refrigerating chamber. The upper points of the pipe open into the cells containing the electrodes, the extremities of each spire opening into two different but adjacent cells. A basin is divided into cells by means of partitions. The electrodes are fixed to conductors of U-form, one arm of each carrying a positive electrode and the other the negative, the positive and negative dipping into adjacent cells.—B. N.

Nitrogen; System of apparatus for manufacture of compounds of ——. Chem. Fabr. Buckau. Fr. Pat. 370,977, Oct. 31, 1906.

The invention relates to a system of magneto-electric apparatus designed for the production of compounds of nitrogen by the treatment of air or other suitable mixture of nitrogen and oxygen, by means of a flame of high tension. The electrodes are so disposed in a magnetic field that the lines of force cut normally the arcs constituting the flame. Such electrodes form the sides of an annular opening of uniform size across which the gaseous mixture to be treated is compelled to pass.—E. S.

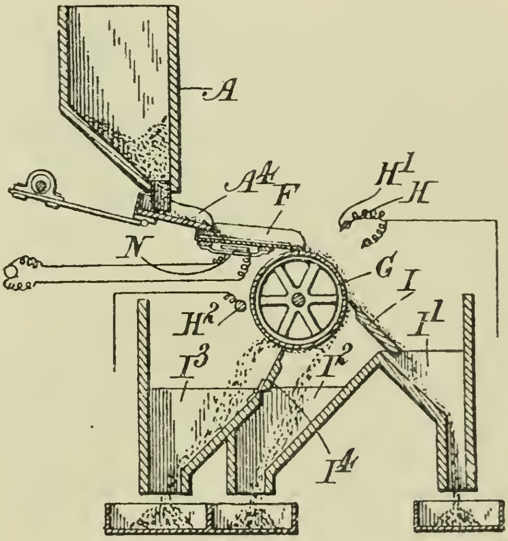
(*B*.)—ELECTRO-METALLURGY.

Nickel and cobalt; Distillation of ——. H. Moissan. Annalen, 1907, **351**, 510—513.

The distillation of nickel and cobalt in the author's electric furnace is described. From 150 grms. of pure nickel heated for five minutes by a current of 500 ampères at 110 volts., 56 grms. of metal distilled over. In another experiment, 200 grms. of nickel distilled over completely in nine minutes. Under similar conditions, 21 grms. distilled over from 150 grms. of pure cobalt in five minutes. From the relative amounts of the metals which distilled over, the author concludes that there is a greater difference between the boiling points of nickel and cobalt than between their melting points (nickel 1470° C.; cobalt, 1530° C.).—A. S.

English Patents.

Separation [electrical] of particles of different dielectric capacities. H. M. Sutton, London. Eng. Pat. 2993, Feb. 7, 1906.



This invention relates to a process of separating powdered materials having different dielectric capacities, and consists in feeding the materials on to an electrically grounded conveyer, through a field in which a silent electric discharge takes place, whereby certain particles acquire a residual polarity, and adhere to a greater or lesser extent to the conveyer. The material is fed from a hopper, A, on to a distributer, comprising a pan, A^4, which shakes in a direction at right angles to the axis of the roller, G, and a grooved or fluted tray, F, which shakes in a direction parallel to the axis of the roller. An electric heater, N, is arranged to heat the materials before they reach the dielectric separater. The latter consists of a rotating roller or conveyer, G, and an electrical charging device, comprising a conductor, H, provided with a series of sharp metallic points, H^1, from which an electrical discharge takes place to the conveyer, the rod, H, being connected to one pole of an electrostatic generator. A releasing conductor, H^2, near the opposite side of the roller, is connected to the other pole of the generator. An interrupter may be connected by a line to the charging device, H, the former comprising a rotating slotted disc, or two slotted discs relatively adjustable to each other in order that the lengths of the openings of the slots may be diminished or increased. The separated particles are delivered by adjustable plates, I and I^4, into shoots, I^1, I^2, and I^3.—B. N.

Electro-depositing apparatus. W. Hartnell, Leeds. Eng. Pat. 8712, April 11, 1906.

Copper or other metal is electrolytically deposited on a revolving horizontal cylinder, which is immersed in the electrolyte above the level of the axle of the cylinder. In order that the driving gear may be placed outside the bath, the axle of the cylinder projects through slots in the sides of the bath, and the slots are closed by slides. By means of chambers outside the bath, and adjoining the slots, the latter may be utilised as overflow orifices. A suitable sleeve passes over the axle to insulate it at the place where it passes through the slots, and rings, which may form part of the sleeve, are placed just outside the bath, and these, by centrifugal action, prevent the electrolyte from passing along the axle to the driving gear.—B. N.

French Patents.

Copper and other metals ; Formation of electrolytic deposits of ——. S. O. Cowper-Coles. Fr. Pat. 371,112, Nov. 5, 1906. Under Int. Conv., April 12, 1906.

See Eng. Pat. 8924 of 1906 ; this J., 1907, 158.—T. F. B.

Alloys of copper and tin ; Process for separating the elements of ——. E. A. Campagne. Fr. Pat. 361,984, Dec. 13, 1905.

The process is an electrolytic one, the copper being obtained in a state of purity by the usual method of electrolytic refining, whilst the tin, in the form of hydrated oxide mixed with lead sulphate, copper, arsenic, antimony, and silver, remains as a residue. The residue is washed, dried, and dissolved in a 10 per cent. solution of caustic soda, and the foreign metals in the solution are precipitated by adding the exactly necessary quantity of sulphide or hyposulphite of sodium. The pure stannate solution is then electrolysed, using sheet iron anodes and tin or tin plate cathodes. The E.M.F. required is 2·5 to 2·8 volts.
—O. F. H.

Zinc ; Electrolytic extraction of —— *from its ores.* C. J. Tossizza. Fr. Pat. 370,803, Dec. 30, 1905.

Salts of zinc are electrolysed, using insoluble anodes, in a vat divided into two compartments by a porous diaphragm. The solution in the anode compartment is saturated with sulphurous acid to act as a depolariser, in order to permit electrolysis to be carried on with a low and constant voltage. Around the cathode is maintained a liquid charged with substances which will neutralise the free sulphuric acid produced at the anodes. Evolution of hydrogen at the cathode is thus avoided, and good deposits of zinc are obtained.—B. N.

Ores ; [Electrical] Process and apparatus for the reduction of ——. M. Ruthenburg. Fr. Pat. 370,300, Oct. 8, 1906.

This invention relates to a process of reducing ores, and consists in first melting a mass of ore, *e.g.*, oxide of iron, and maintaining it in a fluid condition by means of the electric current. Whilst the mass is kept in the molten condition, there is injected into it a suitable agent to combine with the constituent which it is desired to remove. For instance, oxygen is removed from iron ores by injection of carbon monoxide, and sulphur from sulphide ores by injection of air. The electrodes consist of metallic tubes, and are provided at their lower ends, where they come in contact with the molten material, with refractory mouthpieces of carbon, each of the latter being fixed in position by means of a threaded collar. The electrodes and mouthpieces are cooled by a suitable refrigerating agent, the tubes carrying the latter passing through caps which close the upper ends of the electrodes. The electrodes are supported independently of the furnace, so that they may be raised or lowered, and thus adapted to the level of the liquid. An overflow siphon is provided for withdrawing the metal.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 212.)

Njave butter. K. Wedemeyer. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 35—36.

Njave butter, or njari oil, is obtained from the seeds of *Mimusops njave*, a West African tree, belonging to the family of *Sapotaceæ*, to which also belongs the tree yielding shea butter, which this fat resembles. The seeds examined by the author weighed from 10 to 15 grms. each, the shells constituting about a third of the amount. The white kernels yielded about 50 per cent. of fat by extraction with ether, and the residue, which had a bitter taste, contained 19·74 per cent. of proteids. The fat was a white solid at the ordinary temperature. When melted and cooled, it began to form a deposit at 31° C., and at 19° C. solidified to a butter-like mass. It had a slightly rancid odour, recalling that of shea butter. Analysis gave the following results :—Sp. gr. at 40° C., 0·8979 ; acid value, 38·1 ; saponification value, 185·3 ; iodine value, 56·1 ; Reichert-Meissl value, 1·2 ; Hehner value, 96·1 ; acetyl value, 13·4 ; Maumené test, 55° C. ; Zeiss butyro-refractometer at 40° C., 52·0 (D = 1·4606) ; solidification point of fatty acids, 44·1° C ; melting point of fatty acids, 46·6° C. ; neutralisation value of fatty acids, 201·7 ; and unsaponifiable matter, 3·66 per cent.—C. A. M.

Chinese wood oil [*tung oil*]. W. Normann. Chem.-Zeit. 1907, **31**. 188.

Chinese wood oil remained practically unaffected by exposure to light for one week in a sealed glass tube. On saponifying the oil, the clear soap solution remains unaltered if kept in the dark, but on exposure to light, fine crystals gradually separate. The free fatty acids are also sensitive to light, and become polymerised. On heating the oil to 300°—320° C. in a sealed tube, polymerisation proceeds further, and is accompanied by slight decomposition. Oil which has become solid by exposure to light undergoes further change on heating, but oil already polymerised by heat is not affected by exposure to light.—A. S.

Kola nut ; Occurrence of a lipolytic enzyme in ——. H. Mastbaum. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 5—7 ; 31—34 ; 44—46.

The kola nut contains a lipolytic enzyme (*kola-lipase*), which differs from the vegetable lipases hitherto described in the fact that its activity is considerably checked, or even destroyed, by the presence of dilute acids, or by water alone. The enzyme has been found to act upon olive, cottonseed, sesamé, arachis, almond, nut, castor, and curcas oils, and upon cacao butter, the amount of fatty acids liberated in two days by the action of 4 grms. of kola meal upon 20 c.c. of the respective oils ranging from 2·25 per cent. to 4·50 per cent. (calculated on the original oil). The amount of oil hydrolysed, appears to be in approximately direct proportion to the quantity of kola used. Thus, in experiments in which 20 c.c. of olive oil (containing 0·4 per cent. of free fatty acids) were treated for two days with different amounts of kola meal, the following amounts of fatty acids were found :—With 1 grm. of kola, 1·6 per cent. ; 2 grms., 2·75 per cent. ; 5 grms., 5·8 per cent. ; 8 grms., 8·2 per cent. ; 9 grms., 9·2 per cent. ; and 10 grms., 9·9 per cent. The amount of hydrolysis reached, rises rapidly at first with the increase in the time of digestion, but after some time a state of equilibrium is reached. The more free acid the original oil contains, the weaker the action of the enzyme. The enzymic activity is promoted by heat—up to 50° C. ; it is completely destroyed by heating the kola meal for two hours at 104° C. Small quantities of sodium chloride, potassium chloride, potassium bromide, potassium sulphate, ammonium sulphate, potassium ferrocyanide, potassium permanganate, magnesium, nickel, iron, cobalt, manganese, zinc, and copper sulphates, citric and tartaric acids, saccharose, dextrose, urea, and benzene do not destroy the activity of kola lipase ; but the following substances have an injurious effect :—Potassium cyanide, calcium chloride, mercuric chloride, bismuth nitrate, phosphorus pentoxide, arsenic, water, dilute acids, dilute sodium hydroxide solution, alcohol, and chloroform. The lipolytic action is stimulated by the addition of potassium chromate, salicylic acid, ether, and petroleum spirit. Enzymes resembling kola-lipase in their action are found in small quantity in maize, edible chestnuts, and mace nuts, in somewhat greater proportion in oats, and in considerable quantity in black pepper. Coffee and cacao beans, nuts, almonds, wheat, rye, barley, malt, and beans do not contain lipolytic enzymes.—C. A. M.

Fats ; Enzymic hydrolysis of ——. E. Hoyer. Z. physiol. Chem., 1907, **50**, 414. Woch. f. Brau., 1907, **24**, 117—118.

The sudden development of acid that occurs when crushed castor seeds are mixed with water is due to the action of an enzyme and not to bacterial action. This formation of acid, which precedes the action of the lipase upon the oil, is promoted by adding to the mixture a suitable acid, preferably that formed in the seeds themselves. The acid-forming enzyme is soluble in water, and the author's experiments on the lines of Buchner and Meisenheimer (this J., 1904, 262 ; 1905, 246), show that, apart from small quantities of formic and acetic acids, lactic acid is the main product, whilst there is also some carbon dioxide formed. Acetic acid is equally serviceable as a stimulant of the enzymic action. The author has made further attempts to isolate the lipolytic enzyme (this J., 1904, 550 ; 1905, 677). It can be separated in the form of an emulsion by treating the crushed castor seeds with a solvent for oils, and the turbid product, which is very active, is termed " ferment-oil " by the author. Freshly-expressed castor oil also contains a large proportion of the enzyme. When castor seeds are ground with water and then expressed, an emulsion is obtained containing both the acid-producing enzyme and the lipase. On now leaving the liquid to ferment at 14° C., the emulsion separates, yielding a thick scum upon the surface, consisting of about 38 per cent. of ricinoleic acid, 4 per cent. of proteids, and 58 per cent. of water. The lipolytic enzyme thus concentrated is very sensitive to the action of acids and salts, such as manganese sulphate, which, added in minute quantity, stimulate its action. It keeps well in the cold, but has not been obtained in the form of a dry powder. (See also this J., 1902, 1541 ; 1903, 639, 805, 873, 1094, 1137 ; 1904, 259, 614, 1152.)—C. A. M.

Cape berry wax. Bull. Imp. Inst., 1906, **4**, 300—301.

This wax is probably derived from one of the species of *myrica* growing in South Africa, and in its general characteristics resembles myrtle wax obtained from *M. cerifera.* Thus, a sample examined gave the following results :—Sp. gr. at 99° C., 0·8741 ; m. pt., 40·5° C. ; acid value, 4·09 ; saponification value, 211·1 ; iodine value, 1·06 ; m. pt. of fatty acids, 47·5° C. ; and mean molecular weight of fatty acids, 236·1. Samples were submitted to two manufacturing firms for valuation. One of these reported that the wax was unsuitable for candles, but yielded a hard white soap. They estimated its value at two-thirds to three-quarters that of ordinary tallow. The second firm offered to buy a trial consignment of 10 tons at a price not exceeding £29. Although ample supplies of the wax are available, there is as yet no proper organisation for collecting it at the right season.—C. A. M.

Paraffin ; Determination of —— *in the unsaponifiable matter from animal fats.* J. Lewkowitsch. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 51.

The author confirms the value of Polenske's method (see page 271), and shows that when a mixture of 90 per cent. of cholesterol with 10 per cent. of paraffin is acetylated and recrystallised, as in the phytosteryl acetate test, the paraffin becomes concentrated in the later crystallisations. When, however, the paraffin amounts to only 3 per cent., this method of fractionation is less applicable ; thus, in the author's experiments, the first crystallisation-deposit melted at 104°—108° C., and the fifth crystallisation-deposit at 103°—108° C. In order to avoid the destruction of alcohols, the following modification of Polenske's quantitative method is recommended :—The unsaponifiable matter, separated in the usual way, is converted into acetates by Bömer's method. If the quantity of paraffin present is about 10 per cent. of the unsaponifiable matter, it can be detected by the naked eye, floating on the surface of the acetic anhydride solution, and with care can be separated by filtration, washed with absolute alcohol, and weighed. Smaller quantities of paraffin remain dissolved in the hot acetic anhydride solution, and in that case the melting points of the crystals successively obtained are determined in the usual way. If the melting-points of the successive crystallisation-deposits are abnormal, paraffin should be looked for. When the original fat contained only about 0·005 to 0·01 per cent. of paraffin, the phytosteryl acetate test may have been rendered uncertain. In such cases the author unites all the crystals with the alcoholic mother liquors, and evaporates the whole to dryness. The residual mixture of acetates and paraffin is then saponified with alcoholic potassium hydroxide solution, and the soap solution extracted with ether. The residue from the ethereal extract can then be saponified, and the result should afford a valuable indication, as is shown in the following table :—

	Saponification values.	
	Calculated	Found.
Cholesteryl acetate	135·5.	—
1. Cholesteryl acetate, 0·1146 grm. + Paraffin, 0·0100 grm.......	124·6	121·5
2. Cholesteryl acetate, 0·1138 grm. + Paraffin, 0·0200 grm.......	115·2	117·3

Lastly, the paraffin can be determined in a fresh ethereal solution by Polenske's method.—C. A. M.

Saponification process ; Theory of the ——. R. Fanto and M. J. Stritar. Annalen, 1907, **351**, 332—343.

The authors give an account of some preliminary experiments made with a view of studying the course of saponification in homogeneous alcoholic solutions. Quantities of 10 grms. of rape oil (acid value, 2·4 ; glycerol, 9·3 per cent.) were each treated with 10 c.c. of $N/2$ or $2N$ alcoholic potassium hydroxide solution, and after different periods of time the reaction was stopped by adding excess of acetic acid. The total quantity of glycerin set free was determined by Zeisel and Fanto's method, this J., 1902, 992 (see also Lewkowitsch, this J., 1903, 576), and from the difference between this and the amount equivalent to the alkali consumed, the amount liberated owing to the formation of ethyl esters of the fatty acids was estimated. With both $N/2$ and $2N$ alkali, nearly the whole of the glycerin was set free after one hour ; towards the end of the reaction, the relative proportion of glycerin liberated owing to the formation of ethyl esters showed a distinct fall. In the residue the authors were able to isolate erucic acid and arachidic acid (this J., 1898, 673, 853, 1107 ; 1899, 1031 ; 1900, 254 ; 1906, 856).—A. S.

Lard ; Examination of ——. E. Polenske. XVIIIA., page 271.

English Patents.

Fats or fatty substances, or the like ; Cooling melted ——. B. McL. Middleton, East Molesey, A. E. Iveson, Gainsborough, and A. R. Wilson, Brighton. Eng. Pat. 3521, Feb. 13, 1906.

The fat is maintained in a molten state in a vessel, one side of which is formed by a moving endless band or revolving drum. Means are provided for cooling the travelling band, and for removing the solidified film of fat from the same, knives and scrapers serving the latter purpose. The supply of melted fat is kept at a constant level in the vessel by means of a ball-cock on the supply-pipe. (See also Eng. Pat. 25,868 of 1903 ; this J., 1904, 1153.)—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(Continued from page 215.)

(A.)—PIGMENTS, PAINTS.

English Patents.

Paint; Manufacture of permanent white ——. J. Ephraim, Berlin. Eng. Pat. 16,516, July 21, 1906. Under Int. Conv., July 24, 1905.

See Fr. Pat. 368,301 of 1906; this J., 1906, 1226.—T.F.B.

Paint; Anti-corrosive ——. R. J. Goddard, New Barnet. Eng. Pat. 16,833, July 25, 1906.

This invention relates to an anti-corrosive paint consisting of the following substances mixed together in a suitable manner approximately in the proportions given:—20 lb. of pure bitumen, 7 lb. of boiled oil, 8 lb. of turpentine, 3½ lb. of terebene driers, and 2 lb. of paraffin oil. Before application, the paint is heated, and also the surface to which it is to be applied, in order to get rid of all moisture. The paint may be afterwards covered with any desired colour for purposes of decoration.—B. N.

French Patents.

Pigment for house painting. M. Ramos-Garcia. Fr. Pat. 370,794, Dec. 29, 1905.

A white pigment, superior in many respects to white lead, is obtained by the reaction of a solution of zinc oxide in ammonia on a mixture of antimonic acid and gelatinous aluminium hydroxide. The addition of a small quantity of carbon bisulphide facilitates the reaction. The product is dried and pulverised, and is then used in the same way as any other pigment.—M. J. S.

Lakes [from azo dyestuffs]; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 370,957, Jan. 6, 1906.

See Eng. Pat. 27,252 of 1905; this J., 1906, 939.—T. F. B.

Lithopone; Rendering —— *resistant to light.* H. Allendorff. Fr. Pat. 370,500, Oct. 15, 1906.

The addition of the oxides, hydroxides, or easily decomposed salts, such as the carbonates or soaps, of calcium, strontium, barium, magnesium, or aluminium, to lithopone at any stage of its manufacture, diminishes its sensitiveness to light. (Compare this J., 1906, 768,939, 1226.) —M. J. S.

(B.)—RESINS, VARNISHES.

Colophony; "Autoxidation" of ——. W. Fahrion. Z. angew. Chem., 1907, **20**, 356—361.

In a former communication (this J., 1902, 127) the author asserted that colophony exposed to the air in a thin layer was transformed into substances of a peroxide nature, insoluble in petroleum spirit; and subsequently (this J., 1904, 328) he defended his view against the criticisms of Tschirch and Studer (this J., 1903, 1250). Since then he has made further experiments, the results of which support his former conclusions. He finds that the formula of abietic acid (from American colophony) is not $C_{19}H_{28}O_2$, but $C_{20}H_{30}O_2$, and that it has two double bonds in its molecule. When the colophony undergoes "autoxidation," there result, as primary products, two amorphous peroxides insoluble in petroleum spirit, and having the formulæ, $C_{20}H_{30}O_4$ and $C_{20}H_{30}O_6$. These peroxides are very unstable and readily undergo molecular transformation, yielding products which are prone to decomposition with liberation of water, and some of the anhydro-derivatives thus formed are soluble in petroleum spirit. The carboxyl group of the molecule is only involved to a slight extent in this final decomposition, though all the products of the "autoxidation" contain, like colophony itself, small quantities of acid anhydrides. In the author's opinion the great variations in the acid and iodine values of commercial colophony are probably due to the presence of variable quantities of neutral bodies, oxyabietic acids and their anhydro derivatives in addition to abietic acid. As regards the bearing of this tendency to "autoxidation" on the technical applications of colophony, it is pointed out that in the varnish industry it can only be advantageous, and that in the manufacture of soap the peroxides first formed may even have a bleaching effect. In the paper industry, however, it is highly desirable that the sizing should be as inert as possible, so that it may have no action upon the fibres. It has already been asserted that the quality of the paper might be injuriously affected by the presence of colophony, and the author's experience tends to confirm this. Two sheets of filter paper on which the powdered rosin had been left to undergo "autoxidation" for two and a half years, had become yellow and brittle in the places in contact with the rosin, whilst the outer edges were completely intact. (See also this J., 1906, 1057.)—C. A. M.

Abietic acid; Occurrence of —— *in rosin oil.* A. Tschirch and M. Wolff. XX., page 276.

United States Patents.

Wood; Process for extracting products from resinous ——. C. B. Darrin, Walla Walla, Wash. U.S. Pat. 839,119, Dec. 25, 1906.

Steam is introduced under pressure into a retort containing resinous wood, at a temperature of about 340° F., the products being collected and separated by means of their specific gravities. The lighter portions are decolorised and clarified in a still at a temperature of 320° F., the turpentine being simultaneously collected. Subsequently dry heat is applied to the residue in the retort to expel the pitch.—S. R. T.

Amber; Process of utilising waste ——. H. Thiemann, Stolp, Germany. U.S. Pat. 839,336, Dec. 25, 1906.

See Fr. Pat. 345,196 of 1904; this J., 1904, 1226.—T. F. B.

Colours [dyestuffs]; Compounds of organic —— *with fatty acids [for printing inks] and process of making same.* B. Homolka, Frankfort, and J. Erber, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 839,590, Dec. 25, 1906.

See Eng. Pat. 10,079 of 1906; this J., 1906, 768.—T. F. B.

French Patents.

Oils and varnishes used in paints; Substitute for ——. N. G. Liwschitz. Fr. Pat. 370,329, Oct. 9, 1906.

The use of a solution of colophony in mineral oils, as a substitute for vegetable drying oils, is claimed, as is also the special mode of preparation which is said to be essential to a satisfactory result. This consists in refining the rectified petroleum by treating it with sulphuric acid, subsequently neutralising the acid, and filtering through animal charcoal.—M. J. S.

Plastic mass [substitute for linoleum and rubber] from fibrous material; Manufacture of a ——. N. Reif and H. Gonnermann. Fr. Pat. 370,490, Oct. 15, 1906. XIII*C.*, page 265.

(C.)—INDIA-RUBBER, &c.

Caoutchouc; Coagulation of rubber latex, and the elastic properties of pure ——. V. Henri. Compt. rend., 1907, **144**, 431—433.

Latex, derived from *Hevea braziliensis*, was dialysed through collodion membranes, until its conductivity, originally 3300×10^{-6}, was reduced to 5×10^{-6}, and the effect of various methods of coagulation upon the product obtained thereby from the purified latex was studied. The author compares the coagulation process to the precipitation of a negative colloid, being led to make the comparison by the observation that the globules, which are of extreme smallness (0·5—2 μ diam.), collect about the anode when the latex is placed in an electric field.

The main conclusions to be drawn from the observations made are three:—(1) Coagulation of rubber latex by electrolytes is brought about by the positive ions, acids and the salts of di- and trivalent metals being the most active agents (as in the precipitation of negative colloids); (2) weak coagulating agents precipitate the rubber in a pulverulent or flocculent form; powerful agents cause it to separate in the form of a clot having a reticular structure, the size of the "mesh" of which varies with the nature of the agent employed; (3) the elasticity and strength of the rubber vary with the nature of the coagulating agent employed. The following table gives breaking strains and corresponding elongations of samples of rubber prepared by various methods of coagulation:—

Method of coagulation.	Breaking strain (per sq. mm. of original cross-sectional area).	Elongation.
	grms.	
Heat (80° C.)	150	8·5
,, (25° C.)	190	7·2
Acetic acid—weak	175	7·5
,, ,, —strong	210	7·1
Trichloracetic acid	325	6·8
Acid + electrolyte 1	310	,,
,, ,, 2	380	,,
,, ,, 3	660	6·5

—E. W. L.

Rubber exports from Brazil in 1906. Bd. of Trade J., March 14, 1907. [T.R.]

The "Brazilian Review" publishes the following statistics of the exports of rubber from the Amazon during 1906, with comparative figures for previous years. Of the 34,768 tons exported in 1906, 2613 tons were from Iquitos and 32,155 tons from Pará and Manáos. The total quantity exported in 1906 comprised 16,705 tons of fine rubber, 3039 tons of medium quality, 8693 tons of Sernamby, and 6331 tons of Caucho.

Years.	To Europe.	To United States of America.	Total.
	tons.	tons.	tons.
1903	16,062	15,033	31,095
1904	14.335	16,309	30,644
1905	18,657	15,260	33,917
1906	18,576	16,192	34,768

English Patent.

Rubber goods; Process of forming ——. F. Ephraim, Torreon, Mexico. Eng. Pat. 15,311, July 5, 1906.

See U.S. Pat. 819,529 of 1906; this J., 1906, 547.—T. F. B.

French Patents.

Plastic mass [substitute for linoleum and rubber] from fibrous material; Manufacture of a ——. N. Reif and H. Gonnermann. Fr. Pat. 370,490, Oct. 15, 1906.

Fibrous material, such as peat, wood, and waste textile products, are finely divided and then impregnated with ammonia gas or intimately mixed with calcium hydroxide. Tar, oils, and resins in solution are then sprayed into the material, under high pressure. By further treatment with sulphur chloride, nitric acid, or oxygen, a plastic mass is obtained which can be worked up into any desired condition.—G. W. McD.

Rubber; Process for the regeneration of old ——. A. Tixier. Fr. Pat. 370,619, Oct. 19, 1906.

The patent relates to a process of regenerating waste rubber, and purifying and improving the quality of rubber, based on the use of terpineol or an analogous oxygenated terpene derivative as a solvent. It is stated that rubber, whether vulcanised or not, is dissolved slowly by cold, more rapidly by hot terpineol, and that from the solution the rubber can be recovered, in a pure, de-vulcanised condition, by addition of a suitable precipitant. Before precipitating the rubber, some of the soluble impurities may be separated by means of suitable precipitants (*e.g.*, benzene). The process of regenerating waste rubber is carried out in the following manner:—The material is reduced to pulp and digested with terpineol (2 parts to 1 part of rubber) at 100°—150° C., in a closed vessel fitted with an agitator. Soluble impurities are precipitated from the solution by agitation with four times its volume of benzene, the clear liquid is separated, the benzene distilled off, and the rubber precipitated from the residual solution by alcohol or acetone. If desired, a solution of other gummy or resinous substances, such as copal, in terpineol may be added to the solution before precipitating the rubber.—A. S.

India-rubber; Process for regenerating old ——. A. Gentzsch. Fr. Pat. 370,871, Oct. 27, 1906. Under Int. Conv., Nov. 16, 1905.

The patent relates to a process of regenerating old vulcanised india-rubber, by powdering it and then intimately mixing it with small quantities (10—20 parts to 80—90 parts of rubber) of such substances as resins, waxes, petroleum residues, paraffin wax, stearine, and oils or fats (preferably oxidised).—A. S.

India-rubber; Process for the regeneration of ——. A. Gentzsch. Fr. Pat. 370,872, Oct. 27, 1906. Under Int. Conv., Feb. 2, 1906.

Old vulcanised rubber is reduced to a fine powder, mixed with from 1/10 to 1/50 of its weight of a solvent for sulphur (aniline oil, tar, or a mixture of the two), the mixture is softened by heating, and worked up and, if desired, vulcanised (without addition of sulphur or with only a small quantity) in the same manner as ordinary rubber.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 214.)

English Patent.

Leather; Coating of ——. B. J. B. Mills, London. From The Patent Leather Co. of America, Newark, U.S.A. Eng. Pat. 16,598, July 23, 1906.

See Fr. Pat. 368,383 of 1906; this J., 1907, 27.—T. F. B.

United States Patents.

Hides, skins, and the like; Process of tanning ——. W. G. Roach, Cincinnati, Ohio, and A. C. Roach, Newport, Ky., Assignors to The Cincinnati Chrome Leather Co., Cincinnati, Ohio. U.S. Pat. 839,204, Dec. 25, 1906.

The process consists in introducing into the fibres of the hide, substances containing a tanning matter capable of being liberated by interaction under suitable conditions, *e.g.*, by heat or a bath of hot grease. Or, a "reducible metallic substance" is reduced in the fibre by means of a reducing agent introduced in a chemically inactive condition, but which is capable of interaction under conditions similar to the above. Thus the hides may be treated with a bath of chromic acid, then painted with glucose, and immersed in a bath of hot grease.—S. R. T.

Hides; Process of tanning ——. W. G. Roach, Cincinnati, Ohio, and A. C. Roach, Newport, Ky., Assignors to The Cincinnati Chrome Leather Co., Cincinnati, Ohio. U.S. Pat. 839,205, Dec. 25, 1906.

In the process described in the preceding abstract steam may be employed to bring about the conditions necessary for the liberation of the tanning matter in the skin fibre. —S. R. T.

Hides; Process of tanning ——. W. G. Roach, Cincinnati, Ohio, and A. C. Roach, Newport, Ky., Assignors to The Cincinnati Chrome Leather Co., Cincinnati, Ohio. U.S. Pat. 839,206, Dec. 25, 1906.

A "reducible metallic substance" such as chromic acid is introduced into the skin fibre. Glycerin or an organic reducing agent is either simultaneously introduced or painted on the surface, and the hides are then stacked in piles until reduction takes place, after which they are washed and finished as required.—S. R. T.

French Patents.

Leather substitute. Soc. Civile d'Études de l'Indéchirable Grimson. Fr. Pat. 370,616, Oct. 19, 1906.

Bands of suitable material, especially the untearable tissues described in Fr. Pat. 326,698 of 1903, are superposed and cemented together by the aid of a suitable adhesive, preferably rubber solution. The thick band thus obtained is coated with a cork paste, prepared by mixing finely-divided cork with rubber solution, and the whole is vulcanised by one of the ordinary methods. —A. S.

Paste similar to size; Process for the manufacture, from casein, of a composition in the form of a ——. A. Bernstein. Fr. Pat. 370,940, Oct. 29, 1906.

The composition consists of an intimate mixture of an alkali compound of casein with a silicate in the colloidal condition. Milk casein is dissolved in the usual manner by the aid of alkalis or alkaline salts, and an alkali silicate and an aqueous solution of a salt such as calcium, barium, or magnesium chloride, is added to and intimately mixed with the solution. The product is stated to act as a strong agglutinant.—A. S.

XV.—MANURES, &c.

(*Continued from page* 214.)

Artificial fertilisers; Nature and function of ——. A. D. Hall. Cantor Lectures, J. Soc. Arts, 1906–7, **55**, 133—140, 148—154, 178—186, 205—214, 232—239.

The soil can always provide a sufficiency of calcium, magnesium, iron, sulphur, chlorine, and silicon, but the elements nitrogen, phosphorus, and potassium must be replaced in the form of fertilisers. The manure required cannot, however, be ascertained by means of a water-culture, because its correct proportions will depend, not only on the nature of the plant, but also on the amount and availability of the plant-food in the soil. An average crop of swedes, for instance, removes from the soil 98 lb. of nitrogen, 22 lb. of phosphoric acid, and 80 lb. of potash, but all field experiments and farming practice show that little beyond phosphoric acid as a manure is required.

Nitrogen.—This is the most important fertilising element. Too much nitrogen, however, tends to late ripening and a profusion of leaf, since it promotes growth. An excess also often renders the plant susceptible to fungoid attacks. Atmospheric nitrogen, though not directly assimilated, becomes available to plants through the agency of bacteria, such as those living in symbiotic relationship with leguminous plants, but hitherto the tendency of land soon to become " clover sick " has limited the application of this method of fixing nitrogen. These bacteria, and others living independently of a host plant, obtain their energy for the chemical fixation of nitrogen by the oxidation of carbohydrate. They are very widely distributed, and probably account for the accumulation of nitrogen where vegetation is allowed to rot. A field at Rothamsted left to run wild for 25 years was found to have gained nitrogen, amounting in some samples to nearly 100 lb. per acre per annum. But only 21·6 per cent. of the nitrogen supplied to the Rothamsted wheat plot during 50 years has been recovered in the crop, the rest having been either lost as free nitrogen, or remaining in the soil in a practically unavailable form. This is because many soil bacteria either waste nitrogen, or are competitors for it. Recent experiments show that a partial sterilisation of the soil may materially improve the crop.

Nitrogenous manures.—(A) *Sodium nitrate:* The sodium in sodium nitrate is very useful, not directly to the plant, but because it will render soluble and available the potassium in insoluble compounds. A dressing of it renders potash manuring superfluous. This is shown in the following table, in which the yields obtained on mangel plots at Rothamsted, receiving equivalent amounts of nitrogen, are given

Plot.		With sodium nitrate.	With ammonium sulphate.	With rape cake.
		tons.	tons.	tons.
6	Superphosphate and potash	29·6	28·2	29·4
5	Superphosphate only ..	28·3	12·0	14·9

But the use of sodium nitrate spoils the tilth of the soil, causing it to remain very wet. This is due, not to the hygroscopic nature of sodium nitrate, but to its rendering the ground somewhat alkaline, thus bringing about adhesion of the clay. Simultaneous addition of superphosphate or ammonium sulphate may be recommended on this account. Being very soluble, it favours deep-rooted plants, and conduces, therefore, to late maturity, not always an advantage. (B) *Ammonium sulphate:* This is practically as effective, nitrogen for nitrogen, as sodium nitrate, and is as rapid in its action, for the process of nitrification, which generally precedes the utilisation of ammonia by the plant, takes place very rapidly in suitable soils. But its continuous use is not desirable on a soil poor in calcium carbonate, for this is converted into calcium sulphate, and the soil may become actually acid to litmus. It does not penetrate so far as sodium nitrate, and, therefore, favours shallow-rooted crops, as barley. An advantage which sodium nitrate possesses over ammonium sulphate is that in the competition for nitrogen between the plant roots and the soil bacteria, this salt is less generally utilisable by the organisms. (C) *Calcium cyanamide:* This has been found not quite so effective as ammonium sulphate on soils already containing calcium carbonate. Its chief drawbacks are, however, its sensitiveness towards water, and the fact that it must be sown alone, unmixed with other manures. The observation of Löhnis that its decomposition into ammonia and calcium carbonate is helped by bacteria in the soil has been confirmed at Rothamsted. (D) *Basic calcium nitrate:* This is just as good a fertiliser, nitrogen for nitrogen, as sodium nitrate, and on many soils (peaty and clay) would give better results than the latter, on account of the calcium carbonate produced by its decomposition. (E) *Peruvian guano:* This contains nitrogen in many states of combination. Some is available at once, but part is present in compounds requiring to undergo bacterial change in the soil before they are ready for assimilation. The plant is thus fed steadily, and, moreover, any causes which check its growth simultaneously check bacterial activity. (F) *Fish guano, meat meals, seed cakes, and shoddy:* These are slow-acting nitrogenous manures, their speed of action depending on their composition and fineness of division. Their value has probably been much under-rated. Organic sources of nitrogen are less valuable, nitrogen for nitrogen, than sodium nitrate or ammonium sulphate, and yet the farmer prefers them. This is probably because organic manures improve the tilth of the soil, whereas ammonium sulphate, and particularly sodium nitrate, injure it. Thus, on the Rothamsted mangel plots manured with sodium nitrate, ammonium sulphate, and rape cake respectively, the first was found most effective in a good season, but over 26 years the rape cake has shown a great superiority, because of the difficulty of getting a full plant upon the other plots.

Phosphatic manures.—Phosphorus tends to root development, and, therefore, improves the young plants. The insoluble forms of calcium phosphate are brought into solution by the carbon dioxide excreted by the root, and not by the acid cell-sap as has been supposed. (A) *Bones:* As fertilisers, these are sold in three forms: (i.) After treatment with acid; (ii.) in the raw, ground-up condition, as *bone meal*, only the fat having been removed; (iii.) After they have been degelatinised and the greater part of the nitrogen has been removed, as *steamed bone flour.* Bone meal, being coarsely ground, is a poor source of phosphorus, and its value has been over-rated. Steamed bone flour, on the other hand, is a good manure, the fine grinding allowing the phosphorus to pass into solution. (b) *Superphosphates :* These are now manufactured chiefly from African phosphates, which contain but little iron and aluminium. Even the mineral phosphates themselves, when very finely ground, may be used directly as a manure. Superphosphate is rapidly precipitated after application, thus remaining in the surface soil. This precipitate is very finely divided, and thoroughly disseminated. (c) *Basic slag :* This has been very successful with certain crops. The lime it contains is largely responsible, rendering available some of the reserves of potash and nitrogen in the soil. It also induces aeration by granulating the clay.

Potash.—Potash is necessary for the process of assimilation, and the manufacture of carbohydrates will not go on in its absence. It tends to prolong the period of growth, and this is not always an advantage. One of its most important effects is to render the plant more resistant to the attacks of fungoid diseases. Potassium sulphate and chloride are now obtained in large quantities from the Stassfurt district. These salts remain chiefly in the surface soil. Potash particularly encourages the growth of leguminous plants, but except on special soils, and with specially potash-loving crops, it is not usual to find in this country that the use of a potash dressing has any visible effect on the yield, so large is the stock of potash in the soil. Grass land and mangels, however, require it, but the addition of any soluble salt, such as sodium nitrate (see above), is equally effective, setting free the potash in the soil.

Action of calcium carbonate on the three constituents of fertilisers.—(a) *Nitrogen compounds :* Some free base is necessary for the nitrification of the ammonium compound which is formed with the clay in the soil, the bacteria growing freely only in neutral or faintly alkaline media. (b) *Phosphorus compounds :* Calcium carbonate is necessary to prevent precipitation of phosphoric acid in the highly insoluble states of phosphates of iron and aluminium. (c) *Potassium compounds :* Calcium carbonate prevents soluble potassium salts from passing into an unavailable condition, as well as liberating potash from its insoluble compounds in the soil. The author considers that the practice of fattening cattle for the sake of the dung is not so profitable as that of using artificial fertilisers.—F. Sodn.

United States Patent.

Insecticide-fertiliser ; Method of making ——. W. B. Chisolm, Charleston, S.C. U.S. Pat. 839,112, Dec. 25, 1906.

See Eng. Pat. 6429 of 1906 ; this J., 1906, 647.—T. F. B.

French Patents.

Sewage ; Treatment of ——. A. M. Muguet. Fr. Pat. 361,994, Dec. 14, 1905. XVIII*B.*, page 273.

Manures ; Manufacture of artificial ——. E. Martin. Fr. Pat. 370,795, Dec. 29, 1905.

See Eng. Pat. 26,887 of 1905 ; this J., 1907, 214.—E. S.

Superphosphates ; Chamber for treating ——, *and for similar application.* Soc. P. Schmidt and Desgraz G.m.b.H. Fr. Pat. 371,203, Oct. 23, 1906.

The chamber is devised with a steeply sloping hearth, so that the product may fall by gravity, till it comes within reach of tools, without necessitating the entrance of workpeople. Means are provided inside the chamber for washing the gaseous reaction-products by a water jet, and an external fan operates through a series of channels, to withdraw noxious gases for absorption or condensation.
—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 216.)

French Patents.

Diffuser [Self-emptying]. F. R. von Klaudy and F. Junger. Fr. Pat. 371,041, Nov. 2, 1906.

In order to arrange for the automatic discharge of the exhausted slices from the diffuser, the latter is provided with a perforated bottom which can be rotated. When the slices have been washed and drained, the discharge manhole is opened, and the perforated floor is rotated. Exactly opposite the discharge opening is situated a pipe, through which a powerful jet of water can be directed right across the floor to the outlet. Near the outlet is a fixed scraper, extending radially across the revolving floor, which shovels the slices towards the outlet and brings them under the influence of the stream of water.—J. F. B.

Molasses ; Manufacture of alcohol from ——. G. J. Meunier. Fr. Pat. 370,279, Oct. 6, 1906. XVII., page 271.

Briquettes made with any kind of charcoal, and agglomerated with a gum and residual denatured molasses ; Process of manufacture of ——. F. G. Monges. Fr. Pat. 370,725, Oct. 24, 1906. II., page 248.

Carbohydrates ; Manufacture of xanthic derivatives of certain ——. C. F. Cross, J. F. Briggs, and Soc. Franç de la Viscose. Fr. Pat. 370,505, Oct. 15, 1906.

Starch and certain other carbohydrates of a pectic nature, when treated with caustic soda and exposed to the action of carbon bisulphide in the same manner as in the preparation of " viscose " from cellulose, are so gelatinised by the alkali that the action of the carbon bisulphide is merely superficial. According to this invention xanthogenic esters of these carbohydrates are obtained by first saturating the dry powdered substance with carbon bisulphide, and then adding the necessary quantity of caustic soda solution. In this way the gelatinisation of the starch is so delayed that a perfectly homogeneous emulsion of the three constituents of the mixture is obtained, and the " viscose " reaction is then completed in the ordinary manner. A further protection of the starch against the alkali can be obtained by diluting the carbon bisulphide with an inert hydrocarbon before adding the caustic soda.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 218.)

Schizosaccharomyces Pombé and octosporus ; Simple method for obtaining cultures of ——. C. Bergsten. Woch. f. Brau., 1907, **24**, 99.

For the isolation of these two species of fission yeasts, about ten Asiatic currants (not Greek) are placed in about 50 c.c. of sterile wort, to which has been added sufficient pure lactic acid to bring the acidity up to 8—11 per cent. of normal acid. The flask containing the mixture is plugged with cotton, and is placed in an incubator at 35° C. for a few days, until fermentation has set in. Owing to the high temperature and acidity, competing organisms are suppressed, whilst these fission yeasts survive. Occasionally a film of *Aspergillus niger* is formed on the surface, in which case it must be removed by a needle. When the fermentation has fully developed, a few c.c. of the fermenting wort are diluted with water, and a little of this mixture is spread on the surface of a plate covered with solidified and dried wort-agar medium. This culture is incubated at 35° C., and the colonies which develop are examined and propagated in the usual way.—J. F. B.

Yeast ; Separation of the vital and fermentative functions of ——. T. Bokorny. Pflügers Arch., **114**, 535 ; through Z. ges. Brauw., 1907, **30**, 95.

If 2 grms. of pressed brewery yeast, containing 30 per cent. of dry substance, be treated with 2 c.c. of 0·5 per cent. sulphuric acid, the yeast cells are killed, whilst most of the zymase remains in an active state. On the other hand, if 3 c.c. of the acid be employed, the zymase is also destroyed. The poison appears to be absorbed more rapidly by the living protoplasm than by the enzyme. Similarly, 0·015 grm. of formaldehyde is sufficient to kill the yeast cells in 2 grms. of yeast without destroying the zymase entirely ; 0·005 grm. of mercuric chloride kills the cells in 10 grms. of yeast without destroying the fermentative power.—J. F. B.

Yeast cells ; Influence of temperature on the activity of the proteolytic enzyme and zymase of dead ——. A. Petrischewsky. Z. physiol. Chem., 1907, **50**, 251 ; Woch. f. Brau., 1907, **24**, 104.

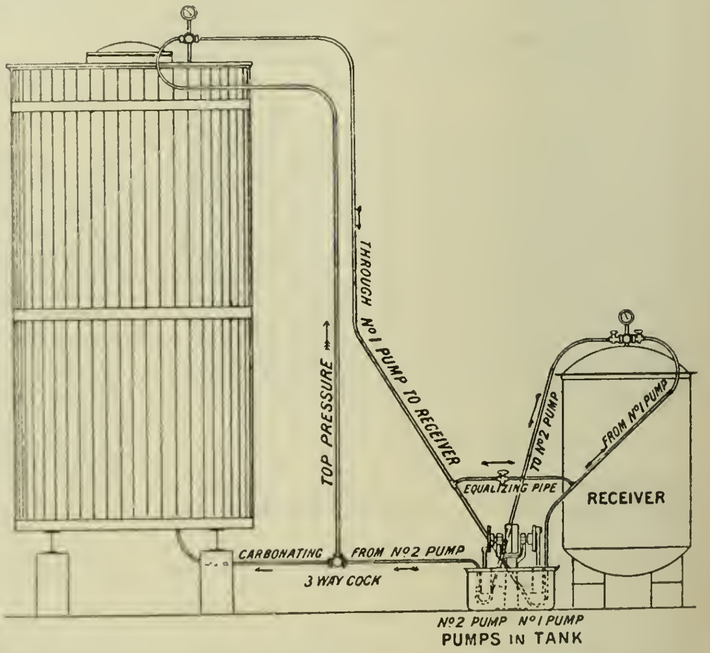
In a study of the influence of temperature on the relative activities of the proteolytic enzyme and the zymase during the autolysis of dead yeast cells without the addition of sugar, it was found that the proteolytic activity was considerably increased with rise of temperature. At 32° C., the greater part of the protein was digested in the first 20 hours, but after that the action became slower. At the ordinary temperature the action of this enzyme was more regular and gradual, whilst at 7—9° C. it was slower still. The velocity of the reaction diminishes as the products accumulate, an observation which suggests that the splitting of proteins may be a reversible process. In studying the activity of the zymase and the destruction of this enzyme by the proteolytic enzyme, the author determined the quantities of carbon dioxide evolved during the autolysis of the yeast at different temperatures. At higher temperatures the quantity of gas produced during the first hour or two was much greater than at the ordinary temperature. Later, however, the evolution rapidly decreased, with the result that the total evolution was 2·5 times less at the higher temperature than at the ordinary temperature. The destruction of the zymase by the proteolytic enzyme is therefore more complete the greater the activity of the latter. In order to exclude the action of the proteolytic enzyme as far as possible, the dead yeast cells were digested in a 20 per cent. solution of cane sugar. In this case the difference between the evolution of gas at the different temperatures was less marked, but still the action of the zymase rapidly diminished as the result of the destructive activity of the proteolytic enzyme. The author concludes that in studying the physico-chemical mechanism of fermentation by zymase, it is absolutely necessary to obtain this enzyme in a pure form. When dead yeast is used, the inimical action of the endotryptase must be minimised by the employment of low temperatures, concentrated sugar solutions, or other means.—J. F. B.

Wort and beer ; Use of Lovibond's tintometer for colorimetry of ——. J. L. Baker and H. F. E. Hulton. J. Inst. Brewing, 1907, **13**, 26—32.

The authors have studied the colorimetry of malt worts and beers by various means, including Lovibond's tintometer, comparison with iodine solutions, and with solutions of coal-tar dyestuffs. As the result of their work they make the following recommendations :—That the Lovibond tintometer be retained, with the use of 52 series glasses, as prescribed by the Malt Analysis Committee (this J., 1906, 552), with the modifications :—(A) The instrument, in a horizontal position, should be directed to a north window covered with white tissue paper ; (B) The tintometer should not be more than 2 or 3 ft. from the window ; (C) The opal screen provided with the instrument should be discarded ; (D) The malt worts should be filtered as bright as possible, but should not be treated with alumina ; beers, unless already fined, should be clarified with alumina ; (E) The 1-in. cell should be used for reading the tint in pale or amber-coloured malt worts and sugars (10 per cent. solution) ; (F) The $\frac{1}{2}$-in. cell should be used for all beers. Pale, mild, and stock ales should be read without dilution, but black beers should be diluted four times. Brown malts should be examined for colour by weighing 3 grms. of very finely-ground malt, and adding to them 300 c.c. of distilled water at 165° F., standing 10 minutes, and reading the filtered solution in a 1-in. cell. The same procedure should be followed in the case of black malts and roasted barleys, the solution being matched in a $\frac{1}{4}$-in. cell and the result being multiplied by two.—J. F. B.

Ales and stout in cask and bottle ; Non-deposit ——. P. K. Le May. J. Inst. Brewing, 1907, **13**, 2—14.

The author describes an apparatus which he has devised for conditioning, pasteurising, and chilling beer, in order to obtain a product which can be kept sound for a long time without throwing any deposit other than a slight resinous film which adheres to the bottom of the bottle. The beer from the fermentation tuns enters the large copper cylinder (see figure) at the bottom, and when the cylinder is about one-fourth full, the hops and priming are added through the manhole, which is then closed down. When the full charge of beer has been pumped into the cylinder, the beer is "roused" by the propellers, and the air valve is closed. Conditioning is then allowed to proceed slowly at a temperature of 58° F. for three days. On the fourth day the pressure in the vessel has risen to 14—17 lb. per sq. in. The connection is then opened between the beer cylinder and the smaller gas receiver, also of stout copper, and the gas is pumped over until a pressure of only 2 lb. remains in the beer cylinder. The beer is now gradually heated up for pasteurisation. The heating is effected by the circulation of hot brine through a coil in the interior of the vessel. The brine is heated in a coil situated in an external tank, and its temperature is regulated so that it is always about 15° F. above that of the beer ; the temperature of the latter is allowed to rise at the rate of 10° F. per hour. When the beer reaches 90° F. it parts with the whole of



its gas, this gas being pumped over into the receiver, in which the pressure rises to about 25 lb., that in the beer vessel being 2 lb. at this stage. The beer must not be "roused" during the process of pasteurisation. At the maximum temperature of 148° F., at which the beer is maintained for 12 hours, the pressure in the beer cylinder rises to about 30 lb. After pasteurisation the beer is cooled very gradually, at first by lowering the temperature of the hot circulating brine, and later by the circulation of artificially cooled brine. When the temperature falls to 50° F., the gas is pumped back from the receiver, entering the beer vessel at the bottom, and the beer is roused. By the time the temperature reaches 45° F., the whole of the gas has been re-absorbed. In summer the beer is chilled to a temperature of 42° F., but in winter a temperature of 28° F. is necessary to ensure the absence of a deposit during storage. The beer is kept at the chilling temperature for two days for clarification, and is then ready for filling into casks or bottles after passage through a filter. All the filtering and bottling operations must be effected in absence of air under a pressure of carbon dioxide, and great care must be observed in the sterilisation of apparatus and vessels.—J. F. B.

Beer ; Sarcina sickness of ——. O. Miskovsley. Z. ges. Brauw., 1907, **30**, 81—85 ; 104—108.

THE author describes three species of sarcina or beer-pediococcus which he had isolated from diseased beers. These organisms possessed the same general characters, and were apparently very similar to, if not identical with, those studied by Claussen. The study of the beer-pediococci has always presented certain difficulties on account of the selection of suitable culture media, the growth in most ordinary media being very slow, and the culture dying out or degenerating after a few transplantations. The author has found that the suitability of the [malt-wort] medium depends to a large extent on the conditions of saccharification, not, however, as regards the products of the conversion of the starch, but as regards those of the albuminoids. For cultivating these organisms, it is important to select a malt as rich as possible in nitrogen, and to make up the mash with water at 60° C., raising the temperature rapidly to 70°—72° C. In this way the action of the proteolytic enzyme is reduced to a minimum, and the nitrogenous constituents of the wort are mainly of the "peptone" type, as distinguished from those of the "amino" type, which result from mashing at low temperatures. Cultivated in a wort of the "peptone" type, carefully sterilised in such a manner as to avoid the coagulation of much of the albumin, cultures of pediococci can be kept alive for years. The addition of 1—3 per cent. of Witte's peptone stimulates the growth and activity of the pediococci to a very marked extent The acidity—both total and volatile—and the turbidity developed by these organisms in wort and beer depend very much on the composition of the liquid, not only as regards nitrogenous constituents, but also, in the case of beer, as regards the degree of attenuation. A partially-attenuated beer is more readily attacked than the same beer more completely attenuated, or even than the wort from which it was prepared. The addition of substances such as Witte's peptone, dextrose, or autolysed yeast liquor to the attenuated beer, favours the sarcina disease. Nucleic acid derived from yeast is an excellent nitrogenous nutrient for sarcina, and artificial culture media can be prepared with this substance in combination with dextrose and mineral salts.—J. F. B.

Brewers' finings ; Manufacture of ——. A. E. Berry. J. Inst. Brewing, 1907, **13**, 44—64.

THE author describes the different varieties of commercial isinglass used for making brewers' finings. A high proportion of insoluble matter and a disagreeable odour are signs of bad quality ; in a good sample the residue from boiling water should not exceed 3 per cent. Sole skin, calf skin, Irish moss, and other substitutes have been used to some extent as finings, but none of them are so successful as isinglass. Isinglass may contain from 10 to 25 per cent. of moisture, and the proportion is subject to great variations, even in the same grades. The author proposes a normal standard of 15 per cent. of moisture. Different grades of isinglass must be selected for different classes of beer ; it is necessary also to vary the blend of isinglass used according to the season of the year, and to make changes when beers are brewed under different conditions. There are two different methods of fining, *e.g.*, by floating off the finings through the bunghole, or by depositing them as a sediment ; different grades of isinglass are required for these two methods. The most efficient "cutting" agent is sour beer, thoroughly sterilised, of course, before use. Other agents are sulphurous and tartaric acids, used generally in admixture. Finings are less liable to decomposition if stored in a concentrated form. They should always be employed at the same concentration and the same consistency if constant results are to be obtained. The question of temperature is very important, 60° F. should not be exceeded. In the case of "stubborn" beers the addition of a little alumina cream is often beneficial. Abnormal composition of the beer, and insufficient attenuation are frequent causes of bad fining. Generally speaking, if a beer can be filtered bright through filter paper it should present no difficulty in fining ; the presence of small proportions of acids and common salt are favourable to the fining.—J. F. B.

Wines, red ; Precipitation of natural colouring matter of and detection of artificial colours in ——. F. Jean and C. Frabot. Ann. Chim. anal. appl., 1907, **12**, 52.

FIFTY c.c. of the wine are treated with about 1 c.c. of 40 per cent. formaldehyde solution, and 4 c.c. of pure hydrochloric acid. The mixture is warmed for several minutes on the water-bath until a precipitate is formed ; excess of ammonia is then added, and heating continued until all the free ammonia has been driven off. The liquid is then cooled and filtered. Natural red wines afford a colourless filtrate ; with wines artificially coloured, the filtrate will show a tint characteristic of the colouring matter added.—J. O. B.

Salicylic acid in wine ; Detection of ——. D. Vitali. Boll. Chim. Farm., **19**, 701. Schweiz. Woch. Chem. Pharm., 1906, **44**, 790.

TOLUENE is the best solvent for shaking out in testing wine for the presence of salicylic acid, since it removes that body, but not organic acids and tannin, which interfere with the iron colour-test. A confirmatory test for salicylic acid consists in dissolving the residue obtained on evaporating the toluene extract in sulphuric acid, adding a few drops of very dilute colourless solution of cupric sulphate, and again evaporating to dryness. A fine green colour is obtained in presence of a trace of salicylic acid. —J. O. B.

Wormwood, essential oil of ; Detection of —— [*in liqueurs*]. L. Cuniasse. J. Pharm. Chim., 1907, **25**, 180—182.

THE distinctive reactions of wormwood oil are due to the ketone, thujone, $C_{10}H_{16}O$, to which also the marked toxicity of the "absinthe" liqueurs is attributed. The presence of this oil in the proportion of 3:1000 in alcoholic solution may be detected by the following reactions :—(1) Combination with hydroxylamine and formation of the corresponding acetoxime. (2) Formation of the phenylhydrazine compound. (3) Formation of a precipitate with acid mercuric sulphate. The solutions in 70 per cent. alcohol are fortified to the extent of 2 or 3 percentages by volume of alcohol, by a suitable addition of stronger alcohol, and then treated with a volume of acid mercuric sulphate solution, corresponding to the alcohol added, and the whole heated on the water-bath. Oils of wormwood, tansy, and fennel give a copious precipitate, whereas anise, star-anise, and hyssop oils give no reaction. (4) Production of a green colour with iodine. (5) The following reaction is more sensitive, showing markedly with a 1:1000 alcoholic solution of the oil. To 10 c.c. of the alcoholic solution add 1 c.c. of a freshly-prepared 10 per cent. solution of sodium nitroprusside, a few drops of caustic soda solution, and 1 c.c. of acetic acid. Wormwood and tansy oils give an intense red colour; the other oils usually present in "absinthe," such as fennel, hyssop, coriander, star-anise, and anise oils, also acetic aldehyde, give no reaction.—J. O. B.

Ferments mutually incompatible. T. Sollmann. XX., page 276.

Starch in barley; Polarimetric determination of ——. C. J. Lintner. XXIII., page 281.

Alcohol Bill in the United States; Amended ——. Oil, Paint, and Drug Rep., March 4, 1907. [T.R.]

On March 1, the Senate passed by a vote of 65 to 1 the Bill amending the new free alcohol law for the purpose of reducing the cost of production, denaturation, and transportation. The issue was whether the provision of Sec. 4 of the Bill, permitting small producers to go into the business of making denatured alcohol, should be nullified by a Finance Committee amendment requiring the continuous presence of a Government storekeeper at each small still throughout the period in which it might be operated. The measure as it goes on the Statute Books, provides as follows:—

"Be it enacted, &c., That notwithstanding anything contained in the Act entitled 'An Act for the withdrawal from bond tax free of domestic alcohol when rendered unfit for beverage or liquid medicinal uses by mixture with suitable denaturing materials,' approved June seventh, nineteen hundred and six, domestic alcohol when suitably denatured may be withdrawn from bond without the payment of internal-revenue tax and used in the manufacture of ether and chloroform and other definite chemical substances where said alcohol is changed into some other chemical substance and does not appear in the finished product as alcohol: Provided, That rum of not less than one hundred and fifty degrees proof may be withdrawn, for denaturation only, in accordance with the provisions of said Act of June seventh, nineteen hundred and six, and in accordance with the provisions of this Act.

"Sec. 2. That the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may authorise the establishment of central denaturing bonded warehouses, other than those at distilleries, to which alcohol of the required proof may be transferred from distilleries or distillery bonded warehouses without the payment of internal-revenue tax, and in which such alcohol may be stored and denatured. The establishment, operation, and custody of such warehouses shall be under such regulations and upon the execution of such bonds as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe.

"Sec. 3. That alcohol of the required proof may be drawn off, for denaturation only, from receiving cisterns in the cistern room of any distillery for transfer by pipes direct to any denaturing bonded warehouse on the distillery premises or to closed metal storage tanks situated in the distillery bonded warehouse, or from such storage tanks to any denaturing bonded warehouse on the distillery premises, and denatured alcohol may also be transported from the denaturing bonded warehouse, in such manner and by means of such packages, tanks or tank cars, and on the execution of such bonds, and under such regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe. And further, alcohol to be denatured may be withdrawn without the payment of internal revenue tax from the distillery bonded warehouse for shipment to central denaturing plants in such packages, tanks and tank cars, under such regulations, and on the execution of such bonds as may be prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury.

"Sec. 4. That at distilleries producing alcohol from any substance whatever, for denaturation only, and having a daily spirit-producing capacity of not exceeding one hundred proof gallons, the use of cisterns or tanks of such size and construction as may be deemed expedient may be permitted in lieu of distillery bonded warehouses, and the production, storage, the manner and process of denaturing on the distillery premises the alcohol produced, and transportation of such alcohol, and the operation of such distilleries shall be upon the execution of such bonds and under such regulations as the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, may prescribe, and such distilleries may by such regulations be exempted from such provisions of the existing laws relating to distilleries as may be deemed expedient by said officials.

"Sec. 5. That the provisions of this act shall take effect on September 1, 1907."

English Patents.

Fermentation of liquids; Continuous ——. L. A. Van Rijn, Singapore. Eng. Pat. 18,045, Aug. 11, 1906.

The fermenting vats are connected by pipes and are placed at slightly different levels in order to maintain a sufficient flow of the liquid. Each vat is provided with a stirring device, the arms of which are fitted with strips of rubber which continually scrape and clean the bottom and walls of the vats. The fermentation may thus proceed for an indefinite time provided that the flow of liquid, temperature, &c., be regulated.—W. P. S.

Wort; Process of treating and ageing ——. J. W. Mackenzie, London. From H. E. Deckebach, Cincinnati, U.S.A. Eng. Pat. 20,144, Sept. 10, 1906.

See U.S. Pat. 803,576 of 1906; this J., 1906, 947.—T.F.B.

De-alcoholising liquids; Apparatus for ——. A. Linzel, Berlin. Eng. Pat. 21,916, Oct. 4, 1906. Under Int. Conv., May 23, 1906.

See Fr. Pat. 369,841 of 1906; this J., 1907, 218.—T.F.B.

French Patents.

Albumin from yeast; Process of preparing ——. M. E. Pozzi-Escot. Fr. Pat. 362,010, Dec. 20, 1905. XVIII., page 272.

Beer wort; Apparatus for clarifying ——. O. Wehrle. Fr. Pat. 370,398, Sept. 26, 1906.

All the taps leading from the double bottom of the mash tun deliver the wort into a large horizontal collecting pipe from which it runs off through a tap. An open vertical pipe rises from the horizontal collecting main. When the wort is running slowly, the volume delivered is not sufficient to fill the horizontal main, and no resistance is offered to its flow. When it tends to run too quickly or when the main delivery tap is partly closed, the wort fills the main and rises up the vertical pipe. Thus a counter pressure is set up which regulates itself automatically and controls the rate of flow of the wort.
—J. F. B.

Beer wort; Arrangement for continuous production of ——. H. Breker. Fr. Pat. 370,401, Oct. 1, 1906.

This specification describes a means by which the ordinary equipment of a brewery working the double decoction process can be adapted to produce wort practically continuously, by converting the mash decoction copper into an auxiliary wort copper. The decoction process is then abandoned, and the wort is brewed very rapidly by the "Schmitz" method. The auxiliary wort copper, formerly the mash decoction copper, is connected with the ordinary wort copper in such a way that filtered wort can be collected in it and pumped into the ordinary wort copper at certain intervals during the boiling of the wort. The time allowed in each vessel for each stage of the brewing process is shown diagrammatically.—J. F. B.

Beer; Process of brewing ——. C. Zimmer. Fr. Pat. 370,728, Oct. 24, 1906.

The malt grist is separated from the husks and is ground to flour in a roller mill in presence of water. The flour is then mashed and saccharified, whilst the husks are mashed separately. A portion of the diastatic wort from the husks is added to the flour-mash in order to ensure its complete saccharification, whilst the remainder is added after the decoction. The grains are thoroughly exhausted by washing and are not used for clarifying the wort. The latter passes to the copper through centrifugal clarifiers or filter-presses.—J. F. B.

Molasses; Manufacture of alcohol from ——. G. J. Meunier. Fr. Pat. 370,279, Oct. 6, 1906.

In this process the vinasse from a previous distillation is utilised for acidifying the wash, thereby avoiding the necessity of adding sulphuric acid. The proportion of acid vinasse employed varies from 20 to 75 per cent. of the total volume of the wash. The sterilisation of the wash is preferably effected by a cold process, *i.e.*, by producing a precipitate in the liquid, which encloses and carries down the bacteria. Suitable reagents are sodium phosphate and salts of iron. The wash is then sown with a pure yeast and fermented.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 219.)

(*A*.)—FOODS.

Milk: Detection of added water in —— *by means of the immersion refractometer.* E. Ackermann. Z. Unters. Nahr. u. Genussm., 1907, 13, 186—188.

A refractometric examination of the serum of a sample of milk is recommended as a means of detecting the presence of added water in the same. The serum is prepared by placing 30 c.c. of the milk in a test-tube, adding 0·25 c.c. of calcium chloride solution of sp. gr. 1·1375, and heating the tube and its contents in a boiling water-bath for fifteen minutes. To prevent evaporation, the mouth of the test-tube is closed by a cork carrying a short length of narrow glass tubing. The contents of the test-tube are then cooled to 17·5° C., the clear serum is decanted into a small beaker, and examined with the refractometer. Normal milk shows a refraction of from 38·5 to 40·5 scale degrees, whilst milk containing 5 per cent. of added water gives a reading of 37·7; with 10 per cent. of water the reading falls to 36·7: with 20 per cent. of water, to 34·8, and so on. The quantity of calcium chloride added is practically without influence on the refraction.—W. P. S.

Caseins [*from cow's milk and goat's milk*]. J. H. Long. J. Amer. Chem. Soc., 1907, 29, 223—230.

An investigation of the prolonged digestion of casein by means of pepsin and very dilute hydrochloric acid has shown that cow's milk casein is very similar to that from goat's milk. They form similar salts, the equivalent weight of cow casein being the lower of the two. Goat casein, however, changes more slowly than cow casein, and yields a much larger residue of "pseudo-nuclein." The electrical conductivities of samples taken during digestion are lower than those calculated from the "free" hydrochloric acid as obtained by titration, with dimethylaminoazobenzene as indicator. The total acidity (phenolphthalein indicator) and the free acidity vary regularly, cow casein giving the higher values throughout. The amino-acids and other final products of hydrolysis are much alike in the two cases, and, as obtained by evaporating the digested liquid, show an increase in weight on the original casein (free from pseudo-nuclein) of 31 7 per cent. for cow casein and 36·4 per cent. for goat casein.
—F. Sodn.

Lard: Examination of ——. E. Polenske. Arbb. aus dem kaiserl. Gesundheitsamte, 1905, 22, 576—583.

(1) *Detection of phytosterol in lard in presence of small quantities of paraffin.*—In testing lard containing cottonseed oil by the phytosteryl acetate method, the melting point of the ester is frequently lower than that of cholesteryl acetate, and this has been attributed, though without proof, to the presence of small quantities of paraffin. If more than 0·1 per cent. of paraffin be present in lard, it is readily detected by the quantity and amorphous character of the unsaponifiable matter. Pure lard yields 0·1—0·2 per cent. of crystalline unsaponifiable matter. The author found that the addition of liquid paraffin, (up to 0·1 grm.) to 0·1 grm. of a mixture of 94 per cent. of cholesterol and 6 per cent. of phytosterol, had practically no influence on the melting point of the acetate, nor had an addition of up to 0·004 grm. of paraffin wax. With amounts of paraffin wax ranging from 0·004 to 0·1 grm. per 0·1 grm. of the cholesterol-phytosterol mixture, the melting point of the acetate was depressed proportionally to the quantity of paraffin wax present; indeed, with 0·1 grm. of the latter, the melting point of certain of the fractions obtained on recrystallising the acetate were identical with that of paraffin wax itself (53° C.). In order to obtain reliable results by the phytosteryl acetate test in presence of small quantities of paraffin, the following method is proposed:—The ethereal solution of the unsaponifiable matter from 100 grms. of lard is allowed to evaporate in a test-glass, the residue is dried at 100° C., and covered with 1 c.c. of petroleum ether (boiling below 50° C.); the glass is stoppered and allowed to stand for 10 mins. The solution and residue are poured into a small funnel containing a plug of cottonwool, and, after draining, the residue is washed three times with quantities of 0·5 c.c. of cold petroleum ether. The insoluble matter is then dissolved in ether, the solution evaporated, and the residue acetylated in the usual manner. The ester is recrystallised three or four times, using 1 c.c. of absolute alcohol each time, and the melting points of the second and subsequent deposits determined. Phytosterol is less soluble than cholesterol in petroleum ether, so that the unsaponifiable matter becomes enriched in phytosterol. The following results have been obtained by this method:—

0·1 grm. of cholesterol-phytosterol mixture.		Amount of paraffin added. 0·01grm.	0·05 grm.	0·1 grm.
		° C.	° C.	° C.
Melting point of ester after	2nd cryst.	117 0	116	114
	3rd cryst.	118·5	118	117
	4th cryst.	119·5	119	118·5

(2) *Detection and determination of small quantities of paraffin in lard.*—The unsaponifiable matter from 100 grms. of lard is mixed in a test-glass with 5 c.c. of strong sulphuric acid, and then the glass, with tied-on stopper, is heated for one hour at 104°—105° C. in a bath of 40 parts of glycerol and 60 parts of water (b. pt. 104°—105° C.), with occasional shaking during the last half-hour. After cooling, the contents are shaken vigorously three times for one minute each time with 10 c.c. of petroleum ether. The united extracts are washed three times with 10 c.c. of water, filtered through a dry filter, evaporated, and the paraffin dried at 100° C., and weighed. Pure lard yields 0—0·003 grm. of resinous matter. If only very small quantities of paraffin are present, it is advisable to repeat the process with the residue, but using only 1 c.c. of sulphuric acid and heating for only half an hour. The following results were obtained:—

Quantity of paraffin added to 0·1 grm. of cholesterol-phytosterol mixture.		0·003 grm.	0·004 grm.	0·005 grm.	0·01 grm.	0·1 grm.	No addition.
		grm.	grm.	grm.	grm.	grm.	grm.
Yield of "paraffin"	after 1 treatment with H_2SO_4 ...	0·0041	0·0056	0·0063	0·014	0·096	0·0027
	" 2 treatments " " ..	0·0033	0·0041	0·0055	0·0105	0·092	0·0005

—A. S.

Seaweed industry in Japan. K. Pietrusky. Chem. Ind., 1907, **30**, 101—108.

The author describes, with illustrations, the seaweed industry of Japan (see this J., 1906, 948). Specimens of *kombu*, analysed by K. Oshima, gave the following results:—

	Water.	Protein.	Fat.	Soluble non-nitrogenous matter.	Crude fibre.	Ash.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Laminaria angustata	22·8	5·5	1·5	47·0	4·5	18·7
,, *longissima*	25·9	6·7	1·7	31·9	6·4	27·3
,, *japonica* .	23·0	5·0	1·6	47·5	5·8	17·2
,, *ochotensis*	24·0	6·6	0·9	41·9	6·0	20·3
,, *religiosa* . .	22·8	4·7	0·8	42·8	10·2	18·6
,, *fragilis* . . .	23·1	4·0	0·7	40·4	7·2	24·7
Arthrothamnus bifidus	24·4	5·8	0·7	45·6	6·4	17·0

Of the two following analyses of *kanten*, (1) was made by O. Kellner, and (2) was published by the Imperial Fishery Board:—

	Composition of kanten.	
	I.	II.
Water	22·80	22·29
Protein	11·71	6·85
Crude fibre	—	6·73
Carbohydrates	62·05	60·32
Ash	3·44	3·81

The iodine content of some Japanese seaweeds is shown in the following table, compiled from figures published by the Imperial Fishery Board:—

Botanical name.	Japanese name.	The raw seaweed contains:	
		Iodine.	Ash.
		per cent.	per cent.
Ecklonia cava	Kajime	0·23	54·83
,, ,, ...	,,	0·25	47·22
,, *bicyclis*	Arame	0·27	50·90
Sargassum sp.	Ginbaso	0·05	52·04
,, ,, ...	,,	0·03	51·94
Laminaria angustata	Kombu	0·18	18·69
,, *longissima*	,,	0·17	27·29
,, *japonica*	,,	0·11	17·16
,, *ochotensis*	,,	0·19	20·31

—A. S.

Ferments mutually incompatible. T. Sollmann. XX., page 276.

English Patents.

Milk, cream, and butter; Treatment [preserving] of ——. D. R. S. Galbraith, London. Eng. Pat. 3206, Feb. 9, 1906.

The process relates to the treatment of milk and cream with an antiseptic, and the removal of the latter before the cream is used for butter-making. For instance, fresh cream is mixed with 1 per cent. of its quantity of formic acid, the acid being added in the form of a 20 per cent. solution. The mixture is kept at a temperature of about 60° F. for two hours, with occasional stirring, and is then mixed with seven or eight times its volume of brine (sp. gr. 1·035) at a temperature of 90° F. After being stirred for about 10 minutes, the mixture is passed through a centrifugal machine, and the separated cream used for butter-making. The butter obtained may be washed with weak brine. Other preservatives, such as fluorides, salicylic acid, or formaldehyde, may be used in place of the formic acid above mentioned. All the utensils employed are washed, before using, in a 1 per cent. formic acid solution, and then rinsed in brine.—W. P. S.

Milk and proteid-containing liquids; Drying ——, and the dry products obtained. J. R. Hatmaker, Paris. Eng. Pat. 12,783, June 1, 1906.

See Fr. Pat. 366,751 of 1906; this J., 1906, 1113.—T. F. B.

French Patents.

Albumin from yeast; Process of preparing ——. M. E. Pozzi-Escot. Fr. Pat. 362,010, Dec. 20, 1905.

Yeast is well-washed and then suspended in three times its weight of water at a temperature of 35° C.; borax solution, containing 10 per cent. of sodium carbonate, is then stirred in, until the yeast forms clots. The mass is filtered, and the colourless yeast thus obtained is submitted to any of the following processes. The yeast may be killed by the addition of acetone, ground, submitted to dialysis, and the albuminous matter obtained preserved by the addition of sodium fluoride or sulphite. Or, the yeast may be mixed with sodium chloride, sugar, &c., and the liquid mass also submitted to dialysis. The third process consists in killing the yeast with acetone, drying it, and grinding the residue to a powder. The albuminous matter obtained by the above methods may be substituted for egg-albumin in any of the commercial processes in which the latter is used.—W. P. S.

Butter, lard, or cream substitute; Preparation of a ——. A. Laurendeau. Fr. Pat. 370,193, Aug. 30, 1906.

One hundred lb. of fat or oil are melted and mixed thoroughly with 60 lb. of water, 13 oz. of calcium carbonate, and 20 oz. of sodium bicarbonate. The mass is then heated to a temperature of about 80° C., and allowed to cool for 48 hours. If it be desired to make a cream substitute, a small quantity of milk and sugar are added. The above-mentioned quantities may be varied according to the nature of the fat or oil employed.—W. P. S.

Butter; Preservation of —— without addition of salt or other admixture. P. A. Sparre. Fr. Pat. 371,091, Nov. 5, 1906.

Butter is preserved without the addition of foreign substances by wrapping it in parchment paper on the outside of which is a preparation of cinnamic acid or balsam containing that substance. A sheet of cloth or paper is covered with the cinnamic acid preparation, and is placed between two sheets of parchment paper; the combined sheets are then wrapped round the butter in the package; this has the effect of preventing the butyric acid fermentation without imparting a disagreeable flavour to the butter.—J. F. B.

Coffee and tea extracts; Preparation of soluble ——. A. Rupeau. Fr. Pat. 370,506, Oct. 15, 1906.

Roasted coffee, or tea, is ground and then placed in a closed vessel provided with a steam-jacket. The bottom of the vessel is perforated, and under this bottom is provided a receptacle for the extract. A solvent, such as acetone, ether, or ethyl acetate, is now allowed to flow from an upper chamber into the vessel containing the coffee, which it percolates, and the extract passes into the lower vessel. When complete extraction has been attained, the connection between the percolator and the lower vessel is closed, and the solvent is distilled off, condensed, and returned to the solvent chamber for further use. The extracted coffee is now removed from the closed vessel, and further extracted with water. The residues resulting from the evaporation of the solvent and the water are dried, powdered, mixed, and formed into tablets, &c. —W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Sewage; Nitrification of ——. G. Reid. Roy. Soc. Proc., 1907, **79B**, 58—74.

With a view of ascertaining the degree of purification effected at different depths in a filter bed, the author has carried out a series of experiments and analyses on samples taken from various parts of the body of the filter. The latter was composed of broken " saggars " (discarded hard burned clay vessels in which china is packed for firing), the size of the material, in four separate sections, varying from 1·5 in. to 1/8 in. After a preliminary settling and straining and septic tank treatment, the sewage was distributed on the filter at the rate of 200 galls. per sq. yard per 24 hours. The total depth of the filter was 4 ft. 6 in., and the sewage passed through this in 35 minutes. The results show that a remarkable degree of purification is attained by the flow of the sewage through the upper 1-ft. layer of the filter; the free ammonia was reduced to about one-fiftieth, the albuminoid ammonia to about one-seventh, and the oxygen absorption in four hours also to about one-seventh. The figures relating to oxidised nitrogen show conclusively that the work of purification is practically completed within a few inches of the surface of the filter. Although it was expected that the process would prove to be a gradual and progressive one, nitrites being formed chiefly in the superficial layers and nitrates in the lower layers, this was not the case. The author considers that the two organisms are at work side by side. At a depth of 3 ft., the greatest purification had been effected, samples drawn from beneath the lowest layer of the filter (4 ft. 6 in.) showing an increase in the free ammonia and a decrease in the nitric nitrogen. This may be accounted for by the fact that in fine-grade filters the air is drawn downwards, carrying with it the products of the combustion which has taken place above, and thus has an asphyxiating action on the organisms below. It is possible that even an anærobic fermentation may be revived in the lower layers. The conclusion is, that the lower 2 or 3 ft. of filter medium are absolutely unnecessary provided that efficient means of distributing the sewage on the filter be provided; further, that so far as the cost of the construction of the filter is concerned, the expenditure might be reduced by about one-half. (See also this J., 1906, 279.)—W. P. S.

United States Patent.

Sewage, &c.; Apparatus for separation of solid matters from ——. C. Kremer, Assignor to Ges. f. Abwässerklarung, Berlin. U.S. Pat. 839,396, Dec. 25, 1906.

See Eng. Pat. 5908 of 1906; this J., 1906, 711.—T. F. B.

French Patents.

Sewage; Treatment of ——. A. M. Muguet. Fr. Pat. 361,994, Dec. 14, 1905.

The sewage is mixed in a closed vessel with peat, 1 part of the latter being used to absorb 4 or 5 parts of sewage. The gases are drawn off by means of an exhaust pump and conducted to a furnace, whilst the peat and sewage mixture may be used as a manure, or mixed with lime, dried, and distilled. The products of distillation are collected and separated, and the coke residue can be employed as fuel.—W. P. S.

Sewage, effluent, &c.; Process for purifying ——. J. F. P. Kestner. Fr. Pat. 370,313, Oct. 8, 1906. Under Int. Conv., Oct. 13, 1905.

See Eng. Pat. 20,750 of 1905; this J., 1906, 1114.—T. F. B.

Purification of liquids [water]; Electrolytic apparatus for the ——. Hinkson Electric Liquid Purifying Co. Fr. Pat. 370,281, Oct. 6, 1906. Under Int. Conv., Oct. 7, 1905.

A series of closed compartments are arranged in a vertical pile, the liquid to be purified being passed successively through the compartments. Bipolar electrodes separate the compartments one from another, and the extreme electrodes are connected with a source of current.—B. N.

Water for feeding steam-boilers or stills; Process for the treatment of ——. J. Meyrueis. Fr. Pat. 370,601, Oct. 19, 1906.

The process consists in heating the feed water containing calcium sulphate and carbonate with strontium chloride either alone or in admixture with barium chloride, with or without the addition of a substance containing tannin. The object is to obtain by a series of double decompositions the most insoluble compounds possible in order to avoid the formation of hard scale.—W. H. C.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page 220.*)

Cellulose; [Mixed] Esters of ——. E. Berl and Watson Smith, jun. Ber., 1907, **40**, 903—908.

The appearance of Lederer's Ger. Pat. 179,947 (see Fr. Pat. 368,766 of 1906; this J., 1907, 30) has led the authors to publish some of the results obtained in an investigation on which they have been engaged for some time past. The largest number of hydroxyl groups in cellulose (referred to a C_6 unit) hitherto replaced by nitro groups is three, whereas results obtained by Cross and Bevan on acetylcellulose (see Eng. Pat. 9676 of 1894; this J., 1895, 987) pointed to the existence of a tetra-acetyl derivative. With a view to explain this apparent discrepancy between the number of hydroxyls replaceable by acetyl and nitro groups respectively, the authors have prepared a number of mixed esters (cellulose acetonitrates). Their results confirm those of Ost (this J., 1906, 606); in no case could they obtain a more highly substituted derivative than one in which three hydroxyl groups (in a C_6 unit) were replaced. Glacial acetic acid and acetic anhydride alone have no chemical action on nitrocellulose, a gelatinous solution being produced, from which, on pouring into cold water, unaltered nitrocellulose is reprecipitated. If, however, a small quantity of concentrated sulphuric acid be added to the gelatinous solution, a vigorous reaction takes place, with partial replacement of the nitro groups by acetyl radicals. The mixture must be strongly cooled, otherwise the acetic anhydride boils over. On pouring the reaction-product into a large volume of cold water, a white, flocculent precipitate is obtained, which dries to a crumbly powder, very easily soluble in ethyl acetate and acetone, less soluble in chloroform and ether-alcohol. The solutions in ethyl acetate leave, on drying, a tough, transparent film, and are specially suitable for the manufacture of artificial silk, and the preparation of insulating material, &c., inasmuch as the products are very little more inflammable than pure acetylcellulose. The relative proportions of acetyl and nitro groups in the products, vary according to the time elapsing between the addition of the sulphuric acid and the pouring of the reaction-product into water. In the experiments, 6 grms. of nitrocellulose (11·07 per cent. of nitrogen) were mixed with 100 c.c. of acetic anhydride and some glacial acetic acid, and after complete solution was attained, 2 c.c. of concentrated sulphuric acid were added to the cooled liquid. By pouring the reaction-product into water after periods ranging from half an hour to twelve hours, mixed esters were obtained, with the compositions given in the following table :—

Duration of reaction in hours.	Product yielded :		Calculated for :	
	Nitrogen.	Acetic acid.		
	per cent.	per cent.		
½	4·19	34·84	$C_{24}H_{31}O_{11}(NO_3)_3(C_2H_3O_2)_6$	$N = 4·06$ per cent. $CH_3CO_2H = 34·79$ per cent.
1	3·97	33·10		
2	4·54	40·86	$C_{24}H_{28}O_8(NO_3)_4(C_2H_3O_2)_8$	$N = 4·81$ per cent. $CH_3CO_2H = 41·24$ per cent.
4	4·86	41·22		
12	2·64	47·74	$C_{24}H_{29}O_9(NO_3)_2(C_2H_3O_2)_9$	$N = 2·51$ per cent. $CH_3CO_2H = 48·39$ per cent.:

For the analysis of the products, the nitrogen was determined in Lunge's nitrometer, and the total nitric and acetic acids by distillation with steam, the vapours being absorbed in $N/5$ sodium hydroxide solution, and the excess of alkali titrated back. Attempts to prepare technically useful formylcelluloses proved unsuccessful. (See also this J., 1905, 685, 1251.)—A. S.

Fibres and fibrous substances for paper-making; Philippine ——. G. F. Richmond. Philippine J. Sci., 1906, **1**, 1075—1084.

The author continues his investigations on the suitability of Philippine fibres for papermaking (see this J., 1906, 863).

Bamboo (*Structural, Bambusa blumeana*, and *Dwarf, B. lumanpao*).—The processes employed for obtaining paper cellulose from esparto and straw can be used for bamboo. Experiments show that no preliminary sorting of the different portions of the stem is necessary. Rotary digesters would probably prove unsuitable in working up this material, as the pulp shows a tendency to roll up into little balls. One pound lots of bamboo chips were boiled with caustic soda in an upright digester over a free flame. The results obtained show that a well-digested pulp is obtained by the use of 10—20 per cent. of caustic soda calculated on the gross weight of the canes, the duration of digestion and the temperature and pressure required being considerably less than in the case of the common soft woods employed for pulp production, and comparing favourably with those used for straw cellulose manufacture. The dwarf bamboo is superior to the "structural" variety, yielding from 44—50 per cent. of unbleached pulp as compared with 41—43 per cent. from the latter, whilst the consumption of bleaching powder is 10—20 and 20—25 per cent. respectively for the two kinds.

Coco-nut palm.—The fibre of this plant is obtained in almost unlimited quantities as a by-product in the production of copra and coco-nut oil. Experiments show that the fibres cannot be economically separated from the cellular matter in which they are embedded. Although not suitable for paper-making, this material can be used in place of wood pulp for the manufacture of roofing and felting materials. The husks need only be prepared by mechanical means alone, possibly followed by a mild alkaline treatment. The fibre is not suitable for bleaching. On treatment with 2 per cent. alkali under pressure for several hours, the fibrous tow shredded from the husks gave nearly 70 per cent. of pulp. The uncleaned husks gave 26 per cent. of pulp. *Buri palm rope* under similar conditions gave 30—37 per cent. of pulp. Hand-made sheets of unbleached paper from these fibres were strong and fairly free from shive.—F. Shdn.

Colophony; Autoxidation of ——. W. Fahrion. XIII*B*., page 264.

Oil of turpentine obtained in the sulphate cellulose process. P. Klarson and H. Person. XX., page 276.

Cellulose and dextrose; Condensation of aromatic hydrocarbons with ——. A. Nastukoff. XXIV., page 282.

English Patent.

Colloidal material [*substitute for celluloid, &c.*]; *Manufacture of a* ——. G. E. Arnold, A. S. Fox, A. C. Scott, and H. E. U. Roberts, Faversham, Kent. Eng. Pat. 3450, Feb. 12, 1906.

The patent relates to the manufacture of a colloidal material which may be used in lieu of, or in combination with, nitrocellulose for the production of celluloid, xylonite, &c. Nitrostarch, either alone, or in combination with nitrocellulose, is dissolved in a solvent such as wood spirit, acetic ether (ethyl acetate), or nitrobenzene. To the more or less plastic mass thus produced, camphor, oils, gums, and other materials are added, and the product so formed is pressed or moulded into any desired form. Denitration is effected by the action of a solution of ammonium sulphide or other known denitrating solution. Good results are obtained by using nitrostarch (65—75 parts), camphor (20—30 parts), and wood spirit and colouring matter as desired.—G. W. McD.

French Patent.

Paper; Process for removing or diminishing the glaze of printed ——. Erste Deutsche Kunstdruck-Papierfabr. C. Scheufelen. Fr. Pat. 370,971, Oct. 30, 1906. Under Int. Conv., Feb. 28, 1906.

See Eng. Pat. 23,684 of 1906; this J., 1907, 220.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 223.)

Strychnos seeds; Presence of saccharose and glucosides in certain ——. J. Laurent. J. Pharm. Chim., 1907, **25**, 225—228.

By successive treatment of the alcoholic extracts of the seeds, prepared with the usual precautions, with the ferments invertin and emulsin, by Bourquelot's method, the presence of saccharose and of one or more glucosides has been demonstrated in the seeds of the following species of *Strychnos*. *S. nux-vomica* was found to contain 0·22 per cent. of reducing sugar, 1·34 per cent. of saccharose, and to show a slight, but distinct polarimetric deviation after treatment with emulsin, indicating the presence of a glucoside. *S. ignatia* gave 1·58 per cent. of reducing sugar, 8·6 per cent. of saccharose, and 1·3 per cent. of reducing sugar formed by emulsin. *S. potatorum* contained 0·2 per cent. of reducing sugar, 1·22 per cent. of saccharose, but showed no increase of reducing sugar after treatment with emulsin. *S. spinosa* yielded 0·6 per cent. of reducing sugar, 1·66 per cent. of saccharose, with no increase in reducing sugar after treatment with emulsin. *S. bakanko* gave 1·32 per cent. of reducing sugar, 1·70 per cent. of saccharose, and 0·52 (?) per cent. of reducing sugar formed by treatment with emulsin. Dunstan and Short have previously (J. Chem. Soc., 1885, **48** [1], 395) recorded the occurrence of loganin in the pulp of *S. nux vomica*, but did not study its behaviour with emulsin. It is found that hydrolysis with emulsin proceeds much slower than usual in the case of the *Strychnos* glucosides, requiring fifteen days at 28° C. for completion. With most glucosides hitherto examined, emulsin hydrolysis is complete in three days.—J. O. B.

Medicinal plants; Physiologically active constituents of certain Philippine ——. R. F. Bacon. Philippine J. Sci., 1906, 1, 1007—1036.

The bark of *Alstonia scholaris* R. Br., or *dita* bark, contains two alkaloids, ditamine and echitamine, which were isolated and examined by the author. Ditamine can be separated from its solutions by making alkaline with sodium carbonate and extracting with ether; the echitamine is obtained by making strongly alkaline with sodium hydroxide and extracting with chloroform. The largest amount of ditamine obtained from 5 kilos. of the bark was 0·3 grm. Echitamine is deposited in crystalline form by the slow evaporation of its chloroform solution; it can be crystallised from alcohol or a mixture of water and acetone. It contains four molecules of water of crystallisation. It is a moderately strong base, being dissociated to the extent of about 28 per cent. in a 1 per cent. solution. When rapidly heated, echitamine melts with decomposition between 200° and 208° C. The hydrochloride can be obtained in the form of needles by the addition of excess of hydrochloric acid to a solution of the base. Echitamine is not a glucoside. 5—7 grms. of pure echitamine were obtained from 5 kilos. of the bark.

Datura fastuosa Linn. var. *alba* Clarke, is a common weed in the Philippines. The air dried leaves contained 0·21 per cent. of total alkaloids, the seeds, 0·465 per cent., and the wood and roots together, 0·17 per cent. Of the total alkaloids more than 90 per cent. is hyoscine, the remainder being hyoscyamine and atropine; thus the plant may become a possible source of hyoscine.

Entada scandens Benth. contains saponin and is used by the natives as a fish poison. Saponin was found in the seeds of this plant by Rosenthaler (see this J., 1904, 592). The results of the author's examination of saponin from the trunk fibre of the plant agree with those of Rosenthaler. The most satisfactory method of obtaining saponin is the following:—The fibre is extracted first with light petroleum, then with methyl alcohol. The alcohol is evaporated, the residue taken up with water, dialysed, evaporated to dryness and again dissolved in methyl alcohol. The solution is concentrated, and fractionally precipitated with ether. The yield is 5—6 per cent. of the fibre employed. The saponin obtained, agreed in its properties with the "saponin B" of Rosenthaler (*loc. cit.*), except that it can be heated to 180° C. before beginning to turn brown. On hydrolysis it is decomposed into galactose and sapogenin, $C_{25}H_{42}O_3$. Sapogenin crystallises from alcohol in white, odourless needles, which do not change even at 270° C. It is insoluble in water, dilute acids, and alkalis.

Argemone mexicana Linn.—This plant was found to contain berberine. Contrary to previous statements, morphine is not present.

Cæsalpinia bonducella Flem.—The common name for the seed of this plant is *bonduc* seed or fever nut. The kernels are exceedingly bitter in taste. They contain neither alkaloid nor glucoside, but about 20 per cent. of a light yellow fixed oil. The ground kernels were extracted with hot alcohol. The alcohol was distilled, and the residue taken up with chloroform. This solution was washed with alkalis, acids, and water, and then diluted with light petroleum. The supposed active principle, bonducin, separated out as a white, amorphous powder, with a nut-like odour and a resinous appearance. It dissolves slowly in strong alkalis. Bonducin which has been freed from all matter insoluble in ether, gives a rose-red colour with concentrated hydrochloric acid. It is not changed by boiling with alcohol and sulphuric acid. By boiling with alcoholic potash, other resins were obtained, but no crystalline derivatives. Bonducin has an exceedingly bitter taste, which it communicates to water, in which it is only very slightly soluble; it is more soluble in dilute hydrochloric acid. It is a resinous mixture, and not a glucoside.—F. Shdn.

Eriodictyon glutinosum; Chemical investigation of ——. G. Mossler. Annalen, 1907, **351**, 233—254.

The product examined by the author consisted of portions of woody stem and leaves of the plant, *Eriodictyon glutinosum, Benth.*, obtained directly from California. By extraction with petroleum ether about 1 per cent. of fatty matter, coloured dark green by chlorophyll, was obtained. The fat was purified by dissolving it in the lowest-boiling fractions of petroleum ether, the greater part of the impurities remaining undissolved, and boiling the solution with animal charcoal. After this treatment the fat melted at 54° C., and had an acid value, 33·1—33·4; ester value, 102·1—102·5; and iodine value, 91·0—91·5. The fatty acids consisted for the most part of an unsaturated acid of the oleic acid series, $C_{15}H_{28}O_2$, and the unsaponifiable matter (15 per cent. of the fat) of a higher hydrocarbon of the paraffin series with between 27 and 31 carbon atoms in its molecule. The residue left after treatment with petroleum ether, was extracted with ether, and the solution shaken with sodium carbonate solution. A yellow sodium salt separated, and the aqueous solution was coloured yellowish-brown, and on evaporation, yielded a resinous mass. The sodium salt was decomposed by treatment with dilute acetic acid, and the substance set free dissolved in ethyl acetate. After purification, it was obtained as a white, tasteless, and odourless powder, melting sharply at 214°—215° C. when heated rapidly, easily soluble in alcohol and ethyl acetate, slightly soluble in ether, choloroform, and benzene, and almost insoluble in water. This compound, which the author names *eriodyctionone*, contains one methoxyl and four hydroxyl groups, and has the composition, $C_{15}H_7O(OCH_3)(OH)_4$. On destructive distillation it yields creosol. The presence in the raw material of a tannin substance, a sugar, and a gummy substance was also detected. (See also Power and Tutin, this J., 1906, 1065.)—A. S.

Cannabinol, the active constituent of hashish. M. Czerkis. Annalen, 1907, **351**, 467—472.

Frænkel (Arch. exp. Path. u. Pharm., 49, 266) has shown that the active constituent of hashish is a substance having the empirical formula, $C_{21}H_{30}O_2$, which contains one phenolic hydroxyl group and yields a trinitro-derivative. For the isolation of pure cannabinol, hashish was extracted with low-boiling petroleum ether, and the extract was distilled at a pressure of 0·1 mm. in Claisen flasks fitted with Thorne's taps, the pressure being recorded by a Macleod gauge. The fractions passing over between 190° and 230° C., were united, dissolved in hot absolute alcohol, and separated from paraffins by freezing. The alcoholic solution was distilled under diminished pressure in a current of hydrogen to remove the alcohol, and the residue again fractionated. The cannabinol distils at 230° C. (corr.) at a pressure of 0·1 mm. By the action of moderate oxidising agents, it appears to be converted into a dicarboxylic acid containing the same number of carbon atoms, whilst on energetic oxidation, it yields butyric and oxalic acids, together with other products. (See also this J., 1898, 269, 372.)—A. S.

Terpene derivatives: Successive distribution of —— *between the various organs of a living plant.* E. Charabot and G. Laloue. Compt. rend., 1907, **144**, 435—437.

The investigation described in a previous note (see this J., 1907, 166) has been carried a step further, by tracing the distribution of the constituents of the essential oil of *Artemisia absinthium* L. (which include the alcohol thujone, $C_{10}H_{18}O$, with its esters, and the corresponding ketone, thujone, $C_{10}H_{16}O$) in the various parts of the plant during the successive stages of its development. Some time before flowering, only traces of thujone are found in the oil, and the stems contain a less soluble oil than the leaves. In the earliest flowers there is at first a less soluble oil than in the leaves, but later, this is no longer the case. In the course of the long-continued growth of the plant it is probable that the highly elaborated essential oil of the leaves reaches the newly-formed inflorescences, and that to replace this there is formed in the leaves a further quantity of essential oil, which, therefore, is of later origin than that contained in the nascent inflorescences. At this stage of development the essential oil richest in esters is that of the roots, that of the stems coming next, and those of the flowers and leaves respectively third and fourth in order of ester-content. The proportion of thujol is not very different in the various parts of the plant, but thujone, of which the stems only contain traces, is present in largest relative proportion in the leaves. Analysis shows that a consumption of odoriferous compounds occurs in the flowers, causing a diminution in the total quantity of oil present in leaves and flowers during the period of fertilisation; confirmation of this is derived from the fact that whilst of all the constituents, thujol diminishes in quantity most markedly, in the flowers this remains fairly constant, the supplies from the leaves, whilst maintaining the thujol-content of the flowers, being insufficient to maintain the total content of this constituent in flowers and leaves. When fructification is effected, a further disappearance of oil from the flowers takes place, particularly of the relatively soluble thujol, the oil probably returning to the vegetative organs when the rôle of the flower is completed.—E. W. L.

Origanum; Cyprus ——. D. Saracomenos. Chem. and Drug., 1907, **70**, 365—366.

Origanum, or red thyme, grows wild in the south-western portion of Cyprus. Distillation is carried on from July to the middle of December. One oke ($2\frac{3}{4}$ lb.) of oil is obtained from 30—45 okes of the herb, with a consumption of 65—70 okes of coke as fuel. Fresh plants yield oil of a dirty-grey colour, gradually changing to a dirty red, similar to the colour of the oil obtained from plants which have been kept for one month before distilling. Analyses by the Government analyst gave the following results:—

	Dark-coloured oil.	Light-coloured oil.
Specific gravity	0·969	0·969
	per cent.	per cent.
Water	2·60	2·00
Light oil distilling below 160° C.	1·80	2·00
Thymene distilling at 160°—165° C.	6·40	2·40
Cymene distilling at 170°—180° C.	7·60	8·80
"Thymol" distilling at 230° C.	81·60	84·80

Much of the oil of thyme of commerce consists merely of thymene and cymene, the "thymol" having been extracted. The author states that Dunstan has isolated the phenolic constituent of the oil and identified it as carvacrol (see following abstract).—A. S.

Origanum oil from Cyprus. Bull. Imp. Inst., 1906, **4**, 296—299.

The name of the plant furnishing this oil is not definitely known, but the oil itself agrees closely in characteristics with the product from *Origanum hirtum*, which is known commercially as Cretan or Trieste origanum oil. It was also closely similar to an oil, said to be obtained from *O. onites*, brought by Dunstan from Cyprus. The sample examined was pale yellow, rapidly changing to dark brownish-red on exposure to the air. Its odour and flavour recalled that of thyme. Analysis gave the following results :—Sp. gr. at 15·5 C., 0·9645 ; refractive index at 23 C., 1·51 ; rotation in a 100 mm. tube, 0° ; solubility in 70 per cent. alcohol, 1 in 1·4 parts ; and "phenol" content by volume, 82·5 per cent. The phenolic constituent, separated by the usual methods, was identified as carvacrol. It is suggested that carvacrol might be profitably extracted from this oil, and used as an antiseptic agent. The dark colour of the oil would prevent its being used for perfuming white soaps, "white thyme oil" from *Thymus vulgaris* being used in preference for this purpose. Two consignments of the oil were sold to dealers in essential oils at the rate of 3s. per lb.—C. A. M.

Oil of turpentine obtained in the sulphate cellulose process ; Purification of ——. P. Klarson and H. Person. Svensk Pappers Tidning ; through Papier Zeit., 1907, **32**, 4.

In recent years, oil of turpentine has become a valuable by-product in the manufacture of cellulose by the sulphate process. The authors have worked out a method for removing the disagreeable odour which the turpentine possesses, due to the presence of evil-smelling sulphur compounds. These compounds are unattacked by caustic alkali, and are only partially attacked by compounds of the heavy metals, but it was found that they are completely decomposed by sulphuric acid. The use of concentrated sulphuric acid is, however, debarred, since although it removes the sulphur bodies, it also resinifies the oil of turpentine, with evolution of much heat. The following process was found satisfactory :—The crude oil is first distilled with steam, until 80 per cent. has passed over, the residue consisting of polyterpenes. The distillate is treated with 5—10 per cent. of its weight of 50 per cent. sulphuric acid, which is run in as a fine stream whilst the oil is shaken or vigorously stirred. The mixture must not be allowed to become warm by the action of the acid, or the product will have a sharp, sour odour, but the reaction must be allowed to proceed in the cold until all odour has disappeared. The oil is finally distilled with steam, and a transparent, highly-refracting liquid with an agreeable smell is obtained.—B. J. S.

Abietic acid : Occurrence of —— in rosin oil. A. Tschirch and M. Wolff. Arch. Pharm., 1907, **245**, 1—4.

Rosin spirit was dissolved in ether and shaken out with sodium carbonate solution. On acidifying and crystallising the precipitate from acetic acid, abietic acid, $C_{19}H_{28}O_2$, or $C_{19}H_{30}O_2$, was obtained, melting at 166°—167° C. A small amount of a phenol-like substance was found on shaking out the ethereal solution with caustic alkali. The ethereal solution, on evaporation and distillation, yielded an oil, boiling for the most part between 315° C. and 385° C.—F. Shdn.

Ferments mutually incompatible. T. Sollmann. Lancet, March 2, 1907 ; Pharm. J., 1907, **78**, 293.

The author states that liquid preparations containing more than one digestive ferment are worthless. He finds that trypsin is destroyed in six hours at 40° C. by pepsin in a solution containing 0·112 per cent. of hydrochloric acid. Pepsin is completely destroyed by trypsin in alkaline solution. The activity of diastase is weakened by pepsin even in neutral solution, but is unaffected by trypsin. Rennin is not destroyed by pepsin, nor is invertin injured by pepsin, trypsin, or diastase. Preparations supposed to contain all the active agents of digestion were found to be entirely devoid of proteolytic or amylolytic properties.

Thymyl trichloracetate. O. Anselmino. Ber. Pharm., 1906, 390. Apoth.-Zeit., 1906, **21**, 1050.

Although it has been claimed that this compound is formed as a solid body, by heating together molecular proportions of thymol and trichloracetic acid, the author finds that, under these conditions, the latter is wholly decomposed into hydrochloric acid, phosgene, and carbon monoxide, whilst the thymol is unaltered. The pure ester can, however, be obtained by the action of trichloracetylchloride in solution in light petroleum spirit on sodium thymol. It is a clear liquid, boiling at 110°—111° C. under 12 mm., and turning bluish-green on exposure to the air.—J. O. B.

Phenols ; Miscibility of solutions of —— in aqueous alkalis with organic substances insoluble in water. R. Scheuble. Annalen, 1907, **351**, 473—480.

The author's experiments were carried out with phenol, *m*-cresol, xylenol ($1.3.4C_6H_3(CH_3)_2OH$), and carvacrol, whilst as substances insoluble or soluble with difficulty in water, octyl alcohol, $CH_3(CH_2)_5CH(OH).CH_3$, toluene, and heptane were used. The quantitative results are shown in the following table :—

5 c.c. of potassium hydroxide solution (250 grms. per litre) mixed with :	Amount of phenolic compound required to produce a homogeneous solution.			
	Phenol.	*m*-Cresol	Xylenol.	Carvacrol.
	grms.	grms.	grms.	grms.
2 c.c. (1·64 grms.) of octyl alcohol	2·6	1·1	1·0	1·8
5 c.c. (4·1 grms.) of octyl alcohol	3·9	1·8	1·7	2·6
2 c.c. (1·74 grms.) of toluene	4·9	4·4	4·1	4·0
3 c.c. (2·61 grms.) of toluene	6·7	5·1	5·0	4·8
2 c.c. (1·36 grms.) of heptane	15·0	6·4	—	4·6

The clear solutions are caused to separate into two layers by further addition of the substance soluble with difficulty in water, and less readily by addition of more water, or even of more alkali of the same concentration as that originally used.—A. S.

Cinnamic acids ; Isomeric ——. E. Erlenmeyer, jun., C. Barkow and O. Herz. Ber., 1907, **40**, 653—663.

In continuation of their researches, the authors show that there must be at least six different cinnamic acids (Ber., 1906, **39**, 1570). These acids are :—(1) Isocinnamic acid of Erlenmeyer, sen., m. pt. 37°—38° C. ; (2) allocinnamic acid of Liebermann, m. pt., 68° C. ; (3) isocinnamic acid of Liebermann, m. pt. 59° C. ; (4) *α*-cinnamic acid, m. pt. 134°—135° C., the commercial acid from storax : (5) *β*-cinnamic acid, m. pt. 132°—133° C. ; (6) isocinnamic acid of Erlenmeyer, jun., and Allen ; (7) a triclinic cinnamic acid. The authors found that the brucine salt of allocinnamic acid is not stable, and attempts to regenerate the original acid did not succeed. If equivalent quantities of brucine and allocinnamic acid are mixed in absolute alcohol and evaporated in a vacuum, a brucine salt melting at 151° C. separates out first, the proportion of base to acid being 1:1. The mother liquors gave a syrup which turned to an amorphous solid on standing. The acid obtained from the salt melting at 151° C. melted at 58°—59° C., and was identical with Liebermann's isocinnamic acid. The amorphous brucine salt also gave the same acid. No evidence of the presence of the triclinic acid was obtained. By recrystallising brucine isocinnamate, m. pt. 151° C., from alcohol, Erlenmeyer's and Liebermann's acids were obtained. Synthetic cinnamic acid gave salts of brucine melting at 135° C. and 113° C. respectively. The cinnamic

acid of storax gave the brucine salt melting at 135° C. This salt contains 2 mols. of acid to 1 mol. of base. If synthetic cinnamic acid be crystallised from 75 per cent. alcohol, there is obtained in the mother liquors an acid, $C_9H_8O_2$, melting at 127°—128° C. When β-bromocinnamic acid is reduced with zinc and alcohol, Liebermann's isocinnamic acid and a triclinic cinnamic acid are produced. The authors conclude that allocinnamic acid is resolved by brucine into the salts of these two acids, and that by repeated crystallisations the triclinic acid is converted into Liebermann's isocinnamic acid.
—F. SHDN.

Phenylethyl alcohol ; Presence of —— in the essential oil from the needles of the Aleppo pine of Algeria. E. Grimal. Compt. rend., 1907, **144**, 434—435.

PHENYLETHYL alcohol, which has hitherto only been recorded as present in the neroli and rose oils, was isolated from that fraction of the pine-needle oil which passed over between 120° C. and 135° C. at 10 mm. pressure. This fraction was saponified, and the ethereal extract of the product distilled under a pressure of 8 mm. The fraction 95° C. to 98° C. from this second distillation was treated with phthalic anhydride (Haller's method), the product extracted with ether, and the aqueous portion then saponified with potash and extracted with ether in presence of excess of sodium chloride. The phenylethyl alcohol, obtained from this ethereal extract, distilled between 218° C. and 220° C. at ordinary pressure, was optically inactive, and had a sp. gr. at 15° C. of 1·0187, and a refractive index at 18° C., $n_D = 1·52673$. It was identical in all its properties with phenylethyl alcohol from other sources.—E. W. L.

Methyl alcohol ; Combination of —— with camphene and with trimethylethylene. A. Reychler. Bull. Soc. Chim. Belg., 1907, **21**, 71—74.

BY heating a mixture of camphene, methyl iodide, and methyl alcohol in a sealed tube to 130°—140° C., the author obtained methyl-isobornyl ether. The reaction probably proceeds as follows :—

$$CH_3OH + CH_3I = CH_3OCH_3 + HI.$$
$$C_{10}H_{16} + HI = C_{10}H_{17}I \text{ (in the nascent state).}$$
$$C_{10}H_{17}I + CH_3OH = C_{10}H_{17}OCH_3 + HI.$$

Thus the hydriodic acid plays the part of a catalyst ; other acids can act similarly in the combination of unsaturated substances with alcohols to form ethers or with organic acids to form esters. By heating a mixture of trimethylethylene, methyl alcohol, and sulphuric acid in a sealed tube to 95° C., the author obtained methyl amyl ether (probably corresponding to tertiary amyl alcohol). The reaction probably proceeds as follows :—

$$CH_3OH + H_2SO_4 = CH_3OSO_2OH + H_2O.$$
$$C_5H_{10} + CH_3OSO_2OH = C_5H_{11}OSO_2OCH_3.$$
$$C_5H_{11}OSO_2OCH_3 + CH_3OH = C_5H_{11}OCH_3 + HOSO_2OCH_3.$$

The commercial method for the preparation of tertiary amyl alcohol and the conversion of trimethylene into propyl alcohol are instances in which the fixation of water by unsaturated bodies is facilitated by the presence of acids.—L. E.

Butyl alcohol ; Preparation of optically active ——. R. Meth. Ber., 1907, **40**, 695—697.

SECONDARY butyl alcohol was mixed with sulphuric acid, treated with excess of barium carbonate, and the clear liquid evaporated *in vacuo* to obtain barium butyl sulphate. By treatment with brucine sulphate, and crystallisation, the brucine salt of *r*-butylsulphuric acid, m. pt. 210° C., was obtained. From this the barium salt was prepared ; it crystallises with 1 mol. of water and has $[\alpha]_D = 0·57°$. On hydrolysis the alcohol was obtained with $[\alpha]_D = 0·32°$.—F. SHDN.

Amorphous carbon ; Reducing and catalytic powers of —— towards the alcohols. J. B. Senderens. Compt. rend., 1907, **144**, 381—383.

ANIMAL charcoal was employed in this work, after thorough extraction with hydrochloric acid, washing, and drying at 100° C. When heated in a glass tube in a combustion furnace, it begins to oxidise in air at 200°, and to reduce nitric or nitrous oxide at 300° C. When the vapours of ethyl alcohol are passed over it at 350°—400° C., no reduction occurs, properly so called, but two modes of decomposition of the alcohol go on side by side, *viz.*, into ethylene and water, and into methane and formaldehyde, the formaldehyde partially decomposing into hydrogen and carbon monoxide. Propyl alcohol yields almost entirely propylene and water. The same catalytic action on these alcohols was exhibited by silicious sand, pumice, dicalcium phosphate, magnesia, and other substances. Possibly it is to the silicious matter in animal charcoal that its catalytic effects, differing from those of charcoals of other origin, are due. Sugar charcoal, for instance, gives with ethyl alcohol, 29 per cent. of carbon monoxide and only 5 per cent. of ethylene, and with propyl alcohol, 32 per cent. of propylene as compared with 88 per cent. given by animal charcoal. Amorphous phosphorus, substituted in these experiments for animal charcoal, shows remarkable activity as a catalyst, causing at 200°—240° C. the dissociation of alcohols with great sharpness into water and olefines, so that the process can be used as a general method of preparing pure olefines
—J. T. D.

Bismuth disalicylate ; Commercial ——. F. Zernik. Apoth.-Zeit., 1907, **22**, 117—118.

THE so-called bismuth disalicylate is not a chemically pure body of the constitution, $OH.Bi:(OCOC_6H_4OH)_2$, but is mixed with more or less basic salt.—J. O. B.

Wormwood, essential oil of ; Detection of —— [in liqueurs]. L. Cuniasse. XVII., page 269.

a-Naphthoquinone, β-naphthoquinone, phthalonic acid, and phthalic acid ; Detection and determination of ——, [and the fluorescein reaction]. M. C. Boswell. XXIII., page 282.

Phthalophenone in the form of test-paper ; Use of —— for detecting hydrocyanic acid. Thiéry. XXIII., page 281.

Mercury solution as reagent for aldehydes, especially formaldehyde : A new ——. E. Feder. XXIII., page 281.

Japanese peppermint oil. Ch. of Comm. J., March, 1907. [T.R.]

AN American Consular report gives the following particulars with regard to the production of peppermint oil and menthol crystals in Japan. The peppermint plant is principally grown in Hokkaido, Yamagataken, Okayamaken, and Shiroshinoken. The price governs somewhat the size of each succeeding planting, and the yield in the United States, where the best is produced, governs the price of the Japanese article to some extent. The smallest quantity manufactured was in 1901, *viz.*, about 50,000 kin (1 kin = 1⅓ lb.) of each article. The new crop will be available in March and April, 1907. The exports of menthol and peppermint oil from Japan during the last five years were as follows :—

	Menthol.		Peppermint oil.	
	lb.	$	lb.	$
1902	72,433	231,072	78,986	82,170
1903	102,468	400,392	102,698	138,444
1904	192,197	543,318	219,691	273,402
1905	222,756	397,404	231,875	245,016
1906 (to July) ..	77,364	151,392	113,761	115,536

The exports of menthol crystals from Yokohama alone to all countries for the ten months ending Oct. 31, 1906, amounted to 45,910 kin, valued at $122,993, against 102,322 kin, with a value $239,954, for the first ten months of 1905 ; and of peppermint oil for the same ten months, 47,409 kin, valued at $70,016, against 76,213 kin, of a value of $100,234 in 1905. About 75 per cent. of the crop of mint in Japan is grown in the Kobe consular district. It is also grown in Uzen (in the north-east) and Hokkaido (in the north). The third crop produces the largest percentage of oil. The quantity of the product required to make 1 kin ($1\frac{1}{3}$ lb.) is :—First crop, 141 lb. ; second crop, 83 to 108 lb., and third crop, 83 to 91 lb. On one acre the first crop will yield 4 lb. of oil ; the second, 8 lb., and the third, $10\frac{2}{3}$ lb. The oil from the first crop will yield 45 per cent. of menthol, the second $47\frac{1}{2}$ per cent., and the third 50 per cent. Crude oil is obtained by heating and pressing the leaves in a large barrel. Menthol is produced from the crude oil in factories by a process of freezing. An average crop of oil is about 333,333 lb. ; but owing to the very low prices prevailing during the last two years, mint growers planted very sparingly in 1906, and the crop was estimated at 189,333 lb., against crops for 1905 and 1904 of 455,999 and 760,000 lb., respectively.

English Patents.

Sulphinic acids ; Separation of —— from solutions thereof, and obtaining them in the condition of stable compounds. C. Dreyfus and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 13,055, June 5, 1906.

CLAIMS are made for the manufacture of ferric salts of aromatic sulphinic acids by the action of a solution of a ferric salt on (1) a strongly-acid solution containing an aromatic sulphinic acid, or (2) an alkaline solution containing an aromatic sulphinic acid, the precipitate formed in the latter case being freed from ferric hydroxide by treatment with a suitable strong or mineral acid ; also, for the manufacture of the ferric salt of toluene-*o*-sulphinic acid by adding a solution of a ferric salt to a strongly-acid solution, such as is obtained in the known methods of preparing toluene-*o*-sulphinic acid by replacing the amino-group in *o*-toluidine by the sulphinic group.—T. H. P.

Saccharin ; Manufacture of ——. W. A. Lynde, Manchester. Eng. Pat. 14,122, June 20, 1906.

CLAIM is made, in the manufacture of saccharin from toluene, for the oxidation of the methyl-group to the carboxyl-group before the introduction of the sulpho- or sulphamino-group. In this way the formation and subsequent separation of *p*-toluene sulphonic chloride are avoided.—T. H. P.

Dialkylbarbituric acids ; Manufacture of ——. P. A. Newton, London. From Fabenfabr. vorm. F. Bayer und Co. Elberfeld, Germany. Eng. Pat. 15,519, July 9, 1906.

SEE Fr. Pat. 367,872 of 1906 ; this J., 1906, 1232.—T. F. B.

United States Patents.

Carbamic acid ester and process of making same. A. Bischler, Assignor to Basle Chemical Works, Basle. U.S. Pat. 839,100, Dec. 25, 1906.

SEE Eng. Pat. 17,167 of 1906 ; this J., 1906, 952.—T. F. B.

Ferric quinate and albumin ; Solution of ——. J. Traube and R. Wolffstein, Berlin, Assignors to R. C. Schüpphaus, New York. U.S. Pat. 839,232, Dec. 25, 1906.

A STABLE, viscous solution, of dark colour, is obtained by mixing a solution of an organic colloid (albumin) with an iron compound and a quinate.—A. S.

Iodine preparation [substituted fatty acid]. E. Fischer, Berlin, Assignor to Farbenfabr. of Elberfeld Co., New York. U.S. Pat. 839,569, Dec. 25, 1906.

SEE Fr. Pat. 362,370 of 1906 ; this J., 1906, 714.—T. F. B.

French Patents.

Substances liable to decompose under the action of oxygen [chloroform, &c.] ; Process and apparatus for the storage of ——. A. Monneyrat. Fr. Pat. 370,991, Jan. 8, 1906.

SUBSTANCES, like chloroform, which are liable to undergo decomposition when stored in presence of air, are packed in closed bottles, *e.g.*, siphons, under a pressure of pure nitrogen gas. A special bottle is described which is filled and emptied for use in an inverted position. The neck of the bottle is fitted with a screw valve ; when it is required to fill the bottle, the air is exhausted by a vacuum pump, and pure nitrogen is admitted. This process is repeated several times, until every trace of oxygen has been removed. The bottle, still in the inverted position, is then placed in connection with a supply of chloroform, which is sucked through the valve, owing to the vacuum which exists in the bottle. When partly full, the valve is closed, the bottle is brought into an upright position, and pure nitrogen is forced in at a pressure of 3 or 4 atmospheres.—J. F. B.

Monochlorhydrin ; Preparation of ——. Deutsche Sprengstoff Akt.-Ges. Fr. Pat. 370,224, Oct. 3, 1906. Under Int. Conv., June 10, 1906.

MONOCHLORHYDRIN can be prepared by the action of a sufficient quantity of sulphur dichloride on glycerol at a moderate temperature. The monochlorhydrin is recovered by distillation in a vacuum.—F. SHDN.

Monochlorhydrin ; Preparation of ——. Deutsche Sprengstoff Akt.-Ges. Fr. Pat. 370,249, Oct. 4, 1906. Under Int. Conv., Jan. 20, 1906.

MONOCHLORHYDRIN can be prepared by the following process :—Glycerol is mixed with aqueous hydrochloric acid, and heated to 105°—140° C. in an autoclave. The monochlorhydrin is obtained by fractionating in a vacuum. —F. SHDN.

Formic acid esters of borneol and isoborneol ; Preparation of —— and of borneol and camphor. O. L. A. Dubosc. Fr. Pat. 370,293, Oct. 6, 1906.

PINENE hydrochloride and metallic formates interact in the presence of formic acid to give formic acid esters of borneol and isoborneol and a metallic chloride, provided that the sum of the heats of formation of the metallic chloride and the formic acid ester are greater than the sum of the heats of formation of pinene hydrochloride and the metallic formate, that is 52 calories. Borneol can be obtained by saponification of the esters, and camphor by oxidation.—F. SHDN.

o-Nitrotoluene ; Mercury compounds of ——, and their transformation into o-nitrobenzaldehyde. Kalle und Co., Akt.-Ges. Fr. Pat. 370,522, Oct. 16, 1906.

WHEN *o*-nitrotoluene suspended in water is heated with freshly-precipitated mercuric oxide and caustic soda, a compound of *o*-nitrotoluene and mercury is formed, which dissolves in alkalis and is reprecipitated by acids. If the reaction is allowed to proceed further, a mercury compound is produced which is insoluble in alkalis, and which, on oxidation with nitric or nitrous acid, furnishes *o*-nitrobenzaldehyde. Example :—A mixture of 30 kilos. of *o*-nitrotoluene, 95 kilos. of precipitated mercuric oxide, and 1000 litres of caustic soda solution (1·8 per cent.) is heated for 30 hours on an oil-bath, using a reflux condenser. After separating any unchanged nitrotoluene by a current of steam, the residue (which contains oxide of mercury and a small amount of mercury) is digested with 10 per cent. hydrochloric acid, which dissolves the oxide of mercury and forms the chloride of the new compound. This is heated with very dilute caustic soda, and the free mercury compound digested cold with 10 per cent. acetic acid, whereby, after filtering, a clear yellow solution of the acetate is obtained. On addition of dilute caustic soda, a heavy crystalline orange mass of the new compound is precipitated. For the oxidation, 20 kilos. of this compound are mixed with 4 kilos. of sodium nitrate and 40 kilos. of water, the liquid is boiled, and 60 kilos. of sulphuric acid (20 per cent.) are added gradually. When the original yellow colour of the precipitate has disappeared, the whole is extracted with ether or benzene, the extract washed with sodium carbonate solution, and evaporated, when *o*-nitrobenzaldehyde remains behind. Free nitric acid may also be employed for the oxidation, and the *o*-nitrobenzaldehyde removed by distillation with steam.—J. C. C.

Fatty acids ; Production of mono-iodo substitution products of the higher ——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated Oct. 23, 1906, to Fr. Pat. 362,370, Jan. 12, 1906. (See this J., 1906, 714 and 1173.)

THE halogenated derivatives of the higher fatty acids are prepared by treating unsaturated fatty acids with a bromide or iodide of a metal, and adding to the mixture an acid which will decompose the metallic salt, and liberate the halogen hydracid; the latter then combines with the fatty acid. Mono-iodo-behenic acid can be prepared by treating monobromo-behenic acid with a metallic iodide. —J. F. B.

Dialkylbarbituric acids; Process for preparing ——. Farwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 370,974, Oct. 30, 1906. Under Int. Conv., Nov. 28, 1905,

See Eng. Pat. 25,494 of 1906; this J., 1907, 113.—T. F. B.

Aromatic sulphonic acids; Manufacture of the sodium salts of ——. P. W. Uhlmann. Fr. Pat. 371,089, Nov. 5, 1906. Under Int. Conv., Nov. 5, 1905.

The sulphonated "melt" is neutralised by pouring it into a hot concentrated solution or suspension of sodium sulphite or carbonate, the quantity of water being so chosen that most of the sodium sulphate produced shall be insoluble in the boiling liquid. The gas, sulphur dioxide or carbon dioxide, which escapes, is collected and compressed for other uses, the sodium sulphate is filtered off whilst the liquid is still hot, and washed with a saturated solution of the same salt, and the sodium sulphonate is recovered from the filtrate.—J. F. B.

Radioactive crystals and their preparation. P. Simon. Fr. Pat. 370,749, Oct. 25, 1906.

The process employed for the preparation of radioactive crystals consists in collecting radium emanation in water, then incorporating this water, as water of crystallisation, in crystalline substances previously dehydrated.—F. Shdn.

German Patents.

Ketones, particularly acetone; Process for preparing aliphatic —— from the calcium salts of the corresponding fatty acids. J. Becker. Ger. Pat. 170,533, Sept. 22, 1903.

In the preparation of aliphatic ketones, the calcium salts employed are made absolutely neutral, and the formation of free lime is prevented during the process by the introduction of a stream of dry carbon dioxide or gas rich in carbon dioxide; a lower temperature is said to be necessary when these modifications are introduced into the process. —T. F. B.

Nitriles or iminochlorides or the acyl-compounds resulting from the action of water on the latter; Preparation of —— and alkyl halides. E. Merck. Ger. Pat. 168,728, March 31, 1904. Addition to Ger. Pat. 164,365, March 22, 1904.

The aromatic acyl-compounds of secondary amines, the organic radicals of which are not united (compare this J., 1906, 393), are heated with phosphorus pentachloride. For example, if dimethylbenzamide is used, the first products are methyl chloride and methylenebenziminochloride, which is converted into methylbenzamide on treatment with water: by further heating, the iminochloride is converted into benzonitrile. Similarly, benzanilide is obtained from benzoylbenzylaniline, benzyl chloride being also produced.—T. F. B.

1-*Chloro-2-naphthol; Process for preparing* ——. Kalle und Co. Ger. Pat. 168,824, Aug. 30, 1904. Addition to Ger. Pat. 167,458, Aug. 18, 1904. (See U.S. Pat. 778,477; this J., 1905, 84.)

Equimolecular proportions of a hypochlorite and an alkali salt of β-naphthol are caused to react in aqueous solution; on acidifying the product, 1.2-chloronaphthol is obtained in a pure state.—T. F. B.

Lactic acid; Process for purifying ——. F. Blumenthal and M. Chain. Ger. Pat. 169,992, Nov. 9, 1904.

Crude lactic acid may be purified by decomposing with steam, the salts of aniline or its homologues. A mixture of 150 parts of 60 per cent. lactic acid and 93 parts of aniline is cooled to - 5° C., and the precipitate is recrystallised from a small quantity of water, and decomposed by means of steam, the acid being subsequently concentrated *in vacuo*.—T. F. B.

Lactic esters and pure lactic acid from lactates; Process for preparing ——. Chem. Fabr. Güstrow, Hillringhaus und Heilmann. Ger. Pat. 171,835, March 25, 1905.

A salt of lactic acid is heated with an alcohol, with addition of sufficient mineral acid to neutralise the base of the lactate. The lactic esters thus prepared may be decomposed, by heating with water, into pure lactic acid and the alcohol, which is recovered.—T. F. B.

Anhydrides of monobasic organic acids: Preparation of ——. Verein f. Chem. Ind. Ger. Pat. 171,787, Dec. 1, 1904. Addition to Ger. Pat. 161,882, March 30, 1902. (See this J., 1905, 1323.)

An alkaline-earth salt of a monobasic fatty acid is mixed with an alkali salt, and heated in presence of phosphorus oxychloride, sulphuryl chloride, carbonyl chloride, or a mixture of chlorine and sulphur dioxide. A good yield of the anhydride is said to be obtained, the mixture behaving as though the alkali salt of the fatty acid had been used (*e.g.*, sodium acetate, instead of a mixture of calcium acetate and sodium sulphate). (See also this J., 1906, 392 and 608.)—T. F. B.

Methyl iodide and ethyl iodide; Process of preparing ——. Weinland and K. Schmidt. Ger. Pat. 175,209, Feb. 17, 1905.

Pure methyl or ethyl iodide may be obtained by decomposing aqueous solutions of dimethyl or diethyl sulphate with an alkali or alkaline-earth iodide.—T. F. B.

Cyanacetylurea and its alkyl- and aryl-derivatives; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 175,415, Feb. 18, 1905.

Cyanacetylurea and its derivatives are produced by condensing cyano-acetic acid with urea or an alkyl- or aryl-urea, in presence of an acid anhydride. The yield is said to be higher than when phosphorus oxychloride is used as condensing agent.—T. F. B.

Methionic acid chloride; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 171,935, Feb. 22, 1905.

Methionic acid chloride is obtained by treating the free acid with phosphorus pentachloride, distilling off the phosphorus oxychloride produced, and purifying the crude chloride by distillation *in vacuo*. It is a colourless fluid, of b. pt. 135° C. (10 mm. pressure). It cannot be prepared from the potassium salt by the above process, chlormethylsulphochloride being then produced.—T. F. B.

Trichlorethylene from symmetrical tetrachlorethane; Process of preparing ——. Konsortium f. Elektrochem. Ind. Ger. Pat. 171,900, May 27, 1905.

In the usual process for preparing trichlorethylene by heating tetrachlorethane with alcoholic alkali solutions, a certain amount of dichlorovinyl ether is produced. This is avoided, according to the present process, by replacing the alcoholic solution by an aqueous solution or suspension of an alkaline substance.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 114.)

Intensification of photographs. L. Lemaire. Bull. Soc. Franç. Phot., 1907, **23**, 72—76.

In the course of experiments with the "ozobrome" process, it was found that mercuric sulphide could replace silver sulphide in the finished print with advantage, the colour being black, and the print generally deeper than the original print. Upon this the present intensification process is based; it consists in bleaching the print in a solution of mercuric chloride (two parts) and potassium bromide (five parts) in water (100 parts), thoroughly washing, first with water and then with a solution of salt, and finally immersing for 10 minutes in a 1 per cent. solution of pure crystallised sodium sulphide.—T. F. B.

French Patents.

Colour photography ; Process of ——. A. Sébe. Fr. Pat. 361,976, Dec. 8, 1905.

The three screens for photography in colour are prepared by staining ordinary dry plates which have been treated with "hypo," as follows:—Green : aqueous solution of picric acid and glycerin, followed by a solution of "aniline green" and ferrous sulphate; blue-violet: solution of methyl blue and copper sulphate; orange-red: solution of ponceau, glycerin, and manganese nitrate. The isochromatic plates for the process are first immersed in an alcoholic 10 per cent. silver nitrate solution, and washed. The positive papers are prepared by treatment with 2 per cent. bichromate solution, the paper for the yellow print being treated with "coralline yellow," for the blue with Prussian blue, and for the red with carmine.—T. F. B.

Silver photographic images ; Conversion of —— into more stable catalytic images. O. Gros. First Addition, dated Sept. 4, 1906, to Fr. Pat. 343,583, May 31, 1904. Under Int. Conv., Oct. 12, 1905.

The silver image of a photograph is converted into a manganese image by treatment with a solution of a manganous salt and potassium ferricyanide, with or without addition of an acid or acid salt; if preferred, manganous ferricyanide may be employed, either alone or with some substance, such as sodium tartrate, which forms a complex salt with a manganous salt (see this J., 1904, 1044). —T. F. B.

Silver photographic images ; Process for colouring ——. O. Gros. First Addition, dated Sept. 4, 1906, to Fr. Pat. 345,033, May 31, 1904. Under Int. Conv., Oct. 12, 1905.

Silver images are converted into manganese images by treatment with manganous salts (see preceding abstract), which are then coloured as described in the principal patent (this J., 1904, 1238), *e.g.*, by cobalt salts.—T. F. B.

Photographs ; Process for the reproduction of coloured ——. E. J. Browne. Fr. Pat. 370,905, Oct. 29, 1906. Under Int. Conv., Nov. 4, 1905.

See Eng. Pat. 22,580 of 1905 ; this J., 1906, 1003.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page 224.*)

English Patents.

Explosives ; Manufacture of safety ——. G. Grobet, Le Moutier, Switzerland. Eng. Pat. 1573, Jan. 20, 1906. Under Int. Conv., Jan. 28, 1905.

See Fr. Pat. 351,793 of 1905 ; this J., 1905, 903.—T. F. B.

Explosives. E. Steele, Berlin. Eng. Pat. 4114, Feb. 19, 1906.

Claim is made for a powder consisting of ammonium nitrate (75—90 parts) and "nitrated or dinitrated resin, or nitrated, dinitrated, or trinitrated mixture of resin and cereal starch" (10—25 parts). In some cases, from 1—5 parts of powdered aluminium may be added. The mixture is granulated by atomised methylated spirit. (See also Eng. Pat. 11,000 of 1904 ; this J., 1904, 999.)—G. W. McD.

Explosives ; Process for rendering —— practically non-hygroscopic. E. Steele, Berlin. Eng. Pat. 4115, Feb. 19, 1906.

The patent relates to rendering explosives non-hygroscopic by treating them with atomised alcohol and a nitrated resin compound. In dealing with explosives of the ammonium nitrate class, the operation is carried out as follows:—Ammonium nitrate (85 parts) is mixed with nitrated resin, or a nitrated mixture of resin and cereal or starch meal (15 parts), in three successive portions of 5 parts each, the mixture being treated with atomised methylated spirit between each operation, and then dried. The effect of the process is to cause the resin particles to envelop the particles of ammonium nitrate, and render them non-hygroscopic. (See also Eng. Pat. 14,676 of 1901; this J., 1902, 1155.)—G. W. McD.

United States Patent.

Explosive. C. E. Bichel, Hamburg. U.S. Pat. 839,450, Dec. 25, 1906.

See Addition of March 6, 1903, to Fr. Pat. 327,868 of 1902 ; this J., 1903, 1064.—T. F. B.

French Patents.

Explosives ; Manufacture of ——. Soc. de Produits Chimiques et d'Explosives Bergés, Corbin et Cie. Fr. Pat. 370,813, Jan. 3, 1906.

Sodium or potassium nitrate is added to explosives containing ammonium perchlorate as the chief constituent, in order to prevent the evolution of free hydrochloric acid on explosion. A proportion of 45—55 parts of ammonium perchlorate to 30—40 parts of sodium or potassium nitrate, is said to be most suitable.—G. W. McD.

Explosives. C. Girard. Fr. Pat. 370,888, Jan. 5, 1906.

According to the present patent, ammonium perchlorate is added to explosives of the class described in Fr. Pat. 350,371 of 1904 (this J., 1906, 199), with the object of increasing the explosive force of the products.—A. S.

Explosives ; Preparation of ——. B. G. Reschke. Fr. Pat. 369,720, Sept. 13, 1906.

See Eng. Pat. 20,309 of 1906 ; this J., 1907, 114.—T. F. B.

Explosives containing nitroglycerin ; Process for protecting —— from freezing. Westfälisch Anhalt. Sprengstoff A.-G. Fr. Pat. 370,132, Oct. 1, 1906. Under Int. Conv., Oct. 21, 1905.

See Eng. Pat. 17,891 of 1906 ; this J., 1906, 1119.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page 226.*)

APPARATUS.

English Patents.

Carbonic acid in flue and other gases ; Apparatus for indicating and recording the percentage of ——. W. H. Porter, Manchester. Eng. Pat. 9540, April 24, 1906.

The apparatus described, has a pump worked by mechanical means, which draws, say, 100 c.c. of boiler-flue gases, and discharges this measured quantity into a burette containing caustic soda or other absorbent of carbonic acid. The burette, however, is only capable of holding 80 c.c., and the remaining 20 c.c., if not absorbed by the caustic soda, passes into a bell, floating and sealed in mercury, and loaded so that it will begin to rise only when 80 c.c. of gas have been delivered by the pump. The rising of the bell works a lever and pen, and the latter marks vertical lines on a drum, driven by clockwork. Supposing no gas is absorbed by the caustic soda, the 20 c.c. all pass into the bell, and so cause the pen to mark the longest vertical line that it is capable of making on the drum; but if a portion of the 20 c.c. is absorbed, the bell will not rise to its full extent, and consequently the line drawn by the pen will be shorter, and the percentage of carbonic acid will be recorded. To compensate for the increase in weight of the bell, as the latter rises and so displaces less mercury, a weight is arranged to gradually reduce its pressure on the bell as this rises, and so maintain the gas within it under a uniform pressure. The apparatus also includes a mercury-sealed valve, arranged so that during the delivery stroke of the pump, mercury is forced by the compression of the gas to seal an outlet to the atmosphere, but at the beginning of the suction-stroke of the pump, this mercury seal is drawn clear of the outlet so that the gas in the burette and bell escape, and the pen falls to zero, ready for the next record.—W. C. H.

Steam; Apparatus for determining the percentage dryness of ——. P. M. Pritchard and The United Alkali Co., Ltd. Eng. Pat. 12,615, May 30, 1906. I. page 246.

INORGANIC—QUANTITATIVE.

Lead; Electrolytic determination of ——. G. Vortmann. Annalen, 1907, **351**, 283—293.

The author has studied the effect of the presence of different metals and acids on the electrolytic determination of lead as peroxide from a nitric acid solution. In order to obtain good results, the solution must contain at least 7 per cent. by volume of nitric acid, of sp. gr. 1·4, and all foreign metals, with the exception of copper, must be absent. If foreign metals be present, the results are usually too high, and can be accepted as satisfactory only when the deposited peroxide on re-dissolving in nitric acid and re-precipitation, suffers no appreciable change in weight. In presence of sulphuric, selenic, and chromic acids, too high results are obtained. In such cases, the peroxide should be re-dissolved in nitric acid, and the solution again electrolysed. In presence of arsenic and phosphoric acids, the separation of the lead is incomplete, satisfactory results can only be obtained by first separating the lead as metal from an alkaline solution containing Rochelle salt, then dissolving it in nitric acid, and finally depositing it as peroxide.—A. S.

Sulphur in insoluble sulphides; Determination of ——. De Paepe. Bull. Soc. Chim. Belg., 1907, **21**, 68—69

The author has compared the following methods for the determination of sulphur (in zinc sulphide):—1. The sulphide is oxidised with nitric acid and weighed as barium sulphate. 2. *Klobukow's method.* The sulphide is treated with hydrochloric acid (density 1·2) in an atmosphere of hydrogen: the sulphuretted hydrogen set free is passed into a $N/10$ iodine solution, excess of the latter being titrated with sodium thiosulphate. The method gives accurate results when carefully performed. 3. *Eliasberg's method.* The sulphuretted hydrogen, set free as in the preceding method, is passed into a solution of hydrogen peroxide in standard sodium hydroxide; the sulphuric acid thus formed, neutralises the alkali, the excess of the latter being titrated. For some unknown reason the results are always slightly low. The two latter methods, of which (2) is to be specially recommended, are sufficiently accurate and may be executed much more rapidly than the first.

Crismer suggests the following process:—The zinc sulphide is introduced into a flask, treated with a known volume of $N/10$ potassium chromate or bichromate solution, and then with an excess of dilute sulphuric acid. When the reaction is finished, an excess of potassium iodide solution is added, the iodine liberated by the bichromate remaining unreduced, being titrated with thiosulphate. At the dilutions used, the colour of the chromate does not interfere with the titration.—L. E.

Gold in auriferous sands; Determination of —— *by the wet method.* A. Fournier. X., page 257.

Zinc [in ores]; Determination of —— *by the ferrocyanide method.* W. H. Seaman. X., page 258.

Zinc; Determination of the proportion of —— *present as carbonate and silicate in ores.* P. H. Walker and H. Schreiber. X., page 257.

ORGANIC—QUALITATIVE.

Mercury solution as reagent for aldehydes, especially formaldehyde; A new ——. E. Feder. Arch. Pharm., 1907, **245**, 25—28.

To a 2 per cent. solution of mercuric chloride there is added an equal volume of a solution of 10 grms. of sodium thiosulphate and 8 grms. of sodium hydroxide in 100 c.c. of water. When the least quantity of formaldehyde is added to this solution, there is an immediate separation of metallic mercury. The solution does not react with ammonium salts, but has the drawback that it becomes turbid somewhat rapidly on standing. If sodium sulphite is used in place of sodium thiosulphate, the solution is much more stable. Although the thiosulphate solution gives a white precipitate with ammonium salts, it is not so delicate as Nessler's solution. The precipitate with aldehyde is grey, owing to the separation of metallic mercury. The solution is prepared as follows:—20 grms. of mercuric chloride are dissolved in water and made up to a litre; 100 grms. of sodium sulphite and 80 grms. of sodium hydroxide are dissolved in water and made up to a litre. Equal quantities of these two solutions are mixed previously to the test, the sulphite solution being added rapidly, with stirring, to the mercury solution. 0·2 mgrm. of formaldehyde gives a distinct turbidity with this solution in a few seconds, whilst 0·05 mgrm. gives a perceptible reaction after 1—2 minutes. The amount of aldehyde in a solution can be determined from the weight of metallic mercury produced, 200 mgrms. of mercury being equivalent to 30 mgrms. of formaldehyde.—F. Shdn.

Wines, red; Precipitation of natural colouring matter of, and detection of artificial colours in ——. F. Jean and C. Frabot. XVII., page 269.

Salicylic acid in wine; Detection of ——. D. Vitali. XVII., page 269.

Wormwood, essential oil of; Detection of —— *[in liqueurs].* L. Cuniasse. XVII., page 269.

ORGANIC—QUANTITATIVE.

Halogens in organic compounds; New method for the determination of ——. G. Bianchi. Bull. Chim. Farm., 1906, **45**, 821—830. Chem. Zentr., 1907, **1**, 664—665.

The author has tested the method proposed by Vaube- and Scheuer (this J., 1906, 286), and concludes, from experil ments with trichloro- and dichloroacetamide and chloralurethane, that it is not generally applicable to organic chlorine compounds.—A. S.

Starch in barley; Polarimetric determination of ——. C. J. Lintner. Z. ges. Brauw., 1907, **30**, 109—111.

Five grms. of the very finely powdered cereal are triturated in a mortar with 20 c.c. of water until no lumps remain; 40 c.c. of concentrated hydrochloric acid (sp. gr. 1·19) are then added, and the mixture is allowed to remain for 30 minutes, by which time the pale yellow coloured paste will have become darker and more fluid. The liquid is then washed into a measuring flask of 200 c.c. capacity, by means of hydrochloric acid of 1·125 sp. gr., 10 c.c. of a 4 per cent. solution of phosphotungstic acid are added, with the object of precipitating the proteins, and the volume is made up to 200 c.c. with the diluted hydrochloric acid. The liquid is shaken and filtered, and the clear filtrate is examined by the polarimeter in the 200 mm. tube. The concentration of the soluble starch in the filtrate is calculated on the basis of $[\alpha]_D = 200{\cdot}3^\circ$ for barley starch dissolved in hydrochloric acid at a temperature of 20° C. Provided the liquid be not allowed to remain longer than two hours before polarising, no decrease in the rotatory power need be feared.—J. F. B.

Phthalophenone in the form of test-paper; Use of —— *for detecting hydrocyanic acid.* Thiéry. J. Pharm. Chim., 1907, **25**, 51—53.

By adding to filter paper impregnated with a 0·05 per cent. solution of copper sulphate, a drop or two of alkaline phthalophenone solution (prepared by reducing with aluminium powder an alkaline, alcoholic solution of phenolphthalein), a test paper is obtained which gives a rose colour in presence of traces of hydrocyanic acid: it is stated to be more delicate than paper impregnated with picric acid.—T. F. B.

α-Naphthoquinone, β-naphthoquinone, phthalonic acid, and phthalic acid; Detection and determination of —— *[and the fluorescein reaction]*. M. C. Boswell. J. Amer. Chem. Soc., 1907, 29, 230—236.

α-Naphthoquinone.—Method 1: *N*/10 stannous chloride solution in 2 per cent. hydrochloric acid is run into the alcoholic solution of the quinone, until the yellow colour of the latter is almost discharged. The solution is then tested after each additional drop, with a drop of a mixture of equal volumes of phenylhydrazine and alcohol, on a watch glass. A bright pink colour is obtained as long as any quinone remains. *Method* 2: To the alcoholic solution of the quinone, 3 or 4 drops of freshly distilled aniline are added, which produces a bright red colour. *N*/10 stannous chloride is then run in until the red colour is discharged on heating to boiling.

β-Naphthoquinone.—*N*/10 stannous chloride is added to the quinone in ethereal solution. A dark green colour results, but the solution suddenly becomes colourless when reduction is complete, each molecule of quinone requiring one molecule of stannous chloride.

Phthalonic acid.—The aqueous solution is titrated cold with *N*/10 potassium permanganate in the presence of sulphuric acid, manganous sulphate being preferably added to accelerate the reaction. Back titration with ferrous sulphate after adding an excess of permanganate, is recommended. Another accurate method consists in measuring the carbon monoxide evolved when the acid is heated to 180° C. with concentrated sulphuric acid, but more time is consumed than by the previous process.

Phthalic acid.—The mixture containing the acid is introduced into a test tube, the lower end of which is immersed in a bath kept at 200°—220° C., and a fairly strong current of air is directed on to its surface by means of an aspirator. The upper part of the test tube is packed with neutral absorbent cotton to catch the sublimed phthalic anhydride. After half an hour, the apparatus is allowed to cool, the end of the test-tube is cut off, the cotton and anhydride are washed into a beaker by standard caustic potash, and the excess of alkali determined by sulphuric acid and phenolphthalein, at the boiling temperature. The indicator must be added solid and not in alcoholic solution.

Fluorescein reaction.—The following results were obtained with various naphthalene derivatives, when 0·01 grm., mixed with an equal weight of resorcinol, and moistened with a drop of concentrated sulphuric acid, was heated to 160° C. for three minutes, and, after cooling, shaken with 2 c.c. of caustic soda and poured into 500 c.c. of water.

	Colour of solution.	Colour of fluorescence.
Resorcinol alone	red	blue
" + phthalic acid	light red	green
" + naphthalene	red pink	green
" + α-naphthoquinone ..	" "	"
" + β-naphthoquinone ..	dark green	none
" + α-naphthol	red	blue
" + β-naphthol	"	"
" + phthalonic acid	dark red	blue green
" + phthalide-carbonic acid	pink red	green
" + homophthalic acid ...	light red	green

—F. Sodn.

Weighted silks; Determination of the charge in ——. G. Gianoli. V., page 252

Paraffin; Determination of —— *in the unsaponifiable matter from animal fats.* J. Lewkowitsch. XII., p. 263.

Lard; Examination of ——. E. Polenske. XVIII*A*., page 271.

Milk; Detection of added water in —— *by means of the immersion refractometer.* E. Ackermann. XVIII*A*., page 271.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 169.)

Radium; Chemical action of ——. M. Berthelot. Annalen, 1907, **351**, 504—509.

(1) Some pure, white paper, free from ash, was sealed in a glass tube (29 c.c. capacity) with a small quantity of a radium preparation, but not in contact with the latter, and kept for 11 months in the dark. At the end of this time, it was found that the whole of the oxygen and 7·6 c.c. of nitrogen had been absorbed by the paper, and 1·5 c.c. of carbon dioxide had been formed. The paper had become yellow where it was nearest to the radium. This action of nitrogen on paper under the influence of radium is similar to that previously recorded by the author (Ann. chim. phys. [7], 16, 62) as occurring under the influence of an electric current. This reaction does not appear to take place, at least not to any appreciable extent, if glass be interposed between the paper and the radium. Of reactions effected by the radioactive preparation through a thin layer of glass, the author mentions the black coloration of glass, probably caused by formation of sulphides or metals. Reactions of this kind, as also the decomposition of iodic anhydride and of pure nitric acid, are accompanied by absorption of heat, and can be effected by the aid of heat alone. A third kind of reaction is the violet coloration produced in glass by the radiation after passage through several layers of glass. This coloration appears to be due to the oxidation of manganese contained in the glass, and is produced also, though much more slowly, by the action of sunlight; the reaction is accompanied by evolution of heat.—A. S.

Hydronitric acid [azoimide]. L. M. Dennis and H. Isham. J. Amer. Chem. Soc., 1907, 29, 216—223.

The authors have succeeded in preparing anhydrous hydronitric acid by allowing dilute sulphuric acid (2 of acid to 1 of water) to drop on to dry potassium trinitride, the acid being carried along by a stream of pure dry air, dried by means of calcium chloride, and then condensed by the use of liquid air. Its melting and boiling points were measured by a thermo-electric junction. The acid is a colorless, mobile liquid, heavier than water. Its boiling point is about 37° C., as given by Curtius. It may be frozen to a white, crystalline mass, melting at − 80° C. It is apparently quite stable at the ordinary temperature, but when heated, or subjected to slight shock, it explodes with great violence, although the damage is quite local. Its purity was ascertained by weighing in a sealed U-tube, and then blowing over the acid into caustic potash solution, neutralising the excess of alkali by dilute nitric acid, precipitating with silver nitrate, and then converting the silver trinitride into silver chloride, which was weighed. Its vapour density, taken in a bath of boiling chloroform, corresponds to the formula, HN_3.—F. Sodn.

Wood charcoal; Catalytic actions produced by ——. G. Lemoine. Compt. rend., 1907, **144**, 357—358.

Alcohol vapour, passed through a glass tube containing wood charcoal (in coarse powder of 1—2 mm., and previously ignited) is dissociated into aldehyde and hydrogen. Wood charcoal at the ordinary temperature induces the rapid decomposition of hydrogen peroxide, with evolution of the whole of its oxygen. The decomposition of oxalic acid and of iodic acid is greatly accelerated by the presence of wood charcoal.—J. T. D.

Cellulose and dextrose; Condensation of aromatic hydrocarbons with ——. A. Nastukoff. Z. Farben-Ind., 1907, 6, 70—71.

The author has previously described the action of benzene on a solution of cellulose in strong sulphuric acid (this J., 1902, 1302). Similar reactions are obtained with homologues of benzene, and the author assigns the name *desoxyns* to the amorphous reaction products. If, when the reaction is complete, the product be poured into five times its quantity of water, and the excess of benzene distilled off, products containing less sulphur (0·43 per cent.) than those previously described, are obtained. On oxidation with alkaline permanganate solution, the desoxyns yield monobasic or polybasic acids corresponding to the hydrocarbon employed, together with carbon dioxide and oxalic acid. For instance, benzoic acid is obtained from phenyldesoxyn, terephthalic acid from tolyldesoxyn, terephthalic and trimellitic acids from xylyldesoxyn (from commercial xylene), and pyromellitic acid from pseudocumyldesoxyn. The composition of phenyldesoxyn, neglecting the sulphur, corresponds fairly well with the formula, $C_6H_7O_2(C_6H_5)_3$, that is, cellulose (see Green, this J., 1904, 382), in which the three hydroxyls are replaced by phenyl groups. The properties of the desoxyns correspond with this view of their constitution. Similar products are obtained if dextrose be used in place of cellulose. The author points out that this reaction between cellulose or dextrose and aromatic hydrocarbons may be of service, for example, in the preparation of trimellitic and pyromellitic acids for use in the dyestuff industry (compare Eng. Pat. 28,638 of 1902; this J., 1903, 414; also Ephraim, Ber., **34**, 2780).—A. S.

Oxidation processes in living cells. O. Mohr. Z. Spiritusind, 1907, **30**, 87—88.

THE author puts forward the following hypothesis as representing the present state of our knowledge of the processes of gradual oxidation which go on in the living cell:—The formation of peroxides, which invariably accompanies all processes of slow oxidation, is one of the constant factors which, like heat, light, &c., play a definite part in the life of the cell and to which the living cell is obliged to adapt itself. This adaptation is manifested in the fact that the cell fulfils its functions with the help of three enzymes having a direct relation to peroxides, *viz.*, oxygenases, peroxydases, and catalases. In order to have a constant source of active oxygen available, the cell secretes oxygenases, which fix atmospheric oxygen with the temporary formation of peroxides. The peroxides, just like hydrogen peroxide, which frequently appears as a secondary product in this kind of oxidation, are only very slightly active in the dilute form. But they become active under the influence of peroxydases, just as hydrogen peroxide becomes active in presence of ferrous sulphate. The system, peroxydase + peroxide, effects the oxidation of various substances which the living organism utilises as nutrients. In certain cases, where the conditions for the formation of peroxides are favourable, the latter may be a source of danger to the cell, since certain parts of the organism cannot withstand energetic oxidation processes. To protect itself, the cell secretes the catalases. The function of the catalase is to decompose and discharge in the form of molecular oxygen the hydrogen peroxide which is produced by the hydrolysis of the organic peroxides. But besides protecting the cell from hydrogen peroxide, the catalase may also act as an agent for converting chemical energy into heat, since hydrogen peroxide is an endothermic compound.—J. F. B.

Prizes.

Prizes offered by the Society of Dyers and Colourists for the solution of technical problems.

THE Council of the Society of Dyers and Colourists offers prizes for the solution of the technical problems specified below, and requests co-operation in developing this scheme, and will be glad to receive additional offers of prizes and problems.

The silver or bronze medal of the Society for a full investigation of the mordanting properties of various tannin materials, more especially—

(*a*) As to the relative affinity for cotton of the tannins of galls, myrabolans, sumach, divi-divi, &c.

(*b*) As to the relative fastness of the colour lakes produced with these tannins and basic colours, in conjunction with antimony, tin, and iron.

(*c*) As to the best method of determining by volumetric analysis, or other means, their relative mordanting power.

The silver or bronze medal of the Society for the best critical essay (not exceeding 10,000 words) on the treatment of effluents from dyehouses and textile factories.

Prize of £10 for a reliable method of distinguishing between unmercerised and mercerised cotton of various qualities, and for the estimation of the degree of mercerisation without reference to lustre.

Prize of £10 for a determination of the average degree of diminution in strength of cotton yarns of various counts brought about by different bleaching processes.

Prize of £20 for a full investigation of the average degree of tendering brought about in cotton yarn of various qualities by—

(*a*) Cross dyeing with acid colours; and

(*b*) Dyeing Aniline Black,

with the object of fixing standards for the trade.

Prize of £20 for a practical method of causing kemps, when present in yarn or piece goods, to take the dyestuff equally with the accompanying wool.

Prize of £10 for a practical method of dyeing full shades of basic colours on cotton, fast to rubbing.

Prize of £10 for the most satisfactory method of using formic acid on a practical scale, as a substitute for hydrochloric or other acids, in dyeing cotton piece goods or yarns an aged Aniline Black.

Trade Report.

CENSUS OF PRODUCTION; COMMITTEE ON THE ——. *Board of Trade, March* 14, 1907.

THE President of the Board of Trade has appointed a General Committee to advise upon the general scope of the census of production and the lines upon which the information required shall be obtained. Other committees, who will consider the special requirements of particular trades, will shortly be appointed, consisting of leading manufacturers and nominees of their Associations.

The names of those who have consented to serve on the General Committee, in addition to the official members representing the Board of Trade and the Home Office, are:—Lord Allerton, Lord Avebury, Right Hon. Charles Booth, Sir Hugh Bell, Bart., Mr. Henry Birchenough, C.M.G., Sir Robert Giffen, K.C.B., Prof. Chapman, and Mr. Sidney Webb.

New Book.

STATISTICAL ABSTRACT FOR THE BRITISH EMPIRE IN EACH YEAR FROM 1891 TO 1905. Third number [Cd. 3328]. Wyman and Sons, Fetter Lane, London, E.C. Price 1s.

THIS publication, which has been prepared in the Statistical Department of the Board of Trade, contains statistics of the trade of each portion of the Empire with foreign countries, and with other portions of the Empire, figures as to the shipping of the Empire, and statements as to the production of coal, iron, diamonds, gold, silver, copper, tin, cereals and other foodstuffs, rubber, cotton, jute, wool, and live stock, and of the consumption of various staple articles. Particulars are also given of the area and population of the Empire and the British Protectorates. In the present number, particulars as to imports and exports are given in greater detail, while the production of silver, copper, and tin, and details of the consumption of spirits and wine in the principal parts of the British Empire, are given for the first time.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

5189. Leuschner. Apparatus for mixing liquids and gases.* March 4.

5295. Bock. Manufacture of large crystals. [Ger. Appl., Sept. 8, 1906.]* March 5.

5721. Kunick (Kunick). Drying liquids on rotating cylinders at temperatures below boiling point. March 9.

5976. Dellwik. Heating kilns and the like. [U.S. Appl., March 22, 1906.]* March 12.

6023. Marks (A.-G. f. Kohlendestillation). Apparatus for cooling, washing, or enriching gases or liquids.* March 12.

6164. Priest and Fenn. *See under* IX.

6171. Macfarlane. Centrifugal drying machines. March 14.

Complete Specifications Accepted.

5189 (1906). Kunick (Kunick). Drying liquids on heated cylinders. March 13.

5264 (1906). Meyersberg. Compression of gases. March 13.

6157 (1906). Wilson. Hydro-extractors. March 20.

7318 (1906). Fawcett, Ltd., and Bottomley. Rotary dryers and coolers. March 20.

10,814 (1906). Graham. *See under* VII.

II.—FUEL, GAS, AND LIGHT.

Applications.

7357A (1906). Vivian. Manufacture of artificial fuel. March 4.

5195. Drawbaugh and Gamble. Fuel composition. March 4.

5234. Barbier and Laurent. Incandescent mantles. March 4.

5244. Westover. *See under* XXIII.

5575. British Thomson-Houston Co. (Gen. Electric Co.). Manufacture of incandescing bodies for electric lamps. March 9.

5576. British Thomson-Houston Co. (General Electric Co.). Apparatus for treating electric conductors, especially filaments, for electric lamps. March 7.

5793. Farnham. Generator for suction gas plant for use with bituminous or other coal. March 11.

6073. Woodruff. Artificial block fuel or briquettes. March 13.

6163. Priest and Fenn. Gas producers. March 14.

6183. Keith and Keith. Apparatus for making air gas.* March 14.

Complete Specifications Accepted.

6088 (1906). British Thomson-Houston Co. (Gen. Electric Co.). Electrodes for arc lamps. March 20.

7479 (1906). Cloudsley and Colman. Apparatus for use in gas manufacture. March 20.

7732 (1906). Simpson. Purification and calcination of peat, lignite, &c. March 20.

7814 (1906). Von Wouwermans and Loewenstein. Gas mixing apparatus. March 13.

15,030 (1906). Boult (Barthel). Burners for liquid fuel. March 13.

16,605 (1906). Bowles and Kammerich. Extraction of gas from liquid hydrocarbon. March 20.

18,879 (1906). Bradley. Gas producer. March 13.

19,780 (1906). De Velna. Utilising close burning coal-dust for making coke. March 20.

24,742 (1906). Tavernier. Manufacture of agglomerated fuels or briquettes. March 13.

25,516 (1906). Cohn. Incandescent mantles. March 13.

26,306 (1906). Zwicky. Carburetting apparatus. March 20.

29,416 (1906). Gebr. Siemens und Co. Electrodes for arc lamps. March 20.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Complete Specifications Accepted.

14,568 (1906). Kuess. Solidification of petroleum or other mineral oils, and transformation of the solidified hydrocarbon into soap. March 13.

19,477 (1906). Breda. Obtaining fatty acids from petroleum residues. March 20.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

5640. Johnson (Badische Anilin und Soda Fabrik). Manufacture of triphenylmethane derivatives and azo dyestuffs therefrom. March 8.

5841. Newton (Bayer und Co.). Manufacture of the monosulphonic acids of *p*-diaminoanthrarufin and of *p*-diaminochrysazin. March 11.

6105. Imray (Soc. Chem. Ind. in Basle). Manufacture of brom-derivatives of indigo. March 13.

6106. Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs. March 13.

6227 and 6228. Badische Anilin und Soda Fabrik. Manufacture of azo colouring matter and pigments or lakes therefrom. [Ger. Appls., May 21 and June 20, 1906.]* March 14.

6336. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable indigo white preparations.* March 15.

Complete Specifications Accepted.

5244 (1906). Ransford (Cassella und Co.). Manufacture of disazo dyestuffs. March 13.

9264 (1906). Newton (Bayer und Co.). Manufacture of azo dyestuffs. March 13.

11,173 (1906). Johnson (Kalle und Co.). Manufacture of thionaphthene derivatives. March 13.

11,479 (1906). Johnson (Kalle und Co.). Manufacture of the leuco compound of thioindigo red. March 20.

14,192 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur and of their leuco compounds. March 20.

17,559 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds containing sulphur. March 20.

21,949 (1906). Bloxam (Durand, Huguenin et Cie.). Manufacture of greenish-blue dyestuffs and their derivatives. March 13.

25,847 (1906). Lake (Chem. Fabr. Griesheim Elektron). Manufacture of black mordant azo dyestuffs. March 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

5498. Rumpl. Producing gloss on cotton.* March 7.

5612. Kämmerer. Treatment of wool with oxidising agents. March 8.

5707. Lord, Lord and Hall. Apparatus for dyeing and treating hanks of yarn. March 9.

5843. Newton (Bayer und Co.). Improving the fastness against water and washing of dyeings on vegetable fibre with substantive dyes. March 11.

5881. Waddell. Apparatus for forming filaments in the manufacture of artificial silk or the like.* March 11.

6152. Schneider. Dyeing wool and woollen fabrics. March 14.

6309. Möller-Holtkamp. Apparatus for sizing and drying cops. March 15.

Complete Specifications Accepted.

11,876 (1906). Pantin, exor. of Abel (A.-G. f. Anilinfabr.). Dyeing hairs, furs, feathers, or the like. Mar. 20.

15,206 (1906). Newton (Bayer und Co.). Dyeing with sulphur dyestuffs. March 20.

20,029 (1906). Stone. Dye tubs or vats. March 13.

21,478 (1906). Weiss. Washing process and composition for dry-cleaning fabrics. March 13.

24,677 (1906). Gaydet. Apparatus for treating with liquids yarns in the form of cops, bobbins, or the like. March 13.

27,727 (1906). Friedrich. Manufacture of artificial threads, films, or the like. March 13.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

6048. Feldmann and Feldmann. Accentuating the granulation of leather by dyeing. March 13.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

5314. Bloxam (Soc. Gen. per la Cinanamide). Manufacture of nitrogen compounds from carbides. March 5.

5657 and 5658. Petersson. *See under* XI.

5889. Raschen, Carey, Tyers, Auden, and United Alkali Co., Ltd. Treatment of sulphurous acid for the production of sulphuric acid or sulphuric anhydride. March 11.

5991. Auchinachie and Wood. Production of carbide of vanadium. March 12.

6405. Salzbergwerk Neustassfurt und Theilnehmer. Manufacture of crystalline hydrate of potash. [Ger. Appl., July 16, 1906.]* March 16.

Complete Specifications Accepted.

5169 (1906). Laureau. Extraction of mineral and organic matter from marine plants. March 13.

5478 (1906). Clemm. Conversion of alkali sulphate and bauxite, &c., into alumina and alkali compounds containing sulphur. March 13.

6529 (1906). Spence, and Spence and Sons, Ltd. Clarification of aluminous solutions. March 20.

10,814 (1906). Graham. Apparatus for condensing and purifying gases, especially in the manufacture of acids. March 13.

20,408 (1906). Vermeesch. Manufacture of ammonia metal compounds. March 13.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

5273. Spitz. Removing enamel or metal coatings from enamelled or metal-coated ware. March 5.

5379. Thomson and Barr. Bleaching kieselguhr and the like. March 6.

5764. Mackenzie (Bolle und Co.). Fusing and refining ceramic substances which are not easily fused.* March 9.

5879. Pilkington. Apparatus for making glass sheets or plates. March 11.

6164. Priest and Fenn. *See under* IX.

Complete Specification Accepted.

18,382 (1906). Weiss. Printing or transferring designs on pottery, earthenware, and similar surfaces. March 13.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

5327. Sefton-Jones (Dada and Fuchs). Treatment of wood with solutions of chromium salts. March 5.

5703. Bamber. Manufacture of Portland and other cements. March 9.

6070. Hales. Substitute for builders' sand. March 13.

6164. Priest and Fenn. Applying gas firing to brick, pottery, and other kilns. March 14.

6396. Stanley. Manufacture of bricks from powdered clay or like material. March 16.

Complete Specifications Accepted.

7443 (1906). Zulkowski. Manufacture of Portland cement. March 20.

19,233 (1906). Kellen. Artificial stone. March 20.

20,901 (1906). Hornell. Compositions for making artificial marble, stone, &c. March 20.

25,043 (1906). Hennings. Manufacture of artificial slate. March 20.

X.—METALLURGY.

Applications.

5273. Spitz. *See under* VIII.

5340. Maunder. Treatment of complex, refractory, and other ores. March 5.

5646. Fitzmaurice. Treatment of ores. March 8.

5655 and 5656. Petersson. *See under* XI.

5727. Cowper-Coles. Production of aluminium. Mar. 9.

5887. Dekker. *See under* XI.

5973. Lake (Soc. Anon. La Carbone). Treatment of metals or alloys by agglomeration. March 12.

6010. Morgan Crucible Co. (Herbert). Separation of the constituents of ores. March 12.

6029. Green. Combined vanning and percussion table. March 13.

6148. Livingstone. Crucible steel furnaces. March 14.

6237. Holman and Holman. Treatment of metalliferous slime and the like. March 14.

6238. Mackenzie (Gerbode). Accelerated annealing of cast iron and cast steel.* March 14.

6337. Raschen, Taylor, and United Alkali Co., Ltd. Recovery of zinc and other metals from liquors. March 15.

Complete Specifications Accepted.

729 (1906). Hughes. Heat treatment of metals. March 20.

11,698 (1906). Swain. Coating iron or steel with tin or like metal. March 13.

13,012 (1906). Masson. Recovery of arsenic and antimony from ores, concentrates, tailings, and slimes. Mar. 13.

20,979 (1906). Butters. Filtering slimes. March 13.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

28,897A (1906). Cowper-Coles. Electrodeposition of iron.* March 6.

5223. Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of electrodes for electrolytic purposes. March 4.

5301. Igevsky. Electric furnace.* March 5.

5345. Allmanna Svenska Elektriska Aktiebolag. Electric furnaces. [Swed. Appl., March 7, 1906.]* March 5.

5574. British Thomson-Houston Co. (General Electric Co.). Insulating material. March 7.

5655. Petersson. Electrically reducing oxide ores and the like.* March 8.

5656. Petersson. Metallurgical reduction and melting processes.* March 8.

5657. Petersson. Charging electric furnaces for producing carbide of lime and carbon.* March 8.

5658. Petersson. Continuously producing carbide from lime and carbon.* March 8.

5887. Dekker. Apparatus for treating minerals by electrolysis.* March 11.

5957. Rodman. Reducing depreciation in lead storage batteries. [U.S. Appl., March 24, 1906.]* March 12.

6193. Grönwall, Lindblad, and Stalhane. Electric transformer furnaces.* March 14.

Complete Specifications Accepted.

9706 (1906). Wainwright and Mann, exors. of Atkins. Electrolytic apparatus. March 20.

23,379 (1906). Lindblad and Stalhane. Electric transformer furnaces. March 13.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

5221. Morgenstierne. Cleansing composition. March 4.

5277. Holt. *See under* XVIII*A*.

Complete Specifications Accepted.

7901 (1906). Böhm. Production of odourless fish oil. March 20.

14,068 (1906). Kuess. *See under* III.

21,072 (1906). Pitchford and Knott. Liquid soap or detergent. March 13.

XIII.—PIGMENTS, PAINTS: RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—Pigments, Paints.

Applications.

6227 and 6228. Badische Anilin und Soda Fabrik. *See under* IV.

Complete Specification Accepted.

5015 (1906). Heide (Union Lead and Oil Co.). Apparatus for making white lead or similar products. March 13.

(*B.*)—RESINS, VARNISHES.

APPLICATIONS.

5238. Austen and Maywald. Paint or varnish remover. March 4.

5365. Peck. Turpentine substitute. March 6.

6301. Dvorkovitz. Manufacture of hydrocarbons of terpene character particularly applicable as a substitute for turpentine. March 15.

6423. Bliss, and The Thames Varnish Co., Ltd. Manufacture of varnishes. March 16.

(*C.*)—INDIA-RUBBER.

APPLICATION

6065. Hutchinson. Composition containing india-rubber and other substances. March 13.

COMPLETE SPECIFICATIONS ACCEPTED.

9808 (1906). Dessau. Elastic substance from the gums of certain sapotaceæ. March 13.

21,493 (1906). Claessen. Manufacture of masses of the nature of vulcanite or india-rubber. March 20.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

5438. Stewart. Tanning, and the manufacture of tanning extracts. March 6.

6048. Feldmann and Feldmann. *See under* VI.

6109. Kuzel. *See under* XVIII.*A.*

6110. Kuzel. Production of bodies and objects with the use of colloids. [Ger. Appl., April 30, 1906.]* March 13.

6216. Guilleteau. Manufacture of artificial leather.* March 14.

COMPLETE SPECIFICATION ACCEPTED.

5169 (1906). Laureau. *See under* VII.

XV.—MANURES, &c.

COMPLETE SPECIFICATION ACCEPTED.

11,215 (1906). Allibon. Apparatus for making artificial manures. March 13.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

12,950 (1906). Wagner. Manufacture of anhydrous grape sugar from corn and analogous farinaceous material. March 20.

XVII.—BREWING WINES, SPIRITS, &c.

APPLICATION.

5224. Rombaut and Rombaut. Beer fermenting and apparatus therefor.* March 4.

COMPLETE SPECIFICATIONS ACCEPTED.

10,598 (1906). Lemaire. Apparatus for collecting yeast from fermenting beer. March 20.

24,229 (1906). Carroll. Distilling and treating spirits. March 20.

28,261 (1906). Nathan. Heating brewers' wort. March 13.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS

APPLICATIONS.

5277. Holt. Apparatus for extracting fats, glutinous matter, &c., from condemned meat and other substances. March 5

6080. Marks (Schwartz). Food substitute.* March 13.

6109. Kuzel. Peptisation of colloidal elements. [Ger. Appl., April 27, 1906.]* March 13.

6303. Nerzagaray. Coffee extracts. March 15.

COMPLETE SPECIFICATIONS ACCEPTED.

10,007 (1906). Ahrens. Preservation of raw meat. March 13.

22,340 (1906). Pabst. Preservation of albumen and albuminous bodies. March 20.

25,211 (1906). Rupeau. Manufacture of extracts of coffee and tea. March 20.

(*B.*)—SANITATION; WATER PURIFICATION.

APPLICATIONS.

6155. Hamblin and Wild. Deodorisation of sewage. March 14.

6220. Wilson. Purification of water. March 14.

COMPLETE SPECIFICATION ACCEPTED.

14,464 (1906). Candy. Purification of water. Mar. 13.

(*C.*)—DISINFECTANTS.

APPLICATION.

6307. Gullen and Brazendale. Deodorising or disinfecting compounds. March 15.

COMPLETE SPECIFICATION ACCEPTED.

26,276 (1906). Nilsson. Disinfection of articles and destruction of insects. March 20.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

5587. Brook. Manufacture of designing paper. Mar. 8.

5891. Marino. Rendering celluloid non-inflammable.* March 11.

COMPLETE SPECIFICATIONS ACCEPTED.

6085 (1906). White. Paper. March 20.

26,944 (1906). Pering. Machine for making washable, fat-proof paper in the cold way. March 13.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

8356A (1906). Dubosc. Process of oxidising camphene. [Fr. Appl., April 6, 1905.]* March 15.

5429. Goldsmith, and The British Xylonite Co., Ltd. Treatment of camphene. March 6.

5542. Vilmar. Production of arbutene.* March 7.

5842. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. March 11.

6301. Dvorkovitz. *See under* XIII*B.*

COMPLETE SPECIFICATION ACCEPTED.

13,150 (1906). Morgan. Manufacture of tobacco extract. March 13.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

5692. Woodiwiss. Production of pictures in colour by photography. March 9.

5784. Baker, and The Gem Dry Plate Co., Ltd. Photographic plates and papers. March 11.

6098. Szczepanik. Production of photographs in natural colours.* March 13.

COMPLETE SPECIFICATION ACCEPTED.

21,584 (1906). Neue Photographische Ges. Converting silver pictures into pictures in higher oxides of manganese, and toning silver pictures. March 20.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

5244. Westover. Apparatus for analysis of gases. [U.S. Appl., April 4, 1906.]* March 4.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. Full particulars will appear later.

London Section.

Meeting held at Burlington House, Monday, Nov. 3, 1906.

MR. R. J. FRISWELL IN THE CHAIR.

THE APPLICATION OF CHEMICAL ANALYSIS TO THE EXAMINATION OF COMMERCIAL SPIRITS.[*]

BY E. A. MANN AND C. E. STACEY.

Early in 1905 the Department concerned with the inspection of liquors in this State took up the question of the quality of the liquors vended to the public through the ordinary channels. Articles in the daily Press averred from time to time that there was much inferior spirit being imported into and sold in Western Australia derived from cheap and undesirable sources, and that the matter called for earnest attention. In consequence, a number of samples were taken to ascertain the general character of the spirits consumed, and the accompanying figures disclose the results obtained. For obvious reasons the names of the various brands are withheld, but all samples were taken personally by the Inspector of Liquors from bonded warehouses or hotels. They are, therefore, samples of the spirits as actually sold to the public. With the exception of one or two published by the Lancet Commission on Brandy and by Hewitt (this J., Jan. 31, 1902), most of the analyses so far recorded are from stocks in distillery bonds, &c. (see especially the figures given by Vasey and Schidrowitz in publications referred to below). In these latter cases, of course, the origin of the spirit was known, and these analyses, therefore, give valuable data on which to found standards, but our own analyses are all of samples of unknown origin, and the task which fell to us was to decide on the analysis alone as to the nature of the spirit. How far we have been able to do this will appear later. All the spirits, with the exception of a few samples of brandy, were imported from outside Australia, and in arriving at our conclusions we have had to depend upon the authenticated data above referred to for our standards, as no local distilleries exist from which we could obtain data first hand.

The following are the principal papers, &c., consulted by us in our work, and they are here given at length, so that subsequently brief references will suffice :—

1. The Lancet Special Analytical Commission on Brandy. "Lancet," Nov. 29, 1902. Supplement.
2. "The Chemistry of Whisky."—I. By P. Schidrowitz. This J., June 30, 1902.
3. "The Chemistry of Whisky."—II. This J., June 15, 1905.
4. "On the Examination of Spirituous Liquids for Secondary Constituents." By A. H. Allen and W. Chattaway. "Analyst," XVI. May, 1891.
5. "Whisky." "British Medical Journal," Dec. 26, 1903.
6. "The Determination of Higher Alcohols in Spirits"—I. By P. Schidrowitz and F. Kaye. "Analyst," XXX., p. 190.
7. "The Analysis of Potable Spirits." By S. A. Vasey. (Balliere, Tyndall and Cox, 1903.)
8. "Standards of Purity for Fermented and Distilled Liquors." By P. Schidrowitz. This J., Feb. 28, 1905.
9. "The Retarding Influence of Aldehydes on the Maturation of Spirits." By J. T. Hewitt. This J., Jan. 31, 1902.
10. "Concerning Injurious Constituents in Whisky and their Relation to Flavour." By Sir William Lauder Brunton and Prof. Tunnicliffe. "Lancet," Dec. 8, 1900.

The lines along which the analyses were made, and the methods employed were as follows :—

Spirit strength.—This was taken from the specific gravity of the spirit, converted by Hehner's tables.

Total acidity.—25 c.c. of the sample were taken, diluted (to prevent interference by colour with end reaction), and titrated with $N/10$ barium hydroxide, using phenolphthalein as an indicator.

Volatile acids.—25 c.c. were distilled almost to dryness,[*] 25 c.c. of water were then added, and the mixture again distilled as far as possible. In the case of whiskies, and, indeed, in nearly all cases, this was sufficient to obtain all the acid, but with the rums, and in the case of a few brandies, another addition of 25 c.c. of water was found necessary. The distillate was titrated with $N/10$ barium hydroxide, and the result calculated as acetic acid.

Fixed acids.—The difference between the amount of baryta required for the volatile acids and that previously used in the titration of total acidity was calculated into tartaric acid and returned as fixed acids. This method was found to be much preferable to estimating the fixed acids in the residue after the removal of volatile acid as recommended by Vasey (7). These residues are frequently too highly coloured to enable a clear end reaction to be discerned. Checks made by the two methods gave concordant results.

Aldehydes, furfural, and ethers were estimated in the manner described by Vasey (7); 200 c.c. of the spirit were distilled till all but about 5 c.c. had passed over, the distillate was made up to 200 c.c., and portions of this used for the different estimations. Repeated distillations of the spirit, as recommended by Hewitt, to get over the last traces of furfural, were avoided as unnecessary, and apt rather to produce furfural.

Aldehydes.—5 c.c. of the spirit distilled as above was measured out by a pipette into a small, narrow cylinder of 20 c.c. capacity, graduated to 1/5 c.c., made up to 16 c.c. by aldehyde-free proof spirit, and 4 c.c. of Guyon and Schiff's reagent added. In a similar cylinder 5 c.c. of 0·01 per cent. aldehyde solution was simultaneously treated in the same way. After standing 15 minutes the solutions were poured into small colorimeter glasses (made from test tubes by flattening the bottom[†]), and their tints compared. Portions of the more strongly coloured solution were poured back into the corresponding cylinder until the tints matched. The comparative strength of the solutions was then ascertained from their respective volumes. Our experience as regards the colour produced by the fuchsin solution corresponds with that of Vasey—we have not in a single instance encountered the opalescence or turbidity described by Schidrowitz (2). Our principal difficulty in connection with this test was in obtaining aldehyde-free alcohol for the control solution and for dilution. Using a good quality of absolute alcohol, we found that the furfural was readily removed, but for the complete removal of the aldehydes the use of aniline phosphate and Hewitt's reagent[‡] alone was quite insufficient. By very careful fractionation of the spirit we got a sample in which very little colour was produced by the fuchsin reagent, and on redistilling this improved spirit with Hewitt's reagent (about 10 grms. per litre), we got an alcohol practically free from aldehyde, a very faint colour being produced by the reagent only after standing for one hour. This difficulty is greater than appears to be admitted by Vasey, and it is rather interesting in this connection to note that in certain investigations of spirits made under the direction of the American Association of Official Agricultural Chemists in 1903[§], one chemist was unable to complete the prescribed work "owing to the impossibility of obtaining aldehyde-free spirit."

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[*] Taken as read.

[*] For this distillation we used pear-shaped flasks made by cutting a portion of the neck from ordinary, old-fashioned gold "parting flasks." These were found to be admirably adapted to the purpose. In this, as in all other distillations, the corks were protected by tinfoil.

[†] None of the special forms of colorimeter was available, and we found these answered admirably.

[‡] Sodium phenylhydrazinesulphonate.

[§] See Report of Twentieth Convention of A.O.A.C., 1903.

We were not successful in preparing our standard aldehyde solutions from aldehyde ammonia as recommended by Vasey. Two specimens of this salt prepared in the laboratory (the commercial article was unobtainable) both gave solutions which were very insensitive to the fuchsin reagent. We were finally compelled to use commercial aldehyde which was apparently pure (Kahlbaum), a 0·01 per cent. solution being prepared by weighing. It is reasonable to suppose that on this account our results as regards estimation of aldehydes may be somewhat in excess[of the truth, but we do not think the error can be anything but slight.

The aniline acetate was prepared as prescribed by Hewitt. Equal volumes of aniline (freshly distilled), glacial acetic acid, and water were boiled for three minutes to destroy furfural. The standard furfural solution was made by weighing out pure furfural (Kahlbaum) in a small tared glass bulb, drawn to a point and sealed. A fairly strong stock solution in alcohol was first prepared, and from this the standards were made up by dilution. The fuchsin solution was made as directed by Vasey (7, p. 29).

Furfural.—We used the colorimeter estimation by means of aniline acetate as recommended by Hewitt (9), but we used two standard solutions, containing respectively 0·001 per cent. and 0·0005 per cent. of furfural. These were distilled, and in every way treated in a precisely similar manner to the test spirit. Five c.c. of the spirit under test was introduced into a cylinder as used in estimating aldehydes, made up to 19 c.c., and 1 c.c. of aniline acetate solution added and allowed to stand 15 minutes, and then compared with the standard. If the standard differ too much in strength from the test solution, a yellow shade is observed in the weaker solution, and the tints cannot be accurately compared; but by using standards of different strengths so as to minimise the difference this trouble is avoided.

Compound ethers.—100 c.c. of the spirit distilled as already described were placed in a flask, and any free acid carefully neutralised with *N*/10 barium hydroxide, using phenolphthalein as an indicator. 25 c.c. of a *N*/10 aqueous solution of sodium hydroxide were then added, and the contents of the flask boiled under a reflux condenser for one hour, cooled, and titrated with barium hydroxide. Of course, if the pink colour in the flask disappeared, an additional 25 c.c. *N*/10 sodium hydroxide solution was added. Each c.c. used in the saponification of the ethers corresponds to 0·0088 grms. of ethyl acetate, and the ethers were expressed as such.

Higher alcohols.—After a great many trials with all kinds of spirits extending over several years, the Röse-Hertzfeld method of estimating higher alcohols has been abandoned in this laboratory, and there seems to be no question that, as stated by Schidrowitz and Kaye, (6), the best existing method of estimating these alcohols is that of Marquardt, as modified by Allen and Chattaway, (4). The following are the details of the method as employed by us during the first part of our work (as will be seen, this was modified by us at a later stage):—Sufficient of the spirit for two estimations,* viz., 210 c.c., was taken, and 40 c.c. of *N*/10 sodium hydroxide added to neutralise any acid, and for the saponification of the ethers; for the latter purpose the flask was connected to a reflux condenser and boiled for an hour. We found 40 c.c. of sodium hydroxide sufficient for all whiskies and for most of the other spirits, but in the case of some rums and a few brandies a larger quantity was required. This can, of course, be readily calculated if the ethers and acidity be estimated before the higher alcohols and a strong solution of sodium hydroxide taken. After cooling, the contents of the flask were distilled off, and the distillate made up to 250 c.c†.

Two portions of 119 c.c. each (equivalent to 100 c.c. of original spirit) were then taken out, and a saturated solution of common salt acidified with a few drops of sulphuric acid was added till the specific gravity of the liquid was about 1·1; usually about 200 c.c. of the salt solution was required. The liquid so obtained was shaken out with carbon tetrachloride in four successive washings of 40, 30, 20, and 10 c.c. respectively; after separation, the tetrachloride was washed with 50 c.c. of the salt solution, and finally with 50 c.c. of a saturated solution of sodium sulphate. The tetrachloride was not filtered as in the original method, as this was thought unnecessary.

The tetrachloride was then treated with an oxidising mixture of 5 grms. of potassium bichromate, 15 c.c. of sulphuric acid, and 30 c.c. of water.* The oxidation was conducted in pear-shaped flasks made from large parting flasks, which were connected with reflux condensers, and the contents kept briskly boiling for eight hours. In spite of the use of tin foil, we occasionally had troubles through leakage and absorption by the corks, and ground glass connections are very desirable for this work—these, however, were not available. After oxidation, the reflux condensers were washed down with 30 c.c. of water, and the contents of each flask were distilled off down to 20 c.c.; 60 c.c. of water was then added, and distillation carried as low as possible. The distillate was then titrated with barium hydroxide solution, using two indicators, methyl orange being employed until the mineral acids present were neutralised, when phenolphthalein was added, and the organic acids estimated. The results were stated in terms of amyl alcohol, each c.c. of barium hydroxide solution used being equivalent to 0·0088 grms. of amyl alcohol.

The carbon tetrachloride (Merck) used in this estimation was carefully purified before use in the first instance, and after recovery for succeeding estimations by preliminary treatment with oxidising mixture, &c., in exactly the manner prescribed by Allen and Chattaway.

The oxidation in this process is long and tedious, and can be considerably shortened by using closed bottles in a water bath as suggested by Allen and Chattaway; the action can then be completed in four hours, as shown by some comparative tests carried out by us. For the reasons given below, however, we adhered throughout to the use of the reflux condensers. We found in one case the estimations of the molecular weight of the acids formed by oxidation very useful in preventing an erroneous return in a doubtful case, but it was not employed in all cases.

At a certain stage in our work, the results from the above process become obviously unreliable. Figures were obtained showing large proportions of higher alcohols quite inconsistent with the rest of the analysis. This led to an inquiry into the process itself, which extended so far that we have thought it best to embody the results in a separate paper.

As a result of this inquiry, we decided to modify the process on the lines indicated in that paper, and a large number of re-estimations of the higher alcohols were accordingly made. These redeterminations of course have replaced the first estimations in the attached table.

Extract.—For the estimation of the total extractive matter, 20 c.c. of the spirit was evaporated to dryness over a water bath, and the residues dried and weighed.

Colouring matters.—Though not, perhaps, of any great importance, we examined the spirits as to the nature of the colouring they contained by the ether test and fuller's earth test, as described by A. E. Leach.† The latter test, however, proved unreliable, as we afterwards found that by it the colour was completely removed from a sample of spirit known to be free from caramel, and coloured only by storage in a cask containing oak shavings. The ether test we found satisfactory. This was carried out as follows:—25 c.c. of the spirit was shaken with about the same volume of sulphuric ether and allowed to separate, and the extraction of colour by the ether observed. The presence of tannin could be readily detected by addition of a few drops of ferric chloride to the ethereal solution.

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* A duplicate estimation of the higher alcohols was made in every case.

† The elaborate precautions suggested by Allen and Chattaway for getting over the last traces of the higher alcohols are considered by Vasey to be unnecessary. In this opinion we concur. By direct experiment we found that by simple distillation we obtained slightly higher results than with Allen and Chattaway's method.

* With only 10 c.c., as recommended, there is not sufficient oxidising mixture to cover the surface of the tetrachloride; even with the elongated, pear-shaped flasks of small cross-section which we employed a considerable portion of the surface of the tetrachloride was left exposed. This seems undesirable.

† "Food Inspection and Analysis." (Wiley and Sons), p. 604.

We had purposely adhered to the methods laid down by other workers, even though, in some cases, it seemed as if they could be modified with at least considerable saving of time. As already stated, it was decided to collect results which could be judged by standards obtained by other workers, and it was considered advisable to avoid any divergence of an important character from their methods unless absolutely demanded by accuracy. The samples were classed as "genuine" or "blended," purely from the result of the analysis, but perhaps these terms call for some definition in the uncertainty which possesses many minds as to their meaning—especially in the case of whisky. By "genuine whisky" we mean a whisky prepared entirely from malt and distilled in a pot-still. By "blended whisky" we mean a whisky either wholly or partly composed of patent spirit from whatever source that spirit may be derived; we have not differentiated in any way between patent grain spirit and, say, maize or potato spirit, because we consider it is impossible to draw any such distinction. "Genuine brandy" and "genuine rum" do not require the same definition, as their origin in pure grape spirit and molasses spirit is sufficiently admitted. It is only in the case of whisky that its origin has been questioned or any slur cast upon its ancestry. Our results can only be considered as an attempt to draw definite conclusions from analytical data. If any errors are found, they will generally be found in favour of the spirit, thus, if we have had any doubt as to the class to which a spirit belonged, we have always given it the benefit of the doubt, and labelled it as "genuine." It is a comparatively easy thing to classify a whisky which is composed of pure malt spirit, or one made almost entirely from patent spirit, but some of the intermediate "blends," containing a large proportion of malt spirit, are not so readily and definitely classified. Some of these were, therefore, undoubtedly classed amongst the "genuine" spirits. Altogether 109 samples (representing 105 distinct brands) of bottled spirits were examined.

Of the 84 whiskies, 21 were classed as genuine and 63 as blended, or 25 per cent. and 75 per cent., while nearly 50 per cent. of the brandies and 30 per cent. of the rums were classed as not genuine. These figures are very interesting when compared with the facts and figures stated in reference No. 5. The following tables give typical examples of the analytical figures obtained from samples which were classed as "doubtful":—

Analysis of whiskies.

	Spirit strength. U.P.	Volatile acids.	Alde-hydes.	Furfural.	Ethers.	Higher alcohols. Mean of two estimations.	Total secondary products.	Colouring.		Ext. grms. per litre.	Fixed acids.
								Caramel.	Tannin.		
1.	15·51	51·51	14·36	4·15	57·46	102·00	231·06	Strong	Present	1·00	25·58
2.	3·96	35·74	13·67	2·00	108·97	159·19	319·57	do.	Strong	1·90	32·76
3.	15·51	7·17	10·33	1·35	37·32	54·83	111·00	do.	Trace	2·35	29·78
4.	14·85	9·86	6·13	1·34	36·26	83·12	136·71	do.	Absent	0·70	9·25
5.	21·39	10·68	7·79	0·93	30·83	117·66	167·89	do.	do.	1·24	13·31
6.	17·03	30·31	10·54	1·63	38·01	110·41	190·90	do.	Present	6·88	31·70
7.	19·04	36·26	33·16	1·29	51·33	108·63	230·57	do.	Slight	1·52	19·40
8.	14·85	22·21	10·38	1·29	39·77	95·92	169·57	do.	Present	0·60	21·55
9.	14·94	74·82	7·18	1·23	38·01	111·98	173·22	do.	do.	0·77	12·35
10.	16·93	38·72	10·51	2·45	59·39	135·43	246·50	do.	do.	1·46	25·30
11.	12·71	15·17	8·41	0·95	40·64	131·47	196·64	do.	Slight	0·71	18·92
12.	17·41	5·08	7·41	Nil	18·57	96·97	128·03	do.	Absent	2·79	3·17
13.	16·27	45·20	15·76	2·31	42·22	187·42	292·91	do.	Present	4·21	25·15
14.	15·42	37·31	25·92	1·65	64·82	162·06	291·76	do.	do.	1·86	59·04
15.	16·46	17·61	21·02	2·33	49·75	189·04	279·75	do.	do.	1·55	46·95
16.	21·50	13·31	5·43	0·72	50·80	145·17	215·43	do.	do.	5·06	9·98
17.	19·36	52·03	10·86	0·87	49·58	178·70	292·04	do.	do.	7·08	65·70

Remarks.

1. High proportion of malt spirit.
2. High proportion of malt spirit.
3. High proportion of patent spirit.
4. Low proportion of malt spirit.
5. Very small proportion of malt spirit.
6. Large amount of added sweetening matter.
10. High proportion of malt spirit.
12. Practically all patent spirit—high artificial extract.
13. High proportion of malt spirit—large artificial extract.
15. Good proportion of malt spirit.
16. Local bottling with second-hand corks—high artificial extract—large proportion of patent spirit.
17. Very high extractives. Supposed to be rye or maize spirit.

Analysis of brandies and rums.

	Spirit strength. U.P.	Volatile acids.	Alde-hydes.	Furfural.	Ethers.	Higher alcohols. Mean of two estimations.	Total secondary products.	Colouring.		Ext. grms. per litre.	Fixed acids.
								Caramel.	Tannin.		
						Brandies.					
1.	17·41	43·64	10·60	0·79	80·24	84·09	219·36	Strong	Present	9·10	70·08
2.	15·98	45·02	11·46	0·68	62·37	121·76	241·29	do.	do.	12·25	50·03
3.	18·36	43·97	10·70	0·59	47·30	100·04	202·60	do.	do.	5·25	45·03
4.	19·25	38·89	15·19	1·08	72·53	97·90	225·59	do.	do.	7·65	74·81
5.	18·17	33·29	14·98	1·07	64·05	101·26	212·65	do.	do.	10·20	60·97
6.	17·41	10·18	3·17	0·21	22·39	56·32	92·27	do.	Absent	0·70	12·72
7.	17·88	40·96	13·84	1·28	71·13	123·86	251·07	do.	Very strong	7·43	70·25
						Rums.					
8.	17·31	50·80	13·67	2·10	76·39	138·84	281·80	do.	Slight	4·50	95·30
9.	10·67	117·38	26·98	4·31	990·23	117·38	1256·28	do.	Present	3·65	34·51

Remarks.

1. Doubtful.
2. Apparently artificially flavoured.
3. Probably grain spirit.
4. Rum flavouring.
5. Artificial flavour.
6. Patent spirit derived from grains.
8. Characteristic aroma lacking—spirit artificially flavoured.
9. Fictitious—apparently entirely a concocted spirit.

Manchester Section.

Meeting held at Manchester on Friday, March 8, 1907.

DR. G. H. BAILEY IN THE CHAIR.

THE ELECTRO-THERMIC COMBUSTION OF ATMOSPHERIC NITROGEN.

BY F. HOWLES, M.SC.

After the researches of Sir William Crookes (1892), and Lord Rayleigh (1897), some investigations were made (1898-9), by Mr. McDougall and myself, in order to determine the most favourable conditions for the oxidation of nitrogen in the flame, exhibited by Sir William Crookes before the Royal Society. These researches led to the following conclusions:—

1. The form of arc chamber used exerted a great effect on the yield of nitric acid.

2. The rate at which the air was supplied to the flame also exerted an effect—too great a supply rendered the arc unsteady, thereby diminishing the yield of nitric acid, and increasing the difficulty of absorption. A deficient supply, on the other hand, also showed a diminished yield of nitric oxide, owing to the produced oxide remaining for too long a period in the neighbourhood of the arc, and so undergoing dissociation.

3. With an arc of constant voltage and the electrodes remaining at a constant distance apart (20 mm.), an increase of the current caused a drop in the yield of nitric oxide, whilst a decrease of current, beyond a certain amount (0·15 ampère) caused the arc to become unsteady and liable to extinction.

4. The yield of nitric oxide under the most favourable condition represented 51·5 per cent. of that theoretically obtainable.

5. When air, most intensely heated, was passed through the apparatus, the result was a decrease in the yield of nitric oxide compared to that obtained when air at ordinary temperatures was used, this phenomenon being attributable to the fact that the increased temperature of the air prevented the sufficiently rapid cooling of the gases after leaving the arc, thus facilitating dissociation of the nitric oxide.

6. The yield of nitric oxide from a low-tension arc playing between carbon electrodes was a mere fraction of that obtained in a high tension arc.

7. The loss of metal from the electrodes was exceedingly small.

8. The substitution of electrodes of oxides of the earth metals for the usual metallic electrodes did not yield satisfactory results in our hands, as those we used were too long, and not heated to a sufficiently high temperature.

These results have been amply confirmed by subsequent investigators—No. 3 more particularly by Muthmann and Hofer(1), who practically repeated the experiments indicated, apparently unaware that the ground had been previously covered.

With regard to the composition of the gases leaving the arc. In addition to nitric oxide, the excess oxygen and nitrogen appear to be the only gases present, since nitrous oxide has not been observed in the exit gases, and if produced, would not subsequently oxidise.

Nitrogen peroxide is formed only at temperatures below 600° C., and nitrogen pentoxide is non-existent at the temperature of any part of the arc. Thus of all the known oxides of nitrogen only nitric oxide remains.

It is now generally conceded that the oxidation of nitrogen in the arc is not due to any specific chemical or electrical action, but is a purely thermal phenomenon. In support of this view, we have the work of Bunsen and Kolbe(2), who exploded mixtures of electrolytic gas and air in varying proportions, and observed nitric oxide in the products of combustion. They further observed that as the percentage of electrolytic gas was increased—and consequently the temperature of explosion—the volume of nitric oxide in the residual gases also increased.

The experiments of Nernst have a very important bearing on this question. By passing air through a platinum or iridium tube, heated by means of an alternating current, the formation of nitric oxide to the extent of 0·64 per cent. by volume at 1760° C., and 0·97 per cent. by volume at 1922°, was observed. From the above experiments, we see also that the volume concentration of the nitric oxide is a function of the temperature.

In the case of an endothermic reaction, such as the combustion of nitrogen, the value K in Guldberg and Waage's formula $K = \frac{P.NO^2}{P.O_2.PN_2}$ (where P.NO, $P.O_2$ and $P.N_2$ represent the partial pressures of nitric oxide, oxygen, and nitrogen, respectively, K being a constant) becomes higher with increasing temperature, and falls to zero as the temperature decreases. Thus for every temperature there is a definite volume concentration of nitric oxide. These values have been determined by Nernst(3). He led air through his electrically heated platinum-iridium furnace, maintained at a definite temperature. After equilibrium had been attained, the gases were rapidly cooled by withdrawing them from the furnace by means of a platinum capillary, in order to prevent the reverse action taking place. They were then analysed in order to determine the nitric oxide content. These results were checked by the values obtained in the electrolytic gas explosions, and finally compared with those obtained by interpolating from the values calculated. The following table offers a comparison of the data thus obtained, in which the percentages of nitric oxide are given under *x*.

Calculated.		Values of *x*.		
T.	*x*.	T.	Observed.	Interpolated
° C.		° C.		
1500	0·10	1811	0·37	0·35
1800	0·34	1877	0·42	0·43
2000	0·61	2023	0·52	0·64
2500	1·79	2033	0·64	0·67
3000	3·57	2195	0·97	0·98
—	—	2580	2·05	2·02
—	—	2675	2·23	2·35

The velocity of reaction is also dependent, in a very high degree, upon the temperature: at 1000° C. it is immeasurably small, requiring 81·68 years for the attainment of ½ equilibrium. At 2100° it is exceedingly great, only 5·06 seconds being necessary for the ½ equilibrium point to be reached.

Thus, the first consideration in the technical production of nitric oxide from an economic point of view is the attainment of an arc of the highest possible temperature, whereby both high nitric oxide concentration and high reaction velocity ensue.

The ordinary high tension arc in air consists of three superimposed zones, all mounting upwards, and of different size and temperature. The first, or lower zone, carries the major portion of the current, and consequently possesses the highest temperature, which is in the neighbourhood of 4200° C. It is probable that in this zone alone the oxidation of nitrogen takes place(4).

The second, or middle zone, is greenish blue in colour, with a temperature of at least 1400° (5). Brode(6) has shown that in pure oxygen, a flame is obtained by the high-tension discharge, practically identical with zones 1 and 2 of the air flame, and that ozone is produced in this flame, but the velocity of dissociation of ozone is exceedingly great—in fact several million times as great as that of nitric oxide at 1000°(7), and its formation is never observed unless special precautions are taken to very quickly cool the gases leaving the flame.

Such being the case it is highly probable that, in the middle zone of the flame in air, a complete dissociation of ozone takes place, and also a partial dissociation of nitric oxide, and that zone 2 is caused by these reactions.

The third, or highest, zone forms the greatest bulk of the flame. It is of a pale yellowish brown colour and possesses a temperature as measured by Muthmann and Hofer of 900°—1000°. It cannot, however, as stated by them, constitute a zone of oxidation of nitric oxide to nitrogen peroxide, since the latter body dissociates completely into oxygen and the lower oxide below a temperature of 600°. It is more probable that a further destruction of nitric oxide takes place in this zone. In the electric flame we thus have a system of constantly decreasing temperature, which is very unfortunate for our purpose. For as we have seen above, the nitric oxide is probably all produced in the first zone. Here, also, would obtain the greatest concentration of the gas. Now the nitric oxide in the mixed gases in leaving zone 1 and passing through zones 2 and 3 would suffer a partial dissociation, since the velocity of reaction at the temperatures represented by these zones is quite appreciable—I am of the opinion that Muthmann and Hofer's determination of the temperature of zone 3 is too low.

We thus come to the second condition that must be fulfilled for an economic production of nitric oxide, *i.e.*, the nitric oxide, containing gases, must be removed from the sphere of influence of the arc as quickly as possible after the reaction has taken place, in order to prevent dissociation in the cooler parts of the arc of the nitric oxide produced in the hottest part. That is to say, one must endeavour to produce such a rapid fall of temperature that the gases retain that nitric oxide concentration which they possessed at the highest temperature to which they were subjected. Of course, in practice this is impossible, but we can attain to a near approximation. I may cite an example from the work of Mr. McDougall and myself, where, in one experiment, we obtained a concentration of 7·5 per cent. of nitric oxide in the gases leaving the arc chamber. Assuming 4200° as the highest flame temperature, the maximum concentration for which would be 10 per cent. of nitric oxide, there is thus a loss in cooling of 2·5 volumes, or 25 per cent.

Muthmann and Hofer(8) obtained a maximum concentration of 6·7 per cent. of nitric oxide, and Brode(9), by withdrawing the gases from between the electrodes by means of a water-cooled quartz tube, obtained a concentration of 8·1 per cent. of nitric oxide, and in order to show the gradual dissociation of this gas as it ascended to zone 3 of the flame, he withdrew the gases from this part by means of a water-cooled platinum capillary, and obtained a nitric oxide concentration of 6·7 volume per cent., whilst in the gases immediately surrounding the flame, a volume concentration of only 4·6 per cent. was observed. Thus, in zone 3, one-third of the nitric oxide leaving zone 2 was decomposed.

We are thus confronted with a third consideration in the oxidation of nitrogen for technical purposes, *i.e.*, one must endeavour to reduce, by some means, the relative volumes of zones 2 and 3 of the flame, in which dissociation of nitric oxide takes place, and at the same time to increase the capacity of the first zone, in which nitric oxide is produced.

So far the results predicted by theory have been well confirmed by the values obtained in practice, and confirm the conclusions Mr. McDougall and myself arrived at from our experiments, a *résumé* of which is given at the beginning of this paper.

A fourth important consideration in the technical production of nitric oxide is the concentration of large amounts of energy in a unit of plant. With the ordinary high tension flame it is not possible, or at least not advisable, to use currents of more than 0·1 to 0·2 ampère; for as the researches of Mr. McDougall and myself have shown, a diminished yield of nitric oxide results. But as the yield of oxide is a function of the energy consumed, since the reaction, $N_2 + O_2 = 2NO$, requires an expenditure of 43,200 cals., a plant constructed for the utilisation of a large number of low current arcs would entail the erection of an enormous number of units, if any large quantity of acid had to be produced. The upkeep and labour charges on such a plant would necessarily be high, and to this fact is attributable the failure of the earlier processes.

Technical processes.—I now propose to briefly review some of the more important processes that have been suggested, or are actually in operation, for the production of synthetic nitrates.

The process proposed by Mr. McDougall, which yielded about 300 kilos. of nitric acid per kilowatt year, is now only of historic interest, as is also that of Bradley and Lovejoy, since both processes suffer from the inherent defects mentioned above.

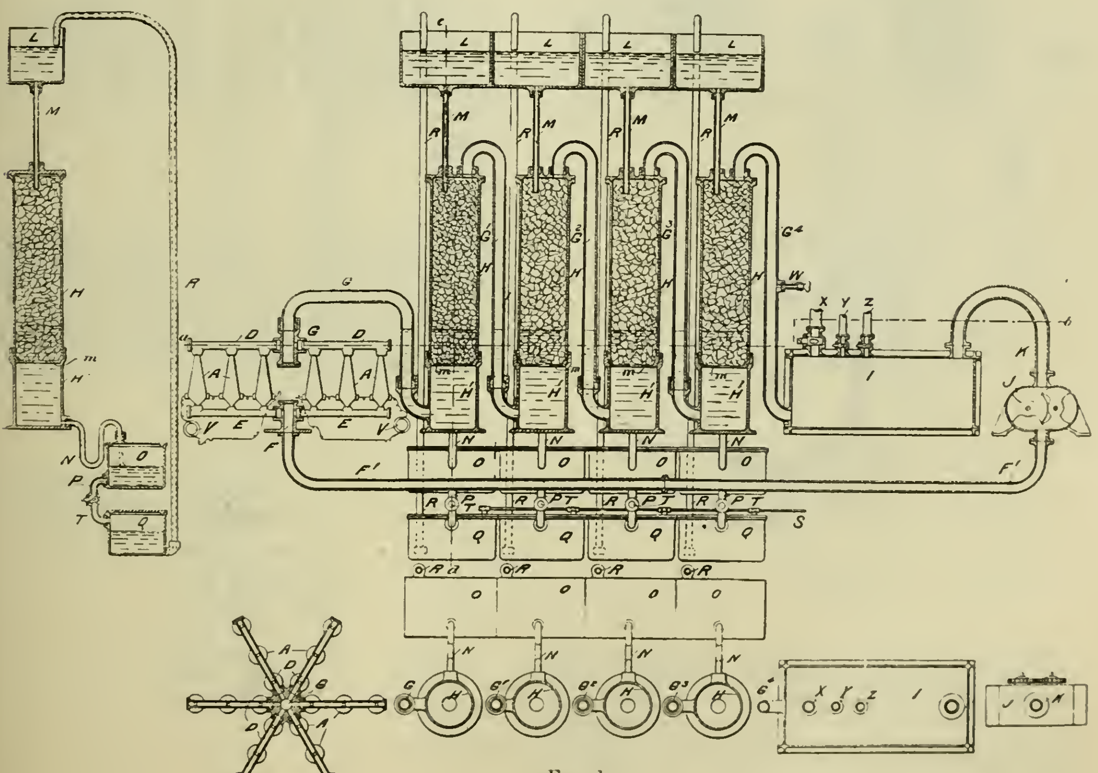
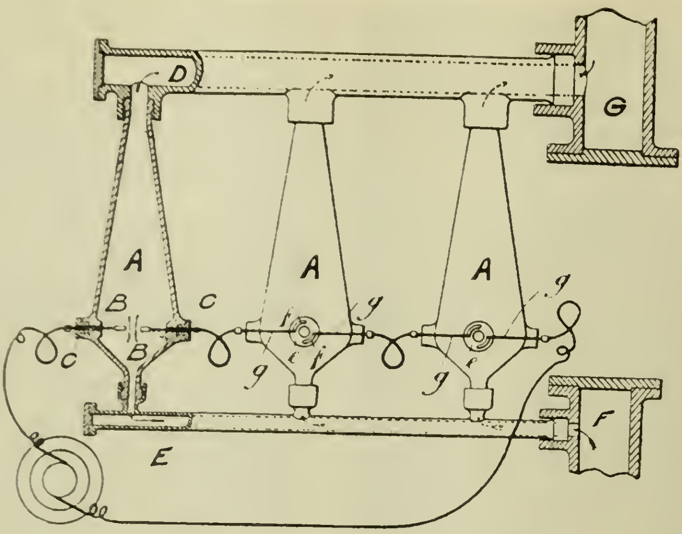


Fig. 1.



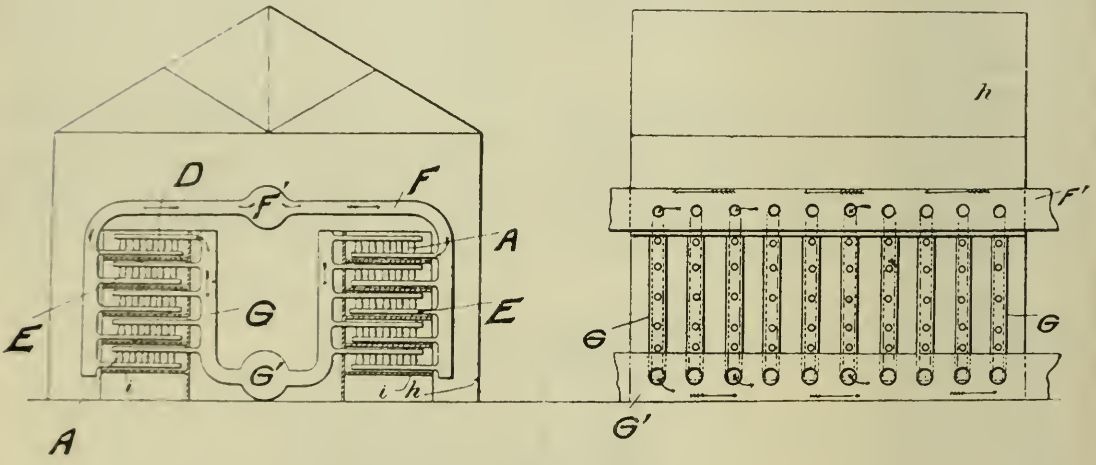


Fig. 2

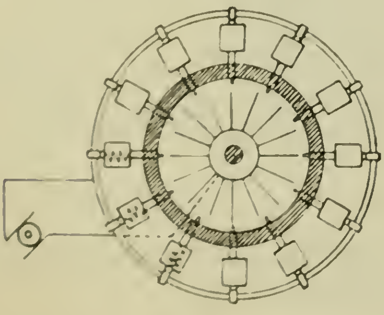


Fig. 3.

The process of J. de Kowalski and M. Moscicki, which has been investigated by the "Initial Comités zur Herstellung Stickstoffhaltiger Produkte," at Freiburg, offers some novel features. These workers state that the output of nitric acid per unit of electrical energy is increased by augmenting the frequency and voltage of the current.

They obtained a maximum output of 440 kilos. per kilowatt year, when using a current of 0·05 ampère of 6000 to 10,000 periods per second, at 50,000 volts. Their apparatus possesses some special features of construction, as will be seen by reference to the following diagram, in which the arcs are denoted by *K*; *E* represents condensers; *C* and *H*, induction coils. It is for this special arrangement that a patent has been granted.

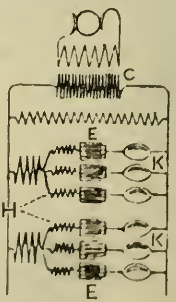


Fig. 4.

Whether a current of high periodicity and voltage, such as the one described above, possesses some special advantage or whether the increased yield is merely the result of some mechanical property of an arc so produced, does not appear to be clear from the experiments of these authors. The latter view is probable, since the yield of nitric acid obtained by Kowalski and Moscicki has been far surpassed by subsequent workers, who used currents of only moderate periodicity and voltage.

This process also, if worked commercially, would require a large number of units of plant, since only $2\frac{1}{2}$ kilowatts are condensed in each arc.

In 1903 an English patent(10) was granted to Eyde and Birkeland for an apparatus in which large quantities of electrical energy could be used for the purpose of effecting reactions between gases at high temperatures.

Plücker(11), in 1861, had shown that, when a high tension discharge passed between electrodes, situated in a magnetic field and at right angles to the magnetic lines of force, a disc of sparks resulted, and that when this phenomenon occurred in a vessel filled with air, the formation of brown oxides of nitrogen was observed.

Lehmann(12), in 1898, applied this arrangement to the high tension electric flame, and obtained a similar spreading of the arc. When a direct current is used, the arc resembles a half-circle, with an alternating current, an approximately circular disc is formed, which is represented by the following diagram, where the electrodes, E and E^1, are alternately + and −.

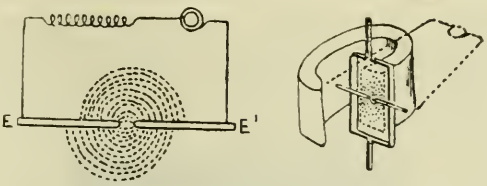


Fig. 5.

It will be seen that the half circles are not symmetrically situated in relation to the electrodes, the centre of the arc lying over the electrode.

Working on these lines, Eyde and Birkeland designed a furnace, in which an arc, absorbing 500 kilowatts, plays between water-cooled copper electrodes, situated in a powerful magnetic field. The magnets are excited by means of a direct current, and consume an amount of electrical energy equivalent to 10 per cent. of that used in the arc. The water-cooled electrodes absorb about 7·5 per cent. of the energy of the flame, and are removed for repairs after being in operation for about 300 hours. An arc of more than one metre in diameter, and 35—40 mm. thick, is thus produced with a working potential of 5000 volts. The construction of the furnace will be readily understood from the accompanying drawings. The arc chamber is shown at 2, the electrodes at 7, the magnets at 12, the air inlet and outlet at 15 and 16 (Fig. 6). With this

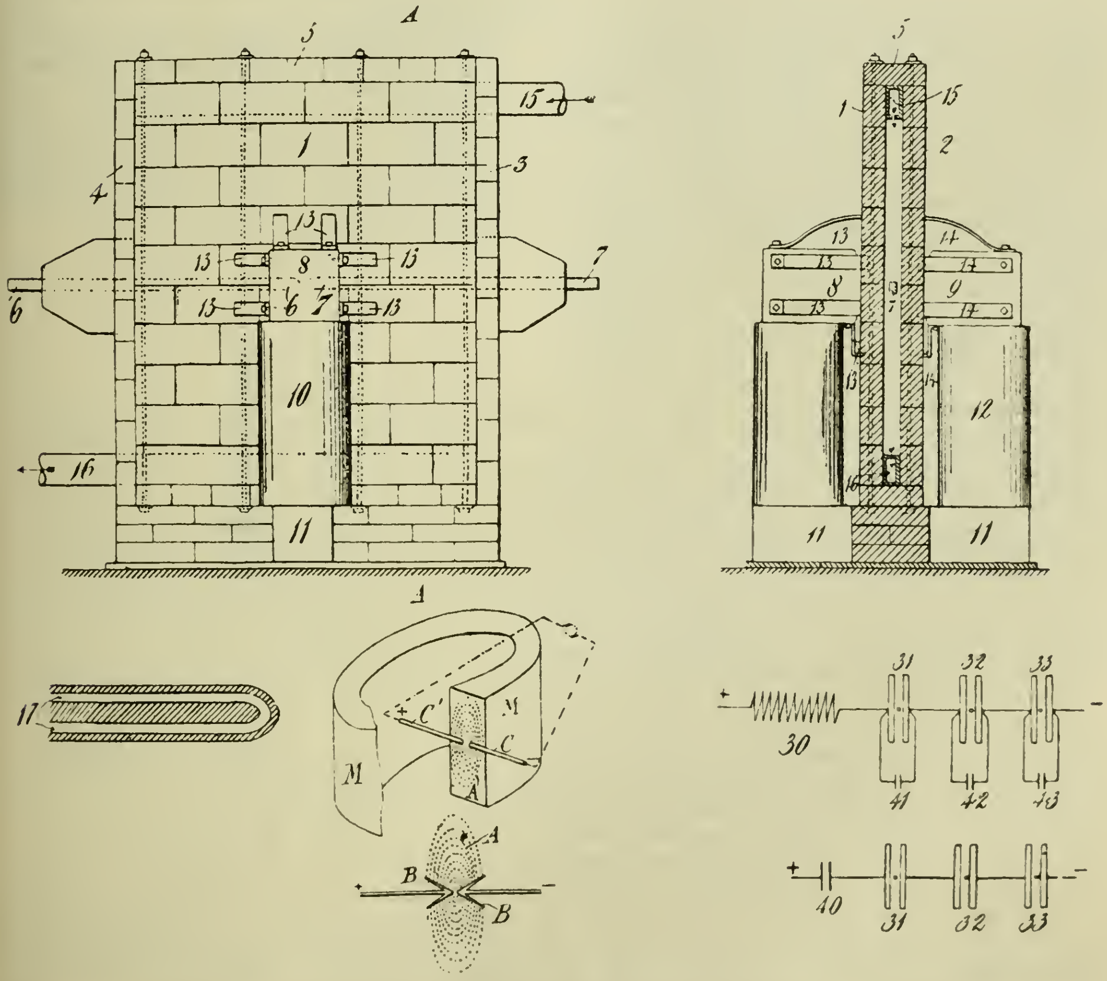


Fig. 6.

furnace a yield of 600 kilos. of nitric acid per kilowatt year has been obtained. The cost of installation is low—for a furnace designed to take 1000 kilowatts, it amounts to only £1 per kilowatt. In the case of the 500 kilowatt furnace, (Fig. 7), 1500 cm. of air per hour are passed into the furnace; the exit gases contain 2 per cent. of nitric oxide. A considerable extension of this process is now under way at Notodden, where it is proposed to use 27,000 E.H.P., produced by hydraulic means. The cost of production per ton of calcium nitrate containing 13·2 per cent. of nitrogen is given as £4, whilst the selling price is £8, the latter figure being based upon a market price of £10 per ton of combined nitrogen.

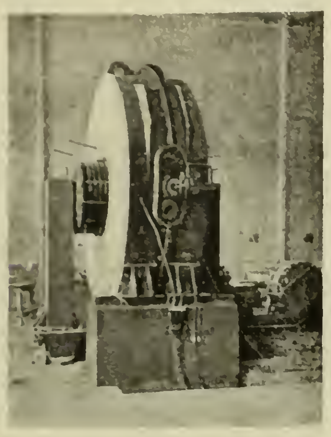


FIG. 7.

When using alternating currents for the production of the electric flame, it is necessary to introduce, in series with the arc, an inductive resistance, which effects a displacement of phase, thus regulating the current, and enabling the flame to burn steadily. A transformer constitutes such an inductive resistance, the iron cores of which, when the current is passing, are converted into magnets. In a patent taken out in 1904 (^{13}) the Badische Anilin und Soda Fabrik claim the use of such a magnetic field, for spreading out the arc. They thereby avoid the use of a separate current for exciting the magnets. Of this arrangement other advantages are also enumerated, notably the self-inductive action in the arc, which the cyclical motion imparted by the alternating current to the magnetic field produces, whereby the inner resistance, and consequently the stability of the arc, is increased. This particular combination of apparatus, however, does not appear to have been technically applied, as in 1906 the same company make use of another method of producing arcs of great power(^{14}). The arrangement consists essentially of an iron tube, one metre or more in length, at one end of which an insulated electrode is situated, a single electrode electrically connected to the tube is inserted at the opposite end. On passing a current of some few thousand volts, an arc is established between the insulated electrode and the wall of the iron tube, adjacent to it. If now air, with a whirling motion, be blown into the tube, the arc travels along the wall to the opposite electrode, and as long as the current of air is maintained, the arc continues to burn steadily between the electrodes. Several insulated electrodes are also used, each in separate tubes, the latter, however, all leading into a common chamber, in which is situated the electrode electrically connected with the tube. It is, moreover, found that, by the use of either single phase or polyphase currents, several arcs in one tube can be obtained, burning quietly side by side, and uniting at the upper end of the tube, which is earthed so that no danger is incurred by touching it. 100 kilowatts of electrical energy have been employed in each arc. This apparatus is extremely simple, and should good yields of acid be obtained, there appears to be no reason why the process should not be a commercial success.

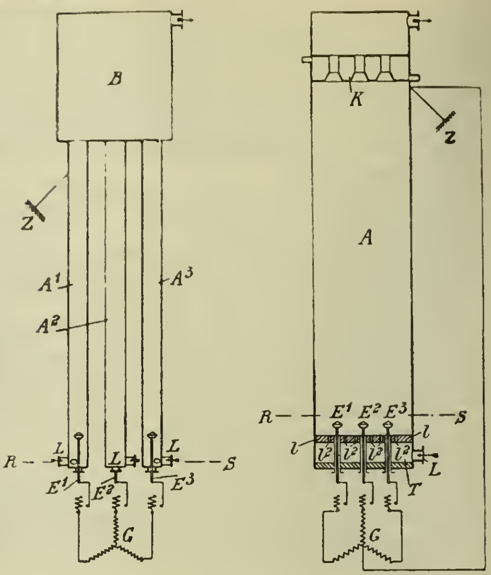


FIG. 8.

Of other methods of burning atmospheric nitrogen, it will be interesting to notice those of Naville and Guye (^{15}) and of Pauling(^{16}), who appears to be working in conjunction with the Salpetersäure Industrie Gesellschaft.

The former workers, by rotating a disc-shaped electrode E—situated in a cylinder of refractory material C—over a metal tube A, conveying the air to be treated, and which forms the second electrode, obtained a spreading of the arc round the periphery of both the tube and the disc. By this method a yield of 400 kilos of nitric acid per kilowatt year has been obtained.

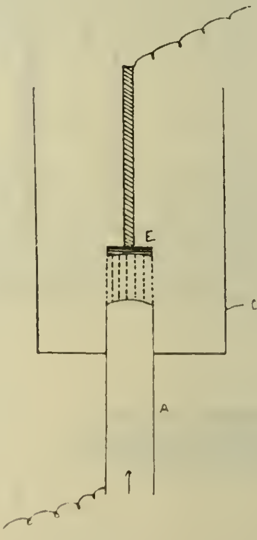


FIG. 9.

The apparatus, devised by Pauling, consists of either straight or curved fixed electrodes, A E, inclined to one another in a vertical plane. At regular intervals, solid conductors, C, which are fixed on the periphery of a revolving wheel, W, pass between the lower ends of the electrodes, thus causing an arc to spring across. By means of an air blast, conveyed by pipes, P, the arc, continually increasing in size, is made to travel upwards along the electrodes, until the points, E, are reached, when it becomes extinguished. As each solid conductor passes the electrodes, a new arc is formed, which, in its turn, goes through the same process.

In another method, the wheel carrying the solid conductors is not used. Opposed tuyères, conveying an air blast, cause the arcs, which are continually produced at A, to lengthen and break at E, as described in the previous process. I have not been able to discover any data relating to the electrical energy consumed in such arcs, or to the yield of acid per kilowatt year by these processes.

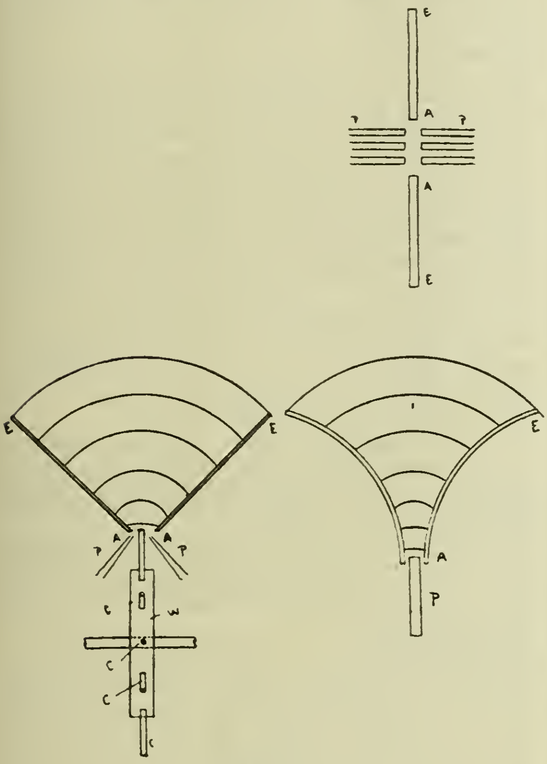


Fig. 10.

Pauling has also endeavoured to oxidise nitrogen without the intervention of electrical energy (17). By passing a mixture of air and steam through thin-walled porcelain tubes, heated to incandescence, he observed the formation of nitric oxide and hydrogen. The latter gas diffused through the walls of the tubes, and this diffusion was increased, either by means of a pressure inside the tubes, or a partial vacuum outside. Later, the gases issuing from the incandescent porcelain tubes were rapidly lowered in temperature by the injection of cold air(18), thus minimising the action due to the phenomenon of reversibility. I am not aware that any statements have been made public concerning the yield of nitric acid obtained by this process.

Häusser(19) also avoids the use of the electric flame in the combustion of nitrogen. He reverts to the explosion method of oxidation, the feasibility of which, as mentioned above, was first demonstrated by Bunsen and Kolbe in 1846. The special apparatus, used by Häusser, consists of a gas engine, in which the usual mixture of air and gas is exploded. The products of combustion are, however, rapidly cooled by the injection of cold water into the combustion chamber. As with the process last described, there appears to be no published data relating to the yield of acid thus obtained.

Thus, in glancing through the processes, either projected or in actual operation, on a commercial scale, for the oxidation of nitrogen, we find that a yield of 650 kilos. of nitric acid per kilowatt year represents the greatest output so far realised. Assuming a mean flame temperature of 3200° C., this amount is equal to $\frac{650}{819} = 0{\cdot}793$ or 79·3 per cent. of that theoretically obtainable. Whether it will be possible in actual practice to increase this quantity either by raising the mean flame temperature, or by a more rapid removal of the gases after reaction from the sphere of influence of the arc, simultaneously with sudden reduction in temperature, is a question which will have to be decided by further investigation.

The relative reduction in volume of zones 2 and 3 of the flame, which I mentioned above as being so essential to successful working, would appear to have been partially realised in the Birkeland-Eyde furnace. The spreading of the "current paths" by magnetic force should tend to equalise the temperature of the flame, and prevent that great opportunity for gradual temperature fall which is observed in the ordinary high tension flame, and which is so inimical to the attainment of a satisfactory yield.

Against this advantage, however, must be placed the energy required to maintain the magnetic field, amounting as it does to 10 per cent. of the quantity consumed in the arc, and which is not included in calculating the yield of acid. The temperature of the flame might be raised by increasing the resistance of the gases, by working under pressures above that of the atmosphere.

It will be interesting in this connection to note some experiments of Muthmann and Hofer(20), who found that by increasing the pressure of the gases surrounding the arc from 1 to 1·4 atmospheres, the velocity of the air passing into the arc chamber could be accelerated, and although the exit gases contained the same percentage of nitric oxide, yet the yield was increased threefold per unit of energy consumed.

Such a result could only be due to increased flame temperature, caused by the added resistance of the air to the passage of the current, consequent upon increased pressure.

These experiments are important, containing, as they do, two elements of success, *i.e.*, an increase in flame temperature, and a more rapid removal of the nitric oxide from the arc, due to the greater air velocity, and this without increased dilution. An extension of this work would probably yield interesting results.

Against the increased yield, however, must be set the cost of compressing the gases, and the difficulties which always obtain in practice in working at high temperatures under pressure.

Absorption of nitric oxide and the preparation of nitric acid.—So far, I have dealt only with the gaseous products of oxidation. After leaving the furnace, the air contains about 2 per cent. by volume of nitric oxide, which becomes rapidly converted, by means of the excess oxygen present, into nitrogen peroxide. The mixed gases then pass on to absorption towers, which present no special features of construction, and down which water or dilute acid flows. In the case of the last tower, milk of lime is used, as it is difficult to absorb the last traces of NO_2 by means of water alone. By this process one obtains an acid of not more than 50 per cent. strength.

The preparation of a concentrated nitrous-free acid from the nitrous gases constitutes one of the most serious problems in connection with this process.

The reaction represented by the equation :—

$$2NO_2 + O + H_2O = 2HNO_3,$$

does not take place in the absorption towers, such an equilibrium appears to exist only in the gaseous state. On condensation, the right hand side of the equation is not produced. The most concentrated acid which has so far been obtained by the condensation of nitrous gases in water in the presence of oxygen, corresponds to the formula, $HNO_3,2H_2O$, and possesses a density of 40·6° B., representing 63·63 per cent. of anhydrous nitric acid. The formation of this acid takes place, according to the following equation, in the Lunge and Bohrmann plate towers, $2NO_2 + O + 5H_2O = 2(HNO_3,2H_2O)$, from which acid of 40°—41° B. is obtained. By passing the gases, however, through towers down which water flows, an equimolecular mixture of nitric and nitrous acids results, which, at the most, cannot attain a concentration greater than that obtained in the Lunge towers. Attempts at further concentration, by the passage of nitrogen peroxide through the solution, simply results in an increase of nitric acid, at the expense of the nitrous. The strongest acid is thus never free from nitrous acid, and each succeeding absorption tower contains less and less nitric acid, whilst at the same time the nitrous acid increases, for, as the free oxygen in the gases becomes consumed, the NO and NO_2 tend to react, as N_2O_3, yielding only nitrous acid. It is not possible to prepare much stronger acid by fractionating the 50 per cent. acid from the first absorption tower, since a product of minimum vapour pressure, boiling at 120°, and containing 68 per cent. of anhydrous acid, is obtained as residue.

Thus in order to prepare the most concentrated acid by the nitrogen combustion process, it would be necessary to either add the 50 per cent. acid to concentrated sulphuric acid, until a dilution of, say, 54° B. be obtained(21), and distil off the nitric acid; or to prepare a salt of nitric acid, and distil, in the usual way, with sulphuric acid, or a bisulphate.

An electrolytic method for concentrating and oxidising the weak tower acid has lately been patented(22). The process consists in refrigerating the oxides of nitrogen evolved during electrolysis at the cathode, and leading them, in the liquid state, slowly to the anode compartment of the cell, where in presence of the nascent oxygen there generated, a solution of pure nitric acid results, all nitrous acid undergoing oxidation. I am unable to say if this process has proved a commercial success.

Thus, although the electro-thermic production of nitric acid has attained a fair degree of efficiency in some of the processes touched upon this evening, the problem of directly manufacturing from the furnace gases a 98 per cent. acid has not yet been solved.

Production of power and a comparison of costs.—Before all other considerations in connection with this most important problem, that of the production of cheap electrical energy comes foremost.

Although certain waterfalls are now available as the cheapest sources of supply, it is not to be supposed that the owners of such properties will not, in the near future, become alive to their economic value. The law of supply and demand will operate in this case as in others more familiar. Again, water power is, generally speaking, only obtainable in a few localities, and these are situated far from the places in which the products of manufacture find a market. These are not the only points to be considered. The upkeep of buildings and plant in isolated situations must of necessity be higher than in those places where materials of construction and skilled labour are readily to hand. Further, the cost per unit of electrical energy at Notodden, which is given as £2, is probably under estimated. The plant has not been in operation for a sufficient length of time for depreciation and the cost of upkeep to be accurately determined.

In connection with this subject, one of the "Times Engineering Supplements" for December, 1905, contains an article in which it is shown that, at the Christiania Electrical Works, run by water power, the cost per kilowatt year, in labour and lubrication alone, amounts to £7 18s. 6d. To this sum must be added fixed charges—interest on capital, wear and tear, &c. The cheapest source of electrical power supplied to the consumer is that of Niagara Falls, for which £10 4s. 6d. is charged per kilowatt year, for quantities of not less than 1200 kilowatts per hour. Assuming an average of these two charges as giving a near approximation to the actual cost, one ton of nitric acid, in electrical energy alone, would cost £13 12s. 8d. On the other hand, very different estimates are given by Wien(23). He reckons £1 per kilowatt year for a single place in Norway, assumedly Notodden, for large water powers in Switzerland and Austria, £2, for Niagara, £4, smaller waterfalls in Austria, £6. It is difficult to reconcile such conflicting estimates, and obtain figures on which reliable calculations can be based.

With regard to resources nearer at hand, and means available for producing electrical energy in our own country, it will be generally conceded that steam power is out of the question for the problem in hand, although it is estimated that, with the best modern appliances, 1 kilowatt year of 8760 hours can be produced in south-east Lancashire for £6. The gas engine, however, offers more hope of success, and it will be interesting to consider the cost of production by this motor when run on gaseous fuel obtained from various sources. The gas obtained by the distillation of coal in closed retorts does not come within the scope of this inquiry, as the only suitable sources of supply would be the modern coke ovens, and the gas in such cases is entirely consumed in carrying out the operations of the works, partly in distilling the coal, tar, &c., and partly in raising steam for power purposes, and also for the rectification of the low boiling fractions of the tar.

We must therefore turn to producer gas as a source of supply. Even the smaller units, of which so many are now on the market, show great economy over steam engines in the production of power. I may cite a case of such a unit, now running in London, and using coke as fuel, with which a four weeks' test was carried out. The results showed that a kilowatt year could be produced for £6 2s. This sum includes all charges. On this basis 1000 kilos. of nitric acid would cost £10 6s. 8d. With the larger plants, however, and taking the Mond producer as the best representative type, a very much greater economy is shown. Using the figures given by Guye in his paper, read before the London Section of this Society, in May, 1906, we find that, with fuel at 7s. per ton, and reckoning £14 as the cost of the outfit, the kilowatt year costs £3 13s. 6d., approximately. Under these circumstances, the energy-cost, per 1000 kilos. of nitric acid, would amount to £6 3s.

At the pit mouth, coal suitable for Mond producers could be obtained at 5s. per ton, thus decreasing the cost somewhat as regards fuel, but not in the same ratio as the difference in cost of the fuels, since the lower priced fuel would contain more ash.

The Mond producers possess the further advantage, that about 90 lb. of ammonium sulphate are obtained per ton of coal consumed. This opens up the possibility of preparing ammonium nitrate and nitrite as a subsidiary industry.

There is still a source of power in this country which is probably cheaper than any we have considered this evening. I allude to the enormous volumes of blast-furnace gases which are regularly produced in the manufacture of iron, and a very large proportion of which, in this country, are just as regularly wasted. The first to apply these gases to the production of power was B. H. Thwaite, who, in May, 1895, was granted a patent for the special methods he employed in effecting a purification of the gases, and using such purified gases in thermo-dynamic motors. A small plant was put down at the Glasgow Iron and Steel Co.'s furnaces, at Wishaw, and has since run continuously, supplying electric light for the use of the works.

Since that date enormous advances have been made on the Continent in the utilisation of blast-furnace gases. The matter has long passed the experimental stage, and success is assured. In Germany alone about 340 blast-furnace gas engines, with a total capacity of 200,000 h.p., were in use in 1902. Since that date, another 100,000 h.p. has been installed, representing 100 engines, each of over 1000 h.p. The Nürnberg Engine Co. are now constructing engines up to 4000 h.p. Other well-known makers of blast furnace gas engines are Deutz, Körting, Berlin-Anhalt Engines, Daner, and the Cockerill. I am also informed that the British Westinghouse Co. are contemplating the construction of engines of more than 1000 h.p. The very finely-divided dust remaining in the gases after scrubbing, and amounting to about 0·17 per cent., does not appear to have any deleterious effect on the working parts of the engines. Very favourable reports as to the condition of the cylinders after the engines had been running for a period of two years have been received. After providing for all the power necessary for the operation of the works, such as heating the blast, blowing, hoisting, &c., there remains a surplus which, when gas engines are used, is estimated at from 500 to 1000 h.p. hours per ton of iron made. Now, in 1906, 9,592,737 tons of pig-iron were produced in Great Britain. For the sake of simplifying the calculations we will assume a yearly production of 10,000,000 tons, or 1250 tons per hour, and, taking an average surplus of 750 h.p. hours per ton, the total available surplus will amount to 750×1250=937,500 h.p., or nearly 1,000,000 h.p.

In Germany, about the same amount of surplus power would be available, in France about one-third of this amount, thus making a total for Europe of at least 2,300,000 h.p.

The shipments of nitre to Europe in 1906, as shown by statistics, were 1,335,689 tons. Assuming a production of one ton of sodium nitrate per 1·6 h.p. year, 2,137,102 h.p. would be necessary to produce the quantity of nitrate above indicated. Thus, the surplus power from the blast furnaces of Europe would be more than sufficient to supply the electrical energy required for the manufacture of nitrates, at the present rate of consumption, in this continent. Our own furnaces could supply energy equivalent to 585,937 tons of nitrate, or 472,404 tons in excess of our own requirements.

The output of iron from the American furnaces is almost equal to that obtained from those of Europe, and, if the surplus power were used for the production of nitre, the world's output of this commodity could be trebled.

Allowing a capital outlay of £10 per kilowatt for the buildings and power outfit and for—

	£	s.	d.
Interest and depreciation, 10 per cent...	1	0	0
Upkeep	0	6	8
Labour	0	6	8
Total per kilowatt year	£1	13	4

(exclusive of blast furnace gases).

It may be interesting to note the relative costs of power derived from the various sources for the production of 1000 kilos. of anhydrous nitric acid, to which end I have drawn up the following table:—

Comparative cost per 1000 *kilos. anhydrous nitric acid when produced from powers of different sources.*

Source.	Cost per kilowatt year.	Cost per ton (1000 kilos. of anhydrous nitric acid.
	£ s. d.	£ s. d.
Water	4 0 0 (average)	6 13 4
Steam	6 0 0 (S.E. Lancs.)	10 0 0
Mond gas	3 13 6	6 3 0
Blast-furnace gases	1 13 4 (excl. cost of gas)	2 15 6

A yield of 600 kilos. per kilowatt year is assumed.

I do not suggest that no other use can be found for this enormous total of surplus power than that indicated above. It is highly probable that in the near future a large proportion will be employed in the iron and steel industry, as is the case in Germany to-day. Nevertheless, a large surplus will remain, which will be available as a source of cheap energy for the electro-chemical industries, cheaper than that obtainable from any other source in this country, and, perhaps, than that derived from most waterfalls, the economy of which is, I think, in many cases over-estimated.

DISCUSSION.

Mr. H. **PORTER** said there seemed to him some analogy between the electric and catalytic processes for the conversion of gases. In the earlier portion of his paper, the author said there was a difficulty in removing the nitric oxide at the point of its formation in the first arc. In his experience of the catalytic processes that was essentially the important point. The chemical reaction took place at a very small part of the contact material. In the catalytic process for the manufacture of sulphuric acid he had come across very distinct traces of nitric oxide. When titrating a vitriol exit, the yellow colour at the point of neutrality slowly changed to a brick-red colour, and on a further addition of soda, it again became yellow, and again slowly turned brick-red, showing the presence of nitric oxide. He had found this same reaction in the contact process. Mr. Howles in his diagrams indicated that this formation did take place at some points more than others, and this was interesting as throwing much light on all these catalytic processes.

Dr. R. S. **HUTTON** said that the question of the cost of power was of primary importance in all electro-chemical industries, and he had studied the subject most carefully, and had had somewhat exceptional facilities for obtaining first-hand information with regard to Norwegian and Alpine water-power plants. He considered Mr. Howles's comparison of the cost of water-power with steam and blast furnace gas power very misleading. It was true that great variations exist in the cost of water-power development, the differences being largely due to the varying amount of civil engineering work necessary for harnessing the power. In the case of the production of nitric acid, in which there was a product of comparatively low value, demanding a considerable expenditure of electric energy, no one with experience in other electro-chemical industries would venture to instal a plant except in those localities where exceptionally economical conditions existed. The present small nitric acid factory at Notodden actually purchased its power at about 33s. per kilowatt year, and many electro-chemical works both in Norway and Sweden and in the Alps had an inclusive cost for power, ranging from 16s. to 40s. per kilowatt year, the latter being considered in those countries the economical limit for such industries as aluminium, chlorates, and carbide. Power at Niagara, which for some years past had been sold at figures ranging from £4 15s. to £5 10s. per kilowatt year, had always been considered expensive. With regard to gas engines, and in particular to those cases in which blast furnace gas was used, although much development might be expected in certain directions, *e.g.*, electric steel manufacture, the enormous capital expenditure, and the actual results obtained by those who had installed gas engine plant in this country, seemed to indicate that Mr. Howles's statements on the subject were very optimistic. The production of nitrates was, in his (Dr. Hutton's) opinion, a most promising electro-chemical development; but under ordinary circumstances it must necessarily be confined to those countries where the facilities for cheap water-power development were exceptionally favourable.

Mr. **HOWLES**, in reply, said he thought it quite probable that nitric oxide might be produced during the catalytic process, as mentioned by Mr. Porter. He had tried to oxidise nitrogen by passing a mixture of steam and air over a mixture of oxide of vanadium and other bodies at an elevated temperature, and he had obtained nitric oxide. Oxide of iron, although less active, could be substituted for oxide of vanadium. With regard to Dr. Hutton's remarks on water power, the figures he quoted as the price at Niagara were taken from the "Times Engineering Supplement," and also from other sources, and represented two points of view as regards the cost of water power. As Dr. Hutton had said, the capital outlay was the main charge, but he did not know whether an adequate sum had been set aside for upkeep, interest on capital, and depreciation in the estimates of 30s. to £2 per kilowatt year given by Dr. Hutton. If these charges were not correctly apportioned, the estimates given would be very materially affected. It was notorious that the capital outlay in water power installation was very large. It was much larger, for instance, than that required to harness blast furnace gases. He had based his calculations upon some figures obtained in actual practice, so that, excluding the cost of the blast-furnace gases, his figures were correct.

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(1) Ber., **36**, 438 (1903).

(2) Annalen der Pharmacie, **59**, 208—217 (1846).

(3) Zeits. Elekrochem., **31**, 1906.

(4) Brode, Oxydation des Stickstoffes.

(5) Muthmann and Hofer, Ber., **36** (1903).

(6) Oxydation des Stickstoffes.

(7) J. H. Clement, Ann. d. Physik, 1904, pp. 334—353.

(8) Ber., **36** (1903).

(9) Oxydation des Stickstoffes.

(10) English Patent 20,049 of 1903.

(11) Pogg. Ann., 133, p. 252.

(12) Die elektr. Lichterscheinungen und Entladungen, 1898, 353.

(13) English Patent 5688 of 1904.
(14) English Patent 9279 of 1906.
(15) French Patent 361,827 of 1905.
(16) French Patents 368,715 and 368,717 of 1906.
(17) English Patent 21,828 of 1902.
(18) English Patent 7870 of 1906.
(19) English Patent 12,401 of 1906.
(20) Ber., 36, (1903).
(21) 54° B. = 120° Tw. = 68·5 per cent. of H_2SO_4.
(22) French Patent 368,716 of 1906.
(23) Zeitschrift f. Elektrochimie, 31, 1906.

Nottingham Section.

Meeting held at Newark-on-Trent, on Wednesday, Feb. 27, 1907.

MR. J. M. C. PATON IN THE CHAIR.

THE CHEMIST'S RELATION TO THE BREWING AND MALTING INDUSTRIES.

BY G. C. JONES.

Sir William Ramsay in a presidential address to this Society (J. Soc. Chem. Ind., 1904, 853) said: "The education of a chemist must be conceived in the sense that it consists in an effort to produce an attitude of mind rather than to instil definite knowledge. Of course the latter must not be neglected." "This attitude of mind," said our next President, Dr. Wm. H. Nichols, in the course of his presidential address (J. Soc. Chem. Ind., 1905, 707), "is the pith of the matter. The young chemist . . . must have learned how to study and have a mind open to see the truth, and courage to follow wherever it may lead," and—he might have added —patience and skill to make others see the truth and follow where it leads. That Dr. Nichols did not add this is explained by the fact that his experience of chemical industrial organisation is American, and he tells us (*loc. cit.*) that in America the "Customary Board of Directors . . . of necessity includes men educated as chemists and engineers, who are able to understand what their subordinates are doing, and to direct them as occasion offers."

As English Boards of Directors are not of necessity so constituted, it is scarcely surprising that the chemist's services have not been so intelligently utilised here as in America, and this is perhaps most noticeable in what I should describe as the not-strictly-chemical industries, among which stand brewing and malting. The technical director is the type which such industries seem most to need at present: and men possessing the necessary qualifications must be found or developed, and given effective control, if in the future it is wished to get the best service from the experienced practical brewer and maltster and his new assistant, the chemist. Lawrence W. Hodson, in a paper on "Continental Brewing Schools" (J. Inst. Brewing, 1904, 34), wrote: "The typical organisation of the technical side of a large Continental brewery is presided over by a technical director, who is a principal in the business. He is not necessarily occupied with either the department of selling or the department of finance. Under him are three departments, the brewing room, the laboratory, the engineering, presided over by the head brewer, the chemist, the engineer, respectively, each of whom is responsible to the technical director. The main object of the schools is to train the technical director."

It is only natural that those possessing a preponderating monetary interest in an industrial undertaking should wish to retain the ultimate control of its activities; but when industries become competitive, as brewing and malting now tend to become, that ultimate control must rest with men possessing something more than the breadth of vision and grasp of elementary business principles essential to the conduct of any large concern. One or more of them must have such technical knowledge and experience as will enable them to get the best service out of their staff, and above all things must they have that scientific attitude of mind, on which our distinguished Past Presidents lay so much stress as the chief aim of a chemical education. In other words, the ideal brewery board would include a practical brewer and a chemist of at least such experience and attainments in their special lines as the board would look for in a candidate for the post of head brewer or chief chemist. It may be doubted if a few years as an under brewer, or a few months spent in an industrial laboratory, increase the capacity for usefulness of a future brewery director; that way may come the little learning, proverbially so dangerous, and the exact antithesis of the attitude of mind of which you may be tired of hearing. It is at least possible that a course of David Hume would serve him better; he might rise from that oppressed by the hopelessness of establishing the relation of cause and effect, but at least he would not deceive himself that he possessed final knowledge, and he would learn to distrust, as self-deceived, those who made that claim. In theory, no number of single instances may justify a generalisation which is broader than the sum of the single instances. In science we find it convenient to go further than this and to resume our knowledge and ignorance from time to time in generalisations, which as men of science we never regard as final, recognising that further knowledge may cause us to modify them. In business, generalisation beyond what the facts justify is in the nature of a business risk, a risk, however, which must be continually faced. And it is the capacity to decide in a given case whether such a generalisation constitutes a reasonable business risk which is the power above all others which must be highly developed in the man who would reconcile science and practice in an industry like brewing, which has realised magnificent results in the hands of practical men, but which is yet far from being put on a scientific basis.

The literature of the subject testifies to the readiness of the chemist and biologist to help the industry, and testifies no less to their skill. We are pardonably proud that the earliest and some of the best work which has been done was the work of Englishmen. But the literature, especially the more recent British literature, testifies to another less admirable circumstance: the will and the skill of the chemist remain, but there is not the evidence one would like to see that he is given sufficient opportunity to organise observation in the brewery and maltings, still less to initiate and carry out experiments to solve definite problems. At present experiment within limits is possible to the process manager, the brewer, but he, as a rule, has responsibilities enough, and does not wish to add to them; moreover, he is by training an artist, respecting the traditions of his art, distrusting change, and—the sceptical young chemist may say—disliking even experiment, as calling those traditions in question. Experiments on the large scale, involving risk of serious loss, are occasionally initiated by those who alone can initiate them, namely, principals in the business who will have to face the risk. It is in the nature of experiments that such risks should occasionally mature; it is not in the nature of an experiment, properly conceived and carried out, that it should teach nothing but fear of further experiment. That such has often been the sole result of so-called experiments is due to their being the work of men who have received no training in scientific method. The chemist whose training, if proper, fits him to attack problems far beyond his laboratory walls and even beyond his province as chemist, has hitherto had too few opportunities to help the brewer and maltster in this way. As Archbutt, discussing a paper on "Factory Costs," read before this section by Garry (J. Soc. Chem. Ind., 1903, 131), said: "The chemist has too often been shut up in a box and expected to evolve everything out of his own inner consciousness."

Certainly the brewer's chemist has sometimes been so treated. Whole-time chemists have been kept in the laboratory engaged in routine analysis of samples, whose collection might more properly have engaged their attention. Mr. A. C. Chapman, in criticising a paper of mine on "Standardisation of Malt Analysis" (J. Inst. Brew., 1905, 282), described the performance of such routine analysis as a "distinct and inferior function of the chemist." I am specially glad to call Mr. Chapman's words to my support, as when they were uttered he believed that we were in disagreement. Consulting chemists with large practices have usually a competent staff to whom the performance of routine analysis, and even more important work, can be deputed, thus leaving the chemist "time for thinking," a consideration often lost sight of in works, as Davis, speaking from a large experience, has pointed out (Handbook of Chem Engineering, p. 338). But though the consultant has had time for thinking he has often been denied the full information necessary even to suggest a means of solving the problems presented to him, and occasionally at least appears to have been deliberately misled.

In discussing Hodson's paper (*loc. cit.*), Mr. W. H. Evans is reported to have said that "he believed with Mr. Hodson that that feeling of reserve and reticence common with many brewers and other proprietors was dying out. There was a tendency on the part of all to work together for their common industry. Some brewers, perhaps, thought they knew a little more than their competitors, and had a desire to keep that knowledge to themselves. To-day he believed that a better spirit prevailed." We must all hope that Mr. Evans' diagnosis as to present tendencies is correct, especially when we remember the admirable traditions for which the industry was formerly famous. But there are to-day great houses which do not encourage—I suppose I must not say, do not allow—their brewers or chemists to publish. Nor do the individual residents of one and the same house always seem to work together to the best advantage. It is worse than useless for anyone to publicly deny that there has grown up, and remains, a measure of mutual distrust which can but hinder progress. The chemist is not wholly trusted by the brewer or maltster, nor is the maltster by the brewer and chemist; nor does the practical brewer meet with the recognition and support which was formerly his; he fancies—and the effect on his efficiency is none the less because it may be, as I believe, only fancy—that he detects a note of undeserved contempt for him in the language or tone of the chemist, and of a new generation of principals who are neither practical brewers nor chemists, but who have learnt some of the new expressions introduced into the industry by the chemist. Personally, I seldom engage in conversation with brewer, maltster, or chemist without meeting with some aspect of this mutual distrust. What seems to be needed is not denial of this uneconomic state of affairs, but, recognising the trouble, to trace it to its source, and endeavour to show that the distrust has no true ground, or if it have to remove it.

The brewer and maltster are apparently afraid to give the consulting chemist the full information, or the means of getting the information, which he needs in order to help them. Are they afraid lest he should learn too much and apply the knowledge thus gained elsewhere? And if so, have they not overlooked the fact that what he may learn from them is very small compared with the knowledge he has acquired in years of effort to help other brewers and maltsters in similar difficulties, and that he brings all this knowledge to bear on their particular problem? And if this is not enough, may I suggest to the brewer that he may, by pressing a chemist to hazard an opinion on insufficient data, receive unsound advice for which not the chemist but the client must be blamed? Such things have happened to the joint disadvantage of client and chemist.

The whole-time chemist has sometimes incurred the disfavour of the practical brewer by challenging the supposed commercial advantage attending the use of high-priced materials. This he was bound to do if he supposed that money was being spent which was unnecessary to secure sound beer and hold and increase the trade. If the chemist's view has in some directions prevailed in opposition to that of the brewer, and trouble or loss has resulted, that is not the fault of the chemist, but of those who took his necessarily imperfect judgment, without giving the brewer and chemist together the opportunity of determining by experiment just how far the cost of raw materials could be reduced without more than corresponding loss in other directions. The brewer has occasionally seemed to regard the presence of a chemist in the brewery as undermining his position as process manager. Certainly a chemical training, in the rare instances where it can be combined with a long experience of practical brewing, should produce an accomplished brewer; such brewer-chemists have been; O'Sullivan's is a name which will be long remembered; others scarcely less famous are with us still, and the list will grow. But the experienced practical brewer need have no fear of extensive competition for his highly responsible and arduous post on the part of the chemist. There is work enough for the latter in helping to make the brewer's life a less continual round of anxiety, while striving to realise his principals' wish to maintain and even improve the character of the finished article, and at the same time reduce all costs to the lowest safe limit.

There is another circumstance which may to some extent explain the distrust which tends to keep even the whole-time chemist in a water-tight compartment. The old superstition that an academic education unfits a man for business dies hard. There are without doubt many highly qualified chemists whose college experience "seems to incline them towards the search for learning rather than to its application." (Nichols: *loc. cit.*) Such men can as a rule serve an industrial organisation only in its research laboratory, under the supervision of a technical director who will direct their activities into channels which may lead to knowledge having a commercial value. But because there are—fortunately—chemists with a love of knowledge for its own sake, it does not necessarily follow that a chemical education renders a man less able to view a problem from a commercial standpoint. The old reproach to this effect against the chemist should surely be removed by this time. One may, in refutation of the charge, justly refer to the paper (J. Soc. Chem. Ind. 1902, 1439) by Garry on "Factory Costs," read before this section, and to the subsequent discussion (1903, 130), and to come nearer my particular subject to the suggestive papers by Moritz on "Ways and Means in the Malthouse" (J. Fed. Inst. Brewing, 1898, 205), and on "The Economics of Brewery Malting" (J. Inst. Brewing, 1905, 491).

The distrust of the maltster by the brewer is shown occasionally by a curious unwillingness to specify requirements. Where a brewery is large enough to justify the engagement of the exclusive services of a chemist or chemists, this disinclination is giving way, with advantage to both brewer and maltster; and certain consulting chemists have influence enough with some of their clients to persuade them to a similar sensible course. But one could name a very large brewery, possessing its own chemical staff, which jealously guards its preferences in the matter of curing: it asks for malt equal to sample. This is a request which the progressive maltster, whose operations are subject to scientific control, finds it fairly easy to comply with; but his task—to give satisfaction to the brewer—would be easier if he knew whether any small divergence from the sample would be less objectionable on the low or the high side; one might be actually preferable, unless his sample chanced to be ideal, and he might, in endeavouring to exactly match his sample, err on the other side. The distrust of the maltster by the chemist is shown in reports like the following:—"There is very little evidence of incomplete modification, and the bulk of the grain is characterised by tenderness and friability. I do not notice many broken or damaged corns, and there is very little mould." I take this report at random; it is not a picked sample of the quintessence of negative praise. The malt referred to was about as good a sample as can be manufactured, and sold at the maximum price obtainable to-day for mild ale malts; and maltsters are prepared, if required, to enter into contracts subjecting them to penalties if the malt delivered is unequal to sample. The only explanation of such negative reports must be the rumour that maltsters have occasionally presented fine samples of malt for analysis by well-known consultants, and have, by exhibiting the report obtained, secured orders, the consultants subsequently discovering that the malt delivered to their brewery clients was unequal to sample. If such things have happened in the past, surely they are at least much less likely to happen to-day. There are, it is true, breweries which make little or no use of the chemist's services, even in the simple matter of controlling deliveries of malt. But such neglect is becoming the exception, and the sooner it is a thing of the past the better the maltster, who realises his true interest in the matter, will be pleased. When sale samples and deliveries of malt are invariably reported on by the brewer's own nominee, the maltster who is most skilful and careful to deliver up to sample will meet with the recognition which he deserves (and I am sure each believes himself the most deserving); and when he seeks a consulting chemist's opinion on his product he will get a less ambiguous and therefore more useful report, as the chemist will in the altered circumstances realise that the practice to which I have referred, of submitting samples which do not fairly represent bulks, has no longer any possibility of even temporary commercial advantage. Remove the possibility of gain, and the practice, if indeed it ever obtained to any extent, will die out.

To a "Diary for the Brewing Room, 1907" (Boake, Roberts and Co.), J. L. Baker contributes an article on the "Purchase of Malt on the Basis of Analysis," and refers in one place to "someone more resourceful than the rule of thumb brewer." Now the practical brewers who know Mr. Baker know quite well that this was not intended as a slighting reference to them; some of the ablest brewers of my acquaintance somewhat proudly proclaim themselves rule-of-thumb men, and are content to be judged by their successful practice and to leave pretensions of science to others. When Mr. Baker proceeds to speak of measuring extract, and suggests that, other things being equal, extract should settle price, that is applied science, for extract is of unquestioned importance, and is capable of accurate measurement. When a practical brewer's experience leads him to, and confirms him in, an opinion of which he may be unable to demonstrate the accuracy, his opinion is at times somewhat harshly termed the prejudice of the rule of thumb man. There is an infinite gradation between a prejudice held in the teeth of all the available evidence, and a faith which has the support of all that evidence, and almost amounts to knowledge. But I suggest that the so-called prejudice of the rule of thumb man, though his reasoning may not bear examination, may at times more nearly represent the truth than the opinion of a chemist, reasoning quite accurately from insufficient or inaccurate data. In asking for fair consideration for the opinions of the practical man, do not let me be supposed to deny that he sometimes has prejudices which prevent him from getting that measure of help from the chemist which the latter would like to give. But the prejudice most potent and difficult to eradicate is one which gains apparent support from the writings or reported sayings of scientific men. Given insufficient and perhaps inaccurate information, and denied the opportunity to observe for himself or to experiment, a chemist has too often been pressed for an expression of opinion, which he has guardedly given, recognising the insufficiency of the data. Less instructed persons have mistaken such a scientific expression of a scientist's opinion for the final verdict of science. And when sometimes, as is inevitable, such an opinion proves to be wrong or less generally true than its author supposed, those same uninstructed persons have held science discredited.

The opinion of the chemist has in some cases reinforced the preconceived view of the practical brewer, while in others it has operated in a contrary direction. One may instance the support given by the chemist to the brewers' objection to "forced malt," and on the other hand, the emphasis laid on "extract" by some chemists, in opposition to the view of many practical brewers that, in running after cheaper extract, one may not only make brewing more difficult, but may so alter the character of the beer as to lose trade.

The practical brewer has no doubt always had his own opinion as to what constituted a normal malt, and has tried to guard against undergrown, badly modified material on the one hand, and on the other against malt which has been too hurriedly grown. The chemist, when he first became associated with the brewer, was called upon to help him in securing the material for which he had a preference. Forcing enabled the maltster for sale to increase the output of his houses, and this consideration was said to outweigh the primary one of satisfying his customers. At any rate, forcing was practised, and the brewer sought means to prevent it. To Moritz and Morris belongs the credit of providing the first check: they devised a test (textbook of the Science of Brewing, 1891), which they asserted enabled them to measure the extent to which forcing had been carried. The sufficiency of the test has been challenged, notably by Briant (J. Fed. Inst. Brewing, 1897, 222), but he agrees that, taken in conjunction with other determinations, it does enable us to identify a forced malt, and to quote definite analytical numbers in support of our opinion. In 1898, Dr. Moritz read a paper before the Institute of Brewing on "Ways and Means in the Malthouse" (J. Fed. Inst. Brewing, 1897, 205), in which he wrote: "Every year there is to my knowledge a perceptible falling off in the making of what is known as 'forced malt.'" The test and the knowledge of the test had been more effectual than the brewers' protests. But it had not entirely stamped out the practice against which it was aimed. If this was the object which Dr. Moritz had in view when he framed the paper to which I have referred, then he is to be congratulated on another success, for the manufacture of forced malt has so far ceased among maltsters for sale, that it may almost be described as a lost art. Dr. Moritz is also to be congratulated on the skill which led him to adopt and elaborate the line of argument found in the paper. He conceived the idea that forcing was not so commercially advantageous to the maltster as had been supposed; he was able to get a few experiments made, which confirmed him in this opinion, and so he made the strongest of all appeals to the maltster. The appeal to the maltster to abandon forcing had reached this stage: (*a*) the brewer dislikes it, and it is to your advantage to satisfy the brewer; (*b*) the brewer's chemist can infallibly detect it; (*c*) the advantage gained in output is largely discounted by the loss in yield.

At the conclusion of the discussion on the paper, the President (Mr. Aldous) said: "He had expected to hear more remarks from the maltsters present." They were not so silent outside: one has since suggested to me that Dr. Moritz must have been misled, as it was well known that forcing not only enabled one to get more malt over the floors, but to increase the yield (weight) of malt from barley. I have every respect for that maltster's experience, which finds ample confirmation elsewhere, but that he should suppose it possible for Dr. Moritz to be the victim of inaccurate information shows that he did not appreciate Dr. Moritz's reasoning. The 1000-corn method needs modification if it is to be applied to the calculation of absolute malting yields; but for comparative purposes, it is, as Dr. Moritz says, probably more accurate than malthouse weighings, and frees the chemist from dependence on the figures of others. Moreover, I have myself witnessed experiments in forcing, carried out in maltings, where the cool, long flooring system has prevailed unchallenged for years, which entirely support Dr. Moritz's contention. But I readily allow that Dr. Moritz's experiments, and those to which I refer, do not prove that forcing is always an uneconomical process, but only that it was uneconomical in those instances. Why maltsters have allowed Dr. Moritz's suggestive presentation of the economics of the question to remain so long unchallenged passes my comprehension. Some of them, at least, know that the forcing system, when scientifically carried out, increases yield as well as output, and the information is useless so long as they keep it to themselves. For so long as the brewer and his chemist refuse to accept forced malt, skill in its production is valueless; the maltster for sale must meet the requirements of the brewer. But if brewers generally recognised that forcing is an economical system, which, if permitted, would materially reduce the cost of malt, then perhaps they might think it worth while to reconsider their attitude towards this system. And if they decide that it is not perhaps so intolerable as has sometimes been stated, they may again permit its use, and allow the maltster to share with them the saving thus effected.

This, of course, raises the whole question of the use of forced malt. Dr. Moritz wrote: (*loc. cit.*) "So far as

I am aware there is no disagreement either among scientific men or among experienced brewers that forced malts are undesirable." Briant (J. Fed. Inst. Brewing, 1897, 222), also speaking from a wide experience, adds his emphatic testimony against the use of forced material. Such opinions must have weight, but the agreement among scientific men as to the sufficiency of the evidence on which forced malt is thus condemned has never been so complete as Dr. Moritz's words might lead one to believe. To name but three, Messrs. Chapman, Heron, and Ling, in all the many public discussions in which this question has arisen, seem to me to have suspended judgment. Ling (J. Fed. Inst. Brewing, 1904, 238) has rather emphasised the disagreement which still exists, and in discussing a paper by the late Dr. Morris (J. Fed. Inst. Brewing, 1896, 224), both Mr. J. Heron and Mr. A. C. Chapman stated their experience that some malts which contained high percentages of ready formed sugars gave satisfactory results in brewing. This evidence seems to me to have at least as much value as anything which has been adduced by the other side, for where in the literature is the evidence that the use of forced malt spells trouble? That its use has been followed by trouble may be granted. Chemists have quite properly suggested the manner in which it may have worked the mischief. But that its use has been proved to be the determining factor of trouble I can find no evidence. Chemists and the experienced brewers for whom they speak may be wise in avoiding forced malt; but that there is any published evidence which would justify scientific men, speaking as men of science and not from some particular experience, in condemning forced malt without qualification, I respectfully deny.

Only recently Duncan (J. Inst. Brewing, 1906, 669) has asked whether, in the effort to avoid forcing on the kiln, which is alleged to be the most vicious form of the art, we have not altered the character of our mild ale malts to their detriment. He quotes the opinion of O. Winde and the experiments of Davis and Ling (Trans. Chem. Soc., 1904, 16), as showing that, for the proper production of colour and flavour, prolonged stewing is necessary at temperatures below 100° F., and must be followed by subjection to a temperature of 150°—158° F., while there is still 15 per cent. of moisture present. He also quotes figures published by Salamon (J. Fed. Inst. Brewing, 1902, 2), which show that such conditions do not exist in the kilning of many malts. My own experience confirms that of Salamon, that moisture percentages are often rapidly reduced below 7 per cent. at temperatures of 130°—140° F., and in such cases it is difficult to import colour without resort to high temperatures which cripple enzymes and often produce an unpleasant flavour.

I have at least once known a brewer, confronted by obstinately sluggish fermentations, to get out of his difficulty immediately by substituting, for the normal malt he has been using, a proportion of admittedly forced material. In this case the trouble and its removal were indubitably connected with the malt by the brewer and his chemist working together scientifically, varying only one condition at a time. The malt is the first thing to be blamed when anything goes wrong, and at times no doubt is the cause of trouble, but it is rarely indeed that the connection established amounts to anything like a proof. The chemists to two large breweries tell me that they have ceased to determine the matters soluble in cold water—the leading test for forced malt. But the strongest ground I have for supposing that forced malt cannot be wholly bad is the knowledge that it is made in brewers' own maltings, presumably because it is found economical and innocuous, or even wholesome. So far as I know such malt finds extensive use at present only in the production of black beers. But one cannot forget that the brewers who complained most loudly of forcing when it was prevalent, now contrast the ale of those days with the beverage of to-day to the detriment of the latter. Many things have changed no doubt, but it is at least possible that we are again face to face with a new illustration of the old adage that "beer is made on the kiln."

To come now to the question of extract. When the chemist was first called to the brewers' aid, he must have been at once impressed by the large differences in the prices paid for materials which on analysis seemed so similar. As I have said before, the chemist in the non-chemical industries has great difficulty in initiating any experiment which may involve some immediate outlay, but which promises no certainty of anything more material than increased knowledge as a result. When the day of diminishing profits arose, however, he had less difficulty in getting a trial for cheaper materials whose use promised an immediate saving. In fact it appears that in some breweries the chemist is, if not the buyer, at least the most trusted adviser of the buyer. Let me quote a contract note given in Baker's article (*loc. cit.*):—

"Sold to Messrs. ——— 1000 quarters pale English malt @ 39s. per quarter of 336 lb., to be delivered to ——— with a guaranteed laboratory extract of 96·5 lb. per quarter of 336 lb. The deliveries to be of substantially the same quality as the sale sample, and to have a colour of about 4 and a diastatic power 35°. The determinations to be carried out under the conditions laid down by the Malt Analysis Committee. 1905. Any variation in the extract, should it exceed 0·75 lb. per quarter, to be allowed for either by us ——— or by Messrs. ——— in proportion to the price per quarter."

Now the very attempt to frame such a form of contract is a recognition that malting more and more tends to become as frankly competitive an industry as say the engineering trades. As such free competition seems inevitable and imminent, it is important that a form of contract, satisfactory to all parties concerned, be arrived at with the least possible delay. The best maltsters will welcome anything which secures them payment for striving to meet the brewer's exact requirements, efforts which before the days of open competition were rewarded by an uncertain preference. The brewer will be glad to know at the beginning of the season what his extract will cost him, and to feel that his contracts are so framed as to make it the maltster's interest to deliver up to sample in other respects such as quality.

It is because I think that Mr. Baker's form of contract fails in this latter respect that I take this opportunity of criticising it. It is true that certain districts produce barleys which in turn yield malts of high extract and only medium quality, as that term is usually understood by brewers. But in a given district (and a maltster may be presumed to buy most of his barley in his own markets) extract follows quality, but does not increase in proportion as the price increases. I speak, of course, of large bulks and not of individual small parcels, which may seem to upset my general statement. To come now to figures. Mr. Baker ignores a difference of 0·75 lb. either way, and seems from his illustrations to regard double this amount as reasonably to be expected. His contract provides for an allowance at the rate of 4·8d. per lb. after the first 0·75 lb. A maltster who has entered into such a contract may deliver up to sample, submit to a penalty, or try to earn a bonus. We will see where his immediate advantage lies. My own experience shows me that the difference in cost to the maltster between malt having an extract of 95 lb. and 98 lb. per quarter may well be 2s. 6d., or, say, 10d. per lb. Mr. Baker allows 4·8d. nominally, in practice you will see immediately much less. The other 5d. or more is what the maltster has to pay for the quality which accompanies higher extracts, and he cannot afford and is not likely to give this away to people who cannot appreciate it. We will suppose that the maltster by delivering exactly up to sample secures to himself a profit P; his profit if he delivers malt of the extract per quarter stated in the left hand column will be as much more or less than P as is stated in the right hand column.

Extract in lbs. per quarter of malt delivered.	Reduced cost of barley.	Increased cost of barley.	Bonus.	Penalty.	Profit.
95·0	15d.	—	—	−3·6d.	P + 11·4d.
95·75	7·5d.	—	—	—	P + 7·5d.
96·5	—	—	—	—	P
97·25	—	− 7·5d.	—	—	P − 7·5d.
98·0	—	− 15d.	3·6d.	—	P − 11·4d.

I think it will be agreed that Mr. Baker's form of contract puts a premium on poor deliveries: it, in fact, assesses the difference in value between two maltsters' deliveries at 7d. when their cost may have differed by 2s. 6d. The difference, 1s. 11d., cannot differ much from the average profit of the maltster to-day, and may exceed it. Mr. Baker may meet me by saying that so great a difference in value would be revealed by other indications. But where does he provide for this in his contract, except in the words "of substantially the same quality as the sale sample"? And why all this accurate adjustment of extract for the sake of 7d. if the larger sum of 1s. 11d. is to be covered by this indefinite clause, and adjustable only in the old-fashioned way, by arbitrary allowance? In practice such allowance is either not claimed or an extravagant claim is preferred. In the old days a suppressed claim affected the preference shown to the maltster when seeking to renew his contracts. But if malting is to be competitive, we must discover means to measure quality no less accurately than extract. With the researches of Beaven and the Transactions of the Guinness Research Laboratory at our disposal, perhaps we shall not have to wait long for a method based on some of the information there made public.

In the absence of such a method, however, I would suggest to Mr. Baker that quality as well as quantity of extract might be temporarily secured as follows:—The allowance of 0·75 lb. either way, originally intended as a concession to the maltster, to be discontinued, and the penalty or bonus to be at the rate of 10d. per lb. per quarter. This may necessitate raising the contract price, or, which may be more convenient, lowering the guaranteed extract. But prices may be left to adjust themselves. Mr. Baker's system holds out a preference to the man who shows a sample superior to his bulks; content to pay a penalty and sure of a profit, such a man can afford to accept a low price and spoils the market for his more scrupulous competitors. The modification I suggest avoids this. It is fair to suppose that Mr. Baker expects to receive on the average malt which is 0·75 lb. below sample, just avoiding a penalty. We will then assume that his contract note is modified as I have suggested, and that in addition the guaranteed extract is fixed at 95·75. Reconstructing our table of profits on this basis we get the following result:—

Extract in lbs. per quarter of malt delivered.	Reduced cost of barley.	Increased cost of barley.	Bonus.	Penalty.	Profit.
94·25	15d.	—	—	– 15d.	P
95·0	7·5d.	—	—	– 7·5d.	P
95·75	—	—	—	—	P
96·5	—	– 7·5d.	7·5d.	—	P
97·25	—	– 15d	15d.	—	P

On this system the maltster's profit becomes a fairly constant quantity, and the brewer pays for what he receives in quality which he values, and does not pay for it when it is lacking. If it be desired to place a premium on quality, then the penalty or bonus should be increased; only those who were confident of their ability to deliver high class material would tender.

For light foreign material I prefer Mr. Baker's original form of contract, for we have no reason to suppose that the extract of, say, a 93-lb. Smyrna is worth more per lb. than that of an 88-lb. malt of similar origin and general character.

I have assumed throughout that quality is valued by the brewer. Certain Burton firms still pay high prices for barley of superior quality, and in spite of the falling dividends of some of them, I should be sorry to believe that these breweries are directed with any lack of skill, commercial or technical. If their management is as sound as their beer, we may adduce the high prices they pay as evidence that, for the production of the pale and stock ales for which they are famous, high-class material —even at very high prices—may find economic employment. To what extent quality can be economically employed in the production of running ales, the staple trade of London and of this country generally, is a question of the utmost importance to the farmer and maltster no less than to the brewer. It concerns the farmer, because on the answer depends the type and quantity of barley which will in the future be grown in certain districts in this country. It concerns the maltster because, till answered, he finds it difficult to devise a uniform system of cost-keeping, an essential in a business which has become keenly competitive; the cost of his various grades of barley he knows, but the relative value which the brewer will put upon them seems largely a matter of caprice. And it concerns the brewer because he cannot afford to use 39s. malt where 37s. malt would serve equally well; still less can he afford to effect a temporary economy by substituting 37s. for 39s. malt if loss of trade is to result.

To the experimental breweries, which certain far-seeing firms have established, must we look for the answer to this question. And the answer will come the sooner if the chemist is taken out of his laboratory and consulting room, and given a large measure of control over the experimental brewery, and allowed to apply the scientific method to the problem from the field to the public house, and so to the farmer's, maltster's and brewer's profit and loss accounts, to which lie his final appeal for judgment as to his helpfulness to the industries.

DISCUSSION.

Dr. E. R. MORITZ wrote: To that part of the paper which refers more particularly to my published communications I take no exception; I think you state my case quite fairly. There are two points raised which are arguable:—1. Does forcing necessarily decrease the yield of malt from barley? 2. Is forced malt objectionable in the brewery?

Broadly speaking, the forcing system does, in my experience, diminish the yield. Within the term "forcing" there can be comprised many modifications of the process, and by some of these it may be possible to put through a lot of stuff and yet not diminish yield. I think I could devise a system which would have that result. Still, if forced malt were unobjectionable as a brewing material, it would pay to elaborate the system, so as to combine the maximum output from a house with a yield which should be diminished to a minimum.

The second point can only be answered satisfactorily by long and varied experience. Conclusions drawn from the result of a few parallel brewings in which only one material is changed, should be accepted with the greatest reserve.

I am convinced by my experience, which happens to be a very wide one, that the economy which could be effected by forced malt, is a false economy, since the danger to the beer would, in the end, be more prejudicial to the profit and loss account than rigid adherence to an orthodox non-forcing of malt.

I can quite conceive that, in certain morbid states of brewing affairs, forced malt might be useful. That, however, proves nothing; and in the nine years which have elapsed since I published my paper on the subject, I have seen nothing to weaken my insistence on the use of malt made on the non-forcing system.

I may consider the term "forcing" to be an unsatisfactory one, and I should protest against the term being employed against a malt merely because it showed some excess of ready-formed soluble carbohydrates; nor is a malt necessarily to be absolved from the reproach of having been forced because the carbohydrates are normal. It is quite possible to get an excess of carbohydrates with certain barleys merely by prolonging the flooring beyond the needs of modification; and it is quite possible, when forcing a malt, to dodge any excess of those bodies. The best test for forcing is the flavour of malt, but the carbohydrate test is of great value when taken in conjunction with other tests, and with full knowledge of the malting characteristics of the barley which has been used.

Messrs. JULIAN L. BAKER and H. F. HULTON wrote: In those cases involving the control of deliveries of arranged contracts where the price of the malt is already decided on, and the nature of the barley is fixed by the "Quality" clause, our scheme operates solely to secure reasonable deliveries as regards extract. This extract, so far as can be seen, is only adversely affected in one of the three following ways:—(1) Excessive moisture. (2) Insufficient modification. (3) Excessive forcing (assuming that such treatment means loss of extract). The brewer neither asks for nor expects extracts above the guaranteed figure; his willingness to pay for excess extract, if obtainable, only being evidence that he does not regard such extract as being of inferior quality, when obtained from one and the same type of barley. While keeping strictly to the same barley, the extract from it sometimes varies between fairly wide limits, according to the skill of the maltster, and if, as is presumably the case, the sale sample represents a well-made piece, our scheme puts a premium on the exercise of that skill, by penalising inferior deliveries. It cannot be to the financial interest of the maltster to supply at the rate of 4·8d. per lb., extract which has cost him in superior barley an extra 10d. per lb. to secure.

Mr. Jones' objections, we submit, only apply to the formation of a contract. We venture to sum up his contention briefly, and we think justly, as follows:—Under Mr. Baker's scheme, in the long run, the maltster can only assure himself of a profit by substituting (in future deliveries) for the barley shown in his sale sample, another, which has cost him so much less than the original, that after he has paid his penalty for deficient extract, he may still be in pocket. In the first place, a substitution would be a distinct infringement of the "Quality" clause, but it is the business of the brewer to look after his own interests. In the meanwhile, consistently low deliveries would be looked upon with suspicion, and although yielding an immediate monetary set-off to the brewer, would prove no inducement to the renewal of the contract. In fact, in cases where the malt supplied was apparently satisfactory and showed no evidence of careless manufacture, and yet gave extracts much below the guaranteed figure, such deficiency by itself might well be taken as sufficient evidence of substitution, and would justify a refusal of the delivery under the "Quality" clause.

A sentence embodying this could be added to the sale note if this species of fraud was widely practised. After all, the real bone of contention is that evasive thing (as measurable in figures) "Quality." Mr. Jones himself admits its non-existence in the case of Smyrna malt, but continues his belief in it as regards English, on the grounds that certain, though by no means all, successful brewers still pay for it as a thing apart from extract. That "Quality" does not always follow extract, however, he also admits, though his figures in the two tables are based on the assumption that the one is an absolute function of the other at the fixed rate of 10d. per lb. This statement we are not inclined to admit. Neither can we accept the modification of our scheme suggested by Mr. Jones, for we do not believe it would be practicable. The method of estimating extract is not susceptible of the refinement necessary to make the suggested alteration a workable one. It certainly would not tend to harmonious relations between buyer and seller to have large sums changing hands in connection with differences represented by tenths of a lb. of extract. Again, the suggestion that the adoption of this scheme may necessitate raising the contract price or lowering the guaranteed extract, seems to discredit the value of the figure of 10d., and render it purely artificial.

The idea which was originally put forward by one of us is by no means to be regarded as incapable of improvement, for no doubt a difference of 6d. or 1s. a quarter can be detected in barley, yet in malt this is rarely the case. Greater opportunities existed for substitution of a cheaper barley in malt contracts before any analytical control of the deliveries was formulated, than at the present time. Our proposition affords some measure of protection to the brewer.

Mr. C. F. Richardson said a brewer might have all the tests he liked, but beyond that of extract or perhaps colour, he could not rely upon any one. He never would do well or have a guarantee of getting the quality he required unless he reposed confidence in the maltster. There were plenty of maltsters who would do their best to attain to the brewer's requirements without faking a sample.

Mr. R. M. Morris said they had all experienced the difficulties, if they were difficulties, stated in Mr. Jones' paper, and they were all the better for the difficulties raised by the chemists. As far as he and the firm he represented were concerned, they felt grateful to the scientific side, for they were better maltsters in every respect than they were 20 years ago. With regard to the particular question of extract on which Mr. Baker had replied to Mr. Jones, his firm had found that so far as they were concerned, it had worked well. The forcing of malt was almost as big a bombshell as the arsenic scare, and they all had to relearn their business. He agreed with a good deal of what Mr. Jones said, and also with Dr. Moritz, but thought it was safer to take the happy medium when there was a great deal of truth on both sides.

Mr. W. A. Warwick said he had known cases in which the quality of the material used had been of the highest, but the beers had not been a success. He had also known instances in which the malt had not been of the highest quality, but the beers had been a success. It was a point worth considering as to how far quality produced the better class article than beer produced, say, from inferior malt made from inferior barley within limits, which had been manufactured on strictly scientific lines and on lines which the brewer required. How far was it possible to produce sound beer from malt giving an extract of 94 or 95, malted from barley of moderate quality?

Mr. H. G. Branson complained that there was no uniformity in malt analysis. Malts were analysed by different men and different reports were received from all, and maltsters did not know how to work. There ought to be a standard method of analysing malts.

Mr. H. Ryder said he completely agreed with the last speaker about the discrepancies which occurred in chemists' analyses of malt. As to the question of extract, Mr. Jones had said there was a large difference between ¾ lb. one way or the other, but what was the difference between the value of that extract? The quality of extract was not so much from the commercial point of view as the value to the brewer. Extract was an elastic term. They could brew their malts for more extract or for less. A brewer brewing beers, however, for keen competition did not rely on the actual quantity of the extract as the quality.

Mr. Jones, in reply, said that Dr. Moritz seemed to agree that forcing might give the maltster good yields. It was unfortunate that the term "forcing" had never been satisfactorily defined, which no doubt accounted for the occasional condemnation of a sample made on what would be called correct lines. He did not plead the cause of forced malt and had an open mind as to its use. But as he knew it to be economical in production, and sometimes satisfactory in use, he had thought it worth while to suggest that the unqualified condemnation of it had proceeded too far. The increase in yield might well exceed 2 per cent., and the resulting malt be quite satisfactory for some purposes; and the increased yield was the least part of the economy effected by the process. Mr. Briant's contribution to the discussion of a paper by Messrs. Baker and Dick (J. Inst. Brewing, 1905, 372) on the "Steeping of Malting Barleys," was an instance of the operation on progress of the prevailing view. Aeration was becoming the rule in Germany, but in the light of Mr. Briant's warning British maltsters would be slow to adopt it. Mr. Baker attributed to him an admission that "quality" was non-existent in light foreign malt, and an assumption that it had existence in English, and that it was an "absolute function of the extract at the fixed rate of 10d. per lb." He could find no grounds in his paper for attributing such views to him. But he did know that most brewers placed a value on quality, that in a given district in England quality was usually accompanied by higher extract, and he believed his suggested form of contract would be preferred to Mr. Baker's by those brewers who appreciated quality, and by maltsters who appreciated its price. The price per pound of extract beyond 95 lb. per quarter was clearly not fixed at 10d. or any other sum for two districts or two seasons, and his suggestion was but a makeshift, but he believed it to be an advance on Mr. Baker's original proposal. Maltsters' profits could not be much further reduced, and if under his scheme, with its heavier penalties, the maltster was to receive as much as he did for the same article under Mr. Baker's scheme, it was clear that the nominal or contract price would have to be raised or the guaranteed extract lowered. But this did not discredit his scheme, as Mr. Baker supposed. Mr. Trotman's suggestion might not at first sight commend itself to some maltsters, but he saw no serious objection to it; a brewer sharing Mr. Baker's views might do so no doubt. He agreed with Mr. Branson and Mr. Ryder that much inconvenience had formerly been caused by the lack of uniformity in analysis. This was avoidable to-day, however. One had only to ask one's chemist to use the methods laid down by the Malt Analysis Committee, 1905, and to state on his report that these methods had been adopted.

Sydney Section.

Meeting held at Sydney, on Wednesday, November 14, 1906.

DR. R. GREIG-SMITH IN THE CHAIR.

THE FIXATION OF NITROGEN BY THE NODULE-FORMER.

BY R. GREIG-SMITH, D.SC.

During the past few years, a renewed interest has been awakened in the application of bacterial cultures of the nodule-former to leguminous crops, chiefly by the work of Moore, who endeavoured to show that the media employed for the growth and conveyance of the bacteria had been too nutritious, and the micro-organisms had in consequence become enfeebled. By accustoming them to a poor medium and keeping them there, he claimed that they remained more vigorous and more capable of fixing atmospheric nitrogen. The reasoning appears to be sound, and the results of the American experiments, as recorded by Moore, favour the idea. I believe, however, that European tests have not been so decisive, while Australian experiments have been negative.

It may be said—for one does not know in detail the methods adopted by the various manufacturers of "nitragin"—that cultures of bacteria for application to a particular crop have been grown from a micro-organism originally isolated from a nodule on the root of a plant of the same crop, and furthermore, that it has been assumed that all the bacteria in the nodules have the same activity. It is true that experiment may justify this assumption, but by the time that the test has been completed, the microbe may have lost its potency. If, however, we doubt the assumption, we realise that we know very little about the microbe, and that until we know more, we cannot hope to advance very far in being able to explain its variability or to utilise it advantageously in agriculture. In considering the properties of the microbe, we are met by the possibility that it may not be capable of fixing nitrogen, *per se*, that it may act, as it were, by suggestion, providing a something which enables the cells of the nodule or of the plant to do the fixation. Some colour was lent to this idea by the fact that Beijerinck and a number of other investigators, including myself, could not prove a fixation in artificial culture. On the other hand, Mazé (1898) showed that a fixation did occur, and since that time it has been confirmed by Moore and by Löhnis (both in 1905). I have recently been able to corroborate the results of these workers, and to indicate under what conditions the fixation occurs. My experiments have brought out certain points in the physiology of the microbe that ought to be considered in selecting a bacterium for the preparation of trade cultures. The researches have been contributed in detail to the Proceedings of the Linnean Society of New South Wales for 1906, but as they may not be readily accessible to all who are interested in the subject, I take this opportunity of bringing before a wider circle of readers the results of my work, and the conclusions to which I have been led regarding the functions and activities of the microbe.

The microscopical examination of sections of the root-nodules on the majority of leguminous plants shows, stretching from cell to cell, structures known as "infection-threads." These have been shown to consist of slime, and to contain imbedded in them the nodule bacteria. After a time the slime disappears, and the microbes appear free. If these bacteria are transferred to an artificial saccharine medium, they, as a rule, produce slime readily. From the fact that slime is formed immediately after the isolation of the bacteria, we can reason that it is being continually formed by the living microbes within the nodules. Even the absence of an infection-thread in the tissues of the lupin nodules does not indicate that the bacteria are incapable of forming these structures, for I have isolated lupin bacteria and have seen the threads produced by them in acidified media. After a time the threads lost their sharp outlines, and the bacteria appeared as felted chains of the irregular forms, known as bacteroids. Since the essential constituent of the slime is made gelatinous by acids, it is probable that the presence of the slime as an infection-thread in the young nodule is made visible by the acid of the nodular sap, and its disappearance is occasioned by the secretion of a substance by the microbes which slowly softens the toughened slime. Certain races of the bacterium undoubtedly secrete enzymes, which digest the slime after its formation in artificial culture.

But the main point to be observed is that the bacteria can and do form slime within the nodule, and as it is not exuded, it must be utilised. We have, therefore, in the slime a product of the bacterium, which is in all probability advantageous to the plant.

The great majority of the bacteria in the nodule are dead (about 99·8 per cent.), but still there are probably enough living cells (about one and a quarter millions in a nodule one-eighth of an inch in diameter) to maintain an active formation of products. As the dead bacteria colour deeply with the ordinary aniline stains, we know that they are not in process of solution, and therefore that the actively growing plant cannot be benefited by the intra-bacterial albuminoids, as some writers would lead us to believe. The living bacteria, when transferred to artificial media, exhibit differences in their slime-forming capacities. Some do not produce it upon any kind of artificial medium, others do not do so immediately, but may be induced to form it by repeated and rapid transference upon suitable pabula. The majority form more or less slime upon all kinds of saccharine media, but a few, while producing it upon artificial media with a plant basis (*e.g.*, saccharose-bean-agar), refuse to do so upon an entirely synthetic medium. Thus the slime-forming function is variable. It is furthermore variable in its persistence. An optimum formation can only be maintained with the majority of the races of the microbe by keeping up a rapid growth (transfers made at least twice a week). The minority do not appear to be quite so sensitive in this respect. The most sensitive are those which readily secrete slime-digesting enzymes.

Some of my best slime-forming races were examined to see if a fixation of nitrogen had taken place, and I found that a gain had occurred. The fixation is so small, however, that it is necessary to continue the experiments for three weeks or a month, at the end of which time the amount gained, after making due allowance for original nitrogen, &c., by check tests, is equivalent to from 0·15 to 0·6 c.c. of tenth normal alkali per 20 c.c. test, that is to say, from 1 to 4 mgrms. of nitrogen per 100 c.c. of medium. In my results, I have always expressed as zero an equivalent of less than 1 mgrm. The gain is small, but it was repeatedly obtained, and there can be no doubt that the bacterium is capable of fixing atmospheric nitrogen under the same conditions that ensure the formation of slime. Under conditions which hinder or prevent slime-formation, such as an unsuitable carbohydrate, there is little or no fixation even when there is a proliferation of cells. Conversely, conditions which favour the production of slime, such as the presence of another bacteria (*e.g.*, *Bac. levaniformans*, which can neither fix nitrogen nor form slime from dextrose, the sugar generally employed), also increase the fixation. The individual tests did not show that the gain was proportional to the formation of slime, but this could probably be accounted for by the comparatively large experimental error, the variation in the gum-content of the slimes, and a more or less autodigestion. By collecting the results, however, and taking averages, the relation between these two functions became evident. This is shown in the following table :—

Nitrogen gained, mgrms. ..	0·0	1·0	2·0	3·0	4·0
Slime formed, grms.	2·6	5·7	7·1	8·6	16·3
Number of tests included ..	16	14	16	7	3

I have a recollection that some writer advanced the idea that fixation could only occur in the acid tissues of the nodule. Such is not the case, for my experiments showed that fixation took place when the bacteria were on a medium originally and permanently alkaline. Indeed, from my work I see no reason why this micro-organism should not be credited with the power of being able to gather nitrogen from the air during its sojourn in the soil. A source of carbon is necessary, but this is also required by other soil bacteria, *e.g.*, *Azotobacter chroococcum*, that are credited with this important function. In artificial media, *Azotobacter* and *Rhizobium leguminosarum*, the nodule-former, make a powerful combination.

The importance of the slime is now apparent, and the consideration of its properties might tell us something more about its uses, while the investigation of the physiological activity of the microbe would probably tell us much concerning the formation of slime and, inferentially, of the fixation of nitrogen.

With regard to the nature of the slime, I have shown that, like all bacterial slimes, the essential constituent is a gum, which may be obtained from it by a method already described (this J., 1904, 105). It is soluble in water and becomes gelatinous upon treatment with acids. As a rule, the solutions are more or less gelatinous, but this may have been partly or entirely caused by the acid in the faintly acid slimes during the preparation of the gum. The chemical reactions of gums prepared from slimes that were produced by several races of the bacterium were much the same, while the decomposition products were identical.*

There is a bacterium, *Vibrio denitrificans*, *Sewerin*, which, while it is morphologically the same as the nodule-former, acts in an opposite manner and, as its name implies, converts the combined nitrogen of nitrates into nitrogen gas. It also produces slime on saccharine media, and the gum obtained therefrom is identical with that from the nodule-former. From this we infer that the formation of the irregular bacteroidal forms has no relation with the fixation of nitrogen as some writers suppose and that their formation is a function of the chemical nature of the gum, a condensation product of which constitutes the capsule of the bacterium. The bacteroids, like the infection-threads, probably result from the action of the acid of the sap, or that formed by the microbes in artificial media, toughening the capsule and preventing the ready separation of the intracapsular contents.

The sugars obtained from the gum by hydrolysis are the same as those derived from the carbohydrate of the nucleoproteid molecule of *Dematium pullulans*, and possibly of the nucleoproteids of higher plants. According to Kossel, the carbohydrate of certain nucleoproteids is hydrolysed to glucose and a pentose. The absence of a definite name for the pentose raises the suspicion that the gum in question had been incompletely investigated, and, indeed, it is possible that the production of furfural had been taken as indicating the pentose. Since gums which give galactose as the only recognisable sugar also yield furfural, this test for the pentoses is of no value by itself. Indeed, all bacterio-vegetable gums and possibly all other gums contain a greater or less amount of those indefinite, reducing substances which have been named furfuroïds. There is therefore reason to believe that the gum of *Rhizobium* is peculiarly adapted for building up the nucleoproteid molecule.

As in the case of all the bacterial slimes that I have examined this slime is nitrogenous, and even after being purified by repeated precipitation from aqueous solution by alcohol the gum still contains nitrogenous material. In one case, for example, 0·73 per cent. of nitrogen was found in the dry ash-free gum. Since the bacterium can fix atmospheric nitrogen, and since the slime is nitrogenous while the dead bacteria of the nodule are not in process of solution during the active growth of the plant, it is evident that it is by means of the slime that the host-plant is benefited, and that probably both nitrogenous matter and carbohydrate serve to build up the nucleoproteids of the higher plant.

The formation of nodules by the bacterium need not be considered as the result of an irritating parasitic action of the micro-organism as some writers imagine, but rather as the consequence of the production of nutrients at that place, the cells in the immediate vicinity of the microbe being better nourished and therefore growing faster than others at a distance. The bacterium is no parasite; there is a true symbiosis between it and the plant. The latter supplies the saline and carbohydrate nutrients, while the former elaborates a nitrogenous slime which is utilised by the plant.

The bacteria are not restricted to the nodule, but may be found at other places. I have isolated them from the stems of lupins, but when taken from these relatively very acid places, they are incapable of forming slime, although by appropriate treatment they can be induced to regain some of the power which they had lost.

The production of slime, which can be measured with the balance, enabled the physiological activities of several races of the bacterium to be investigated with some degree of precision. I use the term "bacterium" in a general sense, for, thanks to having been able to examine the microbe while producing slime luxuriantly (when it was, so to speak, "plump"), I have been able to show that it is a compound organism, allied to *Leuconostoc* or the *Streptococcus* and consisting of cocci contained within a rod-shaped or branching capsule. On this account, I still prefer to name it by Frank's designation, *Rhizobium leguminosarum*, rather than by Beijerinck's *Bacillus radicicola* or *Pseudomonas radicicola* of some American workers.

For the formation of slime a source of carbon is essential, and it may be either dextrose, lævulose, saccharose, maltose, or mannit. Glycerin will also serve, but lactose is a very poor nutrient. The use of whey, therefore, as a basis for the preparation of a medium would probably lead to disappointment. Although there is no necessity for supplying a source of nitrogen, still for a luxuriant and rapid production of slime it is advisable to add some nitrogenous substance; asparagin and nitrate are best, peptone and urea are good, while ammonium salts, such as the phosphate and sulphate, are bad unless organic salts are present.

The majority of the races showed individual differences in response to the action of single nutrients, which showed that they were physiologically different. It was curious that three races from Král, of Prague, *viz.*, lupin, pea, and bean, occupied a group by themselves; there was very little difference between them, and they differed greatly from my Australian races. This may have been on account of their having lost their original slime-forming power and having been induced to regain it under laboratory conditions. This is quite in keeping with my work upon other gum bacteria, the conclusions from which have led me to believe, and, indeed, one infection experiment clearly brought it out, that the host-plant can bring about an alteration in the gum-forming faculty of a bacterium lodging in its tissues, and cause it to produce a particular kind of gum. The majority of the bacteria which are responsible for the production of the vegetable gums belong to a group of microbes, and when this is considered in relation with the action of the host-plant, we have the possibility that there is, or was, one original race or type.

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* A strong solution (mucilage) of the gum is coagulated by alcohol, basic and ammoniacal lead acetates, ferric chloride, phosphotungstic acid, and by copper sulphate, followed by potassium hydrate. Neutral lead acetate or barium hydrate produces a clot, a precipitate, or a gelatinisation. Tannic acid gives an opalescence, and no reaction is obtained with copper sulphate, Fehling's solution, ammonio-copper hydrate, milk of lime, silver nitrate or iodine.

The gum is optically active, and may be either dextro- or lævo-rotatory; that from three races of the bacterium had the specific rotations $[\alpha]_D = -31{\cdot}75°, +29{\cdot}7°$ and $+31{\cdot}7°$. It is easily hydrolysed by 5 per cent. sulphuric acid to a mixture of dextrose and galactose, the former of which preponderates. Furfural is given off during hydrolysis.

It is believed that the bacteria from the nodules of one species of plant are identical, and this was partly borne out in my experiments. Races taken from the nodules of field peas in March and October were physiologically similar. The same could be said about races taken from the nodules of a single plant, *Robinia pseudacacia.* But the pea race from Král was absolutely different from the Australian pea races, and I have obtained many races from the blue lupin. One of these grew well upon vegetable media, but not at all upon synthetic media, and I have obtained other three distinct races from a *single* nodule. There is, therefore, no rule in the matter, and a bacterium taken from a nodule may or may not be identical with its companions.

The optimum temperature for the production of slime is about 22° C., but a Robinia race was exceptional in having an optimum of 26° C. A neutral or slightly alkaline medium is most favourable, but slime can still be produced upon a medium containing originally 0·033 per cent. of phosphoric acid, and probably, finally, about 0·066 per cent. of acid calculated as phosphoric. In one case, a Robinia race, the slime-formation was still active with 0·05 per cent. of phosphoric acid in the original medium. An exception to the rule that an alkaline medium is best was found in a race isolated from the blue lupin. It was acidophile, inasmuch as it formed very little slime upon slightly alkaline media, while a luxuriant formation was obtained upon media originally neutral, but soon becoming acid.

Since the power of fixing atmospheric nitrogen is bound up with the formation of slime, there is little wonder that there have been failures with the trade cultures, for although sugars, such as saccharose and maltose, and other carbonaceous substances, such as mannit and glycerin, have been used in the culture media, the formation of slime as a symptom of the potency of the bacterium has not hitherto been demonstrated, and consequently no special means have been adopted for maintaining this function. Furthermore, since we have had no means of determining the nitrogen-fixing power, the media used for propagating the microbes may have been faulty, as, for example, the whey-gelatin employed by Continental workers and firms. Mazé is apparently the only writer who has noted that there was some relation between fixation and slime, his observations having led him to the conclusion that as fixation was always accompanied by the formation of slime, the latter was the substance which conveyed the nitrogen to the host-plant.

The bacterium produces the most slime on media the nitrogenous and saline matter of which approximate to what is found in soil water, and I am, therefore, inclined to think that media containing the equivalent of about 0·06 per cent. of asparagin and 0·1 to 0·2 per cent. of alkaline phosphate is better adapted for maintaining the potency of the bacteria than the comparatively nitrogen-free media of Moore.

We have seen that the bacteria from the various species of leguminous plants differ physiologically, but not to a greater extent than the microbes from a single nodule may do, and as it is extremely probable that the host-plant can sooner or later modify the activities of the microbe to its own requirements, it is likely that one single race will suit all leguminous plants. This is quite in agreement with the experiments of Moore, who found that any one organism could infect nearly all leguminous plants, provided that it had been grown for some time upon synthetic nitrogen-free media. But it is also evident from the work that I have done, that the microbe must also be capable of producing slime. If it cannot, or if it can do it but feebly, the time required for the regeneration of the power within the tissues of the root-hairs may be too long for the microbe to be of any considerable use to the plant.

There is much to recommend the employment of a culture common for all crops, but the great difficulty would be to know what would be the best race to select. The discovery of a microbe which is acidophile, while the majority are basophile, raises the question whether or not it would be better to employ such a race. As the bacterium has to work in the acid tissues of the root-hairs and of the nodule, we should expect an acidophile race to be superior to all others, inasmuch as it would be less affected by the varying acidity of the nodular sap, with which we must connect the death of the vast majority of the bacteria. Failing the use of such an acidophile race, and, perhaps, until it is proved that it is better than a basophile race, the most reasonable course to pursue is to have a universal "nitragin" for all leguminous crops, consisting of a mixed culture of active slime-forming nodule bacteria.

DISCUSSION.

Mr. T. U. WALTON said the author had proved, by cultivating the bacteria apart from the plant, that they, and not the plant, were the direct absorbers of nitrogen from the atmosphere, secreting it as a nitrogenous slime, which thus became the source of supply for the plant. It was interesting to learn that the bacteria, though existing also in the acid stems of the plant, could only act as nitrogen-absorbers in the less acid root-nodules.

Mr. T. STEEL said it was interesting to note how the bacteria were dependent on the host-plant for the supply of carbohydrate used in producing the nitrogenous slime, which was in turn used by the plant. He thought, however, that the formation of nodule-tissue could not be attributed to the local supply of nutriment. The primary value of the bacterial slime lay in its nitrogen, and so it was utilised in every part of the plant like other food. It seemed more probable that the nodule-tissue was built up from the common stock of food available for all purposes. The nodules were formed because they were useful to the plant as a whole, and not merely because of the proximity of the supply of slime. It was probable that the slime suffered various metabolic changes in the plant before being elaborated into tissue.

Prof. A. LIVERSIDGE asked the author's opinion regarding a recent paper by Jamieson, who attributed the increase of nitrogen in plants to absorption by special organs in the hairs on the leaves.

Dr. GREIG-SMITH, in reply, said that Jamieson's opinions had not met with the acceptance of scientific men.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

(Continued from page 247.)

ENGLISH PATENTS.

Homogenising liquids and semi-liquids; Apparatus for ——. J. C. Shears, Kingston-on-Thames. Eng. Pat. 12,700, May 31, 1906.

THE materials are pumped through fine perforations in a valve-seat by a rotary or other pump. A disc, fitted by grinding to the face of the valve seating, is kept pressed against it by a spiral spring, and is rotated by gearing driven from the pump shaft. The homogenised liquid or semi-liquid escapes between the valve-seat and the disc, and any solid particles which might tend to block the perforations are ground down and removed by the rotating disc.—W. H. C.

Solids contained in liquids or semi-liquids; Process for recovering, in the form of dry powder, the ——. L. C. and I. S. Merrell, W. B. Gere, and The Merrell-Soule Co., Syracuse, U.S.A. Eng. Pat. 19,193, Aug. 28, 1906.

SEE Fr. Pat. 369,337 of 1906; this J., 1907, 110.—T. F. B.

Pyrometers; Water ——. Siemens Bros. and Co., Ltd., London. From F. T. Havard, Chile. Eng. Pat. 24,942, Nov. 6, 1906.

The claim is for enclosing the disc or block in a case of nickel or other suitable material. The case containing the disc is put into the space or material, the temperature of which is to be determined, and when it has attained the temperature of the space or material, it is removed, the disc is quickly taken out and placed in the pyrometer vessel. The case serves to protect the disc from loss of heat during its transference from the source of heat to the water vessel, and also to prevent any of the hot material from adhering to the disc and vitiating the result.—W. H. C.

Filter frame and process of filtration. H. P. Crush, Charlton, Kent. Eng. Pat. 27,592, Dec. 4, 1906.

A rectangular sheet of corrugated metal, 1, is fastened by its upper edge to a bar of wood, 3, and has its other three edges let into a slot in a pipe, 2. The frame so formed is enclosed in a close-fitting bag of filter-cloth, 6, which is caused to spread out at the top by the bent wires, 5. The filter is supported from two cross beams, 15, and is provided with an air-escape pipe, 11, and a connection, 17, to a vacuum main, 16. The filter is suspended in a tank containing the liquid to be filtered, the air escapes by the pipe, 11, which is then closed, and the connection to the vacuum is opened. The clear liquid is drawn through the cloth, and the solid matter adheres to the outside in the form of a cake. When this is of sufficient thickness, the frame is withdrawn from the tank and is suspended over a vessel to receive the cake. The vacuum is then shut off and the air-pipe opened, the wires, 5, which have been drawn inwards by the vacuum, bulge out again and cause the cake to peel off the filter and to fall into the receptacle. If desired, the cake can be washed by placing the frame in a tank containing water, before the vacuum is broken, and drawing water through; it is removed as described above.—W. H. C.

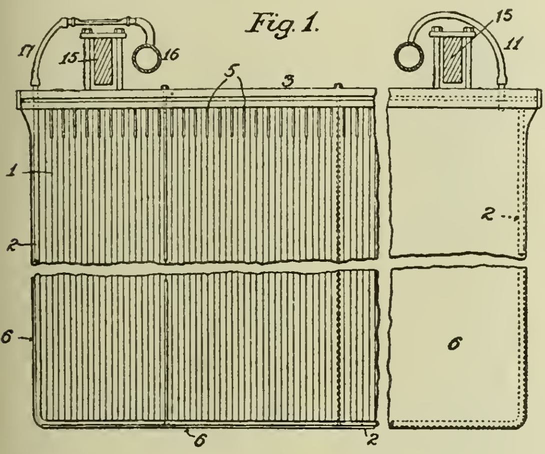


Fig. 1.

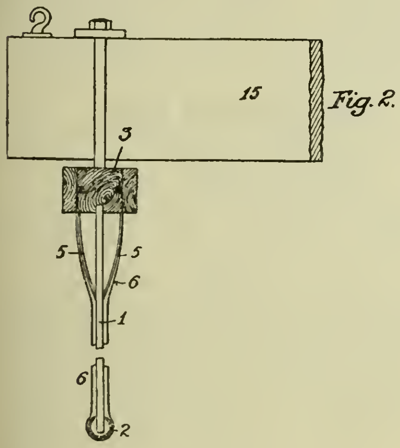


Fig. 2.

United States Patents.

Drying apparatus. J. E. Barney, Boston, Mass., U.S. Pat. 840,037, Jan. 1, 1907.

An elongated drying chamber has a heater located within it at one end and a forcing fan to drive air through the heater into the drying chamber. The air passes through the chamber to the opening of the exhaust duct at the other end. A second fan of smaller capacity situated in the exhaust duct withdraws the air from the drying chamber, and can deliver it either to the external air, or to the intake of the forcing fan. The latter, by reason of its larger capacity, causes the air to impinge violently upon the objects placed in the drying chamber.—W. H. C.

Dryer; Rotary ——. A. Berg, Anderson, Ind. U.S. Pat. 840,602, Jan. 8, 1907.

The claim is for a slightly inclined rotary dryer, surrounded by a steam jacket, and mounted so that it can be rotated. Steam pipes, connected to the annular steam space, are arranged within the drying cylinder. The steam is conveyed into the jacket, and the exhaust steam withdrawn through hollow journals at the end of the dryer.—W. H. C.

Drying drum. E. Vial, Brussels. U.S. Pat. 840,883, Jan. 8, 1907.

See Fr. Pat. 364,291 of 1906; this J., 1906, 898.—T. F. B.

Centrifugal machine. F. Kaehl, Berlin, Germany. U.S. Pat. 840,497, Jan. 8, 1907.

The drum of the machine is formed of two frusto-conical sections connected together at their largest peripheries by a perforated ring, and mounted by a "spider" on a vertical shaft, by which the drum can be rotated within a casing. The upper opening of the compound drum is larger than the lower, through which the material to be separated is fed by a pipe. The separated liquid portion flows away over the edge of the upper opening, and the solid matter is removed from the interior surface of the drum by stationary scrapers, carried by a sleeve which fits over the central shaft, and is discharged through the perforated ring which connects the upper and lower halves of the drum together.—W. H. C.

Separator; Centrifugal ——. N. S. Bök, Stockholm. U.S. Pat. 841,370, Jan. 15, 1907.

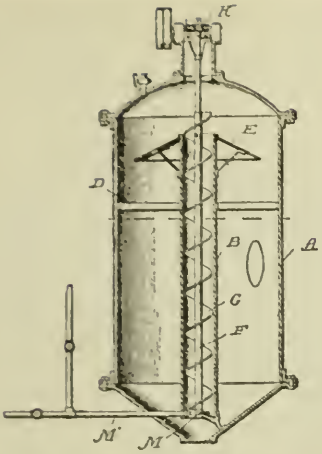
See Fr. Pat. 355,062 of 1905; this J., 1905, 1162.—T. F. B.

Still. A. S. Carr, Hattiesburg, Miss. U.S. Pat. 840,607, Jan. 8, 1907.

An inclined retort, having a charging door at the upper end and a discharging door at the lower end, is set in brickwork over a furnace. Compressed air and/or steam, which may be superheated by passage through a pipe set in the furnace, can be delivered into a perforated pipe arranged along the lower inclined side of the retort. The latter has also a discharge pipe at the lower end, just before the discharge door. The upper end of the retort has a vapour pipe connected to a safety-valve device, from which a pipe leads to a condenser, so that the vapour can only escape from the retort to the condenser when there is sufficient pressure within the former to open the safety valve.—W. H. C.

Crystallisation; Apparatus for ——. A. L. Marshall, New Orleans, La. U.S. Pat. 841,030, Jan. 8, 1907.

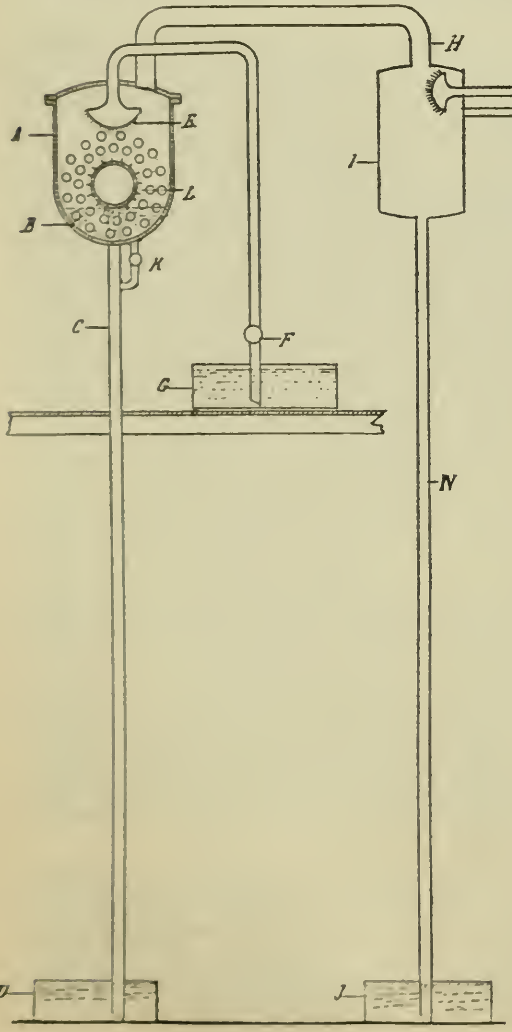
A vertical tube, B, open at both ends, and mounted axially in a tank, A, has a screw, G, rotated within it, by a shaft, F, and the gearing, K. A "scattering-plate," E, is mounted on the top of the tube, B, and a supply of compressed air, the temperature of which can



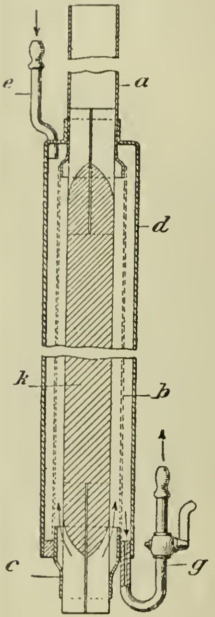
be varied as required, is delivered by a pipe, M, into the bottom of the tube, B.—W. H. C.

French Patents.

Evaporation; Process and apparatus for production of continuous spray in air or vacuum ——. Soc. E. Fontenilles et Cie. Fr. Pat. 371,440, Oct. 22, 1906



The apparatus consists of an evaporating chamber, A, provided with heating pipes, B, and a rotatable drum, L, on the exterior of which are a number of blades. The evaporator is connected by the pipe, H, with a spray-condenser, I, fed with water by the pipe, O, and connected to the vacuum pump by the pipe, M. Both the evaporator and condenser have barometric fall tubes, C and N, connecting them with the tanks, D and J. The liquid is drawn into the evaporator, by the vacuum, through the pipe, F, from the tank, G, and is converted into spray by the rose, E. The spray falls upon the heating pipes, and is concentrated. A further quantity of spray is produced by the drum, L, the blades of which dip into the liquid collecting in the bottom of the evaporator, up to the level of the overflow pipe, C. The vapour passes to the condenser, I, where it meets the water spray and is condensed.—W. H. C.



Dissolving a gas in liquids; Process and apparatus for ——. H. Stroh. Fr. Pat. 371,308, Nov. 10, 1906.

The apparatus consists of a casing, *d*, having gas inlet and outlet pipes, *e*, *g*, and through which a tube, *a*, passes. That portion of the tube, *a*, which is within the casing is formed of wire gauze, *b*, which may be covered with a permeable membrane. A solid core, *k*, is placed concentrically within the tube, *a*, as shown, to reduce the internal space. The liquid enters the tube at *c*, flows upwards through the annular space, and leaves at the top. The gas enters at *e*, flows downwards in contact with the liquid particles on the surface of *b*, and is either wholly or partially absorbed, any residue escaping through the pipe, *g*.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 250.)

English Patents.

Blocks, briquettes, and the like; Manufacture of ——. R. Friedlaender, Berlin. Eng. Pat. 5051, March 1, 1906.

This invention relates to a method of producing blocks, briquettes, and the like from materials in the form of powder or small grains of all kinds, such as coal, sawdust, food and alimentary articles, &c., without the use of any binding agent, by subjecting the materials in a dry or slightly moistened state to an exceedingly high pressure, amounting at least to 800, and generally to several thousand atmospheres. The pressure is not applied suddenly, but is gradually increased, to allow the air and moisture to escape completely from the material under compression, and at the last moment the pressure is increased to the extent required to render "the mass plastic and coherent." To carry out this process, an apparatus is used that comprises a pressure-plunger, a counter plunger, and a rotatable mould-table. If the mould-table rotates in a fixed horizontal plane, it is provided with interchangeable pressure moulds, the weights of which can be adjusted to the nature of the material to be compressed, and to allow of the escape of air and moisture from the material, these moulds or sleeves, during the process of compression, slide up the upper, fixed counter-plunger, the amount of this sliding movement increasing with the pressure. The same purpose can be attained by constructing the mould-table in such a way that it can move vertically up and down in the direction of its axis of rotation, so that the upper, fixed counter-plunger penetrates a certain distance into the moulding box during the compressing process. In this way the counter force produced by the weight of the pressure mould or of the mould-table can be regulated relatively to the friction exercised by the material on the walls of the mould, in accordance with the required expulsion of air from the material, and the length of the air passage between the counter-plunger and the inner surface of the pressure mould is inversely proportional to the quantity of air to be expelled.—W. C. H.

Gas and air ; Apparatus for mixing —— for illuminating purposes. Akt.-Ges. f. Selasbeleuchtung, Berlin. Eng. Pat. 8067, April 3, 1906. Under Int. Conv., April 4, 1905.

See Fr. Pat. 364,840 of 1906 ; this J., 1906, 919.—T. F. B.

Mantles ; Incandescence gas ——. C. P. E. Thorpe and O. W. Dougan, London. Eng. Pat. 13,181, June 7, 1906.

The mantles, before burning off the collodion stiffening, are dipped into a solution of corrosive sublimate, or about 20 per cent. of such a solution may be added to the collodion stiffening solution. The mantles are dried, and when burnt off, they are said to be more tough and durable than they were before the treatment, and the luminosity is said to be only slightly affected.—W. H. C.

Incandescence bodies composed of tungsten for incandescent lamps. Consortium f. Elektrochem. Ind., Nuremberg, Germany. Eng. Pat. 15,021, July 2, 1906. Under Int. Conv., July 5. 1905.

See Fr. Pat. 367,009 of 1906 ; this J., 1906, 1085.—T. F. B.

United States Patents.

Gas and coke ; Apparatus for making ——. L. P. Lowe, San Francisco, Cal. U.S. Pat. 839,939, Jan. 1, 1907.

The apparatus comprises a casing, having "an open roof," below which is a coking and combustion chamber. Refractory material is loosely piled in the "roof." A discharge door is provided at the bottom of the coking chamber to remove the coke from it, and a feed door at a higher level to feed coal or tarry residues into the coking chamber. An oil burner discharges directly into the coking chamber, not lower than the level of the feed door. The products of combustion pass through the open "roof" to heat the refractory material, and are removed through a flue at the top of the apparatus. Means are provided for shutting off the air supply to the oil burner, and to supply oil and steam, thus generating gas in contact with the hot refractory material, which gas is led off through an independent conduit.—R. L.

Gas generator. J. D. Dawson, Beardstown, Ill. U.S. Pat. 840,115, Jan. 1, 1907.

The apparatus comprises an air receiver, from which air is delivered at the bottom of a gasolene tank, through a pipe having vertical nozzles covered by hoods. A small pipe, open at both ends and running inside the air-supply pipe, allows some of the air to pass from the receiver to the outlet pipe of the gasolene tank without coming into contact with the liquid. In the apparatus shown, the supply of air to the receiver is obtained by a compressor driven by a falling weight.—A. T. L.

Gas producer. P. Eyermann, Dubois, Pa. U.S. Pat. 840,447, Jan. 1, 1907.

The producer comprises a brick-lined body-portion, with the usual fire-grate, an upper double-walled metallic casing forming an annular chamber, provided with an inlet pipe and an outlet pipe connected to the ash-pit, a feeding hopper, and a depending fuel-container. Steam- or water-supply nozzles enter the producer below the grate, and at the middle and top of the body portion, and there is a gas-outlet pipe near the top of the producer. Means are provided for producing a down-draught, and gas may be led away through an outlet at the level of the grate having a baffle to deflect the gas upwards.—A. T. L.

Producer gas ; Process of manufacturing ——. W. H. Adams and F. Powell, Portland. Oreg., Assignors to The Ladd Metals Co. U.S. Pat. 840,461, Jan. 8, 1907.

The gas is made in a water-bottom producer, having firebars to support the fuel. Air is admitted above the grate at one side of the producer, and the exit of the gas takes place at the same level on the opposite side. Steam may be admitted below the grate at the same side of the producer as the air inlet, and liquid fuels, rich in volatile hydrocarbons, may be introduced at the top of the producer near the feeding hopper.—A. T. L.

Gas producer. C. J. Atkinson, Milwaukee, Assignor to International Harvester Co. U.S. Pat. 841,100, Jan. 15, 1907.

See Eng. Pat. 25,310 of 1905 ; this J., 1907, 40.—T. F. B.

Gas producer. H. K. Cowen, Chicago, Assignor to International Harvester Co., New Jersey. U.S. Pat. 841,123, Jan. 15, 1907.

The gas producer described contains a fire-pot connected with an air chamber, a fuel magazine which delivers the fuel to the fire-pot, and a chamber above this magazine. The air chamber and upper chamber are connected by a pipe. An explosion engine is connected with the producer. The exhaust port of the engine supplies a pressure tank, which communicates with the pipe connecting the air chamber and upper chamber, thus ensuring a downward flow of the gas, which may be controlled by suitable means.—R. L.

Gas generating retort. T. L. Stewart, Oakland, Cal., Assignor to Stewart and Cooley, Melrose, Cal. U.S. Pat. 841,466, Jan. 15, 1907.

The "retort" consists of a vertical, cylindrical casing, containing a series of horizontal pans or trays mounted on a hollow, vertical, rotating column, through which a heating medium is passed. Oil is supplied to the uppermost tray and passes through openings in successive trays to the bottom of the "retort," which is provided with an outlet for the residue. Air is admitted near the bottom of the "retort," and the gas generated is led away at the top. The oil is spread over the surface of the revolving trays by brushes fixed to the walls of the casing. The bottoms of the trays are hollow, and form chambers communicating with the interior of the central column. These chambers are provided with horizontal baffles, so that the heating medium is brought thoroughly into contact with the vaporising surfaces of the trays. The cylindrical casing is double-walled, the annular space being filled with non-conducting material.—A. T. L.

Power gas ; Process of manufacturing ——. E. Fleischer, Dresden-Strehlen, Assignor to J. E. Goldschmid, Frankfort, Germany. U.S. Pat. 841,499, Jan. 15, 1907.

See Eng. Pat. 26,770 of 1904 ; this J., 1905, 324.—T. F. B.

Arc-light carbon. A. Kufferath, Assignor to L. C. Marquart, Beuel, Germany. U.S. Pat. 840,222, Jan. 1, 1907.

Arc-light carbons for the production of a powerful actinic light are made by adding to the carbon ½ per cent. of a mixture containing equal parts of yttrium nitrate and lead nitrate.—R. L.

Refractory metallic wires or filaments ; Art of making ——. H. C. Parker, New York, and W. G. Clark, Seattle, Wash., Assignors to Parker-Clark Electric Co., Jersey City. U.S. Pat. 840,246, Jan. 1, 1907.

A mixture of iridium chloride and ammonium chloride is deposited on a suitable surface in band or tape form, a volatile reducing agent is added, and the salts are then reduced to metal by heating the tape. The metallic tape is finally slit into wires or filaments.—R. L.

French Patents.

Gas generators. J. R. George. First Addition, dated Oct. 2, 1906, to Fr. Pat. 334,235, July 29, 1903 (this J., 1903, 1189).

The stationary part of the feeding hopper is provided with fixed scrapers, that extend over the distributing plate in the rotating portion of the hopper and ensure the regular and uniform feeding of the fuel when the latter is damp or contains small coal.—H. B.

Gas generator. A. Rosenberg. Fr. Pat. 370,270, Oct. 5, 1906. Under Int. Conv., July 26, 1906.

THE generator, which is designed for the production of gas by the reaction of a liquid upon a solid comprises a cylindrical vessel, provided with a movable cover and nearly filled with water or other suitable reacting liquid; a cylindrical casing of smaller diameter, which serves as recipient for the solid reagent, depends centrally from the cover to near the bottom of the liquid, and is perforated at its lower end to permit the liquid to rise within it as required. The central casing is closed gas-tight at the top by a rotatable plug-valve, a pocket in which allows fresh quantities of the solid reagent to be dropped into the recipient without gas escaping. To start the apparatus, after charging it with the liquid and solid, air is pumped into the space between the liquid and the cover, until the desired pressure is reached. This forces a certain quantity of the liquid up into contact with the solid, and gas is generated in the inner casing; the gaseous pressure forces back the liquid, preventing further reaction; and thereafter the production of gas proceeds automatically, according to the consumption of the gas. The apparatus is fitted with a pressure gauge, safety-valve, gas outlet pipe, and a whistling device for indicating when the solid requires to be renewed.—H. B.

Gas for heating or motive purposes; Apparatus for the production of —— from powdered fuel. G. Marconnet. Fr. Pat. 370,301, Oct. 8, 1906.

THE apparatus consists of a vertical, cylindrical chamber, built of refractory material, at the bottom of which there is supplied, either by blast or by suction, a mixture of air and coal-dust, which enters the chamber tangentially and burns during its ascent through the chamber, with the production of tar-free combustible gas. Owing to the high heat prevailing in the chamber, the incombustible residue from the fuel partly fuses and collects at the bottom, where it is drawn off continuously or from time to time. Any dust which accompanies the gas is removed by passage through a dust-collecting chamber and a reducing column of coke, which may be arranged above or alongside the combustion chamber. Apparatus is described for the production of a continuous supply of a mixture of coal-dust and air of constant composition.—H. B.

Gas of little value produced during dry distillation of coal; Removing without danger ——. H. Koppers. Fr. Pat. 370,690, Oct. 23, 1906. Under Int. Conv., Oct. 23, 1905.

IN order to remove, without danger of explosion, the combustible gases of little value evolved in gas-retorts or coke-ovens during stoppages, charging, and discharging, the retorts or ovens are connected by valved pipes to a by-pass from the main chimney flue, through which the gaseous products of combustion flow continuously. When a stoppage is effected, communication is opened between the retort or oven and the by-pass flue, whereby the gases are admitted into the stream of indifferent flue gases, and become so diluted that there is no danger of explosion.—H. B.

Gas producer for use with all kinds of combustibles, especially woody waste. H. Sire de Vilar. Fr. Pat. 371,268, Nov. 9, 1906.

THE producer described comprises a combustion chamber and a reducing chamber. The heat required to maintain the reducing column in the latter in a state of incandescence is derived from a supplementary combustion of the fuel, already partially burnt. This supplementary combustion is effected on a grate constructed in such a manner that it will only accommodate a thin layer of fuel, in order to favour exothermic reactions, from which the requisite amount of heat for the purpose may be derived. The volatile products given off in the region of the combustion chamber, which is above the fire-grate, are led by an external pipe into the fire-grate, to be converted there into permanent gases; the movement of the gases in this pipe in the required direction is due to the resistance offered to them in it being less than that presented by the whole column of fuel. Steam is generated in a number of Field tubes, enclosed in a small passage between the two chambers. These tubes can be easily taken out for cleaning, and, when the apparatus is working with a moist combustible, can be removed altogether, and their place taken by a flat plate. The scrubber attached to the apparatus consists of a number of similar superposed elements, in each of which is a washing device consisting of two bundles of perforated metal plates (the holes of one plate being opposite the unperforated portions of the other). Water flows down these plates from a perforated shallow basin on top of them, and the gases are compelled to pass horizontally across the bundles of plates, and are washed by contact with, and through the streams of water. The apparatus is provided with a purifying fan, on the forcing side of which a constant pressure is ensured, in spite of variations in the demand for gas, by a double box, which allows several passages for gas through the fan. The continuous working of the engine is ensured by the use of a diaphragm, which separates the exhaust and pressure chambers connected with the fan, and by the use of adjustable overflow levels in them.—W. C. H.

Gas; New method of production of industrial lighting and heating ——. L. Vignon. Fr. Pat. 371,337, Nov. 12, 1906.

ACCORDING to this invention an industrial lighting and heating gas is produced by the action of a mixture of water-gas and steam on iron or its oxides, at a red-heat, or on some other "contact body," such as platinum, at a suitable temperature. The carbon dioxide formed in the reaction is subsequently absorbed.—W. C. H.

Illuminating and heating gas; Process of carbonising coal for producing ——, and apparatus therefor. W. Young and S. Glover. Fr. Pat. 371,383, Nov. 12, 1906. Under Int. Conv., Nov. 17, 1905.

SEE Eng. Pat. 23,650 of 1905; this J., 1906, 1033.—T. F. B.

[Electric] Incandescence bodies with tungsten; Manufacture of ——. Consortium für Elektrochem. Ind., Nürnberg. Fr. Pat. 371,435, Oct. 16., 1906. Under Int. Conv., Oct. 16, 1905.

THE object of this invention is the production of slender incandescence bodies for electric lamps with tungsten. The process consists in making a thicker body with tungsten in a molecular state, for instance, as obtained in the reduction of the oxide by hydrogen, and converting this into a slender body by subjecting it to a very high temperature.—W. C. H.

GERMAN PATENT.

Gases; Process for the purification of ——. Verein. Maschinenfabr. Augsburg und Maschinenbauges., Nürnberg, A.-G. Ger. Pat. 169,818, Dec. 24, 1904.

THE process consists in circulating the gas to be purified through a main or pipe disposed in the form of a ring. A blower and one or more purifiers are arranged in the circuit. Further supplies of crude gas are introduced, and purified gas is withdrawn continuously through pipes, the diameter of which is only a small fraction of that of the main pipe, so that the gas to be purified has to pass through each purifier several times before it passes out of the circuit.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page 250.*)

Octanes from coal-tar oils. F. B. Ahrens. Ber., 1907, **40**, 848—852.

THE material consisted of oils obtained from toluene after nitration. It was distilled, and freed from toluene by treatment with a mixture of nitric and sulphuric acids.

The fraction boiling between 121° and 122° C. forms a colourless liquid, having a sp. gr. of 0·7245 at 23° C., and solidifies in liquid air to a mass resembling paraffin. The monochloro derivative is a colourless, the dichloro derivative a yellow liquid, boiling at 164°—166° C. and 122°—124° C. (49 mm.) respectively. For the production of nitro-compounds the hydrocarbon was heated for 12 hours at 130° C. with five parts of nitric acid of sp. gr. 1·075. The residue left on evaporation was partly syrupy and partly crystalline in character, and consisted of two acids, which were separated by crystallisation from alcohol. The syrupy acid agreed in properties with β-methylhydroxyglutaric acid, whilst the crystalline acid was obtained in the form of small white crystals, melting at 184° C. The tertiary and secondary nitro-compounds are colourless liquids, distilling at 113°—114° C./36 mm. and 114°—115° C./30 mm. respectively, their specific gravities being 0·9671 and 0·9342 at 19·5° C. Of the amino-compounds formed from the nitro-compounds by reduction, the tertiary base is a colourless, strongly-smelling liquid, boiling at 155°—156° C., and having a sp. gr. of 0·8051 at 22·5° C., whilst the secondary base forms two picrates, melting at 108° C. and 82°—83° C. respectively, from which potassium hydroxide separates a colourless, strongly-smelling base, which boils at 164°—166° C., and has a sp. gr. of 0·801 at 22·5° C., and a base having a boiling point of 163°—164° C., and a sp. gr. of 0·788 at 22·5° C.—D. B.

Sulphur; Determination of —— in preparations of ichthyol, by means of sodium peroxide. W. Hinterskirch. XXIII., page 347.

Petroleum refining; U.S. census of ——. Oil, Paint, and Drug Rep., March 11, 1907. [T.R.]

The following table presents the general statistics for the establishments engaged actively in petroleum refining at the censuses of 1900 and 1905:—

	1905.	1900.
Establishments	98	67
Capital	$136,280,541	$95,327,892
Salaried officials	1,974	1,201
Salaries	$2,724,065	$1,811,400
Wage earners	16,700	12,199
Wages	$9,989,367	$6,717,087
Miscellaneous expenses	$5,297,508	$3,330,851
Cost of materials	$139,387,213	$102,859,341
Value of products	$175,005,320	$123,929,384

The following table shows the kind, quantity, and cost of the materials used at the censuses of 1900 and 1905:—

	1905.	1900.
Materials used, total cost...	$139,387,213	$102,859,341
Crude petroleum—		
Quantity (barrels of 42 galls.)...............	66,982,862	52,011,005
Cost	$107,487,091	$80,424,207
Fuel	$5,139,934	$3,120,441
Acids	$2,304,635	$1,735,782
Barrels, cases, &c.	$5,880,310	$2,930,805
Coopers', carpenters' and tinners' materials......	$11,990,038	$8,220,928
Mill supplies	$403,886	$228,926
All other materials	$5,666,501	$3,300,851
Freight	$514,818	$2,897,401

The cost and quantity of crude petroleum used at each census has increased steadily. The increase in cost for 1890 over 1880 was $28,539,202; for 1900 over 1890, $35,544,424; and for 1905 over 1900, $27,062,884. In 1905 the term "acids" included sulphuric acid, alkali, sulphur, and pyrites; in 1900, acids, alkalis, and sulphur; in 1890, sulphuric and all other acids; and in 1880, sulphuric acid, hydrochloric acid, and sulphur. In 1905 the quantity of sulphuric acid used in refining was 211,531 tons. In 1905, 1 lb. of sulphuric acid was used to 6·6 galls. of crude petroleum; in 1890, 1 lb. to 6·7 galls.; and in 1880, 1 lb. to 8 galls.

The following tables show the details of the industry as to the kind, quantity, and value of products, and average price per barrel for the censuses of 1905 and 1900:—

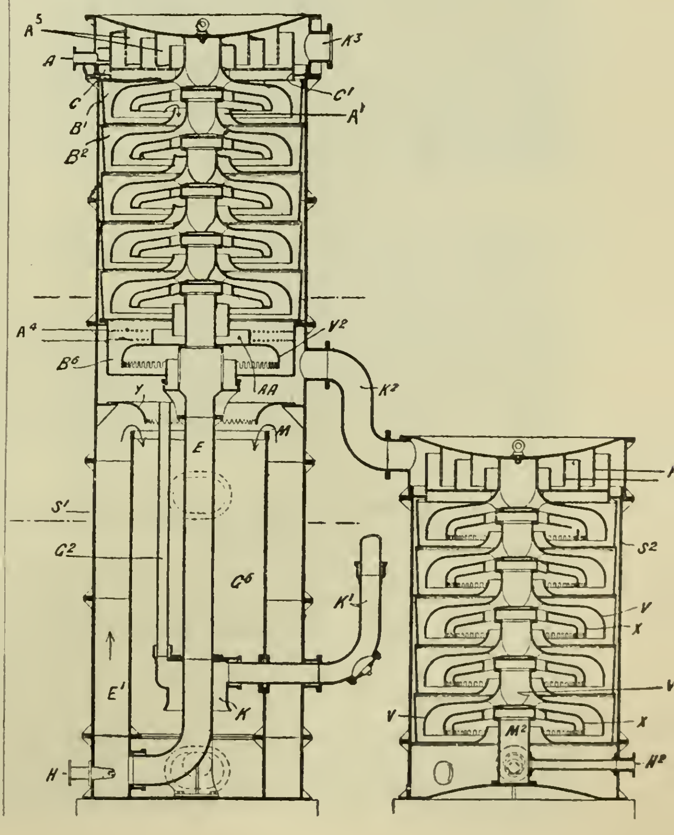
Product.	1900.		1905.	
	No. of barrels.	Value.	No. of barrels.	Value.
		$		$
Burning oils.	31,266,513	82,244,961	34,344,522	100,571,825
Residuum ..	596,615	688,455	3,187,921	3,138,361
Paraffin oils	1,606,783	3,987,037	1,644,400	6,210,279
Paraffin wax	774,924	7,791,149	794,068	10,007,274
Reduced oils	1,766,090	7,108,168	4,352,248	16,794,789
Naphtha and gasoline ..	5,615,554	15,991,742	5,811,289	21,314,837
Neutral filtered oils .	608,185	2,256,626	504,042	1,942,153
All other products	—	3,861,246	—	15,025,802

The following table shows the percentage which the quantity of each product formed of the total quantity of crude petroleum used for the censuses from 1880 to 1905:—

	1905.	1909.	1890.	1880.
Burning oils.............	61·0	71·6	65·9	75·2
Residuum	5·7	1·4	4·6	1·6
Paraffin oils	2·9	3·7	2·7	0·5
Paraffin wax	1·4	1·8	0·9	0·1
Reduced oils	7·7	4·0	3·3	1·6
Naphtha and gasoline ...	10·3	12·9	12·8	10·3
Neutral filtered oils	0·9	1·4	—	—

English Patents.

Distilling apparatus [ammonia]. C. C. Carpenter, London. Eng. Pat. 22,512, Oct. 11, 1906.



The liquid enters the still, S¹, by the pipe, A, and passes through the perforations, C¹, in the trough, C, into the first pan, B¹. The liquor overflows the lip, A¹, from pan to pan until it reaches B⁶, from which it flows down the pipe, E, to the chamber, E¹, where it is mixed with steam, and any required reagent admitted by the tangential nozzles, H. The mixture rises up the chamber, E¹, and flows over the lip, M, into the chamber G⁶. As it flows down this chamber, any sludge present settles out, and the liquid rises under the hood, K, fitted with the balance pipe, G², and passes through the pipe, K¹, to the still, S². The liquid flows down this still from pan to pan, and the spent liquor escapes from the bottom. Steam enters at H², into the pipe, M², and is caused to bubble through the liquid by the "boiling-rings," X. It is then guided by the hood, V, to the passage, V³, by which it passes to the pan above From the top pan of the still, S², the steam and gas, deprived of any liquid by the perforated baffles, A², passes by the pipe, K², to the chamber, AA, and into the pan, B⁶, through the double row of perforations, A⁴. The steam and gas bubble under the baffle, V², and pass upwards, finally leaving the still by the pipe, K³, after being deprived of spray by the perforated baffles, A⁵. By removing the top of either still, the pans and their fittings can be easily lifted out and cleaned.—W. H. C.

Heavy coal-tar oils ; Process for rendering —— odourless. E. Wirth. Dortmund. Germany. Eng. Pat. 24,344, Oct. 31, 1906.

The oil is mixed with from ½ to 1 per cent. of sulphur, and the mixture is heated to about 100° C. A little sulphuretted hydrogen is evolved, and the oil is said to be rendered almost odourless.—W. H. C.

United States Patent.

Oil ; Apparatus for recovering from —— its tarry or asphaltic constituents, with gas as a by-product. L. P. Lowe, San Francisco, Cal. U.S. Pat. 839,940, Jan. 1, 1907.

A distilling chamber is filled with loosely piled refractory material, which can be heated by passing products of combustion over it. Means are provided for shutting off the supply of heating gases, and "for storing the residual heat of combustion." Oil is distilled by passing it through the hot refractory material in the opposite direction. The condensable portion of the vapours is collected separately from the gases. The "stored heat" may be used to reheat the refractory material.—R. L.

German Patents.

Distillation of mineral oils, tar oils, fats, oils, and the like ; Process for the continuous fractional ——. F. Hirzel. Ger. Pat. 172,224, May 27, 1903.

The patent relates to a process of distillation in which the oil or the like is caused to flow backwards and forwards in a thin stream within the still, which is divided into two compartments by a partition. In order to maintain the temperature uniform during the distillation of a particular fraction, the liquid to be distilled is introduced in several streams, so as to form a thin layer of uniform height, just covering the inlet pipes.—A S.

Acetic acid ; Process for obtaining —— by distillation of acetic acid solution containing dissolved salts. L. Marckwald. Ger. Pat. 172,931, Oct. 5, 1904.

In the manufacture of acetic acid from calcium acetate and sulphuric acid, it is difficult to remove the free acetic acid from the charge. The process claimed consists in carrying out the distillation in presence of a volatile liquid, which is immiscible with aqueous solutions of acetic acid. For example, the acetic acid is distilled over from a mixture of calcium acetate and sulphuric acid by the aid of a current of xylol (b. pt. 130°—170° C.) vapour. The distillate separates into two layers, the lower one consisting of an aqueous solution of acetic acid, and the upper one of a mixture of xylol and acetic acid. The acetic acid is recovered from the upper layer by a series of fractional distillations.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

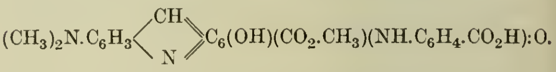
(*Continued from page* 252.)

Aminophenolsulphonic acids and aminocresolsulphonic acids. G. Schultz. Ber., 1906, **39**, 3345—3347.

Aminophenolsulphonic acid III., prepared by fusing with sodium hydroxide the anilinedisulphonic acid obtained from *m*-aminobenzenesulphonic acid, is usually regarded as 5-aminophenol-2-sulphonic acid, and the disulphonic acid from which it is derived as 3·4-anilinedisulphonic acid. This view, however, is not in accord with the fact that aminophenolsulphonic acid III. may be used as the middle component in the preparation of secondary disazo dyestuffs. The author finds that if the anilinedisulphonic acid from *m*-aminobenzenesulphonic acid be converted into the corresponding phenylhydrazine derivative, and the latter or its barium salt be boiled with copper sulphate, the amino group is replaced by hydrogen. The product of the reaction is *p*-benzenedisulphonic acid, and the two compounds mentioned above are, therefore, 3·6-anilinedisulphonic acid and 5-aminophenol-4-sulphonic acid respectively.—A. S.

Gallocyanine dyestuffs ; Condensation of —— with amino-compounds. E. Grandmougin and E. Bodmer. J. prakt. Chem., 1907, **75**, 199—200.

When "Prune pure" (Sandoz) is heated with *m*-aminobenzoic acid, sodium acetate, and glacial acetic acid to 100°—120° C., condensation takes place with the formation of a green crystalline substance, which has, probably, the formula :—

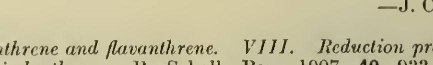


$$(CH_3)_2N.C_6H_3\left<\begin{matrix}CH\\N\end{matrix}\right>C_6(OH)(CO_2.CH_3)(NH.C_6H_4.CO_2H):O.$$

The dyestuff is soluble in alkalis and gives greenish-blue chrome lakes. The condensation product from "Prune" and *m*-nitraniline was obtained in large crystals with a golden lustre ; it is insoluble in alkalis.—J. C. C.

Indanthrene and flavanthrene. VII. Reduction products of indanthrene. R. Scholl and P. Stegmüller. Ber., 1907, **40**, 924—933. (Compare this J., 1907, 194.)

When the disodium salt of N-dihydro-1.2.2′.1′-anthraquinoneanthraquinolazine is heated with caustic soda to 220°—230° C., or when the free acid is heated to 250° C. in an atmosphere of carbon dioxide, one molecule is oxidised to indanthrene at the expense of the other, which becomes reduced to N-dihydroanthraquinoneanthranolazine, $C_{28}H_{16}O_3N_2$. When the latter is reduced by warm alkaline hyposulphite (hydrosulphite), N-dihydroanthraquinolanthranolazine, $C_{28}H_{18}O_3N_2$, is formed, which is easily oxidised to the preceding compound. The substance is also obtained by the reduction of indanthrene with alkaline hyposulphite (hydrosulphite) on the boiling-water bath. When oxidised with air in presence of alkalis or with hypochlorite solution, this substance furnishes anthraquinoneanthranolazine,

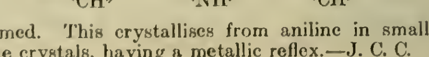


$$C_6H_4\left<\begin{matrix}CO\\CO\end{matrix}\right>C_6H_2\left<\begin{matrix}N\\N\end{matrix}\right>C_6H_2\left<\begin{matrix}C(OH)\\CH-\end{matrix}\right>C_6H_4$$

—J. C. C.

Indanthrene and flavanthrene. VIII. Reduction products of indanthrene. R. Scholl. Ber., 1907, **40**, 933—939. (Compare preceding abstract.)

When indanthrene is reduced by zinc dust and caustic soda in an atmosphere of hydrogen, *N*-dihydroanthrazine,



$$C_6H_4\left<\begin{matrix}CH\\CH\end{matrix}\right>C_6H_2\left<\begin{matrix}NH\\NH\end{matrix}\right>C_6H_2\left<\begin{matrix}CH\\CH\end{matrix}\right>C_6H_4,$$

is formed. This crystallises from aniline in small, red, stellate crystals, having a metallic reflex.—J. C. C.

Dyestuffs ; Influence of a salt at different concentrations on the rate of decolorisation of aqueous solutions of organic —— under the action of light. G. Bargellini and A. Mieli. Atti R. Accad. dei Lincei Roma, 1906 [5], **15**, II., 773—778 ; Chem. Zentr., 1907, **1**, 772.

Equal volumes of solutions of ammonium, magnesium, zinc, and manganese sulphates and potassium and ammonium chlorides, containing equal quantities of dyestuffs (Eosine, Methylene Blue, Safranine, Methyl Violet, Cyanine, Rhodamine, Methyl Green), were exposed to sunlight simultaneously. It was found that, in general, the rate of decolorisation decreased as the concentration of the dissolved salt increased ; for each salt there is a definite concentration, at which the rate of decolorisation is a minimum. In some of the solutions a precipitate is produced which increases in amount as the decolorisation proceeds.—A. S.

Dyewood extracts ; Analysis of ——. F. K. Kopecky. XXIII., page 347.

English Patents.

Indigo leuco-bodies ; Manufacture of ——. Deutsche Gold- und Silber-Scheide-Anstalt, vorm. Rössler, Frankfurt a/Main, Germany. Eng. Pat. 16,012, Aug. 4, 1905. Under Int. Conv., Aug. 13, 1904.

See Fr. Pat. 356.569 of 1905 ; this J., 1906, 14.—T. F. B.

Dyestuffs of the anthracene series ; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5959, March 11, 1906.

See Fr. Pat. 364,219 of 1906 ; this J., 1906, 923.—T. F. B.

Colouring matters [dyestuffs] of the anthracene series ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,132, Sept. 10, 1906.

New dyestuffs are prepared by heating anthracene or its derivatives (excluding those having an anthraquinone structure) with sulphur, with or without the addition of a metal, a metallic oxide, a metallic hydroxide, or a metallic salt. By varying the temperature, or by changing the metallic compound used, different shades are produced. These dyestuffs dye vegetable fibres, from an alkaline hydrosulphite bath, reddish-brown to olive-green shades, which are said to possess excellent fastness. —P. F. C.

Colouring matters from diphenylamine compounds ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 25,977, Nov. 16, 1906.

By combining 1.2.4- or 1.4.2-chloronitrobenzenesulphonic acid, 1.2.6.4- or 1.2.4.6-chlorodinitrobenzenesulphonic acid, or 1.2.4.6- or 1.3.4.6-dichloronitrobenzenesulphonic acid with metanilic acid, *o*-toluidine-*p*-sulphonic acid, or 1.2.4-chloroaminobenzenesulphonic acid, crystalline orange to red diphenylamine derivatives, soluble in water, are obtained (compare Eng. Pat. 25,901 of 1904 ; this J., 1905, 919). These diphenylamine derivatives when condensed with alkylated diaminodiphenylcarbinols yield leuco-compounds, which, on oxidation, are converted into dyestuffs giving, on wool, green shades fast to alkalis, washing, and potting. Example : A mixture of 41·8 parts of the disodium salt of 2-nitrodiphenylamine-4·3′-disulphonic acid (from *o*-nitrochlorobenzenesulphonic acid and metanilic acid) and 27 parts of tetramethyldiaminodiphenylcarbinol are added gradually, with stirring, to 200 parts of sulphuric acid monohydrate at the ordinary temperature. The temperature of the mixture rises to 45°—50° C. After stirring for 1—2 hours, the mass is poured on to ice, and diluted with water to 700 parts, 100 parts of calcined sodium carbonate are added gradually, and the whole is stirred for a few hours. The leuco-compound separates as a crystalline precipitate. It is filtered off, pressed, and dried. For the preparation of the dyestuff, 62·6 parts of the leuco-compound are dissolved in a solution of 11 parts of sodium carbonate in 1000 parts of water, and to the cooled solution, 9 parts of manganese dioxide and 100 parts of 25 per cent. sulphuric acid are added. After stirring for 15 minutes, the whole is heated to 50°C., filtered, and the dyestuff separated by addition of common salt to the filtrate.—A. S.

United States Patents.

Dye and process of making same ; Yellow-red —— [Thioindigo Red]. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 841,003, Jan. 8, 1907.

See Eng. Pat. 10,405 of 1906 ; this J., 1906, 751.—T. F. B.

Azo dye and process of making same. M. Böniger, Assignor to Chemical Works formerly Sandoz, Basle, Switzerland. U.S. Pat. 841,371, Jan. 15, 1907.

See Fr. Pat. 359,222 of 1905 ; this J., 1906, 424.—T. F. B.

Phenylglycine ; Process of making ——. R. Schmidlin, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 841,456, Jan. 15, 1907.

See Eng. Pat. 9700 of 1906 ; this J., 1906, 1214.—T. F. B.

German Patents.

Dyestuffs of the anthracene series ; Method of preparing green to blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 172,464, March 1, 1903.

Dyestuffs giving blue and green shades on wool, and similar to those obtained by sulphonating the condensation products of hydroxyanthraquinones with primary aromatic amines, are produced by heating such *a*-polyaminoanthraquinones as have at least two amino-groups in a position para to each other, with sulphonic or carboxylic acids of primary aromatic amines, in presence of stannous acetate and a suitable solvent, with or without a condensing agent.—T. F. B.

Aryl-p-diaminoanthraquinonesulphonic acids ; Preparation of alkylated —— [Anthracene dyestuffs]. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 174,131, May 21, 1905.

Aryl-*p*-diaminoanthraquinones are heated with dialkyl sulphates until no further quantity of product soluble in water is formed ; the dialkyl sulphate acts as a sulphonating agent as well as an alkylating agent, the dyestuffs being similar to those obtained by sulphonating the condensation products of *p*-halogenated-*a*-alkylaminoanthraquinones with ammonia or amines ; they dye wool blue and green shades from acid baths.—T. F. B.

Dyestuffs ; Method of preparing o-hydroxymonoazo ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 174,905, Sept. 6, 1905.

Diazotised halogen-substituted *o*-aminophenols are combined, in presence of calcium hydroxide, with perichloronaphtholsulphonic acids, *e.g.*, the 1.8.3.6- or 1.8.4.6-acids. The combination is much more complete than in presence of alkali hydroxides or carbonates. The dyestuffs are characterised by the fast blue shades produced on chrome-mordanted wool.—T. F. B.

Dyestuffs of the quinoline group [Cyanine dyestuffs]; Process for preparing ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 178,688, May 26, 1906. Addition to Ger. Pat. 172,118, July 29, 1905.

The alkylhalides of quinaldine bases are treated with formaldehyde and an alkali sulphite, with or without addition of quinoline alkyl halides. The products are identical with those described in the original patent. (See Eng. Pat. 16,227 of 1905 ; this J., 1906, 368.)—T. F. B.

Dyestuffs ; Process for preparing monoazo ——. Kalle und Co. Ger. Pat. 171,667, Jan. 12, 1904.

1.2-Aminonaphthol-3.6- or 4.6-disulphonic acid is diazotised and combined with 2.6- or 2.7-dihydroxynaphthalene ; the dyestuffs produced, dye wool bluish-red to violet shades, which are converted into fast blacks on treatment with chromium salts.—T. F. B.

Lakes ; Process for preparing colour ——. E. R. L. Blumer. Ger. Pat. 174,745 Nov. 16, 1904. V., page 317.

Indophenolsulphonic acids ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 171,028, Dec. 1, 1904.

Indophenolsulphonic acids are produced by the simultaneous oxidation of *p*-phenylenediaminesulphonic acids and phenols in alkaline solution, at a temperature of about 5° C. The resulting products are exceedingly stable, and can be converted into sulphide dyestuffs, which are stated to produce pure shades in dyeing.—T. F. B.

Dyestuff which dyes wool blue from acid baths ; Process for preparing a monoazo ——. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 172,983, April 1, 1905. Addition to Ger. Pat. 171,904, Jan. 17, 1905.

The dyestuff obtained by combining diazotised nitro-amino-*p*-hydroxybenzoic acid ($NO_2 : OH : NH_2 : COOH = 6 : 1 : 2 : 4$) with hydroxynaphthionic acid dyes wool blue from acid baths: the corresponding dyestuffs from the nitro-aminophenolsulphonic acids give red or violet shades. —T. F. B.

Azo dyestuffs susceptible to chroming ; Process for preparing ——. Chem. Fabr. Griesheim-Elektron. Ger. Pats. 172,457, Nov. 19, 1905, and 173,249, Nov. 22, 1905.

The diazo-compound of *p*-chloro-*o*-aminophenol or of *o*-aminophenol is combined with 1.8-dihydroxynaphthalene-3.6-disulphonic acid in acetic acid solution. The combination is more complete than in alkaline solution. —T. F. B.

Dianthraquinoneimines ; Process of preparing —— Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 174,699, Jan. 4, 1905. Addition to Ger. Pat. 162,824, Oct. 30, 1903. (See this J., 1906, 175.)

The dianthraquinonylamine described in the principal patent is obtained in better yield by the interaction of β-aminoanthraquinone and β-chloroanthraquinone in presence of a metallic salt, and either in solution or suspension. By treatment with fuming sulphuric acid, the product is converted into a substance which dyes brownish-red shades on unmordanted wool.—T. F. B.

Alizarin Blue ; Process for preparing an oxidation product from —— and also salt-like compounds of the latter. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 171,836, Jan. 31, 1905.

Alizarin Blue, in neutral or acid solution or suspension, is treated with an oxidising agent (halogen, nitric acid, lead peroxide, &c.), so long as a yellow substance continues to be formed. The product is probably an *o*-quinonoid derivative, and can be converted into dyestuffs, *e.g.*, ammonia converts it into an amide of Alizarin Blue. It also forms salts with acids, which are decomposed in presence of excess of water.—T. F. B.

Dyestuffs of the anthracene series ; Process of preparing bluish-green acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 172,575, Feb. 12, 1905.

By reducing dinitroanthrarufindisulphonic acids with alkali sulphides or sulphydrates, dyestuffs are obtained which dye wool pure blue-green shades from acid baths, thus differing from the products of reduction by other agents, which produce reddish-blue shades. The constitution of the products is uncertain, but they cannot be partial reduction products of the dinitro-compound, since further reduction fails to produce Alizarinsaphirol B. —T. F. B.

Dyestuffs ; Process of preparing m-amino-p-hydroxyazo ——. Wulfing, Dahl, und Co. Ger. Pat. 174,106, Jan. 21, 1905.

Dyestuffs of the general formula, $C_6H_3(OH)(NH_2)N : NR.OH : NH_2 : N_2R = 1 : 2 : 4$), are obtained either by reducing with sodium sulphide the product of combination of a diazo salt with *o*-nitrophenol, or by combining *o*-acetaminophenol with a diazo-compound, and subsequently removing the acetyl group. The dyestuffs obtained dye wool directly in yellow to reddish-brown shades, converted to brown on chroming. They may be further diazotised and combined with other components, if desired.—T. F. B.

p-Dichlorochrysazin ; Process for preparing —— [*Anthracene dyestuffs*]. R. Wedekind und Co. Ger. Pat. 172,300, Aug. 19, 1905. Addition to Ger. Pat. 167,743, Aug. 19, 1904. (See this J., 1906, 472.)

p-Dichlorochrysazin, which may be employed for the preparation of dyestuffs, is obtained by passing chlorine through a boiling suspension of Chrysazin in dilute sulphuric acid of b. pt. 125° C. Chlorine has no action on Chrysazin suspended in boiling water.—T. F. B.

Dyestuffs ; Process for preparing o-hydroxyazo ——. Anilinfarben-und Extraktfabr. vorm. J. R. Geigy. Ger. Pat. 176,227, Feb. 10, 1906. Addition to Ger. Pat. 173,011, Jan. 7, 1905.

The sulphonation of the dyestuff obtained by combining 1-diazo-2-naphthol-4-sulphonic acid with β-naphthol (see Eng. Pat. 1368 of 1905 ; this J., 1905, 1061) is effected by the use of a mixture of mono-hydrated sulphuric acid and chlorosulphonic acid. The reaction proceeds smoothly (for example, at 20°—25° C.), and a better yield is obtained than in the process described in the chief patent.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 253.)

Dyeing with natural indigo. C. Bergtheil. "Indian Planters' Gazette" ; through J. Soc. Dyers and Col., 1907, 23, 89.

Comparative dyeing tests with natural indigo in the form of paste direct from the "mâl" table, and synthetic indigo, B.A.S.F., 20 per cent. paste, in a hydrosulphite-lime vat showed that in every case the colour produced with the natural product was considerably deeper and of a richer "bloomier" shade. The cause of this difference appears to be connected with the presence in natural indigo of the numerous "brown" substances, known as "indigluten" and "indigo brown."—A. S.

Thio Indigo Red B. E. Wray. J. Soc. Dyers and Col., 1907, 23, 70—78.

The author describes the preparation and methods of using Thio Indigo Red (see this J., 1906, 367, 530, 752). For obtaining a pure white discharge on Indigo and on Thio Indigo Red, the following method is recommended. The dyed cloth is printed with a paste composed of 650 parts of gum water or British gum, 50—100 parts of "Hydrosulphite N F conc.," 240—290 parts of water, and 10 parts of caustic soda lye of 76° T., and steamed for 5—10 mins. at 104°—108° C. The material is then passed through cold water acidulated with about 0·5 to 1 per cent. of acetic, sulphurous, or hydrochloric acid, and afterwards treated for 1 minute in a boiling bath containing 5—10 c.c. of caustic soda lye (76° T.) per litre, washed in cold water, squeezed at full width, and dried. The different operations should follow one after the other without delay, especially the washing after the treatment with alkali. For discharging deep shades of Indigo Blue, the quantity of "hydrosulphite N F conc." in the printing paste should be increased to 130—150 parts per 1000.

Goods dyed with Indigo Blue and reddened by an addition of Thio Indigo Red B will not show a yellow spot when submitted to the well-known nitric acid test ; according to the proportion of the latter dyestuff, the spot produced has a tint varying from orange to scarlet. A delicate test for detecting the presence of Thio Indigo Red B consists in treating the dyed material with a dilute solution of bichromate acidified with dilute sulphuric acid, which completely destroys any Indigo Blue present ; after washing, the material has a pure pink shade, from the depth of which the proportion of Thio Indigo Red B present can be judged.—A. S.

Indigo discharges. E. Trepka. Z. Farben-Ind., 1907, 6, 29.

THE author criticises the statements of Radkiewicz (this J., 1906, 1216), that when sodium chlorate is used in combination with potassium ferricyanide for the production of a white discharge, the fibre is tendered, and that for the production of a good white, it is necessary to steam the goods for half an hour after passing through the rapid ager. He finds that excellent results can be obtained with a suitable sodium chlorate, potassium ferricyanide, and citric acid discharge mixture, if the goods be passed through the ager for 3—4 minutes, and that there are no signs of weakening of the fibre. The chlorate discharge is specially suitable for bold patterns on a heavy bottom, for which the chromate discharge is not satisfactory. For a pure white discharge on a heavy indigo ground, the paste should contain at least 200 grms. of sodium chlorate per kilo.—A S.

Cotton ; Preparation of —— to resist direct cotton colours. J. Schneider. J. Soc. Dyers and Col., 1907. 23, 78—80.

THE author has shown previously, in 1896, that cellulose hexanitrate, containing 12—13 per cent. of nitrogen, is not dyed by direct cotton dyestuffs, but only by basic dyestuffs. It is suggested that this property of nitrated cellulose might be utilised for the production of cross-dyeing effects on cotton goods. For instance, a textile fabric made of ordinary cotton yarn, mercerised yarn, and cellulose hexanitrate could be dyed in a single bath in two shades of one colour and the complementary colour of a basic dyestuff. For the preparation of the nitrated cellulose, cotton yarn, free from chlorine, and as dry as possible, is steeped for one hour at 10° C. in a mixed acid containing 72—73 per cent. of sulphuric acid, 21·5—22·5 per cent. of nitric acid, and 5—6 per cent. of water. 80 lb. of mixed acid are required for 2 lb. of yarn. Care must be taken that the temperature does not rise much, and that the yarn is impregnated uniformly. The nitrated yarn is squeezed and hydro-extracted, and then completely immersed, in small quantities, in a large volume of water. It is next washed in warm water, boiled with dilute sodium carbonate solution till free from acid, and after testing as to stability, dried. The stability of the product is tested by drying it at 30°—40° C., and then heating it successively at 80°, 80°—90°, and 90°—97° C., for periods of 10 minutes each. After the last heating, the test-tube containing the nitrated yarn is allowed to cool slowly to 80° C., at which temperature a piece of moistened zinc iodide-starch test-paper placed in the mouth of the tube will be coloured blue if the product is unstable. Properly prepared cellulose hexanitrate exactly resembles ordinary cotton in structure and appearance, except that it has a pale yellow tint. Its temperature of ignition is 175°—180° C., as compared with 250° C. for ordinary cotton. —A. S.

Metals ; Deleterious effects of —— upon dyestuffs, and their remedies. E. Grossmann. Z. Farben-Ind., 1907, 6, 21.

THE author discusses the injurious effect produced when various wool colours are dyed in copper vessels. The fact that better results are obtained with a copper vessel which has been in use for some time, appears to be due to the formation of a protective coating of grease upon the metal. Comparative tests showed that the practice of rubbing over the inner surface of dye-vats with logwood extract is useless. For preventing the injurious effects of copper, an addition of ammonium thiocyanate (sulphocyanide) is most satisfactory, though in acetic acid solutions, and in dyeing with direct cotton dyestuffs, an addition of sodium phosphate is also effective.—A. S.

ENGLISH PATENTS.

Damping yarn. P. Jensen, London. From Baumwoll-spinnerei Bradetz, Kuffler und Reichel, Vienna. Eng. Pat. 6498, March 17, 1906.

ACCORDING to this patent the yarn (in transport baskets) is placed in an apparatus, and damp air is forced through without it being necessary to take the yarn out of the baskets. The baskets are put into cradles, which are suspended by pivots round the circumference of a rotatable circular frame. In the centre space a fan is fixed which sucks suitably humified air up the centre and forces it through the fibrous material, which forms, as it were, a drum. During the damping the circular frame is set in rotation, and even damping is thus said to be ensured. —P. F. C.

Preparing, dyeing, scouring, ageing, setting, bleaching, or otherwise treating with liquids, pieces, warps, or other fibrous material or the like, in cotton, silk, worsted, woollens, or the like ; Apparatus for ——. J. Rhodes, Bradford. Eng. Pat. 4981, March 1, 1906.

THIS machine consists of one or more vats fitted with rows of horizontal rollers arranged on vertical supports. These rollers are arranged in sets of six, so that from one to six pieces or warps can be passed through the machine simultaneously. The six pieces or warps enter the vat over one roller and then separate to their respective series of rollers, finally meeting again at the other end, and passing out through a pair of squeezing rollers. When desired the material may be passed back over supporting rollers, and then again through the vats. —A. B. S.

Washing wool and other fibrous materials ; Machine for ——. F. W. and F. B. Petrie, Rochdale. Eng. Pat. 5824, March 10, 1906.

THE patent relates to a tank scouring machine with a special arrangement for circulating the scouring liquor. The portion of the machine below the perforated false bottom is divided into two or more compartments by means of vertical plates. These are connected by a system of pipes with a pump which draws off the liquor from the compartment below the feeding end of the machine, and forces it up through the false bottom of the upper tank at the delivery end of the machine, from which it runs back by gravity in the opposite direction to the motion of the wool till it reaches the feeding end, and passes again through the perforated bottom. In another arrangement the liquid is drawn from below and forced into the upper tank by side inlets.—A. B. S.

Bleaching textile fabrics ; Process and apparatus for ——. E. Ringenbac, Remiremont, France. Eng. Pat. 8435, April 7, 1906.

SEE Fr. Pat. 353,113 of 1905, and Addition thereto ; this J., 1905, 1011, and 1906, 925.—T. F. B.

Sulphide dyestuffs on animal fibres ; Method of dyeing ——. R. B. Ransford, Upper Norwood. From Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 10,693, May 7, 1906.

THE dyestuffs are dissolved in a solution of glucose and caustic soda, or else in an alkali sulphide, and then precipitated in a finely divided condition by carefully adding dilute sulphuric acid until the bath becomes slightly acid. The material to be dyed is immersed in this solution and well worked with suitable stirring or milling machinery. The dyeings are said to be very even and fast to washing, milling, and light.—A. B. S.

Drying, shrinking, or "ageing" textile fabrics ; Machines for ——. J. B. Whitely, Lockwood, Yorks. Eng. Pat. 5845, March 10, 1906.

IN the machine which forms the subject of this patent, the cloth is looped over a series of rods, which are carried by an endless double chain. Instead of placing the rods on the chain by hand, the whole of the chain is provided with rods, which are either fixed or rotatable. If fixed, the upper parts are covered with plush, cord, or wire-carding to prevent the cloth or other material from slipping. After being led into the machine by guiding rollers, the cloth is automatically looped by an arrangement consisting of a roller connected to a bell crank which is worked by a cam. Another roller at the back of the machine releases the cloth and guides it to a folding device.—P. F. C.

Printing textile fabrics and the like; Machines for ——. J. A. Wilson, Bollington. Eng. Pat. 6654, March 20, 1906.

In the printing of, for instance, scarves by machines known technically as "jumpers," the headings are printed at regular intervals, such as every half-yard, but it has not been possible, hitherto, to print them at intermediate distances except by employing rollers of different size. The object of the present patent is to effect this printing of the headings at intermediate distances, without changing the rollers. The driving shaft of the heading roller is provided with a clutch forming one arm of a lever pivoted to the frame of the machine. The other arm of the lever bears normally against the face of a disc wheel driven from the main shaft by a train of wheels, some of which are interchangeable. As the disc wheel rotates, a snug or projection on its face engages with a roller on the arm of the lever, and forces this outwards, thereby operating the clutch on the shaft of the heading roller. In this way the heading roller (previous to its being jumped in) is caused to cease revolving during the time it would take to make a half revolution, and headings can be printed at distances hitherto unattainable without changing the roller. (Reference is directed to Eng. Pats. 14,076 of 1886 and 7184 of 1892; this J., 1892, 680.) —A. S.

Dyeing or printing in shaded colours or tints; Machines for ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 11,758, May 19, 1906.

The object of this invention is to enable the subdivisions of the colour trough on machines which are fitted with subdivided transferring rollers (for applying the colour to the printing or dyeing rollers) to be refilled without stopping the machine. For this purpose there is arranged in the frame of the machine a supply trough which has the same number of subdivisions as the colour trough. In order to transfer some of the contents of the supply trough into the corresponding compartments of the colour trough, the supply trough has to be raised and tipped. This is accomplished by fixing it to a toothed wheel, which has its axle between the two troughs. If preferred, the supply trough can be permanently fixed higher than the colour trough, and each subdivision can be supplied with a cock, all of which can be opened and closed simultaneously by a common handle.—P. F. C.

Nitrocellulose; Manufacture of —— for industrial purposes [waterproofing]. R. H. Annison and G. T. Oliver. Eng. Pat. 4577, Feb. 24, 1906. XIX., page 340.

United States Patents.

Cellulose products; Manufacturing ——. E. Eck and E. Bechtel, Assignors to Hanauer Kunstseidefabr. U.S Pat. 839,825, Jan. 1, 1907. XIX., page 340.

Cellulose; Solution of ——. E. Eck and E. Bechtel. Assignors to Hanauer Kunstseidefabr. U.S. Pat. 840,611, Jan. 8, 1907. XIX., page 340.

Silk; Process of weighting ——. C. Simon, Paterson, N.J. U.S. Pat. 840,264, Jan. 1, 1907.

The process consists in acting on silk with solutions of a metallic salt and quebracho extract *per se*, or in the presence of a tin salt.—D. B.

Dyeing textile fibre violet-blue; Process for ——. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 840,419, Jan. 1, 1907.

See Addition of June 22, 1905, to Fr. Pat. 349,531 of 1904; this J., 1906, 14.—T. F. B.

Yarn printing machine. W. E. Lyford, Assignor to The Hartford Carpet Corporation, Thompsonville, Conn. U.S. Pat. 840,353, Jan. 1, 1907.

The machine comprises a printing drum and a travelling carriage having a colour box, a roller, and rubbing devices adjustably mounted thereon. The rubbing blocks have curved rubbing faces capable of rubbing the yarn as it travels in either direction. There is a rail for engaging the rubbing devices to move the same simultaneously out of action. By means of a lever pivoted to the ends of the rail and a treadle connected with the lever, the rubbers may be depressed.—D. B.

French Patents.

Metal-ammonium compounds [cuprammonium]; Preparation of solutions of ——. Soc. anon. la Soie Nouvelle. Fr. Pat. 369,973, Sept. 24, 1906. VII., page 319.

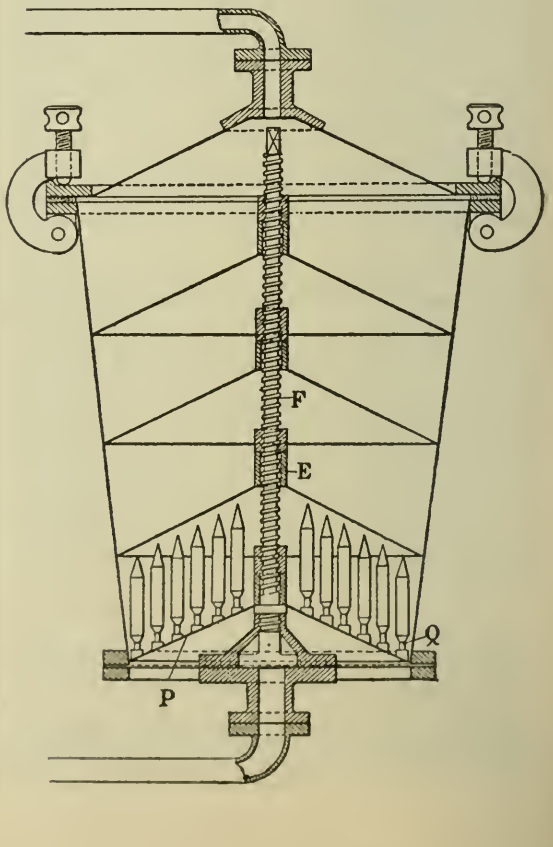
Dyeing, sizing, and bleaching; Method of connecting hanks of thread for ——. C. Fartenaekels. Fr. Pat. 361,991, Dec. 13, 1905.

The hanks of yarn are formed into a continuous band, either by looping them together, or else by fastening them to one another by connecting bands.—A. B. S.

Cotton; Process of dyeing —— with black sulphide dyestuffs. C. Fartenaekels. Fr. Pat. 361,995, Dec. 14, 1905.

In order to render the dyeings faster, and also to increase the weight of the material, the cotton, after dyeing in the usual manner, is treated as follows:—It is first rinsed twice in water, then rinsed in water at 40° C., containing about 20 per cent. of pyrolignite of iron. It is finally treated at 70° C. in a bath, prepared as described below, the quantities given being those required for 100 kilos. of cotton. Two kilos. of starch are boiled with water, and well mixed with 2 kilos. of lard, and then 1 kilo. of liquid logwood extract is added.—A. B. S.

Yarn on bobbins or in cops; Conical vats for the treatment of —— with liquids. Gaydet et fils. Fr. Pat. 370,942, Oct. 30, 1906.



The bobbins or cops are placed on hollow, perforated spindles, which are fixed vertically over the tubes, Q, rising from holes in a series of conical plates, P, arranged one above the other in the dye-vat or other vessel; the plates are of different sizes, the lowest being the smallest, and each is provided at the apex with a nut, E, which engages on a threaded spindle, F, extending vertically through the centre of the vat. The vat itself is of frusto-conical shape, wider at the top than at the bottom, and the dye-liquor is circulated through it by means of a circulating pump in the usual manner. By means of the nuts working on the central spindle, the conical plates carrying the bobbins or cops are screwed down so that their outer edges are pressed firmly against the walls of the vat, thus forming a series of closed compartments therein; the circulating dye-liquor, &c., in passing from one compartment to the next has to pass through the bobbins or cops of yarn.—A. S.

German Patents.

Logwood black; Process for the production of a single-bath —— on animal fibres. W. Zänker. Ger. Pat. 172,662, March 22, 1904.

The process consists in adding to the neutral or acid dye-liquor, ferric-ammonium oxalate alone or with copper oxalate, and also, if desirable, neutral salts and coal-tar dyestuffs. The dyed material is after-treated with bichromate or other oxidising agent. It is claimed that by this method good results are obtained in a single bath, and that no precipitate is produced in the dye-liquor. —A. S.

Dyeings; Process for the production of fast ——. Badische Anilin und Soda Fabrik. Ger. Pat. 174,494, April 8, 1905.

The patent relates to the production of fast colours on the fibre with the dyestuffs obtained by heating 2·2′-dimethyl-1.1′-dianthraquinonyl or its derivatives either alone or in presence of dehydrating agents. The methods recommended consist in dyeing from an alkaline vat prepared with the dyestuffs; or printing with the dyestuffs with or without reducing agents, but in presence of alkali; or in printing with the dyestuffs and a reducing agent without addition of alkali, and then passing the material through an alkaline solution. It is stated that cotton is dyed in red shades, which on washing change to bright orange to yellow tints of great fastness.—A. S.

Lakes; Process for preparing colour ——. E. R. L. Blumer. Ger. Pat. 174,745, Nov. 16, 1904.

A solution in alkali of the condensation product of phenol and formaldehyde is added to a solution of an acid dyestuff until all the latter is precipitated. Textile fibres may be impregnated with the above condensation product, dissolved in alkali, and then dyed with acid dyestuffs. —T. F. B.

Adhesive and finishing materials; Process for the preparation of ——. F. Hecht. Ger. Pat. 174,222, Dec. 24, 1904. XVI., page 334.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(Continued from page 253.)

English Patent.

Dyeing paper pulp. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 5342, March 5, 1906.

The process claimed consists in mixing the acid-, nitro-, azo-, or eosine-dyestuff employed with a suitable precipitant immediately before incorporating it with the paper pulp. The precipitants used must be such as will yield with the dyestuff an exceedingly fine, voluminous, amorphous precipitate. Among those mentioned as specially useful are hydrated alumina, on the one hand, and a barium or lead salt on the other; "Solidogen A" (the condensation product of formaldehyde and the hydrochlorides of the amines constituting commercial aniline base) may also be used, alone or in conjunction with other precipitants. It is stated that by this method a number of vivid and very fast acid- and azo-dyestuffs, hitherto unsuitable, can be used for dyeing paper pulp. The methods described in Eng. Pat. 1760 of 1900 (this J., 1901, 117) for rendering dyestuffs insoluble can be applied in carrying out the process described above.—A. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(Continued from page 256.)

Calcium; Phosphates of —— and their hydrates. H. Bassett, jun. Z. anorg. Chem., 1907, **53**, 34—48.

Dicalcium phosphate.—The only definite hydrate of dicalcium phosphate which exists above 0° C. is the dihydrate, $CaHPO_4,2H_2O$. When ammonia solution is added drop by drop to a solution of bone-ash in hydrochloric acid, the compound, $CaHPO_4$, is at first precipitated and this gives place to the hydrate as the acidity decreases. A mixture of the two results, therefore, by complete precipitation, their relative amounts depending on the original acidity and the temperature during precipitation. The quintuple point at which the phases, $CaHPO_4,2H_2O$; $CaHPO_4$; solid solution; liquid solution; and vapour coexist lies at about 80° C.

Monocalcium phosphate.—The only hydrate of this phosphate which is formed above 0° C. is the monohydrate $CaH_4(PO_4)_2,H_2O$. This hydrate is stable in the presence of solution up to 170°, but if the ratio, P_2O_5/CaO, exceed 4, crystals of the anhydrous salt are obtained at 160°. A solution containing about 35 grms. of calcium oxide and 400 grms. of phosphoric anhydride per litre deposits at 160° anhydrous monocalcium phosphate as lustrous prisms, which quickly absorb moisture from the air, forming the monohydrate. The point at which the phases, $CaH_4(PO_4)_2,H_2O$; $CaHPO_4.2H_2O$; $CaHPO_4$; liquid solution; and vapour coexist lies at about 30° C. (See also this J., 1906, 120.)—F. Sodn.

Calcium; Action of ammonia on the phosphates of ——. H. Bassett, jun. Z. anorg. Chem., 1907, **53**, 49—62.

Anhydrous dicalcium phosphate does not react with ammonia gas, either at the ordinary temperature or at 100° C., but its dihydrate, $CaHPO_4,2H_2O$, reacts readily at 100°, according to the equation:—

$$3CaHPO_4,2H_2O + 2NH_3 = Ca_3(PO_4)_2 + (NH_4)_2HPO_4 + 6H_2O.$$

This reaction really takes place in the solution formed by heating the solid hydrate. It begins, therefore, only when a point is reached in the system, $CaO - P_2O_5 - H_2O$, at which the liquid phase appears. Monocalcium phosphate absorbs ammonia very slowly at the ordinary temperature, but rapidly at 100° with the formation of the compound, $Ca(NH_4)_2H_2(PO_4)_2$, which is immediately decomposed by water into dicalcium phosphate and diammonium phosphate. The monohydrate, $CaH_4(PO_4)_2,H_2O$, gives with ammonia, dicalcium phosphate and diammonium phosphate. This reaction also takes place in the liquid phase first produced, and the dicalcium phosphate reacts further to a great extent, forming tricalcium phosphate. Diammonium phosphate, $(NH_4)_2HPO_4$, is quite stable at 100° in presence of ammonia gas at atmospheric pressure.—F. SODN.

Acids ; Standardising of —— by metallic magnesium, A. Vesterberg. XXIII., page 344.

Calcium carbide ; U.S. regulations for shipments of ——. Oil, Paint, and Drug Rep., March 11, 1907. [T.R.]

THE Department of Commerce and Labour has decided to permit the transportation of calcium carbide on passenger steamers, subject to the following requirements:—"Calcium carbide or carbide of calcium may be transported on passenger vessels when the same is contained in steel drums or steel receptacles, the seams of which are lapped and properly riveted or fastened in such manner as will best insure the maximum strength of the joints, and when the said drums or receptacles are fitted with double covers, so that such drums or receptacles shall be water tight and air tight during such transportation. For packages of one hundred and ten pounds or less, such drums or receptacles shall be made of open-hearth steel of not less than No. 26 gauge. For packages of more than one hundred and ten pounds, such drums or receptacles shall be made of open-hearth steel of not less than No. 24 gauge: Provided, that said calcium carbide or carbide of calcium may also be transported on passenger vessels in cans containing not more than ten pounds of said calcium carbide or carbide of calcium each, such cans to be constructed and packed as follows:—Said cans shall be made of ninety-pound basis tin or terneplate, shall have double and lapped seams, shall have the openings in the tops fitted with tight compression caps, shall be constructed so as to render them water tight and air tight, and shall be packed in substantial wooden cases with not more than sixty pounds total weight of calcium carbide or carbide of calcium in each of such cases.

"Calcium carbide or carbide of calcium must not under any conditions be transported on such vessels in other than such original unopened packages, which must be plainly marked 'Calcium carbide.'"

ENGLISH PATENTS.

Sulphuric acid ; Purification of arsenical —— and the obtainment of arsenic therefrom. J. Raschen, A. E. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 5151, March 2, 1906.

SEE Fr. Pat. 363,947 of 1906 ; this J., 1906, 884.—T. F. B.

Distilling apparatus [ammonia]. C. C. Carpenter. Eng. Pat. 22,512, Oct. 11, 1906. III., page 311.

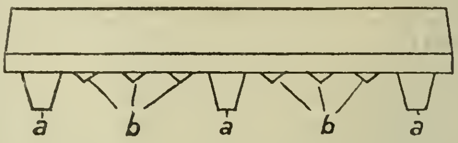
Cyanide of ammonium ; Synthetic production of ——. D. Lance, Paris, and E. G. Elworthy, St. Albans. Eng. Pat. 4409, Feb. 22, 1906. Under Int. Conv., Feb. 22, 1905.

SEE Fr. Pat. 355,504 of 1905 ; this J., 1905, 1231.—T. F. B.

Flux skimmings of zinc, or other similar material ; Process for treating ——. H. A. Leaver and C. von Buch, London. Eng. Pat. 5655, March 8, 1906.

THE skimmings are mixed with an alkaline-earth such as lime, and heated in a muffle furnace. Ammonia is given off and recovered as chloride, and a residue is left consisting of zinc oxide and calcium chloride. This residue is treated with boiling water, the solution transferred to a settling tank, and then evaporated for the recovery of the calcium chloride. The zinc oxide left in the boiling and settling tanks is collected and dried for sale as zinc ash. (Reference is directed to Eng. Pat. 1070 of 1869.)—O. F. H.

Filters for filtering by percolation as applied to acids, alkalis, water, or sewerage. J. Mackenzie and J. and G. McLauchlan, Middlesbrough-on-Tees. Eng. Pat. 23,049, Oct. 18, 1906.



SILICA, "full gannister," or dinas stone or brick which has the following approximate composition:—Silica, 94·25 per cent.; iron oxide, 0·50 per cent.; alumina, 2·80 per cent; lime, 1·75 per cent.; magnesia, 1·20 per cent.; and alkalis, 0·50 per cent.; is broken into small fragments which will pass through a 10-wire, but not through a 12-wire sieve. The broken material is formed into slabs, which are burnt at a temperature of from 2000° to 2500° C. The slabs have the section shown in the figure, with the projections, *a*, *b*, on the lower side, and are placed in a tank and cemented together. The liquid to be filtered is poured on to the top of the slabs, and passes through the porous material, the projections being for the purpose of causing the formation of drops, so that the progress of the filtration is not hindered by the formation of a film of liquid on the under side of the plates.—W. H. C.

Lime and other substances ; The burning of ——. The Associated Portland Cement Manufacturers (1900), Ltd., and D. H. Gibbs. Eng. Pat. 24,823, Nov. 5, 1906. IX., page 323.

Hydrogen ; Producing pure —— from water gas. A. Frank, Charlottenburg, Germany. Eng. Pat. 26,928. Nov. 27, 1906. Under Int. Conv., March 7, 1906.

WATER-GAS is cooled in a suitable apparatus sufficiently to liquefy the carbon monoxide and dioxide, which are then separated. If the water-gas has been produced at a low temperature, and contains chiefly carbon dioxide, with but little carbon monoxide besides hydrogen, it may be completely liquefied, and the hydrogen recovered by fractional distillation. In either case, the hydrogen resulting is further purified by being conducted over calcium carbide at a temperature of over 300° C.—E. S.

UNITED STATES PATENTS.

Chromic acid ; Manufacture of ——. R. Suchy, Bitterfeld, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 841,278, Jan. 15, 1907.

SEE Eng. Pat. 12,618 of 1906 ; this J., 1907, 150.—T. F. B.

Sulphur burner. C. E. Savage, Groveton, N.H. U.S. Pat. 841,576, Jan. 15, 1907.

TWO oven casings are combined end to end, supported at a certain point to rock on a fixed base, a hydraulic cylinder being operated to tilt one rocking end, whilst the other end is tilted by means operated by the movements of the former. An outlet passage is provided "at a moving point," and there is a fixed outlet pipe, with an annular water-seal between it and the oven casing. Numerous details of the apparatus are described.—E. S.

Lime ; Apparatus for hydrating ——. M. Mauran, Niagara Falls, N.Y., Assignor to Castner Electrolytic Alkali Co., Virginia. U.S. Pat. 840,076, Jan. 1, 1907.

THE lime is hydrated in a covered pan, surmounted by an upright stack, up which the lime-laden vapours pass, to meet water sprayed into the upper part of the column, the descending streams of water being caught and dis-

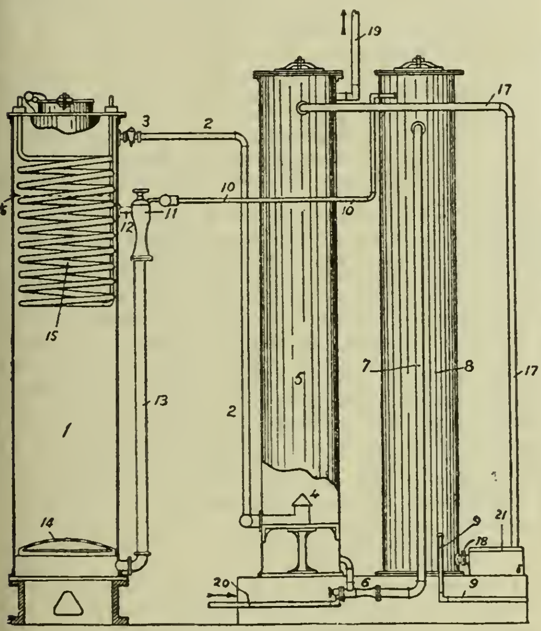
tributed by a series of conical baffle-plates set at various heights. The lowest baffle is provided with a trough, the water accumulating in which is run into a side vessel, from which it is returned to the tank in its heated state to further hydrate the lime. Thus, only water vapour free from entrained lime is passed into the atmosphere.
—E. S.

French Patents.

Concentration of saline solutions [*Sea-water, &c.*] ; *Process and apparatus for* ——. L. Brunot. Fr. Pat. 371,239, Jan. 16, 1906.

The sea-water or other solution to be concentrated is fed into a horizontal rotating drum with perforated sides provided with an inner concentric filter. The centrifugal force causes the solution to become concentrated as it reaches the periphery of the drum, through which it passes to the concentrated-liquor receptacle. The liquor nearer the axis and the ends of the drum becomes less concentrated, and is drawn off through special pipes, which pass through openings in the ends of the drum.
—W. H. C.

Metal-ammonium compounds [*Cuprammonium*] ; *Preparation of solutions of* ——. Soc. anon. la Soie Nouvelle. Fr. Pat. 369,973, Sept. 24, 1906. Under Int. Conv., Sept. 26, 1905.



The apparatus specified (see figure) has the object of economising the ammoniacal vapours carried away during the preparation of cuprammonium solutions by the action of ammonia and air on metallic copper. The apparatus consists of a reaction vessel, 1, with a cooling worm, 15, in its upper portion, a condenser or scrubber, 5, filled with coke, and a saturating vessel, 8. The vessel, 1, is filled with copper shavings and a solution of ammonia up to the level, 16. In order to obtain continuous circulation, the solution is withdrawn at 12 by the injector, 11, and is intimately mixed with air saturated with ammonia coming from the vessel, 8, through the pipe, 10. The mixture of liquid and air is returned to the reaction vessel at the bottom, through the pipes 13 and 14. The de-oxidised air, saturated with ammonia, escapes through the valve, 3, and the pipe, 2, and passes into the bottom of the scrubbing vessel, 5, in which the ammonia is removed by water from the tank, 21, forced up the pipe, 17. The waste gas, retaining only very small quantities of ammonia, is discharged at 19. The ammonia solution from the scrubber is forced by a steam-injector, 6, into the upper part of the vessel, 8, in the form of a spray. Compressed fresh air enters this vessel at the bottom, is saturated with ammonia by the spray, and then passes to the reaction vessel. The impoverished ammoniacal water is collected at the bottom in the tank, 21, and is returned by the pressure of air to the scrubber, 5 ; the compressed air also operates the injector, 11.
—J. F. B.

Hydrogen peroxide ; Electrolytic production of ——. O. Urbasch. Fr. Pat. 371,043, Nov. 2, 1906. XIA., page 327.

Nitrogen ; Process for rendering atmospheric —— *available in the form of nitride.* L. Roth. Fr. Pat. 371,397, Nov. 13, 1906.

The patent relates to the preparation of nitrides by the action of atmospheric nitrogen on suitable substances (mixtures of iron, zinc, or silicon with carbides, or metallic hydroxides or hydrated oxides) at a high temperature (800°—850° C.). The essential feature of the invention consists in causing the air to pass through a solid, porous membrane (burnt clay) before it comes into contact with the heated charge. Owing to the greater diffusibility of the nitrogen, the air after passing through the membrane is concentrated in that element, and better yields of nitride are said to be obtained.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 257.)

[*Pottery*] *Biscuit loss in the manufacture of white ware ; Some phases of* ——. H. Hope. Trans. Amer. Ceramic Soc., 1906, 8, 62—75.

The experiments upon which the author's conclusions are based were made with an average whiteware body maturing at Seger cone 8. The chief causes of biscuit loss are summarised as follows :—(1) Low tensile strength of the body, owing to which the ware may be unable to withstand the pressure of pieces stacked upon it. The addition of ball clay increases the tensile strength of a body, but owing to its greater contraction, it tends to produce crookedness. (2) The tendency of ware to become crooked in drying, and consequently strained when straightened. This may be largely overcome by avoiding an excess of plastic clays in the body ; by allowing the heated air used in drying free access to all sides of the mould ; by the accurate fitting of the moulds in the "jolly rings" ; by avoiding over-firing, &c. (3) The use of clay from which the air has not been properly expelled in pugging. The presence of air may be due to the repugging of small pieces of "scrap," full of air, which should be returned to the "blunger," or to defects in the pug-mill, such as a wrong angle of the knives, or a bad relation in the relative speeds of the vertical and horizontal shafts in a vertical mill. (4) Hard and uneven firing is the cause of much crooked ware, and can only be remedied by greater care in firing. (5) Careless handling of dry, unfired ware by the finishers. (6) The application, in finishing, of undue pressure to unsupported portions of the ware. (7) Rough handling of biscuit ware in the warehouse and in drawing. (8) Bad placing. These last four items are due to carelessness on the part of the workmen, and can only be remedied by greater care in their work. The author's experience is that there is no evidence of any crack originating in the firing itself, with the exception of "dunted," *i.e.*, too rapidly cooled, ware, and consequently the origin of all others may be found in the clay, or in the ware in the unfired state.—W. C. H.

[*Pottery*] *Body dissolution and its causes ; Inquiry into* ——. C. Weelans. Trans. Amer. Ceramic Soc., 1906, 8, 79—90.

The author has inquired into the causes that produce "dunting." Dunted ware may be defined as ware which shews a rift or crack, that has arisen during firing, either in the biscuit kiln or in the glost kiln, and emits a cracked sound. The fracture shows a clean, glassy surface, and is thus distinguished from a clay crack, *i.e.*, a crack caused before the ware is fired, which shows a granular surface. To reduce the tendency to "dunt," in addition to the exercise of the greatest care in ageing the clay mixture, drying the ware, placing it in the kiln, &c., it is recommended that the two extremes of heat should be avoided in firing. Thus a body that gave satisfactory results when fired at Seger cone 8, gave a number of dunted pieces at Seger cone 11, and a number of the pieces that appeared sound when drawn from the biscuit kiln did not stand the glost firing, and of those that apparently stood the latter, a number were found to be dunted after being kept for a time. With under-fired ware, probably only the surface is fused, and the ware is consequently unable to withstand the strain of cooling, and hence dunting takes place. The rules of pottery construction, as to jointing, avoiding sharp corners, &c., must be closely observed. From a number of experiments on vitreous body composition in relation to the following defects, cracking in clay, blistering, and dunting, the most satisfactory results were obtained with the two following mixtures when fired at Seger cone 8 :—Clay, 40 ; flint, 25, 30 ; felspar, 35, 30. In another series, in which 45 per cent. of felspar and 15 per cent. of flint were kept constant, the 40 per cent. of clay consisted first of equal quantities of American and English ball clays ; the latter was then gradually decreased in amount, and American ball clay increased until this formed the whole of the 40 per cent., and in the other members of the series the proportions of the two clays were altered in the reverse way. From these tests it appeared that English ball clay, whilst it prevented cracking in the clay, caused blistering in firing, where the content of felspar is high, and with large pieces increased the dunting. It is advisable to select clays with a view principally to tensile strength. Good results as to vitrification were obtained by using a body containing 15 per cent. of felspar and 45 per cent. of flint, fired at cone 12, instead of depending upon a high percentage of felspar, say 45 per cent., and a low percentage of flint, say 15 per cent., fired at a lower temperature, such as Seger cone 8.

—W. C. H.

Earthenware [pottery] body ; Additions of lime to an ——. H. E. Ashley. Trans. Amer. Ceramic Soc., 1906, **8**, 147—153.

IN the experiments described, the effects are shown of additions, not exceeding 3 per cent., of calcium fluoride and calcium carbonate upon an earthenware body, fired in a muffle kiln at Seger cone 3—4. Under these conditions, neither compound caused any swelling, and the questions of sudden vitrification and warping were not studied. Whiting and fluorspar increase the shrinkage and decrease the porosity, whiting being more effective than fluorspar ; they also enhance the translucency, and increase the strength, measured by resistance to abrasion, fluorspar being more effective than whiting in these respects. The composition of the body used was :—Tennessee ball clay, No. 3, 22 ; English china clay, 36 ; potters' flint, 34 ; and felspar, 8. The percentage additions of fluorspar and whiting and the results of the tests are shown in the following table :—

Measurements.	Body alone.	Body + additions of fluorspar.				Body + additions of whiting.			
	—	0·1	0·3	1·0	3·0	0·13	0·4	1·0	3·0
Shrinkage, per cent.	10·5	11·1	11·1	10·8	11·4	11·1	11·3	10·8	12·7
Absorption, „ „	10·6	10·2	9·4	8·2	6·3	9·0	8·5	7·7	5·4
Translucency, measured by thickness in mm. through which light passed	1·65	1·90	1·80	2·10	2·40	1·90	2·30	1·70	2·00
Loss by abrasion, per cent. 1st hour	2·81	2·34	2·74	1·70	1·60	2·39	2·22	1·70	1·30
„ „ „ „ 2nd hour	2·13	1·64	2·32	1·00	0·90	1·93	1·96	1·50	1·30
„ „ „ Total	4·94	3·98	5·06	2·70	2·50	4·32	4·18	3·20	2·60

—W. C. H.

Fluxing effect of the addition of clay to (Seger) cone mixtures containing little or no clay ; Note on the ——. L. B. Coulter. Trans. Amer. Ceramic Soc., 1906, **8**, 168—171.

IN Seger cones 010 to 1, the theoretical R_2O_3 equivalents are kept constant at 0·3 Al_2O_3, 0·2 Fe_2O_3. In Seger cone 010 only 0·05 of the alumina is introduced as felspar, the remainder being derived from clay. In cone 1, all the alumina is derived from felspar, but cones that are more and also less fusible than cone 1, contain increasing amounts of clay as they recede from cone 1. In order to diminish the fusibility of a batch of material intended for making cone 1, which was a little too fusible, additions were made of a mixture of clay and flint of the composition, $Al_2O_3,10SiO_2$. But instead of such additions decreasing the fusibility, the mixture became more fusible, and the amounts had to be increased, until over 20 per cent. of the mixture was contained in the body. Cones made in this way, however, melted more gradually ; in a sudden or sharp fire, the old cones would go down sooner than the new, but in a steady heat both would go down together. The old cones, where embedded in clay, would show greater fusibility, whilst the new mixtures, with clay already added, would be less affected in this way. Experiments showed that the clay was the fluxing agent, and that flint hardened the mixture, except possibly on the first addition. Thus, the addition of 0·15 equivalent of clay alone to the theoretical body used for cone 02, produced the most fusible mixture, and 0·25 equivalent of clay was required to make a mixture of the same fusibility as the one with no clay. When flint and clay were added together (as $Al_2O_3.10SiO_2$ above mentioned), 0·1 equivalent yielded the most fusible mixture, and 0·2 equivalent made a body equal in fusibility to the one with no clay. In making cones containing ferric oxide and little clay, the following points were noticed :—(1) Diminishing the ferric oxide from 0·14 equivalent to 0·1 equivalent, by substituting clay, increases the fusibility. The clay was increased from 0·034 to 0·082 equivalent. (2) From cone 05 downwards, the fusibility cannot be increased by adding more clay.—W. C. H.

Uranium oxide in glazes of various composition ; The colouring power of ——. F. H. Riddle. Trans. Amer. Ceramic Soc., 1906, **8**, 210—219.

THIS paper contains an account of some experiments made to ascertain the colouring power of uranium, the effect of the ingredients of the glaze upon the colour, and the amount of uranium that can be added to the glaze before it becomes supersaturated. The uranium oxide was added to the glazes as standard "yellow oxide of uranium," really sodium uranate, $Na_2O,U_2O_6,6H_2O$. The amounts used, reckoned as U_3O_8, were :—0·003, 0·006, 0·01, 0·02, and 0·05 equivalents. The glazes, with these additions of the colouring matter, were applied to white, dry pressed, porous biscuit tiles, and fired in separate saggers, in an up-draught muffle kiln. The following table gives the details of the experiments and results :—

Composition of glaze and temperature of firing.	Colour effect of uranium additions.					Glaze.
	Equivalents of U_3O_8 added.					
	0·003	0·006	0·01	0·02	0·05	
A.—Cone 1. 1·0 PbO 0·2 Al_2O_3 2·0 SiO_2 .	pale orange yellow	light orange yellow	stronger orange yellow	dark orange yellow.	orange brown	raw
B.—Cone 1. 0·75 PbO 0·10 CaO } 0·2 Al_2O_3 1·6 SiO_2 . 0·15 K_2O	pale orange yellow	light orange yellow	stronger orange yellow	dark orange yellow	orange brown segregation	raw
C.—Cone 1. 0·50 PbO 0·15 K_2O } 0·2 Al_2O_3 1·6 SiO_2 0·15 ZnO 0·20 CaO	light orange yellow, clearer colour than above	orange yellow somewhat darker	medium shade orange colour	orange brown	dark brown. completely segregated, matt	raw.
D.—Cone 5. 0·30 PbO } 0·35 Al_2O_3 { 2·5 SiO_2 . 0·35 Na_2O 0·35 CaO { 0·5 B_2O_3 .	pale lemon yellow	light lemon yellow	somewhat stronger lemon yellow	dirty lemon yellow, somewhat reduced.	brown, reduced	fritted.
E.—Cone 5. 0·3 Na_2O } 0·5 Al_2O_3 { 4·0 SiO_2 . 0·7 CaO { 1·0 B_2O_3 .	very pale lemon yellow	pale lemon yellow	good light lemon yellow	lemon yellow rather strong shade	dark lemon yellow	fritted.
F.—Cone 03. 0·4 Na_2O 0·4 CaO } 0·25 Al_2O_3 2·5 SiO_2 . 0·2 ZnO	pale straw yellow	light straw yellow	medium straw yellow	strong straw yellow	dark brown reduced	fritted
G.—Cone 10. 0·3 K_2O } 0·5 Al_2O_3 4·0 SiO_2 . 0·7 CaO	reduced	reduced	—	—	—	raw

The colouring power of the uranium is strong, 0·006 equivalent giving a good colour. Glazes containing lead, and high in uranium, gave a deep orange colour, whilst those free from or very low in lead gave a lemon yellow. Glazes with the largest amounts of uranium are not only the richest in colour, but also are the most distinctly orange in shade, and contain the largest amounts of uranium in solution. The lemon-coloration appears to be due to the effect of boric acid rather than to the alkali. Trial A was slightly supersaturated with 0·05 equivalent of U_3O_8; Trials B and D were good with 0·02, but supersaturated with 0·05; Trial C was slightly supersaturated with 0·05; Trials E and F, although blackened and the colour destroyed with 0·05, still retained glazed surfaces; Trial G was not carried above 0·006. The fritted glazes as a whole were capable of taking more raw uranium into solution than the raw glazes.—W. C. H.

Phosphoric acid in [pottery] body mixtures ; Action of ——. C. W. Parmelee. Trans. Amer. Ceramic Soc., 1906, 8, 236—241.

THE author has investigated the action of phosphoric acid in developing translucency, and its effect upon the fusibility of various common materials used in the preparation of bodies. To avoid the action of lime or any strong base, the phosphoric acid was introduced in the form of aluminium phosphate, and to secure as much binding power as possible, ball-clay was used in nearly all the tests, which were fired between Seger cones 9 and 10. From the results it appears that the presence of phosphoric acid gives translucency, tends to improve the colour, and acts as a flux and vitrifying agent when present in sufficient quantity, *viz.*, 0·6 equivalent of P_2O_5, and larger amounts, together with 1 equivalent of alumina, and varying equivalents of other constituents, silica, lime, and potash (introduced as felspar). A slight increase of silica increases the fusibility. Lime, when present in small quantities, increases the fusibility, but considerable amounts make the body refractory. It also gives an enamel-like appearance. The presence of 0·2 equivalent of potash does not affect the translucency, but increases the fusibility, and causes an enamel-like appearance.—W. C. H.

Fineness of ground [pottery] materials ; A standard for the ——. C. F. Binns. Trans. Amer. Ceramic Soc., 1906, 8, 241—249.

AN elutriation process is considered by the author of this paper to be the only simple method for estimating the amounts of particles of different sizes in a mass of finely ground material. For this purpose, instead of the Schoene apparatus, the following, used by Krehbiel, is recommended. The apparatus comprises three cylindrical copper cans, the bottom of each terminating in an inverted cone of 60°. A stream of water is fed into a thistle funnel, which passes to the bottom of the first can, and the overflow from this passes into a similar thistle funnel, and to the bottom of the second can, and similarly from this to the third can. The diameters of the second and third cans are arranged so that the velocity of the stream of water as it rises in the cans decreases, and, consequently, smaller and smaller particles are carried over. The stream is supplied to the first can from a receptacle, provided with an overflow, to ensure a constant pressure. The following table shows (1) the height, (2) the diameter, and (3) the speed at which the water rises in each can, and (4) the size of grain removed :—

	1.	2.	3.	4
	cm.	cm	mm. per sec.	mm.
First can.........	15	5 00	1·50	0·94—0·025
Second „	„	7·32	0·70	0·025—0·01
Third „	„	14·58	0·18	0·01 —0·00

The stream from the third can, carrying the milky washings, is allowed to flow away. 20 grms. of the finely-ground material are agitated with water and introduced into the first can, and the stream of water started. Particles whose diameters are above 0·04 mm. are left in the first can, those above 0·025 mm. in the second, and those above 0·01 mm. in the third, and these fractions are afterwards taken out, dried, and weighed, the fraction whose particles have diameters less than 0·01 mm. being estimated by difference. After obtaining the fractions the grains of which have diameters within the limits just mentioned, the fineness of the sample can be expressed as a numerical value, by the "surface factor" suggested by Jackson, and modified by Purdy.

[The "surface factor" is obtained in the following way:—Invert the mean diameter of each group. Multiply the "surface factor" of each group, thus obtained, by the fractional amount of the quantity of the sample having particles of these mean diameters. The sum of these products is the total "surface factor" for the sample.]

The following examples may be quoted to show the order of the figures of "surface factors" of some American ground materials :—

Felspar.	Eureka Co.	body spar		1028
	..	lawned 160		1047
	..	calcined		1198
Flint	..	French flint		1031
	..	..	lawned 160	1111
	..	,,	re-ground	1324

—W. C. H.

Zinc silicate crystals; A few facts concerning the so-called ——. F. H. Riddle. Trans. Amer. Ceramic Soc., 1906, 8. 336–352.

This paper contains an account of a method by which crystalline glazes can be produced by the use of zinc oxide, and without titanium oxide including the physical treatment involved, both in the preparation and firing of the glazes. To obtain these crystalline glazes, it is necessary to have a soft fluxing matrix, containing large amounts of zinc oxide and silica, which will crystallise out together as zinc silicate, from the supersaturated matrix. In compounding the glaze, the zinc silicate will crystallise out, whether added raw or partly or totally fritted with it, but the best results were obtained by fritting all the materials together in the following proportions :—Zinc oxide, 27·389; potassium nitrate, 7·382; borax, 13·770; whiting, 7·200; boric acid (flaky), 4·466; cupric oxide, 0·600; and flint, 39·693 parts by weight. This mixture corresponds to the formula :—

$$0{\cdot}7ZnO,\ 0{\cdot}075Na_2O,\ 0{\cdot}075K_2O,0{\cdot}150CaO)$$
$$(0{\cdot}0145CuO\ (1{\cdot}375SiO_2,\ 0{\cdot}225B_2O_3).$$

The glaze should be ground as fine as possible, and applied to the surface to be glazed with dextrin as an adhesive. The best results were obtained by bringing the glaze up to a maturing temperature, cooling rapidly to the best crystallising point, and maintaining it at this as long as possible and then gradually cooling down. Oxidising conditions must prevail throughout. The colouring oxide used has no marked effect upon the crystals, but shows them to better advantage. Copper, manganese, and iron were used with equally good results. W. C. H.

Magnesia; Experiments with ——. M. Ogan. Trans. Amer. Ceramic Soc., 1906, 8. 361–368.

Some experiments were made with a fine-grained, plastic clay from New Jersey, which when made up for a terra-cotta body warped so much during burning that it was useless for that purpose. At Seger cone 5 the clay was nearly vitrified, but when sprayed on a regular terra-cotta body, that was quite porous at cone 5 or 6, the clay was more porous and less vitreous than when burned by itself. Mixtures of this clay with various materials were made, and sprayed on to the standard terra-cotta body, and fired at cone 5. The following table gives the more important results of these trials :—

No.	Clay.	Material added.	Result.
	parts	parts	
4	97	$MgCO_3$ 3	No perceptible change in clay.
5	95	,, 5	Perceptible change towards vitrification.
6	90	,, 10	Vitrified.
7	85	,, 15	Vitrified.
8	80	,, 20	Slightly porous.
12	60	Felspar 40	Good vitreous surface.

A series of trials sprayed with No. 7 mixture was vitrified with cone 2 down, and still better vitrified with cone 5 down. Another series, in which No. 12 mixture was used, the members fired where cone 2 was down were vitrified, and those fired where cone 5 was down were fused to melting, and showed the body semi-transparent, crude, and checked like a glaze. Those glazes which would permit the introduction of magnesia without any bad effect from lack of fusion or change of colours were enabled to stand a wider range of temperature change than before. In another set of trials, the following materials were drawn from :—The New Jersey clay, felspar, magnesium carbonate and sulphate, ferric hydroxide and oxide, flint, and potassium nitrate. The formula, (A), was approximately :

$$(0{\cdot}2\,MgO.0{\cdot}23\,K_2O)(1\,Al_2O_3.0{\cdot}2\,Fe_2O_3)(4{\cdot}9\,SiO_2)$$

This matured at cone 01, and was a fair red colour at cone 3, but at cone 4 the colour tended to brown. In another trial, (B), the New Jersey clay was replaced by Florida kaolin; the mixture when burned at cone 02 was not quite vitrified, and the red colour tended to a brown shade. When the magnesium carbonate was increased to 0·4 equivalent, (C), the sample was much softer and more porous than with mixture (A), and the colour was worse when the New Jersey clay was replaced by kaolin. A mixture similar to (B), but with magnesium carbonate omitted, gave a more absorbent sample than (B), but with a better red colour, and not as soft as (C). As far as the experiments went, the use of equivalents of magnesia and lime seemed to show that both would mask iron, but that lime did so to a greater extent. By replacing the equivalent of lime by magnesia in a formula for pink given by Seger, the calcined mass is purple-red rather than pink-red in shade, and the addition of this to a glaze with lime still gives a pink-red. A purple-red is given by using all magnesium carbonate. A matt glaze is given by decreasing the amount of boric acid, and using magnesium carbonate and a little lime. In glazes, part of which was fritted, containing flint, borax, tin oxide, soda, porcelain mixture similar to Seger's, and from 5 to 8 per cent. of magnesium carbonate, this component seemed to check the fluidity too much, but allowed the glaze to adhere to the body better, and to permit of a more even distribution of colour.—W. C. H.

English Patents.

Glass melting furnaces. A. J. Boult, London. From J. Lecomte-Falleur et Cie., Jumet, Belgium. Eng. Pat. 12,915, June 2, 1906.

See Addition of June 18, 1906, to Fr. Pat. 346,012 of 1904; this J., 1906, 1147.—T. F. B.

Fused silica ware; Manufacture of ——. J. F. Bottomley, Wallsend-on-Tyne, and A. Paget, North Cray, Kent. Eng. Pat. 14,674, June 27, 1906.

The object of this invention is to produce articles of fused silica, glazed on both sides. The silica used for the production of the fused ware must be in a fine and even state of division, and after the fusing process, the layer of partially fused material is removed from the surface to be glazed, and to this surface a thin layer of enamel in a finely-divided state is applied. All traces of moisture must be removed from the silica and from the enamel. The enamel is fired in a muffle furnace, and in order to preserve the already glazed silica surface of the article during the firing of the enamel, the silica surface should be coated with a layer of some protecting material, such as sand, which will not react with it at the enamelling temperature. (See also Eng. Pats. 10,670 and 18,437 of 1904; this J., 1905, 673 and 846.)—W. C. H.

Ceramic products. M. and M. Méran, Paris. Eng. Pat. 19,045, Aug. 25, 1906. Under Int. Conv., Oct. 6, 1905.

See U.S. Pat. 827,550 of 1906; this J., 1906, 885.—T. F. B.

United States Patents.

Sheet-glass; Method and apparatus for drawing ——. I. W. Colburn, Franklin, Pa. U.S. Pat. 840,433, Jan. 1, 1907.

The method described of forming a sheet of glass consists in preparing a mass of molten glass, and drawing glass from it in sheet form, the drawing force being applied to the sheet simultaneously in the direction of its length and also of its width. During the continuance of the drawing operation, the sheet is subjected to the action of heat that is intense enough, and applied over an area sufficient to prevent cracking during the drawing. The apparatus comprises a receptacle for molten glass, and a bait for drawing the glass vertically into sheet form. To counteract the tendency of the sheet to narrow, and draw to a rod or thread, two rollers are mounted on axes perpendicular to the plane of the sheet; each roller is placed adjacent to an edge of the sheet, near the bottom, and also engages the glass in the receptacle. The rollers are rotated, by suitable means, in opposite directions, and thus exert a drawing action in the direction of the width of the sheet. Molten glass is supplied to the receptacle by conduits adjacent to the rollers, and consequently on opposite edges of the glass sheet. Independent mechanisms that can be worked at variable speeds are provided for drawing the bait from the molten glass, and for rotating the rollers. Means are provided for supplying heat to the drawn sheet adjacent to the receptacle for molten glass, and also for cooling the sheet as drawn. The receptacle is provided with a cover which has a depressed central portion, across which is a slot that extends into the elevated end portions of the cover.—W. C. H.

Sheet-glass; Process for drawing ——. J. George, Wilcox, Pa., and C. M. Shortle, Bernhard's Bay, N.Y., Assignors to Newkirk Glass Co., Pierre, S.D. U.S. Pat. 840,838, Jan. 8, 1907.

In this process of drawing glass sheets from a body of molten glass, the edges of the sheet or film, as it is drawn up from the molten mass of glass, are kept in contact with vertical surfaces rising from the molten mass. These vertical surfaces and the edges of the sheet are kept at such a temperature as to cause the edges to cling to the surfaces as they pass them. The body of the sheet formed is protected from the direct action of radiated heat. The glass is drawn from an elbow-shaped receptacle attached to the glass tank, and contained in a closed chamber, provided with a means of heating, the sheet being drawn through a slot in the top of the chamber.
—W. C. H.

Porcelain; Process of firing ——. C. Ellis, White Plains, N.Y. U.S. Pat. 840,559, Jan. 8, 1907.

In this process the ceramic ware is placed in a suitable enclosing chamber, and the heat applied by causing a body of burning gas to circulate round the chamber. The body of burning gases is free from unoxidised carbon, and comprises a mixture of combustible gas, a combustion-retarding gas, and an excess of oxygen. The combustion space is separated from the chamber containing the ceramic ware by a porous, heat-radiating wall of refractory material. The mixture of gases is too poor in combustible to burn except under the influence of heat radiated from the walls of the combustion chamber. A drift of the gases is produced through the pores of the wall of the combustion chamber, and the combustion of the gas is completed by the catalytic action of the material of the wall, prior to the contact of the gas with the ware. A zone of approximately uniform temperature is thus maintained by the approximately uniform combustion of the mixture of gases in all portions of the combustion space in the vicinity of the chamber containing the ware.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 257.)

Granulated slag [slag sand]; Drying of ——. C. R. v. Schwarz. X., page 324.

English Patents.

Stone, artificial, for grinding or abrasive or like purposes; Manufacture of ——. J. B. Touya, jun., Tarbes, France. Eng. Pat. 5368, March 5, 1906.

Artificial grinding stones are made by incorporating pulverised rock crystal or emery with a binding material composed of calcined, pulverised dolomite that has been mixed with magnesium chloride, previously rendered liquid by exposure to the air. The mixture is moulded into the required shapes, and dried.—W. C. H.

Lime and other substances; The burning of ——. The Associated Portland Cement Manufacturers (1900), Ltd., and D. H. Gibbs, London. Eng. Pat. 24,823, Nov. 5, 1906.

The arrangement described is for utilising the highly heated gases that escape, especially from kilns of the type known as "flare kilns," during the process of burning lime. It consists of two common flues, one of which can be put in communication with both the top and the bottom of each kiln in a series, and the other with the top of each kiln. A cross flue connects the two common flues, and also leads to a chimney shaft. Dampers are provided to establish or stop communication between the kilns and flues as required. In the process of burning "flare lime," the waste gases from a burning kiln are led into the former common flue, and pass into another kiln of the series, in which a charge of lime is to be dried, and from the top of this latter kiln the gases pass into the second common flue, and thence to the chimney shaft.—W. C. H.

United States Patents.

Bricks, &c.; Manufacturing ——. A. A. Gery, Reading, Pa. U.S. Pats. 839,832 and 839,833, Jan. 1, 1907.

See Fr. Pat. 356,838 of 1905; this J., 1906, 21.—T. F. B.

Stone, artificial; Manufacture of —— *in imitation of marble or granite and the like.* L. Lefranc, Lausanne, Switzerland. U.S. Pat. 841,160, Jan. 15, 1907.

See Fr. Pat. 355,222 of 1905; this J., 1905, 1173.—T. F. B.

French Patent.

Slate; Process for the manufacture of an artificial ——. J. Hennings and O. Kesler. Fr. Pat. 371,269, Nov. 9, 1906.

In this process for the manufacture of artificial slate, a mixture is made of ground cement, with 20 to 25 per cent. of finely-ground manganese oxide. This mixture is agitated with water to make a thin pulp, which is poured into glass moulds in the form of flat plates of suitable dimensions.—W. C. H.

X.—METALLURGY.

(*Continued from page* 260.)

Gilding by fire; and blackening of gilded surfaces. H. Struve. Z. anal. Chem., 1907, **46**, 106—124.

Copper is gilded by treating it with gold amalgam and then heating to volatilise the mercury. The author has examined a number of such gilded surfaces of copper, and finds that when the copper is dissolved away by acid, the remaining film of gold is far from being continuous, but resembles rather a network. It usually contains from 10 to 18 per cent. of mercury, and 1 to 5 per cent. of copper. For effective gilding, about 2·4 grms. of gold per sq. ft. are necessary, of which about 20 per cent. is lost in the process. The temperature and duration of the heating are of great importance. If too high a temperature be used, or the heat be kept up too long, not only is there a loss of mercury, but the copper diffuses through to the surface, so that the gold is covered by a film of copper. This film, exposed to the atmosphere, oxidises, so that the object becomes covered with a black film of cupric oxide.—J. T. D.

Cobalt ores; Method of smelting ——. H. W. Hixon. Eng. and Mining J., 1907, **83**, 426—427.

THE author suggests the following system of treatment for cobalt ores containing silver:—Metallic silver should be separated from the ore by sorting, and smelted directly, either by cupellation with lead or by melting in crucibles. The ore should then be ground in a dust-proof ball mill and roasted to expel arsenic and sulphur, the fumes being passed first through a long dust chamber and then through a "bag-house." The roasted ore should be formed into briquettes with red clay and lime water, and smelted in a blast-furnace with about an equal weight of galena or lead concentrates (containing 50—60 per cent. of lead), and suitable quantities of iron and lime. The base bullion from this operation would be sold to lead refiners or treated for the recovery of the silver. The matte and speiss will contain the nickel and cobalt and the remaining arsenic not volatilised in the roasting process. When a sufficient quantity has accumulated, it is ground in a ball mill, roasted, and smelted with an addition of lead for the recovery of the silver. The resulting matte is treated in a converter for the separation of the iron, lead and most of the cobalt also passing into the slag along with the iron; the fumes are passed through a "bag-house" to recover lead and arsenic. The cobalt is recovered from the converter slag by smelting it in a blast-furnace with a portion of the briquetted flue dust (rich in arsenic) from the roasting of the ore, and the resulting speiss or arsenide of cobalt is roasted to expel arsenic, and treated by chemical methods for the extraction of the cobalt.—A. S.

Titaniferous slags. C. N. Cox and L. C. Lennox. Electrochem. and Metall. Ind., 1906, **4**, 490. Chem.-Zeit, 1907, **31**, Rep. 123.

THE authors have made slags of various compositions, corresponding to mono-, sesqui-, bi-, and tri-silicates, and containing alumina and lime in the ratios 1:3 and 1:4, also magnesia, lime, and alumina in the ratios 3:12:33; these contained titanic acid in amounts from 1 to 14 per cent. With these were also compared a titaniferous slag of Rossi's, and two ferrous oxide slags of Hofmann. All fused between 1270° and 1350° C.; those containing magnesia were most fusible, and those containing alumina and lime in the ratio 1:4 more fusible than those in which that ratio was 1:3. The melting points were all below the temperature existing in the blast furnace, so that there is no reason why such mixtures should not yield readily fusible slags.—J. T. D.

Granulated slag [slag-sand]; Drying of ——. C. R. v. Schwarz. Stahl. u. Eisen, 1907, **27**, 413—415.

THE apparatus consists of a rotating drum, 10—16 m. long and 1·2—1·7 m. diameter, provided internally with blades which cause the damp slag, fed in at one end of the drum, to be gradually carried along to the other and to be continually turned over in the process. The current of hot gases, produced by the combustion of gas from a "half-gas" generator, with heated air, travel from end to end of the drum in the opposite direction to the slag, and are aspirated by means of a controllable exhaust-fan at the end of the drum. They are then sent through flues surrounding the drum so as to prevent loss of heat, and ultimately go to the chimney. The hot dried slag falls through an inclined tube to a screw transporter, where it is mixed, before being carried away, with a quantity of damp slag just sufficient to become itself thoroughly dried in cooling the hot slag; and the steam from this process joins the gases in the combustion chamber. It is claimed that the apparatus is very efficient and economical. In such an apparatus 2½ to 4 tons of slag can be dried per hour, with a coal consumption of 4¼ per cent. of the weight of the dried slag, and an evaporation efficiency of 7½—8½ lb. of water per lb. of coal.—J. T. D.

Manganese; Determination of —— *in presence of tungsten [e.g., in tungsten steels].* G. v. Knorre. XXIII., page 345.

The mineral production of Canada. Eng. and Min. J., March 16, 1907. [T.R.]

THE Mines Branch of the Geological Survey of Canada has issued the preliminary statement of the mineral production of the Dominion for 1906. The figures are given in the following table:—

Product.	Quantity.	Value.
METALLIC—		$
Copper, lb.	57,029,231	10,994,095
Gold	—	12,023,932
Iron ore (exports), tons	74,778	149,177
Pig iron from Canadian ore, tons	104,660	1,724,400
Lead, lb.	54,200,000	3,066,094
Nickel, lb.	21,490,955	8,948,834
Silver, oz.	8,568,665	5,723,097
Cobalt, zinc, and other metallic products	—	350,000
Total metallic	—	$42,979,629
NON-METALLIC—		
Asbestos, short tons	59,283	$1,970,878
Asbestic, short tons	20,127	17,230
Chromite, short tons	8,750	92,100
Coal, short tons	9,916,177	19,945,032
Peat, short tons	250	750
Corundum, short tons	2,274	204,973
Felspar, short tons	15,873	38,740
Graphite, short tons	447	18,780
Grindstones, short tons	5,545	61,624
Gypsum, short tons	417,755	591,828
Limestone for flux in iron furnaces, short tons	366,015	286,632
Manganese ore (exports), short tons	93	925
Mica (exports), short tons	913	581,919
Mineral pigments—		
Barytes, short tons	4,000	12,000
Ochres, short tons	6,837	36,955
Mineral water	—	100,000
Natural gas	—	528,868
Petroleum, bbl.	569,753	761,760
Pyrites, tons	39,611	157,438
Salt, tons	76,387	327,150
Talc, tons	1,234	3,030
Total non-metallic	—	$25,738,612
STRUCTURAL MATERIALS AND CLAY PRODUCTS—		
Cement, natural rock, bbl	8,610	$6,052
Cement, Portland, bbl	2,139,164	3,164,807
Sands and gravels (exports), tons	256,550	139,712
Sewer pipe	—	446,790
Slate	—	24,446
Building material, including bricks, building stone, lime, &c.	—	7,200,000
Total structural materials and clay products	—	$10,981,807
Estimated value of mineral products not returned	—	300,000
Total, 1906	—	$80,000,048

The tons given are short tons of 2000 lb. The metals are valued at average prices in New York for the year.

The total value of the mineral production of Canada for five years past has been as follows:—1905, $69,525,170; 1904, $60,073,897; 1903, $61,740,513; 1902, $63,211,634; 1901, $65,804,611.

Of the gold reported in 1906, the Yukon furnished $5,600,000, and other parts of the Dominion $6,423,932.

Mercury production of Russia. Mining World, March 9, 1907. [T.R.]

THE Nikitovsk mercury deposits in Russia yielded 75,181 tons of cinnabar ore (462,564 lb. of mercury) in 1906, which compares with 82,767 tons of ore (696,436 lb. of metal) in 1905, showing a decrease of 7,586 tons of ore

(233.872 lb. of metal). This practically constituted the total production of Russia, as the Daghistan mine yields comparatively little mercury.

English Patents.

Alloy of iron and hydrogen ; Articles of an ——, and process for producing the same. A. Bontempi, New York. Eng. Pat. 18,742, Aug. 21, 1906.

The finely-powdered alloy of iron and hydrogen is shaped, compressed, and heated in a tightly closed muffle to 1000° F. to 2000° F. in the presence of a relatively volatile metal, such as antimony or lead, or one of the compounds of such metal. The alloy, it is stated, usually takes up 2 or 3 per cent. of the volatile metal, and may be made of a definite electrical conductivity, besides being chemically inert. The articles are rendered nonporous by dipping in molten paraffin.—O. F. H.

Ferro-molybdenum ; Manufacture of ——. H. W. C. Annable, Battersea, and The Ferro Alloys Synd., Ltd., London. Eng. Pat. 5031, March 1, 1906.

See Fr. Pat. 370,645 of 1906 ; this J., 1907, 260.—T. F. B.

Precious metals ; Process for the recovery of —— from ores and material containing same. A. H. Walker, London. From J. A. Just, Pulaski, U.S.A. Eng. Pat. 4796, Feb. 27, 1906.

See U.S. Pats. 814,294 and 820,000 of 1906 ; this J., 1906, 320 and 764.—T. F. B.

Slag ; Process for obtaining a ——. F. Benjamin, Bethen, Germany. Eng. Pat. 1102, Jan. 15, 1906.

See Fr. Pat. 362,419 of 1906 ; this J., 1906, 700.—T. F. B.

Flux skimmings of zinc, or other similar material ; Process for treating ——. H. A. Leaver and C. von Buch. Eng. Pat. 5655, March 8, 1906. VII., page 318.

Furnace ; Melting ——. C. Twer, Uerdingen-on-Rhine, Germany. Eng. Pat. 14,779, June 28, 1906.

The patent relates to a tilting furnace for melting brass, cast iron, &c., the hearth being pivoted at the charging end and supported at the tapping end by a column which can be raised or lowered. The furnace is heated by gas from a producer forming part of the furnace, and the waste gases are used to heat the air supply by being made to travel round the air-inlet passages, in the construction of which corrugated tiles are used to increase the heating effect of the waste gases.—O. F. H.

Converters ; Method of lining [for copper] ——. H. L. Charles and F. A. Heinze, Butte, Montana, U.S.A. Eng. Pat. 16,322, July 19, 1906.

The improvement consists in the use of molten slag or matte instead of a coke fire for drying the linings of copper converters. The lining is put in in the usual way, and the tuyères are then plugged with clay, and the converter body filled with molten slag or matte, preferably slag. The slag is allowed to remain in the converter for about an hour, with a small wood or coal fire on the surface to prevent chilling, and is then poured off, leaving a layer of solidified slag on the inner surface of the lining. The drying is finished by fresh additions of molten slag. A number of vent holes are provided in the body of the converter for the escape of steam.—O. F. H.

Separation of substances having different magnetic excitabilities ; Process and apparatus for the —— with the use of crossing conveying devices. Maschinenbau-Anstalt Humboldt, Kalk, and Metallurgische Ges., A.-G., Frankfort, Germany. Eng. Pat. 20,545, Sept. 15, 1906. Under Int. Conv., Jan. 26, 1906.

See Fr. Pat. 369,799 of 1906 ; this J., 1907, 210.—T. F. B.

United States Patents.

Gold ; Apparatus for extracting and saving ——. J. A. Coombes, Atlantic City, N.J., Assignor to The Aurum Mining Co. U.S. Pat. 840,752, Jan. 8, 1907.

The apparatus consists of a vertical casing containing a pair of horizontal cylinders, one above the other, mounted to revolve in unison and having rigid projections on their peripheries ; and a horizontally inclined casing into the lower end of which the bottom of the vertical casing opens. The ore is fed in at the top of the vertical casing on to the revolving cylinders by means of an inclined hopper and regulator, and is withdrawn through the horizontally inclined casing, the bottom of which is provided with riffles, by a suction fan at its upper end.—O. F. H.

Cyanide process. H. B. Goetschius, Dumont, N.J. U.S. Pat. 840,840, Jan. 8, 1907.

The cyanide solution is first aerated under pressure, and then forced through the ore to be treated against a suitable back pressure. The pressure on the mixture is afterwards alternately released for the purpose of mechanically agitating the mass of ore, and increased to slightly above the initial pressure, in order that disengaged gas and any gas films or bubbles adhering to the particles of ore may be dissolved by the cyanide solution. Before the treatment with cyanide solution, the ore may be treated with an aqueous solution of chlorine, aerated with oxygen or air under pressure, the pressure, during the treatment, being alternately released and increased as described above.—A. S.

Reducing-amalgam ; Apparatus for the manufacture of ——. H. P. Ewell, Rochester, Mich. U.S. Pat. 841,006, Jan. 8, 1907.

The apparatus consists of an amalgamating chamber, washing and drying tanks for the amalgamating material, and a receptacle for the reducing agent. Means are provided for heating the reducing agent in order to maintain it in a fluid state, and air is excluded from its surface by a layer of molten fat or oil. The reducing agent is delivered in small quantities into the amalgamating chamber through a protective layer of fatty substance on the surface of the amalgamating material. The amalgamating chamber is provided with an agitator to facilitate amalgamation.—O. F. H.

Ore chlorination. W. V. Lander, Newton, Mass. U.S. Pat. 841.328, Jan. 15, 1907.

The powdered ore is carried by a stream of chlorine water and in an atmosphere of chlorine gas over a series of riffles, for the collection of concentrates, the solution finally passing into a receptacle and the gold in it recovered. —O. F. H.

Chlorinating apparatus. W. V. Lander, Newton, Mass. U.S. Pat. 841,329, Jan. 8. 1907.

The apparatus consists of a riffle pipe composed of a number of pipe sections, the riffle of one section projecting into the next and overhanging the succeeding riffle ; a chamber at the head of the riffle pipe, and a receiving tank at the foot. The crushed ore is fed by a hopper into the head chamber and carried by a stream of water saturated with chlorine through the riffle pipe, which is made gas-tight, and filled with chlorine gas, the solution finally passing into the receiving tank, which is also made gas-tight. The head chamber and hopper are kept filled with ore in order to prevent escape of gas.—O. F. H.

Ore cyaniding. W. V. Lander, Newton, Mass. U.S. Pat. 841,330, Jan. 15, 1907.

The powdered ore is carried by a stream of cyanide solution over a series of riffles for the collection of the insoluble solids, and the dissolved gold recovered from the solution, air being forced into the solution in its passage over the riffles.—O. F. H.

Cyaniding apparatus. W. V. Lander, Newton, Mass. U.S. Pat. 841,331, Jan. 15, 1907.

Ore and cyanide solution are delivered on to the head riffle-plate of a series so arranged that the foot of one plate overhangs the head of the next. Air-supply pipes are provided for the aeration of the cyanide solution before it reaches the ore, and during its passage over the riffle-plates.—O. F. H.

Pyritous minerals ; Roasting of ——. G. Rambaldini, Miniera di Boccheggiano, Italy. U.S. Pat. 840,253, Jan 1, 1907.

SEE Eng. Pat. 2402 of 1902 ; this J., 1903, 145.—T. F. B.

Ores ; Process of treating ——. C. E. Baker and A. W. Burwell, Cleveland, Ohio. U.S. Pat. 841,102, Jan. 15, 1907.

POWDERED sulphide ores of metals which form fusible chlorides, are subjected to the action of sulphur chloride at a temperature above the fusing point of the metallic chloride, and the metal is recovered by electrolysing the fused metallic chloride thus produced.—A. S.

Ores ; Process of treating ——. C. E. Baker and A. W. Burwell, Cleveland, Ohio. U.S. Pat. 841,103, Jan. 15, 1907.

DRY powdered sulphide ore (*e.g.*, copper sulphide ore) is treated with dry sulphur chloride at a suitable temperature, in order to produce sulphur and the chloride of the metal. The latter is extracted from the reaction-products, and the metal is recovered by electrolysis.—A. S.

Metals [iron and zinc] ; Process of mixing ——. J. D. Prince, New York, and H. S. Rodgers, Covington, Ky. U.S. Pat. 841,178, Jan. 15, 1907.

FOR the production of a homogeneous alloy of two metals of different melting points, the metal with the lower melting point is mixed with a suitable flux, and introduced into the mould simultaneously with the other metal, the latter being in the molten condition. The process is intended specially for the production of zinc-iron alloys. Finely-divided zinc is mixed with an equal quantity of a suitable flux, the mixture is covered with water, and allowed to stand, the water is poured off, and the mass, after drying, is introduced into the mould simultaneously with molten iron, the two metals mixing as they flow into the mould.—A. S.

Coating metals ; Composition for ——. M. Toch. U.S. Pat. 841,603, Jan. 15, 1907. XIII.*A.*, page 329.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 262.)

(*A.*)—ELECTRO-CHEMISTRY.

Iron ; Potential of —— under different conditions, and the influence of occluded hydrogen. T. W. Richards and G. E. Behr, jun. Z. physik. Chem., 1907, **58**, 301—349.

THE method of investigation consisted in measuring the potential of iron, that has been subjected to a great variety of different conditions, on immersing the metal in the solution of one of its salts. The results obtained are summarised as follows :—The potential of pure spongy iron is considerably affected by exposure of the metal to air, probably owing to the formation of a very thin film of oxide or to occluded oxygen. On immersing such iron in ferrous sulphate solution, a low value is at first obtained for the potential, but this gradually rises, and finally a constant value is reached. On subjecting pure spongy iron to very great pressure (up to 350,000 kilos. per sq. cm.), the metal is welded to hard plates with bright surface, but the compact metal has practically the same potential as before. Spongy iron obtained by reduction at low temperatures has a potential, or E.M.F., at least 0·2 volt higher than compact iron obtained by fusion. If the potential of the calomel normal electrode be taken as 0·56 volt, that of compact iron is 0·15 volt, and of spongy or porous iron, 0·17—0·18 volt ; the former is accepted as the normal value. The potential of pure iron is not appreciably affected by sudden cooling from a high temperature. Finely-divided iron obtained by reduction at low temperatures is capable of taking up hydrogen, without the potential of the metal being notably affected. If the metal becomes completely surrounded by hydrogen, its potential is diminished. In these cases the occluded hydrogen appears to be simply adsorbed in the molecular condition. Pure iron when quenched in water, whether in an atmosphere of hydrogen or of nitrogen, takes up hydrogen in an active form, which increases the potential of the metal by 0·15 volt. This hydrogen is rapidly evolved in ferrous sulphate solution, but only slowly in water or potassium sulphate solution, the potential falling to the normal value. Iron is capable, also, of taking up a small quantity of hydrogen in this active form when heated to a high temperature (575° C.) in hydrogen gas. In the authors' opinion this hydrogen in the active condition must be regarded as dissociated but not ionised.—A. S.

Zinc ; Electrolytic deposition of ——, *using rotating electrodes.* T. S. Price. XXIII., page 345.

Tin and arsenic ; Electrolytic separation of ——. A. Lampén. XXIII., page 346.

Electro-decolorisation ; A study in optical sugar analysis. F. G. Wiechmann. XVI., page 333.

ENGLISH PATENTS.

Secondary batteries [; Plates for ——.]. L. Fiedler, Stoke Newington. Eng. Pat. 5493, March 6, 1906.

A SOLUTION is made of 3 parts of a 10 per cent. solution of lead acetate and 1 part of a 10 per cent. solution of phenol, and enough powdered minium is added to produce a plastic mass. The lead frame or grid is completely filled up with this paste and heated to drive off acetic acid, leaving a hard, porous plate of good conducting power. For a positive plate minium alone is added to the solution, and for a negative plate litharge or a mixture of litharge and minium is added.—O. F. H.

Electricity ; Thermochemical generator of ——. L. P. Basset, Epiney, France. Eng. Pat. 16,905, July 26, 1906. Under Int. Conv., July 27, 1905.

SEE Fr. Pat. 356,442 of 1905 ; this J., 1905, 1312.—T. F. B.

UNITED STATES PATENTS.

Furnace ; Electric ——. W. H. Bristol, New York. U.S. Pat. 839,983, Jan. 1, 1907.

THE furnace comprises a receptacle of fused quartz, forming a heating chamber, on which is wound a platinum electric-heating coil, the successive turns being separated from each other by asbestos cord. The wire is flattened, and placed edgewise with respect to the quartz receptacle. An asbestos covering surrounds the receptacle and coil, and this is again encased in a refractory non-conducting material.—B. N.

Arc light carbon. A. Kufferath, Assignor to L. C. Marquart. U.S. Pat. 840,222, Jan. 1, 1907. II., page 309.

Refractory metallic wires or filaments ; Art of making ——. H. C. Parker and W. S. Clark, Assignors to the Parker-Clark Electric Co. U.S. Pat. 840,246, Jan. 1, 1907. II., page 309.

Carbon for electrical resistances ; Process of preparing ——. E. G. Rivers, Richmond, Assignor to Electric and Ordnance Accessories Co., Ltd., Birmingham. U.S. Pat. 841,752, Jan. 15, 1907.

SEE Fr. Pat. 360,284 of 1905 ; this J., 1906, 483.—T. F. B.

Water purifying and filtering apparatus ; Electric ——. J. A. Hyle, Assignor to F. Hesser and D. A. Reagan. U.S. Pat. 840,335, Dec. 25, 1906. XVIII.*B.*, page 338.

FRENCH PATENTS.

[Electric] Incandescence bodies with tungsten ; Manufacture of ——. Consortium für Elektrochem. Ind.-Nürnberg. Fr. Pat. 371,435, Oct. 16, 1906. II., page 310.

Oxide minerals and analogous materials; Process and apparatus for the electric reduction of ——. A. J. Petersson. Fr. Pat. 370,909, Oct. 29, 1906.

THE mineral and carbon are fed separately into the furnace in such a manner that they form distinct vertical columns in direct contact with each other; for example, a middle column of carbon and two outer columns of mineral. The column of carbon is heated electrically to the temperature necessary for its reaction with the mineral. the carbon monoxide produced serving for the reduction of further quantities of the mineral. A circulation of the gases is maintained through the carbon and ore in the furnace in conjunction with external regenerators. In this manner the heat carried off by the gases is conserved. and the carbonic acid is reduced to carbon monoxide by contact with the highly heated column of carbon. The electrodes are protected from attack by the mineral or by the gases, and for further raising the temperature of the reduced metal, provision is made for supplementing the heating by electric currents induced in the material. —R. S. H.

Minerals and allied substances; Reduction and fusion of ——. A. J. Petersson. Fr. Pat. 370,910, Oct. 29, 1906. Under Int. Conv.. Nov. 2. 1905.

THE mineral and carbon are introduced into an electric furnace in such a manner that they form separate columns. The combustible gases formed during the reduction of the mineral are burnt in the column of mineral by introducing the air necessary to maintain combustion. In this manner the mineral is subjected to a preliminary heating before it reaches the reduction zone. (See preceding abstract.)—R. S. H.

Furnaces for producing carbide from lime and carbon; Charging electric ——. A. J. Petersson. Fr. Pat. 370,911, Oct. 29, 1906. Under Int. Conv., Nov. 2, 1905.

THE charges of carbon and lime are introduced separately in such a manner that they form distinct columns, the carbon being in contact with the electrodes, whilst the lime generally surrounds the carbon and does not come in contact with the electrodes.—R. S. H.

Carbide; Continuous production of —— *from lime and carbon.* A. J. Petersson. Fr. Pat. 370,912, Oct. 29, 1906. Under Int. Conv., Nov. 2, 1905.

THE carbon and lime are introduced separately into the furnace, an electric current traversing the carbon and maintaining it at a temperature suitable for its reaction with the lime. The carbon monoxide generated by this reaction is oxidised in the layers of lime by air, the necessary quantity of which for its combustion is introduced. In this manner the lime is subjected to a preheating before it reacts with the carbon.—R. S. H.

Hydrogen peroxide; Electrolytic production of ——. O. Urbasch. Fr. Pat. 371,043, Nov. 2, 1906. Under Int Conv., Oct. 3, 1906.

SOLUTIONS of sulphuric acid, phosphoric acid, &c., or their salts are subjected to electrolysis, and the resulting products are submitted to distillation at a low temperature and at a low pressure. In this manner the oxidation products are decomposed. and a solution of hydrogen peroxide in water is condensed. the de-oxidised solutions being subsequently further treated by electrolysis. —R. S. H.

Electrodes for electrolytic operations. P. Ferchland. Fr. Pat. 371.245. Nov. 8. 1906. Under Int. Conv., Nov. 9, 1905, and Aug. 23, 1906.

SEE Eng. Pat. 24,806 of 1906; this J., 1907, 261.—T. F. B.

Water purifier [; Electric ——]. The Hinkson Electric Liquid Purifying Co. Fr. Pat. 371,055, Nov. 3, 1906. XVIII*B*., page 338.

GERMAN PATENT.

Gases or gaseous mixtures; Process of subjecting —— *to the action of the silent electric discharge.* A. Schneller and D. Koeleman. Ger. Pat. 173,519, Oct. 28. 1903.

THE patent relates to the use of currents of high voltage for the treatment of gases by the silent electric discharge, the improvement claimed consisting in the employment of a moving layer of a liquid of high electrical resistivity, *e.g.*, oil or the like, on the surfaces of the usual solid dielectric material.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Iron and steel; Discussion on the Electro-metallurgy of ——. L. Guillet, P. Girod, E. Stassano, — Saconney. Procès-verbal Soc. des Ingénieurs civils de France, March 1, 1907, 64—77.

THE discussion was opened by L. Guillet, who gave a general survey of the subject, the properties of steels prepared in the electric furnace being compared with those of ordinary manufacture. The author claims superiority for the electric furnace product, particularly in its high power of withstanding shock. The superior quality is explained by three facts:—(1) It is tapped from the furnace at a higher temperature, and this allows of the separation of impurities from the molten mass; (2) the refining is more perfect, since the reactions required are facilitated by the high temperature; (3) the almost complete absence of occluded gas.

P. Girod gave the following data for his furnace of 240 to 250 kw. at Ugine:—Total works cost per ton of steel for fusing and refining raw materials, with water power (0·007 fr. per kw. hour), 21·10 frs.; with blast-furnace gas power (0·02 fr. per kw. hour), 31·50 frs.; with steam power (0·04 fr. per kw. hour), 47·50 frs. Figures are quoted to show the great economy over the ordinary crucible steel process.

E. Stassano described in detail the construction and working of his rotary arc furnace (this J., 1905, 1072). With his smaller furnace of 140 kw., the energy consumption is about 1 kw. hour per kilo of steel, the consumption of carbon electrodes is less than 5 kilos. per ton of steel, and the loss of material under 4 per cent. Still better results are expected with the 1000 h.p. furnace now in use.

M. Saconney, as a result of a personal investigation of the Stassano, Héroult, and Girod processes, considers that the first of these is incapable of economically eliminating phosphorus and sulphur. On the other hand, he adds his testimony to that of others as to the high degree of refining in the Héroult and Girod processes, starting with materials containing considerable quantities of phosphorus and sulphur.—R. S. H.

ENGLISH PATENTS.

Magnetic material for electrical purposes. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 3455, Feb. 12, 1906.

THIS invention relates to a method of producing an insulating coating on iron or steel magnetic materials which may be subjected to varying magnetic fluxes. Instead of coating the magnetic material (steel containing a large percentage of silicon) with a varnish or the like, an insulating coating is produced upon it by annealing it in presence of a limited supply of oxygen. The insulating coating is probably formed largely of oxide of iron separated from the metal by a layer of oxide of silicon. The supply of oxygen must be carefully regulated during the annealing process. The use of such sheets in electrical apparatus is also claimed.—B. N.

Furnaces; Electric induction ——. The Gröndal Kjellin Co., Ltd., and J. Härdén, London. Eng. Pat. 16,269, July 18, 1906.

THIS invention relates to an electric induction furnace, in which the windings of the primary coil consist of hollow conductors, water or other cooling medium being passed through the tubes. A water-cooled or jacketed magnetic screening device is also employed, consisting of inner and outer discontinuous annular water-cooled chambers. The latter are separated by a thick wall of copper, or other suitable material, provided with projections or ledges of circular or spiral form, these preventing leakage of the primary magnetic field.—B. N.

Tantalum or other difficultly fusible metal; Producing homogeneous masses of ——. A. G. Bloxam, London. From Siemens und Halske A.-G., Berlin. Eng. Pat. 22,491, Oct. 11, 1906.

SEE Fr. Pat. 371,207 of 1906; following these.—T. F. B.

Furnace; Electrical induction —— with electrodes. A. Hiorth, Christiania, Norway. Eng. Pat. 28,960, Dec. 19, 1906. Under Int. Conv., June 2, 1906.

THE free ends of a horseshoe-shaped double electrode dip down into the slag, so that the electrodes, together with the slag and smelting mass, form the secondary part of the transformer, the slag thereby serving as the heating resistance.—B. N.

Furnaces; Electrical smelting ——. A. Hiorth, Christiania, Norway. Eng. Pat. 28,961, Dec. 19, 1906. Under Int. Conv., Nov. 6, 1906.

THIS invention relates to the type of induction furnace which is provided with partitions in the annular smelting space. (See Eng. Pat. 28,959 of 1906; this J., 1907, 209.) The raw material is supplied directly above such partitions, so that the current is conducted from one side of the partition to the other entirely or partly through the raw material, the latter at this place being in contact with the hottest and most energetic portion of the slag.—B. N.

UNITED STATES PATENTS.

Metals from ores and other substances; Apparatus for recovering ——. L. Dion, Assignor to The Americus Electro-Hermatic Company, New York, N.Y. U.S. Pat. 840,480, Jan. 8, 1907.

THE apparatus consists of a series of chambers or electric furnaces, each provided with a group of electrodes, a part only of each group being submerged in the liquid contents of the chambers; and a receiver for the condensation products of the fumes arising from the molten metal. Means are provided for the circulation of the liquid bath from one chamber to another, and between the electrodes of each chamber.—O. F. H.

Furnace; Electric ——. L. Dion, Assignor to The Americus Electro-Hermatic Company, Wilkes-Barre, Pa. U.S. Pat. 840,481, Jan. 8, 1907.

THE furnace consists of a chamber having an outlet flue and a shoot with a hopper and regulator for the charge, both communicating with the top of an interior crucible. The inner walls of the crucible have a number of inwardly and downwardly projecting flanges separating a series of electrodes, which pass through the walls of both crucible and furnace chamber. The charge travels down the centre of the crucible between the ends of the flanges and electrodes, and the molten products are collected in the contracted lower portion or well of the crucible and thence tapped.—O. F. H.

Sulphide ores; Extracting metals from ——. R. L. Packard, Washington, D.C. U.S. Pat. 840,511, Jan. 8, 1907.

THE sulphides are converted into sulphates by adding the unroasted pulverised ore to a suitably acidified chloride solution, which is electrolysed until the bath is saturated with chlorine. In the case of gold ores the current is interrupted to permit the chlorine to oxidise the iron salts and effect a complete solution of the gold.—O. F. H.

FRENCH PATENTS.

Tantalum or other refractory metals; Method for the production of homogeneous bodies of ——. Siemens und Halske A.-G. Fr. Pat. 371,207, Oct. 25, 1906.

THE fusion of the metal is effected by means of cathode rays, which are concentrated upon the material to be treated. The cathode is arranged in the form of a reflector inside a glass vessel which is suitably evacuated. If desired, the metal powder to be fused need not be in contact with either of the electrodes. In the case where high-tension alternating currents are employed, the two electrodes may with advantage be so arranged as to focus the cathode rays upon the metal to be heated, thus enabling each in turn to do useful work. The direction of the rays can be regulated by a magnet so as to successively treat different portions of the material.—R. S. H.

Metals; Electrolytic extraction of ——. M. Perreur-Lloyd and A. M. Gardner. Fr. Pat. 371,251, Nov. 8, 1906.

THIS invention relates to a process for the electrolytic extraction of metals, such as copper, from their ores, with the employment of diaphragms between the anode and cathode. A solution of ferrous sulphate is contained in the anode compartment, and, during electrolysis, air is passed through the solution, thus completely oxidising the salt to ferric sulphate. The latter is afterwards reduced, outside the electrolytic bath, by means of sulphurous acid, sulphuric acid being simultaneously formed.—B. N.

Fusion of bodies readily volatilised; New process of —— in the electric furnace. H. Herrenschmidt. Fr. Pat. 371,260, Nov. 9, 1906.

THE invention relates to a process for obtaining, in the electric furnace, substances which are readily vaporised, such as lead, antimony, and tin, in the liquid state. The excess of heat, furnished by the electric arc, is absorbed by a slag which is formed at the surface of the bath of the melted body. The application of the process to the extraction of tin from cassiterite is claimed, and also the combination of the process with that described in Fr. Pat. 369,878 of 1906 (this J., 1907, 208).—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 263.)

Castor oil; Alcoholysis of ——. A. Haller. Compt. rend., 1907, **144**, 462—466.

BY the alcoholysis (see this J., 1906, 1158) of castor oil, the author has obtained the methyl esters of stearic, ricinoleic, and dihydroxystearic acids, showing that these acids are present as glycerides in the oil. At present, the presence of two isomeric ricinoleic acids in castor oil, as stated by Hazura and Grüssner, has not been confirmed. By employing ethyl, propyl, and isobutyl alcohols in place of methyl alcohol, the corresponding esters of ricinoleic acid were obtained. Methyl and ethyl ricinoleates yield œnanthylic aldehyde and methyl or ethyl undecylate, when submitted to dry distillation at the ordinary pressure.—W. P. S.

Phytosteryl acetate test for the detection of adulteration of animal by vegetable fats; Some notes on Bömer's ——. F. M. Jaeger. XXIII., page 346.

Sod oil and moellon; Moisture in ——. F. W. Alden. XIV., page 331.

Fats and fatty acids; Refraction of ——. R. K. Dons. XVIII*A*., page 337.

Thiosulphates; Detection of —— in foods. A. Gutmann. XVIII*A*., page 337.

ENGLISH PATENTS.

Coconut or coprah; Process for preserving ——. R. Marot, Paris. Eng. Pat. 6379, March 16, 1906.

SEE Fr. Pat. 362,369 of 1906; this J., 1906, 702.—T. F. B.

Fats; Process for extracting ——. H. Breda, Charlottenburg, Germany. Eng. Pat. 17,656, Aug. 4, 1906.

SEE Fr. Pat. 368,697 of 1906; this J., 1907, 25.—T. F. B.

UNITED STATES PATENT.

Oil; Apparatus for the purification of waste ——. N. W. Smith, East Rand, Transvaal. U.S. Pat. 841,347, Jan. 15, 1907.

THE apparatus consists of a vessel containing water, and provided with a steam coil for heating it. Above this vessel is placed a receiving hopper, having a conical bottom, and a strainer for removing the larger particles of the impurities. A number of pipes conduct the oil to the lower surfaces of baffle-plates placed in the water vessel. These baffle-plates are superimposed and inclined in opposite directions, and have parallel ribs beneath them, as well as flanges at each lower edge. Means are provided for maintaining a constant level of water in the vessel, for drawing off the oil from above the surface of the water, and for removing the sediment from the vessel. The oil is passed, finally, through a dry filter, constructed of a number of superimposed chambers packed with filtering material, and is then led to a storage tank.—W. P. S.

French Patent.

Saponification of fats [*by means of aluminium hydroxide*]. E. A. Ruch. Fr. Pat. 371,416, Jan. 22, 1906.

Resin soap is mixed with freshly-prepared aluminium hydroxide, and to the mixture is added sufficient aluminium sulphate to combine with the alkali of the soap. The composition thus prepared is used in place of zinc or magnesium oxide in the saponification of fats and oils.—W. P. S.

German Patent.

Distillation of mineral oils, tar oils, fats, oils, and the like; Process for the continuous fractional ——. F. Hirzel. Ger. Pat. 172,224, May 27, 1903. III., page 312.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 265.)

(*A.*)—PIGMENTS, PAINTS.

United States Patent.

Coating metals; Composition for ——. M. Toch, New York. U.S. Pat. 841,603, Jan. 15, 1907.

The composition claimed, consists of tricalcium silicate, a mineral filling material, a pigment, and a binding agent composed of a calcium salt of a weak organic acid, *e.g.*, calcium linoleate.—A. S.

French Patent.

Painting of buildings; Product for use in the ——. M. Ramos-Garcia. First Addition, dated April 19, 1906, to Fr. Pat. 370,794, Dec. 29, 1905.

In the original patent, claim was made for a pigment composed of a double zincate of aluminium and antimony obtained by the action of ammonium zincate on antimonic acid and alumina. It is now found that ammonium zincate, prepared as described in the main patent, is itself suitable for use as a pigment.—A. S.

German Patents.

Lakes; Process for preparing colour ——. E. R. L. Blumer. Ger. Pat. 174,745, Nov. 16, 1904. V., page 317.

Coloured foil; Process for the manufacture of ——. Genthiner Cartonpapierfabr. G.m.b.H. Ger. Pat. 171,999, Jan. 26, 1905.

The colour mixture is applied to a band of paper impregnated with stearine, wax, fat, or the like, and after drying, the paper is passed over a sharp-edged bar or rail in such a manner that the coloured layer is loosened from the paper.—A. S.

Coloured foil; Process for the manufacture of ——. Genthiner Cartonpapierfabr.G.m.b.H. Ger. Pat. 172,820, June 3, 1905.

The colour mixture is applied to a band of parchment-paper, and the whole rolled up loosely and allowed to dry in the air for some days, when, it is stated, the coloured layer becomes detached from the paper. A suitable colour mixture consists of 30 parts of zinc white, 50 parts of collodion (4 per cent.), 15 parts of spirit, and 5 parts of castor oil, together with a suitable colouring matter. —A. S.

(*B.*)—RESINS, VARNISHES.

United States Patent.

Distilling apparatus [*Varnish*]. P. J. Hope, Everett, Mass. U.S. Pat. 841,401, Jan. 15, 1907.

A tank is arranged upon the removable lid of a "varnish kettle," and a coil is placed in the tank. The vapours given off from the kettle are conducted by a pipe which passes through the cover to the upper end of the coil, in which they are condensed, and from the bottom of which the condensate is conducted away through a pipe forming a prolongation of the coil and passing through the side of the tank. The latter is supplied with cooling water by suitable pipes, and has a vertical pipe passing centrally down the tank to the cover, through which a shaft passes into the kettle, where it is provided with agitator-blades. The "hydrocarbons" are fed into the kettle by a valved pipe which also passes through the tank and the cover to the interior.—W. H. C.

(*C.*)—INDIA-RUBBER, &c.

Reclaimed rubber; Experiments on ——. R. Ditmar. Gummi-Zeit., 1907, 21, 608—609.

A reclaimed rubber containing 1·46 per cent. of combined sulphur and 23 per cent. of caoutchouc was vulcanised with rising proportions of sulphur for 45 mins. under 4 atmospheres pressure. The products were tested mechanically and by oxidation. With increasing addition of sulphur, the breaking strain shows a tendency to increase and the extensibility to decrease; the oxygen absorption reaches a maximum at 21 per cent. of added sulphur, calculated upon the caoutchouc present. Determinations of the free and combined sulphur in the vulcanised products showed that the latter remained tolerably constant, *viz.*, between 3·09 and 3·80 per cent., calculated upon the total substance. Taking 3·30 per cent. as the mean, the combined sulphur, after subtracting that remaining in the reclaimed rubber at the outset, would amount to 12·52 per cent. calculated upon caoutchouc. This the author regards as a measure of the maximum sulphur-binding capacity of the rubber. Most of the reclaimed rubbers examined by the author failed to yield the yellow nitrosite characteristic of rubber proper.—W. A. C.

Rubber; World's production and consumption of ——. Bd. of Trade J., March 21, 1907. (From Tropenpflanzer, 1907. No. 2. Prof. O. Warburg.) [T.R.]

The world's consumption and production of rubber is stated to be as follows:—

Year, 1st July to 30th June.	Production.	Consumption.
	tons.	tons.
1899–1900	53,348	48,352
1900–1	52,864	51,136
1901–2	53,887	51,110
1902–3	55,603	55,276
1903–4	61,759	59,666
1904–5	68,879	65,083
1905–6	67,999	62,574

In 1905-6, 42,800 tons of the rubber came from America, and 23,400 tons from Africa, including the East African Islands, while the remaining 1800 tons came from Asia and Polynesia. Of the African rubber, 4500 tons were produced by the Congo State, 1500 tons by French Guinea, 1250 tons by Angola, and 1000 tons by the Gold Coast. Brazil supplied 41,000 tons, the Central American States 400 tons, Mexico 150 to 200 tons, and Bolivia 1100 tons, which, however, is mostly accredited to Brazil.

Of the Asiatic production, Ceylon furnished about 200 tons, and the Malay Peninsula, India, and Burma each 300 tons, the remainder coming from French India and the Malay Archipelago. Brazil's production of Para rubber increases on an average 5 per cent. yearly; the Castilloa rubber production of Central America and Mexico has decreased, whilst Ceara and Mangabeira rubber production has risen more than 100 per cent. in the last five years. African production has risen 50 per cent. since 1900, whilst Asiatic production has fallen off 20 per cent.

English Patent.

Rubber; Recovery of —— from rubber waste. A. J. Boult, London. From W. A. Köneman, Chicago. Eng. Pat. 12,525, May 29, 1906.

See U.S. Pat. 823,053 of 1906; this J., 1906, 704.—T. F. B.

United States Patent.

Rubber substitute; Composition of matter. B. B. Goldsmith, New York. U.S. Pat. 841,509, Jan. 15, 1907.

The composition claimed consists of a mixture of pyroxylin with a vulcanised non-drying oil (maize oil) or drying oil, or with both. A non-drying oil or a drying oil, or a mixture of the two, in the unvulcanised condition, may also be added.—A. S.

French Patent.

Gums or artificial rubbers. Z. Olsson. Fr. Pat. 369,719, Sept. 13, 1906. Under Int. Conv., Sept. 14, 1905, and March 28, 1906.

Glue or other adhesive material is dissolved in water, together with such hygroscopic compounds as calcium or magnesium chloride, &c., and to the solution, mixed with filling materials, chromates, or other oxidising agents are added. It has been found that the outer surface of objects made of such products, rapidly hardens, owing to the action of the light, whilst the inner portions remain quite soft, the hard outer layer preventing the moisture from evaporating. To avoid this difficulty, the patentee proposes to add to the soft mass, before moulding, colouring matters, the tints of which will retard the oxidising action of light on the mass; paraffin oil, mineral oil, or fat of any kind may also be added.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(Continued from page 266.)

Tan [tannin] determination; The present official method of ——. A plea for its retention. R. A. Earp. Collegium, 1907, 88—92.

The author assigns the amount of work which has recently been carried out in comparing the present I. A. L. T. C. method of tannin estimation with other methods to the want of perfection in the method now in use, especially in its being affected by gallic acid and other non-tannins. In analysing a tannin solution containing x per cent. of tannin and y per cent. of non-tannin, the tannin estimated $= x+ky$ when k is some factor, positive or negative according to the nature of the non-tannins present and the method of analysis employed. Where a considerable quantity of gallic acid is present, the results show a marked increase of tannin, the gallic acid combining with the hide-powder to form leather substance. The author has found that this assimilation of non-tannins goes on in the tannery. The action of tannin on hide-powder in the filter bell approaches much more closely to the conditions in the tannery than any shake method. In any tannin solution in equilibrium with hide-powder or leather, there is always free tannin in the liquor; this state of equilibrium is rapidly reached in the shake method, and the detannisation proceeds no further, the solution not necessarily being detannised. If a tannin solution be repeatedly detannised with hide-powder, and the first detannisation removes $\frac{1}{x}$ of the whole amount, W, present, it is easily shown that after n successive extractions the remaining tannin in the solution is W $\left(\frac{1-x}{x}\right)^n$. The expression diminishes with n if $\frac{1}{r}$ is nearly equal to unity. The author has found that in presence of the slightest trace of chrome the precipitation of tannin by gelatin salt solution is prevented. If chrome prevents or hinders the tanno-gelatin reaction, then it is reasonable to suppose that the tannin would not be taken up by the chromed powder.—H. Br.

Tan [tannin] determination; The present official method of ——. H. R. Procter. Collegium, 1907, 107—108.

If Earp's assertion (see preceding abstract) that the gelatin test for tannin becomes inoperative in presence of traces of chrome were correct, then the use of chromed hide-powder for tannin analysis would be impracticable; but the author has proved that the reaction is delicate to the extent of 1 part of tannin in 20,000 even in the presence of a considerable quantity of a chromium salt. The process of absorption which leads to an equilibrium referred to by Earp is a reversible one, and experimental work has shown that acids though absorbed by raw hide are ultimately replaced and expelled by tannin. In the case of tannin and hide-powder, the value of $\frac{1}{x}$ under favourable conditions so nearly reaches unity, that for practical purposes the absorption may be taken as complete; that of gallic acid is much less so, and by chroming the powder, can be still further reduced. If a tannin solution be submitted to successive detannisations, then, assuming that the first detannisation removes 99 per cent. of the tannin and 50 per cent. of the gallic acid, a second would remove 0·01 per cent. more of the tannin, but 2·5 per cent. of the gallic acid, so that the actual error would be much greater in the second detannisation. At present the only method of improvement is to reduce the absorption factor for non-tannins, as, for instance, by chroming. Under these adverse conditions more constant results are obtained by using a definite amount of hide-powder and definite amounts of liquid as in the shake method, than by the uncertain conditions of the filter method. —H. Br.

Tanning materials; Analysis of ——. Proceedings of the third Annual Meeting of the American Leather Chemists' Association. J. Amer. Leather Chem. Assoc., 1907, 2, 6—12.

The following resolutions with regard to methods of analysis were proposed at the above meeting:—(1) That the present method of soluble solid determination in tanning materials be replaced by the following: "To 1 grm. of kaolin in a beaker add 75 c.c. of tannin solution; stir and pour on 590 S. and S. 15 cm. pleated filter paper; return filtrate to paper for one hour, keeping filter full. At the end of the hour pour solution from filter. Bring 800 c.c. of solution to 20° C., refill the filter with this solution and begin to collect filtrate for evaporating and drying as soon as filtrate comes clear. Keep filter full." This resolution was adopted. (2) That an alternative filter paper be adopted for soluble solid determination, owing to the deterioration in quality and lack of uniformity of S. and S. 590. A committee was appointed to select a suitable paper. (3) That a method for determining the acidity of hide-powder be drawn up, and a standard of acidity fixed for report at the next annual meeting. (4) That provision be made to secure uniformity in reporting results of liquor analysis, whether results be reported by weight or volume. (5) For revision of the amount of hide-powder used in liquor analysis. (6) That a standard method of sampling be adopted, and (7) that crude tanning materials be reported on an absolutely dry basis and also "as received." Resolutions 3—7 were referred to the Council for further consideration. —H. Br.

Tanning materials; New method of analysis and examination of ——. G. Herrenschmidt. Collegium, 1907, 67—77.

A quantity of the extract to be analysed is weighed out and dried to constant weight to estimate moisture. A further quantity is weighed and made up to 8°—9° Baumé with tepid water, placed in a bottle of about 500 c.c. capacity and well mixed, not necessarily dissolved.

Nine small pieces of hide are carefully weighed on a hydrostatic balance, a similar piece being weighed and dried to estimate the moisture of the hide. Four of these pieces of hide are put in the bottle containing the extract solution, and shaken for several hours. The four tanned pieces are now removed and squeezed into a basin, the liquor squeezed out being put back into the bottle, along with four more of the untanned pieces of hide, and the whole again agitated for several hours. These four pieces in their turn are treated as the previous pieces, and the bottle is again agitated with the final piece. The nine pieces of tanned leather are now dried, first in the air, and finally in the stove at 100° C. The liquor remaining in the bottle is evaporated in a basin, the residue dried and weighed as non-tannins. The weight of the nine dried pieces of tanned leather, after deducting the dry hide weight, gives the weight of tannin absorbed. The weighings of the dried hide, dried leather, and non-tannin residues are all made on a specially-devised balance, by which it is possible to weigh at 100° C. The method has several disadvantages, three days being required to perform an analysis, but this time may be shortened by allowing the agitation and drying processes to proceed through the night. The pieces of hide should be preserved in salt water surrounded with ice.—H. Br.

Tanning materials ; A new method of analysis of ——. S. C. Dodge. J. Amer. Leather Chem. Assoc., 1907, 2, 38—39.

The total solids and total soluble matters are estimated in the usual way, the non-tannins being determined by shaking a portion of the tannin solution with pure lead carbonate, filtering, and evaporating a portion of the filtrate.—H. Br.

Free acid in tan liquors ; New and accurate method for the determination of ——. A. W. Hoppenstedt. Collegium, 1907, 77—78.

As the present methods of estimating free acids in tannin liquors give decidedly inaccurate results, the following method was devised, which gives accurate results and is easy to work. Dilute 50 c.c. of the tan liquor to 500 c.c. with water. To 200 c.c. of this solution add 20 c.c. of quinine solution, mix, filter, and titrate 100 c.c. of clear filtrate with $N/10$ alkali hydroxide, using phenolphthalein as indicator. The number of c.c. of alkali used, multiplied by 0·066, gives the percentage of acid expressed as acetic acid, in the original solution. The quinine solution is made by dissolving 15 grms. of pure quinine in 110 c.c. of neutral 95 per cent. alcohol, and adding slowly, while stirring, 90 c.c. of water to make up to 200 c.c. The principle on which this method is based is that quinine precipitates tannin and forms soluble salts with the free acids ; these soluble salts react acid to phenolphthalein, and so can be titrated as if the acids were in a free state. (Compare this J., 1905, 1096.)—H. Br.

Sod oil and moëllon ; Moisture in ——. F. W. Alden. J. Amer. Leather Chem. Assoc., 1907, 2, 12—15.

The three methods principally in use for determining the percentage of moisture in sod oil and moëllon were compared : (1) mixing the oil with sand and drying; (2) allowing a roll of filter paper to absorb the oil, and drying in a tube through which air is sucked at 100° C. ; and (3) heating the oil in a platinum basin with a small flame until all the water is driven off. With the first method it was found that when no more oil was used than the sand would absorb, the drying was completed in 14 hours ; it is not advisable to use excess of fat over the sand, and drying beyond 14 hours leads to loss by decomposition of the oil rather than to loss of water. The method of drying in a tube is much shorter (about six hours), but the decomposition of oil is much greater. Driving off the moisture with a direct flame compares very closely with the sand method, but sometimes causes trouble by spirting, especially with poor samples of oil. In the author's opinion the sand method leads to the most accurate results. In discussion, Kopecky considered the sand method most exact, and stated that a few drops of alcohol shortened the time of drying to about six hours. Eachus favoured heating by the flame, as some moellons contain low-grade rosin oil which volatilises and is determined as moisture in the sand method, but is not driven off by the flame. Veitch suggested drying *in vacuo*, as light rosin oil volatilises at low temperatures in presence of moisture.—H. Br.

Chromed hide-powders ; A comparison of ——. H. C. Reed. J. Amer. Leather Chem. Assoc., 1907, 2, 34—38.

This paper contains the results of a series of analyses of different tanning materials, using a number of chromed hide-powders from a variety of sources.—H. Br.

Ulmo extract. Paessler. J. Amer. Leather Chem. Assoc., 1907, 2, 22.

This extract yielded, on analysis, 21·9 per cent. of tannin and 10·2 per cent. of non-tannins. It is made from the bark of the Ulmo tree (*Eucryphia cordifolia*) from Valdivia, Chili. The extract is easily soluble, and is very light in colour. It is excellent for drum tannage, and also for light-weight sole, strap, belt, and upper leathers, and may be used in combination for heavy sole leather.—H. Br.

Leather analysis ; Comparative ——. J. H. Yocum. J. Amer. Leather Chem. Assoc., 1907, 2, 48—52.

Referring to the analyses of American leathers made by Gordon Parker and Turnbull, reported in the Manchester, Liverpool and District Tanners' Federation Year-book for 1906 (this J., 1906, 547), the amount of sugars found range from 20 per cent. down to 2 per cent. As the English demand for American leathers is mainly for the cheaper class, the author assumes that the analyses were of this grade of leather, as no leather sold in the United States to-day, except at a concession in price, contains more than 5 per cent. of sugars. Results of analyses of both English and American leathers are seen in the following table.

	English leather.		Amer. hemlock.		Amer., rapid tan.		Belt.		Harness.		Amer. oak sole.	
Moisture	12·75	13·20	10·76	11·21	11·70	12·10	9·60	10·20	8·50	7·12	12·40	12·30
Ash	0·68	1·10	1·50	1·00	1·40	1·23	0·35	0·27	7·97	1·39	0·41	0·69
Oil and grease	2·20	1·76	2·80	3·25	2·08	2·53	13·77	9·89	29·68	26·80	3·30	2·34
Hide	36·20	35·69	37·21	36·50	41·27	39·26	39·70	40·87	27·40	31·37	38·50	36·61
Combined tannin	21·30	29·72	26·20	28·30	28·82	31·10	30·04	23·77	19·24	26·04	37·93	32·46
Uncombined tannin	14·65	10·12	10·20	9·12	6·40	6·47	4·54	11·80	4·21	3·78	4·56	7·70
„ non-tannin	12·22	8·50	11·33	10·62	8·33	7·31	2·00	3·20	3·00	3·50	2·90	7·90
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·0
Glucose	0·80	0·65	4·20	3·60	2·60	2·16	0·17	0·21	0·48	1·46	0·21	0·38
Epsom salts	none	none	1·28	0·86	1·19	1·12	none	none	none	0·97	none	none
Total tannin—Combined, uncombined and non-tannins	48·17	47·34	47·73	47·94	44·18	44·88	36·58	39·77	26·45 Barytes, 6·11	33·32	45·39	48·06

—H. Br.

Belting leather. W. Eitner. Der Gerber, 1907, **33**, 17—19, 31—33.

It frequently occurs that when leather is weighted by "stuffing," its quality is very much diminished. This is noticed both in heavy and light leathers. In belting leather the breaking power varies with the intensity of the tanning; it is necessary therefore to note how much weight can be given in the tannage without injuring the quality. Some time ago a sample of belting leather came before the author's notice in which only about one-third of the hide on each side was satisfactorily tanned, the middle being only weakly coloured. This leather had been tanned with a mixture of quebracho and oakwood extract. The grease used for oiling the leather was warmed and "drummed" into the leather for one hour; it consisted of 2½ parts of tallow, 1½ parts of blubber or seal oil, and 1 part of mineral oil, and had a melting point of 28° C. The leather had been given a lighter stuffing than "Crown" leather, just sufficient to prevent it being horny and stiff. Examination showed this belting leather to be inferior to the belting leather of to-day as regards its breaking power, both mineral- and vegetable-tanned leathers bearing higher breaking stresses than this. It is necessary to distinguish in the use of the different tanning materials as regards their weight-giving properties, some only slightly penetrating the hide and giving comparatively little weight. Of the vegetable-tanned belting leather, that prepared with oak-bark gives the highest breaking power: it will stand a pressure of 3 kilos per sq. mm. Vegetable-tanned leathers, when well washed from uncombined tannin, give 48 per cent. of leather substance. When, in addition, fat to the extent of 12 per cent. is used, we get a final result of 60 per cent. In quick drum tannage, the time of action of the tanning matter on the hide is not long enough for complete penetration of the hide fibre; the result is that the interior is not satisfactorily tanned. The leather substance is represented by the sum of the hide substance and those substances introduced in the tanning process. The hide substance is a fixed quantity, so the total weight can only be influenced by the tanning substances, which may be variable. The author experimented as to the influence of the fat introduced into the leather, on the tensile strength. Differences were noticed between leathers with 0, 10, 15, 20, and 25 per cent. of fat, but all the leathers containing fat had a greater breaking strain than those without fat, but as the breaking strain increased, so also did the extension. Fats of low melting point give darker coloured leather, with greater extensibility, than fats of higher melting point. During the process of bleaching, the loss of weight due to extraction of fat varies; the loss in case of stearine was 6·6 per cent.; in that of soft tallow, 11·0 per cent.; pressed tallow, 3·75 per cent.; and paraffin wax, 8·4 per cent. The best colour on bleaching was obtained when pressed tallow had been used, and the worst when soft tallow was used.—H. Br.

Dyewood extracts; Analysis of ——. F. K. Kopecky.
XXIII., page 347.

United States Patents.

Hides and skins; Process of treating ——. W. M. Norris, Princeton, N.J. U.S. Pat. 840,794, Jan. 8, 1907.

The hides or skins are first depilated "in lime and arsenic," and then treated with a solution of sodium hyposulphite "to set the gelatinous fibres of the skins." They are next treated with a solution of hydrochloric acid, salt, and water, and, after "slating," subjected to "a slight tawing operation."—A. S.

Fertiliser; Process of making —— from leather scrap. E. J. Fuchs. U.S. Pat. 841,501, Jan. 15, 1907. XV., next column.

Casein compound. B. B. Goldsmith, New York. U.S. Pat. 840,931, Jan. 8, 1905.

Casein is mixed, under the influence of heat and pressure, with an agent or agents, *e.g.*, β-naphthol, capable of rendering it thermoplastic, and also with suitable compounding materials.—A. S.

German Patent.

Vapours; Process for deodorising malodorous ——. B. T. Schümann and C. Elschner. Ger. Pat. 174,326, June 16, 1905.

The evil-smelling vapours evolved when substances containing keratin are heated with sulphuric acid, are deodorised by bringing them into intimate contact with gaseous ammonia or ammonia solution.—A. S.

XV.—MANURES, &c.

(Continued from page 267.)

Manganese; Stimulating influence of —— on germination. H. Micheels and P. de Heen. Bull. Sci. Acad. Roy. Belg., 1906, 288; Woch. f. Brau., 1907, **24**, 130.

The pronounced stimulating influence of manganese salts on plant growth has been shown by Bertrand and others (see this J., 1906, 83 and 705); the authors also have recorded a similar influence in the case of colloidal solutions of tin. They have now conducted comparative trials with colloidal tin and manganese sulphate on the germination and vegetation of wheat, and found that the influence of manganese was considerably greater than that of tin. Colloidal solutions of manganese resemble those of tin in that they play the part of enzymes towards the reserve materials of the wheat corn.—J. F. B.

Ozone; Action of —— on germinating seeds. H. Micheels and P. de Heen. Bull. Sci. Acad. Roy. Belg., 1906, 364; Woch. f. Brau., 1907, **24**, 130.

The authors have studied the influence of ozone on germinating wheat corns. They found that it had a distinctly unfavourable action on the weight of the embryonic plant, and on the length of the acrospire and radicle, whilst it practically inhibited the development of roots. The authors believe, however, that conditions may ultimately be found under which ozone will act as a stimulant favouring the growth.—J. F. B.

Iodine; Japanese ——. A. M. Ossendowski.
XX., page 342.

English Patents.

Manure; Manufacture of ——. T. Macdonald, Driffield, Yorks. Eng. Pat. 24,647, Nov. 3, 1906.

Shoddy, or other like nitrogenous waste matter, is acted upon in lead tanks by about two and a half times its weight of strong sulphuric acid, heated by steam pipes to about 60° C. After thorough agitation, the mass is drained, and the excess of acid is expelled in, for instance, a hydraulic press. The material is then deposited thinly on an open furnace-hearth, exposed both above and below to the action of fire-gases, which heat it to a temperature between 150° and 250° C. The dried material is ground and stored.—E. S.

Peat; Industrial treatment of —— for the purpose of increasing the quantity of nitrogen contained therein, with a view to its employment as manure. E. V. H. Bazin, Chateau de Chamby, France. Eng. Pat. 26,635, Nov. 23, 1906. Under Int. Conv., Dec. 14, 1905.

See Fr. Pat. 360,484 of 1905; this J., 1906, 488.—T. F. B.

United States Patent.

Fertiliser; Process of making —— from leather scrap. E. J. Fuchs, Scranton, Pa. U.S. Pat. 841,501, Jan. 15, 1907.

The soluble tannin is removed from vegetable-tanned leather substances, which are then subjected to the action of a solvent, such as sulphuric acid, and the product is dried and powdered to constitute an ammoniacal fertiliser.
—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(Continued from page 267.)

Sugar industry of Mysore, India; Improvement of the ——. A. Lehmann. Agric. J. of India, 1907, 2, 54—63.

The sugar-cane in Mysore is generally of excellent quality, containing usually 16 to 19 per cent. of sucrose and about 0·5 per cent. of reducing sugars, but occasionally 21·5 per

cent. of sucrose, and less than 0·25 per cent. of reducing sugars. The amount of fibre is usually 8 to 10 per cent., and sometimes as low as 7 per cent. Little has been done in the direction of increasing the yield of cane per acre (30 tons or more). The wooden mills have been replaced by small three-roller iron mills of local manufacture, worked by bullock power. Labour is less than one-seventh of what it is in Louisiana, where large quantities of sugar are produced notwithstanding that the quality of cane is very much inferior to Indian cane. In the present method of manufacture more than one-fourth of the total quantity of juice is left in the cane after milling. With a larger mill one-third of this loss could be saved, and still larger mills would, probably, save two-thirds. As much as 20 per cent. of the total sugar in the juice is sometimes lost by fermentation, and, as a rule, over 13 per cent. of the total juice is lost by underliming. The tendency to underlime the juice is due to a desire to produce a lighter coloured jaggery, which is preferred for direct consumption, but loss on this head can be reduced by making the juice neutral to litmus, still giving a light-coloured jaggery. On the whole, for every 4 lb. of sugar now obtained 5 lb. or more could be got by avoiding these heavy losses. This would probably be quite sufficient to transform a crippled industry into a flourishing one. Further savings could be introduced by manufacturing directly from the cane a much higher grade of sugar than jaggery. Part of this sugar, without being refined, might replace much of the sugar now imported, the rest being refined to the utmost at much less expense than an equal weight of jaggery.
—L. J. de W.

Beetroot juice ; Clarification of —— with 1 *per cent. of lime.* J. Hudec. Z. Zuckerind. Böhm., 1907, **31**, 360—361.

During the last campaign, the Kowalski-Kozakowski method of clarifying beetroot juice has been introduced into some Moravian sugar factories ; in this process the quantity of lime to be added to the juice is previously determined ; the total amount of lime added is about 1½ per cent. (calculated on the beetroot). In the factory with which the author is connected, the consumption of lime in both saturations only amounted to 1 per cent. ; the lime was added in the form of milk of lime of an average density of 25° B. The clarified juice was clear and of a light colour, it filtered readily, and the evaporated juice crystallised well. The saturation mud was stiff, and could be easily extracted. It made no difference to the filtration or to the colour of the juice, whether the carbonation of the latter was carried to an alkalinity of 0·14 or 0·06.—L. E.

Beetroot juices ; Plus sugar in ——. V. Neumann. Z. Zuckerind. Böhm., 1907, **31**, 359—360.

The author has examined the action of freshly-ignited lime on beetroot, diffusion, and saturation juices, with a view to determining the cause of the considerable apparent loss of sugar which was observed at the beginning of the present campaign. The results of the experiments showed that the apparent sugar-content of beetroot and diffusion juices was decreased by treatment with lime, whereas the sugar-content of saturated juice was not affected by a fresh treatment with lime. Hence the higher polarisation of the raw juice, as compared with that of the juice treated with lime, is to be ascribed to the presence of a dextrorotatory substance, other than sugar, which is decomposed by lime.—L. E.

Sucrose ; Action of basic lead acetate on the rotatory power of aqueous solutions of ——. F. Bates and J. C. Blake. Z. Ver. deut. Zuckerind., 1907, 314—323.

A series of solutions containing 26·048 grms. of pure commercial cane-sugar was prepared. To these solutions, increasing quantities (from 0·5 c.c. to 63·0 c.c.) of basic lead acetate solution (sp. gr. 1·25) were added ; a paste of lead sulphate was then added to insure a clear filtrate ; after adjusting the temperature to 20° C., the solutions were made up to 100 c.c., mixed, filtered, and polarised. A preliminary experiment showed that addition of lead sulphate had no effect on the reading beyond that due to the volume of the salt. The results showed that addition of small quantities of basic lead acetate (from 0·5 to 2 c.c.) caused a progressive reduction of the polarimeter reading (the maximum reduction was slightly more than 0·1 per cent.) ; with larger quantities of the reagent (from 2 c.c. to 6 c.c.) this reduction became less ; the solution, to which 6 c.c. of basic lead acetate had been added, gave the same polarimeter reading as a solution to which no reagent had been added ; addition of still greater quantities of the reagent (from 7 c.c. to 63 c.c.) caused a progressive increase of the polarimeter reading (maximum about 1·0 per cent.). The influence of the basic lead acetate on the rotatory power of sucrose appears to be due to the formation of a soluble lead saccharate.—L. E.

Electro-decolorisation. A study in optical sugar analysis. F. G. Wiechmann. Z. Ver. deutsch. Zucker-Ind., 1906, 1056—1082. Electrochem. and Metall. Ind., 1906, **4**, 400—403.

In view of the uncertainty attaching to the use of basic lead acetate in the preparation of solutions of raw sugar for polarisation, the author made experiments as to the decolorising action of the electric current, using water or a mixture of water and hydrogen peroxide as solvent, and electrodes of platinum, lead, and lead peroxide. The best results were obtained by the use of lead electrodes, with water as solvent, the anode and cathode compartments of the electrolytic cell being separated by a diaphragm of parchment, which had been previously boiled with distilled water until all optically active substances had been removed. The solutions clarified electrically yielded uniformly higher results on polarisation than solutions clarified by basic lead acetate. This is probably due to the presence of asparagine or one of its derivatives. If acetic acid be added to the electrically clarified solutions before polarisation, the results by the two methods are practically identical. The following method of working is recommended :—26 grms. of sugar are dissolved in pure water, the solution is made up to 100 c.c. at 20° C., and about 35 c.c. are introduced into each of the two compartments of a small electrolytic cell, having a parchment diaphragm. A current of $ND_{100}=0{\cdot}25$ ampère is then passed through the solution for five minutes, the anode liquid is filtered into a graduated vessel, mixed with 10 per cent. of its volume of an 8 per cent. solution of acetic acid, and examined in the polarimeter. The polarimeter reading is increased by 10 per cent. to compensate for the dilution caused by the addition of acetic acid.—A. S.

Sugars ; Action of ammoniacal zinc hydroxide on some ——. A. Windaus. Ber., 1907, **40**, 799—801. (See this J., 1905, 515 ; 1906, 1234.)

Solutions of dextrose, lævulose, *d*-mannose, *d*-sorbose, *l*-arabinose, and *l*-xylose, on treatment with ammoniacal zinc hydroxide, gradually turned brown and deposited a yellow powder ; after the lapse of four months the solutions had lost their reducing powers, and it was found that by this time 100 grms. of hexose had yielded, on the average, 26 grms. of precipitate, and 100 grms. of pentose, 21 grms. With the exception of *a*-methylimidazole, no bases soluble in ether were found in the zinc precipitates. A similar result was obtained with maltose, although a much smaller yield of *a*-methylimidazole was obtained. Lactose, also, gave a very small yield of *a*-methylimidazole (about one-fifth of that obtained from maltose and one-twentieth of that obtained from dextrose). Sucrose and raffinose solutions slowly turned yellow on treatment with ammoniacal zinc hydroxide, but gave no precipitate. Hence, sugars containing no free carbonyl group do not furnish methylimidazole. Rhamnose yielded both *a*-methylimidazole and a smaller quantity of *a*-*μ*-dimethylimidazole ; this result shows, that amongst the decomposition products of rhamnose, acetaldehyde, as well as methylglyoxal and formaldehyde, occurs. *d*-Galactose, on treatment with ammoniacal zinc hydroxide, yielded a substance which reduced Fehling's solution, gave mucic acid on treatment with nitric acid, and galactosazone on treatment with phenylhydrazine acetate ; hence, the product appears to be closely related to galactose ; on heating it under pressure with ammonia for two hours to 100° C., a deep brown coloured zinc salt was obtained, which was found to contain methylimidazole. Inosite does not yield a zinc methylimidazole, but gives a complex zinc salt, which crystallises in fine needles.—L. E.

Waste water; Action of lime on the purification of —— with and without fermentation. Herzfeld. Z. Ver. deut. Zuckerind., 1907, 120—125.

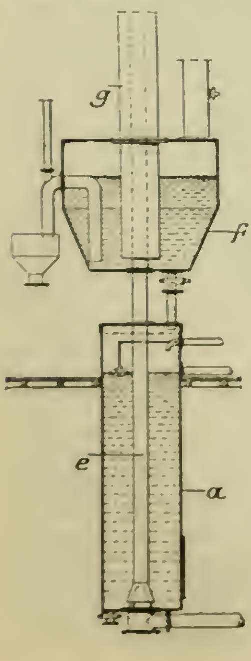
The author quotes the results of experiments on the effect of lime water and calcium carbonate on the purification of sugar factory waste waters before and after fermentation. Waste waters, artificially prepared, were employed: these were obtained by mixing water with 1—3 per cent. of expressed beetroot juice. The fermentations were effected at 27° C. (yeast fermentation), 32° C. (lactic acid fermentation), and 40° C. (butyric acid fermentation) respectively. The chief conclusions drawn from the experiments were as follows:—Addition of lime water to fermented waste water has the effect of removing a considerable proportion of impurities. The waste water, previous to lime treatment, should be kept as long as possible at a sufficiently high temperature to promote fermentation. Before, or during this fermentation, excess of calcium carbonate should be added to the waste water in order to neutralise the acidity produced during fermentation. The purifying action of the lime on the fermented water appears to be due to the fact that in the process of fermentation, a considerable proportion of nitrogenous matter is converted into a form precipitable by lime, the sugar being converted into dextran-, gum-, or cellulose-like substances, which are also precipitable by lime.—L. E.

Sugar production of Germany. Bd. of Trade J., March 21, 1907. [T.R.]

The quantity of raw sugar produced in Germany from September 1, 1906, to February 28 last, being the first six months of the 1906-7 sugar campaign, was 1,899,506 metric tons, as compared with 2,068,211 metric tons during the corresponding months of 1905-6. The quantity of refined sugar produced increased from 903,019 metric tons during the latter period, to 947,761 metric tons during the six months of the present campaign. The total quantity of beets used was 14,171,666 metric tons, as compared with 15,733,478 metric tons during the corresponding months of 1905-6. The total output of sugar (raw and refined) from September, 1906, to February, 1907, expressed in terms of raw sugar, was 2,126,736 metric tons, as compared with 2,295,349 metric tons in the same six months of 1905-6.

United States Patent.

Liquids with gases [Saturation of sugar juices]; Apparatus for treating ——. A. Pagniez, Caudry, France. U.S. Pat. 841,268, Jan. 15, 1907.



The apparatus consists of a lower tank, *a*, for holding the juices to be treated, and a superposed vessel, *f*, for the saturated juices. A pipe, *e*, rises from near the bottom of the tank, *a*, and extends into the upper vessel above the level of the liquid. The pipe, *e*, is surrounded in the upper vessel by a wider pipe, *g*, which extends down below the level of the liquid. The gas is introduced at the bottom of the pipe, *e*, under sufficient pressure to force the liquid from the lower vessel into the upper one. The liquid so forced emerges from the pipe, *e*, into the annular space formed by the larger pipe, *g*, falling thence into the receiving vessel. The upper end of the pipe, *e*, is provided with telescopic sections so that the liquid can be discharged at different elevations.—J. F. B.

German Patents.

Starch; Process for the preparation of soluble ——. H. Kindscher. Ger. Pat. 168,980. Nov. 15, 1902. Addition to Ger. Pat. 149,588 of 1901.

The crude starch is left in contact with excess of chlorine gas until it is rendered soluble. It is then aerated and neutralised, and, if necessary, washed with cold water. It is claimed that by this process the starch is purified in addition to being rendered soluble.—A. S.

Adhesive and finishing materials; Process for the preparation of ——. F. Hecht. Ger. Pat. 174,222, Dec. 24, 1904.

In the preparation of adhesive and finishing materials from vegetable matters by treatment with alkali, the excess of the latter is usually neutralised by hydrochloric or sulphuric acid. The patentee proposes to neutralise the excess of alkali by means of a vegetable oil or resin which is saponifiable by cold alkali.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 271.)

Yeast; Nitrogenous nutrition of ——. H. Pringsheim. Biochem. Zeits., 1907, **3**, 121—286; Woch. f. Brau., 1907, **24**, 125—129.

The fermentative activity of various yeasts was studied with different kinds and concentrations of representative nitrogenous nutrients, *e.g.*, peptone, leucine, asparagine, ammonium sulphate. With peptone there was a regular falling-off of the rapidity of fermentation as the nitrogen concentration was decreased; with the other nutrients the influence of decreased concentration was the reverse. The higher the concentration of these nutrients the slower was the fermentation, starting from a maximum at a concentration of 0·004—0·008 per cent. of nitrogen; this is the concentration at which the whole of the nitrogen is used up. Below this concentration the fermentation was retarded owing to starvation of the yeast. When the reproduction of the yeast was studied in the same way, it was found that the number of cells produced also increased with increasing concentration of peptone and decreased with increasing concentration of the other nutrients, but in this case the maximum reproduction corresponded with a concentration of 0·0321 per cent. of nitrogen. The influence of nitrogenous nutrition on the assimilation of nitrogen from the medium could only be studied in the case of ammonium salts, since yeast excretes as well as assimilates nitrogenous matters. The nitrogenous exchange, assimilation and excretion, increases as the concentration of nitrogen in the medium is increased. The quantity of nitrogen utilised by the yeast is many times greater than the quantity which is retained by it after fermentation. Whether the yeast be sown in small quantities or in such large quantities as to preclude reproduction, there is no connection between the quantity of nitrogen utilised by the yeast and its fermentative effect. Fermentation is accompanied by an exchange of nitrogenous substances long after reproduction has ceased. With large sowings the quantity of nitrogen in the yeast crop may be greater or less than in the seed yeast, according to whether the latter was poor or rich in nitrogen. In the presence of high concentration of nitrogenous nutrient, the exchange of nitrogen which goes on does not stimulate either the fermentation or the reproduction, nor does it contribute to the store of reserve materials of the yeast. Yeast is able to derive its energy solely from the breaking down of the carbonaceous nutrient, but it can also derive it from the breaking down of nitrogenous matters. As regards the production of fusel oil when leucine is added, no increase takes place when the leucine concentration is increased beyond 0·38 grm. per 250 c.c. The production of fusel oil depends not only on the leucine added but also on the amino-acids excreted by the yeast. Yeast growing in media to which nitrogenous matters other than leucine have been added, never produces the maximum quantity of fusel oil which is obtainable when leucine is present from the first. There is a certain concentration of nitrogenous nutrient other than leucine at which the production of fusel oil is at a minimum; above this concentration the fusel oil production is increased

by the increased nitrogenous metabolism; below it, it is increased by starvation of the yeast causing excretion of amino-acids. By adding another nitrogenous nutrient, such as ammonium sulphate, to a natural wort, the influence of the leucine contained therein can be suppressed and the production of fusel oil decreased. Alcohol produced during the auto-fermentation of yeast is rich in fusel oil. The conditions which favour the production of fusel oil, besides the presence of amino-acids in the wort, are high temperatures, deficiency of nitrogen, excess of nitrogen, deficiency of sugar, and high acidity—in short, all conditions which cause the yeast to work under unfavourable circumstances. Fusel oil, like glycerol and succinic acid, is a product of the nitrogenous metabolism of living yeast, and no fermentation by yeast cells can take place without its production, just as no fusel oil can be produced during fermentation by dead yeast.
—J. F. B.

Vinegar; Mineral acids in ——. F. D. Ratcliff. Analyst, 1907, 32, 82—84.

From the results of an investigation on the determination of free mineral acids in vinegar, the author concludes that "whilst Hehner's method would not detect a small addition of mineral acid, Richardson and Bowen's method (this J., 1906, 836) errs as far on the other side, and finds what is not there."—W. P. S.

Vinegars; Composition of English fermentation ——. F. D. Ratcliff. Analyst, 1907, 32, 85.

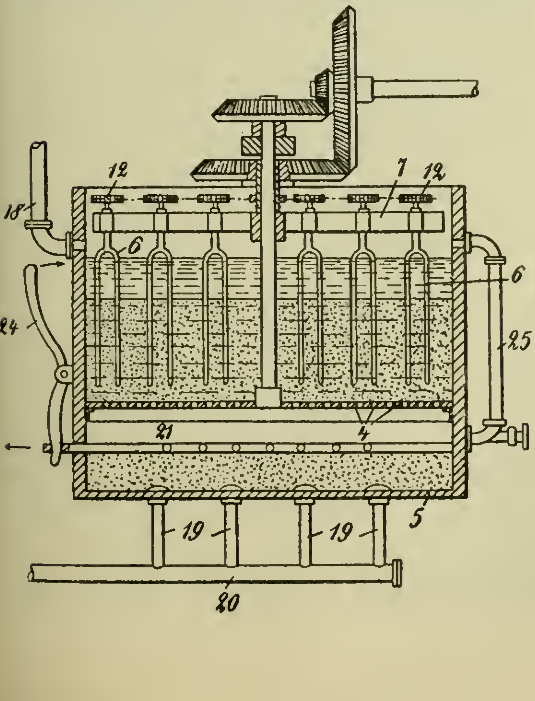
The following figures were obtained on the analysis of the bulk vinegar sent out severally by some of the large manufacturers in Great Britain:—

	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.
Sp. gr.	1·016	1·017	1·0182	1·0155	1·0177	1·0215	1·015	1·0138	1·0115	1·0107	1·0162
Acetic acid......	4·67	5·20	5·00	4·75	4·95	4·90	4·00	4·15	3·90	3·20	4·17
Total solids	2·60	2·35	3·01	2·39	3·38	3·76	2·56	2·01	1·69	1·60	2·52
Ash	0·33	0·48	0·37	0·34	0·23	0·80	0·31	0·43	0·23	0·30	0·19
Alkalinity of ash	0·02	0·007	0·006	0.039	0·015	0·005	0·004	0·006	0·007	0·003	—
P_2O_5	0·072	0·082	0·058	0·051	0·077	0·066	0·036	0·048	0·035	0·020	0·010
Chlorine (grains per gall.)	34·0	68·0	20·7	36·6	111·0	155·4	21·0	125·0	26·8	34·5	11·2
Sulphates (H_2SO_4)	0·041	0·146	0·134	0·046	0·033	0·243	0·176	0·052	0·050	0·105	0·085
Nitrogen	0·076	0·090	0·071	0·046	0·097	0·116	0·069	0·050	0·050	0·037	0·048

The results, unless otherwise stated, express grms. per 100 c.c. of vinegar.—W. P. S.

English Patents.

Beer wort; Preparation and filtration of ——. A. Hellwig, Belchatowie, Russia. Eng. Pat. 4552, Feb. 24, 1906.



In this process the stirring of the mash is so effected that only the particles within the various horizontal layers change their position relatively to one another; the lowest layer, covering the perforated bottom of the tun, is left undisturbed, and serves as a filter. Hot water is continuously supplied at the top of the mash, and the wort continuously drawn off underneath. The apparatus employed is depicted in the accompanying diagram. A row of forks, 6, is attached vertically to the cross-bar, 7, which is slowly revolved, each fork also being revolved about its own axis by means of a chain passing round all the sprocket wheels, 12. On the lower bottom, 5, of the tun is placed a layer of filtering material, and from this bottom, pipes, 19, lead into a pipe, 20, communicating with a pump. After coarsely-crushed malt has been laid on the false bottom, 4, water is admitted through the pipe, 18, and boiling water added until the whole has a temperature of 42° R. (126·5° F.). When the desired level of water above the malt has been obtained, the forks and the suction pump for drawing off the wort are set in motion. By introducing boiling water, the temperature of the mash is raised to 50° R. (144·5° F.), and finally to 61° R. (169° F.). A horizontal stirrer, consisting of rods, 21, oscillated by the handle, 24, is provided, to loosen the sediment settling on the top of the filtering substance; this sediment is then removed by a current of water forced upwards from the bottom of the tun by a pressure pump and conveyed through the pipe, 25, to the top of the tun. With this arrangement it is possible to mash coarsely crushed malt containing 40 per cent. of fine meal, a very good extraction being obtained.
—T. H. P.

Mash tuns. J. E. Bennett, London. Eng. Pat. 5157, March 2, 1906.

The improvements here described relate to mixing and discharging devices, which are applied conjointly to mash tuns, and can be raised, by means of a hydraulic cylinder, clear of the material in the tun. In this way the sparging liquor is allowed to percolate naturally through the material, owing to the absence of channels formed by the apparatus. By relieving the pressure in the hydraulic cylinder, the mixing and discharging devices may be lowered into the mash either with or without operating the central vertical shaft to which they are attached.
—T. H. P.

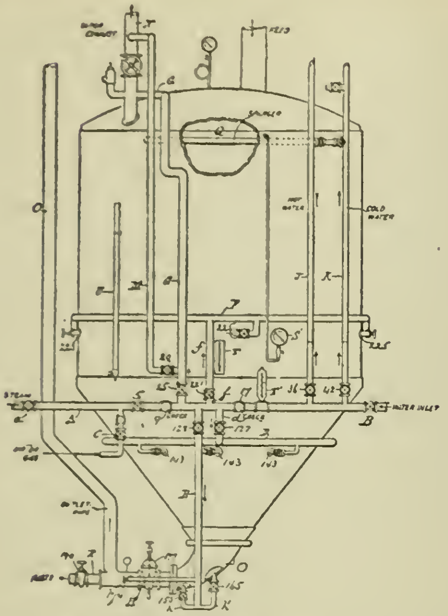
Foods from yeast; Preparation of ——. E. Makin, jun. Eng. Pat. 4365, Feb. 22, 1906. XVIII*A*., page 337.

Yeast for bread-making and the like; Process of treating [invigorating] ——. W. J. Temple. Eng. Pat. 14,067, June 19, 1906. XVIII*A*., page 337.

United States Patents.

Brewing purposes; Cooker for ——. C. Rach, New York. U.S. Pat. 840,370, Jan. 1, 1907.

The brewing vessel (see figure) is provided with a main pipe-line, A, a pipe-ring, D, below the pipe-line, A, and another pipe, F, above the pipe-line, A. There are branches from both rings into the vessel, valved branches from the pipe-line to the rings, and valved steam and water connections to the main pipe-line. It is also provided with a valved pipe, N, from the top of the vessel,



a valved branch. G, from the main steam pipe connecting with the top of the vessel, and a valved exhaust branch, M, from the pipe. G, to the pipe, N, beyond the valve in the latter.—J. F. B.

Wort ; Process of cooling ——. H. E. Deckebach, Cincinnati, Ohio. U.S. Pat. 841,126, Jan. 15, 1907.

The wort is withdrawn from the top of the fermenting tub, and is pumped through an external cooler and strainer ; it is then returned to the tub, also at the top, but at the opposite side to that from which it was withdrawn.—J. F. B.

Air [for forcing beer from barrels] ; Method of purifying ——. J. M. Dieterle, St. Louis, Mo. U.S. Pat. 840,756, Jan. 8, 1907.

The process relates to the preparation of air used in forcing beer from barrels, and consists in discharging compressed air, in the form of fine jets, into the bottom of a vessel containing glycerol. The air rises to the surface of the glycerol, and, thus dried and purified, is passed through an "aroma-imparting" mixture, before being collected under pressure in a suitable storage vessel.—W. P. S.

French Patents.

Brewers' pitch. Deutsche Conservierungsges. für Nahrungs- und Genussmittel m.b.H. Fr. Pat. 371,270, Nov. 9, 1906.

This pitch is prepared by mixing about 12 per cent. of linseed oil, previously thickened by passing air through it, with about 50 per cent. of resin and 38 per cent. of paraffin, the mixture being then further thickened by the passage of air through it. The pitch flows well, adheres strongly to wood and similar materials, does not crack when cold, and communicates no unpleasant flavour to the beer.—T. H. P.

Beer ; Process of making ——. J. House. Fr. Pat. 371,296, Nov. 10, 1906.

See Eng. Pat 18,351 of 1905 ; this J., 1906, 1229. In the French Specification, the temperatures, mentioned in the English Specification as degrees Fahrenheit, are given as degrees Centigrade, the numbers being identical. —T. F. B.

German Patent.

Fermented liquors free from or containing but little fusel oil ; Process for the preparation of ——. A. Koch. Ger. Pat. 170,167, Aug. 21, 1903.

For the preparation of fermented liquors free from or containing but little fusel oil, the patentee proposes to treat the liquor, during the fermentation, with oxygen and to subject it to the influence of an electric discharge. The two wires, with platinum tips, from an induction coil, are immersed in the liquid in the fermentation vessel. Oxygen is introduced through a tube discharging into the gap between the wires, and becomes ozonised under the influence of the electric discharge.—A. S.

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 273.)

(*A.*)—FOODS.

Protein ; Synthesis of —— by means of trypsin. A. E. Taylor. Univer. of California Publications, 1907, 1, 343—347.

Numerous fruitless attempts to synthesize protein by means of the reversed action of trypsin the author attributes to the lack of a sufficiently stable enzyme and also possibly to the sulphates of the products of digestion having been used instead of the free amino-acids or their carbonates. In his recent experiments, protamine sulphate, $C_{30}H_{60}N_{17}O_6,2H_2SO_4$, obtained from the spermatozoa of the striped bass, was chosen as the original substance, it being one of the simplest proteins, and yielding but few amino-acids (mainly arginine) in tryptic digestion. As regards the trypsin it was found that that obtained from the liver of the star-fish was very active, but underwent hydrolysis itself ; whereas the trypsin from the liver of the large soft-shelled clam was much less active, but resisted the action of hydrolysis, and it was therefore employed :—400 grms. of the protamine sulphate were digested with trypsin until hydrolysis was complete, the resulting solution being then miscible with five times its volume of acidulated alcohol without showing any turbidity, and also remaining clear when treated with a cold, saturated solution of sodium chloride. This liquid was now heated to the boiling point, and freed from sulphuric acid by means of barium, the excess of which was removed by means of carbon dioxide, so that the filtrate contained only amino-acids or their carbonates. It was next concentrated until it showed signs of precipitation when cooled, and in this state was mixed with 300 c.c. of a glycerol extract of the liver of the clam, and 20 c.c. of toluene, and the flask sealed up and set aside. The contents (over 4 litres) gradually became turbid, and finally a fine white deposit collected at the bottom of the flask. After five months the contents of the flask were boiled, acidified with sulphuric acid (which dissolved the deposit), filtered, and treated with four times their volume of absolute alcohol. The resulting white precipitate was washed with alcohol, dissolved in water, and reprecipitated with alcohol, this treatment being repeated four times. The final yield of the dried and purified substance weighed 1·8 grms. It was digestible with trypsin, and had the composition and properties of the original protamine sulphate. In the author's opinion this experiment furnishes the first proof in support of the hypothesis that the formation of protein in plants and in the absorption of the products of digestion in animals are both cases of enzymic acceleration.—C. A. M.

Milk and cream ; Detection of cane sugar in ——. W. H. Anderson. Analyst, 1907, 32, 87—88.

The test described originally by Cayaux (Chem. Centr., 1898. 2, 510) is stated to afford a reliable means of detecting cane sugar in milk, cream, infants' foods, &c. It consists in mixing 15 c.c. of the milk, 0·1 grm. of resorcinol, and 1 c.c. of concentrated hydrochloric acid, and heating the mixture to boiling. In the presence of cane sugar a fine red coloration is produced, whilst pure milk is but slightly affected, only turning a brownish colour on continued boiling. The test will readily detect the presence of 0·2 per cent. of cane sugar.—W. P. S.

Butter ; Water in ——. J. Wauters. Bull. Soc. Chim. Belg., 1906, 20, 365—373.

The author holds that the Belgian law, which permits the sale of butter containing any quantity of water

provided the percentage is declared, does not protect the small farmer who places inferior butter on the market, but favours the large and systematic adulterator. He thinks the sale of butter containing more than a certain limiting percentage of water should be prohibited. Samples of butter lose water from the surface first; hence, if a check-analysis may be necessary after some time the sample should be kept wrapped in parchment paper and enclosed in a tight box and should be of sufficient size to allow a sample from the interior to be taken for testing.
—J. T. D.

Fats and fatty acids; Refraction of ——. R. K. Dons. Z. Untersuch. Nahr. Genussm., 1907, **13**, 257—261.

Ludwig and Haupt found that the refractive indices of the insoluble fatty acids in butter varied within much smaller limits than those of the butter fat, and based a method of detecting foreign fats in butter upon this observation. In the case of twenty-five samples of butter fat of known purity examined by the author the refractometer readings (Zeiss) ranged from 39·8 to 46·1 at 40° C., and those of the insoluble fatty acids from 28·5 to 35·0, a variation quite as pronounced. The difference between the two readings, however, was much more constant, and ranged from 10·4 to 12·0. Cocoanut oil showed a difference of 16·9; butter containing 10 per cent. of cocoanut oil, 12·4; and that containing 20 per cent., 13·2. A sample of lard gave the following readings:—Fat, 48·1; fatty acids, 35·0; difference, 13·1. As the refraction of the fatty acids was no higher than that given by pure butter fatty acids, and the difference was only slightly higher, the author concludes that lard cannot be detected in butter in this way. In like manner the variation in different samples of butter is so great that small quantities of cocoanut oil can be detected with more certainty by other tests. The refractive indices of pure triglycerides and their corresponding fatty acids are given, and it is shown that the difference between the two decreases with the rise in the molecular weight of the fatty acids (*e.g.*, butyric acid, 46·0; lauric acid, 17·8; myristic acid, 16·1; palmitic acid, 14·5; stearic acid, 13·1). It is also pointed out that the differences observed with butter, lard, and cocoanut oil are in agreement with the known composition of their respective insoluble fatty acids.—C. A. M.

Aldehyde in cheese; Origin of the ——. Trillat and Sauton. Compt. rend., 1907, **144**, 495—498.

The authors have shown recently that the formation of aldehyde in cheese is accompanied by the appearance of a bitter taste, and they now record their experiments and reasonings on the causes leading to the formation of the aldehydic substances. Oxidation of alcohol in the cheese furnishes but traces of aldehyde, but considerable quantities of the latter are formed during the fermentation of the lactose. This fermentation is particularly liable to take place if moist cheese is exposed for an unduly long time to the atmosphere during certain stages of the manufacture, and the same conditions favour the resinification of the aldehyde, with concurrent production of the above-mentioned bitter flavour.—W. P. S.

Potatoes; Percentage of solanine in ——, and the influence of the cultivation thereon. F. W. Morgenstern. Landw. Versuchs-Stat., 1907, **65**; Z. Spiritusind, 1907, **30**, 95—96.

For the determination of solanine in potatoes, 100—200 tubers are ground to a paste with a little water, and the juice is extracted under heavy pressure. The liquid is heated with a small quantity of acetic acid, and the coagulated albumin is filtered off. The filtrate is evaporated to a syrup on the water-bath; the syrup is treated with alcohol, the alcoholic extract is evaporated to dryness, dissolved in dilute acetic acid, and filtered. The solanine is precipitated from the filtrate by the addition of ammonia drop by drop to the boiling liquid. The solanine is re-dissolved in alcohol and is re-precipitated in the same way as before and dried at 90° C. Solanine is extracted from other portions of the plant by boiling the dry, finely powdered material with dilute acetic acid or with alcohol. The author found in table potatoes, 0·0125 per cent. of solanine, in potatoes for industrial purposes, 0·0115 per cent., and in fodder potatoes, 0·0058 per cent., these being average values in several different samples. Yellow-skinned potatoes contain less solanine than red; potatoes from sandy soils are richer in solanine than those from humus soils, those from dry soils are richer than those from moist. Nitrogenous manuring tends to increase the solanine content, potash to diminish it, whilst phosphoric acid has no influence. Putrefaction and other diseases do not affect the solanine content. When potatoes were exposed to the light for three weeks so that their skins became green, the solanine content increased nearly three-fold. The smallest increase was in the skin, and the largest in the chlorophyll-bearing layer immediately beneath the skin. Solanine is present in all parts of the plant, and the proportion increases towards the growing points, the young leaves and blossoms being richest. During the vegetative period the absolute quantity of solanine in the plant increases, but the percentage decreases in all parts of the plant. In one instance, in July, the plant contained 0·982 per cent. of solanine on the dry substance, and this diminished to 0·2224 per cent. in August.—J. F. B.

Thiosulphates; Detection of —— in foods. A. Gutmann. Z. Untersuch. Nahr. Genussm., 1907, **13**, 261—265.

Flesh.—50 grms. of the finely divided sample are mixed in a flask with 100 c.c. of a mixture of equal parts of alcohol and water, and the whole rendered slightly alkaline with sodium hydroxide, and heated to boiling. After cooling, the mass is pressed, and the liquid treated with 1 to 3 c.c. of a 10 per cent. solution of potassium cyanide and evaporated (not to dryness) on the water-bath. The residue is taken up with the dilute alcohol, the liquid acidified with hydrochloric acid and filtered, and the filtrate treated with about 2 c.c. of a 10 per cent. solution of ferric chloride. A red coloration indicates the presence of thiosulphates—

$$Na_2S_2O_3 + KCN = Na_2SO_3 + KSCN.$$

Fats.—50 grms. are heated for five to ten minutes (with continuous stirring) with 100 c.c. of dilute alcohol (1:1) on the water-bath, and then left to cool. The layer of fat is removed, and the liquid filtered and treated as above described. Sulphites or salts of sulphonic acids do not interfere with the test. The thiocyanate formed cannot be quantitatively determined by titration, since traces of proteids remain in the filtrate and combine with the silver. It is suggested, however, that a colorimetric determination might be possible.—C. A. M.

Phytosteryl acetate test for the detection of adulteration of animal by vegetable fats; Some notes on Bömer's ——. F. M. Jaeger. XXIII., page 346.

Methylfurfural; Determination of ——. K. Fromherz. XXIII., page 347.

English Patents.

Foods from yeast; Preparation of ——. E. Makin, jun., Ainsworth, Lancs. Eng. Pat. 4365, Feb. 22, 1906.

The process consists in sterilising the yeast by mixing it with boiling saccharine matter (molasses) or vegetable oil, or both. If desired, other materials, such as cereal foods, may be added to produce a palatable food or fodder. The claims particularly relate to the manner of sterilising the yeast, and not to the use of sterilised yeast in the food.—W. P. S.

Yeast for bread-making and the like; Process of treating [invigorating] ——. W. J. Temple, Boston, U.S.A. Eng. Pat. 14,067, June 19, 1906.

Three lb. of compressed yeast are mixed with 3 galls. of water, and to the solution are added 6 lb. of malt extract and 7 lb. of maize starch. The whole is then maintained at a temperature of 80° F. for about one hour.
—W. P. S.

Cocoa products, especially chocolate, containing large quantities of albumin; Method of manufacturing ——. F. P. Burckhardt, Gautzsch-Leipzig, Germany. Eng. Pat. 16,628, July 23, 1906.

The process consists in the incorporation of albumin with the cocoa, an essential feature being that the albumin is steeped previously in water or sugar solution. To

100 parts of roasted cocoa kernels are added 30 parts of dry albumin soaked previously in 40 to 60 parts of water, or 60 per cent. sugar solution if it be desired to produce chocolate. The mixture is thoroughly worked at a temperature not exceeding 40° C., and is then allowed to stand for 24 hours. At the end of this time, the mass is heated to a temperature of 60° C., and stirred until it contains only from 12 to 15 per cent. of water. After being kept for a further twenty-four hours at a temperature between 40° and 50° C., 5 parts of the mass, 6 parts of sugar, and a portion of cacao-butter are ground together and the mixture is then heated in a press to a temperature of 400° C. The product is, finally, put into moulds and cooled quickly. If a cocoa rich in albumin is to be prepared, the supplementary addition of sugar is omitted. (See also Fr. Pat. 369,234 of 1906; this J., 1907, 110.)—W. P. S.

Blocks, briquettes, and the like; Manufacture of ——. R. Friedlaender. Eng. Pat. 5051, March 1, 1906. II., page 308.

United States Patents.

Emulsions; Process of homogenising ——. G. Kunick, London. U.S. Pat. 840,500, Jan. 8, 1907.

See Eng. Pat. 28,250 of 1904; this J., 1905, 1249.—T.F.B.

Milk; Apparatus for desiccating ——. A. Just, Pulaski, N.Y. U.S. Pat. 841,153, Jan. 15, 1907.

The milk is injected in the form of a diverging, finely divided stream into a chamber, where it meets a current of heated air. Means are provided for removing the milk powder from the sides of the chamber, and pipes are also supplied for drawing off the heated air and water vapour from the chamber.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Sewage; Purification of —— [*by filtration through peat*]. A. Muntz and E. Lainé. Compt. rend., 1907, **144**, 466—470.

The results of the experiments carried out by the authors show that peat is an excellent medium for use in filters or bacteria beds for the purification of sewage. The experimental filter employed consisted of a stoneware pipe, 35 cm. in diameter and 50 cm. in height; this was filled with peat which had been mixed previously with chalk to neutralise its acidity, and a little garden soil was added to introduce the nitrifying organisms. The sewage was sprinkled over the filter by means of a perforated pipe, the flow through the filter being at the rate of from 1000 to 1250 litres per square metre every two hours. Even with sewage heavily charged with organic matter, an effluent was obtained almost free from ammonia, and in which the albuminoid matter had decreased to about one-fourth of the quantity present in the sewage. The oxidisable matter, as measured by the oxygen absorption, had also decreased to about one-sixth. If the sewage be treated previously in a settling-tank, the peat filter works almost indefinitely; but in case it becomes clogged, the top layers are readily removed and replaced.—W. P. S.

Ammonia in water; New method of determining ——. A. Buisson. XXIII., page 346.

Waste water; Action of lime on the purification of ——, *with and without fermentation.* Herzfeld. XVI., page 334

English Patents.

Garbage or sewage; Process for reducing ——. H. J. Haddan, London. From Edson Reduction Machinery Co., Cleveland, U.S.A. Eng. Pat. 19,727, Sept. 4, 1906.

See U.S. Pat. 829,954 of 1906; this J., 1906, 949.—T. F. B.

Filters for filtering by percolation as applied to acids, alkalies, water, or sewerage. J. Mackenzie and J. and G. McLauchlan. Eng. Pat. 23,049, Oct. 18, 1906. VII., page 318.

United States Patents.

Sewage; Apparatus for purifying ——. A. Vogelsang, Dresden, Germany. U.S. Pat. 840,179, Jan. 1, 1907.

See Eng. Pat. 17,383 of 1905; this J., 1905, 1250.—T.F.B.

Clarification of fluids; Apparatus for the mechanical ——. W. Bottmann, Berlin. U.S. Pat. 839,892, Jan. 1, 1907.

See Eng. Pat. 7878 of 1906; this J., 1906, 904.—T. F. B.

Pathogenic organisms in water or other liquids; Method of effecting the destruction of ——. P. G. Griffith, London. U.S. Pat. 839,926, Jan. 1, 1907.

See Fr. Pat. 360,970 of 1905; this J., 1906, 605.—T. F. B.

Water purifying and filtering apparatus; Electric ——. J. A. Hyle, Assignor to F. Hesser and D. A. Reagan, Altoona, Pa. U.S. Pat. 840,335, Dec. 25, 1906.

An inlet pipe, provided with a contracted discharge end, contains an electrolytic cell, the latter comprising a series of pipes, extending longitudinally through the inlet pipe, and a corrugated plate surrounding the series of pipes. The ends of the latter are secured to discs, which are supported on glass insulators, the series of pipes and surrounding plate acting as the electrodes. The inlet pipe is connected with a service pipe, which, in turn, communicates with the bottoms of the filters. The tops of the filters are connected to a reservoir with a concave bottom, and the latter is provided with a cleaning pipe provided with a valve.—B. N.

French Patent.

Water purifier; [*Electric* ——]. The Hinkson Electric Liquid Purifying Co. Fr. Pat. 371,055, Nov. 3, 1906.

An electrolyser serves to precipitate the animal and vegetable substances from the water, these substances being subsequently filtered off in two separate chambers containing a column of granular material. Arrangements are made for the interconnection of the two filtering chambers, so that one can be flushed out and cleaned by purified water from the other.—R. S. H.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 274.)

Wood pulp; Superheated steam for digesting ——. C. Solbrig. Z. Dampfkessel und Maschinenbetrieb; through Papier-Zeit., 1906, 31, 3770.

The author discusses the advantages of using superheated steam in the manufacture of wood pulp, by both the direct (Ritter-Kellner) and the indirect (Mitscherlich) processes. In the direct process, the use of superheated steam allows of weaker lyes being employed, as these do not become diluted to so great an extent as when wet or saturated steam is used. Also, less steam is required, and the digestion is completed in less time. This diminution of the time required for the digestion is also the chief advantage of the use of superheated steam in the indirect process. It is stated that the use of superheated steam has no injurious effect on the strength of the fibres, nor on the subsequent bleaching of the pulp. The temperature of the steam must not be too high, owing to the effect on the strength of the copper heating tubes. For ordinary purposes, steam superheated to a temperature of 250°—275° C. should be used. Such steam would have a temperature of 220°—240° C. when it enters the heating coil of the digester, and it should be mixed, as it enters the latter, with saturated steam at a pressure of 6—8 atmospheres.—A. S.

Paper sizing. F. Arledter. Papier-Zeit., 1907, 32, 773—774.

The degree of ink-resistance of engine-sized papers depends on a large number of factors besides the percentage of rosin added to the pulp. The deficiency in this respect of machine-glazed papers dried on a single cylinder is cited. In these the smooth under-surface of the paper, which has been in contact with the cylinder, is generally badly sized, whilst the rough top surface is quite hard. This is attributed to the rapid drying from one side only, whereby the steam driven off from the paper lifts the fibres, so that they bend in a direction normal to the surface, and carries the particles of size down the channels so formed to the top side of the sheet. Even on ordinary paper machines with several cylinders, excessive heat in the first cylinder, when the fibres are still plastic, causes bad sizing, wavy paper, and frequent breaks. With proper graduation of the heat in the successive cylinders, sizing is more certain; but here, again, the sizing effect does not depend only on the quantity of size. With slow running and good "felting," an equal hardness of sizing can be obtained with less size than with fast running. At the first drying cylinder the paper is most sensitive to one-sided defects as regards colour, sizing, and surface caused by excessive heat, and these defects are not counteracted by the second drying cylinder, because the paper has then become less sensitive. For good sizing it is important that the paper should be well "closed on the wire," *i.e.*, the pulp should carry the right amount of water and should receive the right degree of shaking, the object being to avoid loss of rosin by a rush of water through the wire before the fibres are fixed. This may also happen if the register rolls carrying the wire do not all revolve properly, in which case the web arrives at the suction boxes too wet, and, owing to the extra work required of the latter, rosin is sucked out of the paper. —J. F. B.

Lignocellulose [*aspen wood*]; *The furfural and methyl-furfural-yielding constituents of* ——. K. Fromherz. Z. physiol. Chem., 1906, **50**, 209—240; Chem. Zentr., 1907, **1**, 643—645.

In studying the chemistry of lignified tissues, the furfural-yielding complex of the lignocellulose itself must be distinguished from pentosans existing ready formed, the latter being readily extracted by cold, dilute alkali. The author has investigated the lignocellulose of aspen wood (mechanical wood pulp). The material was purified by consecutive treatments with cold 5 per cent. hydrochloric acid, alcohol, ether, and 5 per cent. ammonia; the pentosan was then extracted by prolonged treatments, six times in succession, with cold 10 per cent. solution of caustic soda, and the pulp, after acidification with hydrochloric acid, was finally washed and dried. The yield of purified lignocellulose amounted to 55 per cent., the matter extracted by ammonia and caustic soda together being 28·6 per cent., of which 19·8 per cent. was extracted by the caustic soda; the latter quantity was made up of 17·4 per cent. of "wood-gum" and 2·4 per cent. of other bodies. The separate determinations of furfural and methylfurfural were made by the method described in this J., 1905, 212, by means of phloroglucinol. The wood, purified as above, yielded 2·29 per cent. of furfural and 0·5 per cent. of methylfurfural, whereas when it was merely purified by alcohol and ether it yielded 12·68 per cent. of furfural and 0·43 per cent. of methyl furfural. The author, however, rejects the validity of the phloroglucinol method, and corrects his results by the values obtained by the barbituric acid method (this J., 1903, 114); hence the corrected values for the pure lignocellulose are 1·75 per cent. of furfural and 0·37 per cent. of methyl furfural. When the lignocellulose was digested with water at temperatures up to 180° C., the resulting liquor reduced Fehling's solution, and contained both furfural and methylfurfural. Determinations were made of the free and potential furfural and methylfurfural in this liquid, and of the corresponding groups in the undissolved residue. These results showed that the furfural-yielding substances are dissolved at a comparatively early stage, and then undergo partial decomposition into free furfural, which on further heating is decomposed and ultimately disappears. The methylfurfural-yielding substances are only dissolved at higher temperatures, but are decomposed at the same time as the former. The percentage of methylfurfural groups in the residue increases at first and decreases when higher temperatures are reached. The free methylfurfural in the liquid increases rapidly, but on account of its relative instability it does not exceed a certain maximum amount. When the methylpentose, rhamnose, is heated under the same conditions, it is decomposed very much more readily. Neither the furfural nor the methylfurfural can be attributed to pentosan groups, but apparently belong to the cellulose or lignin complex, or both. The soluble products of the aqueous digestion were hydrolysed by sulphuric acid and examined. The products of hydrolysis yielded considerable quantities of furfural, but contained neither xylose nor arabinose; mannose and galactose were identified, the presence of dextrose was doubtful, and there were traces of lævulose.—J. F. B.

Celluloid; *Determination of camphor in* ——. Utz. Celluloid-Industrie. Gummi-Zeit., 1907, **7**, 53—55.

Camphor may be extracted quantitatively from celluloid

Scale divisions (methyl alcohol =8·00).	N—n.	Grms. of camphor per 100 c.c.	Scale divisions (methyl alcohol =8·00).	N—n.	Grms. of camphor per 100 c.c.	Scale divisions (methyl alcohol =8·00).	N—n.	Grms. of camphor per 100 c.c.	Scale divisions (methyl alcohol =8·00).	N—n.	Grms. of camphor per 100 c.c.
8·0	0·0	0·000	12·6	4·6	1·150	17·1	9·1	2·33	21·6	13·6	3·68
8·1	0·1	0·025	12·7	4·7	1·175	17·2	9·2	2·36	21·7	13·7	3·72
8·2	0·2	0·050	12·8	4·8	1·200	17·3	9·3	2·39	21·8	13·8	3·75
8·3	0·3	0·075	12·9	4·9	1·225	17·4	9·4	2·42	21·9	13·9	3·78
8·4	0·4	0·100	13·0	5·0	1·250	17·5	9·5	2·45	22·0	14·0	3·81
8·5	0·5	0·125	13·1	5·1	1·275	17·6	9·6	2·47	22·1	14·1	3·84
8·6	0·6	0·150	13·2	5·2	1·300	17·7	9·7	2·50	22·2	14·2	3·87
8·7	0·7	0·175	13·3	5·3	1·325	17·8	9·8	2·52	22·3	14·3	3·90
8·8	0·8	0·200	13·4	5·4	1·350	17·9	9·9	2·55	22·4	14·4	3·93
8·9	0·9	0·225	13·5	5·5	1·375	18·0	10·0	2·58	22·5	14·5	3·96
9·0	1·0	0·250	13·6	5·6	1·400	18·1	10·1	2·61	22·6	14·6	4·00
9·1	1·1	0·275	13·7	5·7	1·425	18·2	10·2	2·64	22·7	14·7	4·03
9·2	1·2	0·300	13·8	5·8	1·450	18·3	10·3	2·67	22·8	14·8	4·06
9·3	1·3	0·325	13·9	5·9	1·475	18·4	10·4	2·70	22·9	14·9	4·09
9·4	1·4	0·350	14·0	6·0	1·500	18·5	10·5	2·73	23·0	15·0	4·12
9·5	1·5	0·375	14·1	6·1	1·525	18·6	10·6	2·76	23·1	15·1	4·15
9·6	1·6	0·400	14·2	6·2	1·550	18·7	10·7	2·79	23·2	15·2	4·18
9·7	1·7	0·425	14·3	6·3	1·575	18·8	10·8	2·82	23·3	15·3	4·20
9·8	1·8	0·450	14·4	6·4	1·600	18·9	10·9	2·85	23·4	15·4	4·23
9·9	1·9	0·475	14·5	6·5	1·625	19·0	11·0	2·88	23·5	15·5	4·26
10·0	2·0	0·500	14·6	6·6	1·650	19·1	11·1	2·91	23·6	15·6	4·29
10·1	2·1	0·525	14·7	6·7	1·675	19·2	11·2	2·94	23·7	15·7	4·32
10·2	2·2	0·550	14·8	6·8	1·700	19·3	11·3	2·97	23·8	15·8	4·35
10·3	2·3	0·575	14·9	6·9	1·725	19·4	11·4	3·00	23·9	15·9	4·38
10·4	2·4	0·600	15·0	7·0	1·750	19·5	11·5	3·03	24·0	16·0	4·41
10·5	2·5	0·625	15·1	7·1	1·775	19·6	11·6	3·07	24·1	16·1	4·44
10·6	2·6	0·650	15·2	7·2	1·800	19·7	11·7	3·10	24·2	16·2	4·47
10·7	2·7	0·675	15·3	7·3	1·825	19·8	11·8	3·13	24·3	16·3	4·50
10·8	2·8	0·700	15·4	7·4	1·850	19·9	11·9	3·16	24·4	16·4	4·53
10·9	2·9	0·725	15·5	7·5	1·875	20·0	12·0	3·19	24·5	16·5	4·55
11·0	3·0	0·750	15·6	7·6	1·900	20·1	12·1	3·22	24·6	16·6	4·58
11·1	3·1	0·775	15·7	7·7	1·925	20·2	12·2	3·25	24·7	16·7	4·61
11·2	3·2	0·800	15·8	7·8	1·950	20·3	12·3	3·28	24·8	16·8	4·64
11·3	3·3	0·825	15·9	7·9	1·975	20·4	12·4	3·31	24·9	16·9	4·67
11·4	3·4	0·850	16·0	8·0	2·000	20·5	12·5	3·34	25·0	17·0	4·70
11·5	3·5	0·875	16·1	8·1	2·03	20·6	12·6	3·37	25·1	17·1	4·73
11·6	3·6	0·900	16·2	8·2	2·06	20·7	12·7	3·40	25·2	17·2	4·76
11·7	3·7	0·925	16·3	8·3	2·09	20·8	12·8	3·43	25·3	17·3	4·79
11·8	3·8	0·950	16·4	8·4	2·12	20·9	12·9	3·47	25·4	17·4	4·82
11·9	3·9	0·975	16·5	8·5	2·15	21·0	13·0	3·50	25·5	17·5	4·85
12·0	4·0	1·000	16·6	8·6	2·18	21·1	13·1	3·53	25·6	17·6	4·88
12·1	4·1	1·025	16·7	8·7	2·21	21·2	13·2	3·56	25·7	17·7	4·91
12·2	4·2	1·050	16·8	8·8	2·24	21·3	13·3	3·59	25·8	17·8	4·94
12·3	4·3	1·075	16·9	8·9	2·27	21·4	13·4	3·62	25·9	17·9	4·97
12·4	4·4	1·100	17·0	9·0	2·30	21·5	13·5	3·65	26·0	18·0	5·00
12·5	4·5	1·125									

shavings by means of light petroleum spirit boiling at 30°—40° C., in a Soxhlet apparatus. The solvent is evaporated by a current of cold air, and the residual camphor is dissolved in pure methyl alcohol to 100 c.c. After bringing this solution to the standard temperature of 17·5° C., its refractive index is determined by means of an immersion-refractometer. By the aid of the preceding table, the camphor content can be deduced from the refractivity, N, being the refractometer reading of the solution, and n, that of the methyl alcohol.

As a physical means of determining camphor, the refractometer is preferable to the polariscope, since natural and synthetical (inactive) camphors have identical refractivities.—W. A. C.

Methylfurfural; Determination of ——. K. Fromherz. XXIII., page 347.

English Patents.

Dyeing paper pulp. O. Imray From Farbwerke vorm. Meister, Lucius, und Brüning. Eng. Pat. 5342, March 5, 1906. VI., page 317.

Sulphite liquor; Treatment of waste —— and manufacture of compounds therefrom. J. S. Robeson, Camden, U.S.A. Eng. Pat. 22,887, Oct. 16, 1906.

See U.S. Pat. 833,634 of 1906; this J., 1906, 1115.—T.F.B.

Nitrocellulose; Manufacture of —— for industrial purposes [waterproofing, &c.]. R. H. Annison, London, and G. T. Oliver, Waverton, Ches. Eng. Pat. 4577, Feb. 24, 1906.

Waste cotton is purified by steaming it in presence of a solution of sodium carbonate. It is then washed, teased out, dried, and nitrated so as to obtain a nitrocellulose of a low degree of nitration. The nitrocellulose is dissolved without the aid of camphor by steeping it in spirit (1 lb. of nitrocellulose to 1 gall. of spirit) for 12 hours, and then adding 1 lb. of ether. The solution is used with or without the addition of pigments, oil, glycerol, &c., for coating textiles or paper.—J. F. B.

United States Patents.

Paper-making machine. S. Milne, Edinburgh. U.S. Pat. 840,228, Jan. 1, 1907.

See Eng. Pat. 28,611 of 1903; this J., 1905, 102.—T. F. B.

[Wood] pulp; Manufacture of purified soda pine ——. W. H. Sharp, Philadelphia, Pa. U.S. Pat. 841,190, Jan. 15, 1907.

Pine wood is digested with caustic soda, the product is washed, treated with bleaching powder solution, then with permanganate, and finally with dilute sulphurous acid.—J. F. B.

Cellulose products; Manufacturing ——. E. Eck and E. Bechtel, Assignors to Hanauer Kunstseidefabr., Hanau, Germany. U.S. Pat. 839,825, Jan. 1, 1907.

A solution of cellulose in cuprammonium is passed through an orifice having a cross-section a little larger than that of the product to be made. The issuing rope, mass, or block is received in a warm solution of caustic soda which produces a film on the surface of the mass. This is then allowed to remain for a time so that the cellulose may coagulate and become consolidated. The consolidation is completed in a bath of caustic soda, and the cellulose is then treated with acidulated water to decolorise it. The block may then be cut up into rods, strips, or plates.—J. F. B.

Cellulose; Solution of ——. E. Eck and E. Bechtel, Assignors to Hanauer Kunstseidefabr., Hanau, Germany. U.S. Pat. 840,611, Jan. 8, 1907.

Cellulose is impregnated with an aqueous solution of ammonia, a paste of cupric oxide is added, and the mixture is stirred and shaken until the cellulose is dissolved.
—J. F. B.

French Patents.

Cellulose acetates; Production of new derivatives of ——. Farbenfabriken vorm. F. Bayer und Co. Fr. Pat. 371,447, Oct. 27, 1906. Under Int. Conv., Nov. 29, 1905, and Sept. 29, 1906.

The patent relates to the treatment of tri- or tetra-acetate of cellulose with mineral or organic acids, with the production of derivatives soluble in acetone, and forming, when heated with camphor, a plastic mass suitable as a celluloid material. Cellulose acetate (1 part) is incorporated, for example, with a mixture of concentrated hydrochloric acid (5 parts), and water (25 parts). The reaction is regarded as terminated when a sample of the product, after drying, is completely dissolved by acetone.—G. W. McD.

Cellulose esters; Process for separating —— from their solutions. L. Lederer. Fr. Pat. 371,356, Nov. 12, 1906.

Cellulose esters, for example the acetates, can be separated from their solutions by the addition of carbon tetrachloride, in which they are insoluble.—G. W. McD.

Cellulose esters; Process for the conservation and employment of solutions of ——. L. Lederer. Fr. Pat. 371,357, Nov. 12, 1906.

In preparing solutions of cellulose esters by the reaction of an acid anhydride or acid chloride in the presence of a condensing agent, a basic substance, or a salt which will neutralise the condensing agent, is added to the solution. The viscosity of the solution is thus preserved.
—G. W. McD.

German Patents.

Substances resembling celluloid; Process for the preparation of ——. Zühl und Eisenmann. Ger. Pat. 177,778, Nov. 18, 1904.

Resins or resinous substances are added to celluloid-like materials prepared from nitrocellulose and camphor substitutes, in order to improve their hardness and elasticity.—A. S.

Substances resembling celluloid; Process for the preparation of ——. F. Raschig. Ger. Pat. 174,914, July 16, 1905.

The claim is for the substitution of cyclohexanone or its homologues, or cyclohexanol or its homologues, or of mixtures of these compounds, for the whole or part of the camphor usually employed in the manufacture of celluloid.—A. S.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 279.)

Cinchona bark; [Alkaloidal value of] East African ——. O. Hesse. Apoth.-Zeit., 1907, 22, 97.

The trees affording the bark are hybrids of *Cinchona Ledgeriana* and *C. succirubra* derived from Java, and cultivated at Amani, in German East Africa. The amount of quinine sulphate obtained was from 6·4 to 6·8 per cent., in the latter case with 1·93 per cent. of other alkaloids.—J. O. B.

Quinine; New reactions for ——. C. Reichard. Südd. Apoth-Zeit., 1907 [4]; Pharm. Zeit., 1907, 52, 115.

When quinine is heated with caustic potash solution the latter is tinted green or yellowish-green; the colour is intensified if a little α- or β-naphthol be previously added; a similar reaction is obtained with 25 per cent. hydrochloric acid. On being heated with strong sulphuric acid, pure quinine gives a transient blue colour, and with nitric acid a yellow to brownish or reddish colour, although it dissolves to a colourless solution. On adding strong sulphuric acid to an intimate mixture of quinine with diphenylamine, and warming, a permanent green colour is formed. A mixture with cupric sulphate turns green when moistened with water, and the depth of colour is increased by addition of hydrochloric acid. A mixture of quinine and mercuric chloride gives a reddish-brown to blackish colour when moistened with caustic potash solution. With aqueous solution of potassium iodate, quinine gives a green colour changing to yellow; it behaves similarly with ammonium vanadate, and with methylamine hydrochloride. With formaldehyde and sulphuric acid it gives a bluish-black colour.—J. O. B.

Opium alkaloids; Action of hydrogen peroxide on ——. M. Freund and Speyer. Pharm. Zeit., 1907, **52**, 115.

Thebaïne forms with hydrogen peroxide a new base, $C_{19}H_{21}NO_4$, yielding a crystalline hydrochloride, m.pt. 238°—239° C. Thebaïne is regenerated therefrom by the action of reducing agents. Morphine. and its derivatives codeine and dionine, behave like thebaïne. The product of the action of hydrogen peroxide on morphine is a crystalline base, $C_{17}H_{19}NO_4$, m.pt. 274°—275° C.; it forms a crystalline nitrate, m.pt. 206°—208° C. The codeïne oxide, $C_{18}H_{21}NO_4$. crystallises from water in tablets, m.pt. 230°—231° C.; its hydrobromide melts at 174°—175° C. Dionine oxide or ethyl morphine oxide, $C_{19}H_{23}NO_4$, crystallises from water in needles, m.pt. 220°—221° C., and also forms crystalline salts.—J. O. B.

Narceïne; New reactions for ——. C. Reichard. Pharm. Centralh., 1906 [50 and 51]; Pharm. Zeit., 1907, **52**, 115.

In strong sulphuric acid narceïne gives at first a greenish-yellow colour, changing to a darker shade, fading quickly when exposed to the air; when heat is applied a blood red colour is developed. Narceïne gives a permanently colourless solution with hydrochloric acid. When the alkaloid is mixed in aqueous solution with mercuric chloride and evaporated to dryness, the residue treated with hydrochloric acid and again evaporated to dryness, the final dry residue gives a characteristic yellow colour when moistened with a drop of strong sulphuric acid. A strong solution of bismuth chloride is coloured deep red by narceïne. When stannous chloride solution is added to narceïne, together with sodium hydroxide, the mixture, when evaporated, leaves a yellow or yellowish-green residue, becoming darker on strongly heating. When narceïne is mixed with ammonium heptamolybdate solution, a deep blue to black colour is obtained on adding a drop of strong sulphuric acid. The known iodine narceïne reaction is thus manipulated. To the alkaloid on a white porcelain surface a few drops of concentrated sodium iodide solution, coloured dark yellow by decomposition, are added. The narceïne crystals are thereby coloured dark blue; ultimately the mixture becomes a whitish turbid liquid; on adding a drop of zinc chloride to this, a dark blue mass again appears.—J. O. B.

Narcotine; New reactions for ——. C. Reichard. Pharm. Centralh., 1907, **48**, 44; Pharm. Zeit., 1907, **52**, 115.

Narcotine dissolves in strong sulphuric acid without colour, thus differing from morphine, codeine, and thebaine; it does the same in 25 per cent. hydrochloric acid. When mixed with mercurous nitrate, it is coloured deep black by sulphuric acid, the colour changing afterwards to yellowish-red. When a mixture of narcotine and sodium arsenate is moistened with sulphuric acid and cautiously warmed, a characteristic red and violet colour is developed analogous to that given by morphine. Stannous chloride behaves in a similar manner. If narcotine be added to a strong solution of potassium ferricyanide, acidified with hydrochloric acid, on evaporating the mixture to dryness a green residue is obtained which afterwards becomes blue. Potassium ferrocyanide does not give this reaction.—J. O. B.

Hordenine; Constitution of ——. E. Léger. Compt. rend., 1907, **144**, 488—491.

The formula which has been ascribed to hordenine (this J., 1906, 133) is:—$C_6H_4(OH)CH_2.CH_2.N(CH_3)_2$, and the present communication deals with the position of the group, $.CH_2.CH_2.$, the constitution of the remainder of the molecule having been previously established. It is shown that *p*-vinylanisol may be obtained from methyl hordenine methiodide, and this is taken as an experimental proof that the chain, $.CH_2.CH_2.$, exists in the hordenine molecule, and, further, that it occupies a *para*-position as regards the hydroxyl in the phenol group.—W. P. S.

Cantharides; Assay of ——. P. A. W. Self and H. G. Greenish. Pharm. J., 1907, **78**, 324—328.

Twenty grms. of cantharides, in fine powder, are moistened with 3 c.c. of strong hydrochloric acid, and extracted, in a Soxhlet apparatus, with 80 c.c. of benzene for two hours. The residue is washed with 25 c.c. of benzene, and the benzene removed from the extract by distillation and, finally, by a current of air. The distilled benzene is shaken with successive portions of 20 c.c., 20 c.c. and 10 c.c. of a 1 per cent. solution of potassium hydroxide to recover any traces of cantharidin which have distilled over, and the mixed alkaline solution is acidified with hydrochloric acid, made up to 105 c.c. with distilled water, and added to the residue of fat and cantharidin left after distilling off the benzene. The mixture is boiled for 10 minutes under a reflux condenser, and so soon as the layer of fat has separated, 100 c.c. of the hot aqueous layer are pipetted off. The boiling is then repeated four times for five minutes after addition each time of 50 c.c. of distilled water, 50 c.c. of the separated aqueous layer being removed after each boiling. The mixed aqueous solution is acidified with 3 c.c. of strong hydrochloric acid, and shaken with successive portions of 30 c.c., 30 c.c., 20 c.c., and 20 c.c. of chloroform. The chloroform extract is distilled in a tared flask, the residue washed with quantities of 5 c.c., 5 c.c., and 2 c.c. of a mixture of equal parts of absolute alcohol and petroleum spirit saturated with cantharidin, and the cantharidin dried at 60°—65° C. until of constant weight.—A. S.

Santonin; Some new reactions of ——. C. Reichard. Pharm.-Zeit, 1907, **52**, 115.

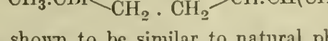
On warming santonin with strong alcoholic potash solution, a carmine-red colour is obtained. Ammonia gives a similar but less intense reaction. When heated with strong sulphuric acid it gives a blue colour. A mixture of santonin with ammoniated mercury or with mercurous nitrate is coloured black on adding sulphuric acid. A mixture of santonin with cupric sulphate or chloride treated with the same acid gives a fine blue colour. Bismuth subnitrate and santonin also give a deep blue colour when touched with sulphuric acid, and diphenylamine under similar conditions, but with the application of heat, a red brown colour is produced.—J. O. B.

Santonin; Bromination of ——. J. Klein. Ber., 1907, **40**, 939—942.

The author finds that when santonin is brominated in acetic acid solution, santonin dibromide, $C_{15}H_{18}O_3Br_2$, is produced if the acid contain 5—10 per cent. of water. On treatment with aniline, this yields santonin monobromide, which melts at 165° C., and not at 149°—151° C., as formerly stated. If santonin be dissolved in strong sulphuric acid, treated with an equal volume of water and then with a drop of ferric chloride solution, a violet coloration results. Monobromsantonin gives no coloration till it has been boiled with sodium hydroxide; the crystalline substance so produced gives the coloration. Santonin dibromide gives a coloration resembling that produced by santonin, but rather more yellowish-red and turbid. Other derivatives of santonin give this coloration. The relation of this colour reaction to the constitution of santonin is discussed.—F. Shdn.

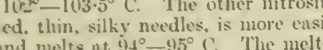
Phellandrene; Synthetic and natural ——. J. Kondakow and J. Schindelmeiser. J. prakt. Chem., 1907, **75**, 141—145.

Phellandrene prepared from carvomenthene dibromide,



$$CH_3.CBr<\begin{matrix}CHBr.CH_2\\CH_2\ .\ CH_2\end{matrix}>CH.CH(CH_3)_2,$$

has been shown to be similar to natural phellandrene in all its properties, with the exception of the optical rotation and the boiling point, which is 176°—185° C. Synthetic phellandrene gives two nitrosites. The one forms stellate groups of crystals, which dissolve with difficulty in benzene, and melt at 102°—103·5° C. The other nitrosite crystallises in isolated, thin, silky needles, is more easily soluble in benzene, and melts at 94°—95° C. The melting points of the nitrites of optically inactive phellandrene and natural phellandrene and the α- and β-nitrites of pseudophellandrene show great similarity. The following formula is suggested for synthetic phellandrene :—



$$CH_2 : C\genfrac{<}{}{0pt}{}{CH : CH}{CH_2.CH_2}\!>CH.CH(CH_3)_2$$

When treated with hydrochloric acid, β-phellandrene gives a monohydrochloride melting at 110° C., and a dichloride boiling at 122·5°—125° C. at 16 mm. The dichloride on further purification melted at 50° C., and the monochloride melted at 126° C. Thus, from the so-called pseudophellandrene, pinene hydrochloride and dipentene bihydrochloride can be obtained. It remains to be proved whether this is due to the presence of pinene in phellandrene, or to the formation of some unknown intermediate product.—F. Shdn.

Turpentine ; Solubility of oil of —— in aqueous alcohol. Vezes, Mouline, and R. Brédou. Procès-verbaux des séances de la Soc. des Sciences de Bordeaux, 1906, 123. Bull. Soc. d'Encour., 1907, **106**, 170.

To obtain mixtures of oil of turpentine and aqueous alcohol which will not become turbid on cooling to some degrees below 0° C., it is necessary to employ alcohol of at least 97·5 per cent. (by vol.) strength, or, if the alcohol have a strength between 92·5 and 97·5 per cent. by volume, the mixture must have a composition corresponding to the expression : $v + 10z > 102{\cdot}5$, where v is the volume of the oil of turpentine, and z the weight of alcohol contained in a unit weight of the mixture.—A. S.

Adrenaline ; Characteristic reaction of ——. R. Krull. Pharm.-Zeit. 1907, **52**, 115 ; Pharm. Weekbl., 1906, 1208.

When a few drops of adrenaline (1:1000) solution are mixed with a little copper sulphate and potassium cyanide solutions, a characteristic red colour is produced.—J. O. B.

Maretine. P. Lemaire. Rep. Pharm., 1907, **19**, 49—52.

This new antithermic, $CH_3.C_6H_4.NH.NH.CO.NH_2(1:3)$, may be regarded as methylacetanilide in which the acetyl radical is replaced by the group, $NH.CO.NH_2$. Its solubility in water is below 1:1000. When heated in a dry tube it decomposes, evolving ammonia ; the alcoholic solution of the residual matter gives a carmine-red colour with excess of sodium carbonate, and a violet colour when heated with a solution of mercuric chloride. Maretine itself gives a carmine-red colour with sulphuric acid containing 4 per cent. by volume of formalin, and varying shades of brown when its solutions in sulphuric acid are treated with oxidising agents ; with ferric chloride it gives a wine-red colour. The aqueous solution of maretine becomes green when treated with a 10 per cent. solution of sodium nitroprusside, sodium hydroxide, and excess of acetic acid. Five c.c. of maretine solution with five drops of hydrochloric acid and 1 c.c. of 1 per cent. sodium nitrite solution give an almost immediate precipitate on shaking. An aqueous solution of maretine acquires a yellow tint on addition of alkali hydroxide. When heated with cupric sulphate solution it yields a deep violet colour. With mercuric nitrate it gives an immediate precipitate, which is dissolved on warming, the solution turning red and suddenly depositing a reddish-brown precipitate. A solution of maretine in hydrochloric acid forms, after prolonged heating with 1 c.c. of hydrogen peroxide, a yellow colour turning to carmine red. One c.c. of the same solution treated with a few drops of furfural diluted with alcohol also becomes yellow, passing to orange-red on heating, and ultimately to violet-brown.—J. O. B.

Bromural [*a-monobromo-isovalerylurea*]. E. Saam. Pharm. Centralh., 1907, **48**, 143. Apoth.-Zeit., 1907, **22**, 163.

Bromural, $(CH_3)_2:CH.CHBr.CO.NH.CONH_2$, is obtained by the condensation of urea with bromo-isovaleryl bromide. It occurs in white, almost tasteless needles, sparingly soluble in water, and soluble in alkalis, from which it is reprecipitated by acids. It sublimes on heating, so that its m. pt., which is about 145° C., cannot be sharply defined. The presence of α-bromo-isovaleric acid may be demonstrated by heating the alcoholic solution for several hours on the water-bath with sodium ethylate. The sodium bromide which separates, is filtered off, and the crystalline residual dimethylacrylic acid, when recrystallised from water, melts at 208° C.—J. O. B.

Vesipirin [*phenyl acetosalicylate*]. F. Zernik. Apoth.-Zeit., 1907, **22**, 152—153.

Phenyl acetosalicylate, obtained by acetylating salol, the salicylic ester of phenol, is introduced under the name of "vesipyrin." It is a white powder with a faint acetous odour and almost tasteless ; m. pt. 97° C. It is insoluble in water, but readily dissolved by alcohol and ether. If 0·5 grm. of vesipyrin be boiled for 3 mins. with 10 c.c. of $N/1$ sodium hydroxide solution, and, after filtering, acidified with 10 c.c. of $N/1$ hydrochloric acid solution; on cooling, acicular crystals of salicylic acid are formed, and the liquid smells of phenol. If 0·2 grm. of vesipirin be dissolved in 5 c.c. of alcohol, the solution should give no colour on adding a few drops of ferric chloride reagent. The filtrate obtained after boiling 0·5 grm. of vesipirin in 10 c.c. of water, should be neutral.—J. O. B.

Tartaric and citric acids ; Distinction between —— by means of calcium formate solution. A. Oetker. Pharm.-Zeit., 1907, **52**, 116.

A solution containing free tartaric acid yields a crystalline precipitate in the cold with a 10 per cent. solution of calcium formate, the microscopical appearance of which is very characteristic. Citric acid, under like conditions, gives no reaction, but on warming the mixture on the boiling water-bath, a precipitate of microscopic needles is formed. Malic and succinic acids give no precipitates.—J. O. B.

Iodine ; Japanese ——. A. M. Ossendowski. J. Russ. phys.-chem. Ges., 1906, 1081. Pharm.-Zeit., 1907, **52**, 169.

The following *algæ* are employed in North Japan for the preparation of iodine. *Fucus vesiculosus*, yielding 0·741 per cent. from the sun-dried weed, and *Laminaria stenophylla*, 0·4235 per cent. ; in South Japan, *Fucus serratus*, yielding 0·7965 per cent. ; *F. digitatus*, 1·2012 per cent. ; and *Laminaria saccharata*, 0·4174 per cent. After the extraction of the iodine from the "vareck," the residue is used as manure ; it contains approximately 3·8 per cent. of nitrogen, 10·8 per cent. of "potash," and 0·55 per cent. of phosphoric acid. Japanese iodine contains about 0·6 per cent. of the iodides of potassium and sodium. —J. O. B.

Rare earths ; New methods of separating the ——. O. Holmberg. Z. anorg. Chem., 1907, **53**, 83—134.

The m-nitrobenzenesulphonates of the rare earth metals show great differences in solubility. They are also much more soluble in hot than in cold water, and the crystals are readily separated from the mother liquor. They are, therefore, readily obtained pure by fractional crystallisation, and offer a satisfactory means of separating these earths. The method has been applied to the preparation of pure neodymium oxide from a didymium oxide containing also praseodymium and traces of samarium. 200 grms. of the oxide dissolved in m-nitrobenzenesulphonic acid and submitted systematically to 160 fractionations gave neodymium oxide, which, examined spectroscopically, was found to be free from samarium, praseodymium, and erbium, and which the author claims to be the purest sample of the oxide yet obtained. Since these sulphonates of samarium, gadolinium, and the yttrium earths crystallise with 7 mols. of water, in thin leaflets, which are not isomorphous with the corresponding salts of the cerite earths, which latter separate as compact crystals with 6 mols. of water, neodymium may be readily separated from samarium, gadolinium, &c., although their salts do not differ much in solubility. Pure samarium oxide has also been obtained by this method from material containing samarium, gadolinium, and some cerite and yttrium earths. Another method of separating the rare earths consists in fractionating their picrates. The treatment of a terbium mineral is given as an example. The oxide, containing yttrium earths, with some terbium, gadolinium, samarium, and neodymium, was dissolved in *m*-nitrobenzenesulphonic acid, and separated by crystallisation into 10 fractions, thereby removing neodymium and most of the yttrium earths. The later fractions furnished oxide, which was dissolved in picric acid, and the picrate recrystallised nine times, the final crystals containing as much as 5 per cent. of terbium. The author is of opinion that the method would be found to pay on the large scale. For the separation of samarium from gadolinium, the sulphonate method, as above, was first employed to get rid of the cerite oxides. Samarium oxide, together with yttrium earths, but free from gadolinium, was contained in the intermediate fractions. It was purified by partial precipitation by means of potassium sulphate. The fractions rich in gadolinium were freed from samarium by the Urbain-Lacombe method (this J., 1903, 1365), and then from terbium by crystallisation of the picrate.—F. Sodn.

Sulphur; Determination of —— in preparations of ichthyol by means of sodium peroxide. W. Hinterskirch. XXIII., page 347.

Mercurous salts; Titration of —— with potassium permanganate. D. L. Randall. XXIII., page 346.

English Patents.

Alkylaminomethylpentyl benzoates; Manufacture of ——. A. Zimmermann, London. From Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. Eng. Pat. 5066, March 1, 1906.

See U.S. Pat. 837,899 of 1906; following these.—T. F. B.

Formic aldehyde; Generation of gaseous ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 7487, March 28, 1906.

See Fr. Pat. 366,605 of 1906; this J., 1906, 1063.—T. F. B.

Isobornyl esters; Manufacture of ——. C. Weizmann and The Clayton Aniline Co., Manchester. Eng. Pat. 10,798, May 8, 1906.

Isobornyl esters are prepared by the action of an organic acid upon pinene hydrochloride in the presence of a small quantity of a zinc salt of an inorganic or organic acid. (Zinc chloride was specified in Eng. Pat. 8266 of 1906.)—J. F. B.

Pharmaceutical compounds [Methylenecitrylsalicylic acid]; Manufacture of new —— and of new intermediate products for use therein. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 16,258, July 18, 1906.

See Fr. Pat. 368,133 of 1906; this J., 1906, 1232.—T. F. B.

Bismuth and mercuric iodides; Compounds of albuminoids with ——. A. Busch, Brunswick, Germany. Eng. Pat. 17,169, July 30, 1906.

Precipitates are formed by adding potassium-bismuth iodide or potassium-mercuric iodide to solutions of egg albumin or sodium caseinate. These precipitates, when freshly formed, are readily attacked by the gastric juice, but if they are heated in the dry state for 8—10 hours at 100°—130° C. they resist the action of acid liquids, but are readily decomposed by alkaline liquids like the pancreatic juice. The precipitates may be heated in an air-bath, or else, after drying, in an indifferent liquid such as toluene or xylene.—J. F. B.

Camphene; Manufacture of ——. F. Koch, London. Eng. Pat. 22,810, Oct. 15, 1906.

Pinene hydrochloride is heated under a reflux condenser with a mixture of calcium oxide (or other metallic oxide) and phenol, for several hours at a temperature of 180° C. The mixture is then distilled until the residue is nearly dry, and the phenol is separated from the camphene in the distillate by shaking with an alkaline solution.
—J. F. B.

Camphene; Manufacture of ——. O. Imray, London. From Basle Chemical Works, Switzerland. Eng. Pat. 1948, Jan. 25, 1907.

In extension of the specification, Eng. Pat. 19,960 of 1906 (this J., 1907, 32), it is found that pinene hydrochloride is decomposed not only by the easily fusible metallic salts of the higher fatty acids there specified, but also by other not easily fusible salts, *e.g.*, of sodium, calcium, &c., provided these salts are employed in presence of an excess of the fatty acid.—J. F. B.

Hexamethylenetetramine derivatives; Manufacture of ——. P. Bergell and A. Wülfing, Berlin. Eng. Pat. 29,093, Dec. 20, 1906.

A compound of hexamethylenetetramine and sodium acetate is produced by mixing together 1 mol. of hexamethylenetetramine and 2 mols. of sodium acetate, in aqueous solution, and evaporating the solution either at atmospheric pressure or *in vacuo* until crystallisation commences. The compound may also be obtained by mixing together suitable proportions of formaldehyde and sodium acetate and a slight excess of ammonia. It is readily soluble in water and alcohol; chloroform and "benzolene" dissolve out from it the hexamethylenetetramine.—A. S.

United States Patents.

Alkylaminomethylpentyl benzoate. T. Emilewicz, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 837,899, Dec. 4, 1906.

Aminomethylpentanol is converted into its alkyl derivatives by means of alkylating agents, *e.g.*, ethyl iodide, and is then treated with benzoic acid or benzoyl chloride, to form the alkylaminomethylpentyl benzoate, $(CH_3)_2C(NRR')CH_2CH(CH_3)O.CO.C_6H_5$; the new compounds are colourless, strongly basic oils, which form salts possessing powerful anæsthetic properties.—T. F. B.

Oxyhæmoglobin; Process of making a solution of ——. W. J. J. Hendrikszoon, The Hague, Holland. U.S. Pat. 840,326, Jan. 1, 1907.

See Fr. Pat. 358,161 of 1905; this J., 1906, 197.—T. F. B.

Terpin hydrate; Process of making ——. L. H. Reuter, New York. U.S. Pat. 840,962, Jan. 8, 1907.

Spirit of turpentine is absorbed in some porous, inactive medium, such as sawdust, and the mass is mixed with dilute sulphuric acid and allowed to stand. After sufficient maceration, the acid and unconverted oil are removed, and terpin hydrate is extracted from the residue.—J. F. B.

French Patent.

Lecithin and lecithin-products; Preparation of ——. A. Fischer. Fr. Pat. 371,391, Nov. 13, 1906. Under Int. Conv., June 16, Aug. 13, and Sept. 26, 1906.

The process consists in the extraction of yolk of eggs, or other material rich in lecithin, with acetone mixed with from 10 to 30 per cent. of ether, benzene, chloroform, or carbon tetrachloride, &c. This treatment removes all fatty and colouring matters, cholesterol, &c., and leaves a residue containing from 30 to 40 per cent. of lecithin, both in the free and combined states. By extracting the residue with hot ethyl alcohol, pure lecithin may be obtained.—W. P. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page 280.*)

English Patent.

Photographs; Production of coloured ——. J. Wagner, Upper Norwood. Eng. Pat. 15,506, July 9, 1906.

Coloured photographs are produced by printing the back of the sensitive paper, in colour, from blocks obtained from the negative, printing the picture on the sensitive surface as usual, and then rendering the paper transparent. —T. F. B.

United States Patent.

Photographic developer. B. L. Williams, Assignor to F. A. Bryant, Lowell, Mass. U.S. Pat. 838,488, Dec. 11, 1906.

The developing solution is intended for use with "gaslight" papers, and is stated to be stable, both before and after use: the exposure required is about one-half that necessary when the known solutions are employed. To prepare the solution, 3 grains of potassium iodide are added to 1 fl. oz. of any normal developer containing an aminophenol, the following being recommended:—35 grains of metol, 50 grains of quinol, 150 of potassium iodide, 550 of sodium sulphite, 1200 of sodium carbonate, and 5 grains of potassium bromide, in 50 oz. of water: in order to secure increased purity in the high lights, it is recommended that a few drops of a solution containing 10 per cent. each of ammonium bromide and potassium bichromate be added.—T. F. B.

French Patents.

Papers or other photographic supports for projection work and their manufacture. R. Ultzen. Fr. Pat. 370,917, Oct. 29, 1906. Under Int. Conv., Oct. 31, 1905.

Photographic papers, the prints on which can, it is stated, be readily tinted with water colours, are obtained by heating linseed, gum tragacanth, gelatin, &c., with dilute acid, until a mobile solution is produced, adding an alkaline substance and milk sugar, and then alkali halide, and coating paper with the mixture: the prepared paper is treated with a solution of silver nitrate at the time of exposure. For example, 50 grms. of linseed are boiled with 1 litre of 0·4 per cent. sulphuric acid, 15 to 20 grms. of sodium phosphate and 100 grms. of milk sugar are added, and the whole is filtered; 20 grms. of potassium bromide and 40 grms. of potassium iodide are then added, and sufficient water to make the total volume 2·5 litres. —T. F. B.

Photographic emulsion. L. Lederer. Fr. Pat. 371,358, Nov. 12, 1906.

To 1000 c.c. of a 2·5 per cent. solution of cellulose acetate are added 35 grms. of a mixture consisting of strontium chloride (4·5 parts), lithium chloride (1·5), water (9), and absolute alcohol (20 parts). A further addition is then made of glycerol (25 grms.), and alcohol (25 grms.). After thorough mixing of the above constituents, a solution of silver nitrate (30 grms.) dissolved in water (40 grms.) and alcohol (75 grms.) is added, followed by the addition of citric acid (10 grms.) and alcohol (40 grms.). —C. W. McD.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page 280.*)

United States Patent.

Explosive [calcium carbide and sodium]. A. E. Nienstadt, Newark, N.J., Assignor to G. H. Rosenblatt, New York. U.S. Pat. 841,172, Jan. 15, 1907.

Calcium carbide is reduced to small particles and is then mixed with a metal, such as sodium, which is capable of decomposing water. The surface of the sodium is thus covered with the coarse powder of calcium carbide, and the whole mixture is then reduced to powder.—J. F. B.

French Patent.

Matches; Method of manufacture of ——. Soc. Anon. des Alumettes et Frottoirs sans Phosphore. Fr. Pat. 371,278, Nov. 9, 1906. Under Int. Conv., Nov. 10, 1905, Jan 1 and Feb. 21, 1906.

Bundles of match sticks are rasped at the end, and the sawdust so produced, fills the spaces between the individual sticks and prevents the heads adhering together, owing to the penetration of the solution during the operation of dipping. The ends are then dipped in finely powdered sulphur, which is caused to penetrate into the roughened ends by heating the bundles to 120° C., or, the ends may be impregnated with nitrated hydrocarbons, stearine, or paraffin, and sulphur. The ends are then impregnated by dipping into a composition consisting of lead nitrate (50 parts), barium chlorate (50), and potassium nitrate (50 parts), followed by impregnation with a mixture of stearine or paraffin and sulphur. The striking composition consists of dextrin (15 parts), gum (1), lead thiosulphate (25), lead peroxide (20), antimony sulphide (2), powdered glass (2), and water (100 parts).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page 282.*)

INORGANIC—QUANTITATIVE.

Acids; Standardising of —— *by means of metallic magnesium.* A. Vesterberg. Z. anal. Chem., 1907, **47**, 81—93.

The author has used metallic magnesium to standardise acids for volumetric work. Having made approximate solutions of acid and alkali, and ascertained their value in terms of one another, he dissolves in a measured volume of the acid an accurately weighed quantity of magnesium ribbon (equivalent to not more than nine-tenths of the acid taken, so as to ensure complete solution within a reasonable time), and then titrates the excess of acid with the alkali solution.—J. T. D.

Acetylene as a precipitant in analysis; Present position of application of ——. H. Erdmann.

Acetylene; Determination and separation of copper by means of ——. H. Erdmann and O. Makowka.

Acetylene; Determination and separation of palladium by means of ——, *in acid solutions.* H. Erdmann and O. Makowka.

Acetylene; Behaviour of noble metals towards ——. O. Makowka. Z. anal. Chem., 1907, **46**, 125—128; 128—141; 141—145; 145—150.

Copper is easily and completely precipitated from cuprous solutions, either ammoniacal or acidified with acetic or tartaric acid, by acetylene, as a granular, easily filterable precipitate of cuprous acetylide, C_2H_2CuO. The authors use an amount of substance containing 0·1 to 0·3 grm. of copper, dissolved in 100 c.c. of water. To this is added 10 c.c. of ammonia of sp. gr. 0·96, and 5 c.c. of a 10 per cent. solution of hydroxylamine hydrochloride to reduce to the cuprous condition, and the precipitation is effected either by a current of purified acetylene, or by adding a solution of acetylene in acetone, about 5 c.c. of which is sufficient. The precipitate is filtered off and washed with warm and cold water to which a little acetylene water has been added; the filter and moist precipitate are then placed in a porcelain crucible of about 75 c.c. capacity, treated with 10—15 c.c. of nitric acid of sp. gr. 1·15, and heated on the water-bath. When decomposition is complete, a few drops of acid, of sp. gr. 1·52, are added, and the whole evaporated to dryness, then gradually heated to ignition, preferably with addition of a little powdered oxalic acid, to reduce any nitrocellulose which might otherwise decompose explosively, and the cupric oxide weighed. Of the other common metals, silver and mercury are the only ones precipitated by acetylene, so that they must be first removed if present, the silver by precipitation as chloride, the mercury by reduction in hydrochloric acid solution to calomel, by means of phosphorous acid. The phosphorous acid does not interfere with the precipitation of the copper. The separation of copper from the alkaline-earth metals, magnesium or cadmium, must be carried out in acetic or tartaric acid solution, to prevent the formation of carbonates, or the precipitate, if formed in ammoniacal solution, must be washed with weak acetic or tartaric acid. If aluminium, chromium, manganese, iron, or cobalt be present, tartaric acid must be added in sufficient amount to prevent precipitation when the solution is made ammoniacal. The same precaution applies to bismuth, antimony, and tin. The separation from lead is best effected in acetic acid solution. All of these separations are sharp and complete. Palladium is precipitated completely by acetylene from solutions acidified with hydrochloric acid. The precipitate is easily filtered and washed, and is quietly decomposed by heat, giving an oxygen compound of palladium, which is easily reduced to metal in a stream of hydrogen. In the filtrate, after rendering it ammoniacal and reducing by hydroxylamine, copper can be precipitated by acetylene. The acetylene method allows of separating palladium directly from platinum and its congeners, except osmium. This metal is precipitated by acetylene as metallic osmium; the mixed precipitate, when washed, dried, and ignited in hydrogen, is weighed as mixed metals, and the osmium is then volatilised by heating in a stream of oxygen, and the remaining palladium again weighed. Gold is also precipitated as metal by acetylene; and if it is to be separated from palladium, the mixed metals obtained, as in the case of osmium, must first be weighed, and then the palladium is dissolved out by nitric acid.—J. T. D.

Zinc; Effect of ammonium salts on the titration of ——, by the Schaffner process. V. Hassreidter. Bull. Soc. Chim. Belg., 1906, **20**, 373—374.

The author finds, contrary to the statement of Deckers (this J., 1906, 911), that the presence of ammonium salts accelerates the appearance of the brown stain on the lead paper indicating the end of the titration, and hence makes the zinc-content appear low.—J. T. D.

Zinc; Separation of ——, from nickel, cobalt, iron, and manganese by means of hydrogen sulphide. W. Funk. Z. anal. Chem., 1907, **47**, 93—106.

The author has examined various methods for effecting these separations, and concludes that:—1. The separation of zinc from nickel in practically neutral solution cannot be accurately effected, even when the proportion of nickel is small. Either zinc is left in solution or nickel is precipitated. 2. The same remark applies to the precipitation in acetic acid solution. 3. Precipitation in formic acid solution answers well. To the solution, rendered practically neutral by sodium carbonate and formic acid, is added 0·2—0·3 grm. of sodium formate for each 0·1 grm. of zinc present. The volume of liquid should be about 150 c.c. for 0·2—0·3 grm. of metals present. Complete separation is thus effected from nickel up to twice, manganese to more than twice, iron to once, cobalt to one-fifth or one-sixth the weight of the zinc present. The final acidity should correspond to not more than 3 per cent. of formic acid. The amount of sodium formate should be kept down as much as possible: the less there is, the more granular and easily filterable is the zinc sulphide precipitate. 4. Treadwell's "salting out" method (this J., 1901, 392) also gives good results, even in presence of greater amounts of nickel than can be dealt with by the formate method. 5. If the proportion of other metals to zinc be not known at all, it is well to work in such a way as to ensure complete precipitation of the zinc; for it is easier to separate co-precipitated metals by solution and second precipitation, than to separate small amounts of zinc from a filtrate containing large amounts of nickel, &c. Where the proportion of zinc to nickel or iron in the original substance is small, a second precipitation will almost always be necessary.—J. T. D.

Zinc; Electrolytic deposition of ——, using rotating electrodes. II. T. S. Price. Faraday Soc. Trans., March 19, 1907 [Advance proof].

The author has continued the work previously described (this J., 1906, 643). With a rotating platinum cathode in a solution of zinc sulphate, to which sodium sulphate and acetate, with or without free acetic acid, have been added, the quantitative results are always too high; this is probably due to the deposition of spongy zinc. When the cathode is silvered or coppered, but the other conditions remain the same, good results are obtained. With 300—860 revolutions per minute satisfactory quantitative experiments were performed. The effect of various other additions was investigated. If ammonium sulphate and ammonia be employed in conjuction with the zinc sulphate, good yields are obtained. Sodium acetate and acetic acid also gvie fair results; but, contrary to the statement in the previous paper, sodium sulphate alone is unsatisfactory. Sources of error, such as loss of zinc and mercury during the washing of the amalgam, in the modified method of Kollock and Smith, recommended in the previous paper, are dealt with. This method is not found to be so satisfactory as at first it seemed to be. The author recommends the use of a rotating silvered or coppered cathode with a solution containing 2 grms. of sodium sulphate and 1 grm. of sodium acetate to each gramme of zinc sulphate, as giving the best quantitative results.—R. S. H.

Sulphur; Transformation of ——, into sulphuric acid. Application to analysis. M. Berger. Bull. Soc. Chim., 1907 [4], **1**, 194—195.

The author finds that when sulphur is treated with fuming nitric acid and potassium bromide in the cold, sulphuric acid is formed. This furnishes a convenient method for the estimation of sulphur, the procedure being as follows: A quantity of the substance to be examined, containing about 0·1 to 0·2 grm. of sulphur, is covered with 10 c.c. of fuming nitric acid and from 0·5 to 1 grm. of potassium bromide is added. The sulphur dissolves, and the solution is evaporated to dryness on the water-bath. The residue is evaporated two or three times with a few cubic centimetres of hydrochloric acid to expel all the nitric acid. It is now diluted with water and precipitated in the usual manner with barium chloride solution.—J. C. C.

Manganese; Determination of ——, in presence of tungsten [e.g., in tungsten steels]. G. v. Knorre. Stahl u. Eisen., 1907, **27**, 380—383.

Tungsten interferes with the determination of manganese by the author's persulphate method; so does molybdenum to a less serious extent. If the amount of peroxide precipitated from the boiling solution of persulphate is determined volumetrically by hydrogen peroxide, the error caused by tungsten is much more serious than when ferrous sulphate is used for the determination; but even in the latter case it is enough entirely to vitiate the results. In the case of tungsten steels, the error is quite avoided by dissolving the sample in the absence of air, when the tungsten remains undissolved and can be filtered off, the small amount oxidised and dissolved during the filtration and washing, being insufficient to affect the determination of manganese. A sufficiency of dilute sulphuric acid is placed in a capacious conical flask, saturated solution of sodium bicarbonate added till the flask is filled with carbon dioxide, and the weighed sample (2—10 grms., according to the amount of manganese) introduced. The flask is then closed by a cork which carries a twice-bent tube, drawn out to a point at the inner end just below the cork, and dipping at the other end under saturated sodium bicarbonate solution. The liquid is warmed till solution is complete, and finally boiled for a few minutes. After cooling, the undissolved tungsten is filtered off and washed two or three times, and the filtrate is treated with 10—12 per cent. ammonium persulphate in small quantities till the iron is peroxidised, then 30—40 c.c. are added in excess, the liquid diluted to 400—500 c.c., boiled for 20 min., and the precipitated manganese peroxide filtered off and washed, dissolved in a known volume of acidified ferrous sulphate solution of known titre, and the unaltered ferrous salt determined.—J. T. D.

Tin and arsenic; Electrolytic separation of ——. A. Lampén. Chem. Ind., 1907, **30**, 128—129.

To separate quantitatively tin from arsenic the following process of electrolysis will serve, provided the tin salt is in the stannic condition. A concentrated solution of the substances is treated with excess of potassium hydroxide solution, 3—3·5 grms. potassium hydroxide for every 0·1—0·2 grm. of tin. The solution is diluted to 50 c.c. and boiled, when it should remain clear. The solution is then brought into the electrolytic platinum basin and diluted to 100 c.c. It is then heated to 50° C and electrolysed, using a current of 0·5 ampère at 3·6—4·2 volts. After half an hour the temperature is raised to 80° C. and the current increased to 0·75 ampère. The deposition of tin is complete after four hours. The figures obtained from experiments show that whether the tin is deposited from a solution containing arsenic or not, identical results are found for the amount of tin deposited. —C. E. F.

Ammonia in water; New method of determining ——. A. Buisson Compt. rend., 1907, **144**, 493—495.

The method proposed is based on the precipitation of the ammonia by mercuric chloride in the presence of sodium carbonate, and permits of the determination of quantities of ammonia varying from 0·0001 to 0·012 grm. per litre. The details of the method are:—One litre of the water to be examined is rendered alkaline by the addition of sodium hydroxide and distilled slowly until about 100 c.c. of distillate have been collected, the latter being received in a vessel containing 10 c.c. of 1 per cent. hydrochloric acid. If much ammonia is present, the distillate is diluted, but not in cases where the ammonia is less than 0·001 grm. per litre. Ten c.c. of 5 per cent. mercuric chloride solution and 10 c.c. of 15 per cent. sodium carbonate solution are added to the distillate, the mixture is placed aside for 24 hours and the precipitate then collected on a weighed filter, washed with 5 c.c. of water, dried at a temperature of 100° C., and weighed. The weight of the precipitate is multiplied by 0·03 to give the amount of ammonia in 1 litre of the water. The composition of the precipitate is only constant when less than 0·5 grm. of mercuric chloride per litre is employed for the precipitation. —W. P. S.

Mercurous salts; Titration of —— *with potassium permanganate.* D. L. Randall. Amer. J. Science, 1907, **23**, 137—140.

The solution of the mercurous salt in dilute sulphuric acid is treated with excess of potassium permanganate, then ferrous sulphate solution is added till the colour disappears. Accurate results can be obtained with mercurous sulphate or nitrate. The author found that ferrous salts could be titrated with permanganate in the presence of at least 3 per cent. of nitric acid.—F. Shdn.

Bismuth; Determination of —— *volumetrically.* L. Moser. Z. anal. Chem., 1907, **46**, 223—241.

The author has made a critical study of the volumetric methods which have been suggested for the determination of bismuth, and, as a consequence, recommends only Löwe's chromate method, as modified by Rupp and Schaumann (this J., 1902, 1558). But accuracy, even by this method, is very dependent on the concentration of the solutions employed. The best results are obtained by working as follows:—To 20 c.c. of the solution, containing about 0·1336 grm. of bismuth, 50 c.c. of *N*/1 potassium chromate solution are added, and the mixture is shaken and made up to 100 c.c. After filtering, an aliquot part of the filtrate (20—30 c.c.) is titrated iodometrically, using *N*/2 thiosulphate. Faintly acid solutions are allowable.—F. Sodn.

Gold chloride and formaldehyde; Reaction between —— *in presence of caustic soda.* L. Vanino and F. Hartl. Z. Chem. und Ind. der Kolloide., 1907, **1**, 272—274.

When an insufficiency of caustic soda is present, the precipitation of gold by means of formaldehyde is not complete. The addition of caustic soda to a previously neutralised solution of gold, in the proportion indicated by the equation: $2AuCl_3 + 6NaOH + 3H.COH = 2Au + 3H.COOH + 6NaCl + 3H_2O$, was found to precipitate only 66 per cent. of the gold present, an additional 3 mols. of caustic soda being required for complete precipitation. These results are similar to those previously obtained in corresponding experiments with silver (Ber., 1903, 3304; this J., 1903, 1261); no hydrogen is, however, evolved when a very large excess of caustic soda and formaldehyde is used. The presence of alcohol hinders the precipitation of gold.—F. Sodn.

ORGANIC—QUALITATIVE.

Phytosteryl acetate test for the detection of adulteration of animal by vegetable fats; Some notes on Bömer's ——. F. M. Jaeger. Chem. Weekblad, 1907, **4**, 1—10; Chem. Zentr., 1907, **1**, 703.

Boemer's phytosteryl acetate test (this J., 1899, 301; 1901, 1147) was published before Windaus (this J., 1907, 69) showed that the phytosterol present in the fat from Calabar beans consisted of a mixture of two isomerides—an *α*-phytosterol melting at 136° C., and a *β*-phytosterol melting at 170° C. Bömer's test is based upon the supposition that addition of phytosteryl acetate to cholesteryl acetate, will, in proportion to the quantity added, raise the melting point of the latter. The author points out that, in the first place, it is incorrect to assume that the relative proportions of the two acetates in the crystals will be the same as in the solution. He finds that the phytosterol content of the crystals varies widely according to whether the first, second, or third deposit is examined. Apart from this, however, the form of the melting-point curves for mixtures of cholesteryl acetate with *α*- and *β*-phytosteryl acetates and also with Calabar phytosteryl acetate shows that the melting points of such mixtures afford no trustworthy criteria as to the composition. The three curves mentioned, show considerable deviation from the straight lines connecting the melting points of the two components; further, with *α*-phytosteryl acetate, the curve shows a distinct maximum, so that two mixtures of the same melting point might differ widely in composition. Bömer's test cannot be regarded as entirely trustworthy even for qualitative purposes, since it is conceivable that among the vegetable phytosterols there may exist some, the acetates of which alone or in ternary or quarternary mixtures would give a melting point curve having a minimum. Also animal cholesterols may exist capable of producing effects similar to those caused by phytosterols.—A. S.

Milk and cream; Detection of cane sugar in ——. W. H. Anderson. XVIII*A*., page 336.

Thiosulphates; Detection of —— *in foods.* A. Gutmann. XVIII*A*., page 337.

Quinine; New reactions for ——. C. Reichard. XX., page 340.

Narcotine; New reactions for ——. C. Reichard. XX., page 341.

Narceine; New reactions for —— C. Reichard. XX., page 341.

Adrenaline; Characteristic reaction of ——. R. Krull. XX., page 342.

Santonin; Some new reactions for ——. C. Reichard XX., page 341.

Maretine. P. Lemaire. XX., page 342.

Tartaric and citric acids; Distinction between —— by means of calcium formate solution. A. Oetker. XX., page 342.

ORGANIC—QUANTITATIVE.

Halogens in organic substances; Determination of ——. L. H. Berry. Chem. News, 1906, **94**, 188.

The method described, is stated to be simple and rapid, and is applicable to extremely volatile substances. The substance is weighed out in a very small platinum crucible, which is then filled with a mixture of 1 part of anhydrous sodium carbonate and 5 parts of quicklime. The crucible is now inverted in a larger platinum crucible, and the space between the two also filled with the mixture of sodium carbonate and lime. The whole is heated for half an hour, at first with a small blast-lamp flame, and afterwards more strongly, until the mass is red hot. After cooling, the contents of the crucibles are dissolved in a large excess of dilute nitric acid (1 : 4), a known excess of $N/10$ silver nitrate solution is added, the whole is well stirred, heated on the water-bath, filtered, and the excess of silver nitrate in the filtrate determined by titration with $N/10$ potassium thiocyanate solution. For substances containing iodine, the lime is omitted, and sodium carbonate used alone, in order to avoid formation of calcium iodate.—A. S.

Dyewood extracts; Analysis of ——. F. K. Kopecky. J. Amer. Leather Chem. Assoc., 1907, **2**, 24—34.

The author suggests the use of heavily chromed hide-powder by the stirring or " maceration " method for the analysis of dyewood extracts, and gives a series of tables of results by this method.—H. Br.

Methylfurfural; Determination of ——. K. Fromherz. Z. physiol. Chem., 1906, **50**, 241—249; Chem. Zentr., 1907, **1**, 645.

The author has studied the precipitation of furfural and methylfurfural by means of phloroglucinol and barbituric acid (this J., 1903, 114), and much prefers the latter reagent. The former method, however, has been worked out for the separation of the phloroglucides of the two aldehydes by extraction of the methylfurfural compound with alcohol (this J., 1905, 212), whereas no means of separating the barbituric acid compounds has yet been devised. The solubility of methylfurfural-barbituric acid in 12 per cent. hydrochloric acid is 2·29 mgrms. per 100 c.c., and this value can be applied as a correction in the determinations. If in separating the phloroglucides of the two aldehydes by means of alcohol, the phloroglucide precipitate be allowed to stand longer than 16 hours before filtration, the quantity of phloroglucide extracted by alcohol gradually decreases as the result of some secondary change, and the values obtained for methylfurfural then become too low.—J. F. B.

Sulphur; Determination of —— in preparations of ichthyol, by means of sodium peroxide. W. Hinterskirch. Z. anal. Chem., 1907, **46**, 241—246.

To 0·4—0·5 grm. of the sample, contained in a nickel crucible 4 cm. in height, is added a mixture of 4—4·5 grms. of fresh sodium peroxide and 3 grms. of coarsely powdered, dry potassium carbonate, in small portions. The mixture is stirred in with a stout platinum wire, and any excess spread over the surface. During this operation the whole mass gets hot and swells up, much ammonia being evolved from the ammonium sulphate present. The crucible, loosely covered, is supported 12—15 cm. above a spirit lamp flame 4 cm. high, until in 15—20 minutes the contained mass becomes solid. The crucible is then lowered into the flame and a rather violent reaction soon commences, causing the mixture to inflame and melt. Care is necessary at this point to avoid loss by spirting. After 1½—2 hours, the crucible is allowed to cool, and placed in water. When the mass is dissolved, the solution is warmed for ½—1 hour on the water-bath with an excess of bromine water, and the crucible is then removed. The solution is filtered, after adding a little magnesium oxide to prevent nickel oxide from coming through the filter, the filtrate is carefully acidified with hydrochloric acid, and the silica separated in the usual way by evaporation. Barium chloride is then added to precipitate the sulphur. If much water be present, it is advisable to dry the sample before use.—F. Sodn.

Nitriles and carbylamines; Methods of determination of ——. H. Guillemard. Bull. Soc. Chim., 1907 [4], **1**, 196—200.

The following methods for the estimation of nitriles and carbylamines have been worked out with special reference to the products obtained by the interaction of cyanides and alkyl iodides. (1) Estimation of carbylamines: (*a*) Good results are obtained by boiling the carbylamine with concentrated sulphuric acid and estimating the ammonia formed. (*b*) When an alkaline solution of sodium hypobromite (5 c.c. of bromine to 100 c.c. of water and excess of caustic soda free from carbonate) is added to ethylcarbylamine, it is immediately decolorised, and the liquid becomes hot. The addition is continued until all odour of carbylamine has disappeared. The carbon dioxide produced according to the equation: $C_2H_5.NC+NaOBr+H_2O=NaBr+CO_2+C_2H_5.NH_2$ is estimated as barium carbonate. (*c*) Carbylamines react with a solution of oxalic acid decomposing the latter with evolution of equal volumes of carbon monoxide and carbon dioxide, which can be estimated as above. Four molecules of ethylcarbylamine decompose 3 mols. of oxalic acid. (2) Estimation of nitriles: This is carried out by estimating the ammonia formed by hydrolysis, with acids. The nitrile is heated to 150° C. for three hours with 50 per cent. sulphuric acid in a sealed tube. (3) Estimation of nitriles and carbylamines in their mixtures: Nitriles are not attacked in the cold by dilute mineral acids or by bromine or hypobromites, or by oxalic acid, so that by adding a little dilute sulphuric acid to a mixture of propionitrile and ethylcarbylamine until the odour of the latter has disappeared, and distilling, the nitrile passes over, and the separation of the two is thus effected. (4) Estimation of nitriles and carbylamines in the mixture resulting from the action of ethyl iodide on a cyanide: The mixture is rendered alkaline with potash, a saturated solution of potassium cyanide added, and the whole distilled. Very little hydrocyanic acid passes over, and a second distillation with potash eliminates this entirely. The ammonia in the distillate is estimated by adding excess of $N/1$ sulphuric acid and titrating back with $N/1$ caustic soda. The presence of carbylamine does not interfere with this titration. The rest of the analysis is carried out as above, care being taken to allow for the ammoniacal nitrogen in estimating the carbylamine.—J. C. C.

Tan [tannin] determination; The present official method of ——. I. R. A. Earp. II. H. R. Procter. XIV., page 330.

Tanning materials; New method of analysis and examination of ——. G. Herrenschmidt. XIV., page 330.

Tanning materials; A new method of analysis of ——. S. C. Dodge. XIV., page 331.

Free acid in tan liquors; New and accurate method for the determination of ——. A. W. Hoppenstedt. XIV., page 331.

Tanning materials; Analysis of ——. Proceedings of the third annual meeting of the American Leather Chemists' Assoc. XIV., page 330.

Sod oil and moellon; Moisture in ——. F. W. Alden. XIV., page 331.

Sucrose; Action of basic lead acetate on the rotatory power of aqueous solutions of ——. F. Bates and J. C. Blake. XVI., page 333.

Electro-decolorisation. A study in optical sugar analysis. F. G. Wiechmann. XVI., page 333.

Vinegar; Mineral acids in ——. F. D. Ratcliff. XVII., page 335.

Potatoes; Percentage of solanine in ——, and the influence of the cultivation thereon. F. W. Morgenstern. XVIII.A., page 337.

Celluloid; Determination of camphor in ——. Utz. XIX., page 339.

Cantharides; Assay of ——. P. A. W. Self and H. G. Greenish. XX., page 341.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 283.)

Iron carbonyl: A new —— [iron tetracarbonyl], and the action of light and of heat on the iron carbonyls. Sir J. Dewar and H. O. Jones. Roy. Soc. Proc., 1906, **79A**, 66—80. (See also this J., 1906, 18.)

The decomposition of iron pentacarbonyl to the orange-red crystalline diferro-nonacarbonyl and carbon monoxide brought about by light, is found to be a reaction of the "first order." Light has no effect, however, above 56° C., and there is thus a displacement of the equilibrium, $2Fe(CO)_5 \rightleftarrows Fe_2(CO)_9 + CO$, in the direction of the liquid carbonyl at higher temperatures; for the reverse action of carbon monoxide on diferro-nonacarbonyl in the dark, which is very slow at ordinary temperatures, is much accelerated by heat. The nonacarbonyl is decomposed, when heated at 95° C., according to the equation, $2Fe_2(CO)_9 \rightleftarrows 3Fe(CO)_5 + Fe + 3CO$, but when dissolved in such a liquid as ether or toluene, change begins at a lower temperature, and a dark green colour develops, without the separation of a solid substance. This latter reaction is probably represented by the equation, $Fe_2(CO)_9 = Fe(CO)_5 + Fe(CO)_4$. The tetracarbonyl is best obtained by heating a mixture of diferro-nonacarbonyl and toluene, in the proportion, 1 grm. of the carbonyl to 20 c.c. of toluene, in a sealed tube, from which the air has been displaced by carbon dioxide. The temperature is maintained at 95° C., with occasional shaking, until all solid has disappeared, and, on allowing to cool, the tetracarbonyl separates in dark green lustrous prisms, of sp. gr. 1·996, amounting to 20 per cent. of the weight of nonacarbonyl taken. It is a remarkably stable substance, being unattacked by hydrochloric acid or by cold sulphuric acid. Nitric acid attacks it, and hot concentrated sulphuric acid gives carbon monoxide and ferrous sulphate. Aqueous solutions of the alkalis have only a very slight action. It is decomposed at 140°—150° C., giving carbon monoxide and metallic iron. It dissolves in organic solvents, such as benzene, ether, &c., forming dark green solutions, which gradually lose their colour on exposure to light, solid being deposited. The formula, $Fe(CO)_4$, is merely empirical, a much higher molecular weight being indicated by experiment. When dissolved in pyridine or alcohol, the colour turns from green to red on boiling, probably owing to a change in molecular state. Alumina saturated with iron pentacarbonyl becomes coloured a darkish purple on exposure to light, carbon monoxide being evolved. In this case possibly a "lake" is formed.—F. Sodn.

Vanadium pentoxide as an oxidation accelerator. A. Naumann, L. Moeser, and E. Lindenbaum. J. prakt. Chem., 1907, **75**, 146—152.

Sugar in the presence of about 0·2 per cent. of vanadium pentoxide is rapidly oxidised by nitric acid to oxalic acid. The best yield of oxalic acid is obtained if the temperature do not exceed 70° C. during the oxidation. When air is bubbled through warm ethyl alcohol and passed over asbestos impregnated with vanadium pentoxide and slightly warmed, the asbestos commences to glow and aldehyde is formed. The presence of vanadium pentoxide accelerates the oxidation of stannous chloride. When small quantities of ammonium vanadate are added to potassium iodide and hydrogen peroxide, there is an immediate separation of iodine. The oxidation of ferrous and mercurous salts by nitric acid, or potassium chlorate and hydrochloric acid, is not affected by the addition of vanadium pentoxide. The pentoxide acts as an oxygen carrier, for the presence of the blue vanadium tetroxide can be detected during the reaction.—F. Sodn.

Uranyl salts; Phosphorescence of —— in liquid air. H. Becquerel. Compt. rend., 1907, **144**, 459—462.

If the light given out by a uranyl salt at the ordinary temperature be examined in a spectroscope, the spectrum observed will be found to differ considerably from that given by the same salt when the latter is placed in liquid air. In the first case, the spectrum will contain bands more or less broad and diffused, whilst in liquid air the same bands, or groups of bands, become subdivided, and are occasionally extremely fine. The bands shown in the emission and absorption spectra undergo similar modification when the salt is placed in liquid air. The phenomenon is not only seen in crystalline substances, but is exhibited by uranium glass, and by the minerals, chlorophane and leucophane.—W. P. S.

Diazo reactions; Influence of light on ——. I. K. J. P. Orton, J. E. Coates, and F. Burdett. Chem. Soc. Trans., 1907, **91**, 35—56.

Sunlight has a considerable effect in the decomposition of solutions of many diazonium compounds; when kept in the dark, these may remain stable for a long time, but decompose rapidly in light, the product varying with the solvent employed: for instance, phenols are formed in aqueous solutions: the methyl, ethyl, or phenyl ethers are obtained in solutions of the corresponding alcohols, a small quantity of the free hydrocarbon being, in some instances, also formed; in acetic acid solution, the phenyl acetate results, whilst, with formic acid, the hydrocarbon is produced, with evolution of carbon dioxide. The yields are, in most cases, quantitative. Iso-diazotate solutions are unaffected by light. When the diazo salts are exposed to light in concentrated solutions of acids, the action is practically the same as in aqueous solution. The action of light on solutions of the following compounds is described at length:—*s*-tribromodiazobenzene; 2.4-dibromodiazobenzene; 5-bromo-4-diazo-*m*-xylene; 6-bromo-5-diazopseudocumene. (See also this J., 1905, 818.)—T. F. B.

Trade Report.

The Patents and Designs Bill.

Times Eng. Suppl., March 27, 1907.

The new Patents and Designs Bill is divided into 36 clauses, of which 17 relate to patents and six to designs, while 13 are general in their application. The first clause enables the grant of a patent to be made to two or more persons jointly. The second clause relates to the deposit of samples in the case of a chemical invention, and thus extends those clauses of the Patent Act of 1883, where drawings are called for, which will thus in future read that the specification shall, "if required, be accompanied by such drawings, and when the invention is a chemical invention by such specimens or samples as may be prescribed." Clause 3 relates to patents of extension, and permits the inventor to request that the term limited in the new patent for the duration thereof may be the same as that of the original patent, or so much of that term as is unexpired. Clause 4 relates to the extension of certain powers under the existing Act to specifications published subsequently to application. In the same way the next clause gives power to post-date applications in cases of disconformity. Clause 6 is important, since it lays down the grounds on which a patent may be opposed, and makes the reason for opposition the existence of a British patent of prior date to the patent the grant of which is opposed. Clauses 7 and 8 modify the arrangement for the sealing of any patent, and specify the form of application for the extension of the time for the payment of fees. Clause 9 is material in that it gives power to the Comptroller to revoke patents on certain grounds, and in Clause 10 it is laid down that any person at a time not less than three years after the grant of a patent may apply to the Comptroller for its revocation on the grounds that the patented article is manufactured exclusively or mainly outside the United Kingdom. In Clause 11 the procedure is set out for petitions for the grant of a compulsory licence, or for the revoke of a patent. The chief sections here are that revocation may be applied for if the patentee fails to manufacture the patented article to an adequate extent, or to grant licences on reasonable terms, and also if any trade or industry in the United Kingdom is unfairly prejudiced by the conditions attached by the patentee to the purchase, hire, or use of the patented article. The next clause deals with certain modifications of the existing Act respecting the date of any patent substituted for a patent obtained by fraud. Clauses 13, 14, and 15 are of minor importance. Clause 16 enacts that " it shall not be lawful in any contract made after the commencement of this Act for the sale or lease of, or licence to use, any patented article, to impose as a condition of such sale, leasing, or licence to use, a condition the effect of which will be to prohibit or restrict the purchaser, hirer, or licensee from employing in his trade or industry any article or class of articles acquired from any person other than the person by whom the condition is imposed or his nominees, and any such condition inserted in any such contract shall be null and void." The last clause in this part relates to provisions as to appeals and references to the Court.

New Books.

Elektrometallurgie des Eisens. Von Dr. Bernhard Neumann, a. o. Professor a. d. Grossherzogl. Techn. Hochschule zu Darmstadt. Wilhelm Knapp's Verlag. Halle a. S. 1907. Price M. 7.

8vo volume, containing 174 pages of subject matter, with 89 illustrations, and an alphabetical index of subjects and names. The matters treated of are classified as follows :—I. Historical. II. New Processes and Apparatus. III. Practical Results. IV. Condition of the Manufactured Products. V. Power required and Heat consumed. VI. Costs. VII. Electric Iron and Steel Production in comparison with the present Iron and Steel Works Practice. VIII. Iron Alloys, *viz.*, Ferrosilicon, Ferrochromium, Ferronickel, Ferromanganese, Ferrotungsten, Ferrovanadium, Ferromolybdenum, Ferrotitanium, Ferrophosphide. Appendix, with Processes of Héroult, Kjellin, Colby, and Stassano.

Ueber die Elektrolytische Gewinnung von Brom und Iod. Von Dr. Ing. Max Schlötter. Wilhelm Knapp's Verlag. Halle a. S. 1907. M. 2.40.

8vo volume, containing 50 pages of subject matter, with 18 illustrations. The subject matter is treated according to the following scheme :—I. History and Occurrence of Bromine, and its Preparation. II. Chemical Processes. III. Electrolytic Processes. IV. Isolation and Purification of Bromine. V. Determination of Bromine. VI. Its Properties and Uses. I. Occurrence and Preparation of Iodine. II. Electrolytic Processes. III. Purification and Analysis of Crude Iodine. IV. Properties and Uses.

Deutsches Patentrecht für Chemiker. Von Dr. Julius Ephraim. Chemiker und Patentanwalt, Berlin. Wilhelm Knapp's Verlag. Halle a. S. 1907. M. 18.

8vo volume, containing 583 pages of subject matter, and the alphabetical index. The matters treated of are arranged under the following heads :—I. Discovery or Invention in General. II. The Functions of Ownership, &c. III. Limitations of Patent Protection. IV. Novelty. V. Application for Patent Rights. VI. The Patent Office. VII. Process of Patenting, &c. VIII. Additional Patent. IX. Inventor and Applicant. X. The Refusal, or Invalidation. XI. Carrying out the Invention. XII. Realisation of Patent Rights. XIII. Limitation and Control of Patent Rights. XIV. Conferring Patent Rights. XV. Penalties and Indemnification. XVI. Duration of Patent Protection. XVII. Specimen Trials ; Sample Testing, &c. XVIII. Government Policy with regard to Patent Rights, and also with regard to Patent Rights in other States.

Ueber Mohnbau und Opiumgewinnung. Bearbeitet von Prof. Dr. H. Thoms, Direktor des Pharm. Instituts der Universität Berlin. Verlag von Gebrüder Borntraeger, S.W. 11, Dessauer Strasse 29, Berlin. 1907. Price M.4. Sonderabdruck aus den Ber. der deutsch. Pharm. Gesellschaft.

8vo volume, containing 60 pages of subject matter, with illustrations, and four sheets of drawings representing poppy plantations. The cultivation of the poppy in various localities is treated of, and the yields of opium from poppies of various growth, &c. An investigation is described and data given of the poppy crops raised in Dahlem in the years 1905-6, and also an investigation of ripe and unripe poppy heads, as to their content of alkaloids.

Science in Sugar Production. An Introduction to the Methods of Chemical Control. By T. H. P. Heriot. Norman Rodger, Altrincham, near Manchester. 1907. Price 6s. net.

Large 8vo volume, containing 104 pages of subject matter, with 19 illustrations and the alphabetical index. The text is subdivided in accordance with the following plan :—I. Introduction.—(i.) What is meant by Chemical Control. (ii.) The Rule of the Chemist in the Sugar Industry. (iii.) Chemical Control without a Chemist. II. The Practical Methods of the Chemist.—(iv.) Fitting up the Laboratory. (v.) Weighing and Measuring. (vi.) Preparing a Solution for Analysis. (vii.) The Density Test. (viii.) The Optical Test. III. Simple Methods of Chemical Control.—(ix.) The Control of the Mill. (x.) Control of Clarification. (xi.) Control of the Imports. (xii.) Control of the Exports. (xiii.) Detection of Avoidable Losses. (xiv.) Control of the Fuel.

Industrial Alcohol. The Production and Use of Alcohol for Industrial Purposes and for Use as an Illuminant and as a Source of Motive Power. By John Geddes M'Intosh, Lecturer on Manufacture and Applications of Industrial Alcohol, Polytechnic, Regent Street, London. Scott, Greenwood and Son, 19, Ludgate Hill, London, E.C. 1907. Price 7s. 6d. net. Copp Clark Co., Ltd., Toronto, Canada. D. van Nostrand Co., New York, U.S.A.

8vo volume, containing 246 pages of subject matter, with 75 illustrations and 25 tables, and an alphabetical index. The subject is subdivided as follows :—I. Alcohol and Its Properties. II. Continuous Aseptic and Antiseptic Fermentation and Sterilisation in Industrial Alcohol Manufacture. III. Manufacture of Industrial Alcohol from Beets; IV. from Grain; V. from Potatoes; VI. from Surplus Stocks of Wine, Spoilt Wine, Wine Marcs, and from Fruit; VII. from the Sugar Cane, and from Sugar-Cane Molasses. VIII. Plant, &c., for the Distillation and Rectification of Industrial Alcohol. IX. Manufacture and Uses of various Alcohol Derivatives, Ether, Haloid and Compound Ethers, Chloroform, Acetone, &c. X. Uses of Alcohol in Manufactures, &c. XI. Uses of Alcohol for Lighting, Heating, and Motive Power.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

6499. Osborn. Separation of solids from liquids. March 18.

6562. Longwood Engineering Co., Ltd., and Walsh. Machine for straining waste liquids or trade effluents. March 19.

6635. Risberg. Centrifugal separators.* March 19.

6890. Féry. Pyrometers. [Fr. Appl., April 3, 1906.]* March 22.

7073. Hubbard. Means for filtering gases. March 25.

7116. Brandenburg. Absorbing, condensing, or purifying gases.* March 25.

7453. Schlieper. Filtrating machines.* March 28.

7522. Heinz. Filtration system. [U.S. Appl., March 28, 1906.]* March 28.

7524. Rustige. Receptacles for containing liquids under pressure.* March 28.

Complete Specifications Accepted.

26,409 (1905). Shaw. Apparatus for evaporating liquids. March 27.

6950 (1906). Leclaire. Filter. April 4.

7538 (1906). Marshall and Hersey. *See under* II.

9032 (1906). Fullerton, Hodgart, and Barclay, Ltd., and Liversedge. Utilising exhaust steam for heating evaporators, vacuum pans, stills, &c. April 4.

10,055 (1906). Collier. Centrifugal separator. March 27.

11,993 (1906). Scheibe. Devices for separating admixtures from gases and vapours. April 4.

12,523 (1906). Dennis. *See under* X.

17,612 (1906). Aitken and Mackie. Apparatus for separating liquids from vapour. April 4.

II.—FUEL, GAS, AND LIGHT.

Applications.

6479. Potter. Manufacture and treatment of incandescent mantles. March 18.

6491. Lymn and Well. Gas producers. March 18.

6500. Ellis (Paterson). Production of gas from hydrocarbon oils. March 18.

6501. Yates and Kershaw. Generators of suction gas-producing apparatus. March 19.

6631. Parker. *See under* III.

6641. D'Heureuse. Incandescent mantles. March 19.

6820. Bouland. Manufacture of agglomerate fuel. [Fr. Appl., March 22, 1906.]* March 21.

6828. Buhlmann. Manufacture of incandescent mantles. [Ger. Appl., June 28, 1906.]* March 21.

6921. Jones. Coke ovens. March 22.

7073. Hubbard. *See under* I.

7116. Brandenburg. *See under* I.

7257. Norman. Increasing the calorific value of liquid fuels. March 26.

7407. Allgem. Elektricitäts-Ges. Manufacture of tungsten filaments for electric lighting and heating by reduction of tungstic acid. [Ger. Appl., March 30, 1906.]* March 27.

7454. Hughes. Gas producers. March 28.

7532. Parker. Destructive distillation of coal and treatment of carbonaceous and other substances. March 28.

7594. Hooton. Manufacture of illuminating gas. March 30.

7642. Lake (Parker-Clark Electric Co.). Filaments for incandescent electric lamps.* March 30.

7650. Collin. Horizontal regenerative coke ovens. [Ger. Appl., April 4, 1906.]* March 30.

Complete Specifications Accepted.

7188 (1906). Bloxam (Lux). Manufacture of incandescence bodies of refractory metals for electric lamps. March 27.

7221 (1906). Colle. Coke ovens. April 4.

7357 (1906). Vivian. Manufacture of artificial fuel. April 4.

7538 (1906). Marshall and Hersey. Filters chiefly for the purification of gas. April 4.

14,799 (1906). Allport. Cove oven plant. April 4.

18,643 (1906). Michaud and Delasson. Production of indestructible filaments for lighting and heating. March 27.

26,314 (1906). Smith. Apparatus for carburetting air. April 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

6500. Ellis (Paterson). *See under* II.

6631. Parker. Destructive distillation of coal and treatment of carbonaceous substances. March 19.

6831. Pope and Clark. Extraction of products from wood.* March 21.

6878. Ganz and Faller. Distillation of illuminating petroleum. March 22.

7263. Vaughan-Sherrin. Distillation of petroleum. March 26.

7532. Parker. *See under* II.

7550. Lake (Friedlaender). Rendering hydroxyl derivatives of aromatic hydrocarbons soluble in water.* March 28.

7615. Craig. Manufacture of pitch. March 30.

Complete Specification Accepted.

14,567 (1906). Kuess. Manufacture of candles, &c., from petroleum or mineral oils. March 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

6490. Imray (Soc. Chem. Ind. in Basle). Manufacture of halogenised vat dyestuffs. March 18.

6723. Meister, Lucius, und Brüning. Manufacture of easily reducible indigo. [Ger. Appl., April 4, 1906.]* March 20.

6814. Imray (Soc. Chem. Ind. in Basle). Manufacture of substantive dyestuffs.* March 21.

6930. Imray (Meister, Lucius, und Brüning). Manufacture of arylthioglycollic-*o*-carboxylic acids. March 22.

6951. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of leuco derivatives from gallocyanine. March 22.

7057 Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of azo colouring matter. March 23.

7146 and 7147. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow azo dyestuffs. March 25.

7148. Bloxam (Act.-Ges. f. Anilinfabr.). New sulphurised dyestuffs. March 25.

7351. Imray (Meister, Lucius, und Brüning). Manufacture of a monoazo dyestuff and of lakes therefrom. March 27.

Complete Specifications Accepted.

7535 (1906). Redfern (Basle Chemical Works). Manufacture of monoazo dyestuffs. April 4.

16,181 (1906). Dreyfus, and Clayton Aniline Co. Manufacture of indigo. March 27.

24,092 (1906). Ges. f. Chem. Ind. in Basle. Manufacture of red vat dyeing dyestuffs from salicylthioacetic acid. April 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

6434. Calico Printers' Association, Ltd., and Hindle. Method and means for printing textile fabrics. March 18.

6549. Kur. Printing calico and similar goods. March 19.

6724. Fussgänger. Method and apparatus for steaming fabrics. [Ger. Appl., March 30, 1906.]* March 20.

6963. Cowper-Coles. Production of cylinders for printing fabrics and paper.* March 22.

7099. Peters. Dyeing with the jigger.* March 25.

7149. Imray (Soc. Chem. Ind. in Basle). Manufacture of a stable hydrosulphite preparation. March 25.

7150. Bloxam (Soc. Anon. des Usines Remy). Manufacture of a finish for use in dressing fabrics.* March 25.

7224. Ashwell, and Ashwell and Co., Ltd. Machinery for dyeing hanks. March 26.

7306. Quern. Bleaching or dyeing flax, hemp, and like yarns. March 27.

7382. Sharp, and Sharp and Sons. Producing silk-like effects on textile fabrics.* March 27.

Complete Specifications Accepted.

9752 (1906). Pickup and Knowles. Machines for printing fabrics. April 4.

20,460 (1906). Becker. Composition for starching fabrics and rendering them non-inflammable. April 4.

21,021 (1906). Sträter. Cop tubes to facilitate the dyeing of yarns. March 27.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

7298. Hargreaves. *See under* VIII.

7641. Jaubert. Manufacture of potassium peroxide or mixtures thereof.* March 30.

Complete Specifications Accepted.

9491 (1906). Hinz. Manufacture of peroxides of manganese and zinc. March 27.

10,581 (1906). Elworthy. Manufacture of carbonic acid, hydrogen, and nitrogen. March 27.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

7298. Hargreaves and Hargreaves. Producing soda compounds and materials suitable for use in the manufacture of glass. March 27.

Complete Specifications Accepted.

11,375 (1906). Hyde. Apparatus for making sheet or other blown glass. April 4.

17,779 (1906). Fry. Glass melting pot. April 4.

1241 (1907). Miller, Filler, and Rottmann. Divided glass melting pot. April 4.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

2605a. Charles. Manufacture of artificial stone. [Ital. Appl., March 1, 1906.]* March 20.

6474. Matthews. Manufacture of mortar for building purposes.* March 18.

6501. Ford. Manufacture of artificial stone. March 18.

6927. Lensch. Production of artificial stone having the appearance of marble. March 22.

7037. Belloni. Coloration of marble. [Ital. Appl., June 21, 1906.]* March 23.

7174. Dondy. Manufacture of artificial marble or stone. March 25.

7178. Chateau and Merklen. Treatment of wood and other porous material for preserving and other purposes. March 25.

7476. Ford. Manufacture of artificial stone. March 28.

Complete Specifications Accepted.

10,244 (1906). Shott. Manufacture of blocks or tiles for paving, &c. March 27.

14,173 (1906). Clark (Amer. Hydrolit Co.). Manufacture of magnesian cement. April 4.

14,879 (1906). Carpenter. Fluid for preventing dust on road surfaces. March 27.

16,012 (1906). Hamblet. Arched kilns for bricks, &c. March 27.

19,973 (1906). Matcham. Furnaces for preparing cement-making materials. March 27.

X.—METALLURGY.

Applications.

6502. Thirot and Mage. *See under* XI.

6522. Nya Ackumulator Aktiebolaget Jungner. *See under* XI.

6554. Churchward. Steel alloys.* March 19.

6626. Thompson (Wadman). Treatment of ores containing lithia.* March 19.

6730. Crispo. Extraction of copper from copper residues.* March 20.

6745. British Thomson-Houston Co. (Gen. Electric Co.). Manufacture of iron alloys. March 20.

7034. McGhie and Barton. Treatment of ores containing arsenic. March 23.

7035. McGhie and Barton. Separation of cobalt from nickel. March 23.

7119. Cowper-Coles. Recovery of metals from ores or residues. March 25.

7223. New Delaville Spelter Co., and Shortman. Extraction of zinc. March 26.

7285. New Delaville Spelter Co., and Shortman. Appliances for zinc extraction furnaces for intercepting and collecting zinc oxide. March 27.

7302. Stewart. Recovering zinc from ores. March 27.

7499. Phillips. Extraction of gold. March 28.

7587. Muirhead. Manufacture of basic open-hearth steel. March 30.

Complete Specifications Accepted.

6937 (1906). Holland. Recovery of metals from liquids. April 4.

7195 (1906). Rolason. Silver alloys. April 4.

10,329 (1906). Savelsberg. Treatment of mattes of the heavy metals. March 27.

12,523 (1906). Dennis. Treating ores and other materials by the aid of heat. March 27.

15,015 (1906). Bosshardt and Garda. Smelting furnaces. April 4.

17,615 (1906). Röchling and Rodenhauser. *See under* XI.

24,526 (1906). Moyano. Utilising inferior calamines by extracting the zinc in the form of oxide. April 4.

25,489 (1906). Perreur-Lloyd and Gardner. *See under* XI.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

6502. Thirot and Mage. Regeneration of electrolyte used in the extraction of copper from bronze and bronze waste. [Fr. Appl., March 26, 1906.]* March 18.

6522. Nya Ackumulator Aktiebolaget Jungner. Alloys for accumulators with invariable electrolyte. [Swed. Appl., March 30, 1906.]* March 18.

6592. Egger. *See under* XIV.

6859. Barton and Deakin. Making electro-depositions on fabrics, leather, paper, &c. March 22.

7407. Allgem. Elektricitäts-Ges. *See under* II.

7515. Gröndal-Kjellin Co., Ltd., and Härdén. Electric and other furnaces. March 28.

Complete Specifications Accepted.

6283 (1906). Kuehnrich. Electric furnaces. March 27.

7829 (1906). Thompson (Westdeuts. Thomasphosphat Werke). Production of compounds of oxygen and nitrogen by electric discharges. April 4.

11,950 (1906). Hess. Electric insulating material. April 4.

17,615 (1906). Röchling and Rodenhauser. Means for obtaining thin liquid dross in electric furnaces for metallurgical purposes. March 27.

21,416 (1906). Kjellin. Electric furnaces. April 4.
25,489 (1906). Perreur-Lloyd and Gardner. Electrolytically extracting metals from ores. April 4.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

6825. Genthe. Process of making linseed oil products.* March 21.
7561. Mason, Gildert and Fryer. Treatment of fatty or waxy bodies to facilitate saponification. March 28.

Complete Specification Accepted.

7380 (1906). Samuel. Manufacture of soaps, detergents, lubricants, batching, candle stock, and the like. April 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

6620. Strange and Pim. Manufacture of white lead. March 19.
6722. Meister, Lucius, und Brüning. Manufacture of body colours. [Ger. Appl., June 1, 1906.]* March 20.
6755. Plönnis. Waterproof paints. [Ger. Appl., May 2, 1906.]* March 20.
7351. Imray (Meister, Lucius, und Brüning). *See under* IV.

Complete Specification Accepted.

8513 (1906). Hall. Manufacture of distemper paints. April 4.

(*B.*)—Resins, Varnishes.

Applications.

6717. Guittet. Driers for paints, varnishes, and oils. March 20.
6843. Lake (Lingner). *See under* XX.
7482. Defrance. Varnish or other vehicle for paint. March 27.

(*C.*)—India-Rubber.

Applications.

7248. Bubenheim. Drying india-rubber, gutta-percha, &c. [Ger. Appl., Oct. 29, 1906.]* March 26.
7371. Wickham. Apparatus for curing india-rubber.* March 20.

Complete Specifications Accepted.

12,526 (1906). Boult (Köneman). Recovery of rubber from rubber waste. March 27.
14,146 (1906). Colombo Commercial Co. (Dixon). Tapping knives for extracting the latex from rubber trees. March 27.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

[illegible]2. Egger. Production of leather for insulating electrical conductors.* March 19.

XVII.—BREWING, WINES, SPIRITS, &c.

Complete Specifications Accepted.

12,242 (1906). Chew, and West and Co. Chilling and carbonating beer and other beverages. April 4.
12,[illegible] (1906). Jordan (Internat. Malt Machine Co.). Malting apparatus. March 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

6622. Holz. Alimentary products. March 19.
6636. Williams. Bleaching and ageing cereals. [U.S. Appl., May 18, 1906.]* March 19.
7500. Boult (Amer. Farm Products Co.). Manufacture of butter.* March 28.

Complete Specification Accepted.

28,695 (1906). Paul and Remington. Manufacture of a food or stimulant from yeast. March 27.

(*B.*)—Sanitation; Water Purification.

Application.

6676. Place. Bacteria beds. March 20.

Complete Specifications Accepted.

15,771 (1906). Patterson. Apparatus for purifying boiler feed waters. March 27.
16,890 (1906). Candy. Purification of water and other liquids. April 4.
18,806 (1906). Dünkelberg. Apparatus for purifying water. April 4.
19,728 (1906). Haddan (Edson Reduction Machinery Co.). Apparatus for reducing garbage and sewage. March 27.
2166 (1907). Krüger. Water purifying apparatus. March 27.

XIX.—PAPER, PASTEBOARD, &c.

Application.

6492. Imray (Meister, Lucius, und Brüning). Manufacture of variegated paper. March 18.

Complete Specification Accepted.

14,177 (1906). Monin. Loading or filling for use in the manufacture of paper. April 4.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

8260a (1906). Dubosc. Process of oxidising camphene. March 18.
6731. Kösters and Ottemann. Manufacture of amides of the higher fatty acids.* March 20.
6843. Lake (Lingner). Manufacture of solid condensation products from copaiba balsam.* March 21.

Complete Specifications Accepted.

8407 (1906). Newton (Bayer und Co.). Manufacture of new pharmaceutical compounds. April 4.
13,056 (1906). Dreyfus, and Clayton Aniline Co. Manufacture of sulphonic chlorides, sulphonic bromides, and sulphonic amides, and derivatives thereof. March 27.
24,830 (1906). Chem. Fabr. von Heyden. Manufacture of isobornyl esters. March 27.
25,864 (1906). Kuzel. Production of colloidal elements. March 27.
2586 (1907). Soc. Anon. Etabl. Poulenc Frères, and Fourneau. Preparation of amino-acid alcohols and their derivatives. April 4.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

7132. Boult (Soc. des Plaques et Papiers Photographiques A. Lumière et ses fils). Manufacture of photographic films.* March 25.
7217. Smith and Merckens. Production of coloured photographs. [Ger. Appl., April 6, 1906.]* March 26.

XXII.—EXPLOSIVES, MATCHES, &c.

Complete Specification Accepted.

3 (1907). Castiglioni. Igniting composition for tipping matches. March 27.

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No. 8, Vol. XXVI. APRIL 30, 1907. No. 8, Vol. XXVI.

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Barker North	V., XI.
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F. Southerden, B.Sc.	IX., XX.
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N.B.—The names in *italics* are those of Members of Committees who retire from their respective offices at the end of the current session.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. Full particulars will appear later.

In accordance with the provisions of Rule 18 of the By-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir Boverton Redwood has been nominated to the office of President, under Rule 8; Prof. Percy Frankland, Mr. C. C. Hutchinson and Mr. Walter F. Reid have been nominated Vice-Presidents under Rule 8; and Mr. Eustace Carey has been nominated a Vice-President under Rule 11. Prof. W. R. Hodgkinson has been nominated an ordinary member of Council under Rule 17; and the Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary.

Extract from Rule 18.—"No such nomination shall be valid unless it be signed by at least ten members of the Society, who are not in arrear with their subscriptions, and by the nominee, nor unless it be received by the General Secretary at the Society's office, not later than the last day of May prior to the commencement of the Annual General Meeting, at which the election to which the nomination refers is to take place. Nor shall any such nomination be valid if the person nominated be ineligible for election under By-laws 12 or 15. No member shall sign more than one nomination form."

London Section.

THE ALLEN-MARQUARDT PROCESS FOR THE ESTIMATION OF HIGHER ALCOHOLS.

BY E. A. MANN AND C. E. STACY.

This J., Dec. 15, 1906, p. 1125.

ERRATA.

Page 1125, col. 2:—In Table I, for "Barium hydroxide required for mineral acid in organic acid," read "Barium hydroxide required for organic acid."

Footnote should read—"By the formula $x = \frac{W - w}{1{\cdot}329 - 1}$"

Meeting held at Burlington House, on Monday, March 4, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

Prof. C. V. Boys, F.R.S., exhibited his gas calorimeter and explained its working. (See this Journal, 1906, 234.)

DISCUSSION.

Mr. ARTHUR H. LYMN asked whether the water which was always at the bottom of the calorimeter would not get rather hot if estimations were taken every ten minutes over twenty-four hours, and thus cause loss of heat. Had Prof. Boys used this apparatus for producer gas, and how had it compared with older instruments, and with the calorific values worked out from a careful analysis of such gas?

Dr. H. G. COLMAN said there existed a rough instrument for controlling the illuminating power of the gas, but that property was getting every day less and less important, whilst the calorific power was becoming more important, and some instrument was required to record the calorific power of the gas as it was being manufactured. He had never used Prof. Boys' calorimeter, although he had made many hundreds of tests with Junkers' calorimeter, which was a very excellent instrument, but possessed certain disadvantages, notably the difficulty in reading the thermometers and of examining every part of the instrument. With Prof. Boys' calorimeter all this was altered. With regard to corrosion, the arrangement suggested appeared excellent, but he had no trouble in that respect with Junkers' calorimeter.

Mr. R. THRELFALL said that testing calorimeters was a very difficult matter, and he might say that Prof. Boys would not have done any good by using hydrogen, because the distribution of temperature in the instrument would not be the same as when gas was used, and therefore the loss would be different. It was necessary to use fuel very similar to that on which the calorimeter was to work in order to make a test. Coal gas could not be used, as its calorific power could not be calculated sufficiently closely.

Prof. CLOWES said that the staff of gas examiners of the London County Council had been daily using twenty of the new calorimeters for nearly a year. The gas examiners had found the working simple and easy, and had at once furnished by its means satisfactory and trustworthy results.

Prof. BOYS, in reply, said the heating of water in the base of the calorimeter was provided against by the circulation through it. He had never had the opportunity of using it with producer gas, but he had used it with hydrogen burning 8 ft. an hour instead of the usual 5 ft. an hour as with ordinary coal gas, and with that it worked exceedingly well. He had compared it with the Junkers instrument in this way. In the first place, the calorific value varied during the course of a day, but not very rapidly, and he had taken alternative tests in the Junkers and his own instrument set up side by side. He repeated that operation at various intervals, and, as far as the small variations which occurred would permit an opinion, the two sets of values were concordant, and he could not say which on the whole gave the higher results. He attempted on one or two occasions to produce pure hydrogen, but was never successful. There was a difficulty in producing hydrogen in a chemical laboratory at the rate of 10 ft. an hour for any length of time. He was glad to hear what Dr. Colman said about the absence of corrosion in the Junkers calorimeter; the inside of some of these instruments which had been in use for some time showed very bad corrosion. He had had one of his own instruments in daily use for nearly a year in one of the official testing places, in which practically no corrosion had taken place; the fine wire was still quite clean, no doubt on account of the preventive action of the very dilute sodium carbonate in which the instrument rested between the tests.

FOUR YEARS' EXPERIENCE IN MEASURING AND TESTING PRODUCER GAS.

BY R. THRELFALL, F.R.S.

An essay on the "Motion of Gases in Pipes," by the author of the present communication, was read before the Institution of Mechanical Engineers in 1904 (Proc. Inst. Mech. Eng., 1904, p. 245). The "Testing of Electric Generators by means of Measured Currents of Air" was the subject of a communication to the Institution of Electrical Engineers in Nov., 1904. A paper on "A Static Method of comparing the Densities of Gases" is printed in Royal Society Proceedings, 1906 (A. 77, 542).

The object of this communication is to give some account of four years' experience in the application of the principles laid down in the above-mentioned papers to the measurement and testing of large quantities of producer gas.

Some notes on measuring fluctuating or intermittent gas streams—such, for instance, as are taken by gas engines, and the continuous recording of the calorific power of producer gas and other related matters, are included in the present communication.

It is considered that a *resumé* of the principles of Pitot tube gas measurement may save trouble in referring to the proceedings of the Engineering Societies—which lie rather outside the general scope of reading of many works' chemists.

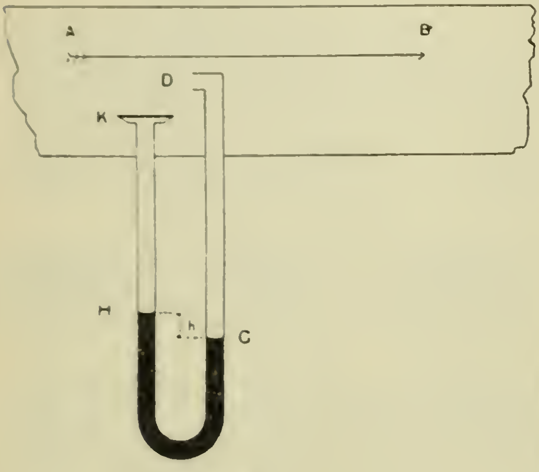


Fig. 1.

The apparatus used by the author is illustrated diagrammatically in Fig. 1. The part of the tube ending at D is termed the facing gauge or "Pitot" tube; the member opening at K is called the side gauge. The Pitot facing-gauge was first described by Pitot in Memoires (Histoire) de l'Academie, 1732, pp. 103 and 363. By observing the rise of level in an open L-shaped facing gauge, Pitot measured the velocity of the River Seine between the Pont Neuf and the Pont Royal, and made it 1050 toises per hour. In his second paper Pitot describes an experiment in which the facing-gauge was passed through the bottom of a boat, and here, of course, a side-gauge had also to be employed. This experiment must have failed, for considerable suction must have been set up in the side gauge as Pitot arranged it, and he does not appear to have been aware of the fact. Pitot's theory of the rise of water in the vertical column of the facing-gauge is simply that the water will rise to such a height as would be necessary to give a velocity of efflux equal to the velocity causing the rise. In the case of a frictionless fluid this is given by Toricelli's theorem $V=\sqrt{2gh}$, (1) where V is the velocity, g the acceleration due to gravity, and h the height to which the water rises. If P be the pressure intensity corresponding to the height of a column, h, we have $h=\frac{P}{\rho g}$ (2), where ρ is the density of the water or other fluid; substituting for h in (1) $V=\sqrt{\frac{2P}{\rho}}$ (3), the form the equation takes in gas measurement. If we can regard a gas as a frictionless fluid Equation (3) undoubtedly will apply to a gas stream, but gases are very far from being frictionless fluids, and it was therefore a legitimate question as to whether the formula quoted does in practice sufficiently approximate to the actual relation of the values in gas streams. In order to answer this question, or indeed make any practical use of the formula, we have to devise some means of measuring the quantity, P, viz., the excess of pressure set up in the facing gauge by the gas velocity over and above the static pressure acting on the gas at the mouth of the gauge tube. The determination of the static pressure in a gas stream is, however, by no means easy; it is, in fact, a difficulty of some standing, and inconvenienced Regnault in his investigation of the specific heat of air. Fig 1 shows a device attributed by Prof. Unwin to Dupré (Théorie Mechanique de la Chaleur, 1869). The gauge tube, which is intended to indicate the static pressure, terminates in a flange a good many times the diameter of the opening. For some reason which is unknown, except in general terms, this mouthpiece gives a pressure only very slightly less than the static pressure at the opening—possibly, when the flange is large enough compared with the opening, the actual static pressure itself. It is desirable to form a clear concept at the outset of the theoretical conditions to be satisfied. In order that the formula may apply with rigour, the fluid must be frictionless, and the static pressure, as well as the Pitot tube pressure, must be ascertained for a definite point in the stream—not the Pitot tube pressure at one point, and the static pressure at another, as shown in the diagram. Now in the practice of gas measurement it is not possible to realise the ideal conditions exactly; it is obviously impossible to have two gauge tubes occupying the same space at the same time, and, moreover, what is required is the velocity of the undisturbed stream, not the velocity of a stream whose velocity distribution is modified by the presence of the gauges themselves. An investigation into the validity of Equation (3) therefore becomes an investigation as to how far the equation may be employed when the conditions postulated by it are departed from to the extent necessitated by practical considerations. A bibliography of the subject is given by the author (*loc. cit.*), but reference will here be made only to the investigation made by Dr. Stanton at the National Physical Laboratory, "On the Resistance of Plane Surfaces in a Uniform Current of Air," Proc. Inst. Civil Eng., Vol. 156 (1903—1904), and to the experiments described by the author (*loc. cit.*). In Dr. Stanton's experiments, where air currents only were in question, it was possible to use very small gauges; in the author's trials gauges large enough to work in gas containing tar were employed. Dr. Stanton determined the velocity of his air stream by an ingenious appliance, while the author actually measured the velocity with which puffs of smoke were carried down a gas main. The result of these trials can best be stated by writing the Equation (3) in the form, $V=K\sqrt{\frac{2P}{\rho}}$ where K is regarded as a constant to be determined. Both investigations showed that the velocity is rigorously proportional to the square root of the Pitot tube pressure, so it is only a question of the constant.

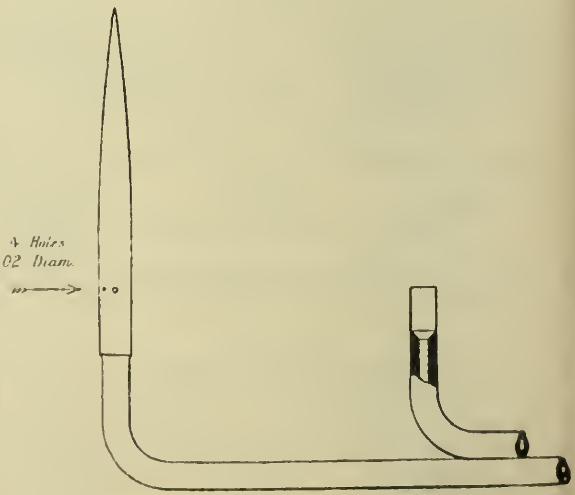


Fig. 2.

By means of the gauge shown in Fig. 2, Dr. Stanton obtained a value for K of 1·03, while the author, using a half-inch brass tube for the facing gauge, and a side gauge with a flange of about ten tube diameters, obtained

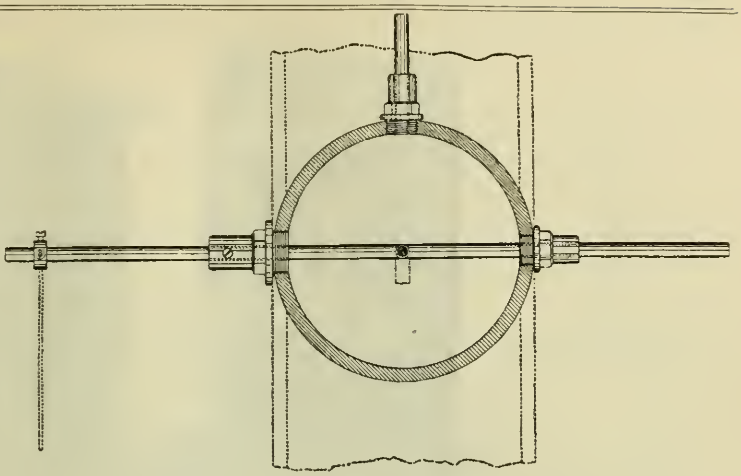


FIG. 3.

a value of 0·974. In the author's experiments the ideal conditions were further departed from than in Dr. Stanton's, for the former placed his flanged gauge close to the wall of the pipe in the cross section containing the facing gauge entrance.

In practical gas measuring, it is often convenient to make the side of the pipe do duty as the flange, *i.e.*, use a side gauge consisting merely of a tube screwed into the side of the gas main and carefully adjusted so as not to project beyond the walls; the arrangement is shown, incidentally, in Fig. 3. In this case, the constant is about 1 per cent. higher—say ·985. It is to be noted that any defect in the action of the flange or its equivalent tends to make the constant too low by increasing the value of P beyond its Pitot tube maximum. How Dr. Stanton came to obtain a value so high as 1·03, the author is unable to surmise, unless, as Dr. Stanton suggests, it is associated with the form of facing gauge employed.

The matter of the applicability of the formula has been dwelt upon at some length, for it is, of course, fundamental, and many chemists have, or used to have, a profound distrust of Pitot tube measurements. This, in the author's opinion, is due to confusion between the Pitot tube used as above described, and used in connection with a side gauge, arranged to give as much "suction" as possible, as in the Swan or Fletcher type of gauge. A gauge of this kind, Fig. 4, was thoroughly examined by the author, who at one time hoped to be able to make use of it, and so obtain the advantage of the higher pressure difference obtainable. The insuperable objection, however, is that the amount of suction set up in such a side gauge is very sensitive to slight displacement of the gauge tube, and is also largely influenced by any kind of deposit which may form at the mouth. There is, also, at present no theoretical treatment of the problem available, nor is the suction rigorously proportional to the square of the gas velocity. The great merit of the Pitot tube, pure and simple, is that it is very insensitive in its indications to variation of form. Thus, of two Pitot tubes—one funnel-shaped, with thin edges, and the other in the form of an almost capillary tube, with thick walls—only a few per cent. difference was observed in the pressure recorded.

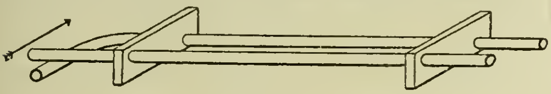


FIG. 4.

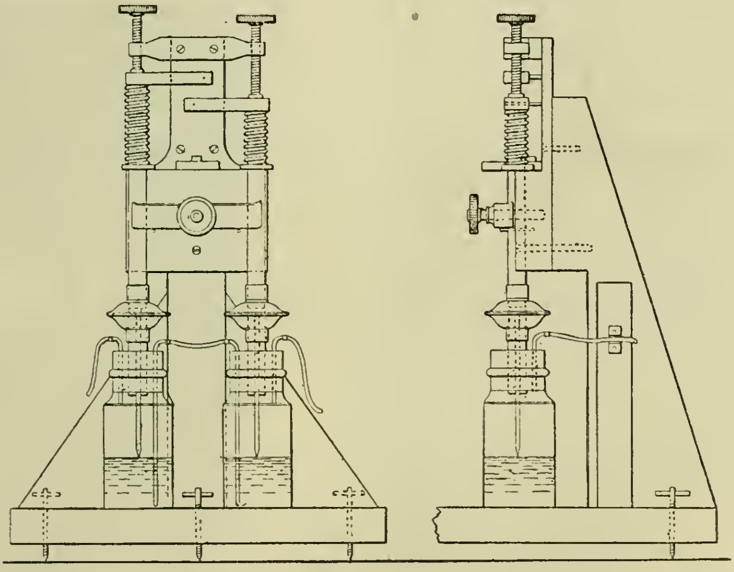


FIG. 5.

The drawback to the use of the Pitot tube for accurate measurements in such cases as occur in producer gas mains, is that the pressure differences to be observed are generally of the order of from one half a mm. of water to 3 or 4 mm. The author claims to have been fortunate enough to have been able to make some advance in apparatus for this kind of measurement. Many years ago, Sir J. W. Swan devised an elegant manometer for the estimation of small pressure differences, but at the same time a form of apparatus liable to considerable capillary and refraction errors, which render it unsuitable for observation of a total pressure difference of the order of 1 mm. The author's home-made apparatus is shown in Fig. 5, and the Cambridge Scientific Instrument Co.'s version of the same affair in Fig. 6, which the author finds more convenient.

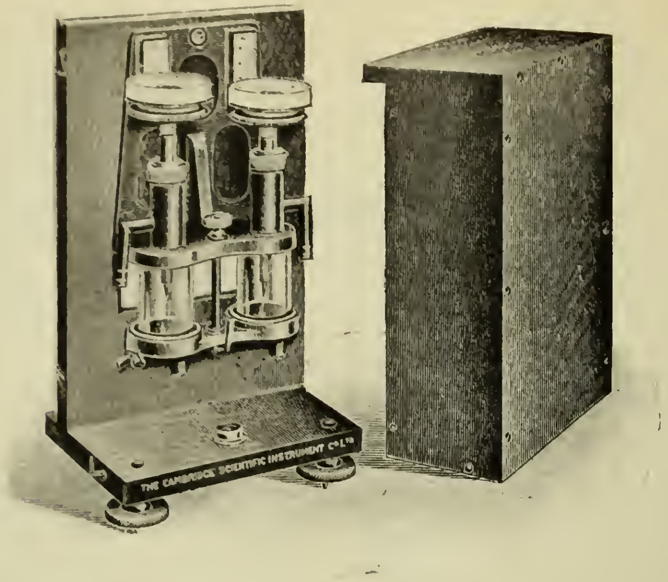


Fig. 6.

These instruments are termed micro-manometers, and are the standards to which the working instruments are referred. The latter are illustrated in Fig. 7—representing the original home-made instrument. Messrs. Chamberlain and Hookham make an improved instrument on the same lines, but it has not been thought necessary to illustrate it.

The instruments as figured in Fig. 7 are those actually employed in practice—the author has in constant use over a dozen of them, with ranges varying from 0 mm. to 0·1 mm., to 0 mm. to 1 cm. water pressure. It will be noted that the scale is not equally divided—the divisions are arranged so that one can read numbers proportional

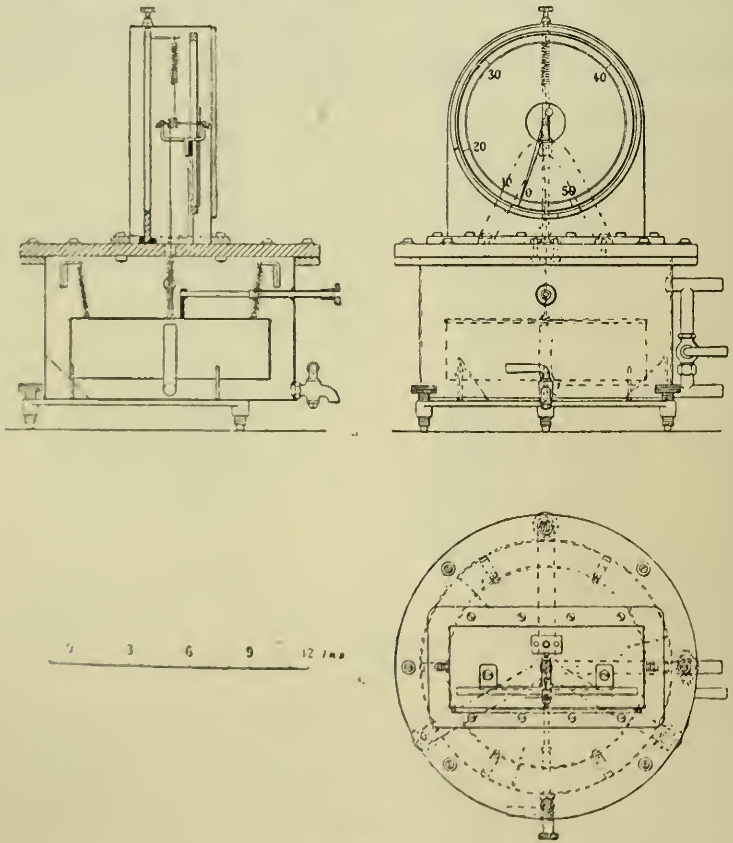


Fig. 7.

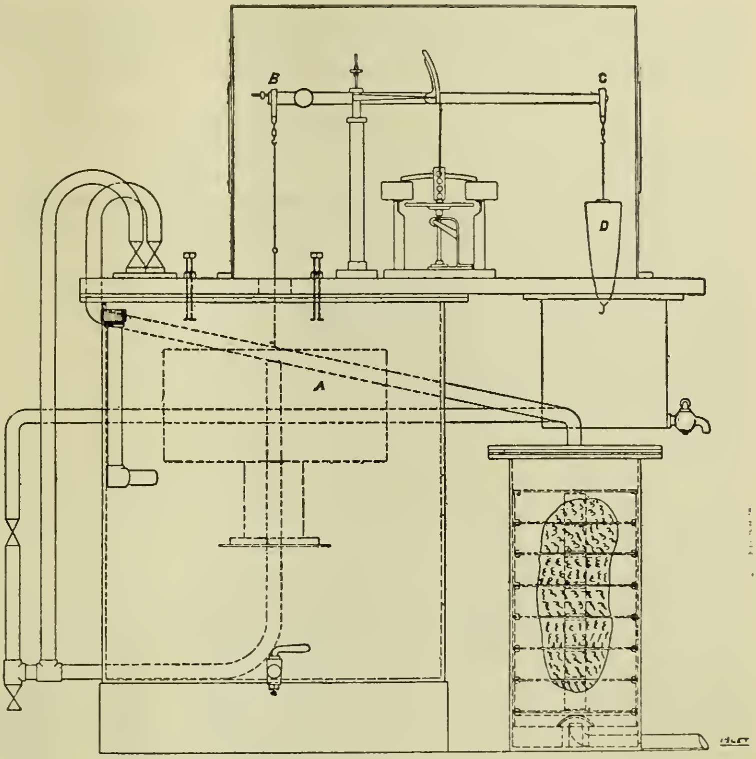


Fig. 9.

to the velocity of the gas in the pipe on which the gauge is being used. These numbers are, of course, proportional to the square roots of the displacements of the bell, which are themselves proportional to the pressure differences acting. These instruments are called stream gauges, and have proved of great service in measuring the rate of delivery of gas to various processes, as will be seen below.

A recording stream gauge, Fig. 8, has also been made which worked very well with only 1 or 2 mm. water pressure. The principle of having the paper record ruled in a manner similar to the division of the dial was adopted; the intervals between the lines on the paper are not equal, but are arranged at such distances apart that the velocity (or delivery) can be read direct. An important part of this instrument was a device for accurately ruling the paper.

The problem of making a satisfactory gas meter operated by forces of 1 or 2 mm. of water pressure only is obviously one of some difficulty. The principle finally adopted is that of causing the counting train to move across a disc kept in rotation by means of a clock—the motion being made proportional to the square root of the pressure difference. The pressure difference operates a bell, which tilts a balance arm, and the tilting is opposed by a counterpoise dipping into a liquid, so that the angular motion of the beam is proportional to the gas velocity. The integrating roller operating the counting train is carried by rafts floating on oil, and thus allowing a practically frictionless motion—the necessary pressure of the roller on the disc being capable of easy and minute adjustment. It has been found that there is no inconvenience in winding a clock once a week, and the self-winding clocks originally adopted have been discarded.

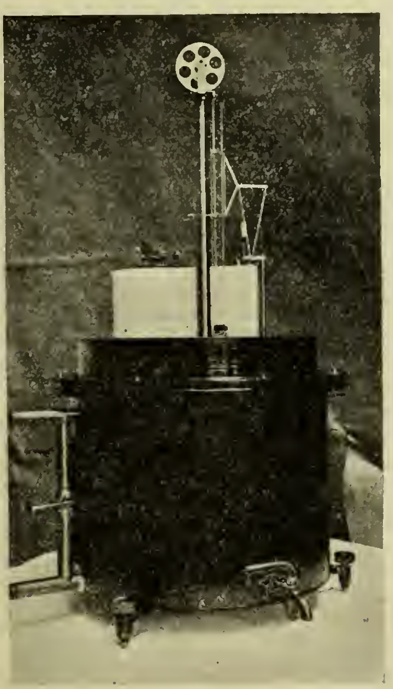
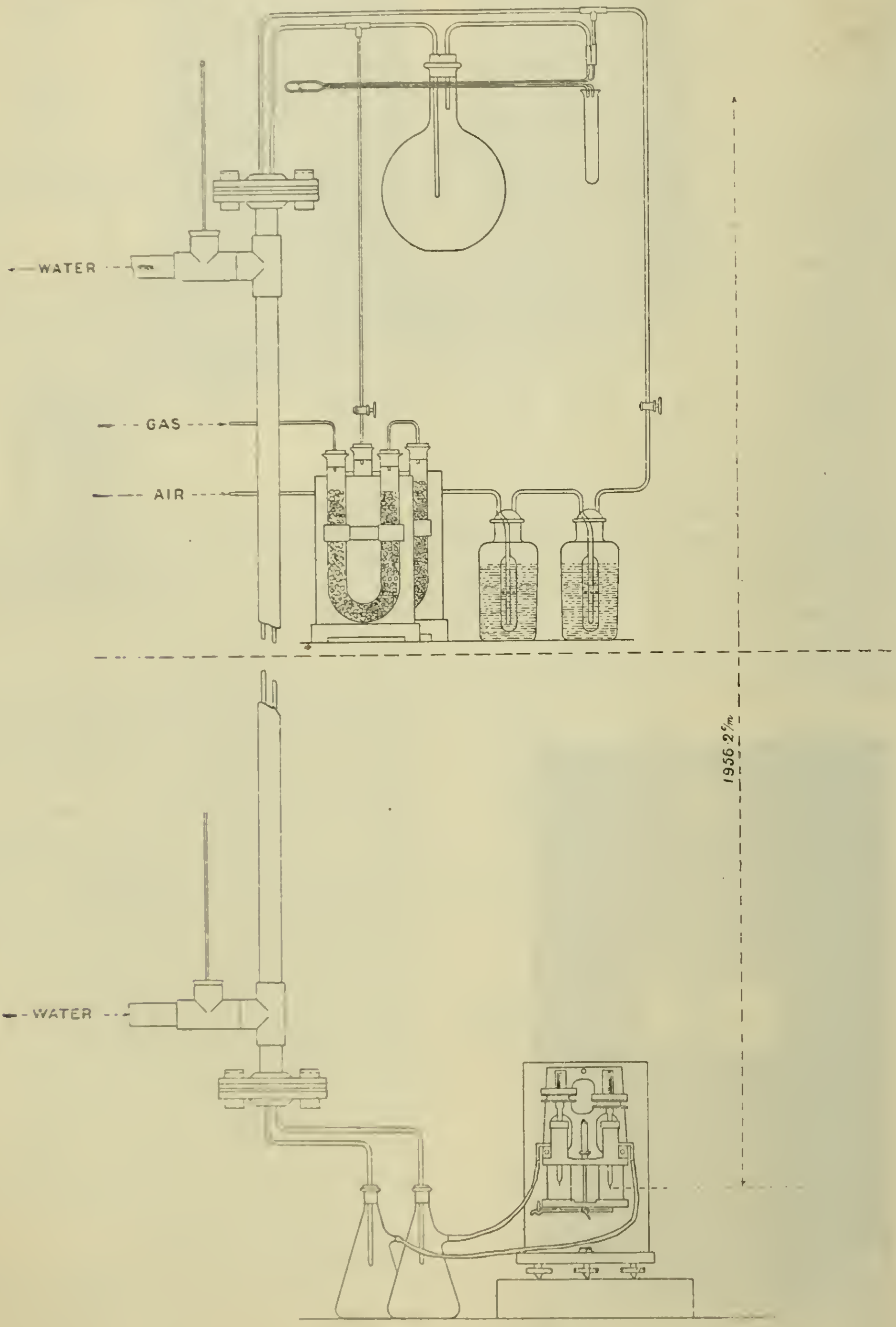


Fig. 8.

Recording stream gauge.

The arrangement of the meter will be sufficiently indicated by Fig. 9. This meter has worked now with perfect satisfaction for several years, as will be shown below. The first meter constructed by the author and used in practice for over a year was on a different principle. The pressure difference was applied to a bell which hung from the arm of an electric-dynamic balance, similar to Lord Kelvin's ampère balances. The current passing in the balance was automatically adjusted by the instrument, so as to keep the force due to the Pitot tube pressure difference always exactly compensated by the electro-dynamic force. The current itself was of course provided from the lighting circuit and passed through an ampère hour meter. As the electro-dynamic force is proportional to the square of the current, and the operating pressure difference from the gauge tubes is proportional to the square of the gas velocity, it is clear that the record of the ampère hour meter is proportional to the gas delivered, and the ampère hour meter can be graduated in cubic feet of gas. The balance worked well over long periods, but it took some attention, and has therefore been entirely superseded by the form illustrated, which takes no more attention than any other gas meter—except the weekly clock winding.

The only factor remaining in Equation (3) for consideration is the density of the gas. This may of course be determined from analysis or by weighing, but the author has found that a very convenient method is to determine the difference between the density of the gas and the density of air by a static method. The accuracy of the micro-manometer renders this a possible and simple operation. Fig. 10 illustrates the arrangements actually employed, and Fig. 11 the principle involved—which is merely that a column of producer gas of sufficient height produces a pressure measurably different from that produced by a column of air of the same height. Using columns of gas and air (contained in composition pipes) in an iron pipe through which water passed—and about 20 m. long—it was shown (Roy. Soc. Proc. A., 77, 542) that the sensitiveness of the method is sufficient to show the difference between "atmospheric" and "chemical" nitrogen—whose densities differ by about 1 part in 2100. The static method has, however, a sensitiveness of about 1 part in



APPARATUS FOR DETERMINING
THE RELATIVE DENSITY OF GASES

Fig. 10.

5000, and is for a chemical works an easier experiment than determining density of gases to anything like this accuracy by weighing.

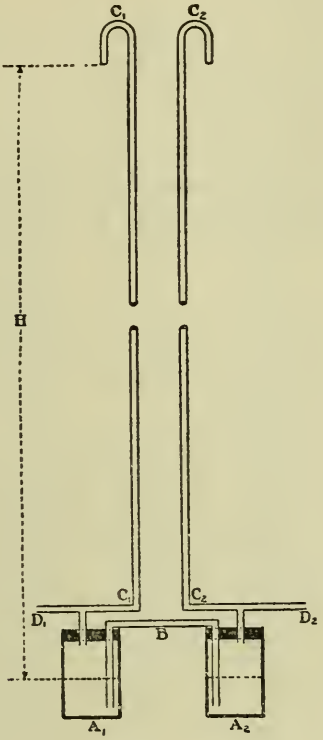


FIG. 11.

Diagram illustrating static determination of relative gas densities.

It may be added that in an experience of experimental work now extending over more than thirty years, the determination of relative densities by the above method was actually the first case the author ever had of an experiment succeeding perfectly at the first attempt. In filling the column with a gas lighter than air, the best way is to displace the air downwards, for then much less gas is required to wash out the pipe. The calculation is very easy.

Let H be the vertical distance between the free ends of the columns and the undisturbed manometric surface, h the difference of level of the liquid in the two branches of the manometer, δ the density of the liquid, ρ_1 and ρ_2 the densities of the gases in the two columns respectively — neglecting very small corrections—H being many times h,

$$\rho_2 = \rho_1 - \delta\frac{h}{H}.$$

In an experiment on producer gas of the Mond variety, twenty settings of the micro-manometer were made showing an error of a single setting as 0·0034 mm.

Data were h = 0·3458 cm. δ = 0·9987 grm/cc. H = 1956·8 cm. Barometer, reduced to 0° C., = 748·6 mm. Temperature uniform throughout at 18° C.

$$\rho_2 = 0·001195 - 0·9987\frac{0·3458}{1956·8} = 0·0010185.$$

or, reduced to 0° and 760°, 0·001102 grm. per c.c.

Ordinary commercial analysis led to a value for ρ_2 of 0·001089 at 0° and 760° mm. It is interesting to note that careful analysis several times repeated will give a result so near to the true value. It is easy to arrange a recording apparatus showing the difference of the density of any particular gas and air on the above principle, and with the great advantage that the force available for producing a record may be made almost as great as one pleases; and this without affecting the time required for a record. The manometers are replaced for the purpose of recording by a couple of spring bells or equivalent float manometers, and the recording lever is operated directly from them. The passage of gas down (or up) the gas column being mechanically interrupted during the period of recording: a simple arrangement of tilt bucket supplied by a minute stream of water will occur to anyone who considers the matter. It was suggested to the author by Mr. H. Darwin. It must be an advantage in some cases to be able to obtain a continuous record of gas density.

The author's attention has been kindly directed (since the paper was read) to Proc. Civil Eng., Vol. 116, 1892 to 1893, pp. 47 and 75, from which it appears that some use has already been made of the static pressure produced by a column of gas in regard to the estimation of the percentage of hydrocarbon vapour in the air in oil tanks, and some experiments were made on this subject by Professor Dewar and Sir Boverton Redwood, of which the author was in ignorance when this paper was written.

Volume of gas delivered by a pipe.—It only remains to consider the best way of obtaining the velocity of the gas stream at a sufficient number of points in the cross section. Fig. 3 shows the arrangement adopted in the case of a large main, which very closely resembles Darcy's arrangement for gauging water pipes (Mémoires présentés à l'Académie des Sciences; Math. Phys., **15**, 1858). If the flow in the pipe be gauged at a considerable distance—say 10 or more diameters of the pipe from any bend or obstruction, it will be found that an investigation of the velocities across one diameter will suffice; but, of course, there is no difficulty in investigating the velocity across a perpendicular diameter as well—and the author generally

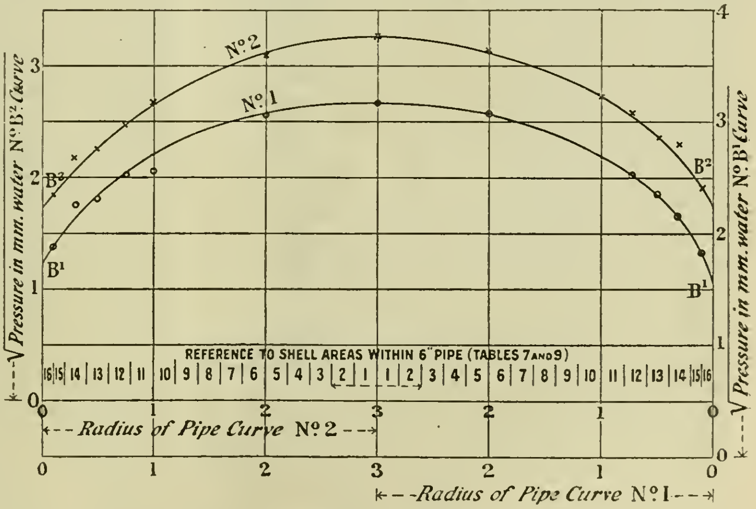


FIG. 12.

Distribution of Velocity Curves for 6-inch pipe attached to Gasometer. Jan. 1, 1906.

No. 1.—Mean Position 0·725*r*. from centre. Ratio of Mean to Maximum = 0·8148. Maximum Velocity = 2406·3 ft. per min.

No. 2.—Mean Position 0·721*r*. from centre. Ratio of Mean to Maximum =0·79. Maximum Velocity = 2472·6 ft. per min.

does this in important cases. The observations for velocity are most conveniently made by means of a stream gauge, and the resulting values plotted as ordinates on a line representing a diameter. In order to get the best result from a given number of observations, the latter should be concentrated at the larger radii; in fact, if we divide the circular cross section into annuli of radii —r_1, r_2, r_3, &c.—and take observations at these radii, we shall make the annuli equal by making the differences, $r_2 - r_1$, $r_3 - r_2$, &c., diminish as the means $\frac{r_1 + r_2}{2}$, $\frac{r_2 + r_3}{2}$, &c., increase.

Setting this consideration aside, however, it is found that in large gas mains the velocity does not vary much till we approach the walls of the pipe.

The delivery of the pipe is, of course, easily computed from these observations. The simplest method is to divide the cross section into about 10 annuli, and calculate the delivery for each by means of a smooth velocity curve, drawn through the points plotted. Full details of such calculations are given in the Journal of Proc. Inst. Mech. Eng., Feb. 1904, Appendix III., from which Fig. 12 and corresponding table is reproduced as an illustration, though it refers to a very small pipe.

The question as to where the facing gauge should be placed in the cross section is not of importance if the velocity distribution is investigated, but as the velocity varies least near the axis, it is generally best to put the facing gauge in the axis itself. Experience shows that the factor necessary to convert the maximum (central velocity) to the mean velocity across the section is not the same for all pipes, but appears to be quite constant for a given pipe over all the velocities measured, which cover those used in practice, even extreme cases. The value fluctuates from about 0·87 in small to 0·97 in large pipes. If a rough idea of the delivery only is required, then in an ordinary producer gas main of a diameter of a foot or more the value 0·9 may be employed.

The author prefers this to the method indicated by Darcy (for the case of flow of water) of placing the facing gauge on a circle of radius of 0·689 of the pipe radius—indeed, a radius of 0·775 of the pipe radius gave a better result. The fact is that the conditions in a producer gas main, within the author's experience, are not those of a simple inclined water pipe, and it is suggested that the enormously more important viscosity in the case of gas streams may be the reason for this.

The following tables may be of use in saving calculation. They are based on a value of K of 0·974, and, therefore, refer to a Pitot tube at the centre of a gas main and a flanged gauge just inside the main in the same cross section as the Pitot tube. If the flanged gauge be omitted, the wall of the main being employed as a flange, the side gauge tube ending truly in the inner surface, the corresponding figure will be about 0·985, and the values for velocity given in the table will need correction to this extent. The tables are calculated from the formula $V = 0{\cdot}9739\sqrt{\frac{2P}{\rho}}$

When V is linear velocity of gas in cms. per second, P is pressure intensity in dynes per sq. cm., ρ is density of gas in grms. per c.c. If the gas be air half saturated at 15° C., and at a pressure of 760 mm. mercury (standard), the Formula (4) reduces to

$$V_1 = 12{\cdot}53\sqrt{\text{Pitot tube pressure in mm. of water}},$$

where V_1 is velocity in feet per second.

If instead of air we employ Mond gas of density 0·00102 grms. per c.c. at 0° and 760°—then at 15° C., saturated, the constant is 14·42 instead of 12·53.

I have to thank Messrs. Chamberlain and Hookham, of Birmingham, for permission to republish these tables, originally compiled by me for their circular on power gas meters, and Mr. H. A. Humphrey for the use I have made of an excellent table of the proportions of any gas and water vapour in a saturated mixture at different temperatures.

Sundry tables.—To facilitate the use of the Pitot tube in air measurement; also a table giving some similar data for facilitating measurement of Mond producer gas.

TABLE I.—*Showing water pressure and air velocity, the air being taken at 760 mm., 16° C. half saturated.*

Pressure in mm. water.	Air velocity in feet per second.	Pressure in mm. water.	Air velocity in feet per second.	Pressure in mm. water.	Air velocity in feet per second.	Pressure in mm. water.	Air velocity in feet per second.
1	12·83	26	65·41	51	91·61	76	111·83
2	18·14	27	66·66	52	92·51	77	112·57
3	22·22	28	67·88	53	93·40	78	113·29
4	25·66	29	69·08	54	94·27	79	114·01
5	28·68	30	70·27	55	95·13	80	114·73
6	31·42	31	71·42	56	96·00	81	115·45
7	33·94	32	72·56	57	96·85	82	116·16
8	36·28	33	73·70	58	97·70	83	116·87
9	38·48	34	74·80	59	98·54	84	117·57
10	40·57	35	75·89	60	99·36	85	118·27
11	42·55	36	76·97	61	100·19	86	118·96
12	44·40	37	78·03	62	101·00	87	119·64
13	46·25	38	79·07	63	101·91	88	120·32
14	48·00	39	80·11	64	102·62	89	121·01
15	49·68	40	81·13	65	103·42	90	121·70
16	51·31	41	82·14	66	104·21	91	122·38
17	52·89	42	83·13	67	105·00	92	123·04
18	54·42	43	84·12	68	105·79	93	123·71
19	55·92	44	85·09	69	106·56	94	124·37
20	57·37	45	86·05	70	107·32	95	125·03
21	58·80	46	87·00	71	108·10	96	125·68
22	60·17	47	87·94	72	108·84	97	126·34
23	61·52	48	88·88	73	109·60	98	127·00
24	62·84	49	89·80	74	110·35	99	127·64
25	64·14	50	90·70	75	111·00	100	128·28

TABLE II.—*Showing water pressure in tenths of a mm., and air velocity in feet per second, the air being taken at 760 mm., 16° C. half saturated.*

	0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
1	12·83	13·45	16·05	14·63	15·18	15·71	16·22	16·72	17·21	17·68
2	18·14	18·59	19·02	19·45	19·87	20·28	20·68	21·08	21·46	21·84
3	22·22	22·58	22·94	23·30	23·65	24·00	24·34	24·67	25·00	25·33
4	25·66	25·97	26·29	26·60	26·91	27·21	27·51	27·81	28·10	28·40
5	28·68	28·97	29·25	29·54	29·81	30·08	30·35	30·63	30·90	31·16
6	31·42	31·68	31·94	32·20	32·45	32·70	32·96	33·20	33·45	33·70
7	33·94	34·18	34·42	34·66	34·89	35·13	35·37	35·60	35·83	36·05
8	36·28	36·51	36·73	36·96	37·18	37·40	37·62	37·83	38·05	38·27
9	38·48	38·70	38·91	39·12	39·33	39·54	39·75	39·95	40·16	40·36
10	40·57									

TABLE III.—*Showing velocity for 1 mm. water pressure and other data for Mond producer gas saturated at t° C. 760 mm. The density for dry Mond gas is taken at* 0·001020 *grms. per c.c.* (*H. A. Humphrey*).

Temp. t° C.	Density in grms. per c.c.	Velocity in feet per second for a pressure of 1 mm. of water.	Relative volumes of dry gas and water vapour in a saturated mixture at t°C. and 760 mm.		Temp. t° C.	Density in grms. per c.c.	Velocity in feet per second for a pressure of 1 mm. of water.	Relative volumes of dry gas and water vapour in a saturated mixture at t° C. and 760 mm.	
			Dry gas per cent.	Water vapour per cent.				Dry gas per cent.	Water vapour per cent.
0	0·0010187	14·02	99·4	0·60	41	0·0008727	15·15	92·39	7·61
1	0·0010144	14·05	99·36	0·64	42	0·0008690	15·18	91·97	8·03
2	0·001011	14·08	99·31	0·69	43	0·0008656	15·21	91·54	8·46
3	0·001007	14·10	99·26	0·74	44	0·0008615	15·25	91·08	8·92
4	0·001003	14·13	99·20	0·80	45	0·0008578	15·28	90·61	9·39
5	0·0009994	14·16	99·14	0·86	46	0·0008543	15·31	90·11	9·89
6	0·0009963	14·18	99·08	0·92	47	0·0008511	15·34	89·60	10·40
7	0·0009922	14·21	99·02	0·98	48	0·0008471	15·38	89·05	10·95
8	0·0009885	14·23	98·95	1·05	49	0·0008435	15·41	88·49	11·51
9	0·0009854	14·26	98·88	1·12	50	0·0008396	15·44	87·90	12·10
10	0·0009816	14·28	98·80	1·20	51	0·0008359	15·48	87·28	12·72
11	0·0009778	14·31	98·71	1·29	52	0·0008325	15·52	86·64	13·36
12	0·0009742	14·34	98·63	1·37	53	0·0008287	15·55	85·97	14·03
13	0·0009703	14·37	98·53	1·47	54	0·0008248	15·58	85·27	14·73
14	0·0009667	14·39	98·44	1·56	55	0·0008209	15·62	84·54	15·46
15	0·0009633	14·42	98·33	1·67	56	0·0008170	15·66	83·78	16·22
16	0·0009600	14·44	98·22	1·78	57	0·0008131	15·70	82·99	17·01
17	0·0009564	14·47	98·11	1·89	58	0·0008095	15·73	82·16	17·84
18	0·0009524	14·50	97·98	2·02	59	0·0008056	15·77	81·30	18·70
19	0·0009490	14·53	97·85	2·15	60	0·0008012	15·81	80·41	19·59
20	0·0009459	14·55	97·72	2·28	61	0·0007972	15·85	79·48	20·52
21	0·0009421	14·58	97·57	2·43	62	0·0007939	15·88	78·51	21·49
22	0·0009384	14·61	97·42	2·58	63	0·0007889	15·93	77·51	22·49
23	0·0009354	14·63	97·26	2·74	64	0·0007848	15·97	76·47	23·53
24	0·0009320	14·66	97·09	2·91	65	0·0007804	16·02	75·38	24·62
25	0·0009283	14·69	96·91	3·09	66	0·0007762	16·07	74·25	25·75
26	0·0009248	14·72	96·72	3·28	67	0·0007718	16·11	73·08	26·92
27	0·0009214	14·74	96·52	3·48	68	0·0007680	16·15	71·87	28·13
28	0·0009178	14·77	96·31	3·69	69	0·0007634	16·20	70·61	29·39
29	0·0009139	14·80	96·09	3·91	70	0·0007588	16·25	69·30	30·70
30	0·0009110	14·83	95·85	4·15	71	0·0007543	16·30	67·95	32·05
31	0·0009072	14·86	95·61	4·39	72	0·0007496	16·34	66·54	33·46
32	0·0009034	14·89	95·35	4·65	73	0·0007450	16·39	65·08	34·92
33	0·0009002	14·92	95·08	4·92	74	0·0007405	16·44	63·57	36·43
34	0·0008969	14·94	94·80	5·20	75	0·0007356	16·50	62·00	38·00
35	0·0008937	14·97	94·50	5·50	76	0·0007308	16·55	60·38	39·62
36	0·0008896	15·00	94·19	5·81	77	0·0007260	16·61	58·70	41·30
37	0·0008867	15·03	93·86	6·14	78	0·007210	16·67	56·97	43·03
38	0·0008830	15·06	93·52	6·48	79	0·007157	16·73	55·17	44·83
39	0·0008798	15·09	93·16	6·84	80	0·007108	16·79	53·31	46·69
40	0·0008755	15·12	92·78	7·22	—	—	—	—	—

Temperature and pressure corrections.—A very important feature of Pitot tube metering is that the corrections of the readings to gas dry at 0° C. and 760° C. are only half what they are for ordinary gas meters—as may be at once deduced from the formulæ. It is well to make this clear by an example. If an ordinary meter is adjusted to measure dry gas at 16° C. and the temperature rises to 17° C. it is clear that the meter will register say 290 cb. ft. instead of 289, which it would have registered had the temperature been 16° C. The Pitot tube meter would in this case have registered only 289·5 cb. ft.

If the pressure changes, we have a rather similar result. If an ordinary meter is adjusted to measure gas at 29 in. of mercury, and the barometer rises to 30 in., then the consumer gets a greater weight of gas than he is entitled to, in the ratio of 30 : 29, or nearly 3 per cent. too much. With a Pitot tube meter the error is in the opposite direction and of half the amount, *i.e.*, the consumer would get 1½ per cent. too little gas. In fact with an ordinary volume gas meter a rise of temperature or fall of pressure operate against the consumer; with a Pitot tube meter a rise of temperature or a rise of pressure operate against the consumer—but the error is only half the error of the ordinary volume meter. This of course applies to a meter operating on gas at about atmospheric temperatures where the percentage of water vapour is small. At higher temperatures the relation of the correction is theoretically more complicated, because the density of steam is in general not the same as that of producer gas: but at such temperatures meters filled with water would not operate on other grounds. In metering producer gas, however, we habitually deal with gas of all temperatures up to 70° C., and it is often a great advantage to have the effect of variations of such temperatures halved automatically.

The result of gas measuring as applied to producer work is exhibited in the curves given on next page, Fig. 13. These curves refer to a bank of Mond producers, burning about 400 tons per week. The total make of gas is measured by a meter of the kind described, the gauge tubes being inserted in the main leaving the gas cooling tower where the temperature is nearly 70° C. The main divides beyond this point into two branches, the gas being cooled to very nearly air temperature in one branch before it is measured; and in the other branch the measurement is made on gas at about 65° C. The two streams are measured by means of stream gauges, whose readings are entered hourly and averaged and reduced to cubic feet of gas at the end of every week. One of the streams is subdivided further on for boiler firing, furnace heating, and so on, and the consumption at each point is regulated by the indications of stream gauges, of which about ten are employed.

The curves exhibit the degree of exactness attained in balancing the delivery in the two main streams against the metered make. The dots represent the make as deduced from the addition of the stream gauge readings; the full lines give the metered make. It will be seen that the agreement is and has been for some years very close, notwithstanding that one of the branches has such a variable delivery that its stream gauge often exhibits a very small reading—too small for high accuracy. The readings are not taken by skilled men, but by ordinary labourers—stokers, &c.—and it is found that they have an ingrained habit of entering a small reading as "0" on the ground presumably that a small flow is not worth troubling about.

The author desires to draw attention to the severity of the test implied in these balances. The temperatures of the streams are widely different, but all the gas is reduced to 0° C. dry; also three pipe calibrations are involved. The error is of the order of 2 per cent., which is considerably

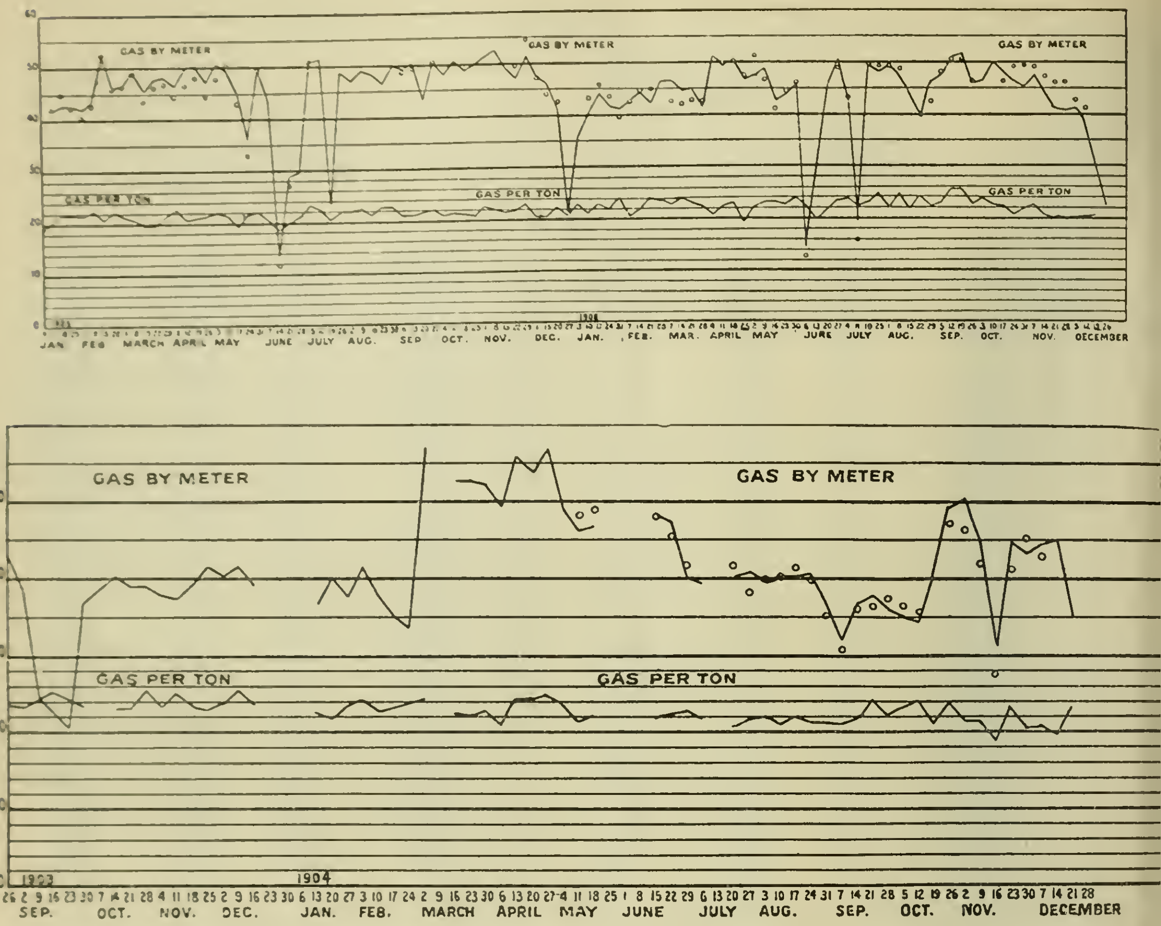


FIG. 13

less than if ordinary volume meters had been employed, for it must be remembered that all the temperatures vary more or less, and the variations produce different percentage errors at each temperature, though only of about half the value which would accompany equally incorrect volume metering.

MEASUREMENT OF GAS PRODUCTION BY ESTIMATION OF AMMONIA.

The author was informed some years ago by the chemist of a works using a Mond plant that satisfactory information as to the volume of gas produced per ton of coal could be obtained from a comparison of the daily make of sulphate of ammonia with the quantity of ammonia in a cubic foot of gas as estimated by analysis. This, like other balancing methods, has the disadvantage that it must be applied over periods long enough for the actual make of sulphate of ammonia to be large compared with the stock in the plant. This objection is not so serious as might appear at first sight, for the period over which the gasification is tested must in any case be long enough to enable the quantity of coal burned to largely exceed the producer stock.

As was expected, some difficulty arose in the application of the method in regard to drawing proper samples of gas. The gas must of course be sampled before it enters the sulphuric acid tower, and it is a question whether it is best to sample it before or after the washer. If samples are taken before the washer there is some danger (in a compact plant, at all events) that the streams of gas from each producer may not be thoroughly mixed together, and it is a matter of common experience that it is difficult to draw samples with certainty by such devices as pipes perforated perpendicular to their length and thrust across a gas stream.

If the samples are taken behind the washer the gas may probably be regarded as thoroughly mixed, but a question arises as to whether ammonia is being absorbed or boiled off into the gas at the time the trial is in progress—though, of course, the steady stream of liquor from the washer (if it is steady) can be sampled and its ammonia allowed for. The gas after leaving the washer is also full of spray, and it is clear that a good deal of the ammonia may be dissolved in the fine drops of water, and therefore care must be taken that neither more nor less spray than the average is collected. It was found that by sloping a sampling tube in different directions in relation to the stream lines of the gas, samples were collected which contained per cubic foot of dry gas very varying quantities of water. The difficulty was got over to some extent by drawing large samples, as shown in the sketch: and the results are given in the tables below. The result of the trials was to impress upon everyone concerned the great advantage from the point of view of accuracy and simplicity of metering the gas direct.

Determination of gas make by a balance of the ammonia.—1, 2, 3, are washing bottles containing dilute sulphuric acid in fair excess; 4 is a water-cooled cooling worm; 5, a gas pump; 6, a small gas holder to regulate the flow of gas into the gas meter, 7. The weak point in the working of the apparatus lay in the valves of the gas pump. These were of leather and gave way repeatedly, requiring renewal about once a week. The ammonia absorption proved efficient. Tests were made from time to time on the water condensed in the cooling worm, and this was found to be free from ammonia. The duration of each test was 24 hours. Results were :—

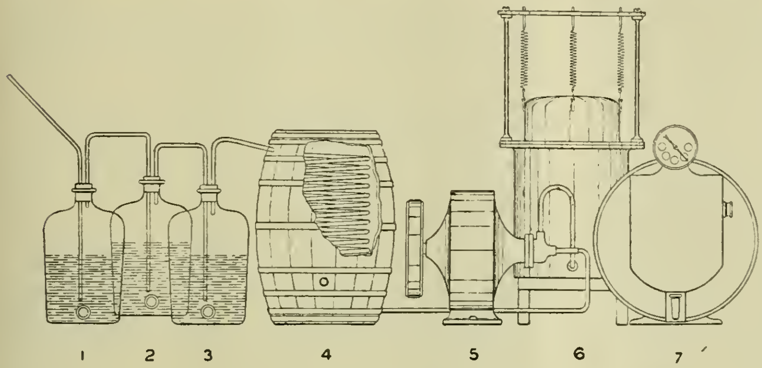


Fig. 14.

Water content of gas into acid tower.

Period.	Water condensed.	Calculated water content which should have been condensed.	Am_2SO_4 grms. per cb. ft. gas.
	litres		
1.	20·85	21·16	0·2031
2.	18·20	18·70	0·2156
3.	16·37	16·89	0·2079
4.	8·11	8·43	0·1934
5.	24·56	25·20	0·2092
6.	21·75	22·59	0·1934
7.	20·49	21·11	0·2462
8.	24·37	25·33	0·2085
9.	22·77	23·55	0·2039
10.	15·15	15·72	0·1755
11.	8·00	8·23	0·2347
12.	25·83	26·90	0·1788

Make of gas per ton of coal as deduced from the ammonia content of the gas and the total production of sulphate of ammonia; each period is about one week, and the metered make per ton of coal is 100 *volumes in each case.*

Period.	Make per ton as percentage of correct make.
1	104·5
2	113·2
3	105·0
4	76·6
5	109·1
6	105·6
7	81·5

Reasons can be given accounting for the failure of the ammonia balance in 4 and 7.

Measurement of Gas Production by Free Nitrogen Balance.

If this could be done it would be an advantageous way of providing a check on the gas meter, or in the alternative of measuring the gasification. Theoretically nothing is easier than to measure the air blast at any point before it enters the producer, and thus to state the volume of nitrogen, argon, &c., entering the plant per unit of time. Analysis of the gas would yield similar information in regard to it. Nitrogen from the fuel could be allowed for sufficiently for the purpose. In practice it is found that the gas stream near the blowers is not steady enough for the Pitot tube to be used satisfactorily in the manner applicable to non-pulsating streams, and it is too expensive to insert an elastic reservoir or ordinary gas meter and regulator for the sole purpose of the measurement. The gas stream is less pulsating after the air-heating tower, but in the plant at the author's disposal the pipe length from there to the producers is insufficient to give a good pipe calibration, and this defect is aggravated in the part of the pipe between the producers and the point where live steam is added.

It will be shown later that the author has worked out a method of measuring pulsating streams by gauges in an apparently satisfactory manner, but at the time of writing the method has not been applied to metering the air—for which, in the author's case, there is no particular temptation. In order to be thoroughly up-to-date it may be suggested that possibly the coal employed in the producers is constantly more or less radio-active than the air or ashes. In this case it might be possible to get at the gasification by measuring the radio-activity of the producer gas, which from an experimental point of view should not be very difficult so far as relative values are concerned.

To conclude this part of the subject, a word may be added on the management of the meters and stream gauges.

The meter itself does not appear to require any attention at all except the weekly winding of the driving clock. This clock should be provided with an ordinary dial, so that no question can arise as to whether it is, or is not, keeping regular time. The gas is passed over a small purifier about 1 ft. in diameter and 2 ft. high, between the gauge pipe and the side of the meter containing bright brass work. The purifier contains some Weldon mud, which instantly deprives the gas of sulphuretted hydrogen, and the brass work keeps perfectly bright. Messrs. Chamberlain and Hookham have arranged a style of meter in which the working parts are not exposed to gas, so in this case no purification is necessary.

It is, of course, necessary that the gauge pipes should have a constant fall to a drain pipe sealed by water, for the slightest film of water across these pipes affects the minute pressure difference—about 2 mm. of water—which actuates the meter. If gauge pipes of 1 in. diameter are used, there does not appear to be any danger of the formation of water films.

The same remark applies, of course, equally to stream gauges. The practice is as follows :—At a certain hour every day a youth walks round the works and reads the stream gauges and meter, at the same time turning the stream gauge cocks so as to equalise the pressure on each side of the bell and allow the pointer to come to zero. If the zero is not correct it is corrected by the adjusting screw, though this seldom happens. A balance of the stream gauge readings as against the meter is made in a few minutes by means of tables by the person who reads the gauges, and it then becomes apparent whether gas is escaping or being used at any other points on the service besides those provided with gauges. In this way a perfect check on the gas consumption becomes part of the ordinary routine. The gas meter is provided with a divided arc showing the tilt of the beam, and is therefore not only a meter but a stream gauge as well, and this is of importance for such balancing as has been described.

Investigation of the Distribution of Carbon among the Products from a Mond Producer Plant Working with Ammonia Recovery and Deduction of Gas made by a Carbon Balance.

The trial lasted for a week, but for various reasons the figures selected referred to a period of sixty hours during which the gasification was sufficiently regular.

The trial was made before the integrating meter was devised, the flow of gas being measured by a Pitot tube and micro-manometer read at equal short intervals of time during the trial. A general sample of the coal used was made and analysed. The results were :—On the moist coal —carbon, 63·58 per cent. ; hydrogen, 4·18 ; water, 11·89 ; difference, ash, &c., 20·35 per cent. The coal was weighed into the hoppers and so into the producers, but the producer stock was ascertained by dipping, an effort being made to have the stock the same at the end of the trial as at the beginning.

Products.

Gas.—The Pitot tube measurements gave an average flow of 5150 cb. ft. of gas calculated as at 0° and 760 mm. pressure per minute. The average of fourteen analyses taken over the period gave for the carbon constituents (gas saturated at 15° C.) :—Carbon dioxide, 13·4 per cent. ; carbon monoxide, 14·41 per cent. ; methane, 1·84 per cent. From this it follows that the gas contained at 0 and 760 mm. 0·015915 grm. carbon per c.c., or 0·993 lb. per 100 cb. ft., or 0·15915 kilo. per cubic metre.

Ashes.—The ashes were weighed, sampled, and analysed as below :—Carbon, 10·03 ; water, 30·96 ; ash, 58·30.

Dust from regenerators and mains.—It had been found that with the kind of coal employed 1200 tons of coal gave 20 tons of dust, containing 60 per cent. of carbon.

The washer mud was also estimated from a figure obtained over a long period, and its composition was taken as being the same as the average composition.

Tar.—The tar was collected and sampled for analysis from each point where it was deposited : the sample was made up by taking from each point a quantity proportional to the production at that point, *e.g.*, one part from each water tower, two parts from the acid tower, one-twentieth part from the tar separator on the drains leading from the gas main. The wet tar mixed as above gave, on analysis, carbon, 69·04 per cent. ; hydrogen, 6·56 per cent. ; ash, 4·83 per cent. The production was estimated from the amount of tar collected over a long period.

The balance of carbon can be expressed as follows :—100 parts = carbon charged.

	Parts.
By carbon in gas deduced from measurement and analysis	89·50
„ ashes	4·42
„ dry dust	1·57
„ washer mud	3·03
„ tar	3·10
	101·62

Taking into consideration the difficulty of adjusting the producer stock, and sampling the coal by hand, the author's present opinion is that the close agreement—or almost correct balance-sheet—shown is, to some extent, fortuitous ; also, the composition of the gas is unusual. The by-products could not be accurately ascertained in such a short trial, owing to uncertainty in the stocks, but, nevertheless, the numbers given are probably fairly accurate, as their production from a given kind of coal under conditions of steady gasification is very regular.

It may be noted that the volume of gas produced at 0° and 760 per ton of coal of composition noted above, is 128,300 cb ft. The calorific power of the coal was also measured, and the corresponding figure for the gas calculated.

In this way it was found that the efficiency of the gasification—excluding coal necessary to raise steam at the producer, was 80·7 per cent.—on the coal gasified. A convenient figure to remember is that 100 cb. ft. of gas at 0° and 760 contain very nearly 1 lb. of carbon.

The results of attempts to balance the carbon in ordinary works practice—taking the figures from the process books—have hitherto been less satisfactory, the gas make per ton of coal deduced from these figures, and the routine gas analyses showing about 10 per cent. more gas than was actually made. The known sources of loss cannot reduce this difference to less than 8 or 9 per cent. Considering the complexity of a carbon balance, this is not surprising.

ON THE MEASUREMENT OF PRODUCER TEMPERATURES.

The necessity of an accurate knowledge of the temperatures at various points in a producer plant need not be insisted upon here. The temperature of the gas leaving the producer is found to be of particular importance in judging of the working of the plant, for it not only indicates when the charge is burning at the top, but gives information as to the burning of the gas itself at the top of the producer—an accident that occasionally happens with some types of producer. This temperature, up to 600° or 700° C., is, however, too high for convenient measurement except by some form of pyrometer. The factor of human endurance also has to be taken into consideration, and it is a question whether faithful records of temperature are likely to be kept by men exposed on the producer galleries to the rigours of a winter night. The author has, therefore, arranged for pyrometers to be placed at the points where the temperatures are required, and for these to be read in the comparative peace and comfort of the pump and blower house. This is attained by the use of platinum platinum-rhodium thermo-couples, which are permanently wired to a switch board, and whose indications are observed by balancing on a potentiometer wire. This method has one great advantage—the potential difference indicated is independent of the resistance of the connections—the current being zero. In a producer plant it is difficult to make certain that the resistance of the contacts remains constant over long periods and without attention. If a deflection method of reading the temperatures be adopted, then the constancy of the resistances has to be assumed. It may be objected that in the potentiometer method a similar assumption has to be made as to the constancy of the potentiometer battery, or that the latter has to be checked by frequent comparison with a standard cell. This, however, is not the case, for the author, in conjunction with Prof. Pollock, showed in 1889 that the Clark cell is a perfectly reliable source of small constant currents (Phil. Mag., Nov., 1889 ; Ser. 5, V. 28, 353). The permissible currents are simply proportional to the area of the electrode surfaces. Consequently, the potentiometer is supplied with current from a large cadmium cell (which is found to have the same property as the Clark cell). Fig. 15. The current is only put on by means of a spring key, which is held down by the observer with one hand, while he moves the slider of the potentiometer with the other, till no motion of the light spot (the circuits being inductionless) occurs on making or breaking the battery circuit. The potentiometer wire is divided directly in degrees Centigrade, so that the tem-

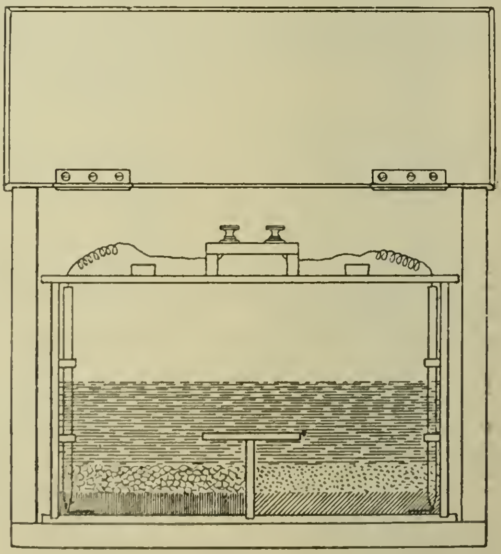


FIG. 15.

peratures are directly read off to 1° C., and entered on a slate. The operation is so rapid that all the temperatures can be read and entered in less than one minute each. The relation between the temperature difference and the E.M.F. of the thermo-couples was of course studied exhaustively to begin with, and a standard thermo-couple constructed, by which others are easily controlled.

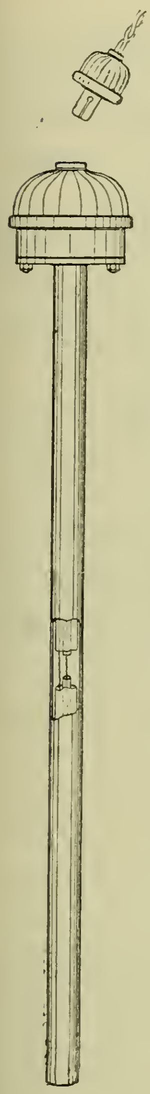


FIG. 16.

Figs. 15 and 16 show the construction of the standard cell, and of the home-made thermo-couples employed. The standard cell is contained in a celluloid box, no glass being used. After six months' or a year's use, it is found that the electrolyte dries up to some extent, which increases the resistance of the cell. The cell is in series with a resistance large enough to swamp all but extreme changes of cell resistance, and to make sure these are not taking place, the cell is changed every few months. The cell in reserve has some water added when it is first taken out, and it is then allowed to rise considerably in temperature by being kept in a warm place for a while. In this way the crust of crystals dissolves, and the cell is then allowed to cool off, and is then ready when next wanted.

The potentiometer wire is of "Eureka" alloy, and it is found that, thanks to the constant use to which it is subjected, it keeps perfectly bright and clean, and it is not necessary to make the contact below the surface of oil. The life of a thermo-couple is longer than the period over which our experience extends. The men occasionally manage to break the heads of the thermo-couples by striking them with poking rods and so forth.

On the whole, the accidents and wear are trifling, and no part of the author's system of measurement has behaved better or given less trouble than the temperature measurements.

It may be added that the temperatures are exclusively read and entered by the men in charge of the pumps and blowers, no skilled assistance whatever being required. A necessary precaution is to begin by having a considerable stock (some ounces) of thermo-couple wire, so that all the thermo - couples give practically identical readings, and couples repaired or remade have the same properties as the others. Thermo-couples are placed at the points where the gas leaves the producers and regenerators, where the air enters the producers, and where the gas enters the washer. From 15 to 20 couples are constantly read.

CONTINUOUS GAS CALORIMETRY.

The author's attention was first drawn to the necessity of having some form of recording calorimeter in 1889. In that year he was engaged in making tests with a 150 h.p. gas engine, and noticed that whenever the engine performed badly, those responsible for it invariably claimed that the gas was bad—a contention not always easy to meet. In 1902 the author succeeded in making a recording calorimeter by the obvious device of keeping the ratio of gas stream to water stream constant, and measuring the temperature difference at the water entry and exit by one of Prof. Calendar's recorders. This instrument was used with good effect during engine trials in 1902 and from time to time when other tests were in progress, being freely shown to anybody interested, and gradually came to occupy a position as an important adjunct to the gas plant—in the author's case displacing two gas testers and giving better and more direct information as to the progress of gasification. An attempt was made by the Cambridge Scientific Instrument Co. to introduce the author's instrument in 1903, but the small response met with indicated that users of producer gas were not aware of the advantages of the calorimeter as opposed to gas testing. A few records of a representative kind are here shown as an illustration of the information which the instrument furnishes.

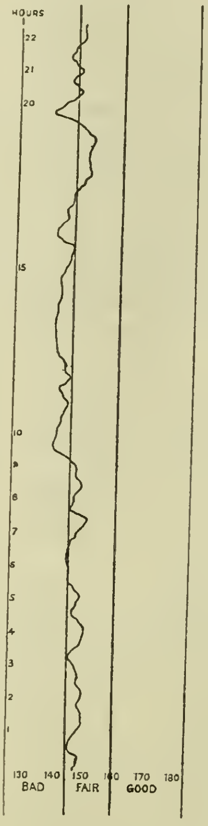


FIG. 17.

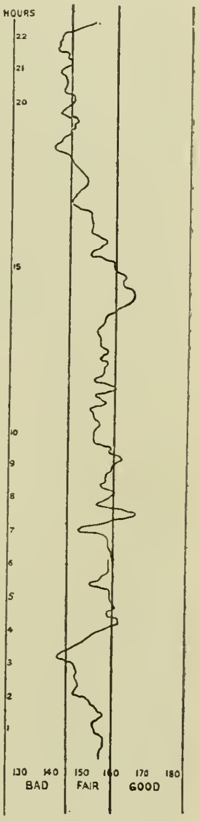


FIG. 17A.

It would be outside the scope of this paper to go into the complicated matter of continuous calorimeter design; but it may be stated that a good, durable, accurate recording calorimeter is not a simple thing to make. Up to the present the author has been satisfied with an instrument in which the volume of gas burned per unit weight of water is kept constant. In hot weather less weight and in cold weather a greater weight of gas is burned per pound of water.

This is sufficient as a guide to producer working, but for engine tests, of course, the necessary corrections have to be applied. It would be quite easy to adjust the apparatus to make its own corrections to 0° and 760, if there were any object in doing so, and the extra complication was not a drawback. The scale on which the calorimeter records, is the scale according to which the products of combustion are cooled to the temperature at which they enter the apparatus—the so-called "lower scale" appears to have been invented to favour the gas engine as against the gas producer. The testing of a calorimeter is a very complicated affair—involving the measuring of the gas and water into the apparatus, the ascertainment of gas, water, and air temperatures at entry, and of the burnt gases and the water at exit. The measurement of air used is performed by analysing the burnt gases, and the gas employed is continuously sampled during the test and afterwards very carefully analysed. The hygrometric state both of the gas and air have to be taken into account before a heat balance can be struck. The result of one such trial was as follows:—

	Per cent.
Heat accounted for by water	96·04
„ otherwise accounted for (exclusive of radiation and conduction loss) ..	0·32
„ unaccounted for	3·63
	100·00

From this it was inferred that the calorimeter record required to be multiplied by 1·041 to give the true thermal power of the gas on the "0° to 0°" scale. This correction is allowed for in ruling the paper of the recorder.

A little consideration will show that calorimeter trials must be carried out on the gas that it is proposed to burn in the instrument, or at all events on a closely similar mixture. This is a difficulty if the gas contains mixed hydrocarbons like coal gas, as the thermal value cannot be sufficiently nearly calculated. Even in the case of producer gas, great pains have to be taken in regard to the correct estimation of the methane. Assuming that the analysis is correctly performed, there are sufficiently large differences between the figures given by different observers of the heats of combustion of gases to prevent excessive confidence being placed upon any of them. The thermal values selected by the author are as follows, on the "0° to 0°" scale.

Gas.	Kilo. cal. per cb. meter.	B.T.U. per cb. ft.
Carbon monoxide	3,060	343·9
Methane	9,556	1074·0
Hydrogen	3,064	344·3

The item "heat otherwise accounted for" has reference mainly to heat carried out by the products of combustion and excess air, whose degree of humidity has changed. It is clear that the excess air leaves the apparatus saturated with moisture, as do the products of combustion. It is easy to be sure that the gas enters the apparatus saturated with water vapour—but the air does not, so that some steam necessarily escapes condensation; the amount depending mainly on the volume of excess air needed.

The calorimeter must also be tested with about the same heat supply as it will get in practice—otherwise the radiation and conduction losses expressed as a percentage of the total heat will not be the same in the test as in practice. It may be mentioned that attempts at testing with pure hydrogen were considered unsatisfactory for this reason, the heat being differently distributed in the calorimeter. The instrument is established in the pump house of the gas plant, where it is easily seen by the foreman in charge. The records are removed daily and placed in a drawer near the calorimeter, so that reference to past records is easy. Arrangements are provided by which the ratio of gas to water stream can be checked in a few minutes at any time, and ordinary sensitive thermometers are placed at the calorimeter inlet and outlet. By means of a table calculated once for all, the youth who removes the diagram on his daily round reduces the thermometer readings to thermal values in B. T. U. and compares the result with the record, in order to check the recorder. It has been found necessary to include a device for stopping the gas if by any chance the water supply is interrupted—an instrument having been destroyed through an accident of this kind. The air supply is, of course, fixed when once a correct ratio of air to gas has been found; the simplest and probably the most accurate way of doing this is to start with too little air and increase the supply till the unpleasant smell of imperfectly burned gas gives place to the sharp smell of sulphur dioxide. The gas is drawn from the main close to the gas cooling tower, and passes through a small scrubber on its way to the calorimeter; this makes the record lag for several minutes.

SULPHUR IN MOND GAS.

Experiments on the estimation of hydrogen sulphide and total sulphur, etc. References to sulphur estimation in coal gas:—

In *Journal Society Chemical Industry*:

1882. 383. Sulphur by combustion in tube.

1883. 128. Sulphur by combustion. Gas and air drawn over platinised asbestos and product collected in potassium carbonate solution.

1883. 370. Also bromine 16, p. 1390. Referee test modified by U-tube absorbers.

1885. 665. Cupric phosphate used for absorbing hydrogen sulphide.

1886. 283. Referee test described in detail.

1888. 61. Quantities of sulphur in gas mentioned.

1891. 726. Lead acetate and thallous hydroxide paper used to detect hydrogen sulphide.

1893. 63. Ammoniacal hydrogen peroxide or hydrochloric acid and bromine.

1893. 375. Hydrogen peroxide or silver nitrate used.

1896. 187. Deals with sulphur-dioxide and trioxide in products of combustion.

1896. 562. Combustion in air in tube.

1897. 761. Apparatus for the estimation of sulphur in coal gas by burning.

1901. 73. Copper sulphate and cadmium acetate used for absorbing hydrogen sulphide.

1902. 1040. Estimation of hydrogen sulphide by the stain of lead acetate paper.

1903. 859. Absorption of carbon bisulphide by aniline.

Journal of Gas Lighting. Vol. 24. 1884. March 16. 461.

Journal Chemical Society:

1900. (T.) 359. Estimation of carbon bisulphide by alcoholic potash.

1901. (AII.) 421. Estimation of hydrogen sulphide with solution of iodine in burette.

1902. (AII.) 582. Estimation of hydrogen sulphide with lead acetate paper.

1903. (AII.) 333. Estimation of carbon bisulphide by alcoholic ammonia.

53. (1) Estimation of hydrogen sulphide by N/10 iodine.

(2) Estimation of hydrogen sulphide by lead nitrate paper.

Reference to Thorpe's Dict. Chemistry gave referee test.

Estimation of total sulphur in gas, from main, after leaving purifiers.—Experiments made by the "works" laboratory had shown a difficulty in the estimation of the "total sulphur" in the gas. The hydrogen sulphide determinations, made by precipitating it as sulphide of copper or cadmium, gave a higher percentage of sulphur than the "total sulphur" test. The usual referee test had been used for "total sulphur." This was, therefore, examined and a method devised to check the results obtained by it. The referee test apparatus consists essentially of two parts: (1) a burner for the combustion of the gas in an atmosphere of air and ammonia; (2) a condenser for the products of combustion. A is a condenser tube, 3—4 ft. long; B, a tower filled with glass balls; C, a catch-pit for condensed liquids; D, a trumpet tube to draw off gases. E, perforated lead cylinder over burner, to carry trumpet tube. F, ammonium carbonate in wire gauze cylinder surrounding burner; G, steatite in burner.

The burner is of the ordinary Bunsen type and the draught created by the burning of the gas carries the products of combustion up to the condenser.

The apparatus is open to several objections:—

(1) When starting up cold, D acts as a condenser and some small amount of liquid is lost, for it frequently trickles down the trumpet tube and is lost at the junction of D with E.

(2) The combustion does not take place in a closed chamber, hence any irregularities in the draught may cause loss of uncondensed vapour.

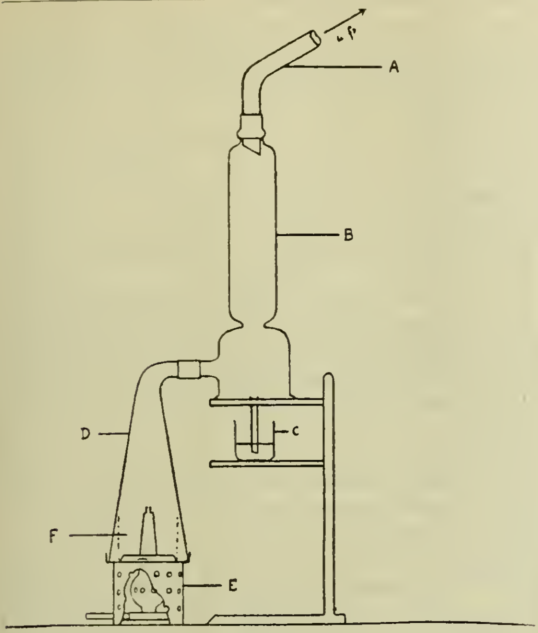


FIG. 18.

(3) The condenser cannot be said to have a very high efficiency, for it is at atmospheric temperature and offers no security that the gases shall be washed before escaping.

An apparatus to check the referee must therefore be free from the above objections and as a first attempt Valentine's test (this J., 1883, 128. as modified by Knoblauch), was taken and arranged as follows:—

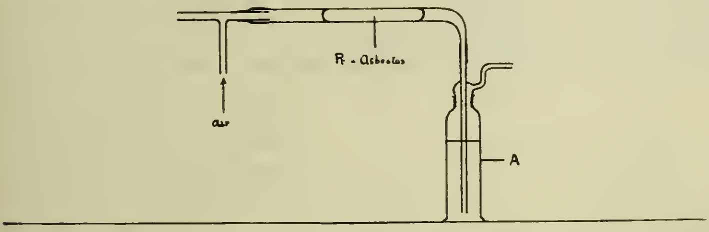


FIG. 19.

A is one of three similar washbottles containing 1 grm. of potassium carbonate and 300 c.c. of water—the last bottle being connected to a water pump.

The gas for testing was taken from a main immediately after leaving the purifier, an inch pipe terminating in a tap and T-piece bringing the gas inside the testing house. From one side of the T was taken the gas for referee test, from the other the gas for Valentine's test. Each stream of gas passed through a meter of similar dimensions, and arrangements were made to keep a constant pressure and also a good stream of gas through the sampling pipe in order to test an average sample.

The apparatus was as follows:—

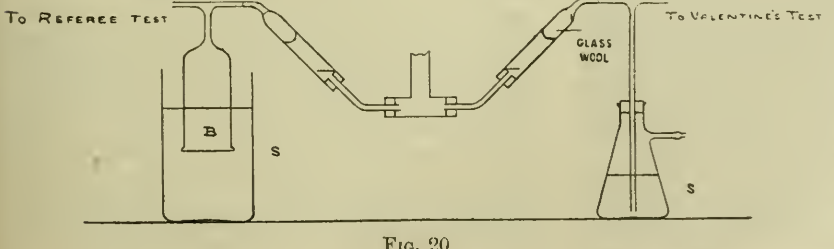


FIG. 20

The sheet rubber valves were necessary, as a "suck-back" on the main was of frequent occurrence and such a diminished pressure would have put the burner out in the referee test, and added to the chance of an explosion in the Valentine test. The bell, B, was added on the referee side, in order to keep a small reserve of gas for the burner in the event of diminished pressure causing stoppage of gas.

A pin-hole disc was afterwards found to be the most suitable means for cutting down the stream of gas to the required speed, the very narrow slit caused by a screw clip choking much more quickly. Parchment and metal discs both worked successfully, a needle of suitable diameter being kept to clear them when choked. The parchment disc was fixed in a ground conical joint and the metal disc soldered on the end of a piece of tubing. The meters were carefully compared and graduated by having a known volume of air passed through them from an aspirator. Those actually used were both 1 per cent. out. The seals, S,S, were adjusted to the seal on the meters, allowing a constant stream of gas to blow past them, while the seals on the meters remained intact. Mond gas was allowed to pass through the apparatus (as far as exit of meter) for three days to make sure that water in seals, meters, etc., was thoroughly saturated and at the conclusion of every experiment the gas was allowed to run slowly through till the next was ready.

Experiment 1.—(5 hours 10 minutes).

Referee test.—(*Room temp.*, 53° F.) 2·92 cb. ft. of gas passed the meter.

The apparatus was washed out, and the solution made up to 500 c.c.; 200 c.c. were taken, hydrochloric acid and bromine added, the solution boiled, filtered, and precipitated with barium chloride; ·1271 grms. of barium sulphate was obtained, equivalent to 0·230 gr. of sulphur per cb. ft.

Valentine test.—2·88 cb. ft. of gas. Passed in 5 hours 10 minutes. Washbottles 1 and 2 were washed out and made up to 500 c.c. 200 c.c., treated as above, gave = 0·0542 grm. of barium sulphate, = 0·10 gr. of sulphur of gas per cb. ft. A trace of sulphur was present in third washbottle.

The ratio of air to gas running through the Valentine test was kept at 6 air 1 gas. Platinised asbestos was used, heated by a triple Bunsen flame. The unsatisfactory result of this experiment is evident, the referee giving a higher result than the Valentine test. The defect in the Valentine test could not be lack of air for oxidation, for the ratio had been kept at 6 air 1 gas by regulating the streams through gas and air meters.

To make absolutely sure that it was not lack of oxygen for combustion which caused the low result, the air was replaced by oxygen and the experiment repeated.

Experiment 2.—Referee test showed 0·483 grm. sulphur per cb. ft. (2·26 cb. ft. of gas passed the meter in 4·5 hours).

Valentine test gave 0·4872 grm. of barium sulphate from 2·51 cb. ft. of gas (4·5 hours), or 0·414 gr. sulphur per cb. ft. The liquid was oxidised with permanganate before adding acid, &c., in order to avoid any possible loss of sulphur dioxide. The third washbottle was free from sulphur. The asbestos glowed intermittently, and a white fume, difficult to condense, was observed in the washbottles. The result being still unsatisfactory, the referee test giving a higher quantity of sulphur, the apparatus was modified by placing a platinum jet in the combustion tube at which the gas could burn before passing over the platinised asbestos.

Experiment 3.—A single Bunsen flame was used, and about 3 in. of asbestos placed in the combustion tube. 12 in. long by ⅝ in. diameter. The experiment was a failure as regards burning the gas before passing it over the asbestos, for a continuous flame could not be kept at the

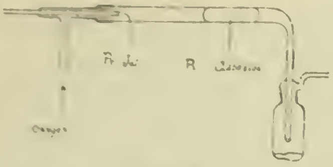


Fig. 21.

platinum jet, owing to the rush of oxygen round it. The oxygen stream was passed through a seal, which was adjusted to "blow off" when the pressure exceeded that of the gas seals.

All experiments are now assumed to burn the gas at the rate of 0·5 cb. ft. per hour, and to extend over the same length of time.

Referee test gave 0·341 gr. of sulphur per cb. ft., and the modified Valentine test, 0·10 gr. per cb. ft.

Experiment 4 (repetition of Experiment 3) gave 0·360 gr. and 0·228 gr. of sulphur per cb. ft. respectively.

Results of Experiments 3 and 4 still showed the referee test to give the higher result. The asbestos was taken out of the combustion tube and tested for sulphur: a little was found to be held by it, but not nearly sufficient to account for the discrepancies in the tests. However, to settle this point, another experiment was run, leaving out the asbestos from the combustion tube, and placing a piece of platinum gauze in the hot part of the tube to break up the stream of gas.

Experiment 5.—The referee test gave 0·430 gr. of sulphur per cb. ft., whilst the modified Valentine gave 0·240 gr. of sulphur per cb. ft. The result was again a failure as regards any check being placed on the referee. Another attempt was now made to devise a new apparatus which should be free from the objections raised against the referee and yet have the principle of combustion for its basis. The apparatus sketched was eventually tried.

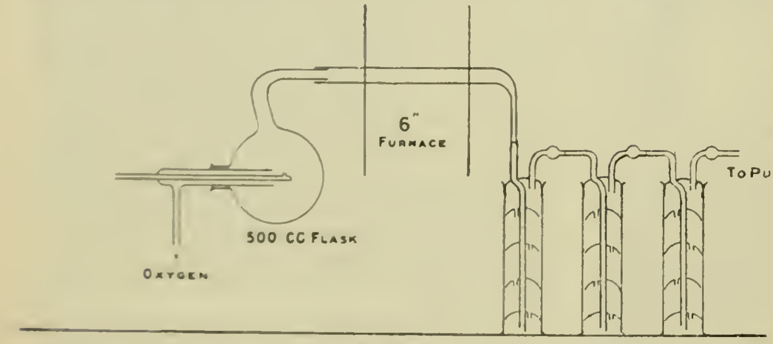


Fig. 22.

A 500 c.c. receiver flask had its neck drawn out and bent almost at right angles. A special burner was then made in glass to fit in the tubulure by means of a piece of rubber tubing. It consisted of two concentric tubes—the inner one prolonged at each end of the outer one, and having one end sealed up and a platinum jet sealed in at right angles. About 2 in. from the opposite end, the inner tube was sealed in to the outer concentric tube and a T sealed on to the outer tube close by. The gas came in by the inner tube, and being fed steadily with oxygen by the outer tube, burned with a perfectly steady flame about 2 mm. high at the platinum jet (1/[illegible] in. diameter).

The flask and burner were arranged so that the flame was not directly under the neck, but the hot gases first came in contact with the bulb of the flask, and so were better mixed with the excess of oxygen before passing through the Jena combustion tube (T) kept at a bright red heat. Contact with rubber was impossible, except at the tubulure, and at this point (which remained cool during experiment) the surface exposed was very small, and was not wetted till the flask and burner were washed out at the close of the experiment.

Experiment 6.—Using new apparatus, the referee test gave 0·2951 gr., and the new test 0·3152 gr. of sulphur per cb. ft. This was, therefore, in so far a successful experiment, the new test giving a higher result than the referee.

A repetition (*Experiment* 7) gave 0·4874 gr. and 0·6133 gr. per cb. ft. respectively, confirming Experiment 6.

In order to see whether platinised asbestos made any apparent difference to the result if placed in the combustion tube, *Experiment* 8 was run with the combustion tube loosely filled with the asbestos used in the previous experiments. The referee test gave 0·146 gr. of sulphur per cb. ft., and the new test, 0·197 gr.

Judging from this result, platinised asbestos has no influence.

A method having now been obtained whereby the referee could be checked in the determination of "total sulphur," experiments were proceeded with in the separation of sulphuretted hydrogen from other sulphur compounds. A sample of gas was taken from the T supplying the referee and new tests by aspirating a similar quantity at the same rate through 10 per cent. cadmium sulphate solution. The cadmium sulphide precipitated was filtered off, oxidised, and precipitated with barium chloride; three washbottles were used for the cadmium solution.

Experiment 9 (estimation of hydrogen sulphide and total sulphur).—The referee gave 0·114 gr. of sulphur per cb. ft., whilst the new test gave 0·201 gr.; the amount of sulphur as hydrogen sulphide obtained as cadmium sulphide = 0·764 gr. per cb. ft. The large difference between this latter and the total sulphur determined by new and referee test was unexplained.

Experiment 10 was run to determine how much sulphur was left after the gas had passed through cadmium sulphate solution. The referee, new, and hydrogen sulphide tests were run in the usual way, and then the gas in the aspirator, which had been through cadmium sulphate solution, was sent through the new test apparatus, and the residual sulphur determined.

The referee gave 0·140 gr. of sulphur per cb. ft.; the new test gave 0·294 gr., and after removal of hydrogen sulphide by cadmium sulphate, 0·104 gr. of sulphur per cb. ft.

0·781 gr. of sulphur per cb. ft. is present as hydrogen sulphide, precipitated as CdS. This experiment still shows that something is radically wrong, the total sulphur by the new test being only one-third of what was obtained by precipitating the hydrogen sulphide and estimating sulphur in the residual gas. A blank was run on the new test for 4½ hours, and gave 0·0007 gr. of sulphur. Various modifications of Experiment 10 were run, only to confirm its result.

Experiment 11.—Using lead acetate in washbottles for absorbing hydrogen sulphide, the referee test gave 0·09 gr. sulphur per cb. ft., and the new test gave 0·12 gr. After hydrogen sulphide was out, 0·06 gr. was indicated, and 0·66 gr. of sulphur as hydrogen sulphide was found.

Experiment 12.—Using cadmium chloride in washbottles for absorbing hydrogen sulphide, meters of referee and new tests were interchanged in this experiment. The referee test gave 0·135 gr. of sulphur per cb. ft., the new test 0·216 gr., and after hydrogen sulphide was out, 0·125 gr.; 0·993 gr. of sulphur as hydrogen sulphide was found. The cadmium chloride was found to contain sulphate, so it was purified, and experiment repeated. A good, clean precipitate was obtained, and to make doubly sure that the sulphide precipitated came from the hydrogen sulphide, it was boiled in a closed flask with hydrochloric acid and the gas caught in bromine. The method succeeded well on being tested by a balance on a known quantity.

Experiment 13 (using purified cadmium chloride in washbottles for hydrogen sulphide).—The referee test gave 0·102 gr. of sulphur per cb. ft., and the new test 0·132 gr.; after removing hydrogen sulphide, the new test gave 0·101 gr. of sulphur per cb. ft. Sulphur as hydrogen sulphide =0·583 gr. sulphur per cb. ft.

There was only one part of the apparatus left which could be in any way connected with these strange results—the meters. Absolute confidence had been placed in these after testing, care being taken that they were always thoroughly saturated with the gas before starting an experiment. To test this point, however, the hydrogen sulphide test was applied to the meter which had been used for the referee test. The gas now came through the meter, through the cadmium chloride washbottles, and so in to the aspirator. The result was surprisingly definite.

Experiment 14.—Sulphur as hydrogen sulphide, 0·032 gr. per cb. ft. New test (total sulphur), 0·154 gr. per cb. ft., proving that the meter was by some means absorbing the hydrogen sulphide.

To confirm this, *Experiment* 15 was run as follows:—Hydrogen sulphide was tested by cadmium chloride, (1) straight from the main, using an aspirator to measure the gas after passing through the washbottles; and (2) after the gas had passed through a meter. (3) A total sulphur new test was run as usual. (4) The residual gas from (1) (*i.e.*, gas which had come through cadmium chloride) was put through new test. (5) Residual gas from (2) was put through the new test.

Results:—Total sulphur by new test was 0·296 gr. per cb. ft. Sulphur as hydrogen sulphide after the gas had been through a meter=0·113 gr. Sulphur as hydrogen sulphide in the gas coming to cadmium chloride without passing through a meter=1·037 gr. Sulphur other than hydrogen sulphide after the gas had been through a meter =0·128 gr. Sulphur other than hydrogen sulphide, the gas coming through cadmium chloride to aspirator (*no* meter),=0·133 gr.

The deductions from experiment are:—(1) The meter absorbs 90 per cent. of the hydrogen sulphide in the gas; (2) the meter does not much affect other sulphur.

The obvious method of estimating the total sulphur in the gas is therefore (1) to remove hydrogen sulphide by aspiration through 10 per cent. cadmium chloride solution (this was proved efficient by placing lead acetate paper after the third washbottle: a precipitate rarely formed in third washbottle). (2) To burn the gas, which has passed through cadmium chloride solution into the aspirator, by passing it through the new test apparatus. The aspirator, in view of the results of Experiment 15, and of the fact that the gas already passes three washbottles, may be relied upon not to alter the content of sulphur other than that as hydrogen sulphide.

Experiment 16 was run on these lines and gave:—Sulphur as hydrogen sulphide, 0·893 gr. per cb. ft.; other sulphur, 0·192 gr.; whence the total sulphur=1·085 gr. per cb. ft.

Summary.—The experiments completed have shown:—

1. That the referee test for the "total sulphur" in Mond gas is quite unreliable, as gas is passed through a meter before it is burned.
2. That the ordinary small meter (wet) absorbs hydrogen sulphide from Mond gas even though special precautions are taken to keep the water in it saturated with the gas.
3. That a satisfactory method of estimating the total sulphur in Mond gas has been found by—
   (1) Removing the hydrogen sulphide by aspirating gas from main through cadmium chloride solution.
   (2) Burning the gas in the aspirator in a specially constructed apparatus.

TAR.—INDICATION OF ITS PRESENCE, AND ESTIMATION OF, IN MOND GAS.

The investigation originated in connection with a question as to the efficiency of the saw-dust purifier. It was thought desirable to establish some visible daily records of the cleanliness of the gas after passing this scrubber.

The apparatus as sketched and described proved of value for this purpose.

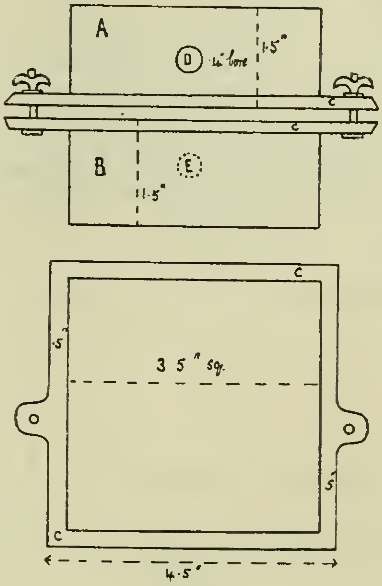


FIG. 23.

It consists, roughly, of a square box in two sections, A and B, identical in size and shape. The body is made of thin sheet copper, the flanges, C, of hard lead provided with thumbscrews for clamping the sections together. The gas entry and exit are at D and E respectively.

A sheet of blotting paper 4·5 in. square is interposed between the two sections and clamped down. The gas passes in at D and away at E for measurement. The blotting paper used is pure white in colour, 0·025 in. in thickness and weighs 0·0615 lb. per sq. ft. It offers little resistance to the water-saturated gas, and the passage of the gas is well distributed over its entire surface. The tar content of the gas is, of course, indicated by the stain produced on the paper, and is estimated by the depth of this stain. The colour varies from a pale yellow (in good gas) *via* a yellowish-brown, to a dark greyish-brown (in bad gas). Although a sheet of glass is let in at the top of the apparatus, it is nevertheless advisable that light should be excluded, perhaps more particularly when making comparative tests. Strong light brings about a conversion of the yellow colour to a greyish-brown.

The apparatus was used in experimental efforts to improve the cleanliness of the gas from tar. Comparative cards were taken before and after each trial. Nine cb. ft. was found to be a good standard volume of gas to use. The velocity of the gas passing the paper was apparently without effect. Nevertheless, to make the results strictly comparable, a time of three hours was allowed.

A point to be noticed is that gas moving at any velocity in glass pipes does not deposit tar in them. Glass connections to the apparatus were found to be clean after extended use.

The Attempted Measurement of Fluctuating and Intermittent Gas Streams of Fixed Periodicity by Means of Pitot Tubes and Meters.

One of the great difficulties in metering gases arises in connection with such regularly pulsating currents as go to feed gas engines, or are produced by pumping. Ordinary meters will not deal with such currents if the fluctuation is violent, and the author knows of no meter which will work correctly on a gas pipe supplying a gas engine only—unless there is some form of regulating apparatus between it and the engine. Another objection to any type of meter except one operated by Pitot and side gauges is that there is a great objection to throttling the gas supply to a large engine.

The difficulty of the problem may be best illustrated by taking a concrete example; and the most exaggerated case, viz., a gas pipe feeding a single four-cycle cylinder may be selected. In this case the engine acts as a gas pump in one stroke out of four strokes.

If the gas in the pipe be regarded as devoid of inertia, the valves as operating instantaneously, and the temperature inside the cylinder and speed of piston as constant, we can make a simple diagram showing how the velocity of the gas in the pipe varies during the cycle.

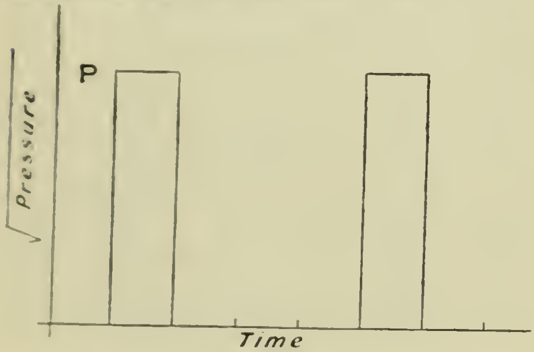


FIG. 24.

It is seen that the above limitations amount to making the velocity of the gas zero, except during the suction stroke, when the velocity rises instantly to its steady value, at which it remains till the valve closes.

If a heavily-damped stream gauge be connected with gauges in such a stream its behaviour will depend on its own natural period of vibration. We will suppose that this is long compared with the period of the fluctuations. In this case the reading of the instrument will be the same as if it were exposed to a pressure difference the time average of the actual pressure difference. Thus, if the pressure attained in the diagram be P, the stream gauge will settle at a reading corresponding to a steady pressure of $\frac{P}{4}$. But a stream gauge is divided in such a manner that the reading of N divisions is proportional to the root of the pressure difference, *i.e.*, $N = K\sqrt{\frac{P}{4}}$, where K is a constant. This, however, is of no use to us in determining the velocity; we do not want to know the square root of the arithmetic time average of the pressures, but the time average of the square roots of the pressures, in the case chosen, $\frac{\sqrt{P}}{4}$. Thus the reading is actually proportional to $\frac{\sqrt{P}}{2}$, and the mean velocity to $\frac{\sqrt{P}}{4}$; or the stream gauge reading interpreted as for a steady stream would give exactly twice the volume of gas going to the engine in a unit of time. In other words, a factor of correction of 0·5 would have to be applied to the stream gauge reading as usually interpreted. Factors for certain other cases calculated on the same basis as the above are as follows:—

1. For a single-acting pump, C = 0·707.
2. For a double-acting pump, C = 1.
3. A stream varying so that the instantaneous velocity varies between 100 and 94·8, C = 0·9995. The variations are supposed to take place instantaneously as in the other cases.
4. A stream varying so that the instantaneous velocity varies between 100 and 90, C = 0·9987.
5. A stream varying so that the instantaneous velocity varies between 100 and 70·7, C = 0·986.

Cases 3 to 5 are of interest as showing that fluctuations such as often occur do need to be taken into account.

In practice, however, it is clear that the inertia of the gas in the pipe cannot be neglected and a method must be devised capable of doing for a gas stream what the oscillograph does for an alternating electric current. Such an apparatus is shown in Fig. 25. A light aluminium disc fits closely, but without touching the inner walls of a circular cylindrical vessel. The gauge tubes are connected above and below the disc, and the latter being mounted on a light spindle and controlled by a spring, moves up and down in obedience to the difference of pressure on its two surfaces. The period of oscillation of the system must, of course, be small compared with the period of the forces, and the damping must be such as will make the system approximately "dead beat." It is hardly necessary to add that the connections to the gauge tubes, and the gauges themselves, must be wide enough and short enough for the pressure differences necessary to pass the volumes of gas requisite to move the disc to be small compared with the pressure difference under investigation.

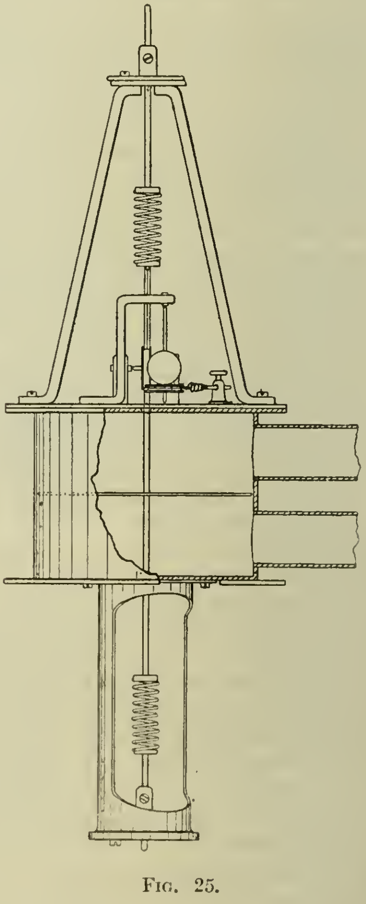


FIG. 25.

The photographic method of registration (Fig. 26) has been adopted simply for convenience; the gauge is quite powerful enough to register its own movements in the same manner as is usual in physiological experiments.

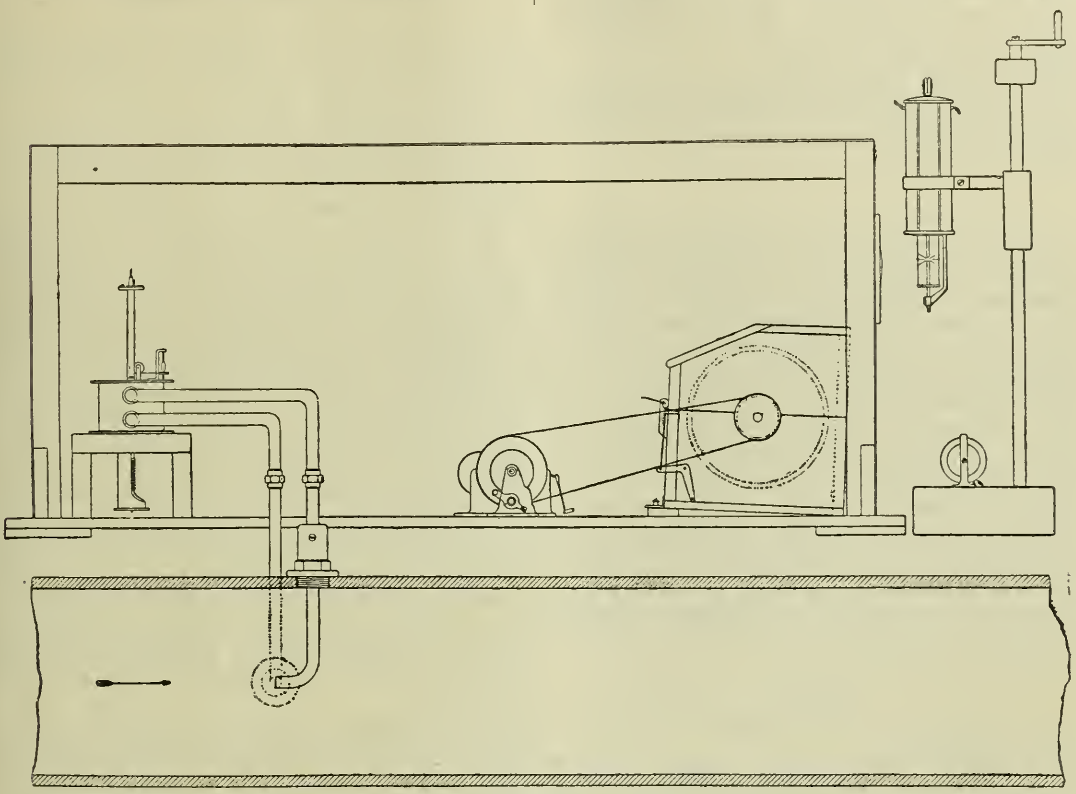


Fig. 26.

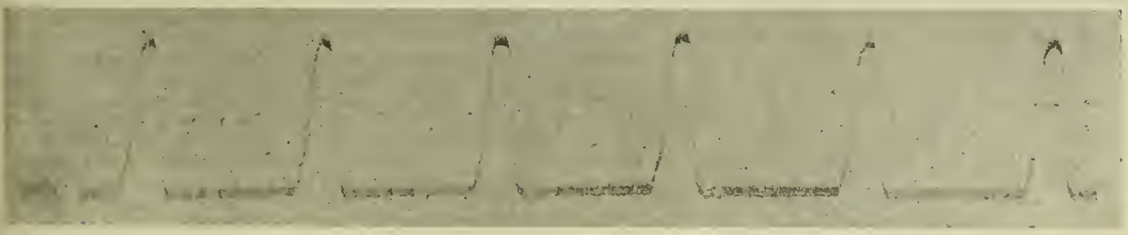


Fig. 27.

Fig. 27 shows a record for a single-acting four-cycle gas engine cylinder, the ordinates of the curve being proportional to the squares of the velocities, but the scale of the curve unknown.

It would, of course, be fairly simple to calibrate the photographic apparatus, but it is even simpler to use the ordinary micromanometer in addition to the photographic apparatus. The procedure then is as follows:—

Let Pa be the pressure shown by the manometer, and *t* the period of the cycle. Let A be the area included between the axis of time and the curve, determined by a planimeter or otherwise. Then A = Pa . *t*, whence the pressure corresponding to unit length of ordinate can be found. (1.) If we assume that the equation $V^2 = K \cdot \frac{2P}{\rho}$ applies to puffy currents, the next step is to construct a curve with ordinates equal to $\sqrt{\frac{2K \text{ ordinate of first curve.}}{\rho}}$ The area cut off between the axis of time, the new curve and ordinates at the beginning and end of the cycle, can be estimated in any convenient way, and then the average velocity is found by dividing this area by the periodic time. (2.) For example, in the idealised gas engine curve, let P be the pressure corresponding to the ordinates A or B, the steady pressure observed by the manometer being P_0. Then by operation (1) $P = 4P_0$, and by operation (2) the area of the second curve divided by the periodic time is

$$\tfrac{1}{4}\sqrt{\frac{K.2.P}{\rho}} = \tfrac{1}{4}\sqrt{\frac{2K \times 4P_0}{\rho}} = \tfrac{1}{2}\sqrt{2KP_0}$$

and this is the mean velocity, agreeing with the statement that the velocity deduced from the stream gauge reading as if the current were steady must be halved to give the real mean velocity. The photographic curves give a factor of 0·49 instead of 0·5 as in the ideal case. The only check the author has as yet succeeded in applying to the above method of measurement has been by closing the gas valve of one cylinder of a gas engine and observing the air pumped in when the engine is run from another cylinder. The mean pressure of the air is given both in the cylinder and air pipe by a light spring indicator, and the temperature can be inferred from the recent measurements of Prof. Hopkinson (Phil. Mag., Series VI.

Vol. 13, p. 84—Jan., 1907). The result of several trials made in this way was to show a fair agreement between the volume of air per minute, as deduced from the Pitot tube measurements, and the same quantity as inferred from the cylinder dimensions, the speed of the engine, and the indicator diagram.

The author has had the advantage of discussing the matter with Prof. Poynting, who indeed kindly suggested the formal statement as to the reduction of the observations given above.

The author desires to make acknowledgment to Messrs. Chamberlain and Hookham for permission to publish some tables facilitating the use of gauges for gas measurement which were originally calculated for a pamphlet issued by them; the Cambridge Scientific Instrument Co., for permission to reproduce the print of a micromanometer; Mr. R. H. Bradbury, the author's chief assistant, for carrying out and calculating most of the gas measurements described and for making the drawings which accompany this paper: Mr. C. H. Beasley, the author's mechanical assistant, for constructing the apparatus described; Mr. A. A. King, chemist, who conducted the experiments on the determination of sulphur in Mond gas independently of the author, Mr. A. Goddard, chemist, who carried out the experiments on the determination of tar and ammonia in Mond gas as part of works routine; the Institution of Mechanical Engineers for permission to make use of material already published in their Journal: and to the author's colleagues for assenting to the publication of information originally obtained for their exclusive use.

DISCUSSION.

Dr. **Divers** having expressed his sense of the very great value of the paper.

Prof. **Meldola** said the general impression produced on him by this paper was the enormous value of bringing scientific training to bear on industrial problems. They must all have been highly impressed by the great skill with which the author had attacked the problems that he had to deal with, and brought to bear upon them all the resources of physics and chemistry. The method by which Mr. Threlfall had determined on a manufacturing scale the densities of gases was most ingenious. As had been pointed out, this method would have enabled Lord Rayleigh to detect the difference in density between chemical nitrogen and atmospheric nitrogen; but, on the other hand, if he had correctly followed the author's explanation, it would have involved the preparation of quantities of gas which would have been very difficult to deal with at the time those investigations by the old globe method were in progress. He hoped the communication would be an encouragement to others who were engaged in industrial research to give the Society the benefit of their experience in a similar way.

Mr. **Arthur H. Lymn** confirmed the statement that the measurement of gas by chemical means was unreliable, though he had obtained results over long periods which were within 5 per cent. of those measured by accurate meters. The latter, however, was the only satisfactory method of gas measurement. The author's work in bringing out a continuous calorimeter would be of the utmost value. Only those with experience knew how difficult it was at times to maintain agreement between the gas engine and gas plant makers. The former very frequently attributed temporary difficulties with their engines to the gas being below standard quality, while the latter were naturally of contrary opinion. A continuous gas calorimeter would automatically settle such points at the moment of their occurrence. He welcomed Mr. Threlfall's suggestion that a standard method should be adopted for estimating tar in producer and power gas, which were now so largely used. A simple standard method would be of great service and would be much appreciated by those interested in the subject.

Prof. **Coker** said he noticed that in the measurements of velocities in pipes Prof. Threlfall had shown a very flat velocity curve, different to that which obtained when water was flowing through the pipes; these latter were much more pointed, and approximately parabolic. There were two kinds of curves for straight pipes, depending to some extent on whether the water was flowing in stream-like motion, or flowing above the critical velocity, namely, in disturbed motion; and he wondered if the author had obtained the critical velocity of air. That seemed just the kind of apparatus for determining it. Were any of the author's experiments conducted below the critical velocity of air, and could he quote any figures?

Dr. **H. G. Colman** said that the first part of Mr. Threlfall's paper was of interest even to those dealing with gas in much smaller quantities than those dealt with by the author. The ordinary meters were sufficient to measure the total bulk of the gas, but the instrument Mr. Threlfall had devised would be of very great value, because although the finished quantity was measured at the meter, the gas had frequently to be divided during manufacture into separate streams, and there were no ready means of telling what proportions were going to each section, because it was too expensive to put up separate meters for each stream. In such circumstances this instrument would be most valuable. For another purpose also it would be of use, namely, in the manufacture of blue water gas, or carburetted water gas. The amount of air blown in made an enormous difference to the working of a water-gas machine, and under ordinary circumstances the only measure was the blast pressure; but the volume of gas depended not only on the static pressure, but on the back pressure of the fuel bed of the apparatus. The pressure shown by the fan might be correct, yet less air might be passing through than was desired, and the instrument devised by Mr. Threlfall would enable the actual volume of air used to be directly determined.

The **Chairman** said there was one point raised by Dr. Colman Mr. Threlfall did not deal with, namely, the application of his producer to the measurement of the amount of air passing into the producer. One of the things which troubled people who worked gas producers was to get some idea of the relative proportion of steam to air entering the producer as compared with that known to be necessary in order to produce the best effect. There were the most divergent estimates as to this, and if Mr. Threlfall's work could in any way help to solve that difficulty it alone would be a most important piece of work.

Mr. **Threlfall**, in reply, said Prof. Meldola had stated that his method of determining densities would not have worked with the small quantity of gas available by Lord Rayleigh, but one point about it was that it worked with very little gas, if this was put into the tube in the right way. If a tube 60 ft. long were filled with hydrogen from the bottom, he did not know how long it would take, but it would be many hours, while by passing the gas in downwards the air was soon expelled. With regard to Prof. Coker's interesting question as to the nature of the stream of gas, he had shown in his paper before the Institution of Mechanical Engineers that all streams in practice were turbulent drifts. Each particle of gas moved at random, but the whole number drifted in one direction.

In reply to the point raised by Dr. Colman and the Chairman, a stream of air propelled by a fan can be easily measured—indeed, most of the earlier experiments were made in currents of air produced by this method and are described in the communications to the Institutions of Mechanical and Electrical Engineers already referred to. If the streams are produced by blowers which act more or less discontinuously the stream must be steadied before measurement by the insertion of a vessel of some volume between the blower and the place where the measurement is made. The author has not found it necessary to measure the air entering a Mond plant, because the method of working is to keep enough producers at work to carry the maximum load; to keep the air saturated at a certain temperature when it enters the producers, and to regulate the blowers according to the pressure gauges, *i.e.*, in accordance with the load.

Manchester Section.

Meeting held at Manchester on Friday, February 8, 1907.

DR. G. H. BAILEY IN THE CHAIR.

SOME CHEMICAL AND PHYSICAL CHANGES IN THE FIRING OF POTTERY, &c.

BY J. W. MELLOR, D.SC.

The problems associated with clay working and pottery manufacture are little known outside a very limited circle; and even within that circle, the strife and stress of commerce prevents incursions into those regions which do not promise immediate profits. These regions should be carefully explored in the laboratories of our universities and colleges. Careful investigation of the "profitless" side issues which constantly occur in our manufacturing processes is of the greatest importance. Pottery has been helped very little, if at all, by pure research, although the chemistry and physics of pottery are probably as complex as of any industry which flourishes at the present age.

The "body" of fine pottery is usually made from a plastic mixture of clays, flint, and felspar, or cornish stone—a native mixture of felspar and quartz. The plastic mixture is moulded into the required shape, dried, and fired in the "biscuit" oven. A fusible mixture is then spread over the body, and the whole refired in the "glost" oven at a much lower temperature than the "biscuit" oven. The melted mixture covers the surface of the body with a glassy film or "glaze."

There are many variations from this procedure in actual practice. The glaze and body, for example, may be fired at one operation with or without a preliminary "baking" of the body. There are also considerable variations in the composition of the body and glaze. Thus we get the chief varieties of fine pottery—earthenware, semi-porcelain, granite or ironstone china, hard porcelain, parian, soft porcelain, and bone china.

The firing of opaque pottery.—The changes which take place in the body during the earlier stages of the firing are comparatively simple—loss of organic and volatile constituents. When the temperature passes 1000°, the fluxes soften, melt, and dissolve the less fusible materials—clays and flint. The process is more or less incomplete in all the different types of pottery. The ware could not retain its shape during the process of firing if the constituents formed a homogeneous solution. In earthenware, the process of dissolution is just about sufficient to cement the less fusible particles of quartz and felspar together. A relatively small proportion of flux is needed, and in thin slices, under the microscope, the original constituents can be readily identified after firing. Fig. 1, for example, represents an unfired sample of earthenware; Fig. 2, a properly fired sample. Semi-porcelain (Fig. 3) is practically the same, although the process of solution may have gone a little further. As in earthenware, the original constituents can be readily identified after firing. The quartz and clays are welded together by the felspathic flux. In "granite" or "ironstone china," and "mortar" bodies, on the other hand, the process of solution is very much further advanced (Fig. 4), and the ware, in consequence, is much more vitreous and hard. Earthenware and semi-porcelain, when fired, are relatively soft and porous. There are no signs of translucency when pieces of granite and of earthenware, say 2 mm. thick, are examined in transmitted light, although some varieties of ironstone china begin to show a glimmer of light when made a little thinner.

The firing of translucent pottery.—The clay used in all these types of pottery is a mixture of "ball" and "china" clay. If the amount of ball clay is reduced below, say, 5 per cent., and the proportions of the remaining constituents—flint, felspar, and china clay—are properly adjusted, the resulting ware when fired is quite translucent in relatively thick pieces. Hard porcelain, or *porcelaine dure* (Fig. 5), is an example. Ordinary earthenware acquires the same general structure (Fig. 6) as hard porcelain if fired much harder than is usually done. The presence of the ball clay, however, renders the "over-fired" body very much less translucent than porcelain. The body loses its shape before the translucent stage is reached. If the flint be omitted from hard porcelain and the felspar increased, translucent "parian" (Fig. 7) is obtained. The firing temperature of hard porcelain—about 1400°—is very much higher than the firing temperature of "parian." In the former, patches of acicular crystals resembling sillimanite frequently occur. These crystals seem to be produced whenever mixtures rich in china clay and felspar are fired over 1300° (W. Vernadsky, Bull. Soc. Min., **12**, 447, 1889; **13**, 256, 1890). The optical properties of these crystals (refractive index, double refraction, terminal planes, optical sign, and optical extinction) resemble sillimanite, although the angles have not yet been measured.

A pocket of crystals in hard porcelain (Chinese) is shown in Fig. 8, and a similar pocket of sillimanite crystals from a piece of volcanic slag (Vesuvius) is shown in Fig. 9. As a matter of fact, similar crystals may be developed at much lower temperatures in the presence of frits and glazes containing lead silicates. Parian, for example, is frequently made with a certain proportion of lead glass, and in that case, the parian, though fired between 1150° and 1200°, may have pockets of these acicular crystals. The lead glass seems to act as a catalytic agent. The so-called soft porcelain, or *porcelaine tendre*, is compounded of a mixture of clay with a glassy frit. In other words, soft porcelain (Figs. 10 and 11) has the nature of a glass rendered opaque by the addition of china clay. I am indebted to the kindness of M. G. Vogt, of Sèvres, for the specimens from which the sections Figs. 10 and 11 were cut. Felspar and artificial glass have been supplemented or replaced in particular cases by other fluxing agents like mica (Chinese porcelain—G. Vogt, Bull. Soc. Enc. Nat. Ind. [5], 5530, 1900), steatite (early Worcester porcelain—A. H. Church, Cantor lectures, 17, 1881), barium sulphate (Josiah Wedgwood's jasper for instance—L. Petrik, Zentr. Glas. Porz., **22**, 1797, 1809, 1907), and bone ash. Practically all the porcelain made in England at the present time has about 50 per cent. of bone ash mixed with clay and cornish stone. Properly fired, bone china is perhaps more nearly homogeneous than any other type of pottery. Here it is seldom possible to identify the original constituents (Fig. 12). Some special reactions occur during the firing of this type of pottery caused by the decomposition of the calcium phosphate. A slight rise of temperature above that required for properly maturing the ware results in the decomposition of the bone ash with the evolution of phosphorous fumes which cause the ware to expand a little after the maximum contraction has taken place. Such ware then acquires the spongy character shown in Fig. 13. Reducing conditions favour the decomposition of the bone ash. The phosphorous vapours at the same time appear to react with the iron oxides (below 1 per cent.) in the body, producing a greenish-blue coloured iron phosphate, which imparts a curious tint to the ware in transmitted light (B. Moore, Trans. Eng. Cer. Soc., 5, 37, 1905). There is also some evidence of the formation of a kind of artificial ultramarine when the ware is fired in a reducing atmosphere (J. W. Mellor, Trans. Eng. Cer. Soc., 5, 41, 1905).

Action of the fluxes.—The particles of china clay are comparatively porous, since they are permeated with numerous capillary pores. If the pores are filled up with water, or Canada balsam, the apparently opaque particles become translucent. In firing, the molten felspathic flux may be supposed to fill up the capillary pores of the china clay particles in much the same way, although the felspar will be dissolving the clay at the same time as it is slowly filling up the pores. Hence, the china clay may remain as an "invisible framework" in the soft pottery body during firing, so that the apparently soft body may still retain its shape; and, after firing, the clay be unrecognisable. "Ball" clay being less refractory than china clay, fuses in the body, and does not seem to behave the same as china clay. But the action of ball clay is not yet clear.

The reaction between the different constituents of the body, in firing, is arrested before the system is in a state of equilibrium. The chemistry of pottery is therefore largely a chemistry of incomplete reactions, and many erroneous inferences have been made from the failure to appreciate this fact. Thus, two bodies may have the same ultimate composition, and yet behave very differently on firing, because the velocity of the reaction, under constant conditions, is different when the bodies are compounded with different materials so as to furnish the same ultimate composition, or with the same materials in a different state of sub-division.

Again, in firing, the composition of the flux is constantly changing as it dissolves the less refractory materials. The softening of the whole body is naturally determined by the speed with which the fluxes react with the clays and quartz, as well as on the fusibility of the product of the reaction. The product of the reaction may be less fusible or less viscous than the original flux. Felspar which has dissolved a little quartz is more fusible than felspar alone; and a mixture of quartz with a little china clay is less refractory than either quartz or china clay alone.

A great many attempts have been made to predict the softening temperatures of clays and similar mixtures from their ultimate composition. We have the work of E. Richters (J. prakt. Chem., 104, 191, 1868; Dingler's J., 191, 59, 150, 229, 1869; 197, 268, 1870). C. Bischof (Dingler's J., 161, 208, 291, 1861; 165, 378, 1862; 169, 353, 455, 1863; 170, 43, 1863; 196, 438, 1870; 198, 396, 1871; 200, 110, 289, 1871). H. A. Seger (Tonind, Zeit., 1, 290, 1877). F. Cramer (Tonind. Zeit., Nos. 40, 41, 1895). P. Jochum (Zeits. Ver. deuts. Ing., 39, 53, 317, 1895). H. A. Wheeler (Missouri Geol. Survey, 11, 146, 1896). T. Ludwig (Tonind. Zeit., 29, 773, 1904); and F. Kochs (Zeits. angew. Chem., 19, 2123, 1906, and with F. Seyfert, 16, 14, 719, 1901). The few generalisations which have been made are said to be in harmony with van 't Hoff's solution laws, but the conditions are so very different from those which pertain to the freezing and melting of dilute solutions, that the agreement of a very limited number of empirical observations with the dilute solution laws at present appears to be due more to chance than to order. At the same time, we must not forget that the clay working industries are not particularly interested in the melting points of clay mixtures, although the softening points are of the greatest importance. As soon as a clay has melted, it is of no technical interest. After the formulæ have done their all, we have ultimately to rely on empirical observations for the softening points of the different mixtures.

The firing of glazes.—The molten glaze is an active flux which is vigorously attacking the body while it is being fired. There is thus a very concentrated solution of body in glaze where the glaze comes in contact with the body. The substances in solution have not time to diffuse uniformly throughout the glaze. The result is that, in cooling the saturated solution, crystalline separations sometimes occur in the vicinity of the body. Fig. 14, for example, shows a fringe of such crystals in the glaze cut from the bottom of an ordinary Berlin porcelain crucible. These crystals seem to grow larger after repeated firings at certain temperatures. The crucibles are then very brittle. A similar phenomenon occurs with porcelain pyrometer tubes. As in the case of many metallic alloys, the crystalline structure develops concomitantly with the brittleness. Ordinary hard porcelain pyrometer tubes, after firing for a couple of days at 1300°, become so exceedingly brittle that they can only be used once. Fig. 15 represents a cross-section through glaze and body of a "new" tube; Fig. 16 a portion of the same tube after firing a couple of days at 1350°. A similar observation applies to unglazed firebricks. These, too, after repeated firings become very brittle, and a set of sections from one sample is shown in Figs. 17—20. The firebrick was made from a mixture of "grog" (*i.e.*, previously fired fireclay, or old bricks) and the raw fireclay. Fig. 17 is nnfired; Fig. 18, once fired at about 1100°; Fig. 19, once fired at 1350°; Fig. 20, fired seven times at 1350°. Here again we have the development of the acicular crystals. Another influence may also be at work. The fireclay mixtures are comparatively low in fluxes. The "grog," &c., at each firing "sucks up" or combines with the fluxes, ultimately leaving insufficient fluxes to bind the whole into a rigid mass. (See F. Austin and J. W. Mellor, Trans. Eng. Ceramic Soc., 1907.)

Temperature plays a most important part in the development of these crystals. G. Tamman (Z. physik. Chem., 25, 441, 1898) has shown the existence of a maximum rate of crystallisation temperature for many organic compounds. The rate of crystallisation "slows down" above and below this temperature, and this the more the further the temperature is away from the temperature of maximum crystallisation. This fact explains many curious results observed in the crystallisation of silicates.

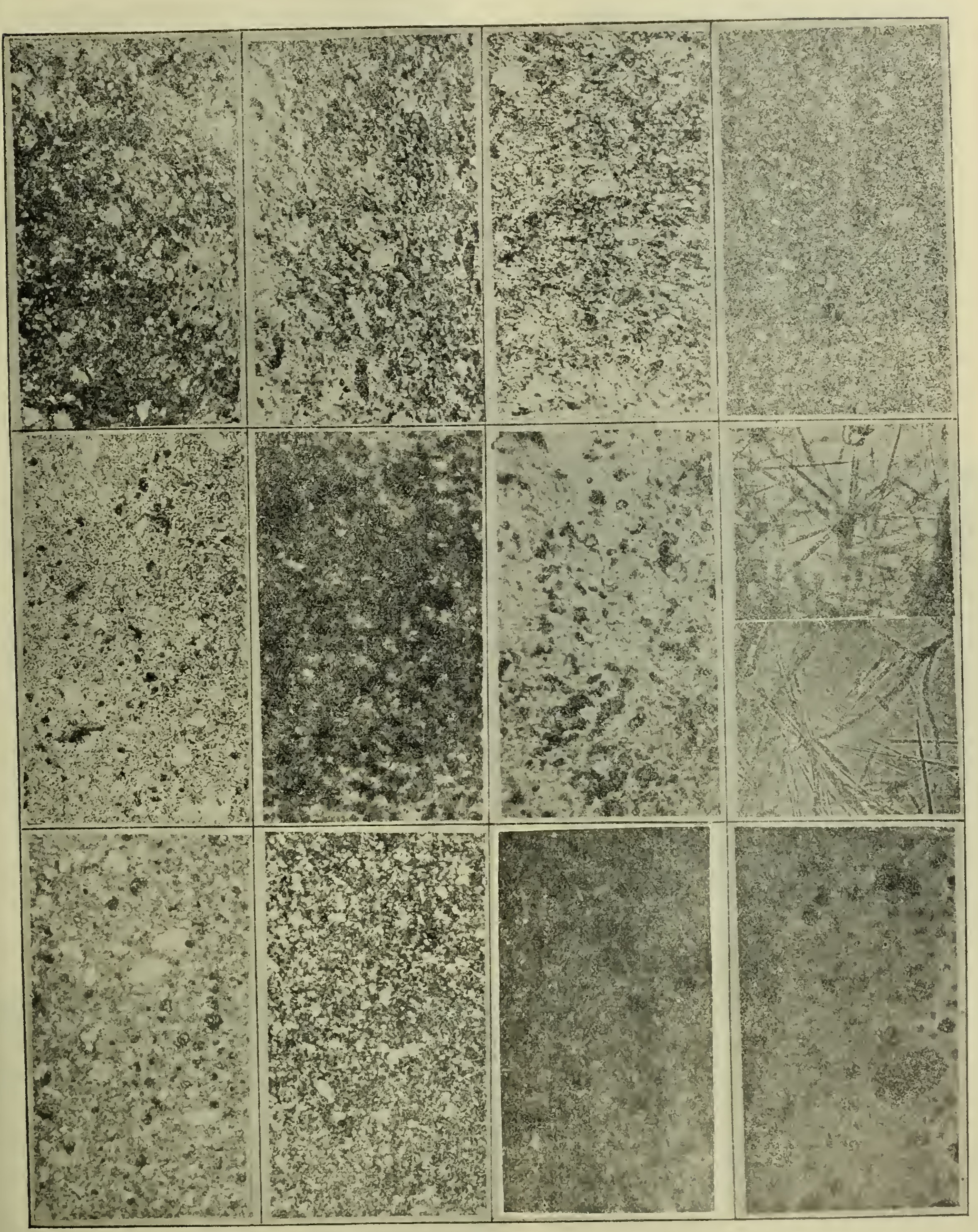
Representing temperatures by the ordinates of Fig. 21, and rates of crystallisation by the abscissæ, we have a curve, resembling A B C, indicating the influence of temperature on the rate of crystallisation. Suppose the maximum velocity occurs at 1300°, there is a zone on each side extending from say 1200° to 1400°, where rapid crystallisation is liable to occur. Outside these temperature limits the rate of crystallisation is negligibly small. If we now represent "time" by the abscissæ of the same diagram, the curve, D E F, will represent the temperature of the pyrometer tube at different intervals of time under one set of conditions. The tube is in the "danger zone" three hours, whereas, under another set of conditions, D G H, a pyrometer tube will scarcely be in the "danger zone" at all. Hence, the one tube is much more likely to show the effects of crystallisation after the firing. Similarly, a substance cooling from a temperature above the "danger zone," with a "flat" cooling curve, may be in the "danger zone" a longer time than if the cooling curve were steeper. In the latter case the substance might pass so rapidly through the "danger zone" that very little crystallisation would have time to take place.

The "danger zone" naturally varies with each substance, and this must be determined empirically for any particular mixture. The above diagram is only an approximation to the possible curve for our pyrometer tubes. The reason that the tubes, after a very great number of firings, lose their crystalline character and become tough again, arises from the fact that the nature of the tube changes with time owing to the further progress of the reaction between the constituents. This probably removes the "danger zone" somewhere else.

The glaze shown in section, Fig. 22, does not exhibit any particular tendency to crystallise when fired in a "glost" oven at about 1200°, although, if the same glaze be refired in an earthenware "glost" oven at about 40° lower, we have the crystalline effect shown in Fig. 23. These crystals clear off when the glaze is refired at 1200°. Obviously, therefore, temperatures in the vicinity of 1160° make the "danger zone" or zone of rapid crystallisation for this particular glaze.

DISCUSSION.

Dr. H. C. H. CARPENTER said he thought that Dr. Mellor had been trying a new experimental method in applying the microscope to problems of pottery manufacture. He had had some experience of the application of the microscope to the elucidation of changes that went on in another type of solid bodies, *viz.*, metals and alloys. The cases were, however, somewhat different, since the photographs shown represented structures of materials viewed by transmitted light; whereas metals had almost invariably to be studied by reflected light on account of their opacity, except in the thinnest films. Had the author observed the formation of a film on the pottery surface produced by polishing? It was well known that something of that kind was produced on metal surfaces by this treatment, and that a properly polished metal surface very seldom conveyed any idea of the structure of the metal underneath when viewed by the microscope, until this surface film had been removed by suitable methods. Had Dr. Mellor examined both unetched and etched pottery surfaces, and did photographs of the latter reveal anything that was not shown by the former? What were the polishing methods employed in preparing the surfaces for microscopic examination? Were both wet and dry blocks used, and, if so, at what stage did the author pass from one to the other?



FIGS. 1 TO 13.—Structure of various pottery bodies, × 50.

1. 2. 3. 4.
8
5. 6. 7 9
10. 11. 12 13.

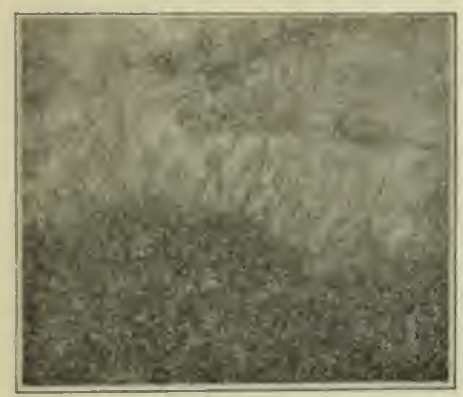
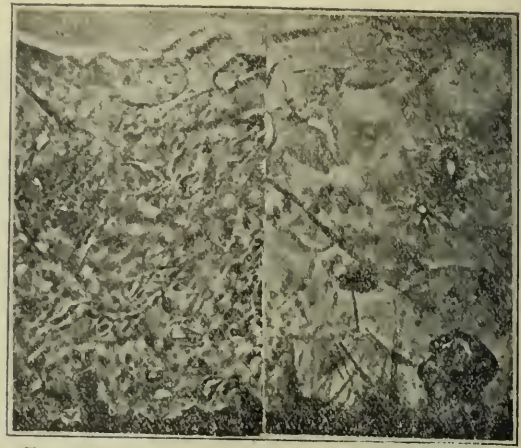
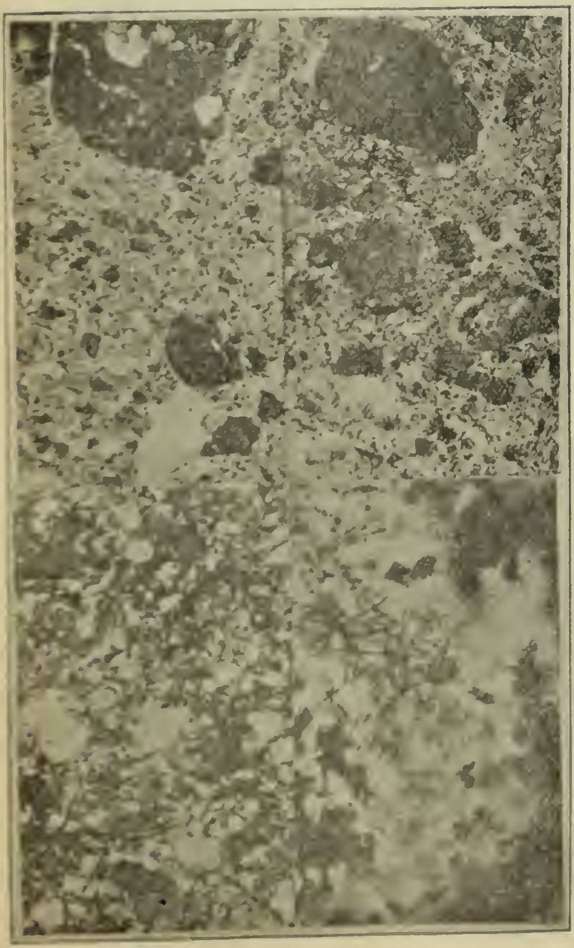


FIG. 14.—Berlin crucible, × 550.



FIGS. 15 AND 16.—Influence of repeated firings at 1300° on structure of porcelain pyrometer tubes, × 100.



17 18
19 20

FIGS. 17 TO 20.—Influence of repeated firing at 1350° on structure of fire brick, × 50.

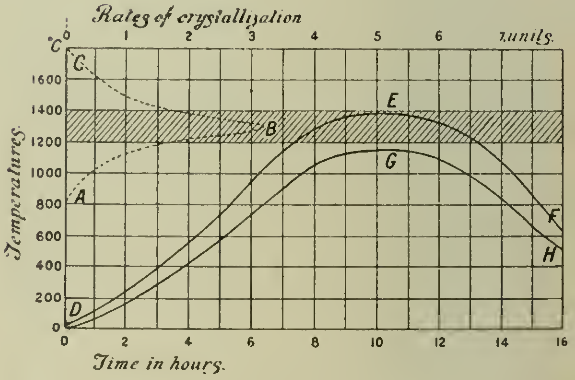
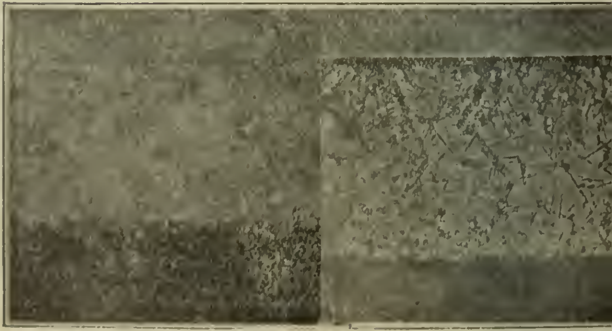


FIG. 21.



FIGS. 22 AND 23.—Influence of temperature on crystallisation of glaze, × 100.

Mr. A. **Lomax** said it was obvious from the illustrations that a microscopical examination of the materials being dealt with was of equal importance with the chemical analysis. He understood Dr. Mellor to say that if earthenware were fired at a much higher temperature, the flux being thereby much more active, the body of the ware would become more glassy. Would earthenware fired at such a very high temperature become translucent as do other bodies at a lower temperature?

Dr. R. S. **Hutton** said that the explanation of the decay of pyrometer tubes was of great practical importance. Once the true cause of these defects was understood it might be possible to specify some material more suitable for their construction. He understood that porcelain, fireclay of various sorts, and silica glass broke down as a result of the rapid crystallisation which set in. Had Dr. Mellor experimented with the new stoneware material of Dr. Buchner, containing fused alumina, and stated to withstand sudden changes of temperature? Independent statements as to its behaviour were difficult to obtain, but it obviously differed considerably from the usual materials and might, therefore, be of interest. Dr. Mellor had emphasised the crystallisation occurring at the surface of contact between the glaze and the "body," but in view of the fact that the glaze formed such a small fraction of the total thickness, was this sufficient to account for the crumbling away of the whole article? The evolution of vapours when porcelain is overheated by some 50° (in the neighbourhood of 1350°) might account in some measure for the attack of the helix of wire serving as the source of heat in small laboratory electric furnaces.

Dr. **Mellor** said that the methods employed were based upon those used by petrologists. He had introduced a number of modifications. He had not noticed the formation of viscous films similar to those studied by Beilby. The only source of danger was a wrong interpretation of the results by the bedding of particles of the grinding powders in the pores of the bodies. Very fine etchings could be obtained with cold dilute hydrofluoric acid (1 : 8). The crystals resembling sillimanite were not perceptibly attacked; clays were slowly attacked; quartz and felspar were quickly attacked; while the glassy "cementing" flux was attacked with extreme rapidity. Good surfaces for observation could also be obtained by polishing bodies possessing a marked heterogeneous structure. In a general way, there was no advantage in working with polished surfaces when the structure could be brought out so well with transmitted light. Metallurgists were at a disadvantage in dealing with opaque bodies because they could not polarise for crystals, and hence they tried to bring out the crystalline structure, indirectly, by etching fluids.

Mr. Lomax emphasised the value of the microscopic work. Especially was this the case in the interpretation of observations. Quite another range of facts could be obtained by working at higher powers in polarised light. When the original constituents of an earthenware body were sufficiently fluxed, the structure was very much like porcelain, but the ball clay alone was responsible for diminished opacity. Of course, earthenware would lose its shape if fired to that temperature; but "ironstone china" was very nearly "porcelainic" earthenware.

He had not seen a specimen of Buchner's material. It was comparatively easy to make an unglazed body withstand sudden temperature changes and also repeated heatings, but directly the "biscuit" body was glazed troubles began. Pyrometer tubes were glazed with the object of protecting platinum wires from the furnace gases. However, crystals also developed in the body of the pyrometer as in firebricks under the conditions stated in my paper. Vapours might be evolved at high temperatures from the tubes used as cores in electric tube furnaces. These tubes were not "phosphatic porcelain," the vapours were, therefore, not phosphorous fumes. Although he had assumed that crystallisation was undesirable in pottery bodies, beautiful decorative effects with crystalline glazes (aventurine and ice-frosted glazes) have been exhibited on the Continent and in America during the past ten years. When crystals were wanted, it was obviously necessary to keep the glazes in the zone of rapid crystallisation instead of hastening past that region.

Meeting held at Manchester on Friday, March 8, 1907.

DR. G. H. BAILEY IN THE CHAIR.

INVESTIGATION INTO THE FORMATION OF BLUE SALT, &c.

BY H. J. BAILEY, A.I.C.

The report for 1905 of the Chief Inspector under the Alkali, &c., Works Act, published August, 1906, contains a discussion on the formation of blue salts, the conclusions arrived at in which did not altogether appear to agree with the practical working experiences of the author. Mr. Linder's experiments appear to lead to the conclusion that blue salt is due to the presence of insoluble ferri- or ferrocyanides formed in two stages by the interaction of ferrous sulphide with neutral or alkaline ammonium cyanide, thus:—

$$6NH_4Cy + FeS = (NH_4)_4Fe(Cy)_6 + (NH_4)_2\ S.$$

The ammonium ferrocyanide so formed interacts with ferrous sulphate contained in the saturator to give ferrous ferrocyanide, a white precipitate, which afterwards is oxidised to Turnbull's or Prussian blue, thus:—

$$(NH_4)_4Fe(Cy)_6 + 2FeSO_4 = Fe_2Fe(Cy)_6 + 2(NH_4)_2\ SO_4.$$

The conclusion therefore is that blue coloration of the salt can only occur when local or total alkalinity produces a precipitate of ferrous sulphide, with which the alkaline cyanides entering the saturator can interact, and that, if the saturator be kept sufficiently acid, blue salt should not be obtained except when excessive priming occurs.

Working with an Otto-Hilgenstock Feldmann still and open saturator, it is invariably observed that, whenever blue salt (or salt afterwards turning blue) has appeared, the steam, entering the saturator with its charge of alkaline gases, was more or less condensing before reaching the saturator; and even if this irregularity were observed and corrected in a freshly-made up or strongly acid saturator, then the resulting salt was invariably tinged with blue. When this occurred, the acid in the saturator lost its "boil" and fell flat.

The following observations throw some light on the subject, which is an important one:—

(1) A still and vat, after having been in work for 10 days, at top-steam pressure, on a good make of white salt, so that a "free boil" was observed in the open part of the saturator, was allowed to prime by raising the steam pressure still further, at a time when the vat at 60° Tw. was nearly half-full of salt. The vat made up 2 in. in height, clouds of steam arose, and most of the salt went into solution. A quick change was effected to put the still into work again, and in 3½ hours the vat was "fished" at 57° Tw., when a good white salt was produced which did not turn blue on standing.

(2) A saturator (open type) which had been giving a good white salt for three weeks, owing to a temporary blockage in a waste gas bend "blew" badly for some five minutes. The attendant lowered his still pressure slightly while the obstruction, a choked condensation pipe, was removed. On returning to the vat, the steam pipe leading into the vat was tested and condensation was observed. This was at once rectified, everything being done within rather more than half an hour. The next batch of sulphate had a decidedly blue tint, deepening on storage. After about three "fishings," the blue tinge disappeared from the salt, and good white salt was obtained for the remaining period. The vat was in work some seven weeks.

The working temperatures of the saturator at various periods during saturation were taken, as also the temperature of the steam, ammonia, &c., as they entered. The saturator was worked on the intermittent "fishing" principle, and the cycles, from making up to "fishing," occupied from 6—8 hours. The following are the results:—

A.

Time.	Steam temperature.	Saturator temperature.	Twaddell.
p.m	° C.	° C.	
2.15	just made up	—	—
2.30	90	97	66·5
3.0	96	104	68·0
4.0	97	107	70·0
4.30	97	108	71·5
5.0	96	108	71·5
5.30	96	106	68·0 (Salt separating)
6.30	95	105	63·0
7.0	95	104	61·0
8.0	95	104	59·0 (Fishing)

B

Time.	Steam temperature.	Vat temperature.	Twaddell.
p.m.	° C.	° C.	
12.45	94	100	64·5
1.30	93	104	70·0
2.0	93	107	71·0
3.0	93	101	72·5
4.0	94	111	73·5
4.30	93	109	71·0 (Salt separating)
5.0	93	109	69·0
6.0	94	109	66.5
6.30	94	108	64·0 (Fishing)

In both these typical cases, the salt made was of a good white grey. No trace of blue or discoloration was noted after three weeks' storage. Samples of the acid liquor were taken from the saturator, both after the vat had been freshly made up and at "fishing" point, and were tested for iron and free acid:—

A. *Sample of "made up" vat.*

	Twaddell.	Fe_2O_3.	Free H_2SO_4.
		per cent.	per cent.
I	68	0·25	18·72
II	66	0·24	20·68
B. *Sample of "fishing" liquor.*			
I	58	0·52	4·12
II	57	0·46	4·65

The above samples when filtered hot were all of a light yellow colour, and the salts crystallised from the filtered solutions dead white. Portions of the samples were tested in the laboratory to discover, if possible, how blue salt could be made therefrom.

(1) Fifty grms. A (I.) were placed in a beaker, and ammonia liquor (freshly made) distilled into it for ten minutes. The temperature in A rose from 30° C. to 97° C. The solution was cooled so that salt crystallised out; no blue colour appeared. The free acid found after the test was 14·41 per cent.

(2) Fifty grms. (B) (I.) were treated as above; a bluish-green colour was noticed at first. The temperature rose from 30° C. to 95° C. The salt produced was slightly blue. The filtered cold solution was colourless. The free acid in solution amounted to 5 per cent. No precipitate of sulphide of iron was noticed.

(3) Sample A was treated with distilled liquor, but the distillate was passed through a condenser so as to keep the temperature below 30° C. A dark green precipitate was produced. The distillation was continued for 10 minutes, then the sample was vigorously boiled at a temperature of 101° C., evaporated to half its bulk, and allowed to crystallise. The salt had bright blue colours; the solution was also blue. The free acid in the solution amounted to 14·25 per cent. No black precipitate of ferrous sulphide was observed during the distillation.

(4) Solution B was treated with distilled liquor in the hot. The temperature rose from 94° C. to 98° C. during the distillation. The distillation was continued until the solution was nearly alkaline, and then allowed to crystallise. The salt was found to be of a dead white colour; the filtrate had a pale yellow colour. No sulphide of iron had been formed.

(5) Solution B was treated with hot distillate from the liquor. The temperature rose from 97° C. to 102° C. The distillation was continued till B was strongly alkaline; a black precipitate of sulphide of iron was formed. The salt which crystallised out was of a buff-brown colour when dried, the solution also was of a greenish-brown colour. A portion of hot solution was acidified with sulphuric acid, when effervescence occurred and H_2S evolved. The salt from this portion was white, and no trace of blue or green was observed in the solution.

(6) Solution A was treated with hot distillate from liquor, and the temperature in A kept above 100° C. 2 c.c. of raw cold liquor were introduced during distillation, when the temperature dropped from 103° C. to 100° C. Then the solution was cooled and the salt allowed to crystallise out. The salt was found to be dead white, the solution was pale yellow. There was a greenish colour produced where cold raw ammonia liquor met the solution A, which immediately disappeared with effervescence.

(7) Solution B was treated as above. The temperature dropped from 100° C. to 98° C. on introducing cold liquor, then rose again to 100° C. A green colour was noticed as in (6) where cold liquor met B, disappearing immediately with effervescence. The salt obtained was dead white in colour, and the solution pale yellow; no trace of blue or green was observed in either, nor any trace of black sulphides in either (6) or (7) when the cold liquor was introduced.

(8) Experiment (6) was repeated with A at 70° C., when the resultant salt and solution were both found to be also free from blue or green colorations.

(9) Solution A, kept at a temperature of 95°—100° C. was treated with condensed distillate from liquor. A greenish precipitate was formed, the solution afterwards boiled down. The crystallised salt, as also the solution, were deep blue in colour.

(10) Solution B was treated as in (9), whilst the temperature was kept between 100° C. and 103° C. in B. The resulting salt and liquor were deep blue.

In both (9) and (10) black sulphide of iron was noticed. where the condensed distillate met the hot solutions, immediately redissolving with effervescence.

(11) Solutions A and B were both treated with a few drops of potassium cyanide solution in the cold. A brisk effervescence occurred, and the salt obtained was in both cases blue, solution B giving a much deeper tinge than A. Both solutions were boiled down after addition of cyanide to allow the salt to crystallise out.

(12) Fifty c.c. of an 0·2 per cent. iron solution (ferrous iron) were treated with 5 grms. concentrated pure H_2SO_4; 2 c.c. of dilute potassium cyanide solution were added, when a deep blue colour was immediately produced. On boiling the solution, the blue colour was maintained.

(13) Experiment (12) was repeated, but with boiling solutions, when a deep blue colour was produced.

The ammonia liquor for the above tests was, in each case, tested for cyanides, and was always fresh. Cyanides were found in small proportions in each test made. The total ammonia ranged from 0·77 per cent. to 0·81 per cent.

It thus appears that the formation of blue salt is due to the presence of volatile cyanides in the saturator for a sufficiently long time to enable them to interact with the iron present in the acid. It can occur quite readily in a strongly acid solution, provided that time to react be allowed.

In ordinary working, the heat of reaction in a strongly acid solution is such that condensed cyanides entering the saturator would be more liable to be immediately vaporised, than in a partially or nearly saturated solution. This may no doubt explain why temporary irregularities in still working do not so readily give blue salt at the time when the liquor is strongly acid or "freshly made up."

If the formation of blue salt be due to local alkalinity, it is difficult to explain how it comes about that when a saturator "burns" or works on the alkaline side for a period it is quite possible to fish white or grey salt by adding an excess of acid at the time of "burning," and that such salt does not turn blue on storage.

When a vat has occasionally commenced to "burn," under the author's observation, the temperature of the steam and vat have been far too high to allow of volatile cyanides being fixed, and salt fished at such a time is invariably brown or "burnt," and if redissolved in acid and recrystallised, gives no trace of blue. The reaction of the volatile cyanides with the ferrous or ferric salts present in the acid, appear to take place only when sufficient time contact is allowed for their interaction, and this only occurs when condensation of the steam and gases entering the saturator takes place; it is also accompanied with bad results on the still working and high "waste liquors."

Several attempts to decompose the blue precipitate formed have been made, but without permanent success when the solutions were acid.

As a general rule, in order to make white salt, the still pressure should be so arranged that the steam enters the saturator dry. To this end, the liquor entering the top of the still must be superheated, and all steam pipes must be well covered. The temperature of the saturator must also be kept at 100° C., or slightly above if possible, and the size of the saturator should be so proportioned that this can be done by the steam carrying the ammonia from the still.

Priming of the liquor in the still, if continued to any extent, might cause "blue salt," by providing sufficient condensed cyanides for interaction in the vat; but in the author's opinion it is a rare cause, and may actually occur for a few minutes without the resultant salt being blue.

Further experiments, with a view to ascertain whether acid cyanides can interact with acid ferrous or ferric salts in the presence of ammonium sulphate, are being made.

The author wishes to thank Mr. Carpenter, H.M. Chief Inspector of Alkali Works, and Mr. Linder for their valuable criticism and suggestions.

Discussion.

Mr. R. **Forbes Carpenter** hoped that the discussion of the paper would ultimately prove that no irreconciliable differences existed between the views held by the author and himself as to the causes leading to the production of blue salt. While Mr. Linder's experiments recorded in the last Annual Report showed that local alkalinity in the saturator was, he believed, a necessary precedent condition, Mr. Bailey's experiments had naturally led him to attach very great importance to the conditions produced by low temperature in the saturator and in the gases and vapours coming to it from the still as favouring condensation. Low temperature in favouring condensation tended to produce two conditions necessary before blue salt resulted: (1) Local alkalinity in the interior and neighbourhood of the vapour distributing pipe, because there would be lessened boil in the saturator liquors, and so less rapid mixture of their contents, leading even to stagnant conditions in parts. (2) Increased solubility of hydrocyanic acid, and so increase opportunity for formation of ferrocyanide in alkaline or neutral solution in the above-mentioned proximity to the distributing pipe. Soluble iron salts must also be present. These were usually present in some measure in the acid. Various accidental circumstances, such as were mentioned in the report, might lead to a temporary increase in the percentage of iron present in the liquors in the saturator.

The product first formed in these conditions was ammonium ferrous ferrocyanide, a *white*, insoluble salt, which pitched with the crystals of ammonium sulphate, and was fished with them. On exposure to air, oxidation took place, with the familiar blue tinge as a result in the mass of ammonium sulphate crystals.

At one works known to him, the workmen among themselves had invented a test by applying a ferric salt in acid solution to a sample fresh drawn from the saturator. Each man on taking over the charge of the saturator from his mate applied the test, so that the blame, if due, might attach to the right person. Since it was clearly recognised that the objectionable white ammonium ferrous ferrocyanide might be already formed, to be fished with the salt at a *later* stage only.

Had Mr. Bailey applied oxidation tests to the samples of salt obtained in his experiment, so as to prove absence of contamination? The most convenient way was to add a few drops of hydrogen peroxide, when blue colours would at once develop if ferrocyanides were present.

One set of Mr. Bailey's laboratory experiments was quite apart from those carried out on samples of liquor derived from the factory, *viz.*, those in which to solutions of iron salts, rendered strongly acid by sulphuric acid, solution of potassium cyanide was added with resultant blue coloration. Mr. Linder had repeated these experiments, but without obtaining any blue colour, or even tint, unless the precaution was observed of pouring the strong potassium cyanide carefully on the surface of the acid solution. As the cyanide had a strongly alkaline reaction, at the junction of the two liquids a momentary precipitation of ferric oxide was observed. On shaking, this immediately, of course, dissolved; but locally alkaline conditions had lasted sufficiently long to result in the formation of a trace of ferrocyanide, with resulting very slight blue tint in the solution. These conditions were very special, and were not those obtaining in a saturator.

Conversely, the experiments of both Mr. Linder and Mr. Bailey showed that the conditions for avoiding blue salt were to avoid priming, therefore to keep steam pressure regular; to avoid condensation of liquor distillates in the saturator, therefore to keep up the temperature of the latter and maintain a good boil and rapid mixing of the saturator contents, and so avoid local alkalinity in solution, which, generally speaking, would still show excess of free acid, and so also avoid opportunity for solution of hydrocyanic acid from the vapours, or the saturator liquor. Also avoid accumulation of iron salts.

Mr. W. H. **Coleman** said that his experience tended to confirm the view taken by Mr. Carpenter and Mr. Linder in the Alkali Report, that the formation of blue salt was due to an alkaline saturator. It seemed to him that when condensation took place in the pipe conveying the ammonia gas and steam to the saturator, one had all the conditions necessary for the formation of ammonium ferrocyanide, and consequently of blue salt. The interior surface of the iron pipe would be covered with a film of condensed liquor containing ammonia and hydrocyanic acid, and this would combine with the crust of iron sulphide nearly always found on the interior surface of the pipe to form ammonium ferrocyanide, which would form Prussian blue with any iron contained in the saturator liquor when it became acid again. Of course white ferrous ferrocyanide would be formed first, which would oxidise into the blue ferric compound.

In view of this paper, he had tried some experiments in the laboratory, and had found that with an average sample of gas liquor, Prussian blue was always formed if the distillate was allowed to become alkaline when an iron compound was present in the acid in which the gas was absorbed. No blue was formed when either ammonium sulphocyanide or ferrocyanide was distilled in the presence of ammonium bicarbonate or sulphide, so that it seemed that in order to get blue salt the gas liquor must contain ammonium cyanide.

There was more danger of getting blue salt when very fresh gas liquor was distilled, as on standing most of the ammonium cyanide was converted into sulpho- or ferrocyanide.

Mr. H. J. **Bailey**, in reply, said he was inclined to agree with Mr. Carpenter that fixation of cyanides could only occur in the alkaline state. He had found it extremely difficult to get a neutral cyanide. He had tried distilling ammonium sulphate with potassium cyanide made as neutral as possible, and had obtained a brilliant blue colour on distilling into ordinary saturator liquor. The samples were allowed to stand exposed to the air for three weeks before comparing the colours, and all crystallised salts were then treated with hydrogen peroxide and stood the test. The colour of the salt when fished was never taken as conclusive. Blue salt had to be sold generally at something like 20s. under the price of white or grey salt. Since working on the theory of still temperature, he had never had "blue salt" except in case of accidents, although for six months previous nothing but "blue salt" had been made. The potassium cyanide referred to by Mr. Carpenter was not neutral, but as nearly so as it could be made.

In reply to Mr. Coleman, if the iron piping was the cause it was difficult to explain the erratic way in which blue salt was formed, and there was always enough iron in the acids used commercially to supply all the iron salts necessary. With continuous fishing saturators, the Twaddell never went below about 61°, which corresponded to about 8·5 per cent. free acid, and yet blue salt had been made in such saturators. He agreed with Mr. Coleman that it was necessary for the cyanides to occur as ammonium cyanide to give blue salt, but that he had also found a solution of ammonium sulphocyanide to be distillable to a certain extent, although text-books said the reverse.

He was afraid an insufficiency of acid would not account for all the difficulties met with, as where a series of steam bubbles containing from 14 to 18 per cent. of free ammonia passed through a dilute acid solution, as in a sulphate saturator, there must always be points of local alkalinity; and if there were no other conditions necessary, "blue salt" should, in his opinion, be continually made; but his opinion was that the temperature and time of contact did not allow of the fixation of the cyanides, unless the steam carrying these cyanides was partially condensed before passing through the acid liquor. That would come to be the solution generally accepted. The routine of the sulphate house had no doubt a great deal to do with the question and required the closest personal supervision.

Meeting held at Manchester on Friday, April 5, 1907.

DR. G. H. BAILEY IN THE CHAIR.

ACTION OF HEAT ON QUARTZ AND MAGNESIA PYROMETER TUBES.

BY T. J. AUSTIN AND J. W. MELLOR, D.SC.

Fig. 1 shows the minute structure of the quartz pyrometer tubes made by the Thermal Syndicate. The longitudinal canals in the glassy quartz are air bubbles in the original fused quartz, which have been drawn out in the making of the tubes. After heating two or three times to 1350°, the tube disintegrates and crumbles to pieces. The state of the tube after firing seven times is shown in Fig. 2. The heating and cooling was very gradual, extending over three days. Fig. 3 is a time-temperature curve of the same oven which was taken simultaneously with Féry's and Le Chatelier's pyrometers. No crystalline formations were observed in polarised light.

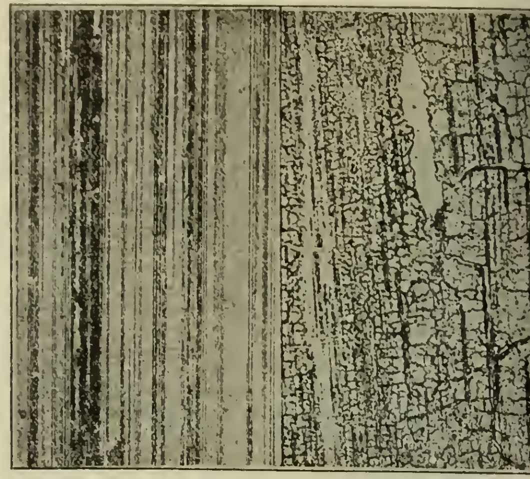


FIG. 1. FIG. 2.

Quartz pyrometer tube, × 24.

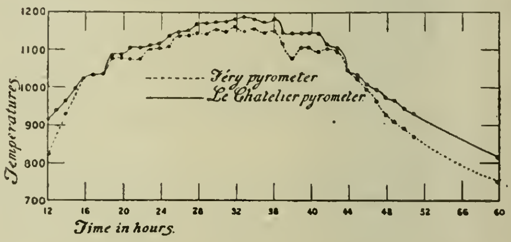


FIG. 3.

The unglazed magnesia pyrometer tubes did not suffer any marked change when heated under the same conditions. There was no particular increase in "brittleness." The structure of the new tube is shown in Fig. 4, and after firing seven times in Fig. 5. Tubes made from fused magnesia are therefore very promising, provided they prove sufficiently impermeable to gases likely to injure the pyrometer wires. If the tubes were glazed in order to diminish their permeability to the furnace gases, they would probably become more susceptible to "dangerous" crystallisation.

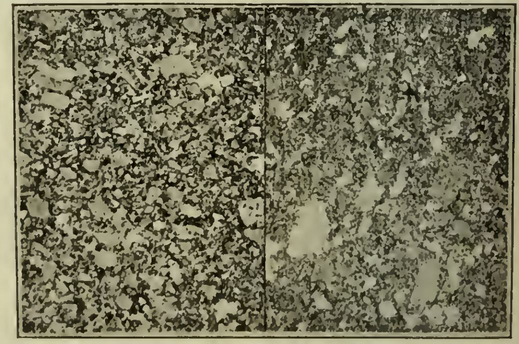


FIG. 4. FIG. 5.

Magnesia pyrometer tube, × 24.

We thank Dr. R. S. Hutton for kindly supplying us with the specimens used in this work; and Mr. S. T. Wilson, Park Works, Fenton, for firing the tubes in his china biscuit ovens.

New York Section.

Meeting held at Chemists' Club on Friday, Feb. 15, 1907.

MR. GEORGE C. STONE IN THE CHAIR.

THE ORIGIN AND PRODUCTION OF CAMPHOR.

BY PROF. H. H. RUSBY.

One of the most important questions with regard to camphor relates to the practicability of introducing and cultivating the camphor tree for the production of camphor in other countries than those of which it is a native. An answer to this question requires a preliminary review of the principal facts regarding the present sources of supply and the conditions of production.

For many years, three sources of camphor were known, namely, the interior of China, the Island of Formosa, and Japan. Of these, the Formosan product was for a long time very important. It was nominally controlled by the Chinese, so that it, as well as the China product proper, went under the general name of Chinese camphor. The Chinese, however, neglected the industry in every way, so that it finally declined to small and unimportant proportions. Under these circumstances, and after the war with China, Japan assumed the control of the industry in Formosa. The character of this control, both as regards the production and the commerce of camphor, is entirely satisfactory in ordinary times, but under certain conditions, it may become a serious menace to other countries. The use of camphor products in the manufacture of military explosives has now become so important that the control of the camphor supply confers a very great advantage upon the country thus favoured.* It is by no means impossible that this consideration may yet largely determine the question of the undertaking of some war. The subject of introducing the industry into other countries thus assumes a national importance far in excess of ordinary questions regarding agricultural extensions, and many suggestions regarding such operations, in various countries, have been made. Some of the questions thus raised are answered in the following statement:—

The camphor tree belongs to a hardy branch of the family *Lauraceæ*, or laurel family, and it shares in their hardy qualities. It grows freely, easily, and abundantly in its forests, and its range of adaptability to variation in soil, altitude, and climate is very considerable. It grows well in the Mediterranean basin, on both sides of that sea, and is common in southern Europe as an ornamental tree. Such attempts as have been made in British India show it to be adapted to growth over large areas of that country. It can be grown in Australia, in Mexico, in the West Indies, and in Southern California. I have seen it doing well in Florida, and know of its cultivation as far north as the Carolinas. It appears, therefore, to be easy of introduction into sub-tropical countries. There are forest belts running for thousands of miles along the Eastern Andes of South America, where closely related and similar trees grow in great abundance and variety and attain a large size, and there seems little doubt that the camphor tree would flourish there. The prospects for the cultivation of the camphor tree thus appears to be most promising.

The proper answer to the second question is much more doubtful. It must be remembered that camphor is not a crop in the sense in which fruits, seeds, roots, tubers, &c., are crops. Camphor is a proximate principle, originating as a derivative of certain physiological processes in the plant. Its relations to these processes have not been studied. We do not know whether they are continuous. Certainly there is the best of evidence that they are not regular in intensity. Although the process is primarily physiological, its amount is very likely determined by pathological conditions. In any case, we are justified in believing that the amount of camphor produced depends upon exigencies which make its production in the tree more or less of an emergency process. In other plants, the occurrence of products which appear to have similar relations to those governing camphor formation is highly irregular. Cinnamon, a close relative of camphor, is collected only from a small portion of the wild trees, each of which must be tested by the collector. The wood of another related tree which I have encountered in Venezuela yields an oil consisting almost wholly of apiol, but one must search pretty carefully in making his selection among the trees, lest he cut those which contain none or very little of it. The camphor tree, we are told, exhibits a similar peculiarity. The collectors find it necessary to select the most experienced of their number as an expert, to examine the trees individually, selecting and marking those which promise a satisfactory yield, these being only a small minority of the whole. So wide is the variation in this respect that there is scarcely such a thing as an average percentage yield of camphor.

The above facts at once raise a serious doubt in the case of any particular country as to the yield of camphor, even though the tree grew satisfactorily. We know, for example, that the yield of eucalyptol is very unsatisfactory from trees growing in some regions. There is no way of deciding such a question except by trial, and when it comes to this, we are faced by the fact that not until the trees are about fifty years of age can any satisfactory conclusions be drawn. Even if the experiment be wholly successful, this is a very long time to wait for a financial return. The element of foreign competition in the production of camphor is thus seen to be pretty completely eliminated, so far as private enterprise is concerned. It is not likely that any other party than a wealthy government, which can afford not only to wait for a century, but to lose its investment if the enterprise fails, is likely to undertake this business.

So far as the extraction of the camphor is concerned, once it is formed in the tree there is very little in the way of obstacles to contend against. The wood is simply chipped up and the camphor is driven off by means of steam. Of course the grade or quality of the product will vary more or less according to the care exercised in the process, but the operation in general is of the simplest character.

The most important cause of the decline of the Formosa camphor industry, in the hands of the Chinese, was the fact that collection was necessary in a country dominated by the fiercest of savages, the workmen pursuing their vocation under the most dangerous conditions. After its collection, the camphor was handled by speculators who were not only of the greediest character, but who had not sufficient judgment and restraint to avoid the destruction of their own business. One of their offences was that of ill-treating their collectors to such an extent as to make their industry unprofitable. At the same time, they kept the foreign trade in a most unsatisfactory state by conniving at, or permitting speculative corners, so that the commerce in camphor was really hazardous. A far more serious offence was the ruthless destruction of the trees, with no provision for afforestation—very much what we have seen occur among the turpentine forests of the United States. Under the control of the Japanese, all of these conditions have been changed. The force of collectors is organised, their product is all taken by the Government, and they are guaranteed a fair return for their labour. Out of the proceeds of the business, the Government provides a large and adequate police force, maintaining a frontier line beyond the region of collection, which the savages are not allowed to pass. The selling of the camphor is transacted by the Government through a single agent, who secures the privilege by bidding against competitors, and who is required to maintain certain conditions in the domestic and foreign trade which tend to stability and regularity.

PURIFYING AND REFINING OF NATURAL CAMPHOR.

BY GUSTAV DROBEGG.

The purification and refining of natural camphor does not offer many scientific problems. The principal methods applied in practice are:—

Resublimation.—In Europe this is done principally in glass retorts, yielding a round, concave cake weighing 6—8 lb., having an opening in the centre. In America the camphor is sublimed from flat iron pans with iron covers, yielding plates of about 18 in. square, and 1 in. thick, weighing from 8—10 lb.

Condensation.—Camphor vapours are led into large stone or metal chambers, where they are cooled and condensed to a microcrystalline powder, which is afterwards pressed (hydraulically) into cubes or plates.

Crystallisation.—The crude material is dissolved in boiling benzene or petroleum ether, allowed to settle, filtered, and, after crystallisation, dried in centrifugal machines.

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* (See, however, Schüpphaus, p. 383, col. 2.)

Crude camphor appears in commerce as a coarse wet powder of a greyish-white colour. Chinese camphor is packed in round wooden pots of about 150 lb. net content; Japanese in lead-lined wooden boxes containing about 130 lb. net.

The rare kinds of camphor—borneol, Chinese camphor, Sumatra camphor, &c.—do not come in consideration from the point of view of the refiner.

The principal impurities of crude camphor are water, camphor-oil, iron, sand, wood, &c. The camphor-oil is separated from the crystalline product in Japan, and in the past has been of little value. At present it is much higher in price, owing to its valuable ingredients. Light oil of camphor has a sp. gr. of 0·895 to 0·920; b. pt., 170°—180° C., and contains pinene, camphene, dipentene, phellandrene, &c. Heavy oil of camphor, having a sp. gr. of 0·960—0·970 and b. pt. 240°—300° C., contains sesquiterpene, safrol, eugenol, cineone, fenchone, terpinone, &c. Besides these compounds, both of the oils contain a large amount of camphor in solution, which years ago was a profitable commercial raw material after being frozen out.

To the refiner the two most objectionable impurities of crude camphor are oil and water, which must be removed before refining, as the oil gives the refined camphor a fatty touch, and the water renders it opaque. The elimination of water and oil is often effected by washing in a centrifugal machine with small quantities of water; the liquor draining off contains both oil and water. The separation is also done by hydraulic pressure; or for freeing it from water only, by placing the camphor in an air-tight chamber in layers 3—4 in. thick and 12 in. apart. Between those layers are inclined metal gutters charged with pieces of calcium chloride, which are subsequently regenerated. Another method of separation of oil and water from the camphor is to crystallise it from boiling benzene or petroleum ether solution (see p. 387), this prepared material being the most desirable for refining. The process of refining consists in mixing the prepared material with a little lime, charcoal, or iron filings, according to quality, and charging each pan with about 12 lb. of material; the subliming pans are heated slowly for two hours, and then fired rapidly up to 190° C., this temperature being kept for from 12—16 hours. After cooling, the refined product is removed from the cover by slightly heating the cover, and then cut into the desired shape.

HISTORY AND USES OF CAMPHOR IN PHARMACY AND MEDICINE.

BY PROF. VIRGIL COBLENTZ.

History.—The wood of the camphor tree was known and highly prized in the Far East long before the stearoptene made its appearance in commerce. There are two distinctly different varieties of the drug, the one form called the Chinese or Japanese camphor, derived from the camphor laurel (*Cinnamomum camphora*), indigenous to Central China, Formosa, and the Japansee Islands, and Borneo camphor (*Dryobalanops aromatica*) indigenous to Borneo and Sumatra. This Borneo variety, chemically known as borneol or camphyl alcohol, is, without doubt, the first that came to the notice of Europeans.

In a Thibetan work on medicines, (1) taken from the Sanskrit, which appeared during the 8th century, camphor is mentioned under the name of "Karpūra" as a Hindoo remedy. This Malay camphor found its way from the East by way of Arabia, carrying with it its origin as indicated through the names Káfur and Caphura. It is highly probable that this drug was employed as a medicine during the prevalence of the pest in Constantinople during the years 451 to 490 A.D. During this period the Byzantine Empire was the centre of art and learning, and naturally attracted men of science and learning from the East. One of the oldest relics of the Arabian literature, the poems of Imru-l-Kais (2) (6th century), mentions camphor. About this time, Aetius of Amida, an Alexandrian physician attached to the court of the Emperor Justinian, employed this very costly addition to his celebrated all-healing ointments, calling it "Caphura."

Up to this period, and subsequently for centuries, camphor was regarded as one of the rarest and most precious of perfumes, being classed along with musk, ambergris, civet, and sandal-wood. These drugs were mentioned in A.D. 636, among the treasures of Chosroes II., of the Sassanian dynasty of Persian kings, in the palace at Madain, north of Babylon. (3) Among the immense stores of valuables disposed of at Cairo, following the downfall of the Fatimite Khalif Mostanser, in the 11th century, were large quantities of camphor of Kaisur, and hundreds of "melons in camphor," which were adorned with gold and jewels, and contained in vessels of gold and porcelain. (4) During the early part of the 7th century, camphor figured largely among the tribute gifts made by the Indian princes to the Chinese, in the Teenpaou period (742—755). The Cochin Chinese offered as tribute Barus camphor, which was stated to be found in trunks of very old trees. Between A.D. 1342 and 1352, the Great Khan sent from Pekin to Pope Benedict XII. treasures of silk, precious stones, musk, and camphor. Abul Hasan Ali el Masudi, about A.D. 912, made many journeys to the East, and was among the first to point out the source of camphor, stating this to be the Malayan Archipelago, more particularly Fansur. This place was visited in the 13th century by Marco Polo, who called it "Kaisur," which is now believed to be Barus, a town in Western Sumatra.

The variety of camphor thus far described was the Borneo camphor which was found in trunks of the Sumatran *Dryobalanops aromatica*. Nothing is known as to the origin of the manufacture of the Chinese laurel camphor. Garcia de Orta (1563) states that only the Chinese camphor is exported to Europe, while that of Borneo and Sumatra is too costly, and is all consumed in embalming and eating, *i.e.*, for the preparation of the betel leaves for chewing.

Engelbert Kaempfer, (5) the learned explorer, who resided in Japan in 1690—2, described the tree under the name of *Laurus camphorifera*, and declared that this was an entirely different tree from that which yielded the camphor of Borneo. This latter variety of camphor was imported into Japan by the Dutch, and from thence into Holland. Interesting in this connection is an ancient "History of Druggs," by Pomet (date unknown), from which the following is quoted:—"Camphire is a resinous and very combustible gum, and of a penetrating smell, easie to dissipate into the air, because of the Sulphur and volatile Salt, of which it is composed, which flows from the Trunk and large branches of several great Trees." "This rough or unrefined Camphire is sometimes to be met with at Rouen, from whence it is sent to Holland to be refined, because nobody else will take the Pains or Trouble to do it but the Hollanders." "I wonder what all our Chymists have thought on, that they never have inserted into their Books the Manner and Way of Refining Camphire." "I will lay down the Manner of Refining it, which was never told me by any Person, but as I discover'd it by Experience."

The Abbot Hildegard (11th century), of Ruprechtsberg, near Bingen, mentions the various medicinal uses of this drug, naming it "Ganphora." Caspar Neumann (1683—1737), (6) the first German apothecary possessing a scientific education, author of a work on Pharmacognosy, describes camphor as a product of the oil of thyme, known in England as *sal volatile thymi*. Later, camphor was confused with thymol and other stearoptenes. The first Pharmacopœia to recognise camphor was the Pun-tsao-kang-muh, of Le-she-tchin, published in the middle of the 16th century; this work recognised both varieties of this drug. The first Persian Pharmacopœia, (7) published by Mir Muhamed Husian (1769—71) mentions this drug under the name of "Káfût." In 1693 the physician and apothecary Diederich Hoffstadt, of Wittenberg, published a formula for a "Heavenly Theriac" (*Panacea cœlestis*), which was made up of 184 medicinal remedies, among which was camphor. After the decline of "shot-gun" therapeutics, exemplified in the so-called "theriacs," camphor was administered in the form of a bolus or large pill-mass. In this form it was employed at one time by the monks as an anaphrodisiac, which, however, was supplanted by small sacks of camphor hung about the neck. This practice is still in vogue to-day among certain classes, being used, however, for the purpose of warding off disease.

Pharmaceutical and medicinal uses.—Pommet's "General History of Drugs" (17th century) gives some early peculiar views as to the medicinal virtues of camphor. "Camphire when refined is of a white Chrystalline Colour, and a strong odiferous Smell, volatile in Quality, and ready to dissolve in oily and spirituous Bodies: Being set on Fire, it is almost unextinguishable, burning not only in the Air, but Water, and therefore is a proper Ingredient for all Sorts of Wild Fire." "It is also good in continual and intermitting Fevers, whether Putrid, Malign or Pestelential being given inwardly or hung about the Neck; because being of such subtile Parts, it insensibly enters into the pores, and causes Rarefaction and Perspiration." The chief action of camphor is upon the nervous system, being used as antispasmodic and stimulant in diseases of the typhoid character where there is a frequent irritated pulse, dry skin, and nervous derangement. It is employed in functional nervous disorders, *e.g.*, hysteria, dysmenorrhœia, flatulence, colic, &c. In Germany camphor is generally used as a cardiac and stimulant. Locally it is an anodyne; in large quantities it is an irritant with benumbing influence on the peripheral nerves of the mucous membranes. It is eliminated as campho-glycuronic acid. Overdoses produce faintness, vertigo, headache, delirium, insensibility, and paralysis. There is no known antidote; after evacuation of the stomach, the symptoms are combated as they arise.

Camphor possesses an inhibitory action upon the growth of spores as strong as that of salicylic and benzoic acid.

Emerson Reynolds, of Dublin, introduced a preparation known as "Thiocamph," obtained by passing sulphur dioxide over camphor, when an absorption of the former took place; on heating, the absorbed gas was given off, 200 grms. of thiocamph yielding 20 litres of gas. The smallest quantity of camphor noticeable by its odour is 0·000005 grm. per litre of air, artificial musk being noticeable to the extent of 0·000001 grm. per litre of air. When triturated or brought into intimate contact with various organic substances, camphor passes into solution, which, upon the addition of water, again breaks up into its constituents. Among these substances are salol, resorcinol, menthol, the naphthols, catechol, thymol, various solid organic acids, &c. The oldest pharmaceutical preparations of camphor were solutions in various fatty, volatile, and mineral oils, alcohol and vinegar. At present there are from thirty to forty different forms in which this drug is employed in pharmacy and medicine.

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(1) Pub. of Csoma de Körös, Jour. Asiat. Soc. of Calcutta, iv., 1^2, Geschichte der Pharmazie, Schelenz, 55.

(2) Pharmacographia, Flueckiger and Hanbury, p. 511.

(3) Geschichte der Chalifen, Pharmacographia, Flueckiger, 511.

(4) Kaeuffer, Geschichte von Ostosien, *ibid.*

(5) *Exoticarum plantarum Japonicarum*, 1712.

(6) Lebensbeschreibung Neumanns, Phar. Ztg., 1896, 88; 1898, 262.

(7) Kobert, Histor. Studien, 1893, 299.

TECHNICAL APPLICATION OF CAMPHOR.

BY R. C. SCHUEPPHAUS, PH.D.

Two-thirds of the total production of camphor is consumed in the celluloid industry. Comparatively small quantities of waste celluloid (scrap) are used in the manufacture of artificial leather, varnishes, pool and billiard balls, and phonograph records. Twenty years ago, when camphor was cheap, I found it in a shellac composition, an imitation of celluloid, where it served no useful purpose, and had undoubtedly been added for the purpose of deception. Owing to misleading statements in the literature bearing on the subject, it is widely believed that celluloid can be and is manufactured by subjecting an intimate mixture of finely pulped nitrocellulose, preferably moist, and pulverised camphor to the joint action of heat and pressure. As a matter of fact, the material is made by passing an intimate mixture of nitrocellulose, either moist or dry, and camphor in conjunction with a suitable solvent, ordinarily wood or grain alcohol, or a mixture of the two, and such other materials as it is desired to incorporate therewith, between slightly heated rolls, until finally the whole mass is converted into homogeneous sheets. These sheets are either pressed into dense blocks and thereafter cut into sheets of definite thickness, or they are fed into a press and formed into rods, tubes, and the like.

In 1884 I made an extensive series of experiments on the action of heat and pressure on intimate mixtures of nitrocellulose, both dry and moist, and camphor. There was no difficulty in obtaining hard, horn-like, transparent masses, but in all cases there were clear indications of incipient decomposition, with formation of an acid. The nitrocellulose employed was the ordinary factory product of substantially the same properties as the article produced to-day. In some cases explosion ensued. The evolution of acid may be masked when basic substances, such as zinc oxide, are contained in the mixture. It may be of interest to note that the liquid obtained by passing nitrogen dioxide over camphor dissolves nitrocellulose with ease.

A few words regarding the history of celluloid may not be out of place. It is a very old practice to add camphor to varnishes, with the object of preventing cracking and curing other defects. Daniel Spill, the inventor of the material commonly called celluloid, knew of this practice, and availed himself of it in making his caoutchouc compositions. He communicated his ideas to Alexander Parkes, a name well known in the celluloid industry. In his British patent of 1869 Spill described his fundamental discovery that ordinary grain alcohol in conjunction with camphor is an efficient solvent of nitrocellulose. The celluloid industry, like the coal-tar industry, was born on British soil, but it attained its quickest and most vigorous growth in the United States, into which tons of the material made in Spill's works were imported. When later on the American owners of Spill's rights brought a suit for the infringement of his patent, this suit was first won, but finally lost, Spill's invention being held to be anticipated by the somewhat older Parkes' patent. In his specification Parkes names, among a large number of solvents and menstrua, absolute alcohol and camphor. It was decided that in following Parkes' directions these two might be used jointly, and that there was no invention in Spill's substituting commercial grain alcohol for the absolute.

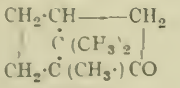
The widespread idea that camphor enters largely into the manufacture of explosives and smokeless powders has no foundation in fact. It was undoubtedly produced by the publication of Nobel's first patents on the manufacture of nitroglycerine propelling powders when the marked rise of the price of camphor in recent times began. There was also an earlier patent of his on the manufacture of waterproof fuse that calls for the employment of camphor. The grains of a certain sporting powder were hardened at one time by means of a camphor solution, but the quantities consumed must have been small. Military explosive gelatin, which contains camphor, is but little used at the present time. The last large quantity made in this country was furnished by Mr. Hudson Maxim and myself to equip the Brazilian dynamite cruiser, "Nictheroy," in 1894.

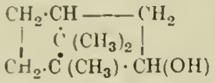
SYNTHESES OF CAMPHOR.

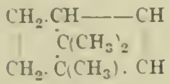
BY F. J. POND, PH.D.

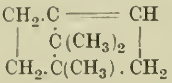
The preparation of synthetic camphor by a process which shall permit of the synthetic product competing in the open market with natural camphor is a matter of very considerable interest and commercial importance at the present time, owing to the unusually high prices of natural Japanese and Formosa camphor. During the past six or seven years, considerable time, study, and money have been devoted to this subject, with varying degrees of success. To-day, at least one process is apparently a commercial success, and is capable of yielding a synthetic camphor which is being brought into the market and is competing to some extent with natural camphor. *Synthetic camphor* means a substance consisting essentially of the compound, $C_{10}H_{16}O$, which is identical with natural camphor in its chemical structure and in all its chemical properties, and does not refer to the compound long known under the name "artificial camphor," which is prepared by passing dry hydrogen chloride through well cooled, dry turpentine oil, and consists of the hydrochloride of the terpene, pinene, and has the formula, $C_{10}H_{16}\cdot HCl$. This pinene hydrochloride has a camphor-like odour, but otherwise is of course a totally different product from natural camphor. In order to avoid confusion with this substance, the artificially prepared true camphor is termed synthetic camphor.

A knowledge of the molecular structure of natural camphor was of fundamental importance in the synthetic preparation of camphor. This has been fairly well supplied by the results of many investigations, especially by those of Bredt(¹). Bredt's formula for camphor, which has been conclusively established by the synthesis of camphoric acid by Komppa (this J., 1904, 78), and his formulæ for the related compounds, pinene, camphene, and borneol, are :—


Camphor.

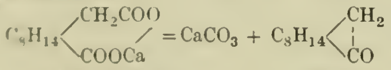

Borneol.


Camphene.


Pinene.

It has long been known that camphor is obtained by the oxidation of natural borneol with nitric acid, chromic acid, or potassium permanganate. While this in itself is of no commercial importance, the oxidation of synthetic borneols forms the last step in the preparation of synthetic camphor. It should also be noted that camphene yields some camphor upon oxidation with a chromic acid mixture, as also with some other oxidising agents.

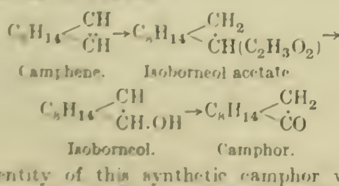
Of the various syntheses of camphor, one of the most important from a theoretical view point is the partial synthesis, which was accomplished by Bredt and v. Rosenberg(²) by the dry distillation of the calcium salt of homo-camphoric acid, $C_{11}H_{16}O_7Ca$; on heating, this salt forms calcium carbonate and camphor, this synthesis being quite analogous to the syntheses of many ketopentamethylenes :—


$$C_8H_{14}\left\langle\begin{matrix}CH_2COO\\ \quad / \\ COOCa\end{matrix}\right. = CaCO_3 + C_8H_{14}\left\langle\begin{matrix}CH_2\\ | \\ CO\end{matrix}\right.$$

Calcium salt of homocamphoric acid. Camphor.

This synthesis of camphor is in reality only a partial synthesis, since up to the present time homocamphoric acid has been prepared only from a derivative of camphor, *viz.*, camphonitrile, $C_{10}H_{15}OCN$. Naturally, this synthesis is of no commercial significance in itself.

A discovery of the highest importance for the commercial synthesis of camphor was made in 1892 by Bertram and Walbaum(³), who found that when camphene is heated at 50° to 60° C. for a few hours with a mixture of glacial acetic acid and 4 per cent. of half strength sulphuric acid, isoborneol acetate readily separates in good quantity; the resultant oil is washed with water, and, without further purification, is converted into isoborneol, $C_{10}H_{17}OH$, by treatment with alcoholic potassium hydroxide. This isoborneol smells like borneol, melts at 212° C., and is converted into ordinary camphor by oxidation with nitric acid or with a solution of chromic anhydride in glacial acetic acid. This synthesis of camphor may be represented as follows :—


$$C_8H_{14}\left\langle\begin{matrix}CH\\ \dot{\ddot{C}}H\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CH_2\\ \dot{C}H(C_2H_3O_2)\end{matrix}\right. \rightarrow$$

Camphene. Isoborneol acetate

$$C_8H_{14}\left\langle\begin{matrix}CH\\ \dot{C}H.OH\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CH_2\\ \dot{C}O\end{matrix}\right.$$

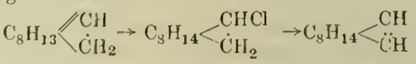
Isoborneol. Camphor.

The identity of this synthetic camphor with Japan camphor was especially established by Bertram and Walbaum's observation, that it gave a mixture of borneol and isoborneol by reduction with sodium and alcohol.

This synthesis of camphor by Bertram and Walbaum is the basis of many of the more recent processes proposed for the manufacture of camphor, the modifications suggested being to use other acids than acetic for the formation of the isobornyl esters, and other oxidising agents than chromic acid. At the time of its discovery, *viz.*, in 1892, camphene was an expensive compound found only in chemical museums, and prepared with difficulty in relatively small quantities at a time. As a natural product, camphene has been recognised as a constituent of about 12 volatile oils, although in all probability it occurs together with pinene in many other oils, but always in relatively small quantities. Previous to the year 1901, camphene had been artificially prepared in very small quantities by the action of concentrated sulphuric acid upon pinene(⁴), and by the elimination of hydrogen-chloride, -bromide, and -iodide from pinene hydro-chloride, -bromide, and -iodide, and from the corresponding bornyl-chloride, -bromide, and -iodide. The agents which had been used for the removal of the halogen acids from these compounds were sodium acetate and glacial acetic acid(⁵) at 200° C., alcoholic potash at a high temperature, aniline(⁶), caustic potash, and calcined magnesia(⁷), sodium alcoholate(⁸), (distillation over) lime (⁹), (heating with) water under pressure(¹⁰), and (heating with) sodium benzoate or stearate (Berthelot and Riban). None of these agents, however, was found to act completely; the yield of camphene was small, and the product always contained some pinene halogen hydride. Camphene had also been formed by the action of dehydrating agents upon borneol and isoborneol(¹¹). Obviously, therefore, before a synthesis of camphor based on Bertram and Walbaum's reaction could attain any commercial success, a cheap method of preparing large quantities of camphene had to be worked out.

Since 1901, the following methods have been developed and patented for the commercial manufacture of camphene in large quantities, by the removal of hydrogen chloride from pinene hydrochloride :—Heating the hydrochloride with bases of the aliphatic series(¹²) such as methylamine, dimethylamine, &c., and with piperazine and piperidine; by heating the hydrochloride with alcoholic, aqueous, or gaseous ammonia(¹³); by heating with aqueous sodium hydroxide or ammonia in the presence of a soap(¹⁴) (sodium or ammonium stearate, the latter being used as a solvent for the pinene hydrochloride); by heating the hydrochloride with aqueous or anhydrous alkaline phenolates(¹⁵), with aqueous, alkaline solutions of the higher fatty acids(¹⁶), and with lead acetate in a glacial acetic acid solution(¹⁷). The camphene obtained by many of these new methods is said to be formed almost quantitatively, and to be exceptionally free from chloride.

Based upon the adequate supply of camphene now made available, various syntheses of camphor have been proposed. One of the more important of these syntheses, which is carried on in a commercial way, consists in the preparation of pinene hydrochloride from turpentine oil, which contains about 70 per cent. of pinene; the conversion of this pinene hydrochloride into camphene, and the transformation of this camphene into isoborneol, which in turn is oxidised to camphor, is represented by the following formulæ :—


$$C_8H_{13}\left\langle\begin{matrix}/\!\!/ CH\\ \dot{C}H_2\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CHCl\\ \dot{C}H_2\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CH\\ \ddot{C}H\end{matrix}\right.$$

Pinene. Pinene hydrochloride. Camphene.

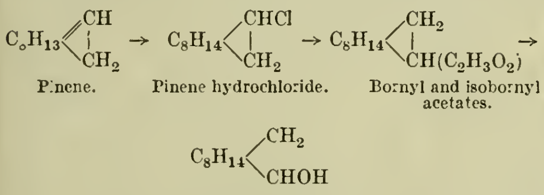
which is converted into camphor as already described.

The camphene obtained by a suitable method is treated with a mixture of glacial acetic acid and 4 per cent. of half strength sulphuric acid, according to the above-mentioned method of Bertram and Walbaum's, their patent(¹⁸) having expired. Isobornyl acetate is readily formed by this treatment, and separates as an oil, boiling at about 225°. This is then saponified, and the resulting isoborneol is precipitated as a solid mass, which is filtered and crystallised from petroleum ether or benzene. The pure isoborneol is then oxidised to camphor, the use of various oxidising agents having been patented; some of these agents are :—Permanganate in glacial acetic acid solution(¹⁹), aqueous solution of permanganate (on a benzene solution of isoborneol)(²⁰), permanganate in an acetone solution(²¹), gaseous chlorine(²²), ozone (on a solution of isoborneol in petroleum ether or acetic acid(²³), nitrous acid(²⁴), air or oxygen in presence of a contact substance(²⁵), a mixture of nitrous and nitric acids(²⁶), and hypochlorite solutions(²⁷).

An important modification of the above synthesis consists in the direct oxidation of the isobornyl acetate or other isobornyl esters by means of chromic acid, nitric acid, permanganate, or other oxidising agents(²⁸); this method yields camphor without requiring a saponification or the isolation of isoborneol.

Another interesting synthesis of camphor which was patented last year by A. Hesse(²⁹), is based on the action of an organomagnesium halide on an ethereal solution of pinene hydrochloride, prepared from turpentine oil. When the reaction is complete—*i.e.*, when the complex magnesium compound of pinene hydrochloride has been formed—oxygen or air is passed through the mixture until oxygen is no longer absorbed. Upon the addition of ice and dilute acids, the reaction product separates into two layers, the upper ethereal layer being separated, dried, and the ether removed by distillation. The solid residue is crude borneol, which is purified and converted into camphor by oxidation. This process of preparing borneol is said to be subject to some uncertainty, and unexpected and unsatisfactory results are frequently obtained. Hence, this synthesis, while theoretically attractive, appears rather uncertain in practice. A third synthesis of camphor, which appears to have been suggested for its commercial manufacture, is based upon the action of acetates on pinene hydrochloride. Pinene hydrochloride is converted into a mixture of bornyl and isobornyl acetates by treatment with anhydrous acetates in glacial acetic acid solution; the bornyl acetates are hydrolysed to a mixture of borneol and isoborneol, which is then oxidised to camphor. The principle involved in this synthesis is not new, since Wagner(³⁰) in the year 1899 showed that when pinene hydriodide is treated with silver acetate and glacial acetic acid, it is converted into a mixture of dipentene, terpinyl acetate, camphene, bornyl- and isobornyl acetates; Wagner regarded the dipentene and terpinyl acetate as the normal products of the reaction, while camphene and the bornyl acetates were produced in larger quantities at higher temperatures, and were considered as secondary products. According to more recent suggestions, pinene hydrochloride is heated in a glacial acetic acid solution with lead acetate(³¹) at a temperature of 180°; the reaction product consists of bornyl and isobornyl acetates with other substances. Zinc acetate(³²) may also be used instead of lead acetate, and appears to yield the same result rather more conveniently and at a lower temperature.

This process may be formulated as follows:—



$$C_8H_{13}\left\langle\begin{matrix}CH\\ |\\ CH_2\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CHCl\\ |\\ CH_2\end{matrix}\right. \rightarrow C_8H_{14}\left\langle\begin{matrix}CH_2\\ |\\ CH(C_2H_3O_2)\end{matrix}\right. \rightarrow$$

Pinene. Pinene hydrochloride. Bornyl and isobornyl acetates.

$$C_8H_{14}\left\langle\begin{matrix}CH_2\\ \\ CHOH\end{matrix}\right.$$

Borneol and isoborneol.

It is too early at this time to pass a critical opinion as the value of this synthesis.

Another class of synthesis of camphor consists in the formation of bornyl esters by the direct action of various organic acids upon turpentine oil, hydrolysing these bornyl esters to borneol and isoborneol, and oxidising these alcohols to camphor. It has long been known that when French turpentine oil is heated with benzoic acid at 150° C. for 50 hours, it yields a mixture of camphene, terpinene, fenchyl alcohol, isoborneol, and borneol(³³). In 1897, the writer obtained a mixture of isobornyl acetate, terpinyl acetate, terpenes, and polymerisation products by the application of Bertram and Walbaum's acetic-sulphuric acid treatment to American oil of turpentine; on saponifying with alcoholic potash, isoborneol was formed to the extent of about 15 per cent. of the turpentine employed. The first attempt to carry this reaction out on a large scale, and, in fact, the first attempt to my knowledge to prepare synthetic camphor by any commercial process, was undertaken in 1902 by the Ampère Electro-Chemical Co., who operated under the Thurlow patent. According to the patent specification, camphor was synthetically prepared as follows:—Anhydrous turpentine was heated at 120° to 130° with anhydrous oxalic acid, and the resulting product, said to consist of a mixture of borneol, camphor, bornyl oxalate and formate, and waste polymerisation products, was saponified with lime and distilled with steam. The resultant camphor and borneol were separated and oxidised to convert the borneol to camphor. The assumption of the direct formation of camphor by the action of oxalic acid on the turpentine oil has since been proved to be erroneous, and although there was 30 to 40 per cent. of esters formed by the process, a large part consisted of terpinyl esters; a large amount of the diterpene, colophene, $C_{20}H_{32}$, was also produced, and the amount of borneol or isoborneol formed was never sufficient to ensure the commercial success of the process. At all events, synthetic camphor made by this process never came into the market in any considerable amount, The process seems to have been abandoned, and the German patent of this company is said to have been cancelled.

Among other syntheses of similar character may be mentioned the action of certain aromatic hydroxy-acids, such as salicylic acid, on turpentine oil(³⁴); this treatment yields bornyl and isobornyl esters of salicylic acid, which upon hydrolysis give borneol and isoborneol; camphor is formed by the oxidation of these two alcohols. Similarly the action of *o*-chlorobenzoic acid upon turpentine oil(³⁵) yields esters which may be converted into borneols, and then by oxidation into camphor. In every case, however, where turpentine oil is treated directly with an organic acid for the formation of bornyl or isobornyl esters, the results are not very satisfactory, and the yield of camphor seems to be too small to warrant their commercial application. In my opinion, the formation of bornyl esters by these processes is not so much due to the direct action of the organic acids upon the pinene in the turpentine oil, which I am inclined to believe does not unite with the acids to form bornyl esters to any considerable extent, as to the action of these acids upon the camphene which is present in some turpentine oils to the extent of 12 to 15 per cent.; it is also possible that there is a slight conversion of pinene into camphene by the action of the acids, which then increases the yield of bornyl esters in some degree. The presence of camphene in American oil of turpentine to the extent of 10 to 15 per cent. has been proved, and when pure camphene, instead of turpentine oil, is treated with anhydrous oxalic acid according to Thurlow's method, it is almost quantitatively converted into isoborneol.

The above-mentioned syntheses of camphor are the most important ones suggested for the commercial manufacture of camphor; they are all protected by patents. There are undoubtedly many others which are being worked out in secret, or are pending in the patent offices.

Synthetic camphor, made by one of the above-mentioned processes, is now being brought into the market in some quantity, and is competing with natural camphor. It is identical with natural camphor in all respects except in its action upon polarised light; while natural camphor is optically active, either dextro- or lævo-rotatory, synthetic camphor is optically inactive. The purification of the crude camphor obtained by any of the above syntheses is a matter which involves many technical difficulties; purification by crystallisation and by sublimation has been used, and there are a variety of other methods, some being used secretly, and others being protected by patents.

As to the commercial success of synthetic camphor in the future, there seems to be no doubt that, with the present prevailing prices for natural camphor, the synthetic article can successfully hold its own. But should there be a drop in the price of natural camphor to the level at which it stood five or six years ago, it is very doubtful whether the synthesised camphor could seriously compete with the natural product. Moreover, if turpentine oil, the crude raw material for all the syntheses now employed, is increasing in price, and if a simultaneous lowering in the price of natural camphor occurred, the manufacturers of synthetic camphor would find themselves in a serious difficulty.

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(2) Bredt and v. Rosenberg, Ann. Chem., **289**, 1.

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(4) Armstrong and Tilden, Ber., **12**, 1753.

(5) Wallach, Ann. Chem., **239**, 6.

(6) Bruhl, Ber., **25**, 146.

(7) Kachler, Ann. Chem., **197**, 96.

(8) Wallach, Ann. Chem., **230**, 238.

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(10) Kachler, Ann. Chem., **197**, 96.

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(25) Stephan and Rehländer, U.S. Patent No. 801,485, Oct. 10, 1905.

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NOTES ON THE ANALYSIS OF CAMPHOR.

BY J. E. CRANE AND C. M. JOYCE.

The analysis of camphor is a subject of growing importance owing to the high prices now prevailing, and to the introduction into the market of synthetic camphors which vary in composition and contain impurities different from those found in the natural article. The analysis presents a very difficult problem, as no derivative of camphor suitable for separation and estimation has been discovered. The oxime, the phenylhydrazone, and other derivatives may be prepared, but the yields are not quantitative. It has been suggested that the camphor might be converted into the insoluble semi-carbazone, but even if feasible its preparation would be too complicated for a technical method of analysis. Reliance must, therefore, be placed upon physical methods similar to those used in sugar analysis. Thus the concentration of a benzene solution may be determined by its specific gravity, or by its optical activity. As pure camphor can be sublimed leaving no residue, this property gives a direct method for its estimation.

A sample of pure camphor was prepared by several recrystallisations of sublimed camphor from proof spirit. The degree of purity of the recrystallised products was indicated by their melting points. The melting points corrected for stem exposure were as follows:—Sublimed camphor, 177½°–178½° C.; first crystallisation, 178°–179° C.; second crystallisation, 179·4° C., interval 0·3° C.; third crystallisation, 179·4° C., interval 0·3° C. The sample of pure camphor was used in standardising the methods described below:—

I. *Sublimation.*—Two 3-in. and one 2-in. watch glasses, all carefully ground, are selected and the weight of each taken. About 1 grm. of the camphor sample is weighed out exactly on the 2-in. glass and covered by one of the 3-in. glasses. The two watch glasses containing the sample are placed on a metal dish over a tiny flame, and the camphor is sublimed from the 2-in. to the 3-in. watch glass in the course of thirty minutes. The size of the flame and hence the duration of heating may vary considerably without affecting the result, as may be seen from the table below, but care must be taken not to continue the heating after the sublimation is complete. The flame is then removed and the glasses are allowed to cool for five minutes. The 3-in. watch glass, now containing the camphor, is taken up, quickly covered with the other 3-in. glass, cooled in a desiccator for one hour and weighed. The 2-in. glass from which the camphor was sublimed is weighed, giving the non-volatile impurity.

The loss of camphor by evaporation is large but fairly constant, and by applying a correction for this loss approximately check results may be obtained. The following results were obtained with impure camphor.

Duration of heating.	Weight of sample.	Weight of sublimate.	Percentage of sublimate.	Average.
mins.	grms.	grms.		
10	0·9206	0·8923	96·92	97·05
10	0·8781	0·8515	96·99	
10	1·0256	1·0010	97·60	
10	0·8737	0·8446	96·68	
20	1·0993	1·0671	97·07	96·86
20	0·9058	0·8754	96·65	
30	0·8827	0·8604	97·47	97·04
30	1·0185	0·9858	96·83	
30	0·8490	0·8220	96·83	
45	1·0425	1·0117	97·05	96·80
45	1·1252	1·0863	96·54	
60	1·0687	1·0332	96·68	96·68

The results are accurate within ± 0·5 per cent.
Correction = + 3·0 parts per 100.

This method furnishes a rough but quick assay of camphor.

II. *Specific gravity.*—Exactly 10 grms. of the sample are weighed out in a 100 c.c. flask. Pure benzene is added and the solution is made up to 100 c.c. at 20° C. The specific gravity is taken with a pyknometer at 20°/15·5° and the concentration of the solution obtained by reference to the table giving the percentage purity of the sample. This table was made by preparing solutions of various concentrations of the standard camphor in commercial pure (Merck's) benzene, and taking the specific gravities in a 50 c.c. pyknometer at 20° C., compared with water at 15·5° C.:—

Specific gravities of camphor, benzene solutions at 20°/15·5°.

Sp. gr.	Grms. per 100 c.c.	Sp. gr.	Grms. per 100 c.c.	Sp. gr.	Grms. per 100 c c.	Sp. gr.	Grms. per 100 c.c.
0·8782	0·0	0·8856	8·0	0·8924	15·5	0·8991	23·0
0·8787	0·5	0·8861	8·5	0·8928	16·0	0·8996	23·5
0·8791	1·0	0·8865	9·0	0·8933	16·5	0·9000	24·0
0·8796	1·5	0·8870	9·5	0·8937	17·0	0·9005	24·5
0·8800	2·0	0·8874	10·0	0·8942	17·5	0·9009	25·0
0·8805	2·5	0·8879	10·5	0·8946	18·0	0·9014	25·5
0·8810	3·0	0·8883	11·0	0·8951	18·5	0·9019	26·0
0·8815	3·5	0·8888	11·5	0·8955	19·0	0·9024	26·5
0·8819	4·0	0·8892	12·0	0·8960	19·5	0·9028	27·0
0·8824	4·5	0·8897	12·5	0·8964	20·0	0·9033	27·5
0·8828	5·0	0·8901	13·0	0·8969	20·5	0·9037	28·0
0·8833	5·5	0·8906	13·5	0·8973	21·0	0·9042	28·5
0·8837	6·0	0·8910	14·0	0·8978	21·5	0·9046	29·0
0·8842	6·5	0·8915	14·5	0·8982	22·0	0·9051	29·5
0·8846	7·0	0·8919	15·0	0·8987	22·5	0·9055	30·0
0·8851	7·5						

III. *Polarisation.*—The optical estimation of camphor is performed according to the method of Landolt,* modified by Foerster.† This consists in polarising the camphor in benzene solution in a Laurent polarimeter

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(*) Optical rotation of Organic Substances, 1902, pp. 191 497, and 640.

(†) Berichte, 1890, 2981.

The concentration is given by the formula: $c = 115{\cdot}205 \left(1 - \sqrt{1 + 0{\cdot}04367\frac{a}{l}}\right)$. Where c = wt. camphor in 100 c.c. solution, a = rotation, and l = length of tube in decimeters. This method was applied to the assay of camphor by omitting the distillation used by Foerster to separate the camphor from non-volatile substances, and dissolving the camphor sample directly in benzene, the solution being prepared in the same way as described for the specific gravity determinations. Care must be taken to keep the solution and instrument at 20°, as slight variations in temperature cause considerable variations in the specific rotatory power of the solution. (See Foerster's table.) Several determinations were made with the standard recrystallised camphor and E. and A. "c.p." benzene. As the results obtained were from 2 to 3 per cent. higher than the theoretical ones, the solvent used was examined and was found to contain considerable quantities of toluene and thiophene. Merck's crystallised benzene (reagent) was accordingly substituted, and satisfactory results were obtained, as follows:—

Concentration by weight.	Reading.		Concentration calculated.
	S. and H.	Laurent.	
5·0	24·1 =	+ 4·167°	5·13
10·0		+ 8·348°	10·07
25·0		+22·167°	25·14

Readings with a Schmidt and Haensch instrument provided with a bichromate screen agreed with those performed in a Laurent.

A further method has been proposed by Arnost,* based upon the extraction with petroleum ether and subsequent estimation of the camphor by the volume expansion of the solutions, but it is impossible to obtain accurate and concordant results by this procedure.

The application of these methods to the assay of crude natural and synthetic camphors will now be considered.

The analysis of natural camphor.—Crude natural camphor contains as impurities 3—7 per cent. of moisture, a few per cent. of camphor oil, and 0·1 to 0·4 per cent. non-volatile matter. In the sublimation method the moisture is driven off, the camphor oil is partly retained in the sublimate, causing too high results, and the non-volatile impurity is exactly estimated. The specific gravity method gives still higher results, owing to the presence of camphor oil and to the slight solubility of the water in benzol, both of which increase the specific gravity. The camphor oil also increases the polarimetric reading, but as its specific rotatory power is much less than that of camphor, the results are lower than in the other methods.

A sample of crude Japanese camphor, examined by the three methods, gave the following results:—

I.—*Sublimation.*

Duration of heating.	Weight of sample.	Weight of sublimate.	Sublimate.	Corr.	Camphor.	Non-volatile matter.
mins.			per cent.		per cent.	per cent.
10	0·9965	0·9198	92·30	2·77	95·1	0·18
10	0·8284	0·7654	92·41	2·77	95·2	0·17
30	1·0708	0·9849	91·98	2·77	94·7	—
30	0·9588	0·8843	92·21	2·77	95·0	—
				Average	95·0	0·18

II.—*Specific gravity.*

Concentration by weight.	Sp. gr. at 20°/15·5°	Concentration by sp. gr.	Camphor.
			per cent.
13·6	0·8900	12·9	94·9
25·0	0·9000	24·0	96·0
30·0	0·9043	28·6	95·3
		Average ..	95·4

III.—*Polarisation.*

Concentration by weight.	Reading.	Concentration calculated.	Camphor.
			per cent.
10·0	3·867	9·34	93·4
13·6	5·300	12·65	93·0
25·0	10·167	23·24	92·9
30·0	12·583	28·20	94·0
		Average ..	93·3

The melting point of the sublimate was 174°—175·5° C. corrected, proving that the sublimate was not pure camphor, but contained a small amount of camphor oil. The result by Method I., 95·0 per cent. camphor, is therefore too high. The still higher result by Method II. 95·4 per cent. camphor, is due to the influence of the two factors mentioned, *viz.*, camphor oil and moisture. An attempt was made to correct for the latter, and pure benzene was shaken with water and the specific gravity taken of the clear, supernatant solution. It was found that the density had increased from 0·8782 to 0·8794. Furthermore, the amount of water dissolved by the benzene varies with the temperature. The following empirical method was then tried, using first pure camphor and afterwards crude camphor. Ten grms. of camphor were dissolved in benzene and washed with benzene into a 100 c.c. graduated, stoppered cylinder, the volume of the solution amounting to 60—70 c.c., 10—20 c.c. of water were added, the cylinder was thoroughly shaken, and allowed to stand until the layers had completely separated. The volume of the benzene solution was read off at 20° C., and the specific gravity taken at 20°/15·5°.

Camphor.	Volume.	Sp. gr.	Concen.	Camphor.	Camphor corr.
	c.c.			per cent.	per cent.
Pure	66·0	0·8930	16·2	106·9	100·0
,,	62·5	0·8937	17·0	106·3	100·0
Crude	65·0	0·8925	15·6	101·4	95·1
,,	61·5	0·8931	16·3	100·2	94·0

The high results obtained with pure camphor show the effect of water on the specific gravity, and the values obtained for the crude camphor were corrected by dividing them by 1·066. The mean of these corrected results, 94·5 per cent., is still too high, due to the presence of the camphor oil.

An attempt was also made to separate the camphor from its impurities by distillation according to the Foerster method. The distillate was collected and dissolved in benzene in a special graduated receiver, the volume of the benzene solution read at 20° C., and its concentration obtained from its specific gravity at 20°/15·5° C.

Weight of sample.	Vol. of solusion.	Sp. gr.	Concentration.	Weight of Camphor.	Camphor.
	c.c.				per cent.
3·8660	32·9	0·8887	11·40	3·751	97·0
3·0763	31·6	0·8869	9·35	2·956	96·0
3·2338	32·4	0·8871	9·58	3·104	96·0
3·5113	29·0	0·8891	11·90	3·451	98·3
3·0633	32·3	0·8869	9·42	3·043	99·3
3·3585	34·5	0·8869	9·42	3·255	96·9

This method was applied to pure camphor, varying the conditions of the distillation, with the above results. These discordant results, all low in spite of the positive error in the specific gravity due to the solubility of water in benzene, show that the camphor was not entirely driven over, or that there was a loss of camphor in washing out the condenser. Further experiments will be made by us in the hope of overcoming these difficulties.

The impurities in crude camphor affect the polarimetric value least of all, and the average result obtained by this method, 93·3 per cent. camphor, is probably not far from the true value. The difference between the percentage of sublimate and this value, gives approximately the percentage of camphor oil, and the composition

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(*) Z. Unters. Nahr. u. Genussm., 1906, 532—539.

of this sample was, therefore:—93 per cent. camphor; 2 per cent. camphor oil; 5 per cent. moisture; 0·18 per cent. non-volatile matter.

Analysis of synthetic camphor.—Synthetic camphor contains as impurities certain intermediate products, such as camphene, borneol, &c. These sublime with the camphor and are soluble in benzene, so that Methods I. and II. give too high results. Method III. is not available, as synthetic camphor is almost optically inactive, giving a slight lævo-rotation. It serves, however, to distinguish synthetic from natural camphor. The following results were obtained with a sample of crude synthetic camphor: Method I., 98·2 per cent. sublimate, m. pt. 150°—155° C.; very impure.

The failure of these methods leaves the assay of synthetic camphor in a very unsatisfactory state, but the purity of a sample is indicated by its melting point.

The melting points of several synthetic camphors were as follows:—Porchester, 171°—173°; Schering, c.p., 171°—175°; Schering, crude, 150°—156°.

Crude natural camphor may be analysed with a considerable degree of accuracy by the polarimetric method, which can be controlled by the other methods, but we have yet to find a satisfactory method for synthetic camphor. A chemical procedure for the exact determination of the purity of both forms of camphor found in commerce is greatly to be desired.

We wish to express out thanks to Messrs. H. W. Wiley, F. D. Dodge, and R. C. Schüpphaus for the help they have given us in this work.

DISCUSSION.

Prof. **CHARLES DOREMUS** said that erroneous statements had been made concerning the manufacture of synthetic camphor in the United States. There was at present no synthetic camphor made in America, the works which were formerly employed with this production having been closed.

Dr. **H. SCHWEITZER** stated that as early as 1890 he was engaged in the manufacture of synthetic camphor, or a substitute for the natural product from either spirits of turpentine or light or heavy camphor oil. The firm felt already at that time that camphor costing about 17 cents per pound was too expensive. The experiments started, as a matter of course, from pinene hydrochloride, obtained from spirits of turpentine, which was known as "artificial camphor." Although synthetic camphor made therefrom was only isolated experimentally, yet pinene hydrochloride treated with alkalis, acids, among them oxalic, benzoic, salicylic, very much in the manner described in the various patents, was employed practically for the manufacture of celluloid articles. The products obtained in these experiments were undoubtedly mixtures of camphene, borneol, and camphor, and gave good results, as shown by a comb which was still in his possession. But the low price of camphor at that time did not permit their commercial use. To-day the chances of the synthetic product were better, as the price of natural camphor was above $1.00 per lb. Yet the problem of the commercial production of camphor could not be considered solved as long as turpentine was the starting material. Turpentine was a comparatively rare raw product, its price being subject to arbitrary fluctuations. If camphor could be obtained from a cheap substance found in abundant quantities, the artificial production of it would become a safe and paying enterprise. In this respect Raschig's research appeared important, the cyclo-hexanols produced by treating phenol and cresol with hydrogen in the presence of metallic nickel being nearly related to borneol and camphor.

Prof **WILLIAM McMURTRIE** referred to the great progress which the Department of Agriculture had made in the cultivation of camphor trees in various parts of America.

Mr **ALBERT PLAUT** said that Ewen McIntire, of New York, planted a number of camphor trees on his estates in South Carolina twenty years ago; these had now grown to about 30 ft. in height, and Mr. McIntire has expressed his willingness to present them to the Department of Agriculture for experimental purposes.

Mr. **JOHN H. STEVENS** explained the difficulty experienced by Dr. Schüpphaus in his endeavour to ascertain the solvent power of camphor upon nitrocellulose. It might be true that from the point of view of a chemist, camphor will not dissolve pyroxylin. But Hyatt spoke as a mechanician. In every case he combined the camphor and pyroxylin by the aid of heat and pressure, and the means he used were such as could hardly be reproduced in an ordinary laboratory. He had witnessed Hyatt's work from the start, and had also heard him announce the word "celluloid" as an expressive designation for his compound. In the early process referred to by Dr. Schüpphaus, Hyatt added powdered camphor to wet nitrocellulose, and then ground the mixture to an extremely fine state of subdivision. The wet pulp thus formed was pressed into cakes or blocks, which were thoroughly dried and then subjected to prolonged heat and powerful pressure in suitable dies or forms. Under those conditions the mass became amalgamated at a temperature lower than the point at which camphor is said to melt. As to the charge that this process was impracticable because of its high cost, it should be borne in mind that the product sold for $5 per lb., and a dental plate moulded from it brought $1.50. Hyatt himself soon realised the limited scope of his original method, and in his later patents preferred to lower the melting point of the camphor by the addition of alcohol. This made possible the conversion and manipulation of the compound at a lower temperature, say, 80°—100° C.

Dr. **SCHUEPPHAUS** said he had not denied the possibility of the so-called conversion of nitrocellulose by means of camphor at elevated pressure and temperature. To show the influence of pressure, it was only necessary to recall Spring's experiments on the formation of metallic sulphide, for instance. Aside from the phenomenon of decomposition, he considered the process impracticable. How could such materials as the imitations of amber, tortoise-shell, and ivory be produced? He had always regarded celluloid as a chemical compound of nitrocellulose and camphor, the combination being easily accounted for by the aldehydic nature of the one and the ketonic of the other. Analogous compounds of glucose and cane sugar with camphor had been described by Schiff, and compounds somewhat similar to benzaldehyde with the anhydride of mannite had been noted by Meunier. Spill did not use only mobile solutions. In the patent of 1869 he mentioned rolling or moulding a material obtained by softening the nitrocellulose by means of his solvents. Long before Bertram and Walbaum, Bouchardat and Lafont (1886) converted camphene into borneol acetate and obtained borneol by saponification. In 1879 Kachler and Spitzer saponified borneol acetate and oxidised the borneol with nitric acid. The oxidation of the acetate was also described in earlier literature. Many good substitutes for camphor, including quite a series of ketones, had been brought out, but none equalled camphor. It was quite probable that Sabatier's reaction might furnish a suitable cheap compound. Haller and Martine had already prepared menthone and menthol, starting from sodiummethylcyclohexanone. Baeyer called attention to the resemblance existing between the esters of hydroterephthalic acid and terpene compounds.

Mr. **STEVENS** replied that it would be somewhat difficult to make tortoise-shell by the original dry camphor process, and it was for reasons of this kind that Hyatt finally added sufficient alcohol to make his compound plastic in hot rolls. Nevertheless, he was guided throughout by the knowledge that camphor was the real solvent, and his methods were always distinguished from those of Parkes and Spill by the solidity of his compound and his economical use of liquids. Hyatt always kept in view the high value of camphor as a final component, and treated the alcohol as a temporary auxiliary of heat and pressure. On the other hand Parkes and Spill worked with collodion or jelly-like masses and exaggerated the importance of a mere solvent action to be exerted in the usual way by means of camphor-spirits. In consequence of this, their mixtures contained an excess of solvent which was difficult to remove.

Yorkshire Section.

Meeting held at Great Northern Victoria Hotel, Bradford, on Monday, March 18, 1907.

MR. F. W. BRANSON IN THE CHAIR.

AN INDIGO-YIELDING PLANT.

BY ARTHUR GEORGE PERKIN, F.R.S.

Some months ago Prof. Dunstan, Director of the Imperial Institute, sent me a quantity of dried "Gara plant" which had been forwarded by the authorities in Sierra Leone for an examination of its dyeing properties and the colouring matter which it contains.

The following account of the plant, and its preparation for use in the dyeing operation as carried out amongst the tribes of Sierra Leone and the natives of Western Sudan has been supplied me by the Institute: "The Gara is a woody climber, from 10 to 40 ft. long. It is a leguminous plant of the sub-order *Papilionaceae*, and of the species *Lonchocarpus cyanescens*. The herb is used by natives of Sierra Leone as a dye, and regarded as superior to the many other herbs used for the same purpose."

Several species of this genus are also employed by the Indians of South America for poisoning fish, or rather for intoxicating them so that they float upon the surface of the water and are easily captured.

Method of preparation.—"The method of preparing this herb as a dye differs among the tribes of Sierra Leone and the interior and those of Western Sudan. In the former countries the young leaves are collected along with some more matured ones, roughly pounded, and dried in the sun. In this state it is sent to the market as "Gara," and sold to the dyers.

The natives of Western Sudan carefully strip the trees of every strong leaf. In about ten days the new leaf buds open into young and tender buds, which are collected, pounded when quite raw, made into balls, and dried in the sun. As the colouring matter exists only in the young and tender herbs, the Sudan Gara is always considered superior, and, by the method of balling before drying, only the surface is exposed to atmospheric conditions, which after a time seem to lessen the quantity of colouring matter in the Sierra Leone Gara dried in scattered and roughly pounded leaves.

Dyeing.—The Gara thus prepared is put into a country pot and soaked in water for 12 hours. This water assumes a yellowish colour and is thrown away. The Gara is now put into a vessel without water, covered, and left to ferment two or three days, depending on the temperature. During this fermenting period, the powdered bark of the root of the "brimstone" tree, *Morinda citrifolia*, is thrown into the ferment with some potash. When fermentation is completed, the Gara is transferred to the vat (generally a country pot buried in the earth), water is added, also potash and a decoction of the root of the *Morinda citrifolia*. These are employed as mordants. The vat is kept open during the day, exposed to the heat of the sun, and covered at night. This exposure goes on for a period of about nine days, during which time the contents of the vat are stirred three or four times a day. The dye is now ready for use. The cloth to be dyed is thrown into the vat, moved and turned about in the liquid, left there for some time, and then dried in the sun. This operation is repeated until the desired colour is obtained. The richness of the colour depends on the quality of the dye, *i.e.*, the tenderness of the Gara used, and its collection just about the flowering season, but the permanence of colour depends solely on the judicious use of the mordants, *Morinda citrifolia* and potash."

Experimental.—The material obtained from the Institute consisted of the dried leaves and stems, evidently the Sierra Leone product, and possessed a peculiar dull green tint. Dyeing experiments carried out in the usual manner with striped mordanted calico revealed the presence of a small quantity of yellow colouring matter, but the shades obtained were extremely poor and of little interest. Suspecting, therefore, that the plant contained an insoluble dye of the nature of Lokao green, or indigo, it was investigated in this respect, and with satisfactory result.

250 grms. of the material were repeatedly extracted with boiling water until the extracts no longer possessed a brownish black tint, and the residue was introduced into a large bottle and well covered with water. A solution of sodium hydrosulphite (20 grms.) and caustic soda (10 grms.) was then added, and the mixture maintained at a temperature of about 60° for six hours. The yellow coloured extract, which quickly developed a deep blue scum, was decanted off, and air was aspirated through it until no further development of the blue colour could be detected. As in this condition it was extremely difficult to filter, the mixture was raised to the boil, and treated with a considerable quantity of salt, which caused the precipitate to assume a granular form. It was collected, washed first with water, then repeatedly with boiling dilute hydrochloric acid, and finally with boiling alcohol. The spongy blue product was extracted with boiling nitrobenzene, in which some quantity dissolved, but a considerable amount of a pale brown amorphous compound remained unattacked. Crystals separated from the nitrobenzene solution on cooling, and these were washed with alcohol, then with dilute caustic soda solution, and finally with hydrochloric acid. On analysis the following figures were obtained: $C=73{\cdot}03$; $H=4{\cdot}27$; $N=10{\cdot}83$ per cent.; $C_{16}H_{10}N_2O_2$ requires $C=73{\cdot}28$; $H=3{\cdot}82$; $N=10{\cdot}69$ per cent. These results, together with an examination of its properties, proved conclusively that this compound was indigotin, and to further confirm this fact dyeing trials with the Gara dye were carried out. It was found as a result that full blue shades could be obtained upon calico by submitting the fabric to three or four dips in the hydrosulphite extract of the plant, oxidation, of course, being allowed to take place between each dip.

Experiments were now instituted to ascertain, if possible, approximately the amount of colouring matter in the crude material (250 grms.) by repeated extraction with the alkaline hydrosulphite solution, and treating the product in the manner just described. For this purpose six digestions occupying one day each were found necessary, and from these extracts 1·65 grms. of pure indigotin was isolated. Naturally, this quantity must be somewhat less than that which is actually present, for the operations described involve a fair loss, but unfortunately I am not aware of a better method for the estimation of indigotin when precipitated in the plant substance. Again, also, it is likely that the fresh plant, by suitable processes, could be made to yield considerably more of the colouring matter than that formed by the somewhat primitive methods of which a description is given above. Attempts will be made by the authorities of the Imperial Institute to obtain samples of the air dried unfermented plant for examination in this and other respects, and I am in hopes that it will be possible to arrange for an analysis to be carried out on the spot with the fresh material.

In view of the fact that it has now been shown that the colouring matter derived from the Gara plant is indigotin, the method of preparation of the dyestuff and the subsequent dyeing operations are not difficult to understand. The preliminary pounding of the leaves has an obvious purpose, and the method of balling employed by the natives of the Western Sudan in interesting, as such a procedure has been applied to woad for very many years past, and again a similar process is mentioned by Bancroft (Philosophy of permanent colours, Vol. 1, 1813, p. 168) as used by the natives of one of the Cape Verd Islands. The advantage claimed for such a procedure is not perfectly clear in this instance, unless it be that by the second fermentation, which precedes the dyeing operation, the indigotin thus formed, being in the moist condition, and naturally in a finely divided state, is more susceptible to the subsequent reduction process which occurs in the vat. This vat has some resemblance to the well-known potash vat, for in this the root bark of the *Morinda citrifolia* is employed. This material is a class of madder, and contains a colouring matter, morindone, and its glucoside, morindine, which corresponds to the alizarine and ruberythric acid of the *Rubia tinctoria*.

In connection with indigo fermentation vats, it has been shown by Wendelstadt and Binz (Ber., 1906, 1627), that woad contains two distinct micro-organisms, one red and the other white, and that under suitable conditions the latter appears to be able to reduce indigo. It seems thus highly probable that the organism capable of effecting reduction of the indigo in this primitive class of vat is contained in the fermented Gara itself.

Curiously enough, mention is made in Bancroft's work (*loc. cit.*), p. 189 and 191, of two distinct plants of a different class to the indigofera, one a vine or creeping plant named "Taroom akkar," which grows in Sumatra, and a second occuring in Africa on the windward coast. Though the former yielded indigo, the blue dye given by the latter, and which is commonly used by the natives, is stated to be a different substance, but this is probably incorrect. Mention is also made that a few roots of it were planted in the settlement of Sierra Leone, and it is thus quite possible that the "Gara" dye is here referred to. The practice of developing the indigo by fermentation, &c., within the plant itself, and the subsequent employment of the material for dyeing purposes, has no doubt been common in out of the way districts in the past. I understand that this is still the case in some parts of China, and I have with me a specimen of "aidama" indigo from Japan which has been prepared in this way.

Discussion.

Prof. W. M. Gardner said it was possible that the best source for the commercial production of indigo had not yet been found.

Mr. F. W. Branson asked if the toxic effects of the plant on fishes were due to the presence of any substance like picrotoxin.

Mr. A. G. Perkin, in reply, said that it was impossible to say if the plant was richer than the best known indigo plants until they were able to get the unfermented leaf to examine. The Dutch had no doubt been ahead of us, both in the quinine and in the natural indigo industry, and for many years past they had employed scientific men in Java to investigate the best conditions for the cultivation of the plant and the manufacture of indigo from it. We were now, very late in the day, doing the same in India, and it was hoped that the work being done would save the industry from extinction. He had no knowledge if this special plant had a toxic nature, but had referred to other members of the species which possess this property. This effect might possibly be due to the presence of a cyanogenetic glucoside.

Meeting held at the Queen's Hotel, Leeds, on Monday Feb. 25, 1907.

MR. F. W. BRANSON IN THE CHAIR.

THE TESTING OF GLAZED CLAY-WARE.

BY JOHN W. COBB.

If a clay or mixture of clays alone or with other minerals is moulded into any desired shape, and then hardened by fire, clay-ware is obtained. If this ware is covered wholly or partly by a vitrified coating run and fixed by fire, the product is glazed clay-ware; the term therefore includes nearly all pottery and many building materials. Experience indicates that there are many degrees in the resistance offered by glazed clay-ware to destructive agencies, and it may be of interest to consider how far it is possible to determine the excellencies and deficiencies of this material before using it. The glazed brick may be taken as typical of glazed clay-ware in general, on account of its simplicity in shape and structure. It contains the elements of glazed clay-ware in their simplest combination. A normal glazed brick consists of two essential parts: first, the brick itself, tough, hard, chemically resistant, more or less porous; and second, the glaze above it, smooth, non-porous, chemically resistant, more or less bright and transparent. If the glaze is transparent, the colour of the glazed brick face is often given by another coat between the clay and the glaze, but if the glaze is opaque, it carries its own colour. On the advisability of knowing the resisting power of glazed bricks before putting them into use little need be said. The contrast between the fine and uniform surface of a good glazed brick wall and the patchy unsightly appearance of a bad one is very striking, and is nearly always due to the quality of bricks used when the wall is built.

The questions that suggest themselves are:—What are the influences tending to cause deterioration in such a piece of glazed clay-ware as a glazed brick, and how do they affect the brick, the glaze, or the glazed brick as a whole? How is the glazed brick to be tested in the office or the laboratory as to its power of resistance (paying particular attention to such tests as may be made without special laboratory appliances), and what results are to be expected from the tests applied?

In the first place, it is plain that anything which happens to destroy the complete soundness or wholeness of the brick itself, to make it crumble or crack, at any rate near the face, is bound to result in a breaking away of a portion of the glaze, and the ruin of the glazed brick in appearance and utility. Hence, little consideration is required before concluding that a degree of excellence, in the sense of complete soundness, which would be quite sufficient for an unglazed building brick, even a high-class facing brick, may be quite inadequate for a glazed brick of which so much is demanded. This is found to be the case. The most perfect glaze cannot save the imperfect brick, for the glaze is such a delicate indicator of the perfection or imperfection of the clay it covers.

The agencies likely to do the harm may be considered in the following order:—Frost, crystallisation in the brick and efflorescence from it, dirt suspended in liquid or in the atmosphere, corrosive liquid or vapour, pressure, changes of temperature, scouring, and percussion.

Frost and crystal formation.—The bad effect of frost is generally understood to be due to the force of expansion of water in freezing, to which any brick walled damp, or in a damp situation, is particularly exposed. Alternate freezings and thawings are to be resisted if harm is not to follow. With respect to crystal formation and efflorescence, the disintegrating force is the formation of crystals in the interior of the brick. The material for the formation of such crystals may have several origins.

"Mineral incrustations are mostly white or greyish, more rarely yellow or green, these latter being due to vanadium. In appearance the incrustations vary according to the solubility of the component salts, from floury or woolly powders to stalactitic masses, and may result from various causes, present either in the raw clay, or introduced in the water employed in brick making, or from pyrites in the clay or fuel, or from the ash of the latter material. Again, the infiltration of soluble substances from the mortar or combination of the alkalis in the latter, with the gypsum in the bricks, or, finally, the absorption of nitrates from the soil, and ammonia or sodium chloride (near the sea) from the air may give rise to incrustation." (Günther, this J., 1897, p. 331.)

The disruptive force of freezing water is easily understood, since the water is both expanding and crystallising; but why the formation of crystals should be in itself a disruptive force when no expansion takes place during the crystallisation is not very easy to see. It seems quite clear, however, that the crystallisation can do the damage even when not accompanied by an expansion. My own experiments, inducing very complete disintegration, were made mainly with sodium thiosulphate, $Na_2S_2O_3,5H_2O$. I thought that the disintegration was due to expansion, but Dr. Dawson, of Leeds University, has made tests which show that the crystallisation of $Na_2S_2O_3,5H_2O$ is not accompanied by expansion. The specific gravity of a solution of thiosulphate expressed by the formula, $Na_2S_2O_3,7H_2O$, at 20° C., compared with water at 4° C., was found to be 1·673; that of the solid crystals, 1·750. It seems, therefore, as if there is a force, perhaps somewhat akin to surface tension, which, by tending to secure continuity in the crystal form, enables the growing crystal to displace adjacent matter, and so to exercise a disruptive action on any material enclosing it. The results obtained leave no doubt as to the reality of the force and its effectiveness. They suggest as a general inference that much of the natural disintegration of rocks, which is put down to the expansion of water in freezing, may really be more dependent on the force of crystallisation of ice. The effect of freezing or crystal formation on the brick is to loosen its whole structure, and to make it rotten and incapable of withstanding the pressure of other forces acting upon it, be they chemical or mechanical. The crystals may effloresce on the outside of the brick where unglazed, and the brick itself is often crumbly and rotten underneath the efflorescence. The direct effect on the glaze is usually trifling, unless the crystals are formed from the decomposition of the glaze itself. This is considered below under "corrosive agents." Indirectly, however, the effect on the glaze may be great, and that on the glazed brick as a whole disastrous. The freezing water or growing crystals cannot come through the non-porous and inelastic glaze, but they often crack it, snip it, or lift it bodily from the brick it covers. Examination of a wall of bad glazed bricks which has seen service will often disclose the working of this agent, especially in those courses near the ground which are most liable to be damp. An efflorescence will sometimes be found on the face of the brick where the glaze ought to be, or underneath a lifted glaze. If for any reason the glaze and the brick are not suited to one another, and so do not cohere firmly, then the spoiling is facilitated. Underground work is most liable to show these defects. It is possible to test the liability of a brick to disintegration by the alternate freezing and thawing of water. It is, however, very much simpler to test the liability to disintegration by internal crystal formation.

Crystallisation test.—A glazed brick is placed, glazed face downwards, in hot water saturated with sodium thiosulphate, in such a way that an inch depth of the brick is immersed. After soaking, the brick is cooled completely in the open air, to allow crystallisation of the salt and the soaking and cooling are repeated as often as may be necessary. A bad glazed brick begins to crack on the glazed face, and to soften and flake in its substance, after a few alternate soakings and coolings, a good one only after many, and so a decided difference is manifested between the good and the bad brick tested side by side. Probably in the vast majority of cases, if not in all, resistance to the crystallising test and to the freezing test, is the property of the same brick, so that the freezing test is not necessary if the crystallisation test is made.

Fig. 1 shows a very poor glazed brick which was submitted to me for testing. After a few alternate soakings and coolings its condition was bad, and after allowing to stand for a time, atrocious. Coming to bricks of a better class, the effect of testing is not so ruinous. As seen in Figs. 2 and 3, cracking, sometimes interestingly symmetrical, and local or general shelling away of the glaze, are the usual results. If there is a tendency to "crazing" it is displayed by the formation of a network of cracks, or a few long-line cracks. I do not think it practicable to lay down a rule that the brick should stand so many alternate soakings and coolings without injury, because the exact conditions as to temperature, cooling, &c., are not so easy to get every time. The test is essentially comparative, and I believe it to be the most useful single test in the whole range of tests. The crystallisation test gives comparative results quickly, that is in a day or so, and is useful on that account. If a brick which has been subjected to it is exposed to the weather afterwards, the dire effects of the internal crystallisation and efflorescence are much more manifest, as can be seen in Fig. 4. This was photographed from bricks tested in the same way, and to about the same phase of destruction, as those shown in Figs. 2 and 3, but afterwards exposed to the weather for three months. The destruction is complete in the case of nearly every glazed brick, excepting the salt-glazed. One result of the tests made as above, is to show that the ordinary brown salt-glazed brick (when it has been really made by applying salt vapour, and not simply dipped in a brown glaze and burnt like an ordinary glazed brick) is one of the most indestructible of bricks. Another result is to show that a dense unglazed brick burnt to a light chocolate shade, may be very little affected by the crystallisation test, even when exposed afterwards to the weather. No doubt this is due to the fact that since it absorbs so little water, very little actual crystallisation can take place within it; the results justify the value placed upon such a brick for engineering purposes. It might then be thought that the less water a glazed brick could absorb, the better it would resist the crystallising test, but apparently other variations are of much greater consequence in glazed bricks, for in my own experiments there has been no relation found between the porosity of the glazed brick and its resistance to the crystallisation test. The determination of porosity or water absorption may be advisable for other purposes, however, and is easily made.

Porosity determination.—The brick is first dried, unless it is known to come straight from the kiln, and weighed; the drying may be done on an iron plate directly above a gas burner. It is then placed in water for 24 hours, with one unglazed face just above the water surface, to allow the air to come out and the water to enter with ease. For a few minutes at the end of the soaking the brick is completely immersed; then it is removed, drained for five minutes, wiped over quickly to remove externally adhering water, and weighed again. The increase in weight is a measure of the porosity.

It is interesting to note that, as a rule, bricks made by the so-called plastic process, in which the clay is mixed with an excess of water, seem to stand the crystallising test better than those made by the other processes in use, the semi-plastic and dry, in which less water is used, and greater pressure is used to thoroughly bind the clay. Such a result is not surprising if we realise the effect of adding an excess of water. In the first place, the very finely divided portion of the raw clay is thoroughly wetted. It can assume a sort of colloidal state, and so surrounds all the grosser particles with a sort of slime. On drying, the slime becomes a binding element, which has its effect in the production of a very sound brick on burning. In the second place, the excess of water helps greatly to secure the absence of air in the mass of moist clay. If air is present, then, on pressing the brick, it is obviously liable to be spread in air films or cushions between the grains of clay, and so to prevent soundness and continuity of structure in the finished brick. Unsoundness so produced is very different from the fine and uniformly distributed porosity which results normally in drying and burning, from the shrinkage of every particle of clay in the brick on its own centre. When, on subjecting to the crystallising test, a continuous air film is replaced by one of liquid in which crystallisation occurs, the disruptive effect is likely to be considerable.

Liability to efflorescence; Estimation of soluble salts.—The crystallising test shows the extent to which a glazed brick can resist the disintegrating effect of an efflorescence, but does not show in any way the liability of a brick to efflorescence on account of the soluble salts it contains. A chemical test of the quantity of the soluble salts is necessary for that, and can be made as follows: Portions of one brick, or better, of several bricks, is broken up to about pea size, shaken on a coarse sieve, 25 to the inch, and the dust which passes through rejected. (Rejecting the dust does little or no harm, and makes the task easier of execution.) Fifty grms. are then covered in a porcelain beaker or evaporating dish, with 250 c.c. of distilled water, allowed to stand some hours, preferably in a warm place, and the liquid poured off through a washed filter paper. The treatment is repeated with another 250 c.c. of water, and the two filtrates evaporated together to dryness, the evaporation being finished in a weighed platinum or porcelain dish or crucible. The residue is dried at 120° C. and weighed. The percentage of soluble salts = weight of residue × 2.

The residue can be subjected to ignition or to any qualitative or quantitative tests desired. A mode of determining soluble salts, without breaking the brick, is described in the Tonindustrie Kalender, 1907, ii. Teil, page 120. A bottle is filled with distilled water, and on the mouth of it is placed the smooth unglazed surface of the brick. The bottle and brick are then inverted together, and placed, bottle uppermost, on two glass rods over a dish. The drops of water draining through the brick are collected in the dish below. The residue left on evaporation corresponds with the soluble salts originally present in the brick.

Dirt in air or liquid.—The next harmful agent to be considered is the dirt carried by air or liquid. Dirt may discolour the brick face either from the back or from the front. Dirty liquid causes discoloration from the back by penetrating the pores of the brick, and so reaching the back of the covering glaze. If the glaze is opaque then the colour of the face of the brick is naturally unaffected, but otherwise it is spoilt by unsightly staining. Discoloration from the front is one of the commonest forms of deterioration in glazed clay-ware. Dirt carried by liquid or the atmosphere is often deposited temporarily on any glazed brick face, and, unless that face is of the proper character, a portion of the dirt is liable to find there a permanent lodgment. The only way to prevent this happening is to make the glaze perfectly smooth, with nothing of the egg-shell surface about it, which may look harmless or pretty in a new glaze, and to allow no minute pinhole depressions, but to insist on a smooth glassy surface.

Liability to discoloration.—To test the liability to discoloration from dirty liquid, the brick may be immersed, glazed face downwards, for about an inch above the glazed surface in red ink; the stain will spread through the clay, and may or may not show through the glaze: or a hole may be made in the glazed face, or under it at the side, and red ink be poured in (see Figs. 5 and 6). This is the common method of making the well-known "ink test." Sometimes excessive porosity accelerates the discoloration, by conveying the discolouring liquid more quickly to the face. A comparison of this effective porosity may be made by placing two bricks side by side in red ink, immersing them about 1 in. deep, with the glazed face uppermost, and out of the liquid, and noting the rate at which the red stain rises on the side of each brick. In making this test, it is necessary to ensure first that the immersed faces of the bricks are not sealed by accidental glazing or fire-flashing. A convenient plan is to make the ink test, and the crystallising test together. This can be done by adding ink or any staining fluid to the saturated solution of sodium thiosulphate before proceeding with the crystallisation test.

The liability to take in dirt from the front, which has been alluded to as so serious a matter, is partially determined by the ink test, when made by complete immersion of the glazed face, but the best test is to rub into the glazed face damp soot or lamp-black, and then to wipe it off. The smooth bright glaze is unaffected, but not the rough dull glaze. Small depressions in the glaze, which did not appear before, become defined black points. The test shows unmistakeably the great value in one respect of a good glazed surface: it will not hold dirt. The effect of a dirty town atmosphere is at least as bad as anything that can be done by this rubbing: the dirt can be easily removed from a smooth glaze, but not from a rough one. If a good glazed brick wall is washed occasionally, the dirt on the face should come away completely. Apart from the holding of ordinary dirt, it is very desirable in such situations as the walls of hospitals and schools that a glazed surface should not harbour bacteria. If a glaze will not stand the black carbon test without disfigurement, it will hold bacteria, and so should not be used.

Corrosive liquid or vapour.—The action of corrosive liquid or vapour tends, in the first place, to destroy the surface film of glaze, which must therefore be of a chemically resistant composition. Whether the destruction of the surface film, if accomplished, is very harmful, or comparatively harmless, depends on the structure of the whole substance of the glaze under the surface film. If the glaze is fused throughout to a close and solid glass, it has an enormous advantage over one which consists of a somewhat spongy or honeycombed mass, wanting in solidity and continuity, covered by a very thin, continuous surface film. In the former case, the removal of the surface film simply exposes a similar film below it. In the latter case, as soon as the first thin film is gone, then the exposed surface is comparatively rough and hollow in structure; it easily corrodes further, and, being porous, easily holds dirt, and so is soon disfigured. The spongy structure is commonest in glazes containing undissolved solid particles, whether there by accident or added to secure opacity. It is therefore often noticeable in glazed bricks rendered impervious by the use of an opaque glaze. The action of corrosive liquid is of fundamental importance, at times in connection with glazed clay-ware used for chemical purposes, but the tests are best made with the special conditions in view, which vary widely.

Corrosive vapour.—Glazed bricks may be used successfully to resist highly corrosive vapours, as in lining the fume-closet of a chemical laboratory. More commonly, the surrounding atmosphere is not so corrosive, but in towns, especially industrial centres, it always contains some acid constituents, such as sulphurous and sulphuric acids, formed in the burning of coal or coke. Our testing aims at deducing with some probability what may be expected to be the result of a slightly corrosive atmosphere, acting for a long time, from the observed result of a much more corrosive atmosphere acting for a comparatively short time.

The following test is described in the Toninindustrie Kalender (ii. Teil, p. 160):—"Weber's Wetterbeständigkeitsprüfer (weather-resistance tester) consists of a large glass bell with a broad rim, and stands on a glass plate. Inside the bell stands a porcelain vessel containing hydrochloric acid, and a tripod of glass rods, on which the glazed pieces to be tested are laid. The pieces remain for 24 hours inside the bell, with about 5 mm. depth of acid in the porcelain vessel. The effect of the acid vapour on the glaze is comparable with that of a long damp winter. After 24 hours, the test pieces are dried, without wiping, in a warm dust-free place. If the glazed surface shows a white scum it is not weather resistant. Good glazes are, after drying, quite clear, without scum." It is to the credit of glazed-brick makers in this country that only very inferior grades of their wares are in the least affected by the 24-hours test made in this way. Soft enamels, burnt at low temperatures, and badly constituted chemically, are attacked, and some of the so-called majolica glazes, when badly made, although these can be manufactured quite resistant. The glazes on fancy tiles and "art-ware" generally, are also prone to fail. Generally, however, the test is not sufficiently severe for the better qualities of glazed bricks, which are burned at higher temperatures and covered with a more much resistant glaze. Moreover, liability of a glazed surface to acid attack is often local, and so it is advisable to test very much larger surfaces than can be conveniently exposed in the form of apparatus described; a few square inches is not enough. The test, therefore, takes in my own laboratory a rather different form (see Fig. 7).

Corrosive Vapour Test.—A glazed sink is placed on an iron plate, under which a small flame is kept burning. The bricks to be tested are placed in the sink with the glazed faces upwards, and also a crucible containing strong hydrochloric acid. The upper edges of the sink are coated with vaseline, and a sheet of glass, put on the top, and gently pressed down, makes of the sink an air-tight chamber, in which the vapours of the acid may act on the glazed bricks. The glazes may be tested in this chamber for weeks or months without inconvenience, the gas flame being just large enough to keep the chamber gently warmed and charged with fumes of acid. At the conclusion of the exposure, the brick is dried, and any residue thereon noted. It is then further tested by rubbing any damp carbon powder, such as soot or graphite, into the face for some minutes. If the glaze is a sound one, the black powder will not hold, and can all be wiped away with ease. If, however, the surface film has been destroyed, and the glaze below the film is not sound, but is bubbly or spongy, then the black powder is forced into the face and sticks there. Although the form of test just described gives results quickly in some cases, it may with high-class glazed bricks take weeks or months. A more searching test is necessary for rapid work, and it may be made by substituting hydrofluoric acid for hydrochloric acid, the hydrofluoric acid being placed in a platinum, rubber, or lead holder. No glaze will stand hydrofluoric acid, so

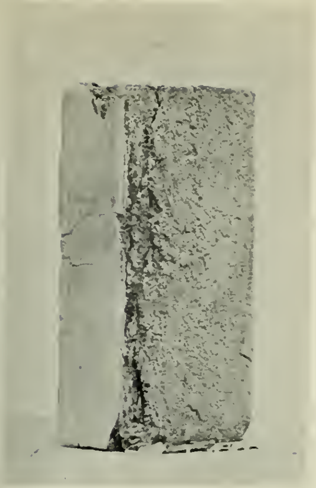

Fig. 1.

Bad glazed brick after crystallising test.

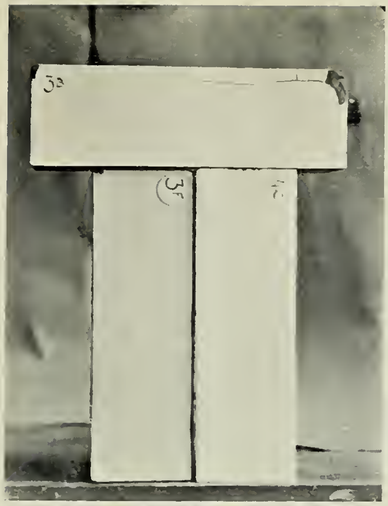

Fig. 3.

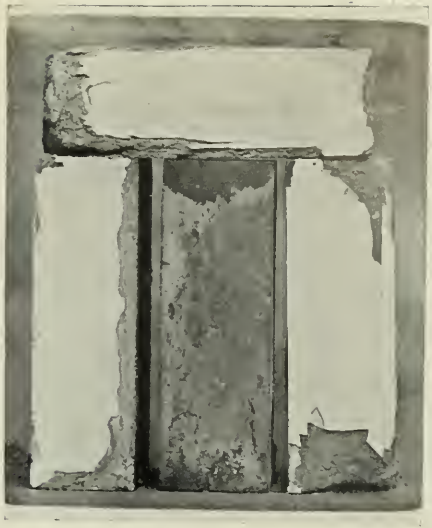

Fig. 4.

Glazed bricks after crystallising test and three months' weathering.

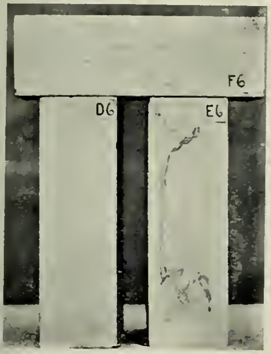

Fig. 2.

ter crystallising test. D6, good; E6, F6, not so good.

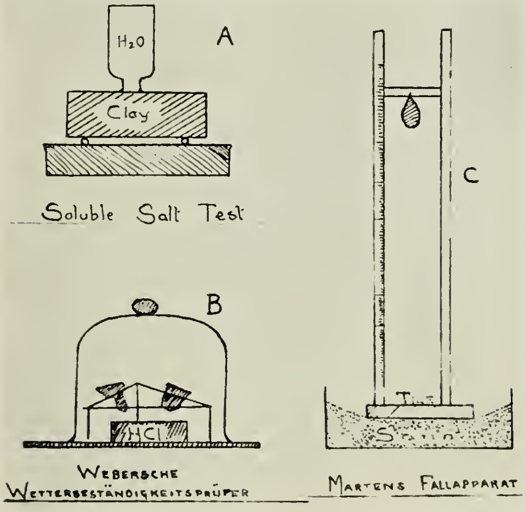

Fig. 9.

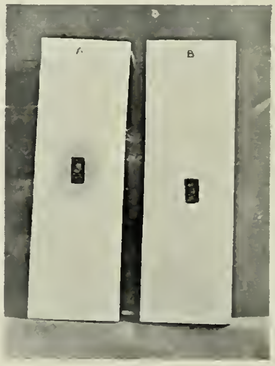

Fig. 6.

Result of ink test. A, not impervious; B, impervious.

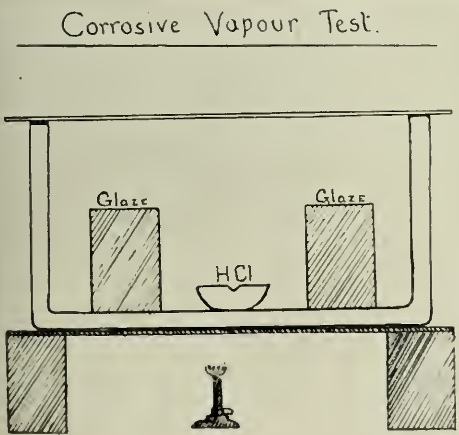

Fig. 7.

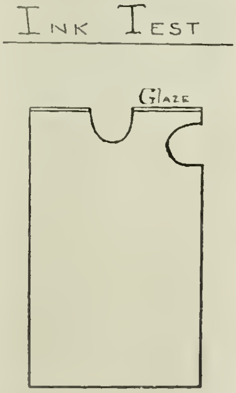

Fig. 5.

Ink is poured into either of the holes shown.

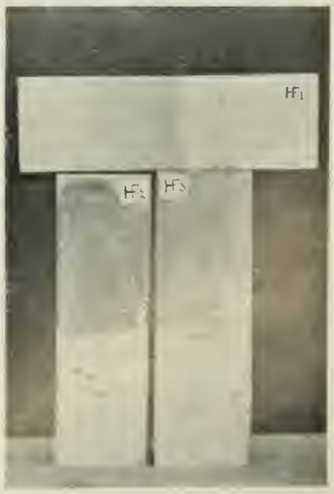

Fig. 8.

After exposure to hydrofluoric acid and rubbing with carbon powder.

far as I know, but glazes display considerable difference after the same exposure to it, more especially when the rubbing with black carbon follows. The test is particularly useful for determining the solidity of structure of a glaze under the surface film. Fig. 8 shows glazed bricks of different makes exposed together for some 12 hours to hydrofluoric acid vapour, and rubbed with carbon dust. Half the glaze on each brick was protected by coating with wax before exposing, and the difference between the exposed half and the protected half at the end of the test, is a measure of the action on the glaze. There are considerable differences between bricks of different makes in the way they stand this test, and so a comparison between them can be made. Generally speaking, bright transparent glazes come out considerably better than opaque enamels, because they are so much less liable to be spongy in structure. The oxide of iron in the clay may dissolve in the hydrochloric acid, forming the yellow chloride, and so cause a discoloration in the clay, which may show through the glaze. Again, in the case of certain crystalline glazes, the crystals may be completely removed by solution in hydrochloric acid, and the colour and general appearance of the glaze considerably altered.

Pressure.—The next deteriorating influence to be considered is that of pressure. The lower courses of a glazed brick wall are often subjected to great pressure, and the growing use of higher buildings is increasing the average pressure to be borne. If a glazed brick were to fail completely to bear the pressure, the consequences would be serious, but even any local unsoundness, particularly near the edges of the glazed face or just underneath it, is liable, under pressure, to cause cracking or shelling away of the glaze, especially round the edges. At this point may be indicated the part played by joints in the preservation of large glazed surfaces. The substance of the brick, and the mortar or cement between the bricks, are hard substances in a degree, but they can give way and crumble a little locally without doing much general damage. A glazed surface, however, is different. If pressure is brought to bear upon its edges it cannot crumble, it splinters or cracks. Hence in constructing a wall from units of glazed surface, it is inadvisable that any two of these units should be in actual contact, unless it is certain that they will never be pressed one against the other, which is hardly ever the case. It is one function of the mortar or cement joint to provide a cushion between the brittle edges of the inelastic glazed surfaces. The force of pressure in destroying glazed surfaces is most often seen in a wall, or more particularly in an underground passage, when very narrow joints have been used between the bricks or tiles. To test the liability of a glazed brick to suffer from applied pressure, one way is to determine directly the crushing strain of the brick in a mechanical testing machine. To make the crushing test satisfactorily is only possible with special equipment, and as a matter of fact, high class glazed bricks never seem to fail under pressure in the sense of crushing as a whole. A glazed brick is more likely to fail locally at an edge or corner just under the glaze, and to an extent that would be of no consequence if the brick were not glazed. Probably the best test to detect liability to such fracture is the crystallising test previously described. It will be understood from the above that the direct pressure test cannot replace the crystallising test.

Change of temperature.—That change of temperature often causes partial or complete destruction of glazed clay ware, it is unnecessary to explain, but the range and rate of variation to be resisted may vary within wide limits, and the test is best made to correspond with the special requirements.

Percussion.—Resistance to fracture by the falling of a hard substance upon a surface of clay ware is specially important for roofing tiles, and Marten's "Fall-Apparatus" is made for this purpose. (See Tonindustrie Kalender, 1907, ii., Teil, p. 159). In that apparatus, diagrammatically shown in Fig. 9, a pear-shaped weight is caused to fall from a measured height on the surface of the tile bedded in sand. The weight and height can be altered, and deductions made accordingly. (I have had no experience with this test.)

Scouring.—The effect of scouring may be due to sand carried in liquid or blown in air, or to actual rubbing. The result is scratching of the glaze, and ultimately the wearing away of the surface film. The lower courses, especially at the corners, of brick walls built in busy places, often show the effects of knocking, rubbing, and scratching. Hardness of glaze and solidity of structure under the surface film will be understood to be necessary, if scouring is to be resisted. A test which would certainly be useful, if the details were worked out, is the application of a sand-blast or a scouring of the glazed face with sand and water, followed by the rubbing in of damp carbon powder. The chief difficulty in either case is to control and standardise the amount of scouring.

Any of the tests which have been described may have to be somewhat modified to suit the sort of glazed clay-ware tested. Only such tests as are capable of fairly general application have been considered. Some of them are very simple and obvious, but, so far as I know, they have not been systematically described or collected. Moreover, it has been my desire to simplify the apparatus and manipulation described for testing as far as possible, so that means of distinguishing between good and bad might lie to hand for everybody interested in the quality of glazed clay wares.

In conclusion, let me express my thanks to the directors of the Farnley Iron Co., in whose laboratory my tests have all been carried out, and also to Mr. C. P. Finn for assistance in the experimental and photographic work.

Discussion.

Mr. F. W. **Branson** said he would like a little further information about the scouring test. Compressed air might be used, and the test made with sand of a definite size. The differential test with hydrofluoric acid was extremely interesting. He mentioned a case in which sodium carbonate derived from the shales with which some local bricks had been made had caused injury to a coating of "Adamant" on the inner walls of the Leeds School of Medicine.

Dr. H. M. **Dawson** said the thiosulphate test appeared to be quite different from the ordinary freezing test. Water, on freezing, increased in volume about 10 per cent., whereas the supercooled thiosulphate underwent on crystallisation a contraction, the amount of which might easily be calculated. Although, therefore, the changes in volume on solidification were entirely different, yet in both cases the same disintegrating effect was produced. It seemed possible that, in the thiosulphate test, molecular forces between the material of the clay-ware and the supercooled solution, such as give rise to surface-tension phenomena, came into play. If the very minute pores of the brick were imagined to be completely filled with the supercooled liquid at the temperature of the room, then, when crystallisation began, the accompanying contraction would result in a considerable pull upon the walls of the cell pores, which might, perhaps, account for the observed disintegration. The test might throw some light on the internal structure of the material. In particular a comparison between the results of the porosity test and those of the disintegration test would be of interest, since differences in porosity would be expected to influence the behaviour in the thiosulphate test.

Mr. F. W. **Richardson** asked what importance the author attached to the presence of alkaline salts in clays. Various opinions were held as to the amount of iron which could be allowed in a good clay. The production of a vitreous surface appeared to be very important. He would like to know if the application in the form of a paste of some substance in a thin layer might not be useful. Why should the hydrofluoric acid test be applied in an earthenware sink covered with glass which would be corroded by the acid? Would not a lead oven and solid calcium fluoride, decomposed when required by sulphuric acid, be preferable to the method suggested in the paper? It seemed difficult for anyone to reach definite conclusions without considerable experience, and he would like to know if a standard brick or clay could not be obtained as a guide.

Mr. T. **Fairley** said he did not think the difference of density of the solid mass of crystals, as compared with the density of the liquid from which they were formed, or the difference of their volumes, fully explained the disintegration. Crystals might occupy the same volume as their parent liquid, but the form and shape of the mass would be controlled by the form of the crystals, so that in the direction of the greatest dimension of the crystals there would be an increased pressure, and in that of the least dimension a diminished pressure. In towns where bituminous coals were used, the bricks were covered with hydrocarbons of a tarry or greasy nature, which made it very difficult to get the surfaces of the brick clean. Soap or soda was then necessary, and he would like to know if these were deleterious.

Mr. J. W. Cobb, in reply, stated that the scouring test was not standardised. It had only been mentioned in the paper as desirable, and was emphatically in the preliminary stages. Dr. Dawson's theory was interesting, but it would lead to a compression rather than an expansion effect. The size of pores was perhaps important; the same water absorption did not lead to the same resistance in the crystallising test. Mr. Richardson's question about alkalis and iron oxide could not be answered simply; the proportions of all the constituent oxides, mode of manufacture, temperature of burning, and the use of the finished articles had to be considered together. A lead oven would no doubt be quite satisfactory, but was not, perhaps, so generally available as the sink mentioned, which served the purpose. A vitreous dip was practicable—indeed, the glazed brick was itself an example. Standards were not yet set up excepting by the individual; all the tests described were comparative. Mr. Cobb agreed with Mr. Fairley as to the probable cause of the disintegrating effect of crystallisation: in the paper he had indicated the action of some force other than that due to expansion. Glazed bricks could be quite easily cleaned if they were not allowed to go for a very long time without any attempt to clean them, always provided that the glaze was not of the spongy or pin-holed character mentioned in the paper. The simple rubbing test, with damp soot, was particularly useful in this connection. No ordinary washing solution, alkaline, or otherwise, would injure good glazed bricks, but water should serve.

Obituary.

MARCELIN PIERRE EUGENE BERTHELOT.

Berthelot was born in Paris on Oct. 29, 1827, his father being a physician. After a course of education at the Lycée Henri IV., where he specially devoted himself to philosophy, he turned his attention to science, and in 1851 was appointed assistant to Balard, Professor of Chemistry at the Collége de France. In 1854, Berthelot not only took his degree of *docteur ès sciences*, but his first step to fame through his doctoral thesis on the compounds of glycerol with acids. In this research he followed up the lines indicated in Chevreul's classical work; his labours on the synthesis of the fatty bodies are well known. During the nine years which he spent at the Collége de France, he was engaged chiefly on problems of synthetic chemistry, and his results are summed up in the "Chimie organique fondée sur la synthese," published in 1860. In 1859 he was chosen Professor of organic chemistry at the École de Pharmacie, and here he remained for six years. At the end of this period he was appointed to a chair of organic chemistry, created for him at the Collége de France. This chair he occupied for the remainder of his life. In 1865 he turned to the second branch of study with which his name is specially associated—that of thermochemistry, and his researches are described in two large volumes, "Mécanique chimique fondée sur la thermo-chimie," published in 1879. These were followed by two more volumes on the same subject in 1897. He may, indeed, be defined the creator of thermochemistry. By a natural extension of these studies he was led to the investigation of explosives, both from the theoretical and the practical points of view, the former being represented in his work "Sur la force de la poudre et des matières explosives," published in 1872, his practical experience and skill being called forth as head of the French Explosives Committee. Among the many synthetical discoveries he made, the one perhaps the most important for chemical industry was that of the direct combination of carbon with hydrogen to form acetylene, though great industrial importance may be attached to his synthesis of the fundamental organic compounds, methane, formic acid, methyl and ethyl alcohols, and benzene. In 1878 he discovered persulphuric acid.

Later in his life, Berthelot turned his attention to the history of chemical science, and his book on "Les origines de l'alchimie," with his publication, with translations and notes, of various old Greek, Arabic, and Syriac treatises on alchemy, throw a flood of light on the chemistry of the Middle Ages. Berthelot, who succeeded Pasteur in 1889 as perpetual secretary of the Academy of Sciences, was Minister of Public Instruction in the Goblet Cabinet in 1886—1887, and Minister of Foreign Affairs in the Bourgeois Cabinet in 1895—96. From 1876 he was Inspector-General of Higher Education, and after his election as a life Senator in 1881, he continued to take a lively interest in education questions. In 1873, he was elected a Fellow of our Royal Society.

In November, 1901, the great chemists from every country assembled in Paris to do honour to Berthelot. The hall of the Sorbonne was crowded with men of science who had come to the celebration of his jubilee, whilst foreign academies and universities to the number of over a hundred, sent congratulatory addresses. A medal which had been struck for the occasion was then presented to Berthelot by the President of the Republic. Fifty years earlier he had published his first scientific work, "On a safe and easy method of demonstrating the liquefaction of gases."

Berthelot died suddenly at Paris on March 18, 1907, following the shock received caused by the death of his wife. His son, Daniel Berthelot, is already well known for his researches in chemical physics, and occupies a chair at the Ecole supérieure de Pharmacie.

ROBERT WARINGTON.

Robert Warington was born in 1838, and was the son of Robert Warington, F.R.S., one of the founders of the Chemical Society, and for a long time the chemist to the Society of Apothecaries. Being of delicate health, he was educated at home, learning chemistry from his father. In 1859, he acted for some time as voluntary assistant in the Rothamsted Laboratory of Lawes and Gilbert, and in 1862 he proceeded to the Royal Agricultural College at Cirencester as assistant, first to the late Dr. Augustus Voelcker, and then to Prof. A. H. Church. In the nine years following, Warington was chemist at Sir John Lawes's tartaric acid works, but in 1876, being desirous of devoting himself entirely to research, he returned to the Rothamsted Laboratory, where he remained until 1890. Though Warington's interest was chiefly centered upon agricultural chemistry, he nevertheless published many papers dealing with inorganic chemistry, and he likewise prepared a detailed account of the various salts of tartaric and citric acids as they naturally occur, and as they are produced. In 1876, Warington introduced several improved analytical methods which both economised time and ensured increased accuracy. During this period, too, he conducted the research on nitrification, which brought him renown. The work of Schloesing and Müntz on the production of nitrates in the soil by the agency of living organisms, published in 1877, was repeated by Warington, and he continued to investigate the conditions favourable to the process. He demonstrated the fact that light inhibits the change, and that drying the soil would destroy the organism. He, further, investigated the distribution of the organism, and showed that it was confined to the surface layers of ordinary soil, being only present in appreciable quantity in the portion usually stirred by the plough. Observing that oxidation of the ammonia or urea employed, sometimes stopped at the stage of nitrite, he succeeded in showing that the action proceeds in ordinary soils in two stages, due to different organisms, one oxidising ammonia to nitrous acid, the other completing the oxidation, and yielding nitric acid. Warington had actually succeeded in isolating the nitrous and nitric organisms, though not fully to his own satisfaction, when his researches were unfortunately interrupted, and before he could resume them, Winogradsky's elegant method of isolation, by the employment of a nutrient silica jelly, was published. In the course of his nitrification researches, Warington also observed and studied that other process of denitrification, whereby previously formed nitrates are again reduced, often with loss of free nitrogen. He further found a method of determining small quantities of nitrates by means of indigo, and devised his standard process, which in a modified form is often used in water analysis. But he was most widely known, and his name will be longest remembered for his admirable text books on agricultural chemistry, and most especially for that standard work, "The Chemistry of the Farm," which has already run through 15 editions. Robert Warington was, for several years, Sibthorpian Lecturer on Rural Economy at Oxford, and he was elected to the Royal Society in 1886. He died at Harpenden, March 20, 1907.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, & MACHINERY.

(*Continued from page* 308.)

English Patents.

Drying liquids on heated cylinders; Process for ——. G. Kunick, London. From J. Kunick, Berlin. Eng. Pat. 5189, March 3, 1906.

See Fr. Pat. 366,286 of 1906; this J., 1906, 973.—T. F. B.

Compression of gases. G. Meyersberg, Berlin. Eng. Pat. 5264, March 3, 1906.

The invention relates to the method of compressing gases in which the energy is transmitted from the pump to the gas by means of a liquid. A vertical fall pipe, divided into a number of vertical sections, is connected to the delivery of a centrifugal pump by a rotary valve. The fall tube has an air-inlet pipe near the top and a compressed-air outlet near the bottom. The liquid delivered by the pump is allowed to fall in the form of pistons down the successive vertical compartments of the fall pipe. Each liquid piston draws in a quantity of air, compresses it, and carries it down to the compressed air outlet. The liquid is then drawn in again by the pump and circulates over again. Several fall pipes may be arranged in series to form a stage compressor, connected to a single pump, which circulates the water in the opposite direction to that taken by the air.—W. H. C.

Packings for Glover and other towers, tunnels, and the like, used in processes for concentrating liquids, absorbing gases, and like purposes. J. Mackenzie, Middlesbrough, and J. M. Gibson, Buckley. Eng. Pat. 17,832, Aug. 8, 1906.

The claim is for a new form of tower packing constructed of earthenware or other suitable material. The tower is filled with a number of "bridge-pieces" of the shape illustrated, Fig. 1 being a plan, Fig. 2 a longitudinal section, and Fig. 3 a cross-section on the line, ZY, of Fig. 2. The pieces are of greater breadth than depth, and the upper surface, B, is curved and may have longitudinal grooves. The lower surface has smooth, sloping sides, D, which terminate below in a longitudinal ridge, E, having a saw-like lower edge, from the points, C, of which the liquid drips in separate drops. The pieces have rectangular ends, A, by which they can be built into the walls of the tower lining. They are packed into the tower at short vertical intervals, in horizontal rows, so that they form bridges which extend across the interior of the tower from wall to wall, and they are so spaced that the liquid drips from the points, C, of one piece on to the centre line of the upper surface of the piece immediately below. The cross-section of the pieces may be varied, if desired, and forms are shown which have convex upper and concave lower surfaces, or which have straight surfaces and are set at an angle.—W. H. C.

FIG. 1.

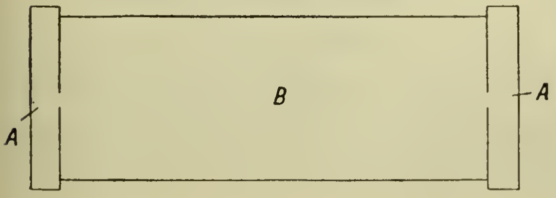


FIG. 2

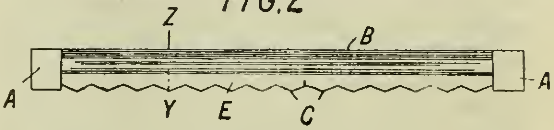
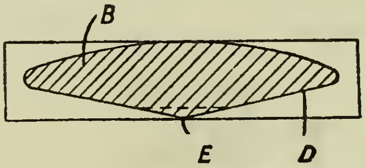


FIG. 3.



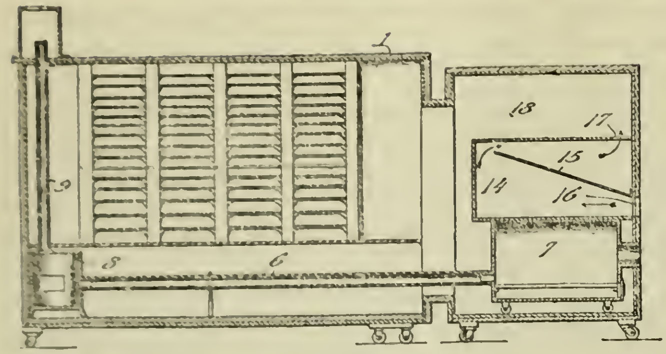
United States Patents.

Desiccating plant. E. W. Cooke, New York, Assignor to The Cokel Co. U.S. Pat. 841,939, Jan. 22, 1907.

See Eng. Pat. 14,854 of 1905; this J., 1905, 1319.—T. F. B.

Drying apparatus. A. Coleman, Kerby, Oreg. U.S. Pat. 842,769, Jan. 29, 1907.

The drying-chamber, 1, has a primary heater, 7, connected by a flue, 6, which passes below the drying chamber,



with an auxiliary heater, 8, situated at the other end of the drying-chamber. The auxiliary heater, 8, has an outlet flue, 9, and a heating drum, 14, provided with a baffle-plate, 15, and arranged over the primary heater, 7. Air enters the drum, 14, by the opening, 16, and passes by the passage, 17, into the chamber, 18, which communicates with the drying-chamber, 1.—W. H. C.

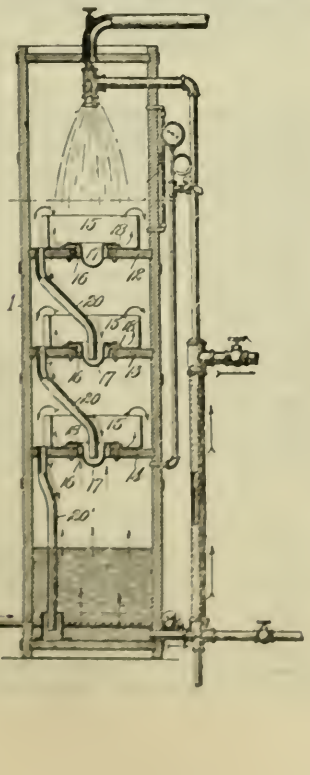
Pyrometer. G. Heeley and C. Féry, Assignors to Cie. pour la Fabr. des Compteurs et Matériel d'Usines à Gaz, Paris. U.S. Pat. 842,314, Jan. 29, 1907.

See Eng. Pat. 5668 of 1905; this J., 1906, 256.—T. F. B.

Separating materials; Apparatus for ——. T. Blass, Lebanon, Pa. U.S. Pat. 842,614, Jan. 29, 1907.

The mixture to be separated is fed from a hopper into the smaller end of the innermost of two horizontal, concentric, conical drums, which are mounted on a shaft and rotated by suitable gearing. The inner drum is perforated and has an extension at its larger end. A fluid under pressure is delivered into the annular space between the drums, passes through the perforations and maintains the materials, thrown outwards by the centrifugal force, in a "stratified" condition, so that the heavier and lighter particles can be withdrawn by separate discharge pipes.—W. H. C.

Still; Continuous ——. E. Krepper, St. Louis, Mo. U.S. Pat. 843,217, Feb. 5, 1907.



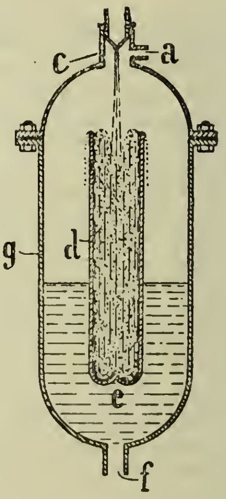
A vertical column or casing, 1, is divided by horizontal shelves, 12, 13, 14, into several compartments. Pans, 15, are arranged on each shelf, provided with seal cups, 17, which extend into holes, 16, in the shelves, and having rims, 18, which are bent over so as to form hoods. Overflow pipes, 20, pass from each shelf outside the pans, through the shelf to the seal cup next below. The liquor is fed into the top pan and flows down from shelf to shelf. The steam or other heating medium enters the lowest compartment, and with the vapours given off, passes upwards through the openings, 16, and bubbles under the rims of the seal cups. The vapour given off passes from the top compartment by a pipe, to the condenser.—W. H. C.

French Patents.

Filter. E. Goldman and Co., Incorp. Fr. Pat. 371,696, Nov. 21, 1906. Under Int. Conv., Aug. 18, 1906.

See U.S. Pat. 834,637 of 1906; this J., 1906, 1136.—T. F. B.

Saturating liquids with gases; Process and apparatus for ——, *combined with a hydrodynamic mixer.* C. Malmendier and M. Stühler. Fr. Pat. 371,714, Nov. 21, 1906. Under Int. Conv., Nov. 30, 1905.



The liquid injected under pressure through the jet, *c*, draws in the gas through the tube, *a*. The jet of liquid impinges on the surface of liquid contained in the upright cylinder, *d*, and causes a vortex to form. The gas is carried down with the liquid in the form of bubbles, and the two are caused to return together along the sides to the upper end of the cylinder, by the aid of the curved bottom, *e*. The liquid, saturated with gas, overflows into the outer vessel, *g*, from which it escapes by the pipe, *f*.
—W. H. C.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 310.)

Coal-testing in the United States. J. S. Burrows. Times Eng. Suppl., 1906, 315; 1907, 10, 27.

A concise abstract of this work appeared in this J., 1906, 257. The above references give the full details of method and procedure.

[*Petroleum*] *Fuel oil question in Boryslaw.* M. Wielezynski. Petroleum, 1907, **2**, 485—487.

The author's experiments show that in accordance with the higher temperature of combustion of crude oil, and the higher velocity of the products of combustion, due to the use of the atomiser, the heating surface must be of larger dimensions than with coal, to produce the same result in the boiler. The high temperature of the products of combustion can be advantageously utilised for superheating the steam, thus reducing the loss of heat in the chimney stack and economising the consumption of steam in the atomiser. A fire-bridge is desirable to prevent the undue cooling resulting from the direct contact of the flame with the boiler. The air for combustion should be warmed by passing it through flues in the bridge, and be supplied to the extent of 50 per cent. in excess of theoretical requirements.—C. S.

Flame in gas and petrol motors. Dugald Clerk. J. Gas Lighting, 1907, **97**, 746—747.

Mechanical power can be obtained by means of flame in the following different ways:—(1) *Explosion-vacuum method.*—A vessel fitted with a non-return blow-off valve is filled with a mixture of gas and air; the mixture is ignited, the excess pressure generated by the explosion blows off through the valve, and the remaining gas cools rapidly, producing a partial vacuum which may be utilised to operate an engine communicating with the vessel. (2) *Flame-vacuum method.*—A moving piston draws a flaming gas mixture into a cylinder through a valve; the valve closes, and the piston continues the expansion in the cylinder. The gas in the cylinder then cools, producing a partial vacuum, and on the return stroke the piston is forced back by atmospheric pressure. (3) *Non-compression explosion*, and (4) *compression explosion method.*—In these two methods a mixture of gas and air is exploded within a cylinder provided with a piston; in the former case the mixture is not compressed before ignition, but by first compressing the mixture, as in the latter case, a much higher efficiency is obtained from the same weight of charge. (5) *Expansion at constant pressure without explosion.*—A cylinder is fed with gas and air under pressure, the mixture burning at a grating or gauze as it enters the cylinder, so that the pressure in the latter never rises above the supply pressure. A small volume of the cool mixture, when inflamed, thus yields a large volume at the same pressure, and a small movement of the supply-pump piston produces a large movement of the motor piston. Of the above methods, the fourth is that used almost exclusively in modern gas and petrol engines; the great majority of these motors operate on the Otto cycle, in which an explosion occurs at every second revolution, but in the Clerk cycle the engine receives an impulse at each revolution. The theory of the internal-combustion motor suffers from the want of accurate knowledge concerning the properties of the operative gases, and the chemical reactions occurring within the cylinder at high and varying temperatures and pressures. It has been assumed that on exploding the gaseous mixture, complete combustion is coincident with attainment of maximum pressure. The author's investigations lead to the conclusion that that is not the case, but that combustion continues for an appreciable time after the maximum pressure is indicated. This factor must be taken into consideration in making deductions as to the specific heat of the gases within the cylinder.
—H. B.

Methane; Determination of —— in fire damp. N. Gréhant. XXIII., page 435.

English Patents.

Pitch; Application of —— to artificial fuel making as a waterproof agglomerant and preservative. T. Marriott, Kingston-on-Thames. Eng. Pat. 5435, March 6, 1906.

Rich soft pitch is mixed in a heated condition with peat, peat dust, or peat moss dust, in order to make it hard and brittle when cold, so that it can then be pulverised for mixing with fuel in the manufacture of briquettes. The peat, &c., may also be mixed with tar or anthracene oil before being incorporated with the pitch.—C. S.

Fuel briquettes [*from raw cotton waste*]; *Manufacture of* ——. P. C. Mehta, Bombay. Eng. Pat. 18,131, Aug. 13, 1906.

The waste material (leaf, stalk, seed, shells, &c.) separated in the process of cleaning cotton, is mixed with a suitable proportion of the size dust falling from the warp threads in cotton looms, the mixture being moistened (*e.g.*, by steam) and moulded into briquettes.—C. S.

Fuels or briquettes: Process for manufacturing agglomerated ——. A. Tavernier, Puteaux, France. Eng. Pat. 24,742, Nov. 5, 1906.

See Fr. Pat. 359,249 of 1905; this J., 1906, 365.—T. F. B

Coke ovens. H. W. Seymour. Leeds. Eng. Pat. 9327, April 20, 1906.

Two sets of horizontal flues are arranged in each side wall, but are divided into equal parts in such a manner that the gases entering one set first traverse a full length flue and then two half-length flues, whilst in the other set they traverse two half-length flues first and then a full length flue. At the further end the gases from both sets enter a common return flue under the sole of the oven on their way to the chimney. These sets are duplicated in each side wall, and the gases are supplied with air from parallel air channels fitted with a considerable number of communicating inlets, so that the air supply is distributed uniformly to the whole length of the gas flues, to avoid local overheating.—C. S.

Metallurgical coke or other kinds of coke; Process for utilising close-burning coal dust for making ——. G. de Velna, Paris. Eng. Pat. 19,780, Sept. 5, 1906. Under Int. Conv., Sept. 12, 1905.

See Fr. Pat. 357,687 of 1905; this J., 1906, 116.—T. F. B.

Burners for liquid fuels. A. J. Boult, London. From G. Barthel, Dresden, Germany. Eng. Pat. 15,030, July 2, 1906.

The burner comprises a mixing tube slightly constricted in cross-section at the flame end so that a small proportion of the combustible mixture is deflected through very small perforations in the walls of the tube, thus forming an auxiliary flame. A close coil, in which the liquid fuel is gasified, surrounds the perforated end of the mixing tube and the auxiliary flame, protecting the latter from draughts and deflecting it so that it continuously ignites and keeps up the main flame. The gasified fuel from the coil passes to a jet at the other end of the mixing tube and draws in air by ejector action. Several forms of mixing tube are described, the restriction at the flame end being formed by an inward flange or bend, by an internal tubular cap, or by an external cap with a smaller opening than the end of the mixing tube.—A. T. L.

Gas manufacture; Apparatus for use in ——. J. L. Cloudsley, jun., Reigate, and H. G. Colman, London. Eng. Pat. 7479, March 28, 1906.

To obviate the disadvantages due to variations of pressure caused by the surging of the liquid in the hydraulic main, the dip pipes are provided with serrated edges under the liquid in the main, so that any sudden rush of gas is split up into small bubbles, and a pressure governor is interposed between the retorts and the exhauster (say, between the foul main and the exhauster). The gas thus passes through the hydraulic main without causing material disturbances of the liquid, and a very small seal may be maintained.—H. B.

Gas mixing apparatus. P. von Wouwermans and L. Loewenstein, Vienna. Eng. Pat. 7814, March 31, 1906.

The invention relates to apparatus for producing a compressed mixture of gas and air for the supply mains of an incandescent gas lighting system, the object being to reduce risk of explosion or of interruption in the working. A hydraulic rotary drum compressor, driven by an electric motor, comprises two compressor drums delivering gas and air separately to a small mixing chamber communicating with the bell of a small holder mounted above the compressor. No mixing can take place in the compressor, even under excessive back-pressure. The tank of the holder is enclosed, and the upper portion forms an air chamber outside the bell; this chamber is connected to the air-intake pipe of the compressor so that any mixture escaping from the bell is drawn back into the compressor. All points requiring packing against leakage to the atmosphere are sealed with liquid; thus the top of the air chamber is a loose cover dipping into a seal. The outlet from the bell is through a pipe covered at its mouth with wire gauze to prevent firing back from the burners into the bell. A U-shaped controlling rod attached to the bell rises and falls in a vertical channel, sealed with liquid, at the side of the holder tank and carries stops which engage with three tumbler switches. The central switch starts and stops the motor in certain positions of the bell. If this switch fails, and the bell falls, the lowest switch, which is connected in parallel, is closed and starts the motor. If the bell rises too high, the uppermost switch is opened and stops the motor. This switch remains open when the bell falls, and the motor is not restarted. The bell, falling to its lowest position, throws over a tumbler lever actuating a four-way cock, which normally connects the low-pressure gas supply main to the intake of the compressor, and the outlet from the bell to the lighting main, but when actuated as described, first closes all four pipes, and then connects the low-pressure gas main to the lighting main. The tumbler lever in addition closes the switch of an auxiliary electric lighting circuit, and opens a two-pole switch of the motor. Finally, the gas supply to the compressor communicates with a weighted bell, sealed in oil and carrying a lever which switches off the motor if the pressure of the gas supply falls below a predetermined limit.—A. T. L.

Gas producer. W. H. Bradley, Bellevue, U.S.A. Eng. Pat. 18,879, Aug. 23, 1906.

See U.S. Pat. 838,946 of 1906; this J., 1907, 191.—T. F. B.

Carburetting apparatus; Construction and working of ——. J. Zwicky, Mollis, Switzerland. Eng. Pat. 26,306, Nov. 20, 1906. Under Int. Conv., Nov. 21, 1905.

The carburetter consists of a vertical, closed, cylindrical casing, centrally within which is a bell, arranged to work up and down between vertical guides. The air-supply pipe passes centrally upwards from the bottom of the casing into the bell, reaching nearly to the top of the bell when the latter rests upon the bottom of the casing. A horizontal metal plate, having a central hole for the passage of the air pipe, divides the bell into two equal compartments, and to the under surface of the plate is fixed a strip of metal, arranged to form a spiral passage, in which is packed porous material extending downwards not quite to the lower edge of the bell. The casing is filled with carburetting fluid nearly to the top of the bell. On forcing in air, the bell rises to a certain height, thereby removing the porous material from the action of condensed water that may have accumulated at the bottom, and the carburetted air, bubbling up through the liquid from the foot of the bell, passes off through filtering material provided at the top of the casing and in a separate condenser.—H. B.

Incandescent bodies for incandescent light; Hardening ——. M. Sensenschmidt, Frankfurt-on-Maine, Germany. Eng. Pat. 6432, March 16, 1906. Under Int. Conv., March 16, 1905.

The burners used for hardening the incandescent bodies are raised, lowered, and held in any desired position by hydraulic pressure applied to a plunger by means of a three-way tap. Reference is directed to Eng. Pat. 13,197 of 1901; this J., 1902, 907.—C. S.

Incandescent mantles; Manufacture of ——. T. Terrell, London. Eng. Pat. 6814, March 21, 1906. (See Eng. Pat. 11,042 of 1902; this J., 1903, 619.)

The unburnt mantles are coated with an inflammable stiffening substance, *e.g.*, collodion, starch, or the like, then partly dried, and formed on a (preferably steam-) heated former. The finished mantle can be incinerated on an ordinary burner by applying a light to the top of the mantle, which shrinks during the incinerating process to the proper size. The gas is then turned on low for a few seconds, to burn off any residual carbonaceous matter, whereupon the mantle is ready for use.—C. S.

Electrodes for arc lamps. The British Thomson-Houston Co., Ltd., London. From General Electric Co., of Schenectady, N.Y., U.S.A. Eng. Pat. 6088, March 13, 1906.

The electrodes, which are intended for use in flaming arc lamps, are composed principally of a refractory conducting substance, such as magnetic oxide of iron, with smaller quantities of fluoride or phosphate, or a mixture of fluoride and oxide, of an alkaline-earth metal. As the refractory conducting component, the mixtures of metallic oxides mentioned in Eng. Pats. 7298, 7299 or 14,196 of 1904 (this J., 1905, 491, and 611) may be employed, and a mixture of calcium fluoride and oxide preferably forms the smaller component. To form the electrode, a thin tube of sheet iron is filled with the mixture; the lower end of the tube is then closed by crimping it over a wooden plug, whilst the upper end is closed by crimping it over a metal disc.—H. B.

Filaments for lighting and heating installations: Method of producing indestructible ——. G. Michaud and E. Delasson, Montreuil, France. Eng. Pat. 18,643, Aug. 20, 1906. Under Int. Conv., Sept. 30, 1905.

See Addition of Sept. 30, 1905, to Fr. Pat. 346,307 of 1904; this J., 1906, 271.—T. F. B.

Candles or other illuminating bodies for night-lights, lamps, or such like; Manufacture of —— by means of petroleum and other mineral oils. V. J. Kuess, Tunis. Eng. Pat. 14,567, June 26, 1906.

See Fr. Pat. 367,448 of 1906; this J., 1906, 1141.—T. F. B.

United States Patents.

Carburetted air apparatus. T. H. Glasscoe, Wanstead. U.S. Pat. 842,846, Jan. 29, 1907.

See Fr. Pat. 370,059 of 1906; this J., 1907, 191.—T. F. B.

Blast-furnace gas; Process of enriching ——. C. Ellis, White Plains, N.Y. U.S. Pat. 843,079, Feb. 5, 1907.

Gas suitable for use in gas engines is obtained by passing blast-furnace or similar gases through a deep bed of fuel in a gas-producer, and simultaneously injecting air in sufficient quantity to supply the heat necessary for the endothermic reduction of the carbon dioxide in the furnace gases, and to maintain an efficient gasifying temperature. The air may be previously heated, and may be diluted with products of combustion or other "endothermic" agent to prevent local over-heating in the fuel-bed.—A. T. L.

Gas; Apparatus for producing ——. C. Ellis, Assignor to Combustion Utilities Co., New York. U.S. Pat. 843,669, Feb. 12, 1907.

The steam-jet injector of a pressure gas-producer is caused to draw in a mixture of air and combustion products from the chimney-stack of a furnace, in controllable proportions. A valved pipe, leading the combustion products to the injector, is provided with a valved branch near the injector leading from the atmosphere.—A. T. L.

Gas-generating apparatus. G. M. S. Tait, Montclair, N.J., Assignor to Combustion Utilities Co., New York. U.S. Pat. 843,715, Feb. 12, 1907.

A continuous-working down-draught producer is claimed, comprising a cylindrical casing, open at the bottom, and sealed in a water-trough. The lower part of this casing surrounds the inverted conical lower end of the producer chamber, which terminates above the water-level in the trough, the space between the cylindrical and conical walls forming an annular gas-collecting chamber, provided with a gas-outlet pipe. Air is admitted centrally, near the top of the producer beneath the feeding hopper.
—A. T. L.

Gas producer. C. J. Atkinson, Milwaukee, Wis., Assignor to International Harvester Co., New Jersey. U.S. Pat. 843,787, Feb. 12, 1907.

The patent relates to a device for automatically regulating the supply of water to the vaporiser of a suction gas producer, in proportion to the quantity of gas made. The feed-cup has two compartments, open at their tops, one of which is connected to the vaporiser, and the other to a waste pipe. Water is supplied to the feed-cup by a swinging pipe, which normally delivers to the waste-pipe compartment, but delivers to the other compartment when drawn aside by a rod connected to a flexible diaphragm on the scrubber. The diaphragm is returned to its normal position by a spring when the reduction of pressure in the scrubber ceases.—A. T. L.

Gas producer. H. K. Cowen, Chicago, Ill., Assignor to International Harvester Co. U.S. Pat. 845,163, Feb. 26, 1907.

The gas-outlet pipe of a suction gas producer has heat-radiating wings, and is enclosed in a casing forming a heating chamber for the air supply. A partition separates the heating chamber into two compartments, in communication with one another, so that the air is forced to take a circuitous path. A constant-level water-supply cup is provided on the air-inlet to the heating chamber, and permits a continuous flow of water, which is regulated by a needle valve.—A. T. L.

Gas washer. F. E. Bachman, Port Henry, N.Y. U.S. Pat. 844,312, Feb. 19, 1907.

The washer comprises a vertical cylindrical casing divided by vertical walls into a number of concentric annular chambers open at the bottom to the interior of the casing. Each annular chamber contains a spiral shelf, extending from its inner wall nearly to the outer wall. The dust-laden gas enters tangentially, passes downwards in a spiral course through the annular chambers, and leaves the washer by a central uptake. The inner surface of the outer wall of each annular chamber is wetted from the top in such a manner as not to spray the gas.—A. T. L.

Gas washer. F. E. Bachman, Port Henry, N.Y. U.S. Pat. 844,313, Feb. 19, 1907.

A vertical cylindrical casing is provided with a tangential gas-inlet near the top, and a central uptake for the gas-outlet leading from the lower part of the chamber. The inner surface of the casing is kept wetted without spraying the gas by means of two water-boxes outside the casing, arranged to give a constant head of water, just sufficient to overcome the gas pressure. One water-box is placed below the gas-inlet, and the other is at the level of the top of the gas-inlet pipe, and extends around the major part of the circumference.—A. T. L.

Tar extractor ; Centrifugal ——. W. W. Gore, Beloit, Wis., Assignor to Fairbanks, Morse and Co., Chicago, Ill. U.S. Pat. 845,460, Feb. 26, 1907.

The cylindrical casing is divided into a number of compartments by annular partitions, the end compartments having suitable openings for the inlet and outlet of the gas. Each compartment is provided with a rotary impeller, comprising a disc having radial blades on both sides, but the impeller of the last, or gas-outlet, compartment has blades on the inlet side only. The impellers are mounted on a common shaft. The gas passes outward and inward over the impellers in each compartment, and is drawn through the washer by the impeller in the outlet compartment. There is a number of water jets at the top of each compartment, the water escaping through sealed pipes at the bottom of the compartments into a tank below the washer.—A. T. L.

Steam and combustion gases ; Apparatus for producing a mixture of ——. E. Schmidt, St. Petersburg. U.S. Pat. 845,128, Feb. 26, 1907.

See Fr. Pat. 354,724 of 1905 ; this J., 1905, 1103.—T. F. B.

Gas purifying materials ; Process of revivifying ——. H. L. Doherty, Madison, Wis. U.S. Pat. 843,524, Feb. 5, 1907.

The spent oxide is re-oxidised by a regulated current of air diluted with indifferent gases, the temperature not being allowed to rise above 120° F., by the following process: A quantity of an indifferent gas is passed through the oxide in a closed circuit, and the gas is gradually replaced by air in inverse proportion to the tendency of the oxides to rise in temperature. The gas-circuit initially includes a cooler ; the oxidation is completed by the final circulation of pure, warm air.—A. T. L.

Carbide ; Process of utilising marl, making ——. H. L. Hartenstein. U.S. Pat. 844,018, Feb. 12, 1907. XIA., page 417.

Mantles for incandescent gas lighting ; Process for producing ——. J. A. E. H. Boullier, Paris. U.S. Pat. 844,849, Feb. 19, 1907.

See Fr. Pat. 323,959 of 1902 ; this J., 1903, 487.—T. F. B.

Luminant for electric lamps ; Manufacture of ——. J. A. Heany, York, Pa. U.S. Pat. 842,546, Jan. 29, 1907.

A filament, consisting throughout of substantially pure metallic titanium, and stable at an efficiency at which a carbon or titanium-carbon filament rapidly disintegrates, is formed by passing an electric current through a filament of titanium nitride in a vacuum. The current dissociates the nitride, and causes the metal to sinter and shrink into a dense, homogeneous, shiny filament.—A. T. L.

Luminant in electric incandescence lamps. F. M. F. Cazin, Hoboken, N.J. U.S. Pat. 844,778, Feb. 19, 1907.

The filament consists of a core made from an alloy of metals of the ruthenium-osmium class, a concentric adhering layer of rare metals having less affinity for oxygen than the metals of the core, and an outer layer of the oxides of the rare metals.—A. T. L.

Carbons of arc-lamps ; Process for utilising waste ends of ——. R. Peters, Heidelberg, Germany. U.S. Pat. 845,256, Feb. 26, 1907.

See Ger. Pat. 158,151 of 1904 ; this J., 1905, 742.—T. F. B.

French Patents.

Briquettes of anthracite, coaldust, coke, lignite, &c., for industrial and domestic heating. F. Gaertner. Fr. Pat. 371,275, Jan. 17, 1906.

The powdered fuel is mixed cold with icica (a *genus* of resin-yielding trees) and a nitrate, the mixture being afterwards heated and pressed in moulds.—C. S.

Briquettes, anthracite ; Manufacture of ——. A. Bienaimé and A. Requier. Fr. Pat. 371,417, Jan. 22, 1906.

To obtain a binding medium having the same rate of combustion as the anthracite employed, pitch is incorporated with coking coal (*e.g.*, 10 per cent. of the former and 15—30 per cent. of the latter), a little tar or heavy oil being added, if necessary, to facilitate mixing. The briquettes are subjected to a process of distillation at a constant temperature of 800°—900° C., whereby the coal is coked, and a hard, uniformly burning product is obtained. Lime, magnesia, &c., may be incorporated with the mass, in order to lower the fusing point of the ash constituents.
—C. S.

Fuel, artificial ; Manufacture of ——. Composite Fuel Syndicate, Ltd. Fr. Pat. 371,496, Nov. 14, 1906.

Powdered coal is thoroughly mixed with magnesia cement, formed of a mixture of chloride, hydroxide, and carbonate of magnesium, and heated with or without the addition of lime and/or clay. The resulting mass is then mixed with a quantity of prepared oil and water, and formed into briquettes. The oil and water are first mixed and heated separately from the coal dust, and the oil is previously treated with sulphur chloride or other suitable reagent to increase its density and viscosity.—W. H. C.

Coke-oven; Vertical ——, with arrangement for the withdrawal of the by-products, and having the walls heated by Bunsen-burners. R. Barlen. Fr. Pat. 371,538, Nov. 16, 1906. Under Int. Conv., Feb. 9, 1906.

THE claim is for a series of vertical coking chambers arranged in two parallel rows with a space or passage between. The ovens are heated by combustion chambers divided into vertical groups by horizontal partitions, and provided with dampers, these chambers being disposed between each pair of ovens, and provided with Bunsen-burners on the side next the passage. The latter is covered over and is situated over the waste-gas flue, so that it acts as a preheater for the air and gas, which is brought from the purifying plant by mains passing longitudinally along the upper portion of the passage, and having vertical distributing pipes to the burners, which are arranged in a vertical series corresponding to the horizontal partitions. The coal is charged into the top of the ovens, and the coke withdrawn from below. The heating is uniform horizontally, but increases progressively downwards, so that the lower layers of coal are coked first, and the products of carbonisation which leave the ovens at the top are not decomposed by coming into contact with highly heated coke.—W. H. C.

Coke-oven; Sectional hearth for —— formed of frames filled with stamped earth. Soc. D. C. Otto und Co., G.m.b.H. Fr. Pat. 372,054, Dec. 3, 1906.

THE floor or hearth of the coke-oven is formed of frames filled in with stamped earth and arranged in a series of step-like stages. The latter are so placed that the lowest, which extends to the rear end of the oven, can be withdrawn first. Each stage passes under the one above and is provided with a projecting piece which engages with a similar projection at the other end of the lower side of the stage situated immediately above, so that one stage is withdrawn after the other. Ordinarily the stages are kept in position by bolts which are withdrawn when it is desired to draw out the stages.—W. H. C.

Gaseous mixtures for lighting, heating, and motive power; Production and purification of ——. P. Sabatier. Fr. Pat. 371,703, Jan. 30, 1906.

THE process consists in distilling combustible solids or liquids, or a mixture of both, in the presence of steam in such a way as to obtain a maximum yield of illuminating constituents; treating the purified gas with metallic copper at 650° C., whereby the hydrogen content is increased; treating with powdered or reduced nickel, cobalt, or iron at 500° C., in order to convert carbonic oxide into methane and liberate hydrogen from the illuminating constituents; and finally removing carbon dioxide by special means. The first stage of the process is carried out, for example, in a coke-oven heated by producer gas: the carbonising chamber has a perforated and inclined false bottom beneath which tar, &c., is sprayed by superheated steam. The coke formed is transferred to a cooling chamber, and hot water sprayed on it, the water-gas passing into the carbonising chamber. The dilution of the volatile products from the coal, tar, &c., with water-gas increases the yield of illuminating gas and ammonia. The gas produced in this way contains 25 to 30 per cent. of carbonic oxide. It is purified in the usual manner, and finally washed with water at 60° C. The gas is then passed through copper turnings in an apparatus maintained at about 650° C. by waste heat from the coke oven. Ethylenic compounds are decomposed as follows:—$C_2H_4 = C_2H_2 + H_2$, and the acetylene and allied hydrocarbons yield benzene, methane, &c., solid carbon, and free hydrogen. The carbon liberated decomposes the water vapour taken up in the final washing, yielding hydrogen and carbon dioxide. The gas is then treated at the same temperature with reduced copper; a portion of the remaining ethylenic compounds is reduced, benzene is partially converted into methane, and carbon dioxide is converted into carbon monoxide by the reaction: $CO_2 + H_2 = CO + H_2O$. The gas now consists of a mixture of hydrogen, methane, carbonic oxide, carbon dioxide, ethane, ethylenic hydrocarbons, pyrogenetic products of acetylene, naphthalene, anthracene, and a considerable quantity of water vapour. This gas, containing about 50 per cent. of hydrogen, after treatment with nickel, cobalt, or iron at 500° C., consists principally of ethane and other illuminants, methane, hydrogen, and carbon dioxide. The latter is removed by the use of one or more of the following processes: absorption by alkali carbonates or slaked lime, freezing out by means of a liquid air machine, absorption by wood-charcoal at a suitable temperature, or by diffusion. The lighting power is greater if the gases are passed more quickly through the copper and the nickel, cobalt, or iron.—A. T. L.

Carburetted air; Apparatus for the production of ——. W. von Dulong. First Addition, dated Nov. 2, 1906, to Fr. Pat. 371,005, Oct. 31, 1906.

Two additional forms of apparatus are described, adapted for carburetting cold air with heavy oils. The perforated plates are but slightly inclined to the horizontal, and are not more than 2·5 mm. apart. In one form, flat rectangular plates slope upwards towards the air inlet; in the other form, the plates are of zig-zag section, sloping alternately upwards and downwards towards the air inlet. The perforations are vertical, and the air passes through the perforations as well as between the plates.
—A. T. L.

Motive fluid for closed cycle combustion motors; Preparation of a ——. P. Winand. First Addition, dated Nov. 6, 1906, to Fr. Pat. 363,021, Feb. 6, 1906.

SEE Eng. Pat. 24,818 of 1906; this J., 1907, 143.—T. F. B.

Gas generator. M. D. Charlouis. Fr. Pat. 371,917, Nov. 6, 1906.

THE gas generator and scrubber, which are closed by water seals at their lower ends, are connected together near their lower ends by means of a pipe or chamber through which the gas flows from the generator to the scrubber.—H.B.

Gasifying oils; Apparatus for ——. L. Kurzer. Fr. Pat. 371,659, Nov. 10, 1906. Under Int. Conv., Nov. 30, 1905.

THE apparatus is suitable for heavy oils and comprises two cylindrical drums rotating on horizontal axes. The carburetting drum contains a number of concentric tubes which rotate as a whole with the casing. These tubes are covered with absorbent material such as cloth, and are kept wetted by the carburetting liquid in the lower part of the drum. The air enters through a filter on the hollow trunnion of the drum, passes longitudinally between the tubes, and then through the other hollow trunnion to the purifying drum, in which gasification is completed. This drum consists of a smaller cylinder packed with fibre, as far as possible, in distinct vertical layers. The two drums may be in a common fixed casing, the concentric tubes and the chamber packed with fibre being mounted on the same shaft.—A. T. L.

Gas and air; Process for obtaining a mixture of —— of constant composition. Akt.-Ges. f. Selasbeleuchtung. Fr. Pat. 371,555, Nov. 17, 1906. Under Int. Conv., Nov. 23, 1905.

SEE Eng. Pat. 25,596 of 1905; this J., 1907, 41.—T. F. B.

Hydrogen; Production of pure —— by means of water-gas. A. Frank. Fr. Pat. 371,814, Nov. 26, 1906. VII., page 408.

Suction gas-producer. L. Bought. Fr. Pat. 372,040, Dec. 1, 1906.

THE main, upper portion of the producer is lined with refractory material; the lower portion, which is of inverted truncated-conical form, is constructed of metal and bears on its exterior a series of gutters, into which water flows from an annular heating chamber arranged round the upper part of the combustion chamber. The air supply is directed over the surface of the gutters on its way to the lower end of the producer (which is enclosed within a water-sealed ash-box); the evaporation of the water from the gutters thus keeps the conical metallic piece cool, preventing the adhesion of clinker, and also furnishes the requisite supply of steam. The lower, contracted end of the fuel hopper, which surmounts the producer, extends downwards into the combustion chamber through the central annular opening in the water-heating chamber; there is thus left, between the chamber and the end of the hopper, an annular space through which the hot producer gas flows on its way to the scrubber, and its heat is partly transferred to the water in the chamber. The water-inlet valve to the scrubber is connected to a flexible diaphragm device, which at each suction stroke of the engine opens the valve and admits a regulated quantity of water into the scrubber.—H. B.

Gases; Industrial separation of —— by the novel application of a physical property. A. Jouve and G. Gautier. Fr. Pat. 372,045, Dec. 3, 1906.

The process is based on the difference of molecular viscosity of the gases and upon the greater or less rapidity with which they pass through narrow orifices. It is applied particularly to the separation of poisonous carbon monoxide from gaseous mixtures. The impure mixture of gases is caused to pass through a pipe or conduit, the whole or a portion of the sides of which are formed of porous materials or are perforated with fine holes. The impurities pass through the porous partition into another conduit arranged behind, the impurities and the purified gas being collected separately.—W. H. C.

Nitrogen and sulphur; Process for extracting —— from spent gas-purifying material. Les Fils de A. Derome. Fr. Pat. 372,099, Dec. 4, 1906.

Electric incandescence lamps. The Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 371,557, Nov. 17, 1906.

In order to prevent the crystallisation and weakening of the filament, which occur after a few hours' use when pure tungsten or molybdenum have been employed, there is incorporated with the paste of tungsten or molybdenum (made, for example, from the dioxide or trioxide with ammonia, amines, or benzidines), a small quantity of an oxide, oxalate, nitrate, or the like of the rare earth metals, thorium, zirconium, cerium, lanthanum, and erbium. The paste is then formed into filaments. —H. B.

Incandescence electric lamps; Leading-in wires for ——. S. O. Cowper-Coles. Fr. Pat. 371,613, Nov. 19, 1906. Under Int. Conv., May 5, 1906.

The platinum wire usually employed for the leads in incandescence lamp bulbs is replaced by a wire made of pure (*e.g.*, electrolytic) iron, coated with aluminium by passage through a bath of molten aluminium. The pure iron wire may first be tinned, before it is coated with aluminium. The object of the aluminium covering is to ensure the adherence of the wire to the glass and to protect the iron from corrosion.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 312.)

Asphaltum; New deposits of ——. K. Charitschkow. Techn. Westnik., 1907, 1, 74. Chem.-Zeit., 1907, **31**; Rep. 116.

Samples of asphaltum from the Terek district were found to be rich in bitumen. The material was insoluble in alcohol or benzene, but soluble in chloroform and carbon bisulphide, in the latter to the extent of 86·5 per cent. The bitumen melts at 300° C. and is very hard and brittle. The asphaltum has the sp. gr. 1·2. The portion soluble in carbon bisulphide consists of: carbon, 75·42 per cent.; hydrogen, 7·86 per cent.; nitrogen, 0·06 per cent.; sulphur, 0·888 per cent.; ash, 4·35 per cent.; and oxygen, 11·42 per cent. Asphaltum from the Dead Sea contains carbon, 77·84 per cent.; hydrogen, 8·93 per cent.; oxygen, 11·54 per cent.; and nitrogen, 1·7 per cent.; and, therefore, only differs to any considerable extent in the percentage of nitrogen.—C. S.

Paraffin; Determination of —— in ozokerite and ceresin. J. Marcusson and H. Schlüter. Chem.-Zeit., 1907, **31**, 348—349.

The bituminous and other impurities in ozokerite may be removed by heating the crude substance with concentrated sulphuric acid to 180° C., as suggested by Lach and v. Boyen, the purified product being ceresin. For the detection of paraffin in ceresin many attempts have been made to obtain solutions richer in paraffin by extracting the substance with alcohol, and to identify the paraffin in these by its crystalline structure; but as Lewkowitsch (*Technol. u. Analyse der Oele, Fette u. Wachse*, 1905, p. 660) has shown, this method is uncertain, and only applicable in the case of a large proportion of paraffin. As regards the method of Ulzer and Sommer (this J., 1906, 286), the authors find that their limits for the refraction of ceresin (11·5—13·0) are too small. They have examined commercial samples with refractions of 17·1, 17·7, and 17·8 respectively, and have prepared mixtures containing 30 per cent. of paraffin, the refraction of which was 13·5, or practically the same as that of the upper limit of Ulzer and Sommer. The following quantitative method is based upon the different behaviour of the two substances towards solvents, and upon Graefe's qualitative method (this J., 1903, 574, 575). Three grms. of the sample, freed from rosin, saponifiable substances, &c., are dissolved in 30 c.c. of carbon bisulphide gently heated beneath a reflux condenser. The solution is cooled in water at 25° C. (the more ceresin present the greater the turbidity), and then treated with 300 c.c. of a mixture of 96 per cent. alcohol and ether (1:1) at 25° C. The precipitate is rapidly separated with the aid of a filter-pump, washed with 25 c.c. of the alcohol-ether at 25° C., and dissolved off the filter by means of hot benzene, the solution evaporated in a weighed dish, and the residue weighed. Preliminary experiments showed that paraffins of every description remained in solution in the carbon bisulphide, whereas about 60 per cent. of the ceresin hydrocarbons were precipitated. Hence the proportion of paraffin in a mixture may be calculated by means of the formula:—

$$p = 100 - \frac{100a}{60} = \frac{5}{3}(60 - a),$$

where p represents the amount of paraffin and a the quantity of precipitate. The amounts of ceresin precipitated at 20° C. are somewhat higher than those obtained at 25° C. From the (tabulated) results given by different samples, the authors conclude that a ceresin must be regarded as adulterated when the precipitate at 25° C. is less than 50 per cent. of the original substance, whilst if it amounts to 55 per cent. and over it is unquestionably pure. In the case of amounts between 50 and 55 per cent. further tests are required. For this purpose the mother liquor is concentrated by distilling off part of the solvent, and the resulting precipitate separated from the cooled liquid. This process is twice repeated, so that in all four precipitates are obtained, and the crystalline structure and refraction of these at 90° C. is determined. In the presence of paraffin the final precipitates are crystalline, the appearance of the crystals being plainly distinguishable from the slight crystalline lustre of the final precipitations from pure ceresins. The refractive power shows a marked decrease between the first and second precipitations in the case of mixtures of paraffin and ceresin, whereas with pure ceresins there is a gradual decrease. Moreover, with the latter the refraction of the first precipitate is only slightly higher than that of the original substance, whereas in the case of adulterated samples the increase is very pronounced. Thus a pure ceresin with a refraction of 13·8 gave a first precipitate with a refraction of 14·6 and a second precipitate with a refraction of 11·0. On the other hand, a ceresin containing 50 per cent. of paraffin had a refraction of 7·5, and yielded a first precipitate with a refraction of 16·7 and a second with 6·9. The amounts of the first precipitate obtained with pure ceresins are approximately the same, even when the original substances differed widely in melting point and refractive power. For example, ceresins melting at 67°—70° C. and 83°—84° C. yielded respectively 64 and 61 per cent. at 20° C.; and two others with refractive powers of 12·6 and 17·8 gave 66 and 67 per cent. respectively at the same temperature. —C. A. M.

Petroleum: Two types of acid oxidation-products of ——. K. Charitschkow. Petroleum, 1907, 2. 480—481.

The naphthenic acids from the alkali sludge, solidify with difficulty, and can be converted into aromatic ethyl-, methyl- and other esters, viscous glycerides, and characteristic copper salts readily soluble in hydrocarbons, and furnishing dark green solutions. They also give the Rosenthaler and Koutscherow reactions with vanillin in acid solution, or in presence of sulphuric acid (ketone reaction). The extractibility of the copper salts by hydrocarbons forms a characteristic reaction for these acids, which, from their faintly acid properties, may also be regarded as lactone-alcohols. On the other hand, when petroleum is oxidised by air in presence of alkali (at 150° C.), a considerable quantity of another series of acids is present in the undissolved alkaline residue, from which they can be separated by water and isolated by decomposition with hydrochloric acid, followed by extraction with petroleum spirit, washing, and concentration. These acids are very viscid and syrupy, with the sp. gr. 1·2 at 15° C., readily soluble in alcohol, ether, and other organic solvents. They can be distinguished from the naphthenic acids by the absence of the copper salt reaction, and by their solubility in aqueous acetic acid, as also by their red colour reaction with caustic soda and sodium nitroprusside (Legal's reaction), and the absence of the Rosenthaler reaction. The composition corresponds with the formula, $C_{21}H_{27}O_5$. They probably belong to the class of polybasic ketone-acids.—C. S.

Oils and varnishes; Reduction of Italian import duty on certain ——. Bd. of Trade J., April 11, 1907. [T.R.]

An Italian law, dated 24th March, reduces the import duty on mineral, resin, and tar oils, other than heavy oils (Tariff No. 8 *b*), from 48 to 24 lire per 100 kilos.; and on non-spirituous varnishes containing mineral oils (Tariff No. 81 *b*), from 40 to 30 lire per 100 kilos. Article II. of the law abolishes the internal tax established by the law of 8th August, 1895, on the transformation or rectification of crude mineral oils, and the extraction of mineral, resin, or tar oils from the residues of the distillation of mineral oils, from tar, or from any other products of national origin. By Article IV., the rate of the restitution of duty paid on mineral oils employed in national factories for the extraction of salts of quinine is reduced to 2·75 lire for each kilo. of salts of quinine, &c., exported. The date on which the law is to come into force will be determined by royal decree.

English Patents.

Petroleum or other mineral oils; Process for the solidification of ——, *and the transformation of the solidified hydrocarbon into soap.* V. J. Kuess, Tunis. Eng. Pat. 14,568, June 26, 1906.

See Fr. Pat. 367,449 of 1906; this J., 1906, 1141.—T.F.B.

Petroleum residues for combustion in a furnace and for the production of coke or carbon; Method of and means for utilising ——. V. Kridlo, Prague. Eng. Pat. 24,192, Oct. 30, 1906.

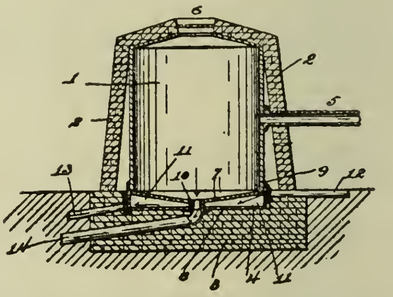
The residues, freed from gas, are melted, with partial combustion, on a wide-meshed grating by a separate fire, so that they drop through the grating in the form of stalactites, which fall down from the grating by their own weight or the effect of external shaking. A second grating may be provided, underneath the first, and on this the falling mass will be completely coked or carbonised before it is pushed down into the fire or removed from the apparatus.—C. S.

United States Patents.

Distilling apparatus [for gas-liquor]. H. A. Abendroth, Berlin, Germany. U.S. Pat. 843,318, Feb. 5, 1907.

The claim is for an ammonia still so arranged that the gas-liquor is preheated in a fore-warmer by the waste-liquor from the still. The warmed liquor then passes through a decomposer, where it is further heated by the gases coming from the main still without coming into actual contact with them. The gases from the decomposer are caused to bubble through a small column placed above the decomposer and fed with cold gas-liquor. The ammonia is retained by and passes on with the liquor to the fore-warmer and the uncondensed gases escape. The liquor flows from the decomposer to the still proper, where the ammonia is driven off and conducted to a condenser.—W. H. C.

Wood-still retort. H. Copilovich, Hinckley, Minn. U.S. Pat. 840,753, Jan. 8, 1907.



Referring to the figure, 1 is the retort surrounded by brickwork, 2, and with foundation brickwork, 3. At the bottom, 7, of the retort, there is a neck, 10, surrounded by a cooling chamber, 11. The cooling fluid enters the chamber at 12, and leaves by the pipe, 13; 8 is the bottom of the cooling chamber, and 9 the joint where the cooling chamber is bolted on to the retort. The retort is charged at the manhole, 6, and the vapours and tar escape at 14; 5 is a pipe to lead away permanent gas.—C. E. F.

Wood; Process of "distilling" ——. C. S. Hammatt, Jacksonville, Fla. U.S. Pat. 843,599, Feb. 12, 1907.

The wood is caused to travel in a thin layer through a series of chambers or retorts provided with conveyors. A current of wood-gas or other inert, non-oxidising gas is caused to pass over the wood in each chamber. The gas passes successively through a heater, the retort, a condenser, and back to the heater. Each current of gas is of increasingly higher temperature. That which passes first over the wood is only sufficiently heated to distil off the turpentine and other oils without decomposing them, whilst in the later stages the gas is heated so strongly as to cause destructive distillation of the wood. Each successive retort is isolated, and the volatile products are condensed and collected separately.—W. H. C.

Pyroligneous acid; Process of purifying ——. J. R. Garroway, Glasgow. U.S. Pat. 844,860, Feb. 19, 1907.

See Eng. Pat. 6798 of 1905; this J., 1906, 477.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 314.)

1.6-*Dihydroxyanthraquinone.* O. Frobenius and E. Hepp. Ber., 1907, **40**, 1048—1051.

1.6-Dihydroxyanthraquinone is obtained by treating *a*-nitroanthraquinonesulphonic acid with sodium methoxide to form sodium methoxyanthraquinonesulphonate, heating the latter with 10 parts of sulphuric acid of 60° B. for 1¼ hours at 120° C., adding sodium chloride to separate the sodium salt of α-hydroxyanthraquinonesulphonic acid and heating the same with calcium hydroxide under pressure at 195° C. for 12 hours. The melt is then dissolved in water, precipitated with hydrochloric acid, and the precipitate recrystallised from glacial acetic acid. 1.6-Dihydroxyanthraquinone obtained in this manner forms orange-yellow needles, melting at 271°—272° C. It is readily soluble in benzene and alcohol, and gives a yellow solution with ammonia or dilute alkalis. Its solution in concentrated sulphuric acid has a reddish-yellow colour. Oxidation with potassium nitrate and sodium hydroxide under pressure leads to the formation of flavopurpurin.—D. B.

Indigo, Java ; The occurrence of isatin in some samples of ——. A. G. Perkin. Chem. Soc. Proc., 1907, **23**, 30—31.

During the examination of samples of Java indigo rich in indirubin, for yellow colouring matter (Proc., 1904, 20, 172) by extraction with sodium carbonate solution and isolation of the products from the neutralised liquid with ether, there was obtained, in addition to kampherol, a small amount of substance crystallising from benzene in orange needles, melting at 200°. This gave the thiophen reaction, and was found to consist of isatin. The quantity present was exceedingly small, and in many other samples it appeared to be absent, but the point is interesting, as it indicates that the formation of indirubin during the manufacture of natural indigo follows the well-known synthesis of Baeyer (Ber., 1881, **14**, 1745). Indirubin appears to be most readily formed when the fermented plant extract is oxidised under slightly alkaline conditions, and in these circumstances the oxidation of a portion of the indoxyl to isatin would appear to be facilitated.

English Patents.

Disazo dyestuffs ; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort-on-Maine, Germany. Eng. Pat. 5244, March 3, 1906.

The product of condensation of *m*-aminobenzaldehyde-bisulphite and 1.2-diamino-5-naphthol-7-sulphonic acid (prepared as described in this J., 1907, 15) is dissolved with addition of sodium carbonate, and the diazo solution from 9·3 kilos. of aniline is added. The product is separated, mixed with water and 50 kilos. of hydrochloric acid (21° B.), cooled to 0° C., and 7·1 kilos. of sodium nitrite gradually added, and the whole allowed to stand at 0° C. The diazo-compound is then poured into a cold alkaline solution of 25 kilos. of 2.6-naphtholsulphonic acid. The resulting disazo dyestuff dyes unmordanted cotton scarlet-red shades, which are fast to light and washing, and resist the action of acids. The same dyestuff is produced if the diazobenzene solution be added after the combination with the naphtholsulphonic acid, instead of before.—J. C. C.

Dyestuffs ; Manufacture of azo ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 9264, April 19, 1906.

See Fr. Pat. 365,415 of 1906 ; this J., 1906, 923.—T. F. B.

Thionaphthene ; Manufacture of derivatives of ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 11,173, May 12, 1906.

See Fr. Pat. 366,611 of 1906 ; this J., 1906, 1038.—T. F. B.

Thio-indigo Red ; Manufacture of leuco-compound of ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 11,479, May 16, 1906.

See Fr. Pat. 366,613 of 1906 ; this J., 1906, 1038.—T. F. B.

Colouring matters containing sulphur [Thioindigo dyestuffs] ; Manufacture of ——, *and of the leuco-compounds thereof.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 14,192, June 20, 1906.

See Fr. Pat. 367,709 of 1906 ; this J., 1906, 1143.—T. F. B.

Compounds containing sulphur [Leucothioindigo dyestuffs] ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,559, Aug. 3, 1906.

See Addition of Aug. 16, 1906, to Fr. Pat. 367,709 of 1906 ; this J., 1907, 89.—T. F. B.

Dyestuffs ; Manufacture of new greenish-blue ——. A. G. Bloxam, London. From L. Durand, Huguenin and Co., Basle, Switzerland. Eng. Pat. 21,949, Oct. 4, 1906.

When gallocyanines, obtained by the action of nitrosodialkylanilines on gallic acid and its derivatives, are condensed with aromatic diamines having at least one amino-group free (such as dimethyl- or diethyl-*p*-phenylenediamine, *m*-phenylenediamine, &c.), new dyestuffs are obtained which are fast to fulling and to chlorine. These dyestuffs are only sparingly soluble in water, but may easily be converted by chemical reducing agents or electrolysis into the corresponding leuco-compounds, which are much more soluble, and may be fixed under better conditions, whether by dyeing or printing.—J. C. C.

Dyestuffs ; Manufacture of black mordant azo ——. H. H. Lake, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 25,847, Nov. 15, 1906.

See U.S. Pat. 839,489 of 1906 ; this J., 1907, 250.—T. F. B.

United States Patents.

Dyestuff ; Blue sulphur [sulphide] —— *and process of making same.* A. L. Laska and G. List, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 841,877, Jan. 22, 1907.

See Eng. Pat. 6198 of 1906 ; this J., 1906, 585.—T. F. B.

Dyestuff ; Green sulphur [sulphide] ——. A. L. Laska, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. U.S. Pat. 843,156, Feb. 5, 1907.

See Eng. Pat. 23,864 of 1906 ; this J., 1907, 194.—T. F. B.

Dyestuff ; Red tetrazo ——. H. Witter, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 842,048, Jan. 22, 1907.

See Fr. Pat. 370,265 of 1906 ; this J., 1907, 251.—T. F. B.

Dyestuff ; Azo ——. O. Dressel and M. Kahn, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 843,077, Feb. 5. 1907.

See Fr. Pat. 365,415 of 1906 ; this J., 1906, 923.—T. F. B.

Dyestuffs ; Azo ——. M. Kahn, R. Kothe, O. Dressel, and A. Ossenbeck, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 843,137, 843,149, and 843,756, Feb. 5 and 12, 1907.

See Fr. Pat. 367,504 of 1906 ; this J., 1906, 1143.—T. F. B.

Dyestuff ; Black azo —— *and process of making same.* K. Hagemann and O. Stange, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 843,808, Feb. 12, 1907.

See Fr. Pat. 364,004 of 1906 ; this J., 1906, 923.—T. F. B.

Anthracene derivative. K. Thun, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 844,835, Feb. 19, 1907.

See Fr. Pat. 371,219 of 1906; this J., 1907, 251.—T. F. B.

Gallic compounds and alkyldiaminoarylthiosulphonic acids, &c. ; Leuco-products from ——. C. de la Harpe and R. Burckhardt, Assignors to Dye Works, formerly Durand, Huguenin et Cie., Basle, Switzerland. U.S. Pat. 842,303, Jan. 29, 1907.

See Eng. Pat. 20,397 of 1906 ; this J., 1907, 44.—T. F. B.

Gallocyanines and aromatic amines ; Leuco derivatives of ——, *and a greenish-blue dyestuff, and process of making same.* H. Lorétan, Assignor to Dye Works, formerly L. Durand, Huguenin et Cie., Basle, Switzerland. U.S. Pats. 844,155 and 844,156, Feb. 12, 1907.

See Eng. Pat. 21,949 of 1906 ; preceding these.—T. F. B.

Dyestuff ; Azo ——, and process of making same. W. Herzberg, Assignor to Act. Ges. f. Anilinfabr., Berlin. U.S. Pat. 842,548, Jan. 29, 1907.

Dianisidinedisulphonic acid is diazotised, and the diazo-compound is combined with β-naphthol. The resulting dyestuff dyes wool direct from an acid bath clear red shades, which are fast to washing and milling.—J. C. C.

Indigo colouring matters ; Process of reducing ——. R. Wimmer, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 843,566, Feb. 5, 1907.

See Addition of July 5, 1905, to Fr. Pat. 348,360 of 1904 ; this J., 1905, 1223.—T. F. B.

Anthracene dyestuff ; Process of making an ——. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 844,914, Feb. 19, 1907.

See Eng. Pat. 17,242 of 1905 ; this J., 1905, 1298.—T. F. B

Anthraquinone compounds [Dianthraquinonyls] ; Process of preparing ——. R. H. Scholl, Karlsruhe, and M. A. Kunz, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine. U.S. Pat. 845,129, Feb. 26, 1907.

See Fr. Pat. 357,239 of 1905 ; this J., 1906, 66.—T. F. B.

Dyestuff ; Monoazo ——, and process of making same. T. Kroeber, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 844,814, Feb. 19, 1907.

The nitroamino-α-naphtholsulphonic acid obtained by reduction of Naphthol Yellow S, is diazotised and combined with β-naphthol. The resulting dyestuff dissolves in water to a bluish-black solution, becoming violet on addition of ammonia, and in concentrated sulphuric acid to a violet-blue to blue solution. It dyes unmordanted wool in blue-black tints, which become deep brownish-black on chroming.—A. S.

Sulphide dyestuffs from waste dye liquids and washing liquids ; Apparatus for recovering ——. J. Schmitt, Belfort, France. U.S. Pat. 845,013, Feb. 19, 1907.

See Eng. Pat. 11,317 of 1904 ; this J., 1905, 330.—T. F. B.

French Patents.

Lakes derived from monoazo dyestuffs ; New series of ——, and process for their manufacture. Act.-Ges. f. Anilinfabr. First Addition dated Jan. 19, 1906, to Fr. Pat. 361,647, July 26, 1905. (This J., 1906, 325, 996.)

The preparation of the dyestuff and the lake therefrom is combined in one operation. Twenty-three parts of sodium *p*-aminophenylnaphthyl-1.2-triazole-3.8-disulphonate are diazotised and mixed with a solution of 20 parts of barium chloride in 100 parts of water. The whole is poured into a solution of 17·5 parts of sodium β-naphthol-3.6-disulphonate, to which has been added 1000 parts of a 5 per cent. paste of aluminium hydroxide, and about 20 parts of finely-powdered barium sulphate. The violet lake is rapidly formed.—J. C. C.

Dyestuffs ; Manufacture of yellow [azo] ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 371,957, Feb. 6, 1906.

See Eng. Pat. 2622 of 1906 ; this J., 1906, 922.—T. F. B.

Dyestuffs ; Process for preparing yellow sulphine [sulphide] ——. L. Cassella und Co. Fr. Pat. 372,137, Feb. 12, 1906.

See Eng. Pat. 4097 of 1906 ; this J., 1906, 1142.—T. F. B.

Dyestuffs derived from dihydronaphthimidazole ; Process for producing disazo ——. L. Cassella und Co. Fr. Pat. 371,899, Oct. 17, 1906. Under Int. Conv., Dec. 19, 1905.

See Eng. Pat. 5245 of 1906 ; this J., 1907, 15.—T. F. B.

Dyestuffs of the triphenylmethane series ; Production of ——. Badische Anilin und Soda-Fabrik. Fr. Pat. 371,742, Nov. 22, 1906. Under Int. Conv., Aug. 11, and Oct. 27, 1906.

Disodium 2-nitrodiphenylamine-4.3′-disulphonate is obtained in red prisms by heating a solution of 259·5 kilos. of sodium *o*-nitrochlorobenzene-*p*-sulphonate and 173 kilos. of metanilic acid in 800 litres of hot water, to which 106 kilos. of sodium carbonate are added, for 10 hours in an autoclave to 140°—145° C. Dipotassium 2.6-dinitrodiphenylamine-4.3′-disulphonate is prepared by boiling a solution of 282·5 kilos. of dinitrochlorobenzenesulphonate in about seven times its weight of water, to which has been added gradually a concentrated aqueous solution of 173 kilos. of metanilic acid and 410 kilos. of sodium acetate, for about half an hour, and then precipitating with potassium chloride. Fine yellow needles separate, which are very soluble in water. These diphenylamine derivatives may be condensed with tetramethyldiaminodiphenylcarbinol to form leuco-compounds. Example : A mixture of 41·8 kilos. of the disodium salt of 2-nitrodiphenylamine-4.3′-disulphonic acid and 27 kilos. of tetramethyldiaminodiphenylcarbinol is introduced during 15 minutes into 200 kilos. of sulphuric acid (monohydrate). The temperature rises to about 45°—50° C. After 1—2 hours the condensation is complete. The mixture is poured on to ice, diluted to about 700 litres, and 100 kilos. of sodium carbonate added gradually. After some hours the leuco-derivative is deposited as a yellow, crystalline precipitate, slightly soluble in water, readily soluble in alkali. For the oxidation, 62·6 kilos. of this leuco-derivative are dissolved in 1000 litres of water, with the addition of 11 kilos. of sodium carbonate, and, after cooling with ice to 15° C., 9 kilos. of manganese dioxide paste and 100 kilos. of 25 per cent. sulphuric acid are added. After 15 minutes, the mixture is heated to 50° C. and the dyestuff precipitated by salt. It dyes wool deep green.—J. C. C.

Black dyestuffs [Sulphide dyestuffs] containing sulphur ; Process of manufacture of ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 372,104, Dec. 4, 1906. Under Int. Conv., Dec. 5, 1905.

By using a much smaller quantity of polysulphides than is usual in the preparation of sulphide colours, dyestuffs are obtained directly in the crystalline form and having enhanced dyeing properties. Example : A paste containing about 15—20 per cent. of sodium dinitrophenolate is prepared by mixing 80 kilos. of dinitrophenol, a solution of 140 kilos. of crystallised sodium sulphide, and a solution of 56 kilos. of sodium carbonate in about 100 litres of water (the quantity of polysulphides corresponds to 1·35 mols. of tetrasulphide to 1 mol. of dinitrophenol). This is heated to 90° C., the vessel closed, and the temperature raised to 130° C. in about 30 minutes, and maintained at this point for about nine hours. The pressure is 1½—2 atmospheres. After releasing the pressure and heating again to expel the ammonia formed, the dyestuff is filtered off and dried. Similar dyestuffs, producing blue-black shades on cotton, are obtained from *p*-hydroxy-*o′p′*-dinitrodiphenylamine and *o*-*p*-dinitro-*m′m′*-dichloro-*p′*-hydroxydiphenylamine, but in this case 1½—2½ mols. of alkali polysulphide are used to 1 mol. of the hydroxydiphenylamine derivative.—J. C. C.

German Patents.

Anthraquinone-di- and tri-sulphonic acids ; Process for preparing ——. R. Wedekind und Co. Ger. Pat. 170,329, Nov. 6, 1903.

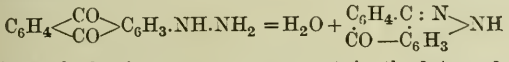
When anthraquinone-α-monosulphonic acid is treated with fuming sulphuric acid, in absence of mercury, a mixture of the 1.7- and 1.6-disulphonic acids is produced, together with some trisulphonic acid, the constitution of which has not been ascertained. The mixture of acids may be heated under pressure with milk of lime, calcium chloride, and potassium nitrate (see Fr. Pat. 336,938 ; this J., 1904, 438), when a mixture of 1.6- and 1.7-dihydroxyanthraquinones, with 25 per cent. of dihydroxyanthraquinone-monosulphonic acid, is obtained. The latter dyes chromed wool fast red-violet shades. The mixture of dihydroxyanthraquinones may be separated by heating with milk of lime, in which the 1.6-compound is easily soluble.—T. F. B.

Nitro-compounds suitable for conversion into p-nitro-derivatives of a-hydroxyanthraquinones ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 170,728, March 20, 1904.

The aryl ethers of α-hydroxyanthraquinones (see Ger. Pat. 158,531 ; this J., 1905, 885) can be readily nitrated, the compounds thus obtained being suitable for conversion into *p*-nitrohydroxyanthraquinones. Thus, nitration of diphenylanthrarufin produces a hexanitro derivative, four nitro groups being in the benzene rings, and two in the anthraquinone ring, in the *p*-positions to the oxygens.—T. F. B.

Anthraquinone derivatives ; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 171,293, July 31, 1904.

Hydrazine derivatives of anthraquinone are heated with dehydrating or condensing agents, such as aniline and aniline salts, when they are converted into pyrazole derivatives, thus :—



$$C_6H_4\Big<\begin{matrix}CO\\CO\end{matrix}\Big>C_6H_3.NH.NH_2 = H_2O + \begin{matrix}C_6H_4.C:N\\CO—C_6H_3\end{matrix}\Big>NH$$

If two hydrazino-groups are present in the 1.4- or 1.5-positions, double ring-formation occurs. The pyrazole derivatives are feebly basic, stable substances, suitable for preparing dyestuffs and therapeutic products.
—T. F. B.

1.2.2′.1′-*Anthrazine ; Process for preparing* ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 172,684, Aug. 11, 1905.

By heating β-anthramine to a high temperature with an alkali hydroxide, a good yield of 1.2.2′.1′-anthrazine is obtained.—T. F. B.

Quinizarins ; Process for preparing chloro-substituted ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 172,105, June 5, 1904.

Chloro-derivatives of quinizarin are obtained by condensing quinol with chlorophthalic acids, in which not more than one *o*-position to the carboxyl groups is occupied by halogen.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 317.)

Aniline Black formation by the steaming and oxidation methods ; Influence of halogen acids and oxy-acids in ——. F. Erban and A. Mebus. Färber-Zeit., 1907, 18, 50—53, 66—70.

The authors have investigated the influence of bromine and iodine in Aniline Black formation in two directions : (1) their use in the form of oxy-acids as oxidising substances in the place of chlorate, and (2) the use of aniline hydrobromide or hydriodide in place of aniline hydrochloride. Three printing pastes prepared with aniline salt and equivalent amounts of alkali chlorates, bromates, and iodates, and allowed to stand for 12 hours, showed no change in the case of the chlorate, whilst the one prepared with bromate became a dirty green colour immediately the aniline salt was added, and, after 12 hours, was a deep brown. The reaction proceeded much more slowly in the case of the iodate, owing to its difficult solubility ; but on standing, the paste acquired a deep blue-black colour (partly owing to liberated iodine acting on the starch thickening) and was found to contain much free iodine. Vanadium solution was added before printing to each paste, and half the printed material was steamed and the rest aged. The colour containing bromate gave a brown in both cases, whilst that containing the iodate gave a light grey. In both cases these and other experiments showed that bromates and iodates were of no practical use as oxidising agents, owing to their quick decomposition and formation of substances of a quinonoid nature. The use of bromine in the form of aniline hydrobromide (produced by mixing aniline salt and sodium bromide in the printing paste) with a printing paste containing sodium chlorate, gave a very good black under certain conditions. Experiments showed that aniline hydriodide is quite useless for Aniline Black formation.
—A. B. S.

Nitrous acid in dyehouse water [; Determination of ——]. E. Ristenpart. Z. Farben-Ind., 1907, 6, 94—96.

In order to estimate the amount of nitrous acid in water, the authors make use of the fact that silk-fibroïn is converted by nitrous acid into a diazo compound which, on heating, is decomposed into a phenolic compound of a yellow to brownish colour. A scale of tints was prepared by immersing equal quantities of bluish-white dyed silk in solutions containing from 1/16 to 128 mgrms. of nitrous anhydride per litre of water. To decompose the diazo-fibroïn, the temperature was raised to 90° C. for half an hour. This converted the golden yellow diazo compound into the catechu-brown phenolic compound and gave a scale of colours from white through cream and orange to brown. If the water contains much iron, which would give a yellow colour, oxalic acid is added. Nitric acid has no effect on silk up to a strength of 100 mgrms. of nitric anhydride per litre. The nitrites in water are probably formed partly by the reduction of nitrates. The presence of more than 1 mgrm. of nitrous anhydride per litre of water is injurious for pale shades, as it is impossible to obtain a pure white ground. The bad effects of nitrous acid can be neutralised by the addition of hydrogen peroxide, $HNO_2 + H_2O_2 = HNO_3 + H_2O$. Twice the theoretical amount of hydrogen peroxide should be taken.—A. B. S.

Ice-colours ; The discharging of ——. S. Filipkowski and E. Trepka. Z. Farben-Ind., 1907, 6, 93—94.

The authors state that the ice-colours are more easily discharged the weaker the naphthol grounding employed in their manufacture. To colours, such as Naphthlyamine Claret, which it is difficult to discharge, Induline Scarlet (from 0·6—0·8 grm. per litre) may be added direct to the diazo bath, and the usual hydrosulphite discharge may then be printed on. The Induline Scarlet will resist a good soaping and scouring, but not bleaching. In order to obtain coloured hydrosulphite discharges with basic dyestuffs, either aniline or phenol is added ; in the latter case 20—25 grms. of phenol per 1 litre of printing paste.
—A. B. S.

English Patents.

Fuel briquettes [from raw cotton waste] ; Manufacture of ——. P. C. Mehta. Eng. Pat. 18,131, Aug. 13, 1906. II., page 397.

Threads, films, or the like ; Manufacture of artificial ——. E. W. Friedrich, Blaton, Belgium. Eng. Pat. 27,727, Dec. 5, 1906. Under Int. Conv., Dec. 11, 1905.

The invention consists in preparing a solution of cellulose by the use of very much less ammonia (about one-half) than has hitherto been considered necessary. A solution of a part of the cellulose, silk, &c., in presence of a suitable metallic compound, in a solution of ammonia, containing the usual proportion of ammonia, is first prepared, and to the solution thus obtained the rest of the material is added in separate portions, together with the corresponding quantity of metallic compound and, at the same time, further portions of ammonia in solutions of successively diminishing strength. Care must be taken that precipitation does not occur through the presence of an undue excess of water. The solution is finally converted into threads, films, &c., in the usual manner.
—J. C. C.

Dyeing hairs, furs, feathers, or the like, and a material therefor. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 11,876, May 21, 1906.

SEE Fr. Pat. 366,427 of 1906 ; this J., 1906, 982.—T. F. B.

Dyeing with sulphur [sulphide] dyestuffs. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 15,206, July 4, 1906.

SEE Fr. Pat. 367,921 of 1906 ; this J., 1906, 1218.—T. F. B.

Yarns in the form of cops, bobbins, or the like ; Apparatus for treating with liquid ——. C. Gaydet, Roubaix, France. Eng. Pat. 24,677, Nov. 3, 1906.

SEE Fr. Pat. 370,942 of 1906 ; this J., 1907, 316.—T. F. B.

Dye tubs or vats. F. I. Stone, Atlanta, U.S.A. Eng. Pat. 20,029, Sept. 8, 1906. Under Int. Conv., Nov. 8, 1905.

SEE U.S. Pat. 814,173 of 1906 : this J., 1906, 372.—T. F. B.

Dry cleaning fabrics ; Washing process and washing composition for ——. E. Weiss, Weiden, Bavaria. Eng. Pat. 21,478, Sept. 28, 1906.

SEE Fr. Pat. 366,547 of 1906 ; this J., 1906, 981.—T. F. B.

UNITED STATES PATENTS.

Artificial silk and other silk goods ; Manufacture of ——. H. E. A. Vittenet, Villefrance, France. U.S. Pat. 842,125, Jan. 22, 1907.

SEE Addition of Feb. 3, 1905, to Fr. Pat. 350,383 of 1904 ; this J., 1906, 474.—T. F. B.

Cellulose threads ; Process for manufacturing glossy ——. R. Linkmeyer, Herford, Germany. U.S. Pat. 842,568, Jan. 29, 1907.

SEE Eng. Pat. 4765 of 1905 ; this J., 1906, 371.—T. F. B.

Mercerising cotton ; Machine for ——. L. Cippolina, Ligure, Italy. U.S. Pat. 845,160, Feb. 26, 1907.

SEE Eng. Pat. 9683 of 1903; this J., 1903, 993.—T. F. B.

Textile fabrics ; Process of dyeing ——. E. Spatz, Hackensack, N.J., Assignor to United Piece Dye Works, Lodi, N.J. U.S. Pat. 842,122, Jan. 22, 1907.

THE improvement in the dyeing of fabrics consists in causing the fabric to travel first in one and then in the opposite direction through a constantly renewed and overflowing dye-bath, collecting the overflow, and then passing the fabric back and forth through the collected overflow.—J. C. C.

Formaldehyde sulphoxylates ; Process of making ——. R. Müller and W. Wollenberg, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 841,999, Jan. 22, 1907.

SEE Eng. Pat. 3222 of 1906 ; this J., 1906, 980.—T. F. B.

Fireproofing textile material. W. H. Perkin, jun., Assignor to Whipp Bros. and Todd, Ltd., Manchester. U.S. Pat. 844,042, Feb. 12, 1907.

SEE Eng. Pat. 8509 of 1902 ; this J., 1903, 623.—T. F. B.

FRENCH PATENTS.

Formaldehyde-sulphoxylates ; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 372,131, Feb. 10, 1906.

SEE Eng. Pat. 3222 of 1906 ; this J., 1906, 980.—T. F. B.

Hydrosulphites ; Production of ——, *dry and quite stable.* Badische Anilin und Soda Fabrik. Fourth Addition, dated Nov. 3, 1906, to Fr. Pat. 341,718, March 28, 1904.

VII., page 407.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 319.)

Fusion of potassium chloride with potassium chromate and bichromate and silver chloride. S. Shemtschushny. J. Russ. Phys.-Chem. Ges., 1907, **38**, 1135—1145. Chem. Zentr., 1907, **1**, 867—868.

THE author, along with Loevinson-Lessing, has previously (Iswiestja d. Petersburg. Polytechn., **5**, 207) shown that the micro-structures of mixtures of salts differ little from those of metallic alloys. Further experiments with mixtures of potassium chloride with potassium chromate and bichromate and silver chloride have confirmed this statement. The three pairs of salts mentioned form eutectics melting respectively at the following temperatures :—68·5 KCl + 31·5 K_2CrO_4, 658° C.; 27·5 KCl + 72·5$K_2Cr_2O_8$, 366° C. ; 30KCl + 70AgCl, 306° C. Mixtures of potassium chloride with more potassium chromate than is required for the eutectic, yield mixed crystals containing at the most 4 molecules of potassium chloride per 100 mols. of the mixed salts. Potassium chromate undergoes transformation at 679° C., the colour changing from yellow to red. Mixed crystals also separate from mixtures of potassium chloride and bichromate containing more of the latter salt than is required for the formation of the eutectic.—A. S.

Barium nitrite ; Preparation of ——, *by double decomposition of barium chloride and sodium nitrite in molecular proportions.* J. Matuschek. Ber., 1907, **40**, 990—996.

THE failure of Witt and Ludwig (this J., 1904, 61) to obtain a good yield of barium nitrite without the use of considerable excess of sodium nitrite was explained by Meyerhoffer (*ib.*, 185). The author's experiments show that Meyerhoffer's explanation is correct, and that by reducing the amount of water present to the minimum requisite to hold in solution the quantity of barium nitrite theoretically obtainable, thus producing a solution of barium nitrite as concentrated as possible, and at the same time permitting as small a quantity as possible of sodium chloride to enter into solution, a good yield of pure barmiu nitrite is obtained from the salts in molecular proportions. The salts (200 grms. of crystallised barium chloride and 113·6 grms. of sodium nitrite) are intimately mixed together, placed in an apparatus in which the temperature during the whole treatment can be maintained at 100° C., and 60 grms. of water added. When reaction is complete, the solution formed is filtered off by suction aided by compression of the solid residue, and on cooling yields 163 grms. (80·5 per cent. of the theoretical amount) of crystals, which after washing with a saturated solution of barium nitrite are practically pure barium nitrite. In industrial practice, the mother liquor can be used in a second operation, and thus practically the theoretical yield of nitrite be obtained.—J. T. D.

Cupric compounds ; Reduction of —— *in ammoniacal solution by ferrous salts.* F. Herrmann. Chem. Ind., 1907, 30, 152—155.

IN ammoniacal solution, a cupric salt is converted into a cuprous salt by ferrous sulphate. Using no excess of the latter, only ferric hydroxide is precipitated. In any case, a solution of cuprous salt of known strength is thus obtainable.—F. SODN.

Sulphides ; Conditions of precipitation of metallic ——. M. Padoa and L. Cambi. XXIII., page 435.

ENGLISH PATENTS.

Gases ; Apparatus for condensing and purifying ——, *the same being especially applicable for use in the manufacture of sulphuric and other acids.* J. G. Graham, Farnworth, Lancs. Eng. Pat. 10,814, May 9, 1906.

THE invention is illustrated with reference especially to its application in the manufacture of sulphuric acid. A leaden shell or column, supported by exterior framework, has passages for the ingress and egress of the gases at the lower and upper ends, and a downward supply of acid is supplied from an elevated tank. Within the column cross-pieces of glass or earthenware, corrugated or otherwise, are arranged crosswise in series one above another, the surfaces of each crosspiece being placed at an angle to the horizontal plane. The blocks or supporting devices of brickwork are shown in various forms, adapted to strengthen the column and the contained baffle-plates, which supersede ordinary coke packing. When gases containing excess of nitrous fumes are passed up the tower, it is stated that the distribution of the gases effected by the described arrangement, effects elimination of the nitrous compounds, leaving "the resultant sulphuric acid practically free from them, thus effecting a saving of nitrate of soda in the manufacture." The apparatus may also be used in washing smoke from furnaces, &c., and in absorbing associated sulphurous acid fumes.—E. S.

Packings for Glover and other towers, tunnels, and the like, used in processes for concentrating liquids, absorbing gases, and like purposes. J. Mackenzie and J. M. Gibson. Eng. Pat. 17,832, Aug. 8, 1906. I., page 395.

Marine plants; Treatment of —— for the extraction of chemical, mineral, and organic matters, and their employment in arts and industries. J. H. Laureau, Paris. Eng. Pat. 5169, March 2, 1906.

See Fr. Pat. 352,069 of 1905, and Additions thereto; this J., 1905, 892, 1172; 1906, 19, 315. The addition of a small quantity of formaldehyde at a suitable stage of the process, for the purpose of preserving the solutions and products from decomposition, is also claimed.—A. S.

Alkali sulphate and bauxite or other aluminiferous material; Conversion of —— into alumina and alkali compounds containing sulphur [thiosulphates]. A. Clemm, Mannheim, Germany. Eng. Pat. 5478, March 6, 1906.

See Fr. Pat. 363,893 of 1906; this J., 1906, 884.—T. F. B.

Aluminous solutions; Clarification of ——. H. Spence and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 6529, March 19, 1906.

Solutions produced by acting upon aluminous materials with sulphuric acid containing arsenic, having finely-divided matters in suspension slow to subside, are treated with finely-divided calcium sulphide, or with solution of sodium sulphide, or with hydrogen sulphide. The slow precipitation of the arsenic thus effected "curdles" the suspended matters, and causes the liquid to clear more quickly.—E. S.

Peroxides of magnesium and zinc; Manufacture of ——. F. Hinz, Berlin. Eng. Pat. 9491, April 23, 1906.

See Fr. Pat. 364,825 of 1906; this J., 1906, 928.—T. F. B.

Ammonia metal compounds; Manufacture of ——. J. J. M. A. Vermeesch, Schaerbeek, Belgium. Eng. Pat. 20,408, Sept. 13, 1906.

See Fr. Pat. 369,973 of 1906; this J., 1907, 319.—T. F. B.

United States Patents.

Lime; Apparatus for hydrating ——. W. S. Osborne, Marietta, Pa. U.S. Pat. 845,189, Feb. 26, 1907.

The apparatus described comprises a means for moistening lime, consisting of a settling chamber provided with a spout, which discharges into the inner of two concentric rotating vats, of which the inner vat is arranged to overflow into the outer at a point above its bottom. Means are provided for stirring the lime in the mixing vat, whereby the "pits" and unhydrated matter settle, whilst the powdery hydrated lime overflows the sides of the vat, and is received into a hopper. From the receiving-hopper the material passes into cooling vats closed from the atmosphere, and delivery shoots provided with valves are arranged to control the delivery of material to the cooling vats, whereby the material may be fed into one of them, whilst other material is cooling in the other. Between the spout and the mixing-vat a frame is arranged, which is formed of two V-shaped angle-irons connected together and forming an X-shaped frame, with an opening through which the material passes to the vat; from this frame ploughs or agitators project into the mixing-vat, which is rotated by suitable means.—W. C. H.

Lime; Method of hydrating ——. W. S. Osborne, Marietta, Pa. U.S. Pat. 845,190, Feb. 26, 1907.

In the method described the burnt lime to be hydrated is finely pulverised, and conveyed through an air-separator, by the use of an exhaust-fan, whereby the fine material is separated from the coarse, which is returned to be reground. The fine material is conveyed and blown into a suspension chamber, in which whilst in suspension it is subjected to the action of water or steam. By imparting a whirling movement to the current of air and steam or water, the moistened particles are separated from the current, and the unmoistened particles maintained in suspension. The moistened material is allowed to settle into vats, and is then agitated so that the hydrated powdery particles can overflow the sides of the vats, and pass into closed vats or storage-bins, whilst the unhydrated particles settle and are subjected to further agitation.
—W. C. H.

Ferrous carbonate; Process of making ——. A. Flügge, Hanover, Germany. U.S. Pat. 842,452, Jan. 29, 1907.

See Eng. Pat. 27,316 of 1906; this J., 1907, 150.—T. F. B.

Sodium perborate; Process of manufacturing ——. O. Liebknecht, Frankfort, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 842,470, Jan. 29, 1907.

See Eng. Pat. 503 of 1906; this J., 1907, 150.—T. F. B.

Alkali perborates; Process of making ——. O. Liebknecht, Frankfort, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pats. 842,471, 842,472, and 842,473, Jan. 29, 1907.

See Eng. Pat. 503 of 1906; this J., 1907, 150.—T. F. B.

French Patents.

Sulphuric acid; Concentration of ——. O. Dieffenbach. Fr. Pat. 371,685, Nov. 20, 1906.

The invention depends upon the fact that sulphuric acid of over 60° B. gives off, on boiling, vapours from which by appropriate cooling, concentrated acid condenses, leaving the steam to pass off. To ensure tranquil boiling of the acid, coke or the like may be introduced; or, preferably, air is passed through. The receiver for the vapours is provided with means, such as the use of baffles, for collecting the concentrated acid, and returning it to the retort. Ger. Pat. 122,267 is referred to.—E. S.

Nitric acid; Concentration of dilute —— by means of nitrates for combining with the water. O. Boeters and R. Wolffenstein. Fr. Pat. 371,797, Nov. 26, 1906.

Dilute nitric acid is distilled over calcium nitrate, previously rendered anhydrous by heating to from 150° to 200° C. The calcium nitrate takes up the water from the acid, and may be afterwards again heated to render it anhydrous for a repetition of the process. Other suitable nitrates (magnesium nitrate is named) may also be used. (Reference is made to Ger. Pats. 62,714 of 1891 and 82,573 of 1893.)—E. S.

Electrolyser for the decomposition of alkali chlorides with recovery of hydrogen. L. Bridelance. Fr. Pat. 371,852, Nov. 29, 1906. XIA., page 418.

Hydrosulphites; Production of ——, dry and quite stable Badische Anilin und Soda Fabrik. Fourth Addition, dated Nov. 3, 1906, to Fr. Pat. 341,718 of March 28, 1904 (this J., 1904, 900). Under Int. Conv., Sept. 20, 1906.

The process described in the Second Addition to the main patent (this J., 1905, 333) is modified so as to consist substantially in precipitating anhydrous hydrosulphites from their aqueous solutions, without rise of temperature, by caustic alkalis (solid or in solution), the process being so conducted that the concentration of the resultant caustic lye may not be below about 25 per cent. The precipitated sodium hydrosulphite filtered off is washed with alcohol and dried in a vacuum. (Compare also the First and Third Additions to the main patent, this J., 1905, 333, 1172.)—E. S.

Glycerins of every description, including spent soap lyes and distillery by-products (vinasses); Process and apparatus for the purification of crude ——. L. Rivière. First Addition, dated Nov. 3, 1906, to Fr. Pat. 367,752, July 4, 1906. XII., page 421.

Potassium carbonate or bicarbonate; Manufacture of —— of high percentage, from charcoal residues, or other analogous products. E. Grün. Fr. Pat. 371,506, Nov. 15, 1906.

Lyes derived from vegetable charcoal, or similar products of destructive distillation, containing mainly potassium carbonate, but also a few per cents. of sodium carbonate, besides such impurities as potassium sulphate and chloride, are, after suitable concentration, subjected to the action of carbon dioxide, under pressure, at a temperature between 25° and 45° C. The potassium bicarbonate "of great purity" which separates when the solution attains a density of 39° B. is removed. The mother liquor is heated to between 100° and 135° C., and on cooling, sodium bicarbonate separates. Carbon dioxide is again passed into the cleared liquor at about 50° C., eventually under pressure, to precipitate potassium bicarbonate on suitable cooling. The residual solution is concentrated, the sodium bicarbonate present is converted by heating into carbonate, which, on separating, leaves a liquor which may be subjected to special treatment with respect to the contained impurities. The process is subject to modifications according to the constitution of the lye.—E. S.

Ferrous carbonate; Process for preparing pure ——. A. Flügge. Fr. Pat. 371,876, Nov. 28, 1906. Under Int. Conv., Nov. 30, 1905.

See Eng. Pat. 27,316 of 1906; this J., 1907, 150.—T. F. B.

Hydrogen; Production of pure —— by means of water-gas. A. Frank. Fr. Pat. 371,814, Nov. 26, 1906. Under Int. Conv., Nov. 28, 1905, and May 7, 1906.

Water-gas is passed over a metallic carbide, *e.g.*, calcium carbide, heated to above 300° C. The constituents of the water-gas, other than hydrogen, are thus absorbed or decomposed, and pure hydrogen is obtained. Before being passed over the carbide, the water-gas may be freed from carbon dioxide and monoxide by treatment with lime and cuprous chloride solution respectively, or it may be treated according to the process described in Eng. Pat. 26,928 of 1906 (this J., 1907, 318).—A. S.

Nitrogen and sulphur; Process for extracting —— from spent gas-purifying material. Les Fils de A. Derome. Fr. Pat. 372,099, Dec. 4, 1906.

The material is heated to redness, with or without admixture of a hydrated base, steam being injected into the heated mass in the retorts to aid in decomposing cyanides. The volatile products, consisting of sulphur, ammonium salts, free ammonia, and carbon bisulphide, are condensed in a chamber, preferably by water-sprays, and the gases leaving this chamber are passed through sulphuric acid to absorb ammonia, and through a condenser to collect carbon bisulphide. The sulphur deposited in the cooling chamber is washed with water, and the washings added to the liquor from the chamber. This liquor is distilled with alkali, and the ammonia and carbon bisulphide collected as above described.—A. T. L.

German Patent.

Gases [air]; Process for the separation of mixed ——. W. Lachmann. Ger. Pat. 167,931, Sept. 6, 1902.

The patent relates to a process for the separation of mixtures which are gaseous at the ordinary temperature and pressure, especially air, into constituents of different boiling points by means of fractional distillation. The modification claimed consists in leading the mixture, *e.g.*, air, in the gaseous condition, upwards through a rectifying column, through which some of the liquefied gas is passing downwards in the opposite direction. A further enrichment of the mixture in the higher boiling constituent is attained by causing the liquefied gas escaping from the main rectifying column to pass downwards through a second supplementary rectifying column into a receptacle, in which it is allowed to evaporate, the vapour evolved being passed upwards first through the supplementary rectifying column, and then, conjointly with the gaseous mixture under treatment, through the main rectifying column. Whilst in the Linde process the whole of the air is compressed to the critical pressure, in the present process only a portion is so compressed; and, further, only a portion of the liquefied gas flows through the rectifying column.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 323.)

Pottery; Investigations of ancient ——. H. Le Chatelier. Z. angew. Chem., 1907, 20, 517—523.

These investigations have been made upon the composition and production of Greek, or so-called Etruscan pottery, burnt, black pottery from Denmark, Egyptian porcelain, enamelled Egyptian blocks, Egyptian statuettes of a sandy body with blue glaze, antique blue and artificial *lapis lazuli*.

Greek pottery.—In two pieces of pottery body of about the 5th century, the author found distinct quantities of alkali. In one, a thick foot-piece, the alkali amounted to 2·2 per cent., and must have occurred in the clay used, which was rich in mica. The other, a thin piece of the wall of a vase, contained 4·2 per cent., part of which was derived from the glaze. The temperature at which an already made object was burned can be determined by re-heating it through a range of temperatures, and noting that at which a contraction of volume occurs. In this way, a firing temperature of 950° C. was found for Greek pottery, and a temperature slightly exceeding this injures the red colour. The fusibility of these kinds of clay, which are like those used for Danish pottery, depends upon the content of alkali, and as all the points on the surface where a more concentrated solution of salt was found fused much more quickly than the rest, it seems that some alkali in a soluble form was added during the making or enamelling, and that the black enamel can be reproduced, not by vitrification of a clay, but by re-burning a mixture of clay, excess of iron oxide, and some sodium carbonate. The mineral, glauconite—a hydrated silicate of iron, magnesium, and potassium—can be made plastic by fine grinding, and when fired at 1000° C. gives a good, reddish-brown glazed stoneware.

Black pottery from Denmark.—This is produced by burning the clay articles in iron vessels, in contact with organic materials, such as roots of broom, fern, &c. The tar, produced by the distillation of these materials, penetrates the burnt clay, and the black coloration is due to carbon.

Egyptian porcelain.—The author examined a fragment of a porcelain statuette that was undoubtedly of Egyptian origin. The interior was transparent and blue, and the exterior opaque and white; this surface had resulted from the alteration of the main body of the fragment by the action of moisture and carbonic acid. Its composition agreed with that of soft Sèvres porcelain of the present day, *viz.*: silica, 88·6; alumina, 1·4; iron oxide, 0·4; lime, 2·1; soda, 5·8; and copper oxide, 1·7 per cent. The author was able to reproduce this body by burning the following mixture at 1050° C. in an oxidising atmosphere: blue glass, 40; Greek sand, 55; and white clay, 5 parts. The glass corresponded with the formula:

$$(0{\cdot}23CaO, 0{\cdot}13CuO, 0{\cdot}64Na_2O)(3{\cdot}3SiO_2)$$

The superficial alteration is doubtless the result of the high content of alkali. From this it appears that the ancient Egyptians did produce a genuine porcelain, and that specimens found there had not all been obtained from China.

Enamelled Egyptian blocks.—Some of these are not carved out of natural stone, but are cast ceramic products. In addition to these, however, the author has found some rectangular carved stones, covered with a green enamel, which were found by analysis to be made from steatite. He found on reproducing carved specimens of steatite, which would become hard on burning, that they warped and burst during firing, owing to want of homogeneity. After determining the coefficients of expansion at 1000° and 1400°, he was able to enamel the pieces with a blue alkali-copper glass, which gave specimens that exactly resembled the green Egyptian specimens. The glass had the formula: $4SiO_2(0{\cdot}33CuO,0{\cdot}67Na_2O)$. The change from blue to green must be ascribed to the solution of a certain amount of magnesium, derived from the steatite.

Egyptian statuettes with a sand body, and blue glaze.—Salvétat concluded that these small figures had been chiselled out of natural sandstone, which, owing to its content of water, was quite soft. The results of the author's observations, however, are quite different. He found four kinds of bodies or pastes: (1) white sandy paste of coarse grain, very soft, dense, with a blue coating; (2) coarse paste, coloured brown by manganese, bound together with soda, with a play of violet colour; (3) hard, very fine paste, bound together with soda, and coloured with copper: dark-blue glaze; (4) very fine and very soft paste, soft cast, very thin, green glaze. The analyses of these and of a natural Egyptian sandstone were:—

	1.	2.	3.	4.	Sandstone.
Silica	94·4	92·3	93·9	95·3	93·8
Alumina	2·4	1·1	1·0	1·6	1·0
Iron oxide	0·2	0·3	0·13	0·4	0·25
Lime	1·3	0·6	0·7	1·65	0·07
Magnesia	—	—	—	—	2·7
Manganese oxide .	—	2·4	—	—	—
Copper oxide	0·5	0·8	0·84	0·4	—
Soda	1·2	2·5	2·4	0·64	—
Water	—	—	—	—	1·5

The presence of almost spherical air-holes in these pastes showed that they had been originally mixed with water. Moreover, fragments of burnt clay have been found in Egypt that must have been used in modelling these statuettes. Further, the microscopic examination of these statuette bodies shows that they are composed of angular and very fine sand grains, characters that are never shown by quartz or natural sandstones. The sand must have been very finely ground, which would increase the plasticity of these bodies, which, as shown by the small content of alumina, were very poor in clay. Articles composed of a similar paste, which was very easily cast, and developed a much greater hardness on burning than the Egyptian pottery, were made from the following mixture: Plastic clay, 10; ground sand, 30; and Fontainebleau sand, 60 parts. This was slightly richer in alumina than the Egyptian bodies, and required 13 per cent. of water for mixing. With regard to the glaze, the microscope shows that it consists of quartz grains, the interstices of which are filled with blue glass. A similar glaze is given by a mixture of equal parts by weight of finely ground sand and blue glass of the composition, $4SiO_2,0{\cdot}33CuO,0{\cdot}67Na_2O$. The blue colour depends upon the ratio of copper to silicon, and an increase of the former causes a green colour. When burnt at 1000°, the coating is quite matt, and is glazed by a short firing at 800° C. after being smeared with sodium carbonate solution.

Antique blue, and artificial lapis lazuli.—The following formulæ were obtained by the analysis of some Egyptian products:—

1. Dark blue ball	$3{\cdot}10\ SiO_2\ (0{\cdot}48\ CuO,\ 0{\cdot}46\ CaO,\ 0{\cdot}06\ Na_2O)$
2. Light blue ball	$2{\cdot}04\ SiO_2\ (0{\cdot}42\ CuO,\ 0{\cdot}51\ CaO,\ 0{\cdot}07\ Na_2O)$
3. Artificial lapis, intensely blue	$2{\cdot}50\ SiO_2\ (0{\cdot}36\ CuO,\ 0{\cdot}54\ CaO,\ 0{\cdot}10\ Na_2O)$
4. Vase, dirty blue-green	$3{\cdot}00\ SiO_2\ (0{\cdot}42\ CuO,\ 0{\cdot}50\ CaO,\ 0{\cdot}07\ Na_2O)$

The polarising microscope showed quartz in all, except No. 2. When heated to temperatures ranging from 900° to 1100° C., these colours undergo changes from blue to green or black, but the original colour can be restored by again heating to a somewhat lower temperature. Sodium carbonate is used as a fusing material, since silica, lime, and copper oxide cannot be fused together at a temperature low enough to allow of the formation of the blue colour. From a number of experiments, the author found that "calcium blue" could be produced from the mixture corresponding with the formula:

$$2{\cdot}5SiO_2(0{\cdot}35CuO,0{\cdot}55CaO,0{\cdot}1Na_2O).$$

The silica must be very finely ground, otherwise double the quantity is required, though it still shows a sufficiently deep colour. With precipitated calcium silicate almost the theoretical proportions can be used, and the content of copper oxide increased. The best mixture is: $2{\cdot}20SiO_2$ $(0{\cdot}48CuO,0{\cdot}50CaO,0{\cdot}02Na_2O)$. These can be made from the following mixtures: Silica, 75 or 66; copper oxide, 14 or 19; calcium carbonate, 28 or 25; and sodium carbonate (dry), 5 or 1 part. This ordinary "calcium blue" is always very pale. Its intensity is increased by repeated firing, after previous re-grinding, and is due to the increase of the size of the crystals. An intense blue is given by increasing the content of copper oxide, preferably introduced in two portions, by adding a blue glass, corresponding with the formula, $4SiO_2(0{\cdot}33CuO,0{\cdot}67Na_2O)$; otherwise, incomplete union of the copper oxide colours the mass black. On burning, a very hard body exactly like the artificial Egyptian lapis is obtained; in firing, the temperature must not go beyond 900° to 1000°. A "barium blue" can be obtained from a composition similar to that for the "calcium blue." but the temperature of burning need not be so carefully limited; it is preferable to melt the mass, in order to obtain a complete reaction. and then develop the blue by heating again to 900° for an hour.—W. C. H.

English Patent.

Pottery, earthenware, and similar surfaces; Printing or transferring designs on to ——. A. J. Weiss, Vienna. Eng. Pat. 18,382, Aug. 16, 1906.

The articles on to which the transfers are to be pressed, are subjected to an intermittent rotary motion, and the pressing rollers to a reciprocating or up and down motion. The rollers move downwards while the article is at a standstill, and press against its side and bottom surfaces, to press the transfer designs on to them; after this, they move upwards, and are brought out of contact with the article to be decorated, and whilst the rollers are out of contact with it, the article is slightly rotated in order that another portion of the surfaces may be presented to the action of the rollers in the next cycle of operations. The claims also cover the details of an apparatus for carrying out this process. The two principal parts of the apparatus are a table, to support the article to be decorated, to which an intermittent rotary motion can be communicated, and a head, arranged above the table, which can be moved vertically up or down. To the under side of the head or plate, arms are pivoted; these arms carry the pressing rollers, and are pressed against the surfaces of the article to be decorated by means of springs. The parts of the apparatus can be adjusted to deal with articles of varying shapes and sizes.—W. C. H.

United States Patents.

Glass; Process and apparatus for fire-polishing plate ——. P. T. Sievert, Dresden, Germany. U.S. Pat. 843,238, Feb. 5, 1907.

See Fr. Pat. 369,409 of 1906; this J., 1907, 95.—T. F. B.

Glass sheets: Method of making ——. F. L. O. Wadsworth, Morgantown W. Va., Assignor to Pressed Prism Plate Glass Co., New York. U.S. Pat. 844,552, Feb. 19, 1907.

In the method described two sheets of glass are formed out of contact with each other, and their surfaces are brought into welding contact, upon interposed open-meshed material, only after they are brought to sheet form, and whilst still plastic, and during the formation of subsequent portions of the same sheet or sheets. The compound sheet is then subjected to pressure acting upon the entire cross-section of the sheet between the surfaces that apply the pressure.—W. C. H.

Glass articles; Manufacture of ——. R. E. H. Jonkergouw, Billancourt, Assignor to Soc. Anon. du Chryso-Cerame, Paris. U.S. Pat. 845,552, Feb. 26, 1907.

See Eng. Pat. 16,165 of 1906; this J., 1907, 94.—T. F. B.

Mica; Manufacture of pulverised ——. P. Dorler, Munich, Assignor to R. Tiller, Hamburg, and H. Duelfer, Cassel, Germany. U.S. Pat. 845,450, Feb. 26, 1907.

See Eng. Pat. 23,149 of 1905; this J., 1906, 181.—T. F. B.

Enamelling or glazing metallic and other surfaces. W. Atkinson and J. Smith, Bradford. U.S. Pat. 843,985. Feb. 12, 1907.

See Eng. Pat. 12,554 of 1906; this J., 1906, 1147.—T. F. B.

French Patent.

Pottery; Process and installation for burning ——. J. Billon. Fr. Pat. 371,796, Nov. 26, 1906.

The inventor claims the use of mineral oil as the combustible in this process of burning pottery. The apparatus used for the process consists of a raised tank to hold the oil, which, under a certain amount of pressure, passes down a pipe to a distributing receiver, to which several tubes are attached. These tubes serve to project the liquid combustible on to all parts of the grate, and are provided with valves, by means of which the fire can be regulated at different points of the grate. The apparatus may be modified to include a vaporiser for the oil, which is then injected into the grate in the form of gas.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 323.)

Dust; Use of deliquescent salts for the prevention of ——. A. Houzeau and G. A. Le Roy. Bull. Soc. Ind. de Rouen, 1906, 353. Chem.-Zeit., 1907, 31, Rep., 127—128.

The use of calcium chloride solutions for "watering" roads was first introduced in 1828, but no progress was made with the procedure for about 30 years. In 1859 trials were made at Lyons with hydrochloric acid, which formed calcium chloride with the lime contained in the soil. Good results were also obtained at Rouen, where the applications of calcium chloride solutions were continued for several years in succession, beginning in 1873. Houzeau calculated that the use of such solutions was 30 per cent. more economical than ordinary efficient watering, because calcium chloride remained damp for six days. Of late years magnesium chloride solution of 30° B. has been substituted for the calcium salt, as it is alleged to have greater disinfecting properties and to render wood pavement fireproof. Calcium chloride, however, remains the more generally suitable material. Its chief sources are by-products of the ammonia-soda and Weldon processes, of the boric and acetic acid manufactures, and of the mineral water industry. The ammonia-soda process yields calcium chloride solution of 10—12 per cent. strength, the Weldon process a solution of 16—17 per cent. For the purpose of dust prevention, calcium chloride solution has several advantages over petroleum or water containing tar. It is cheaper, requires no previous dry cleaning of the road surface, and does not, like oil or tar, give rise to an unpleasant mud during a thaw. The disinfecting properties of calcium chloride are fully equal to those of tar-containing solutions.—O. R.

Cement production of the United States in 1906. Bd. of Trade J., April 11, 1907. [T.R.]

The following statement, issued by the United States Geological Survey, shows the approximate production of hydraulic cement in the United States for the year 1906. The returns on which it is based are complete with the exception of those from four small plants:—The total production of all kinds of hydraulic cement in 1906, including Portland, natural rock, and puzzuolana cement was 50,027,321 barrels, valued at $54,015,713. Of this total 45,610,822 barrels were Portland cement, with a value of $51,240,652; 3,935,275 barrels were natural rock cement, with a value of $2,362,140, and 481,224 barrels were puzzuolana cement, valued at $412,921. The total production of cement in 1905 was 40,894,308 barrels, valued at $36,012,189.

English Patents.

Slate, artificial; Manufacture of ——. J. Hennings, Kreis Jork, Germany. Eng. Pat. 25,043, Nov. 7, 1906.

See Fr. Pat. 371,269 of 1906; this J., 1907, 323.—T. F. B.

Portland cement; Manufacture of ——. K. Zulkowski, Prague, Austria. Eng. Pat. 7443, March 28, 1906.

See Fr. Pat. 364,022 of 1906; this J., 1906, 886.—T. F. B.

Furnaces or kilns for preparing cement-making materials or the like. C. A. Matcham, Allentown, U.S.A. Eng. Pat. 19,973, Sept. 7, 1906.

See U.S. Pat. 842,848 of 1907; following these.—T. F. B.

United States Patents.

Marble; Process for integral or through coloration of ——. E. L. Belloni, Milan, Italy. U.S. Pat. 844,846, Feb. 19, 1907.

The marble is subjected "successively to the action of salt solutions of gradually increased osmotic power." In order to obtain "highly-concentrated salt solutions," "a saturated solution of the acid radical of the base desired" is first obtained, and the degree of concentration of the solution is then increased by the introduction of "fresh quantities of the acid radical of the base, combined with a radical different from the first-named acid radical," but soluble in solvents of it.—W. C. H.

Cement; Process of burning ——. C. A. Matcham, Allentown, Pa. U.S. Pat. 842,848, Jan. 29, 1907.

The cement material is fed into one end of a substantially horizontal kiln, and allowed to flow through it to the discharge end. At the inlet end of the kiln, means are provided for creating a draught through it, from the discharge end to the inlet end. This draught draws a stream of powdered fuel into the discharge end of the kiln, together with a volume of air at normal temperature, and simultaneously introduces a relatively large volume of heated air, immediately under the incoming powdered fuel and air. The powdered fuel forms a combustible mixture with the air, and the flame is drawn in a substantially straight path through the kiln, into the combustion zone, and in contact with the cement material, without materially disintegrating the lining of the kiln.—W. C. H.

Lime; Apparatus for and method of hydrating ——. W. S. Osborne. U.S. Pats. 845,189 and 845,190, Feb. 26, 1907. VII., page 407.

Lime and cement forming material; Process of calcining ——. C. Ellis, White Plains, N.Y. U.S. Pat. 843,878, Feb. 12, 1907.

This process of calcining limestone, &c., consists in mixing a predetermined amount of water with hot gases derived from a lime-kiln, whereby the water is converted into steam; to this mixture a predetermined amount of air is added, and the resulting mixture is passed, as an accelerated draught-current, through a shallow bed of ignited fuel, at a rate greater than the fuel can react with the gases, and the resulting mixture is then burned in contact with limestone.—W. C. H.

Cement; Process of burning —— and apparatus therefor. C. Ellis, White Plains, N.Y., Assignor to Combustion Utilities Company, New York. U.S. Pat. 844,857, Feb. 19, 1907.

This process of sintering cement and like materials in rotary kilns, consists in passing a stream of the material through the kiln, and causing a jet of mingled fuel and air to impinge upon the material, the fuel and air being introduced in quantity sufficient to approximately satisfy the draught of the kiln, and thereby substantially avoid an insulating air stream between the flame and the material to be heated. The flame impinges end-on both upon the material and upon the ascending wall of the kiln at a point above where the material should drop away to prevent unduly prolonged adhesion of the material to the wall. The flame is spread out into a fan shape, and is projected into the kiln, obliquely to the axis; the major axis of cross-section of the flame is nearly horizontal. The flame is projected from a burner situated at a point below and to one side of the axis of the kiln, and directed to the opposite side of the kiln. The flame is widespread in an approximately horizontal direction, and relatively thin in a vertical direction, and impinges against the shoulder formed at the line between the calcining and clinkering zones, and penetrates for a substantial distance into the calcining zone. The burner comprises inner and outer tubes, the outer being capable of longitudinal adjustment beyond the inner, and of a projecting hood on the outer side of the discharge orifice to prevent excessive spreading of the outer side of the flame. The discharge orifice is relatively long in one direction, and narrow in the opposite direction, and is narrower at its inner side than at its outer side.—W. C. H.

French Patents.

[*Road*] *Dust; Preservative, with a wood-tar basis, against* ——. S. Mattar and R. Funcke. Fr. Pat. 371,521, Nov. 15, 1906.

For preventing the formation of dust on roads the product obtained by heating wood tar to about 200° C. to remove the easily volatile constituents is used, either alone or preferably added to a mixture of creosote or anthracene oils, or to distillation products of petroleum or resinous vegetable oils.—W. C. H.

Blast-furnace slag; Process for the utilisation of ——. G. L. Lamort. Fr. Pat. 371,610, Nov. 19, 1906. Under Int. Conv., Nov. 24, 1905.

According to this invention blast-furnace slag is utilised and made into paving flags, paving blocks, building materials, &c., by the addition of sand or other inert material to the slag, whilst in a fluid condition. The claims also include the products thus obtained.—W. C. H.

Wood; Process and arrangements for the injection of liquids into ——. P. Houter and A. L. de Sainte-Croix. Fr. Pat. 371,960, Nov. 29, 1906.

The process described is for staining, fire-proofing, preserving, hardening, or perfuming any kind of freshly cut wood, on which the bark is left. The sap, gums, and other natural products are removed from the wood, by passing through it, in the direction of the fibres, by pressure or suction, a stream of water, alcohol, or other suitable solvent, to remove the natural products by mechanical displacement or by solution; then, by the same means, the material to be injected is introduced into the wood, which it completely penetrates. A series of varied tints can be imparted to the wood, by injecting one or more colouring substances, of different shades, either in the same or in the opposite direction, in cylinders, sectors, or any other form. In carrying out the process, the portion of the cross-section of the log, that is to be impregnated, is isolated, *e.g.*, covered with a flat, inverted basin, with sharp edges which penetrate the wood, and provided with a supply-pipe for the liquid. A tight joint between the wood and the basin may also be made by means of an elastic rim placed between the wood and the rounded edge of the basin. The injecting apparatus may also consist of two cylinders of different diameters, the larger and lower of which is forced on to the end of the block to be treated, and is filled with the injection material, which is forced into the wood by a piston, this piston being rigidly connected with one in the smaller cylinder, which is moved by admission of some fluid under pressure.—W. C. H.

Bricks and similar products; Furnace for burning ——. A. M. Chmelewski, *née* Gustin. Fr. Pat. 371,831, Nov. 27, 1906.

The furnace described comprises an inner central separating wall, and an outer wall, which is separated from the inner one by a certain distance, and forms with it a continuous chamber. This chamber can be divided into a number of special compartments by means of screens. The crown of the furnace consists of a temporary covering formed of the mass of bricks and articles to be burnt that are introduced into the chamber. The lower part of the exterior wall is provided with openings for filling the chamber, and for fuel, and openings or vent-holes are arranged in the temporary crown or covering. The inner wall is provided with a smoke channel which communicates with the compartments of the continuous chamber, and with valves which regulate, open, or close the communication between the channel and the compartments. Firing-holes, provided with movable covers, are arranged in the covering layer; these firing holes are vertical channels formed by the piling up of the articles to be burnt. The smoke channel is formed along the length of the central wall, either in the wall above the level of the floor of the kiln, or below it. It may also be arranged in or under the lateral wall, either below the floor of the continuous chamber, or formed by suitable pipes arranged above or on the sides of the furnace; in each case the channel is provided with openings towards or into the bottom of the continuous chamber. Combustible material may be introduced into the lower part of any of the compartments, or through the covering layer on the top, and each compartment is provided with an opening or entrance, which can be regulated, opened, or closed by suitable arrangements.—W. C. H.

Plaster; Arrangement for the continuous burning of ——. F. Raithel. Fr. Pat. 371,989, Nov. 30, 1906.

The apparatus described consists of two concentric burning chambers, the bottom of the outer one being higher than that of the other. Both chambers are heated by a single fire, the gases from which follow a definite course, and pass round the outer chamber before escaping into the chimney flue. The first stage of the burning of the plaster takes place in the outer, or cooler, chamber, and from this the material is passed, by means of scrapers attached to a central revolving shaft, through openings, provided with doors, into the inner and hotter chamber, where the burning is completed, and from this the fully burnt product is discharged by a second set of scrapers, mounted on the same shaft, into cooling vessels. The different operations are thus carried out in a continuous manner.—W. C. H.

Cement mixture for rough-casting and covering the façades of buildings and structures of all kinds. L. Simonsen. Fr. Pat. 371,530, Nov. 15, 1906.

The composition described consists of a mixture of cement and a liquid binding material, which is formed of a solution of casein dissolved in ammonia and digested in hot or boiling water.—W. C. H.

Hydraulic limes and cements; Treatment of —— to improve their qualities. E. Boyer and J. Velin. Fr. Pat. 371,953, Nov. 30, 1906.

According to this invention carbon dioxide is used to convert the injurious component, quicklime, in hydraulic materials into a useful component, a basic carbonate. The treatment consists in re-burning and re-carbonating, in a horizontal furnace, at a temperature of about 600° to 700°, hydraulic materials already burned, which are carried by trucks or other means of transport, and moved in the same direction as that taken by the gases and smoke derived from the grate.—W. C. H.

German Patents.

Building blocks ; Process for the manufacture of light —— from sawdust, gypsum, and glue solution. R. Schulze. Ger. Pat. 173,037, July 16, 1905.

Sawdust is treated with aluminium sulphate, dried, and made into a paste with milk of lime and a mixture of gypsum and glue solution. Blocks are made from this paste in the usual manner. It is claimed that the blocks are very strong and durable, as only insoluble compounds are formed, and no gas is evolved during their preparation. —A. S.

Sorel cement ; Process for the manufacture of dry ——. J. Abel, F. Janson, and E. Rocke. Ger. Pat. 169,663, Sept. 1, 1904. Addition to Ger. Pat. 154,976, Oct. 6, 1903 (this J., 1905, 500).

According to the present patent crystallised magnesium chloride is heated until it is completely dehydrated and a portion of the hydrochloric acid is evolved, but instead of carefully regulating the heating so that the residue contains the desired proportions of magnesium chloride and magnesia, the heating is discontinued whilst excess of magnesium chloride is still present, and the composition of the residue is afterwards adjusted by addition of burnt magnesite.—A. S.

X.—METALLURGY.

Pig-iron production of the world. Eng. and Min. J., March 23, 1907. [T.R.]

The reports of the three great iron-producing nations give the output of pig-iron for the year 1906 as follows, reduced to metric tons :—

	1905.	1906.
United States	23,340,258	25,712,106
Germany	10,987,623	12,478,267
Great Britain	9,746,221	10,311,778
Total	44,074,102	48,502,151

Germany showed last year the largest proportional gain, 13·6 per cent. The increase in the United States was 10·1 per cent., and that in Great Britain 5·8 per cent., the total gain for the three countries being 10 per cent.

Iron and steel production of France in 1906. Bd. of Trade J., March 28, 1907. [T.R.]

The French "Journal Officiel" publishes the following statistics relating to the production of iron and steel in France during the year 1906, with comparative figures for the preceding year :—

——	1905.	1906.
	Metric tons.	Metric tons.
Cast iron—		
Forge pig	705,691	741,571
Foundry pig	635,672	591,275
Bessemer pig	160,411	149,971
Thomas pig	1,530,671	1,784,726
Special pig	44,267	51,489
Total	3,076,712	3,319,032
Welded iron and steel, worked—total	669,841	736,918
Mild steel, worked—total	1,442,071	1,454,456
Ingots	2,240,284	2,371,377
Blooms and billets	1,051,054	1,052,167

Ferrous oxide ; Reduction of —— by hydrogen and carbon monoxide. W. Wyss. Metallurgie, 1906, **3**, 26—27 ; Z. angew. Chem., 1907, **20**, 579.

Attempts to determine the oxygen-content of iron by ignition in a current of carbon monoxide instead of hydrogen proved unsuccessful. In experiments with hydrogen the results came out higher, the higher the temperature employed. With carbon monoxide the results were much higher than with hydrogen. They attained a maximum when the temperature of ignition was 1025° C., falling again with further increase of temperature ; the iron became richer in carbon during the test. The results indicate that, contrary to the prevailing opinion, carburisation of iron in the blast furnace may be effected by the carbon monoxide present in the ascending current of gas even at temperatures higher than that corresponding to a red heat.—A. S.

Graphite ; Effect of foreign elements in pig-iron upon the separation of ——; F. Wüst. Metallurgie, 1906, **3**, 169—175, 201—205. Z. angew. Chem., 1907, **20**, 581—582.

Other elements besides manganese and silicon have an influence on the separation of graphite in pig iron. The author examined the effect of tin, sulphur, and phosphorus. In presence of tin, iron cannot take up so much carbon as usual. Tin has no appreciable effect on the formation of graphite if silicon be present, but it favours such formation in metal free from silicon. In presence of excess of carbon, iron is capable of taking up about 16 per cent. of tin. Sulphur causes a lowering of the saturation point of iron for carbon, but tends to prevent the separation of graphite by silicon. In iron free from silicon, phosphorus has no effect on the separation of graphite until its quantity exceeds about 2·5 per cent., but with larger proportions of phosphorus the separation of graphite is accelerated. In presence of about 0·9 per cent. of silicon, the acceleration of the separation of graphite does not become evident until the proportion of phosphorus rises above 3 per cent.—A. S.

Iron-carbon alloys ; Influence of silicon on ——. F. Wüst and O. Petersen. Metallurgie, 1906, **3**, 811—820; Science Abstracts, 1907, **10A**, 172.

The authors made specimens by heating Swedish cast iron with excess of carbon, and afterwards with more or less ferrosilicon. A portion was afterwards held for some time at 10° above the solidification temperature. The ratio of the difference between 4·3 and the total carbon to the silicon-content is found to be very roughly constant, averaging 0·303 between 2 and 5 per cent. of silicon, falling to about 0·18 at 13 per cent., and 0·13 at 27 per cent. of silicon. This ratio is interpreted as the amount of carbon displaced by 1 per cent. of silicon, the solidification temperature being taken as that of the eutectic for the given amount of silicon, and the alloy as being saturated with carbon under the given conditions. With increasing silicon the solidification temperature is gradually raised from 1130° to about 1245° with 27 per cent. of silicon. The effect is so slight within practical limits of working that it may generally be neglected. The duration of the change has an inverse relationship to the amount of graphite in the specimen. The metallographic study supports the probable existence of the compound, Fe_2Si—either free, or as Fe_2Si-rich solution in iron containing also some carbon.

Cast iron ; Relation between composition and properties of malleable ——. F. Wüst. Metallurgie, 1907, **4**, 45—53. Science Abstracts, 1907, **10A**, 172.

It is found as a result of the author's experiments that the soundness of malleable cast iron is independent of the silicon, phosphorus, and sulphur contents, so long as these do not exceed 1·2, 0·1, and 0·2 per cent. respectively. If cementite is decomposed in the annealing process, then the soundness is more or less affected according to the amount of temper carbon oxidised out. The ductility and tensile strength are reduced with increase of sulphur beyond 0·15 per cent. A repetition of the annealing process does not bring about any change in soundness and ductility, but it is found to be possible to increase the tensile strength by this means.

Ferrosilicon ; Relation between specific gravity and silicon-content in ——. J. Rothe. Mitt. der Königl. Materialprüfungsamt., 1907, **25**, 51—52.

The author has determined the specific gravities of a number of samples of ferrosilicon, to ascertain whether this determination could be used as an index of the content of silicon. The figures show, however, that the variation of specific gravity with silicon-content is not rapid enough, especially just above and below 25 per cent. (the percentage above which ferrosilicon may be imported into Germany duty-free), to allow the percentage of silicon to be inferred from the specific gravity. The figures are as follows (water at 4° C. = 1) :—

Silicon-content.	Specific gravity.	Temperature.
per cent.		° C.
11·58	6·96	20·3
15·81	6·88	20·7
22·83	6·51	17·3
23·47	6·51	19·5
24·26	6·48	17·2
29·04	6·40	19·9
32·05	6·18	16·7
47·25	4·55	21·0
77·29	2·93	19·6

—J. T. D.

Auriferous ore containing insoluble arsenides ; Notes on the occurrence and treatment of an ——. J. K. Wilson. J. Chem. Met. and Min. Soc. of S. Africa, 1907, **7**, 244—248.

THE ore is from quartz veins at the Nooitgedacht Mine, Lydenburg District. The veins, which appear to have been subjected to intense heat and pressure since their formation, as well as subsequent weathering, are in places still heavily mineralised, arsenical pyrites predominating. The bulk of the gold, however, being free and fairly coarse and associated with oxidised rubbly quartz and ferric oxide, is extracted by amalgamation, and the tailings treated by the cyanide process without concentration. The tailings have the following composition :—Silica (SiO_2), 36—40 ; iron (Fe_2O_3), 40—43 ; iron (Fe_3O_4), *nil*—2 ; alumina (Al_2O_3), 11·8—12·5 ; arsenic (as arsenide), 2·05—4·7 ; sulphur (S), 0·2—2·0 ; antimony, *nil*—heavy traces ; copper (Cu), *nil*—to traces ; and acid salts (as H_2SO_4), *nil*—0·087 per cent. The amount of free acid or acid salts present is thus very small, even in tailings which have been exposed to the weather for some years, and does not account for the heavy consumption of lime. Experiments showed that the consumption of lime is due principally to the presence of arsenic which exists in the form of arsenides insoluble in water, the arsenides acting slowly upon alkalis decomposing them. It was also shown that cyanide solution dissolves these arsenides and is decomposed by them, that arsenic may be partially precipitated from cyanide solution by the addition of lime in excess, some of the cyanide being regenerated, and that this precipitate is more or less soluble in excess of neutral or slightly alkaline cyanide solution. Based on the results of these experiments, the method adopted is to add the lime to the ore and allow complete reaction to take place before adding the cyanide. In the case of current tailings the lime is added in the mill, and in the case of accumulated tailings the requisite amount of lime is fed into each truck as the vat is charged, the charge is saturated with water, allowed to soak for twenty-four hours, and the water drawn off. Cyanide solution containing 0·04 to 0·06 per cent. of potassium cyanide is used throughout the treatment, and after each wash the charge is leached dry.—O. F. H.

Last drainings. H. A. White. J. Chem. Met. and Min. Soc. S. Africa, 1907, **7**, 239—244.

THE author gives the following results of two years' working on a particular mine, showing the effect of increasing the proportion of solution :—

	1905.	1906.	Dec., 1906
Charges .... dwts. ..	4·279	3·980	—
Residues .... ,, ..	0·851	0·745	—
Last drainings .... ,, ..	0·710	0·390	0·21
Zinc used ....lb. per ton	0·53	0·51	—
Cyanide used .... ,,	0·49	0·55	—
Solution .... per cent.	141	156	166

It is then calculated that the cost of handling the extra tonnage of solution is more than repaid by the increase in the amount of gold recovered, experiments having shown that approximately one-ninth of the value of the last drainings gives the value of dissolved gold per ton of dry residue. For the purpose of checking the efficiency of leaching and washing, the author advocates the use of a diagram of gold and cyanide values in solutions leaving the tanks, taken at regular and frequent intervals. Two such diagrams are given, from which it is shown that the practice of commencing with weak or medium solutions is not as a rule to be recommended, as the first leachings very soon begin to carry gold, but practically no cyanide or alkalinity, so that when sent to the "weak" extraction boxes, they mix with solutions nearly saturated with zinc, and reduce their protective strength to the point where zinc hydroxide separates out, thus largely accounting for the objectionable "white precipitate" found in the "weak" boxes.—O. F. H.

Colloidal silicic acid in slimes. W. A. Caldecott. J. Chem., Metall. and Min. Soc., S. Africa, 1907, **7**, 217.

THE author draws attention to a statement by A. W. Warwick (London Mining J., April 29, 1905) as to the presence of colloidal hydrates in ore slimes, and points out that this fact may lead to an explanation of the difficulty of settling accumulated slimes or slimes from partly weathered pyritic ore, as compared with slimes from freshly mined pyritic banket ore. In the weathering of pyritic ores, the sulphuric acid produced may decompose any aluminium silicate or magnesium silicate present, with formation of colloidal silicic acid which would considerably retard settling, and also have an injurious effect in leaching and filter-pressing. Experiments showed that addition of a small quantity of gelatinous silicic acid to slimes had a marked retarding influence on the rate of settling.—A. S.

Nickel and tin ; Alloys of ——. E. Vigouroux. Compt. rend., 1907, **144**, 639—641.

BY the direct action of pure nickel upon pure tin, the author has prepared alloys containing respectively 73·64, 83·65, and 92·71 per cent. of tin. The first of these is of an iron-grey colour, hard, and of crystalline texture, and has the properties of being sonorous like certain ordinary bronzes. The second alloy is of a more bluish shade, and its surface shows numerous cavities in which crystals can be discerned by the naked eye. It is not sonorous. The third resembles tin in appearance, but is harder, and has a striated surface. All three alloys are non-magnetic (showing that the nickel is not, in the free state), and when treated with nitric acid, all leave a more or less crystalline metallic residue.—C. A. M.

Calcium ; Alloys of ——. L. Stockem. Metallurgie, 1906, **3**, 147—149 ; Z. angew. Chem., 1907, **20**, 587.

CALCIUM will not alloy with iron, but mixes with copper in all proportions. Copper containing calcium is brittle, and becomes lighter in colour as the proportion of calcium is increased. The alloy containing 20 per cent. of calcium is white, and disintegrates on exposure to the air. Copper-calcium alloys could probably be used in place of copper-phosphorus alloys. Aluminium and magnesium also alloy with calcium in all proportions ; both of the metals mentioned make calcium brittle. It is suggested that calcium would prove very useful in copper refining and in foundry-work, and also as a substitute for magnesium in nickel refining. (See also this J., 1905, 93, 676, 1179 ; 1906, 187, 222.)—A. S.

Platinum amalgam ; Property of ——. H. Moissan. Compt. rend., 1907, **144**, 593—594.

ON shaking a solution of platinum in mercury with water for about 15 seconds, a semi-solid mass is produced. This emulsion, which is about five times the volume of the original amalgam, is not altered when allowed to stand for a year. It can be heated to 100° C. without change of volume or liberation of gas ; nor does it separate when cooled to − 80° C. When exposed *in vacuo*, however, its volume diminishes, a little water separates, and bubbles of gas are given off. Emulsions are also produced with sulphuric acid, ammonia solution, ammonium chloride solution, sodium chloride solution, acetone, glycerol, anhydrous alcohol, ether, turpentine oil, carbon tetrachloride, and chloroform, but apparently not with anhydrous benzene. Platinum amalgam that has been shaken with air does not form an emulsion. Amalgams of silver, gold, and copper do not behave in this way, but platinum amalgam to which sodium has been added still swells up and forms an emulsion when shaken with water.—C. A. M.

Zinc sulphate : Determination of —— in roasted blende. H. Pommerenke. Bull. Soc. Chim. Belg., 1907, **21**, 128—132.

The whole of the zinc present as sulphate in roasted blende may be removed by treatment with a sufficient quantity of boiling water. Any basic salt is decomposed during this process and is obtained in solution as the normal sulphate, $ZnSO_4$.—F. Sodn.

Iron ; Rusting of ——. J. N. Friend and G. T. Moody. Nature, 1906, **74**, 540 and 564. Science Abstracts, 1907, **10A**, 167.

In Friend's experiments pieces of cast iron, wrought iron, and pure iron were sealed up in vessels containing water and air only ; the water had been well boiled to get rid of dissolved carbon dioxide, and the pieces of iron were all polished. After keeping for several months the wrought iron and pure iron were unchanged, but the cast iron turned a shade darker in tint. Pure iron remained perfectly bright in a solution of hydrogen peroxide, a slow stream of oxygen being evolved ; after some hours an odd speck or two of rust appeared. The wrought iron decomposed the peroxide rather more rapidly, and the specks of rust were more numerous. The cast iron was covered with rust in a few minutes, the peroxide being decomposed very rapidly. The author thinks it possible that oxygen and water alone are sufficient to cause the impurer forms of iron to rust. Moody considers that Friend's results confirm his own experiments, which led him to consider that rusting is primarily a case of acid attack (this J., 1906, 539.)

Iron ; the rusting of ——. W. R. Dunstan. Chem. Soc. Proc., 1907, **23**, 63—64.

As a result of a long series of experiments (Dunstan, Jowett, and Goulding, this J., 1903, 745 ; 1905, 1235), it was shown that the rusting of iron can take place in the absence of carbonic acid, and that only iron, oxygen, and liquid water are necessary for rusting to occur. In order to elucidate the chemical change involved, and to explain the inhibiting effect on the rusting of iron produced by some substances and especially by alkalis and potassium bichromate, the working hypothesis was suggested that the formation of hydrogen peroxide is concerned in the change, rusting being prevented by those substances which are capable of decomposing the peroxide. Recently, G. T. Moody (this J., 1906, 539) has published an account of experiments he has made which in his opinion prove that iron cannot rust in the absence of carbon dioxide. In the experiments recorded by the present author (*loc. cit.*) elaborate precautions were taken to ensure the absence of carbon dioxide, but it has been thought desirable to repeat the experiments made under somewhat different conditions by Moody. His conclusions have not, however, been confirmed : the results of experiments carried out in the manner described by him show that iron rusts freely in the absence of carbonic acid, provided that iron, oxygen, and liquid water are brought together.

Iron ; The mechanism of the rusting of ——. G. T. Moody. Chem. Soc. Proc., 1907, **23**, 84.

The author has previously shown that the presence of acid is essential for rusting to occur. The following experiment enables the exact mechanism of the production of rust to be visualised :—In the bottom of a glass cylinder are placed some rods of bright iron, such as French nails. These are only loosely packed, for the most part heads upward, and are so arranged that some of them remain vertical whilst others occupy inclined positions. Recently boiled distilled water is then poured into the cylinder until it stands about 1½ in. above the heads of the nails. The mouth of the cylinder is loosely closed with a sheet of paper so as to exclude dust, and at the same time to allow free access of air to the water, whereby carbonic acid and oxygen are absorbed. In the course of 24 hours the water shows signs of becoming turbid, and shortly afterwards a copious separation of brown particles from the solution is distinctly observed. These brown particles are continuously formed and gradually settle on the heads of the nails and on the upper parts only of those nails which are inclined. The under parts of the inclined nails and the vertical nails remain bright, no general corrosion of the surfaces being observable. At the end of seven days a thick layer of hydrated ferric oxide has collected on the upper surfaces of the nails and also on the bottom of the cylinder. If a sheet of hardened filter paper or some other material, which allows of diffusion, be placed in a horizontal position immediately over the nails at the beginning of the experiment, the rust which separates from the solution above it gradually collects on its upper surface and eventually forms a thick layer.

The separation of the rust from the water and its non-formation on the surface of the iron can be explained only as an oxidation of ferrous iron actually in solution. This is in strict accordance with the experimental evidence already advanced, and shows that, in rusting, iron is first dissolved with formation of ferrous salt which subsequently oxidises to rust. (See also this J., 1906, 539.) In absence of acid, pure iron was allowed to remain in contact with water and oxygen for several weeks without even one speck of rust being formed, and without the iron undergoing any change either in appearance or in weight. It was specially noteworthy that when pure iron was placed in a dilute solution of hydrogen peroxide free from acid, no oxidation or other change in the iron occurred, although oxygen was freely evolved from every part of the immersed metal. In this way the indifference of iron towards oxygen in presence of water could be easily and conclusively demonstrated. In the experiment shown, the iron was undoubtedly dissolved by carbonic acid, and the ferrous bicarbonate thus formed was converted into rust by oxygen, which, simultaneously with the carbonic acid, diffused into the solution from the atmosphere.

English Patents.

Metals ; Heat treatment of —— during manufacture into various articles. T. V. Hughes, Birmingham. Eng. Pat. 729, Jan. 10, 1906.

The furnace used consists of a vertical heating chamber filled wth a non-oxidising gas and opening out of a horizontal cooling chamber. The articles to be treated are introduced into the cooling chamber, then carried up and down the heating chamber and out through the cooling chamber. The buoyancy of the heated gas in the vertical chamber is relied on to prevent the admission of atmospheric air into the cooling chamber. Means are also adopted for increasing the density of the atmosphere in the cooling chamber.—O. F. H.

Mattes of the heavy metals ; Process for the treatment of ——. J. Savelsberg, Papenburg on Ems, Germany. Eng. Pat. 10,329, May 2, 1906.

See U.S. Pat. 825,983 of 1906 ; this J., 1906, 851.—T. F. B.

Iron or steel ; Method of coating —— with tin or the like metal. J. Swain, Manchester. Eng. Pat. 11,698, May 19, 1906.

The articles, particularly castings of iron or steel, are cleaned and dipped in potassium hydroxide solution, and then subjected to an electric current in a bath having iron anodes, the solution being made from iron or steel turnings, hydrochloric acid, and alkali or alkali chloride. When the articles have received a sufficient deposit of iron, they are rinsed, dipped in a solution of zinc chloride, and finally dipped in the molten tin or other metal.—O. F. H.

Ores and other materials; Process and apparatus for treating —— by the aid of heat. W. B. Dennis, Blackbutte, U.S.A. Eng. Pat. 12,523, May 29, 1906.

See U.S. Pats. 833,679 and 833,680 of 1906; this J., 1906, 1101.—T. F. B.

Antimony and arsenic; Wet process for the recovery of —— from ores, concentrates, tailings, and slimes. J. R. Masson, East Melbourne, Vic. Eng. Pat. 13,012, June 5, 1906.

See Fr. Pat. 366,873 of 1906; this J., 1906, 1102. Reference is directed, under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pats. 5271 of 1881; 1305 of 1882; 8415 of 1891; 11,123 of 1904; and 10,309 of 1906.—T. F. B.

Slimes; Process and apparatus for filtering ——. C. Butters, London. Eng. Pat. 20,979, Sept. 21, 1906.

The apparatus consists of a series of filter frames or "filter leaves" carrying a fibrous filtering material enclosed in filter cloths, the interior of each filter leaf being connected to a vacuum pump by a flexible rubber joint. The series of filter leaves are allowed to hang freely in the filtering vat, which is then filled with the pulp of slimes and water, and the liquid drawn through the filter by the vacuum pump until cakes of slimes are formed on the outsides of the filter leaves, when the vacuum is reduced, and the excess of slimes returned to the storage tank. The vat is then filled with the solvent solution, which is drawn through the filter by again increasing the vacuum, and the cakes of slimes, with or without washing, are detached by water or air under pressure admitted to the interior of each filter leaf. Claim is made for the cleaning or regenerating of the filter cloths by washing the filter leaves with dilute hydrochloric acid.—O. F. H.

United States Patents.

Ores; Process for treating refractory ——. L. V. Atkinson, Carshalton, England. U.S. Pat. 841,657, Jan. 22, 1907.

The gases given off during the roasting of sulphide ores are returned to the furnace at intervals, air being admitted at other times; weak acid is sprayed upon the ore in the furnace, and the metals are removed as sulphates in acid solution. Means are provided for grinding the ore during its passage from one hearth to another of the multiple-bedded roasting furnace used.—O. F. H.

[Ore] Briquet and process of making the same. J. S. Robeson, Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 841,718, Jan. 22, 1907.

The ore, *e.g.*, iron ore, is mixed with a binding agent composed of sulphite liquor (concentrated, if necessary) and wood tar, then formed by pressure into the desired shapes or masses, and heated to a degree sufficient to expel a portion of the sulphur present in the binding agent.—A. S.

Ores; Process of treating ——. J. H. Ryan, Portland, Oreg. U.S. Pat. 841,721, Jan. 22, 1907.

Sulphide ores containing nickel or cobalt are finely-ground, mixed with sodium chloride, and roasted in stages at successively higher temperatures, being kept in agitation throughout the process. The "roaster gases" are "converted into a solvent solution," into which the hot roasted ore is introduced.—A. S.

Gold and gold-silver ores; Process of treating ——. J. A. Just, Assignor to The Just Mining and Extraction Co., Syracuse, N.Y. U.S. Pat. 841,983, Jan. 22, 1907.

The base metals and silver are removed by treatment with sulphuric acid and a suitable chloride in the presence of an "oxygen" salt. The residue is cyanided for the extraction of the gold, after washing first with water to remove free acid and then with an alkaline solution.
—O. F. H.

[Nickel] Ores; Method of treating ——. C. A. Diehl and W. Koehler, Cleveland, Ohio. U.S. Pat. 842,139, Jan. 22, 1907.

The ore is first completely chlorinated and then heated in presence of water vapour to a temperature sufficient to decompose some of the chlorides, leaving the others, such as nickel chloride, unchanged.—O. F. H.

Alloy; Magnetic ——. R. A. Hadfield, Sheffield. U.S. Pat. 842,403, Jan. 29, 1907.

The claim is for an iron-silicon-manganese-aluminium alloy containing silicon 2—4·5 per cent., manganese not exceeding 0·7 per cent., and aluminium not exceeding 1·3 per cent.—O. F. H.

Blast-furnace. H. W. Hixon, Victoria Mines, Ontario. U.S. Pat. 842,663, Jan. 29, 1907.

The furnace has a rectangular lining of refractory material surrounded by an air jacket having its outer wall curved outwardly and divided by vertical partitions into a number of parallel passages. The air supply for the furnace is admitted to the top of the passages in the air jacket, the tuyères being connected to the lower ends of the passages.
—O. F. H.

Blast-furnace gas; Process of enriching ——. C. Ellis. U.S. Pat. 843,079, Feb. 5, 1907. II., page 398.

Ore heating and drying device for furnaces. U. Wedge, Ardmore, Pa. U.S. Pat. 842,736, Jan. 29, 1907.

The apparatus consists of a drying chamber on the top of a roasting furnace having a metallic roof, the drying chamber being provided with a central rotating shaft with an arm carrying stirring blades, which direct the dried ore towards the feed opening near the centre of the roof of the furnace. The feed opening is provided with a valve, which is automatically opened and closed by the rotating arm.—O. F. H.

Furnace; Roasting ——. F. Klepetko, New York, N.Y. U.S. Pat. 843,825, Feb. 12, 1907.

The furnace is of the multiple-bedded type, with a vertical rotating shaft carrying stirring arms, and provided with means for the water-cooling of both shaft and arms.
—O. F. H.

Steel; Manufacture of ——. J. de Maya, Assignor to La Soc. de Moya et Cie., Paris. U.S. Pat. 842,802, Jan. 29, 1907.

See Fr. Pat. 349,233 of 1904; this J., 1905, 677.—T. F. B.

Cast iron; Manufacture of articles from ——. A. E. Outerbridge, jun., Philadelphia, Pa. U.S. Pat. 842,906, Feb. 5, 1907.

The grade of the iron is modified as required, by adding to the metal in the ladle, after tapping, a silicon compound relatively high in silicon.—O. F. H.

Semi-steel castings; Twin-cupola process of making ——. J. C. Davis, Chicago, Ill., Assignor to The American Brake Shoe and Foundry Co., New York. U.S. Pat. 843,197, Feb. 5, 1907.

Grey pig iron and "carbon steel" are melted in separate furnaces or cupolas, about 10 per cent. of white pig iron is added to the steel while melting, predetermined proportions of molten metal from each furnace are thoroughly mixed in the ladle, and finally poured directly into the moulds.—O. F. H.

Steel, iron, and other metals; Process of toughening or annealing ——. W. F. L. Frith, London. U.S. Pat. 843,563, Feb. 5, 1907.

See Eng. Pat. 23,939 of 1901; this J., 1903, 34.—T. F. B.

Iron and steel; Treatment of ——. H. Luckenbach, San Francisco, Cal., Assignor to W. H. Kelly, San Francisco, Cal., G. L. Robinson, F. E. Fishel, and J. J. Robinson, New York, N.Y., and F. F. Nolte. U.S. Pat. 843,569, Feb. 5, 1907.

The claim is for a process of purifying iron by passing dry superheated steam into the bottom of a vessel into which iron from a blast-furnace is tapped, and continuing the injection of superheated steam after the vessel is filled.—O. F. H.

Steel ; Process of manufacturing ——. B. E. Eldred, Assignor to Combustion Utilities Company, New York. U.S. Pat. 843,592, Feb. 12, 1907.

The process consists in controlling the temperature in a Bessemer blow by introducing into the air supply a regulated quantity of an endothermic gas, such as carbon dioxide or furnace gases.—O. F. H.

Zinc from zinc ores ; Furnace for obtaining ——. A. Desgraz and P. Schmidt, Hanover, Germany. U.S. Pat. 843,872, Feb. 12, 1907.

See Fr. Pat. 367,368 of 1906 ; this J., 1906, 1155.—T. F. B.

Sulphide ores ; Process for the treatment of ——. H. Baker and A. T. Smith, Western Point. U.S. Pat. 843,986, Feb. 12, 1907.

See Eng. Pat. 22,235 of 1905 ; this J., 1906, 1153.—T. F. B.

Ores ; Treatment of —— preparatory to smelting same. F. Heberlein, London. U.S. Pat. 844,355, Feb. 19, 1907.

See Fr. Pat. 367,394 of 1906 ; this J., 1906, 1155.—T. F. B.

Metals from sulphides ; Process of obtaining ——. T. J. Heskett, Brunswick, Vic. U.S. Pat. 844,452, Feb. 19, 1907.

See Eng. Pat. 26,980 of 1905 ; this J., 1906, 1049.—T. F. B.

Metals ; Separation of —— from their ores. R. E. Saunders, London. U.S. Pat. 844,620, Feb. 19, 1907.

See Eng. Pat. 21,839 of 1905 ; this J., 1906, 320.—T. F. B.

Projectiles ; Manufacture of armour-piercing ——. R. A. Hadfield, Sheffield. U.S. Pat. 844,675, Feb. 19, 1907.

See Eng Pat. 15,219 of 1904 ; this J., 1905, 676.—T. F. B.

Copper ; Process of hardening ——. R. T. Anderson, Assignor to E. J. Anderson, Parkersburg, W. Va. U.S. Pat. 845,606, Feb. 26, 1907.

The process consists in placing the copper between but out of contact with bodies of zinc, and heating the whole to a temperature sufficient to cause volatilisation of the zinc and combination between the copper and the zinc vapour.—A. S.

Cinnabar ore ; Furnace for reducing ——. C. F. Burgess, Yreka, Cal. U.S. Pat. 845,690, Feb. 26, 1907.

The apparatus consists essentially of an inclined shoot, constructed of or lined with non-heat-conducting material, and extending from a heating furnace below up to the discharge opening of an automatic feeding hopper. A series of leaves or shelves, mounted on trunnions, is arranged in the shoot, the uppermost shelf being connected by levers with trap-doors, which close the discharge opening of the hopper. When the top shelf is in a horizontal position, the trap-doors are opened, and ore falls from the hopper on to the shelf. By suitable gearing the shelves are given an intermittent tilting motion in such manner that whilst alternate shelves are horizontal the others are vertical, and in this manner the ore is discharged from shelf to shelf through the shoot, meeting on its way the hot gases from the heating furnace below. The fumes, &c., from the ore are led off to condensers through a suction pipe at the upper end of the shoot.
—A. S.

French Patents.

Metal [alloy] containing aluminium. A. Chambaud. Fr. Pat. 371,525, Jan. 25, 1906.

See Eng. Pat. 9750 of 1906 ; this J., 1906, 1153.—T. F. B.

Ores ; Apparatus for agglomerating fine ——. J. C. Bergquist. Fr. Pat. 371,648, Oct. 26, 1906.

The apparatus consists of a furnace composed of two inclined revolving cylinders, the lower end of one and, at a lower level, the upper end of the other projecting into a rectangular chamber. The lower cylinder is provided with a series of scrapers attached to an endless chain, which, after travelling downwards through the cylinder, are cooled on their return by passing through a trough of water. The upper cylinder serves as a preliminary heating chamber, whilst the temperature of the lower cylinder is sufficient to just fuse the ore, the scrapers serving to break up and detach the clotted ore from the inside of the cylinder.—O. F. H.

Cast-iron ; Flux for treating ——. J. Davies. Fr. Pat. 371,581, Nov. 17, 1906. Under Int. Conv., Nov. 18, 1905.

See Eng. Pat. 23,783 of 1905 ; this J., 1906, 1153.—T. F. B.

Blast-furnace slag ; Process for the utilisation of ——. G. L. Lamort. Fr. Pat. 371,610, Nov. 19, 1906. IX., page 411.

Alloys ; Process for the manufacture of metallic ——. W. Rübel. Fr. Pat. 371,695, Nov. 21, 1906.

The alloy is made by adding about 2 per cent. of vanadium in the form of ferro-vanadium to a fused mixture of 50 to 60 per cent. of copper and 40 to 50 per cent. of zinc. About 0·2 per cent. of aluminium may be added to the fused alloy in order to raise its temperature sufficiently to allow of the complete diffusion of the vanadium.
—O. F. H.

Ores ; Process and apparatus for washing ——. W. Sauerbrey. Fr. Pat. 371,751, Nov. 23, 1906. Under Int. Conv., Jan. 9, 1906.

The ore is placed in a number of shallow rectangular boxes with perforated bottoms, which are suspended from the circumference of a wheel, which dips into a tank of water. The revolution of the wheel carries the boxes one after the other through the water, which, entering by the perforated bottom, washes out the lighter gangue over the sides of the boxes.—O. F. H.

Carbon steels ; Process for tempering ——. S. N. Brayshaw. Fr. Pat. 371,851, Nov. 28, 1906. Under Int. Conv., Dec. 2, 1905.

See Eng. Pat. 25,004 of 1905 ; this J., 1907, 21.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 328.)

(*A.*)—ELECTRO-CHEMISTRY.

Ozone, nitric oxide, and hydrogen peroxide ; Thermic relations of production of ——. F. Fischer and H. Marx. Ber., 1907, **40**, 1111—1119. (See also this J., 1907, 200.)

1. The formation of ozone by a glowing Nernst filament in liquid oxygen has been further investigated. The concentration of the resulting ozone solution continued to increase, though at a diminishing rate, as long as the experiment was continued. The highest concentration reached was 3·91 per cent. of ozone. 2. When highly ozonised air is blown across a Nernst filament, the ozone-concentration is lowered. In these experiments, only a small proportion of the ozonised air comes into actual contact with the filament, and is raised to the highest temperature. 3. Nothing is decided from these experiments as to the oxygen-ozone equilibrium below 2000° C. ; but the ozone-concentration actually reached in the experiments is certainly always lower than that corresponding to equilibrium.—J. T. D.

Ammonia ; Influence of pressure on the synthesis of —— in the electric spark. E. Briner and E. Mettler. Compt. rend., 1907, **144**, 694—697.

When a mixture of three volumes of hydrogen and one volume of nitrogen is submitted to the action of the spark in a closed vessel at ordinary temperatures, about 3 to 4 per cent. of ammonia by volume are produced. If the vessel be plunged in liquid air, the whole of the gas can be transformed into ammonia, since the product is removed from the destructive action of the spark. In studying the effect of pressure between 20 and 800 mm. of mercury, the authors find a well-marked maximum at 100 mm., the yield attaining 0·17 grm. of ammonia per kilowatt-hour. The power was measured on the primary of the induction coil by a watt-meter, and since the nature of the discharge varies with the pressure, the actual energy consumption may differ considerably with the pressure, but has not been taken into account.—R. S. H.

Electrolysis of molten sodium nitrate. C. Couchet and G. Némirowsky. Z. Elektrochem., 1907, **13**, 115—117.

NITRITE and sodium oxide are produced when molten sodium nitrate is subjected to electrolysis with alternating or continuous current. The best yields of nitrite are obtained with graphite electrodes. With increase of temperature and current density, the reduction is favoured. In the presence of free alkali, and assisted by the reducing action of the fine graphite powder which is detached from the electrodes, yields of nitrite, corresponding to 110 per cent. of the calculated current efficiency, can be obtained. —R. S. H.

ENGLISH PATENTS.

Electrodes for arc lamps. The British Thomson-Houston Co. From General Electric Co. Eng. Pat. 6088, March 13, 1906. II., page 398.

Electrolytic apparatus. G. J. Atkins, Tottenham. Eng. Pat. 9706, April 25, 1906.

CLAIM is made for the use of a porous diaphragm between the fixed and rotating electrodes of a trough-shaped electrolytic apparatus of more or less completely circular cross-section, such as described in Eng. Pat. 11,470 of 1904 (this J., 1905, 446).—O. F. H.

Electric transformer furnaces. A. R. Lindblad and O. Stalhane, Ludvika, Sweden. Eng. Pat. 23,379, Oct. 22, 1906. Under Int. Conv., May 8, 1906.

SEE Fr. Pat. 370,583 of 1906; this J., 1907, 261.—T. F. B.

UNITED STATES PATENTS.

Cell; Electrolytic ——. G. O. Seward and F. von Kügelgen Holcombs Rock, Va. U.S. Pat. 842,256, Jan. 29, 1907.

BETWEEN a central and an outer annular electrode is placed a tubular, non-conductive partition, the latter comprising a number of "water-cooled curtains," insulated from one another, the space between them being filled with a chilled and solidified layer of the electrolyte.—B. N.

Luminant for electric lamps; Manufacture of ——. J A. Heany. U.S. Pat. 842,546, Jan. 29, 1907. II., page 399.

Luminant in electric incandescence lamps. F. M. F. Cazin. U.S. Pat. 844,778, Feb. 19, 1907. II., page 399.

Insulating lacquer and material [from stearine pitch], P. Boërche, London, England. U.S. Pat. 842,615. Jan. 29, 1907.

STEARINE-PITCH is converted into an insoluble and infusible insulating material by heating it to a temperature between 220° and 285° C. If desired, any article can be coated with an insulating lacquer by first coating it with a thin layer of either melted stearine-pitch or with a solution of the same, and then exposing the coated article to a temperature somewhat above 220° C.—W. H. C.

Plate; Storage-battery —— *[Electrode].* W. Morrison, Assignor to Exmoor Storage Battery Co., Chicago, Ill. U.S. Pat. 842,801, Jan. 29, 1907.

THIS invention relates to a storage-battery support or grid, consisting of an alloy containing lead, antimony, and phosphor-tin.—B. N.

Carbon electrode. T. P. Sharts, Readsboro', Vt., Assignor to C. J. Howe, Jamaica, Vt., and W. C. Davis and J. H. Cole, Readsboro', Vt. U.S. Pat. 845,585, Feb. 26, 1907.

A HARD carbon electrode is formed by burning atomised hydrocarbon oils or petroleum in a confined space. The carbonaceous products are collected in a mass and moved to different positions for "thickening" the material in successive homogeneous layers.—A. T. L.

Disintegrating amorphous bodies; Method of —— E. G. Acheson, Stamford, Ontario. U.S. Pat. 843,426, Feb. 5, 1907.

THE process described of disintegrating and "deflocculating" amorphous bodies, consists in mixing them with a solution, which has effects upon them similar to those produced by tannin. The mass is then ground, and the "deflocculated" particles are separated by decantation, and the suspended particles are subjected to treatment by a "flocculating" material, *viz.*, a solution of alum. The "deflocculated" particles separated are dried and moulded into articles, which are subjected to the action of heat. —W. C. H.

Graphite; Deflocculated ——, *and process of deflocculation thereof.* E. G. Acheson, Stamford, Ontario. U.S. Pat. 844,989, Feb. 17, 1907.

THE process described consists in "deflocculating" graphite, thereby rendering it miscible with water, oil, &c., by treating graphite with a deflocculating agent, such as gallotannic acid, the effects of which are similar to those produced by tannin. The article thus obtained is claimed as a new product. (See also preceding abstract.)—W.C.H.

Carbide; Process of utilising marl, making ——. H. L. Hartenstein, Constantine, Mich. U.S. Pat. 844,018, Feb. 12, 1907.

THE marl is mixed with coke or other carbonaceous material, and the mixture fused or melted by means of an electric current. The marl may be dried and disintegrated, or calcined, and may also be mixed with limestone prior to its mixture with the carbonaceous material. The calcined marl may be passed, whilst hot, into a mixing chamber containing heated carbonaceous material, and a "superheating compound" may also be added, and the product passed directly into an electric furnace.—W. C. H.

Electrolytes; Apparatus for regenerating ——. L. H. Baekeland, Yonkers, N.Y., Assignor to Development and Funding Co., New York. U.S. Pat. 844,314, Feb. 19, 1907.

A CLOSED regenerating tank, provided with a sealed overflow, contains a body of salt supported above the bottom. Spent brine is led in and distributed above the body of salt, through a sealed inlet, provided with a gas escape. A brine-supply tank at a higher level is connected with the regenerating tank in a closed circuit containing a pump, and the electrolyte is circulated through the two tanks, passing transversely beneath the body of salt.—A. T. L.

FRENCH PATENTS.

Electric incandescence lamps. The Westinghouse Metal Filament Lamp Co. Fr. Pat. 371,557, Nov. 17, 1906. II., page 401.

Incandescence electric lamps; Leading-in wires for ——. S. O. Cowper-Coles. Fr. Pat. 371,613, Nov. 19, 1906. II., page 401.

Gaseous endothermic reactions; Mode of obtaining ——, *by the aid of voltaic arcs produced in oxygen between fused metallic oxides.* Salpetersäure Ind.-Ges.m.b.H. Fr. Pat. 371,883, Aug. 8, 1906.

LUMINOUS or flame arcs are produced in oxygen gas between melted metallic oxides, the latter being produced and maintained in a state of fusion, by the arc itself, on suitable metallic electrodes.—B. N.

Electrolyser for the decomposition of alkali chlorides, with recovery of hydrogen. L. Bridelance. Fr. Pat. 371,852, Nov. 29, 1906.

Carbon rods, forming the anode, are lodged in a framework of cement, or other suitable material not attacked by chlorine or by the solutions used, the frame carrying a vertical partition which divides the anode compartment into two portions. The partition is provided with openings at the top and bottom, the anode liquid entering at one side of the anode compartment, flowing to the bottom of the first division, and rising to the top of the second division before making its exit. The upper opening provides for the passage of gas from one division of the anode compartment to the other. The cathode consists of a cast-iron armature, in which is lodged a perforated sheet-iron plate, a cathode being bound on each side of the anode frame with intervening diaphragms of cement, asbestos, or other suitable material. In the upper portion of the cathode is a special arrangement for recovering the hydrogen liberated during the electrolysis. Several elements, each formed in the above manner, are placed in the same electrolytic bath, the latter thus forming a common cathode compartment, and any of the elements may be dismounted without arresting the flow of the current.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Steel directly from iron ores; Some laboratory experiments in making —— with the electric furnace. J. W. Evans. J. Canadian Mining Inst., 1906, **9**, 128—142.

A brief account of laboratory experiments is given. The most satisfactory results were obtained with a furnace of the reflected arc type as devised by Moissan. In treating ores high in titanium, the amount of titanium in the steel produced can be regulated by varying the proportion of lime used as flux. In the author's opinion, the direct electrical production of the finer grades of steel would prove an advantageous means of treating the large deposits of titaniferous and sulphurous iron ores and magnetic iron sands in Ontario and Quebec, Canada.—A. S.

Cyanide solutions; Electrolytic precipitation of ——. C. P. Richmond. Eng. and Mining J., 1907, **83**, 512—515.

By the cyanide treatment, after roasting, of the complex sulphide ore from the San Sebastian mine, near Santa Rosa, Salvador, an extraction of 95 per cent. of the gold was attained. The chief difficulty encountered was the co-precipitation of copper along with the gold. The following method proved satisfactory, both the gold and the copper being obtained in forms suitable for sale. The gold and copper are precipitated electrolytically, using peroxidised anodes of rolled lead, $\frac{1}{8}$ in. thick, 22 in. wide, and 4 ft. long, and cathodes consisting of lead plates, $\frac{1}{16}$ in. thick. The electrolytic vat is 30 ft. long, 10 ft. wide, and 4 ft. 8 in. deep, with an inclination of 1 in. from head to foot. It is divided by weir partitions into 12 compartments, in 10 of which precipitation is effected, whilst in the last two the solution is allowed to settle, preparatory to passing it through zinc precipitation boxes. Each compartment contains 25 anodes and 24 cathodes. The different compartments are connected in series, and the current-strength works out at 1 ampère per sq. ft. of anode surface, with a resistance of 4—4·5 volts for each compartment. The solution passes through the electrolytic vat at the rate of 150 tons per 24 hours. After 20—30 days, the cathodes, with a dense adherent deposit of copper and gold, are removed, and used as anodes in an electrolyte, consisting of 2—3 per cent. sulphuric acid, contained in a box divided into four compartments, each holding five anodes and six lead cathodes. The compartments are connected in series, and a current equivalent to about 5 ampères per sq. ft. of anode surface is employed, the average resistance of the box being 8 volts. The copper dissolves, and is re-precipitated at the cathode, where it falls to the bottom. The gold settles to the bottom at the anode. The gold slime is dried, and smelted in graphite pots. The average life of the anodes in the first electrolytic tank is from 8 to 12 months. When disintegrated, they are smelted in a small cupola furnace, and the resulting metal used for making fresh anodes.—A. S.

Acetate copper [*"Allotropic" copper*]. C. Benedicks., Metallurgie, 1907, **4**, 5—17, 33—44. Science Abstracts, 1907, **10A**, 170.

A series of experiments is described which proves that the peculiar properties of the metal obtained by electrolysis of copper acetate, ascribed by P. Schützenberger (Compt. rend., 1878, **86**, 1265) to an allotropic modification of copper, are due to the presence of acetic acid in solid solution in the copper, from 0·62 to 1·72 per cent. being observed. The following are the reasons for the view that the acetic acid is held in solid solution, and not merely mechanically mixed. The microscope shows no inclosures in freshly polished specimens, although, later, oxidation commences at various centres. The specific volume increases by 0·0080 c.c., at most, per 0·5 per cent. of carbon (1·25 $C_2H_4O_2$). If this were only mechanically mixed it would cause an increase of 0·0106 c.c.—the difference being beyond the order of errors. The very high electrical resistance, considerable hardness, properties under stress, and reaction with nitric acid, also indicate that the acetic acid is in solid solution. Further, if acetic acid were only held mechanically, it would be expected that high velocity of rotation of cathode, which undoubtedly gives denser metal, would also result in low acetic acid content—whereas the opposite is the case. Low temperature of electrolyte appears to favour a high acetic acid content. Higher temperatures, and higher velocities of rotation of cathode, increase the susceptibility of the deposited metal to oxidation in the air.

Alloys rich in chromium; Electrochemical analysis of ——. G. Gallo. Accad. Lincei, Atti, 1907, **16**, 58—67. Science Abstracts, 1907, **10A**, 181.

Ferrochromes and other alloys of iron containing a high proportion of chromium are readily dissolved, prior to analysis, by electrolysing a 15 per cent. solution of potassium chloride, rendered slightly alkaline with potassium hydroxide, using the alloy under examination as anode and a platinum wire cathode. With a current of 0·5 ampère at a P.D. of 8—10 volts, 1 grm. of metal is dissolved in four hours, the chromium being oxidised to chromate, which remains in solution, whilst the iron, and any nickel and manganese, are precipitated as hydroxides.

English Patent.

Electric furnaces for metallurgical purposes; Means for obtaining thin liquid dross in ——. H. Röchling and W. Rodenhauser, Völklingen, Germany. Eng. Pat. 17,615, Aug. 4, 1906.

See Fr. Pat. 368,631 of 1906; this J., 1907, 55.—T. F. B.

United States Patents.

Electrolytic apparatus; J. H. Ryan, Portland, Oreg. U.S. Pat. 841,720, Jan. 22, 1907.

The claims relate to an electrolytic apparatus in which the solution from a leaching tank is caused to flow continuously, by a tortuous path, through an electrolytic depositing tank. The depositing tank is divided by partitions into a number of independent compartments, communicating with each other, and provided with separate outlets, through which the spent solution can pass to a sump tank. Anodes and cathodes are disposed in the several compartments and are connected electrically in multiple. The electrodes are so placed that the space between them is less the further they are from the inlet end of the depositing tank, and means are provided by which they can be simultaneously adjusted.—A. S.

Alkali metals; Production of ——. G. O. Seward and F. von Kügelgen, Holcombs Rock, Va. U.S. Pat. 841,724, Jan. 22, 1907.

The process consists in electrolysing a fused mixture of an alkali chloride (sodium chloride), an alkali fluoride (sodium fluoride), and an alkaline-earth chloride.—A. S.

Metals; Process for the electrolytic refining of ——. A. Schwarz, New York. U.S. Pat. 842,254, Jan. 29, 1907.

THE concentrates of the ore are compressed into solid masses or cakes, which are then supported in a framework of an insoluble conductive material, and afterwards subjected, as anodes, to the action of the electric current in an electrolytic bath.—B. N.

Ores; Process of concentrating ——. A. Schwarz, New York, Assignor to Schwarz Ore Treating Co., Phœnix, Ariz. U.S. Pat. 842,255, Jan. 29, 1907.

THE pulverised ore is mixed with a fused mixture of a non-resinous hydrocarbon, solid at ordinary temperatures, such as paraffin and rosin-oil. On treatment with water, the metallic constituents of the ore adhere to the resinous matter, and the mixture, with its "entrapped values," is separated from the tailings, and finally the "values" are recovered.—B. N.

Reducing compounds; Process of —— [electrically]. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 842,273, Jan. 29, 1907.

THIS invention relates to a method of reducing silicon compounds, for the formation of silicides, such as those of manganese, or manganese and iron. The silicon compounds, together with manganese ore or ferromanganese and a reducing agent and flux, are fused so as to form a bath which is employed as a resisting conductor between the electrodes of an electric furnace, and the compound is reduced by passing sufficient current through the bath to form the silicide without substantial volatilisation.—B. N.

Electroplating apparatus. H. R. Boissier, Great Neck, N.Y. U.S. Pat. 843,321, Feb. 5, 1907.

THE apparatus comprises a tank, into which extends an inclined shaft or support, the "squared" lower end of the latter resting in a polygonal step-bearing on the bottom of the tank. The upper end of the inclined shaft is connected eccentrically by means of an extensible horizontal arm with a vertical shaft, the lower end of the latter being connected with an eccentrically journaled electrode. When the vertical shaft is rotated, the inclined shaft moves in a conical path. Immediately below the electrode, and connected to the inclined shaft, is a receptacle adapted to contain the articles to be plated. Conducting pins or rods, radiating from and rigidly secured to the inclined shaft within the receptacle, serve to conduct the current to the articles, the receptacle being also provided on its base with toothed strips. Guide members are connected with the receptacle, and are adapted to engage a stationary part of the tank, so as to cause the direction in which the receptacle is inclined to change, according as the guide members engage different surfaces of the tank.—B. N.

FRENCH PATENTS.

Copper; Metallurgical and electro-metallurgical process for obtaining pure ——. L. Jumau. First Addition, dated Oct. 27, 1906, to Fr. Pat. 367,452, June 26, 1906 (this J., 1906, 1155).

THE present addition relates to the gradual introduction into the closed vessel (referred to in Fr. Pat. 367,452, this J., *loc. cit.*) of the theoretical quantity of sulphurous acid under pressure to the solution of the copper salt, in order that the temperature may be raised without at the same time greatly augmenting the pressure in the closed vessel. The yield and purity of the copper are thus increased. By the use of sulphites, such as neutral or acid sulphites of ammonium, a greater yield may be obtained than with sulphurous acid. Gaseous reducing agents, such as carbon monoxide, also sulphur, carbon, and wood, are mentioned as being advantageous for the production of copper by this process, in cases where the ores to be treated do not contain sulphur.—B. N.

Metals and metalloids; Process for the extraction of —— from ores or compounds containing them. H. Herrenschmidt. First Addition, dated Oct. 30, 1906, to Fr. Pat. 369,878, Sept. 18, 1906 (this J., 1907, 208).

ACCORDING to the main patent, aluminium-boron is prepared by first heating, in an electric furnace, bauxite or the like with boric acid or a borate and sufficient carbon to reduce the boric acid and the oxide of iron present in the bauxite, and then, after separating the iron or ferro-boron, heating the remaining artificial corundum with boric acid or a borate and a further quantity of carbon to obtain aluminium-boron. According to the present addition, when it is not required to obtain artificial corundum nor to obtain the aluminium-boron in a pure condition, the process is carried out in one stage, sufficient carbon being employed to combine with the whole of the oxygen of the bauxite and the boric acid or borate.—A. S.

Metals and metalloids; Process for the extraction of —— from ores or compounds containing them. H. Herrenschmidt. Second Addition, dated Nov. 2, 1906, to Fr. Pat. 369,878, Sept. 18, 1906.

ACCORDING to this additional patent, the carbon of the electrodes of the furnace is utilised for the reduction of the mixture of ore and boric acid or a borate in the preparation of metals and metalloids by the process described in the main patent. (See also preceding abstract.)—A. S.

Metals and alloys, particularly aluminium, silicon, magnesium, chromium, &c.; Process and apparatus for obtaining —— by reduction of their oxides or compounds. E. Viel. First Addition, dated Oct. 31, 1906, to Fr. Pat. 359,042 of Oct. 31, 1905 (this J., 1906, 323).

THE internal carbon lining of the furnace may form one electrode, the other being a movable cylindrical carbon rod, and the bed of the furnace may be inclined to a side outlet, or it may be cup-shaped with a central outlet. The furnace may also be rectangular with two inclined rectangular carbon electrodes which pass through holes in the side of the furnace lined with refractory non-conducting material. In using the furnace for the preparation of aluminium, a flux such as aluminium fluoride is added, the metal being refined by the addition of iron or other metal which has a strong affinity for silicon, but does not readily combine with aluminium. Claim is also made for the use of an excess of carbon in order to produce a carbide of aluminium, which may be subsequently reduced to the metallic state.—O. F. H.

Ores; Treatment of —— by electrolysis. N. H. M. Dekker, First Addition, dated Nov. 14, 1906, to Fr. Pat. 367,495, June 28, 1906 (this J., 1906, 1157).

IN the main patent the material to be treated was contained in baskets. The object of the present addition is to abolish these baskets, and also provide a means of recovering the elements liberated in combination with hydrogen. The anodes and cathodes are disposed horizontally and alternately in the electrolytic bath, the electrode, supporting the material to be treated, being encased in a frame forming the sides of a shallow tray. Insulating pieces, placed on the upper portion of the frame, support the metallic plate forming the second electrode. Several pairs of electrodes are in this way arranged in the bath, each pair being separated by a horizontal insulating plate. The bath is also provided with a cover and exit tube for leading off the disengaged gas, in order that the sulphur, arsenic, or antimony disengaged in combination with hydrogen may be recovered.—B. N.

Furnace; Electric induction ——. The Gröndal Kjellin Co., Ltd. Fr. Pat. 372,052, Dec. 3, 1906. Under Int. Conv., July 18, 1906.

SEE Eng. Pat. 16,269 of 1906; this J., 1907, 327.—T. F. B.

Ores; Magnetic separator for ——. The Edison Ore Milling Syndicate, Ltd. Fr. Pat. 372,058, Dec. 3, 1906. Under Int. Conv., Dec. 11, 1905.

THE separator consists of a drum of non-magnetic material and an electro-magnet, one pole of which is placed on the exterior and the other in the interior of the drum. The poles are curved to fit the drum, and the cross-section of each is gradually reduced towards its extremity. The powdered ore is fed on to the rapidly revolving drum close to the extremity of the external pole, the non-magnetic particles being thrown off almost at once, whilst the magnetic particles adhere to the drum until they pass out of the magnetic field.—O. F. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 329.)

Wax from the palm tree, Raphia Ruffia, of Madagascar. A. Haller. Compt. rend., 1907, **144**, 594—598.

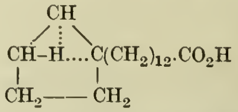
The wax obtained from the leaves of this tree is of a light chestnut colour. It is nearly insoluble in most organic solvents in the cold, but dissolves more or less completely on heating. Boiling benzene dissolves it without residue. The author's attempts to remove the colour by treating the solution of the wax in benzene with animal charcoal were unsuccessful. Hot absolute alcohol dissolves about 90 per cent. of the wax, leaving a dark brown residue melting at about 77° C. The solution forms a white gelatinous mass on cooling, and the soluble product when dried is a friable white powder, which, however, becomes dark brown again when melted, and has the same melting point (88° C.) as the crude wax. The latter distilled under a pressure of 10 mm., yields a light rose-coloured product which passes over at about 280° to 300° C., whilst a black residue with a tarry odour remains behind. The distillate has the same melting point as the fraction soluble in alcohol, but differs in its colour. Analysis of the crude wax, of the distillate, and of the fraction soluble in alcohol, gave results corresponding with the formula, $C_{20}H_{42}O$. It is pointed out that similar waxes have been found by Etard in the leaves of various plants, notably oats, barley, wheat, and lucerne, and that to these, too, the formula $C_{20}H_{42}O$ has been assigned. There is a difference, however, in the melting points, Etard's *lucernol* or *medicagol* melting at 76° C., so that possibly the wax from *Raphia Ruffia* consists of a mixture of the two compounds. The author shows that his wax is an alcohol resembling arachidic alcohol ($C_{20}H_{42}O$) in its properties, though not identical therewith, since the latter melts at 71° C., and its mixture with the *Raphia* wax at 74° C.—C. A. M.

Chaulmoogric and hydnocarpic acids ; Constitution of ——. M. Barrowcliff and F. B. Power. Chem. Soc. Proc., 1907, **23**, 70—71.

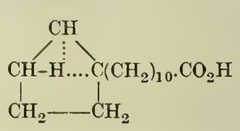
It was shown in the previous communication that chaulmoogric acid (this J., 1904, 669), although isomeric with linolic acid, absorbs but two atomic proportions of iodine or bromine, and must therefore contain in its structure both a closed ring and an ethylenic linking. By its oxidation in alkaline solution with limited quantities of potassium permanganate, it affords *a*-dihydroxydihydrochaulmoogric acid, $C_{18}H_{32}O_2(OH)_2$ (m. pt. 105° ; $[\alpha]_D = +11{\cdot}6°$), *β*-dihydroxydihydrochaulmoogric acid, $C_{18}H_{32}O_2(OH)_2$, (m. pt. 93° ; $[\alpha]_D = -14{\cdot}2°$), and ketohydroxydihydrochaulmoogric acid, $C_{18}H_{32}O_4$. Further oxidation gives on the one hand an optically inactive tricarboxylic acid, $C_{18}H_{32}O_6$ (m. pt. 68°), which is *n*-pentadecane *aa′γ*-tricarboxylic acid—

$$CO_2H.(CH_2)_2.CH.(CO_2H).(CH_2)_{12}.CO_2H,$$

and on the other hand, formic acid and a keto-acid, $CO_2H.(CH_2)_2.CO(CH_2)_{12}.CO_2H$. The latter compound, on oxidation, affords *n*-dodecanedicarboxylic acid, $(CH_2)_{12}.(CO_2H)_2$, and *n*-undecanedicarboxylic acid, $(CH_2)_{11}.(CO_2H)_2$. By the addition of hydrogen bromide to chaulmoogric acid and its subsequent elimination, an optically active mixture of acids is obtained, which, when oxidised, affords a keto-acid, $C_{18}H_{32}O_5$ (m. pt. 126°), to which the formula, $CO_2H.CH_2.CH(Me).CO.(CH_2)_{12}.CO_2H$, is ascribed. These results can be explained by considering that chaulmoogric acid exists in a state of tautomerism between the compounds, (*a*) 1-*a-carboxy-n-dodecyl-*Δ^4 cyclo*pentene*, and (*b*), 1-*a-carboxy-n-dodecyl-*1 : 4-bicyclo*pentane*. Its constitution may therefore be represented by the following formula, in which the hydrogen atom connected with the dotted lines is considered to be in a state of equilibrium between two adjacent carbon atoms :—



Since hydnocarpic acid (this J., 1905, 741), on oxidation, affords products which are perfectly analogous to those obtained from chaulmoogric acid, its constitution is represented by the formula :—



Mercuric acetate in glacial acetic acid solution ; Action of —— upon unsaturated fatty acids. A. Leys. XXIV., page 436.

English Patent.

Fish oil ; Process for the production of odourless ——. E. Böhm, Vienna. Eng. Pat. 7901, April 2, 1906.

The fish or blubber oil is heated in an open boiler to a temperature of about 150° C., until all the water has been evaporated, and is then further heated in a vacuum boiler to a temperature of from 350° to 400° C. for two or three hours, or until a sample, removed for the purpose, proves to be entirely free from odour. Instead of heating under reduced pressure, the operation may be carried out in an atmosphere of inert gas or of superheated steam.—W. P. S.

United States Patents.

Oil from oleaginous seeds ; Process of extracting ——. R. S. Woodward, jun., New York. U.S. Pat. 843,983, Feb. 12, 1907.

The seed meal is subjected to the action of a known quantity of superheated steam at a constant temperature and pressure, the amount of moisture thus introduced being varied according to the water content of the fresh meal.—W. P. S.

Cottonseed oil ; Apparatus for extracting ——. R. S. Woodward, jun., New York. U.S. Pat. 843,984, Feb. 12, 1907.

The apparatus consists of a battery of jacketed vessels, each jacket being connected separately to a steam-pipe, and the interior of each vessel with a second steam-pipe. Both steam-pipes are provided with graduated stop-valves adapted to admit known amounts of steam during definite periods, and also with reducing and safety valves, the latter being placed on the pipes connecting the steam-pipes with the vessels and jackets.—W. P. S.

Insulating lacquer and material [from stearine pitch]. P. Boërche. U.S. Pat. 842,615, Jan. 29, 1907. XIA., page 417.

Soap. L. H. Reuter, Assignor to Basic Chemical Co., both of New York. U.S. Pat. 842,010, Jan. 22, 1907.

To an alkaline soap there is added a quantity of a salt of zinc sufficient to neutralise the free alkalinity of the soap ; the liquid is then heated and converted into dry soap.—J. F. B.

French Patents.

Fatty acids ; Combination of slightly volatile compounds, containing alcoholic hydroxyl, with ——. E. Twitchell. Fr. Pat. 371,689, Nov. 20, 1906. XX., page 434.

Soaps; Process of bleaching ——. O. Geisel. Fr. Pat. 371,900, Oct. 24, 1906.

The boiling soap is treated little by little in the kettle with a fresh solution of sodium hypochlorite prepared by mixing chloride of lime and sodium carbonate, preferably in equal quantities, with water, and decanting the liquid from the insoluble calcium carbonate.—C. A. M.

Glycerins of every description, including spent soap lyes and distillery by-products (vinasses); Process and apparatus for the purification of crude ——. L. Rivière. First Addition, dated Nov. 3, 1906, to Fr. Pat. 367,752, July 4, 1906 (this J., 1906, 1161).

The hydrofluosilicic acid in the precipitated alkali fluosilicates may be recovered by treatment of these salts with lime, preferably partially carbonated, in an autoclave; or with hydroxides of barium, magnesium, &c.; or by the action of acids or alkali bisulphates. If phosphoric or sulphuric acids or bisulphates be used, the resulting phosphates or sulphates may be boiled with barium carbonate and water, either in an autoclave or under ordinary pressure, to convert them into potassium or sodium carbonates, which may be separated in a state of sufficient purity for commercial products. In treating distillery by-products, ammoniacal nitrogen may be removed by neutralising the substance with lime and heating the decanted vinasse in an autoclave with magnesia or barium hydroxide. The glycerin solution after removal of ammonia and alkali salts may be concentrated, and treated with a solvent such as alcohol, which also precipitates mineral and organic matters; the glycerol is recovered by distillation. Pure ethyl acetate may take the place of alcohol as a solvent, and the portion that remains in the aqueous layer may be recovered by distillation.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 330.)

(*A.*)—PIGMENTS, PAINTS.

English Patent.

White lead or similar products; Apparatus for making ——. H. C. Heide, London. From Union Lead and Oil Co., New York. Eng. Pat. 5015, March 1, 1906.

See Fr. Pat. 363,833 of 1906; this J., 1906, 857.—T. F. B.

United States Patents.

Pigment and process of making same. W. J. Armbruster, St. Louis, Mo. U.S. Pat. 841,303, Jan. 15, 1907.

Separate solutions of barium hydroxide and aluminium sulphate are mixed with a solution of a colouring matter suitable for forming a lake pigment, in the presence of reagents permitting the concurrent precipitation of aluminium hydroxide and barium sulphate and the formation of a lake.—C. S.

Lake [from azo dyestuff] and process of making same; Orange ——. R. Kirchhoff, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 842,560, Jan. 29, 1907.

See Eng. Pat. 27,496 of 1904; this J., 1904, 1243.—T. F. B.

Pigment colours; Yellow and orange ——. M. Becke, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 844,845, Feb. 19, 1907.

See Eng. Pat. 28,259 of 1904; this J., 1905, 1243.—T. F. B.

French Patents.

Lakes derived from monoazo dyestuffs; New series of ——, *and process for their manufacture.* Act.-Ges. f. Anilinfabr. First Addition, dated Jan. 19, 1906, to Fr. Pat. 361,647, July 26, 1905. IV., page 404.

Lithopone; Process of rendering —— *unalterable by light.* H. Allendorff. First Addition, dated Nov. 2, 1906, to Fr. Pat. 370,500 of 1906 (this J., 1907, 264).

Soaps of alkaline-earth metals or of aluminium may take the place of the oxides or hydroxides previously claimed. —C. A. M.

Water colours; Manufacture of ——. H. Schmincke and Co. Fr. Pat. 371,735, Nov. 22, 1906.

By the addition of salts obtained by the action of alkalis on albumin, the pigment in water colours may be kept more completely in suspension when mixed with water, so that it is only necessary to add just sufficient of the agglutinating substance to give the required consistency to the liquid. Thus good results are obtained by grinding together, *e.g.*, 1000 grms. of sienna earth with 100 grms. of gum arabic and 100 grms. of a 20 per cent. solution of the ammonium salt of protalbinic acid, whereas without this addition more than 500 grms. of gum arabic would be required.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Turpentine or abietic acid; New method for the determination of crude —— *in resins of different kinds, oil- or copal-varnishes, pitch, and paper.* H. Rebs. XXIII., page 436.

Oils and varnishes; Reduction of Italian import duty on certain ——. III., page 402.

United States Patents.

Turpentine from wood; Apparatus for extracting ——. G. R. Pride, Jacksonville, Fla. U.S. Pat. 840,955, Jan. 8, 1907.

The retort is fitted with a removable carrier and a cover, both of them making a steam-tight joint with the top of the retort. The carrier is fitted with a steam pipe, connecting with a steam inlet in the bottom of the retort, and carries at its upper end a number of radiating Γ-pipes, the downward limbs of which are perforated, for admitting steam into the upper part of the carrier. The steam escapes through perforations in the bottom of the carrier into the bottom of the retort, and is carried off through a discharge pipe.—C. S.

Amber varnish and process of making same. W. F. Weber, Washington, D.C. U.S. Pat. 840,812, Jan. 8, 1907.

Amber is mixed with a fatty oil, in the proportion of not more than 1½ pints of the latter to 1 lb. of the former. The mixture is heated in an open vessel to not less than 600° C., until a scum of softened amber collects on the surface, whereupon the temperature is raised to above 700° C. and the scum maintained in an unbroken condition until the amber is completely dissolved. After cooling, the mixture is treated with sufficient oil of turpentine to bring it to workable consistency, and is then reheated and stirred until admixture is complete. —C. S.

Varnishes, balsams, and resins; Manufacture of ——. A. Kronstein, Karlsruhe, Germany. U.S. Pat. 843,401, Feb. 5, 1907.

See Eng. Pat. 17,378 of 1900; this J., 1901, 1123.—T. F. B.

Printing ink, and process of making same. E. Klein, New York. U.S. Pat. 841,156, Jan. 15, 1907.

For the preparation of a base for printing ink, insoluble in water and alcohol, " a mixture of a fat, oil, and wax " is washed with a suitable liquid, *e.g.*, a salt solution, and then heated, with stirring, to about 400° C. The mass is next cooled, and again heated to a lower temperature than before, these operations being repeated in order " to eliminate glycerol and acrolein " and to convert the product into a viscous liquid, which is filtered and incorporated with a suitable colouring matter. In certain of the claims, the inclusion in the mixture of " a prepared incombustible substance, exemplified by metallic elements, which will retain its appearance under the influence of a heat of 400° C.," is mentioned.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Manihot Glaziovii ; India-rubber from ——. A. Zimmermann. Gummi-Zeit., 1907, 21, 637—643.

In German East Africa the Ceara rubber tree is the only one which is planted in any quantity, there being at least 1½ million trees in the colony. For economic reasons, the method, common elsewhere, of collecting the latex in liquid form is not adopted, but the cuts are brushed over with a coagulant, and the solidified latex is stripped and rolled into balls, which are then cut into slices and washed. As coagulant, any acid which is cheap enough is used ; the juices of wild oranges and of the fruit of *Adansonia digitata* give good results, and experiments are being made with a view to utilising the pulp of sisal leaves. For tapping, any kind of knife serves, provided that the blade be not too pronouncedly wedge-shaped ; instruments combining a number of blades have not hitherto proved of value. A long series of experiments is recorded, bearing on the location of the cuts. If a second cut be made within a short time close to (5 cm. or so) an existing one, the new cut will yield very much less latex ; but if it be made 24 hours later, it will yield as much as or more than the old one. The best total yields from a given tree are obtained, (1) by disposing series of small close cuts in successive narrow rings round the tree, or, still better, (2) by tapping large surfaces, *e.g.*, the whole trunk and the larger branches, for a prolonged period in intervals of a few days. Both these methods, however, entail excessive labour, and the system which at present obtains in the chief plantations consists in covering successive vertical strips of the tree, 20—30 cm. long and about 5 cm. wide, with small close cuts. The average cost of producing 1 kilo. of dry unwashed Lewa rubber is estimated at 0·8 rupee for labour, and 0·5 rupee for coagulant, altogether 1·30 rupees, or 1s. 5d.—W. A. C.

India-rubber ; Melting point of ——. R. Ditmar. Gummi-Zeit., 1907, 21, 670—671.

The temperature of liquefaction was determined on a number of washed rubbers, and was found to be, in general, lower, the greater the resin-content. There are exceptions, however ; thus, Kinsembo, with 4·78 per cent. of resin, melts at 170° C., whilst Congo, with 7·87 per cent., melts at 180°. It is pointed out that Para rubber vulcanises freely at a temperature (143° C.) well below that at which the raw rubber softens.—W. A. C.

India rubber resin. R. Ditmar. Gummi-Zeit, 1907, **21**' 669—670.

The clear resin extracted from Borneo rubber has a yellowish colour, and the general appearance of colophony. It contains no free acid, melts at 92°—95° C., and shows a saponification value of 28·1. No oxygen is taken up when air is bubbled through a boiling solution of the resin.
—W. A. C.

Albans from Ficus Vogelii. D. Spence. Ber., 1907, **40**, 999—1000.

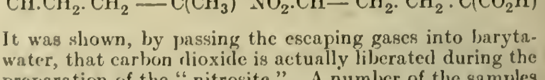
By repeated fractional crystallisation from absolute alcohol of the resin extracted by acetone from the rubber of *Ficus Vogelii*, two fractions were obtained, melting at 201°—205° C. and 154° C. respectively. The higher-melting substance, *a-alban*, crystallised in small irregular needles, easily soluble in benzene, chloroform, and ether, soluble with difficulty in cold alcohol or acetone. The second fraction, *β-alban*, m. pt. 154° C., formed pointed crystals, and resembled the first in properties. The two albans have the same empirical formula, $C_{16}H_{28}O$; the molecular weight of *a-alban*, as determined by depression of the freezing point of benzene, was found to be 438.—A. S

"*Caoutchouc substance*" *and resins from the latex of Ficus Holstii and of another Ficus ; Action of iodine and bromine on the* ——. F. Eduardoff. Gummi-Zeit., 1907, 21, 635—636.

In studying the question of the pre-existence or otherwise of rubber in rubber-latex (see this J., 1905, 35), the author has investigated the action of iodine and bromine on extracts of the latex of *Ficus Holstii* and of another *Ficus*, in which extracts, it is assumed, the contents of the globules of the latex are present in an unaltered condition. The extracts were obtained by shaking the latex with (1), ether free from alcohol, (2), ligroin (b. pt. 50°—60° C.), (3), benzine (b. pt. 80°—160° C.), and (4), chloroform, and were dried over anhydrous sodium sulphate. On submitting the dried extracts to the action of an excess of iodine, it was found that both resins and rubber, obtained after removal of the solvent and excess of iodine, were free from halogen, although the melting point of the resin, in the case of *Ficus Holstii*, was lowered from 210° to 60°. In the case of the other *Ficus*, no alteration in the melting point (60°) occurred. Bromine, on the other hand, was found to act readily upon the extracts when added in excess, a tetrabromide of the "rubber substance" being precipitated This product was found to agree with the corresponding derivatives of Congo-Loanda rubber and of Para rubber in all particulars except temperature of decomposition, which was 130°, that of the Para derivative being 150°. It is suggested that this may indicate a lower degree of polymerisation in the latex. The resin was affected in just the same way as by iodine. Experiments on the utilisation of the bromination process as a quantitative method for the estimation of rubber met with little success, the yield of tetrabromide from the ether, ligroin, or benzine extracts differing from the theoretical by about 9 per cent., that from the chloroform or carbon tetrachloride extracts by about 18 per cent.—E. W. L.

Caoutchouc ; Nitrosites of ——, *and their application in the analysis of raw rubber and rubber goods. II.* P. Alexander. Ber., 1907, **40**, 1070—1078.

The "nitrosites c" of a large number of samples of rubber, of widely different origin, were prepared by passing the gases evolved from a mixture of starch and nitric acid (sp. gr. 1·4) into a solution in carbon tetrachloride of the washed, acetone-extracted rubber, the product being isolated by decanting the carbon tetrachloride, dissolving the solid residue in acetone, filtering the solution, and evaporating to dryness. Analysis of the nitrosites gave the following results :—South American rubbers, mean of 18 estimations, carbon, 43·52 ; hydrogen, 5·41 ; nitrogen, 11·51 per cent. ; African rubbers, mean of 20 estimations, carbon, 44·98 ; hydrogen, 5·38 ; nitrogen, 11·65 ; Asiatic rubbers, mean of 4 estimations, carbon, 44·54 ; hydrogen, 5·29 ; nitrogen, 12·21 ; Guayule, mean of 2 estimations, carbon, 44·42 ; hydrogen, 5·07 ; nitrogen, 12·28 ; the mean of all the results being, carbon, 44·92 ; hydrogen, 5·37 ; nitrogen, 11·67. These figures are practically the same as the mean of all those hitherto obtained for Weber's "nitrosate," viz. : carbon, 45·01 ; hydrogen, 5·43 ; nitrogen, 12·01 (see this J., 1905, 203), and agree neither with the nitrosate formula, $C_{10}H_{16}N_2O_4$, nor with Harries' "nitrosite c" formula, $(C_{10}H_{15}N_3O_7)_2$, but with a composition represented by $C_9H_{12}N_2O_6$. The formation of a C_9 derivative of the above formula is explained on the assumption that two NO_2 groups enter the dimethyloctadiene molecule additively, and that the two methyl groups are simultaneously oxidised, one of them being entirely eliminated from the molecule as carbon dioxide, the product being 5·6-dinitrocyclooctene-1-carboxylic acid :—



$$\begin{array}{lcl} C(CH_3).CH_2.CH_2.CH & & NO_2.C(CO_2H).CH_2.CH_2.CH \\ \| \qquad\qquad\qquad\quad \| & \rightarrow & \quad\;\; | \qquad\qquad\qquad\qquad\quad /\!\!/ \\ CH.CH_2.CH_2 — C(CH_3) & & NO_2.CH — CH_2.CH_2.C(CO_2H) \end{array}$$

It was shown, by passing the escaping gases into baryta-water, that carbon dioxide is actually liberated during the preparation of the "nitrosite." A number of the samples of rubber were vulcanised, with 7·5 and 15 per cent. of sulphur, under similar conditions, the product completely freed from acetone-soluble products, a sulphur determination made, and the "nitrosite" prepared and analysed. It was thus shown that the whole of the sulphur of vulcanisation passes into the "nitrosite," but the weight of nitrosite, after deducting combined sulphur, was found to be considerably greater than that calculated from the rubber present. This is probably due to partial oxidation of the sulphur to SO and SO_2 groups. The close agreement between the properties and composition of the "nitrosites" from different rubbers would appear to justify the conclusion that the only difference between their fundamental hydrocarbons is one of degree of polymerisation.—E. W. L.

English Patents.

Elastic substance produced from the gums of certain sapotaceæ. M. M. Dessau, Merton. Eng. Pat. 9808, April 26, 1906.

See Fr. Pat. 367,472 of 1906 ; this J., 1906, 1161.—T. F. B.

Rubber ; Recovery of —— from rubber waste. W. A. Köneman, Chicago. Eng. Pat. 12,526, May 29, 1906.

See U.S. Pat. 823,054 of 1906 ; this J., 1906, 704.—T. F. B.

Vulcanite or indiarubber ; Manufacture of masses of the nature of ——. C. Claessen, Berlin. Eng. Pat. 21,493, Sept. 28, 1906.

See Fr. Pat. 369,797 of 1906 ; this J., 1907, 212.—T. F. B.

United States Patents.

Elastic substance similar to indiarubber, and its method of manufacture. L. Roland, Paris. U.S. Pat. 842,839, Jan. 29, 1907.

See Fr. Pat. 364,075 of 1906 ; this J., 1906, 895.—T. F. B.

Caoutchouc solutions ; Process for the production of aqueous ——, and the regeneration of rubber waste. P. Alexander, Charlottenburg, Germany. U.S. Pat. 844,077, Feb. 12, 1907.

The caoutchouc is dissolved in a suitable solvent, and the solution is treated with concentrated alkali solution. Water is then added, and the mixture heated by steam until the solvent has been distilled off. The resulting viscous caoutchouc mass is separated from the alkaline liquid and dissolved by stirring with hot water. In the case of rubber waste, a similar process is employed ; the solution of the caoutchouc mass in hot water is finally separated from insoluble impurities, and the caoutchouc precipitated by the addition of an acid.—W. P. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 332.)

Catechol-tannins in sumach ; Preliminary communication on the determination of ——. M. Nierenstein and T. A. Webster. Collegium, 1907, 116.

No quantitative method for the determination of catechol-tannins in sumach yet exists. The authors propose to use a solution of diazobenzene chloride, which forms precipitates with catechol but not with pyrogallol-tannins (see this J., 1906, 896, 912). The precipitate, after standing one night, is filtered, washed with water, acidified with hydrochloric acid, and a nitrogen estimation made by the Kjeldahl method. The method is stated to show promising results.—H. Br.

United States Patent.

Glue substitutes ; Process of making ——. A. Bernstein, Berlin. U.S. Pat. 845,681, Feb. 26, 1907.

See Fr. Pat. 370,940 of 1906 ; this J., 1907, 266.—T.F.B.

XV.—MANURES, &c.

(*Continued from page* 332.)

Ammonium salts and the constituents of the soil ; The interaction of ——. A. D. Hall and C. T. Gimingham. Chem. Soc. Proc., 1907, **23**, 61—62.

As it has been observed that an acid reaction develops in soil which has been repeatedly manured with ammonium salts, the authors have re-examined the action of ammonium salts on the chief constituents of soil. Solutions of various strengths, *N*/1 to *N*/100, of ammonium sulphate, chloride, or other salt were shaken for twenty-four hours with silica, clay, calcium carbonate, and humus respectively, and the composition of the resulting solution was determined. With silica, there is no action. With clay, a double decomposition takes place between the ammonium salt and zeolitic bodies in the clay, ammonium being withdrawn from solution and replaced by equivalent quantities of calcium, magnesium, and potassium. With varying strengths the reaction can be represented by the equation :

$$\frac{(\text{Ammonium withdrawn from solution})^2}{\text{Ammonium remaining in solution}} = \text{K},$$

as long as the clay is in excess. If the clay is not in excess, it can only take up a fixed amount of ammonium whatever the strength of the solution. No acid reaction is produced, and there is no adsorption of the salt as a whole. With calcium carbonate, the reaction does not proceed far, and the extent may be represented by an equation of similar form. With natural humus from various sources, the reaction is similar to that with clay ; other bases, chiefly calcium, are displaced by ammonium ; there is no development of acidity and no adsorption. The acid reaction observed in the field is thus not due to inorganic causes ; a biological origin has been found.

Calcium Cyanamide ; Formation of ——. F. Foerster and H. Jacoby. Z. Elektrochem., 1907, **13**, 101—107.

The fixation of nitrogen by calcium carbide, according to the process of Frank and Caro (this J., 1903, 809), with the formation of calcium cyanamide, has been studied; particular attention being paid to the influence upon the reaction of temperature and admixture of calcium chloride or fluoride. Below 1000° C., the absorption of nitrogen by finely powdered calcium carbide is limited and takes place very slowly, but between 1050° C. and 1100° C. the reaction readily occurs and proceeds rapidly, until the theoretical quantity of nitrogen required to form calcium cyanamide, CaN_2C, has been fixed. Admixture of calcium chloride, as first observed by Polzenius (Ger. Pat. 163,320), lowers the temperature of reaction to a very marked extent, a rapid absorption occurring from 700° C. upwards. The influence of the proportion of calcium chloride has been studied, it is found that the rate of absorption increases with the content of calcium chloride, up to 30 per cent., although the effect becomes less marked as the percentage increases. Admixture of calcium fluoride with the carbide is also advantageous, but the temperature of reaction is not brought quite so low as in the case of the chloride. Here an addition of 2 to 5 per cent. seems to be most favourable, since with an increase of percentage of the fluoride the quantity of nitrogen absorbed in a given time diminishes. In explanation of the effect of admixtures of salts the authors suggest that the removal of the film of cyanamide from the carbide may assist the reaction ; the softening and fusion of the mass may also increase its power of dissolving nitrogen. At 800° C., in two hours, mixtures of calcium carbide with 15 per cent. of calcium chloride reached a content of 17·6 per cent. of nitrogen, with the gas under a water pressure of 132 mm., and 19·9 per cent. with a pressure of 1840 mm., thus showing a slight favourable influence of pressure.—R. S. H.

Superphosphates; Determination of free acid in ——. J. van Dormael. Bull. Soc. Chim. Belg., 1907, **21**, 103—115.

THE following method of determining free phosphoric acid in superphosphates is both rapid and accurate. Five grms. of the material, dried for three hours in the water-oven, are digested for three hours at the ordinary temperature with 100 c.c. of ether in a stoppered flask, the mixture being shaken at intervals. Fifty c.c. of the filtered extract are evaporated to dryness, the residue is taken up with water, and the solution, filtered if necessary, is then titrated with $N/4$ sodium hydroxide solution, using methyl orange as indicator. The yellow colour appears as soon as all the phosphoric acid has been converted into mono-sodium phosphate.—F. SODN.

Bone-meal phosphoric acid; Influence of ammonium sulphate on the manurial value of ——. O. Böttcher. Landw. Vers.-Stat., 1907, **65**, 407—411. Chem. Zentr., 1907, **1**, 907.

EXPERIMENTS on oats with two "fermented blood bone-meals" and steamed bone-meal in comparison with superphosphate, showed that on a humous, sandy-loam soil, ammonium sulphate increased considerably the manurial value of bone-meal phosphoric acid, whereas sodium nitrate had no such effect. In the most favourable case the yield was more than doubled by addition of ammonium sulphate. In all cases, the fermented bone-meals gave no better results than the steamed bone-meal.—A. S.

Lime and magnesia; Influence of —— on phosphate manures. F. Westhausser and W. Zielstorff. Land. Vers.-Stat., 1907, **65**, 441—447. Chem. Zentr., 1907, **1**, 907.

IN pot experiments with a poor soil, the water-soluble phosphoric acid of superphosphate was rendered unavailable for mustard plants by small additions of calcium carbonate and magnesium carbonate. An addition of calcium sulphate, on the other hand, caused a slight increase of yield. A moderate addition of calcium or magnesium carbonate or of lime or magnesia had a favourable effect on the manurial value of Thomas-meal phosphoric acid, but larger additions acted injuriously. —A. S.

ENGLISH PATENTS.

Manures and such like; Apparatus for the manufacture of artificial ——. G. H. Allibon, Belfast. Eng. Pat. 11,215, May 14, 1906.

THE invention supersedes hand labour in connection with emptying the "dens" or boxes used in the manufacture of artificial manure, such as superphosphates, by mechanism, whereby injury and nuisance from escape of foul gases are avoided or lessened. A "den" of circular form has an opening at one side guarded by two sliding doors. Radial scrapers are connected to a hollow rotating shaft working on a screw. Means are provided for automatically reversing the action of the rotating mechanism. The sliding doors work in grooves radiating from the centre of the den in the floor and roof thereof, and when in place, with the den charged, form the radii of a circle, and meet at a point behind the central shaft. When the hot charge is set, and ready for removal, the doors are slid out, leaving a cut or cavity into which the action of the central shaft with its scrapers delivers the material, to be removed by a suitable conveyor.—E. S.

Superphosphate pits or chambers; Method and apparatus for emptying ——. A. G. Bloxam, London. From Anglo Continentale (vormals Ohlendorff'sche) Guano Werke, Hamburg. Eng. Pat. 27,837, Dec. 6, 1906.

FOR emptying the pits an apparatus is used having projections acting as scrapers mounted on an endless band so arranged as to extend from front to back of the heap of superphosphate and travelling in an approximately horizontal plane of the heap, with movement also in a vertical plane, so that at each passage through the pit the band acts at a somewhat lower plane. A conveyor at a lower level than the floor of the chamber receives the superphosphate as it is thus mechanically discharged. It is stated that the scrapers tend to subdivide and thereby to aërate the superphosphate, whereby it is improved. —E. S.

FRENCH PATENT.

Manure having manganese for its base, and method of its application. J. Lecarme. Fr. Pat. 371,704, Jan. 30, 1906.

A SALT of manganese, preferably the sulphate, is added to ordinary chemical or farm manure, in such proportion that when the manure is distributed, there may be from 10 to 40 kilos. of the manganese salt to the hectare of land. Or, the manganese salt may be mixed with sand or earth and distributed in the proportion indicated.—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 334.)

Egyptian gum arabic trade. Bd. of Trade J., April 4, 1907. [T.R.]

THE exports of gum arabic in 1905 and 1906 were as follows:—

To	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
	Kilos.	£ E.	Kilos.	£ E.
United Kingdom	1,374,155	34,159	985,343	20,000
British Possessions in Far East	133,048	3,344	—	—
France.........	1,677,517	40,471	1,513,314	30,834
Austria-Hungary	664,936	16,364	672,644	13,752
United States of America	1,230,830	30,518	1,942,016	39,823
Germany	2,139,827	52,553	1,141,644	23,392
Belgium	940,947	23,156	—	—
Italy	349,104	8,517	289,435	5,860
Other countries .	328,119	8,050	1,145,544	23,669
Total	8,838,483	217,132	7,689,940	157,330

Forests of the tree from which gum arabic is obtained are found in the Kordofan Province, and also near Gedid in the White Nile Province. The natives are free to collect the gum, the only tax being a royalty levied at Omdurman. This royalty varies according to the price of the gum, and last year was about 2s. 6d. per 99 lb. The best gum, and the largest crop, comes from Kordofan. The grading of the gum is mostly done by the foreign buyer.

Beet sugar production of Europe. Ch. of Comm. J., April, 1907. [T.R.]

THE following statistics are quoted by the French Consul at Prague, showing the production of beet sugar in Europe for the last three years, with provisional figures for the current year based on the results so far obtained:—

	1906–7.	1905–6.	1904–5.	1903–4.
	tons.	tons.	tons.	tons.
Germany.......	2,250,000	2,415,136	1,598,164	1,927,681
Austria-Hungary	1,335,000	1,509,870	889,373	1,167,959
France.........	755,000	1,089,684	622,422	804,308
Belgium	280,000	328,770	176,466	209,811
Holland........	190,000	207,189	136,551	123,551
Russia	1,450,000	968,000	953,626	1,206,907
Other countries .	430,000	415,000	332,098	441,116
Total	6,690,000	6,933,649	4,708,700	5,881,333

Sugar and molasses in one jet; Continuous mixer for producing white ——. L. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1907, **24**, 1008. (Compare this J., 1907, 108.)

THE following results were obtained in a factory in which the continuous cooling mixer was installed. First jet syrup from the raw sugar centrifugals having a purity of 75° and a density of 86° Brix was concentrated to 90° and passed through the mixer 11 m. long with a total cooling surface of 42·93 sq. m. (including jacket 17·45 sq. m. and cooling frames 25·48 sq. m.), and a capacity of 26·5 hectolitres. The fall in temperature was from "75° or 80° C. to 18° or 29° C.," and the apparatus was able to treat 30 hectolitres (660 galls.) per hour. The mother liquor separated by a filter-press was molasses of purity 58°, whilst the cake of sugar left in the press had a purity of 85°. The latter was dissolved in the second carbonatation juice and introduced at the end of the boiling. It was thus possible to send molasses to the distillery in less than 18 hours after commencing work on the beetroots. When working beetroots containing 15·5 per cent. of sugar it is possible to obtain white sugar and molasses making only 16·5 litres per 100 kilos. of roots. The purity of the massecuite is slightly lowered by introducing the whole of the press-cakes of sugar at the end of the boiling. The very pure massecuite is easily dried in the centrifugals to an extra white sugar. The drainings passed through a mixer give by filtration a syrup having a purity of 71° to 73°. This syrup is concentrated and passed through a second mixer. For a factory working 750 tons of beetroots, two mixers would suffice, each with two filter-presses of 60 sq. m. of filtering surface. Owing to the rapidity of the work, the products are much less coloured than usual.—L. J. de W.

Sugars; Some compounds of guanidine with ——. I. R. S. Morrell and A. E. Bellars. Chem. Soc. Proc., 1907, **23**, 87—88.

When an alcoholic solution of guanidine is added to dextrose, lævulose, mannose, arabinose, rhamnose, galactose, or maltose, dissolved in ethyl alcohol, white, microcrystalline precipitates are obtained. The general formula for dextrose-, lævulose-, and mannose-guanidine is $3C_6H_{12}O_6,2CN_3H_5$. In $N/2$ solutions, the compounds are dissociated into their components to the extent of 71 per cent. The depression of the freezing points of mixed dextrose and guanidine solutions was determined on the lines of H. Euler's researches (Ber., 1905, **38**, 2551; 1906, **39**, 350), and the results confirm his view as to the acid character of carbohydrates in aqueous solution. The strength of guanidine as a base compared with sodium hydroxide was determined by (*a*) the saponification of ethyl acetate, (*b*) the velocity of fall in rotation angle of a hyoscyamine solution in the presence of guanidine (Will and Bredig, Ber., 1888, **21**, 2777). The strengths of guanidine and sodium hydroxide were found to be in the ratio of 0·8 : 1. Aqueous solutions of dextrose-, lævulose-, or mannose-guanidine show a gradual fall in optical rotation to a minimum value, which is the same for the three compounds. This behaviour is similar to that investigated by Lobry de Bruyn in the action of alkalis on sugars. The results obtained from the study of the mutarotation of solutions of dextrose-, lævulose-, or mannose-guanidine may be summarised as follows: (1) The fall in optical rotation to a constant minimum represents an apparent equilibrium in the case of dextrose- and lævulose-guanidine between two sugars through an intermediate substance, X, the concentration of which is very small, $G \longleftrightarrow X \longleftrightarrow F$. (2) The velocity constants for the transformation of dextrose into lævulose, and *vice versa*, were found to be 0·0015 and 0·0021 respectively; the velocity constants for the change of mannose into lævulose and dextrose are 0·0005 and 0·00036 respectively. The velocity of the reverse change of lævulose and dextrose into mannose is very small. (3) There is a slow disappearance of X, the intermediate substance, to form acids. When optical equilibrium has been reached, the ratio of lævulose to dextrose remains constant until the formation of acids ceases.

Mannitol; Test for purity of ——. O. Carletti. Boll. Chim. Farm., 1907, 5. Schweiz. Woch. Chem. Pharm., 1907, **45**, 145.

Mannitol differs from other derivatives of the carbohydrates in that it does not form furfural with sulphuric acid. The following test is based on this fact. A few drops of a 1 per cent. alcoholic solution of either thymol, naphthol, or menthol, or other phenolic body, are added to a few c.c. of sulphuric acid in a test tube. A solution of 0·10 grm. of the mannitol in 5 c.c. of water is then carefully floated on. In the presence of dextrose, sucrose, or other carbohydrate impurities a coloured zone, tinted rose to violet, will be formed at the line of contact of the liquids. —J. O. B

Starch; Difference between the resistances of natural —— and artificial amylose towards barley extract. J. Wolff and A. Fernbach. XVII., page 426.

English Patent.

Grape sugar from corn and analogous farinaceous material; Process of manufacturing anhydrous ——. T. B. Wagner, Chicago, U.S.A. Eng. Pat. 12,950, June 2, 1906.

See U.S. Pat. 835,145 of 1906; this J., 1906, 1165.—T. F. B.

French Patents.

Disinfection to prevent bacterial growth during the treatment of vegetable substances, especially in the sugar industry. E. Schumbeck. Fr. Pat. 371,708, Nov. 21, 1906. Under Int. Conv., Nov. 21, 1905.

The patent relates to the prevention of the growth of bacteria, for example in beetroot, during the preliminary stages of manufacture. Carbolic acid or formaldehyde in the proportion of about one part to sixty thousand parts of material under treatment, is added, largely diluted with water, to the beetroot on the weighing machines and in the slicing machines.—G. W. McD.

Brewing sugars; Process for denaturing ——. R. Charlie. Fr. Pat. 371,855, Nov. 28, 1906. XVII., page 427.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 336.)

Brewing trade of Austria-Hungary and Germany in 1905–6. Bd. of Trade J., April 4, 1907. [T.R.]

The production of beer in Austria during the year 1905-6 amounted to 19,500,000 hectolitres, of which 1,370,371 hectolitres were exported. Although the quantity of beer produced in Germany is nearly four times as great as that produced in Austria, the exports from the latter country exceed those from the former. The German production in 1905-06 amounted to 72,000,000 hectolitres, and the exports to 931,000 hectolitres, or little more than 1 per cent. of the total, as compared with 7 per cent. from Austria.

Hectolitre = 22 imperial gallons.

Malt; The kilning of ——. O. Winde. Woch. f. Brau., 1907, **24**, 133—136.

The author refers with approval to the views expressed by Kropf (see this J., 1906, 438), and states that every portion of the malt kiln should be capable of easy and accurate adjustment as regards temperature and draught, so that the quantity of moisture in the malt at any given stage and temperature can be controlled. The drying and curing of Munich malt may be divided into four stages:—(1) Withering, during which the moisture of the malt is reduced from 40—50 per cent. to 15—20 per cent., the temperature rising from 25° to 37° C. During this stage the partial saccharification necessary for the development of the aroma takes place. (2) The development of the aroma by the action of a temperature of 66°—70° C. for several hours without further loss of water from the malt. (3) The subsequent gradual drying of the malt to a moisture-content of 7—10 per cent. at a temperature rising to 100°—105° C. (4) The curing and slight roasting at a temperature insufficient to cause a browning of the starch of the endosperm. The actual time given to each stage varies according to the construction of the kiln, whether a two-floor or three-floor kiln, but the author expresses the opinion that the total time of 48 hours, generally given could be considerably shortened by proper control. The critical temperatures are those recorded in the malt; the air temperatures are only utilised as a means for obtaining the former. The character of Munich malt does not consist only of its colour, but depends on the composition of its extract as modified by the effect of certain closely defined temperatures in presence of certain closely defined limits of moisture. Without this modification the depth of colour obtained by high curing temperatures is accompanied by a harsh and penetrating flavour. The kilning of Pilsener malt is divided into three stages:—(1) A rapid removal of water at a low temperature, the moist green malt being spread very thinly, and the temperature not being allowed to exceed 35°—37° C. until the moisture is reduced below 30 per cent. (2) A continuation of the first stage with gradual rise of temperature to 47° C., this temperature on no account being exceeded until the moisture falls to 8 per cent., after which it may rise to 50° C. This stage is critical as regards the subsequent development of colour (compare the second stage in the Munich process). (3) Complete curing of the malt at the highest temperature permissible. The moisture having been eliminated, the temperature can now be raised above 50° C. without danger, and, provided stages one and two have been properly carried out, pale malt can stand a final curing temperature of 85°—88° C. for two to three hours without darkening. The author calls attention to the extreme importance of records not only of temperatures, but of the moisture in the malt, which should be determined every three hours. Finally, the malt should be cooled before it is stored away, and the cooling should take place without much absorption of moisture. The storing of hot malt may be the cause of much damage.—J. F. B.

Malts; Occurrence of high proportions of soluble matters in certain ——. L. Briant. J. Inst. Brewing, 1907, **13**, 132—139.

The author points out that the percentage of soluble matters found in finished malt represents the balance between the amount produced and the amount utilised by the growing embryo. A high content of soluble matters may be due either to an abnormally high production ("forcing") or an abnormally low consumption (restriction of root growth), and the analytical results will not distinguish between the two. Again, from an analytical point of view, the effects of excessive production might be covered by a correspondingly excessive respiration and development of root growth. The effects of "forcing" may be produced not only on the malting floor, but also on the kiln, especially if the latter be deficient in area or draught. In dealing with certain types of thin-skinned, mellow barley of high quality, it may be found that even with slow, cool, prolonged germination, the analytical figures for soluble matters are such as might indicate "forcing." This is due to a natural ease of germination which results in over-modification under cool conditions, whereas real "forcing" is the excessive stimulation of enzyme activity by high temperatures.—J. F. B.

Malt; The "soluble albuminoids" of ——. M. J. Cannon. J. Inst. Brewing. 1907, **13**, 140—143.

In expressing the amounts of total and non-coagulable albuminoids in malt, the determinations are made in the cold water extracts. The author points out that the proportion of albuminoids in the extract depends very largely on the temperature at which the extraction is made, and that if the malt be treated with water at 150° F., an average mashing temperature, the proportions of albuminoids extracted are 0·8—1·25 per cent. higher than at the ordinary temperature.—J. F. B.

Malt; Souring of the —— in potato distilleries. P. Thum. Z. Spiritusind., 1907, **30**, 119.

The following method of preparing the malt has been tried in a potato distillery: The malt is steeped over night in water to which have been added 200 c.c. of 66 per cent. pure sulphuric acid per cwt. of malt. In the morning the liquid is run off, and the malt is passed through the crusher. This process was tried in alternate tuns side by side with the ordinary process, with the result that it showed a higher yield of spirit per lb. of starch and per unit of tun capacity. It is especially useful in the case of coarse-skinned and small potatoes which give mashes containing large proportions of unsaccharifiable residues. The attenuations were a few tenths of a per cent. higher, and the development of acidity during fermentation was slightly lower with the acid process as compared with the ordinary process.
—J. F. B.

Starch; Difference between the resistances of natural —— and artificial amylose towards barley extract. J. Wolff and A. Fernbach. Compt. rend., 1907, **144**, 645—646.

According to Maquenne and Roux (see this J., 1906, 192, 601, 707), natural starch contains two classes of substances—amylose and amylopectin—which are saccharifiable by two diastases respectively. The amylose-saccharifying diastase occurs in an active state in malt; the amylopectin-saccharifying diastase only becomes active when malt extract undergoes stimulation (*loc. cit.*). The authors have compared the actions of barley and malt extracts on solutions of artificial amylose and starch. To obtain an amylose solution, the amylose was heated to 150° C. with water for ten minutes; the starch paste was treated in the same way. Fifty c.c. of 1 per cent. starch or amylose solution were treated with 5 c.c. of 10 per cent. barley or malt extract at 45° C., the amount of maltose formed being determined at intervals. The experiments gave the following results: Pure amylose is converted practically completely into maltose by both barley and malt extracts. The amylose in natural starch is saccharified much less rapidly than artificial amylose by barley extract. The amylose in natural starch is saccharified much less rapidly by barley extract than by malt extract. Barley extract, unlike malt extract, does not acquire the property of saccharifying amylopectin (*i.e.*, it does not undergo excitation). From an examination of the osazones prepared from the barley extract conversion products, the authors have concluded that maltose is the only sugar formed under the conditions of their experiments.—L. E.

Phosphorus compound; Organic —— formed by yeast-juice from soluble phosphates. W. J. Young. Chem. Soc. Proc., 1907, **23**, 65—66.

It has been shown by Harden and Young (this J., 1905, 809; 1906, 490) that when soluble phosphates are added to a fermenting mixture of yeast-juice and dextrose a large increase in the rate of evolution of carbon dioxide is observed. This rate soon diminishes until a constant rate is attained, which is usually approximately equal to that observed with the original yeast-juice and dextrose. It has been further shown that at the end of this period of increased fermentation, the phosphate has undergone some alteration, and is no longer present in a form precipitable by magnesium citrate mixture, and it was suggested that a combination with the dextrose to form a phosphoric acid ester had taken place. Experiments on the chemical nature of this compound have been carried out, and although not yet complete, it has been thought advisable to communicate a preliminary notice of the results so far obtained, in view of the publication of Iwanoff (Zeit. physiol. Chem., 1907, 50, 281), who appears to have obtained the same substance independently. A lead salt of the compound was prepared from the fermentation mixture by first removing any free phosphate by magnesium nitrate and then adding lead nitrate. Analyses of two preparations, in which the carbon, hydrogen, lead, and phosphorus were determined, gave the empirical formula, $C_3H_5O_6PPb$. On suspending this salt in water and removing the lead with hydrogen sulphide, an acid solution is obtained which reduces Fehling's solution and gives Hohlisch's α-naphthol reaction. It is slightly dextro-rotatory, and can be titrated with alkalis, using phenolphthalein as indicator, in a similar manner to phosphoric acid. On evaporating to dryness on the water-bath, a charred mass is left which contains free phosphoric acid and has a strong odour of caramel, whilst on evaporation at the ordinary temperature in a vacuum over sulphuric acid, a syrupy mass is left, which soon darkens in colour and decomposes. When the solution is boiled for several hours the compound is slowly hydrolysed, phosphoric acid being set free, and a substance formed which reduces Fehling's solution more strongly than the acid itself, and rotates the plane of polarised light to the left. The nature of this reducing substance has not been exactly determined, and experiments with this object are in progress.

Alcoholic fermentation; Influence of manganese salts on ——. E. Kayser and H. Marchand. Compt. rend., 1907, **144**, 574—575.

When a small quantity of manganese sulphate (1—1·5 grms. per litre) is added to a saccharine wort sown with yeast, fermentation appears to be retarded at first, but it finishes in about the same time as when no manganese is present. In presence of manganese the yeast shows a very marked tendency to "break." The principal effect of the manganese salt, however, is to cause the fermentation to proceed to a further limit than is usually the case. Thus in a wort containing 24·48 per cent. of sugar there was observed a greater disappearance of sugar and a larger production of alcohol, glycerol, and volatile acid than in the same wort without manganese (see table).

	Wort containing 24·48 per cent. of sugar fermented alone and after addition of 1 grm. (A), and 1·5 grms. (B) of manganese sulphate per litre.					
	With wine yeast.			With cider yeast.		
	—	A	B	—	A	B
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Sugar destroyed.....	16·88	21·99	22·16	22·01	24·20	24·23
Alcohol (by volume).	8·1	10·8	11·3	10·9	12·0	12·0
Glycerol	0·84	0·98	1·11	1·02	1·18	1·23
Fixed acids, as succinic acid	0·079	0·079	0·067	0·117	0·108	0·085
Volatile acids, as acetic acid	0·077	0·094	0·118	0·083	0·093	0·119

The lactate and acetate of manganese had the same favourable effect as the sulphate, but the succinate and the phosphate, whilst still causing a greater disappearance of sugar than in the blank experiment, gave a somewhat lower yield of alcohol, possibly owing to increased glycerol formation. Manganese nitrate is even more favourable than the sulphate, in spite of the fact that other nitrates, like potassium nitrate, are distinctly unfavourable to alcoholic fermentation. The author suggests that the above observations might be utilised in distillery practice for obtaining higher yields of alcohol from thick mashes.
—J. F. B.

Brewing process; An American ——. E. Ruffer. Woch. f. Brau., 1907, **24**, 145—146.

The author describes the process which he has adopted in an American brewery: The mash is mixed, without an external mashing machine, at a temperature of 45° C., 2200 lb. being mashed in three to four minutes. At the same time four sacks of malt grist are mashed, also at 45° C., in the rice copper, together with the necessary quantity of rice or maize grits; this mash is allowed to stand for fifteen minutes and then boiled for one hour with direct steam. The main mash is then stirred and heated to 56° C.; the mash from the rice copper is added, and the temperature in the mash-tun rises to 75° C. After forty-five minutes' pause, the wort is run off. The above plan was adopted to cure a tendency to excessive attenuations. For bottle beers the brew consists of 2000 lb. of malt grist, 960 lb. of rice, and 250 lb. of sugar; for cask beers, 2200 lb. of malt grist and 840 lb. of maize grits. Malt costs $2·5 per 100 lb. delivered, and maize grits with a yield of 78 per cent. extract cost the same; Pacific hops cost 14 cents and New York 25 cents per lb.
—J. F. B.

Sarcina; Detection of ——. W. Bettges. Woch. f. Brau., 1907, **24**, 149—152.

Klöcker (Die Gärungsorganismen, p. 66) states that when beer is sterilised in a vessel plugged with cotton-wool for fifteen minutes at a pressure of 1—1·5 atmospheres, it loses about one-half of its alcohol-content. The author finds, however, that the proportion of alcohol thus lost varies very widely according as the plug is tight or loose. When a sterile liquid containing a definite percentage of alcohol is required, it is best to place it in a closely-stoppered bottle and sterilise it in steam at atmospheric or a slightly higher pressure. In detecting sarcina in yeast by means of a slide-preparation enclosed in vaseline, the best nutrient medium to employ is a completely fermented, unhopped, pale wort, the proportion of alcohol in which is reduced to 4 per cent. by the addition of soluble malt- or barley-starch. When, however, flasks are used in the investigation, the percentage of alcohol in the fermented liquid employed should be from 5 to 6; in this case, too, the yeast to be examined should possess a certain degree of purity as regards aërobic bacteria. When these conditions are fulfilled, the flask method gives results as certain as those yielded by preparations surrounded by vaseline.—T. H. P.

English Patents.

Wort; Method of heating brewers' ——. L. Nathan, Zurich. Eng. Pat. 28,261, Dec. 11, 1906. Under Int. Conv., Dec. 29, 1905.

In the process described, the wort-pan receives the bulk of the heat required from a steam-coil. At the same time an electrical heater is suspended in the pan, and serves to regulate the temperature of the wort in the manner necessary for the production of palate-producing substances.—W. P. S.

Yeast; Apparatus for collecting —— *from fermenting beer.* N. G. Lemaire, Maestricht, Holland. Eng. Pat. 10,504, May 4, 1906.

The yeast skimmer consists of a narrow, but deep receiver placed inside the tun, and communicating with the outside by means of a discharge tube. This tube serves as a hollow axis on which the receiver can be turned on its side, until its mouth is plunged beneath the surface of the beer. The receiver is operated by a handle outside the tun, and is returned to a vertical position when sufficient yeast has been discharged.—J. F. B.

Spirits; Distilling and treating ——. J. E. Carrol, London. Eng. Pat. 24,229, Oct. 30, 1906.

This specification is a modification of Eng. Pat. 19,126 of 1900 (this J., 1901, 270). In certain cases it is desirable that the foreshots and feints should not be treated in the superheater; for this purpose, a branch pipe and stop-cocks are provided, so that these fractions can be passed direct to the condenser. The fine spirit is treated in the superheater as before. The superheater may consist of a convolute vapour pipe stack, surrounded by a similar wider pipe, superheated steam being introduced into the annular space between the two. The air-inlet pipe has an intake above the superheater, and a rose or nozzle delivering into the lower part of the vapour pipe stack.
—J. F. B.

French Patents.

Grape-musts and other fruit juices; Preservation of ——. K. Schwarz. Fr. Pat. 371,918, Nov. 7, 1906.

The fresh juice is drawn off into bottles which have been treated with small proportions of sulphur dioxide; the bottles, not quite full, are then heated to a temperature of 30°—40° C., after which they are allowed to cool slowly.
—J. F. B.

Brewing sugars; Process for denaturing ——. R. Charlie. Fr. Pat. 371,855, Nov. 28, 1906.

Methyl Orange is added to syrups with a view to their subsequent identification. [French practice.]—J. F. B.

Beer worts; Preparation of —— in the dry or nearly dry state. J. G. Maardt. Fr. Pat. 371,650, Nov. 2, 1906. Under Int. Conv., Dec. 19, 1905.

An extract of crushed green malt is mixed at a temperature of 30° C. with purified starch, and the mixture is then heated at about 70° C. until the starch is converted into maltose and dextrin. In order to avoid subsequent turbidities, the conversion of the starch is completed by steaming the mash at a temperature of 160° C., until it becomes nearly dry. If necessary, an extract of hops or other substances may be added to the mash. The product is dissolved in water when required for use.
—J. F. B.

Beer and other beverages; Process and apparatus for the refrigeration and saturation with gas, of ——. L. Chew et Société. H. J. West and Co., Ltd. Fr. Pat. 370,557, Oct. 15, 1906.

The apparatus consists of a refrigerating receptacle, a differential pump, and a storage refrigerator. The whole apparatus is filled with carbon dioxide gas under pressure, the pressure of gas in the storage refrigerator being greater than that in the refrigerating receptacle. The liquor is driven by the pump into the refrigerating receptacle, where it is cooled to about the same temperature as that of the carbon dioxide in the same vessel. The return stroke of the piston withdraws the partially carbonated liquor, together with some carbon dioxide, from the bottom of the refrigerating receptacle. The next stroke of the piston compresses the mixture of gas and liquor, and drives it into the storage refrigerator, where further absorption of gas occurs.—L. E.

Glycerins of every description, including spent soap lyes and distillery by-products (vinasses); Process and apparatus for the purification of crude ——. L. Rivière. First Addition, dated Nov. 3, 1906, to Fr. Pat. 367,752, July 4, 1906. XII., page 421.

German Patent.

Spirit; Apparatus for the separation of the first products from ——. M. Strauch. Ger. Pat. 170,168, Jan. 6, 1905.

The patent relates to apparatus provided with a column for the separation of the first products by means of dephlegmating devices, heated by vapour or liquid. Within the separating column is disposed a preheating vessel for the spirit to be distilled, this vessel communicating by perforations with a distributing dish or cup in the dephlegmating column. Above these perforations the preheating vessel is enlarged to form a kind of reservoir for any excess of spirit when this is delivered to the apparatus too rapidly.—A. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page 338.*)

(A.)—FOODS.

English Patents.

Albumin and albuminous substances; Process for the preservation of ——. F. Pabst, Halle-on-the-Saale, Germany. Eng. Pat. 22,340, Oct. 9, 1906.

The material, such as fresh albumin, egg-yolk, meat-juice, fresh meat, or fish, is placed in a suitable vessel and subjected to an atmosphere of carbon dioxide, under pressure, the air being exhausted from the vessel before introducing the carbon dioxide. The pressure should amount to three atmospheres or more, and additions of carbon monoxide and other substances to the carbon dioxide may be made. (Reference is directed to Eng. Pats. 25 of 1879, 5153 of 1882, 246 of 1883, 1653 of 1888, 19,817 of 1891, 15,558 of 1894, and 21,387 of 1897; this J., 1883, 294, 483; 1889, 207; 1892, 259; 1895, 767; 1898, 1067).—W. P. S.

Coffee and tea; Process for the manufacture of extracts of ——. A. Rupeau, Bordeaux, France. Eng. Pat. 25,211, Nov. 8, 1906.

See Fr. Pat. 370,506 of 1906; this J., 1907, 272.—T. F. B.

United States Patents.

Coffee; Method of improving [the odour and flavour of] ——. A. E. B. Gram, Copenhagen. U.S. Pat. 843,530, Feb. 5, 1907.

Raw coffee is subjected to the action of an atmosphere of nitrogen dioxide and air, and is then roasted. The treatment is stated to improve the odour and flavour of the coffee.—W. P. S.

Milk powder; Manufacture of ——. A. Glas, Berlin. U.S. Pat. 843,938, Feb. 12, 1907.

See Eng. Pat. 23,100 of 1904; this J., 1905, 247.—T. F. B.

French Patent.

Grape musts and other fruit juices; Preservation of ——. K. Schwarz. Fr. Pat. 371,918, Nov. 7, 1906. XVII., page 427.

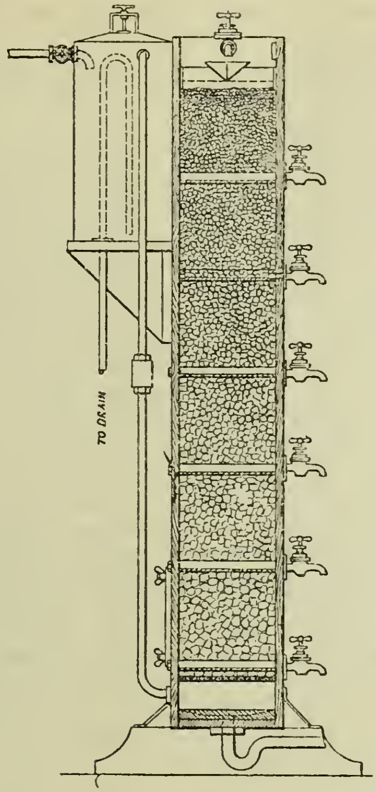
(B.)—SANITATION; WATER PURIFICATION.

Sewage; The organic colloids of ——. J. H. Johnston. J. Roy. Sanit. Inst., 1906, 27, 548—552.

The results of experiments are recorded in which sewage was submitted to dialysis in order to determine the amount of organic colloids contained in it, the relation of the manner in which these colloids are removed in filter-beds to the purification of sewage being also discussed. The apparatus employed consisted of a circular glass dialyser with a parchment bottom, suspended in water. Ordinary domestic sewage, filtered through paper and sterilised by the addition of sulphuric acid, was used; the volume of the sample taken was 50 c.c. and of the distilled water 500 c.c., the latter being renewed during the dialysis. The albuminoid nitrogen remaining in the residue in the dialyser was taken as the measure of the organic colloids contained in the sample. The results show that, on the average, 52 per cent. of the albuminoid nitrogen was in the colloidal state. From further experiments, in which the filtered sewage was simply placed in a bottle filled with glass beads, it is seen that 16 per cent. of the albuminoid nitrogen was removed by the surface action of the beads. Biltz and Kröhnke have also found (this J., 1904, 619) that the mere presence of surfaces, without any bacterial coating, effects the removal of colloidal matter, and it appears that this removal takes place in a filter-bed, mainly in virtue of the surface action of the material of the bed or of the surface of the material coated with any colloidal or other matter already deposited on it. The colloidal matter, after removal from the liquid, is subject to biological action in the bed, and a portion left after this action is partly washed out of the bed by the liquid and partly retained in the bed. A knowledge of the fact that about one-half of the dissolved organic matter contained in domestic sewage is in the colloidal condition, together with a recognition of the physical laws relating to colloidal solutions, is considered to be of importance in designing and working sewage systems in the future. (See also this J., 1905, 483.)
—W. P. S.

Sewage; Treatment of ——. W. D. Scott-Moncrieff. Paper read before the Royal Sanitary Inst.; through Engineering, 1907, 83, 355—356.

The author describes an apparatus by means of which it is possible to gain information as to the effect of filtration of a definite quantity of a sample of sewage, in a given time, through any filtering material. The apparatus is shown in the accompanying diagram. It consists of a galvanised iron box, 8 ft. high, with a cross-section 3 ft. by 1 ft. It is filled to a depth of 6 ft. with screened coke, river ballast, broken slag, or other filtering material, which rests on a perforated plate near the bottom of the box. At successive vertical distances of 1 ft. from the



perforated plate, six gutters or troughs are disposed among the filtering material, these troughs communicating with cocks on the outside of the tank, so that samples of the sewage can be withdrawn after passing through any of the 1 ft. zones. The sewage is fed into a tipping-trough in the top of the box, and falls on to a perforated plate to ensure uniform distribution. For the purpose of aerating the filter, an aspirating tank is provided by which air is drawn through the filtering material. In discussing the uses of the apparatus, the author points to the necessity of determining, for a particular sewage, the best kind of filtering material, and the most satisfactory conditions with respect to the rate of flow through the filter, period of rest between each discharge, quantity of air, and depth of filter. (See also this J., 1907, 272.)—A. S.

Manganese in drinking water; Determination of ——. H. Noll. Z. angew. Chem., 1907, **20**. 490—492.

For the determination of the small quantities of manganese which may be present in drinking water, the author finds that satisfactory results can be obtained by precipitating the manganese as dioxide by means of bromine, treating the washed precipitate with potassium iodide and hydrochloric acid, and titrating the liberated iodine with $N/100$ or $N/1000$ thiosulphate solution.—A. S.

Nitrous acid in dyehouse water [*; Determination of* ——]. E. Ristenpart. V., page 405.

English Patents.

Water; Purification of —— *and apparatus for use therein.* F. Candy, London. Eng. Pat. 14,464, June 25, 1906.

The process relates to the purification of water impregnated with colouring matters from peat and other vegetable substances, &c. For this purpose the water is conducted into a pipe fitted inside a horizontal rotating cylinder. The interior wall of the cylinder is provided with buckets into which the water falls from perforations in the side of the pipe, the cylinder being thus caused to rotate after the manner of a water-wheel. Before commencing the operation, a charge of "nodular chalk" is placed inside the cylinder; this chalk is kept in motion by the movement of the cylinder, and is brought into intimate contact with the water. The water leaves the cylinder through perforations in the ends of the latter, and is collected in a trough over the edges of which it falls through a perforated plate on to a filter composed of highly oxidising material. The trough is provided with a cock by means of which any sediment may be drawn off, as required.
—W. P. S.

Garbage and sewage; Apparatus for reducing ——. H. J. Haddan, London. From Edson Reduction Machinery Co., Cleveland, U.S.A. Eng. Pat. 19,728, Sept. 4, 1906.

See U.S. Pat. 829,955 of 1906; this J., 1906, 949.—T. F. B.

French Patents.

Water purification; Process for expelling dissolved gases by atomising a liquid, and for ——. P. Kestner. Fr. Pat. 371,486, Jan. 24, 1906.

If a liquid holding a gas in solution is atomised in the presence of a large proportion of inert or insoluble gas, the liquid which collects will afterwards be found to contain a much smaller proportion of dissolved gas than before. The claim is for the process of expelling a soluble gas from a liquid by atomising the latter in the presence of a large volume of another gas or of air. The process may be applied to the purification of water by first treating it with a volatile antiseptic, and then atomising the water in the presence of a large volume of air and thus driving out the excess of disinfectant. Another application suggested, consists in atomising weak solutions of ammonia in a current of air. The ammonia expelled from the liquid is recovered by passing the air through a suitable acid.—W. H. C.

(*C.*)—DISINFECTANTS.

English Patents.

"*Tobacco extract*" [*insecticide*]; *Manufacture of* ——. T. Morgan, Liverpool. Eng. Pat. 13,150, June 7, 1906.

Tobacco is subjected to dry, or destructive distillation; the distillate is used as an insecticide, whilst the retort residue is also a marketable product.—W. P. S.

Disinfecting articles and destruction of wood worms, parasitic larvæ, and the like. A. R. Nilsson, Stockholm. Eng. Pat. 26,276, Nov. 20, 1906. Under Int. Conv., Nov. 25, 1905.

See Fr. Pat. 371,733 of 1906; following these.—T. F. B.

United States Patent.

Bacterial poisons; Process for obtaining solutions of ——. P. Bergell and F. Meyer, Berlin. U.S. Pat. 842,612, Jan. 29, 1907.

The process is one for producing solutions of bacterial poisons, each solution containing a specific toxin for immunisation purposes. It consists in treating the dry bacterial poisons with anhydrous liquid hydrochloric acid, evaporating the acid, and extracting the product.
—W. P. S.

French Patent.

Disinfecting various materials; Method for ——. A. R. Nilsson. Fr. Pat. 371,733, Nov. 22, 1906. Under Int. Conv., Nov. 25, 1905.

The objects to be disinfected are allowed to remain for a period of at least one hour in a chamber which has been evacuated. Carbon bisulphide vapour is then introduced into the chamber and penetrates completely into the materials.—G. W. McD.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 340.)

Turpentine or abietic acid ; New method for the determination of crude —— in resins of different kinds, oil- or copal-varnishes, pitch, and paper. H. Rebs. XXIII., page 436.

English Patents.

Paper ; Machine for manufacture of washable, water- and fat-proof —— without smell or taste. J. Pering, Dellbrueck, Germany. Eng. Pat. 26,944, Nov. 27, 1906.

In this machine the paper is carried over several different rollers, by means of which it is alternately sized, smoothed, and polished by a cold process. The various rolls are driven by a pair of parallel endless chains travelling in contact with them, these chains also carrying the paper by means of clamps. The sizing, smoothing, and polishing rolls are caused to rotate on the underside of the paper in a direction opposite to the travel of the paper. The sizing rolls, revolving in troughs, apply size, and the smoothing rolls apply powder to the paper, whilst the polishing rolls are caused to rotate at a higher speed than the other rolls. Arrangements can be made for treating both sides of the paper if desired.—J. F. B.

Cellulose esters ; Process for obtaining —— from solutions. L. Lederer, Sulzbach, Germany. Eng. Pat. 26,501, Nov. 22, 1906.

See Fr. Pat. 371,356 of 1906 ; this J., 1907, 340.—T. F. B.

Threads, films, or the like ; Manufacture of artificial ——. E. W. Friedrich. Eng. Pat. 27,727, Dec. 5, 1906. V., page 405.

French Patents.

Paper, card, fabrics, and similar materials ; Process for rendering —— impermeable to water and grease. J. Pering. Fr. Pat. 372,158, Dec. 6, 1906.

See Eng. Pat. 26,944 of 1906 ; preceding these.—T. F. B.

Nitrocellulose composition ; A new non-inflammable —— intended as a substitute for celluloid and horn. E. Mestrallet-Pétry. Fr. Pat. 372,018, Dec. 1, 1906.

A semi-transparent material is obtained by heating animal glue (20 parts) with water to a thick liquid, and then adding oil (1 part) and camphor ($1\frac{1}{2}$ parts). This mixture is then incorporated with celluloid (10 parts) by rolling or other means. By using Russian glue and castor oil a transparent product is said to be obtained.—G. W. McD.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 343.)

Citronella oil trade of Ceylon. Oil and Col. Trades J., March 30, 1907. [T.R.]

The exports of the southern province of Ceylon, where most of the citronella oil is prepared, have declined slightly in the past year, the total exports being 1,242,110 lb. as against 1,309,416 lb. in 1905. Still, the period under review has been an eminently satisfactory one. The market in January opened at 75 cents per lb., in April it was 92 cents, and in July 1.15 Rs., closing in December at 1.06 Rs. The following are the figures regarding distribution, in pounds :—

	1905.	1906.
United Kingdom	398,707	484,049
Germany	197,976	97,369
Belgium	2,161	—
France	11,925	20,182
India	3,645	4,117
Australia....................	60,288	69,681
America	623,999	563,030
China	10,499	3,610

The production is valued at fully 120 lacs of rupees.

Brucine oxide. A. Pictet and G. Jenny. Ber., 1907, **40**, 1172—1175.

Brucine oxide, $C_{23}H_{26}N_2O_5$, is formed in the same way as strychnine oxide, by gently warming brucine in a 3 per cent. solution of hydrogen peroxide (see this J., 1905, 1123). Brucine oxide crystallises with $4\frac{1}{2}$ molecules of water, which are lost at 110° C. When containing water it melts at 124°—125° C., and when anhydrous, at 199° C. with decomposition. It is soluble in alcohol, chloroform, and water ; insoluble in ether, light petroleum, and benzene ; the aqueous solution is neutral. After several crystallisations it has no action on starch and potassium iodide. It is now found that strychnine oxide does not give a coloration with this reagent. Also the melting point of strychnine oxide regenerated from its salts is higher than previously stated (*loc. cit.*). It is now found to be 207° C. when containing water of crystallisation, and 216°—217° C. when anhydrous. When brucine oxide is treated with sulphurous acid, brucine is produced. Brucine oxide is slightly lævo-rotatory in aqueous solution, having $[\alpha]_D = -1{\cdot}66°$ or $-1{\cdot}63°$. It is a monacid base, and several of its salts are described.—F. Shdn.

Thioquinine and thiocinchonine. E. Comanducci and L. Pescitelli. Gaz. chim. ital., 1907, **36**, II., 781—786.

For the preparation of thioquinine, $(C_{20}H_{23}ON_2)_2S$, a solution of 5 grms. of anhydrous quinine in dry chloroform is heated with a few grms. of phosphorus pentasulphide for 3—4 hours on the water-bath under a reflux condenser. The yield is about 3 grms. from 5 grms. of quinine. The product separates from alcohol as a microcrystalline, yellowish powder, having an odour resembling that of onions. It sinters at 140°—142° C., and melts completely at 150°—152° C. It is soluble in alcohol and chloroform, and with difficulty in ether. Its solutions in nitric and sulphuric acid show a blue fluorescence. Thioquinine gives the thalleioquinine reaction.

Thiocinchonine, $(C_{19}H_{21}N_2)_2S$, is prepared in an analogous manner ; yield, 0·65 grm. from 5 grms. of cinchonine. It is an amorphous powder, with an odour of garlic, insoluble in water, almost insoluble in ether, soluble in alcohol and chloroform. It decomposes at 190°—192° C.—A. S.

Bakankosin, a new glucoside from the seeds of a species of Strychnos from Madagascar. E. Bourquelot and H. Hérissey. Compt. rend., 1907, **144**, 575—577.

The seeds of *Strychnos bakanko* contain considerable quantities of a glucoside to which the authors give the name of *bakankosin.* The glucoside is extracted from the seeds, previously ground and freed from fat, by digestion with 95 per cent. alcohol in a continuous extraction apparatus. The alcoholic extract is evaporated, the cane sugar is removed by fermentation, and the bakankosin is isolated and purified by several crystallisations from water or alcohol. The purified product crystallises in large colourless crystals, having a bitter taste. It loses 4·81 per cent. of moisture at 115° C. ; it melts at 157° C., and has a specific rotatory power $[\alpha]_D = -205{\cdot}2°$, calculated for the anhydrous substance. Bakankosin contains nitrogen ; it is hydrolysed slowly on boiling with dilute mineral acids, and yields dextrose. It is hydrolysed by emulsin, but the action is extremely slow, requiring several weeks. It has no toxic properties.—J. F. B.

Jute seeds ; [Toxic glucoside in certain ——]. R. Kobert. Sitz.-Ber. naturf. Ges. Rostock., 1906. Apoth.-Zeit., 1907, 22, 179.

The seeds of *Corchorus fascicularis* are mucilaginous, sweet, non-toxic, and edible ; those of *C. olitorius* are purgative ; those of *C. capsularis, C. bengalensis, C. acutangulus, C. argutus,* and *C. trilocularis* contain fat ; and the last three, besides a green fluorescent body, a toxic glucoside, the corchorin of Tsuno and W. Friboes. Corchorin is intensely bitter, readily soluble in water and in alcohol, but insoluble in ether, chloroform, and benzene, so that it cannot be isolated by shaking out with the last-named liquids. It is very slightly precipitated by neutral lead acetate, but is thrown down by ammoniacal lead acetate. It gives a bluish-green colour with strong sulphuric acid. It is removed from strong aqueous solutions by means of ammonium sulphate. Corchorin is hydrolysed by boiling with dilute mineral acids, forming a sugar and a decomposition product, which is insoluble in neutral and acid aqueous solvents, but soluble in alcohol. It is very poisonous, being allied to the digitalis glucosides.—J. O. B.

Columbin. T. Ulrich. Z. oesterr. Apoth.-Ver., 1907, **45**, 87. Chem.-Zeit., 1907, **31**, [Rep.], 137.

Pure columbin, prepared from Columbo root, crystallised from chloroform in long, silken needles, melting at 182° C., and having a composition corresponding to the formula, $C_{28}H_{30}O_9$ (not $C_{21}H_{22}O_7$ as hitherto accepted). It was optically inactive, and was not a glucoside, since it did not reduce Fehling's solution after being treated for 24 hours with emulsin and water. (See also this J., 1906, 906, 1115.)—C. A. M.

Essential oils ; Constituents of ——. F. W. Semmler. Ber., 1907, **40**, 1120—1124.

From the results of his investigations, the author makes the following statements : (1) that the existence of tricyclic compounds in essential oils can no longer be doubted ; (2) that a large proportion of sesquiterpenes and sesquiterpene alcohols are derived from a tricyclic terpene ; (3) and that this tricyclic terpene can be prepared. The high boiling point (183°—185° C.) of this new tricyclic terpene, as well as its specific gravity (0·882), shows that it cannot possess a simple bicyclic arrangement such as camphene, pinene, or sabinene, but that it has the bicyclic arrangement united to another simpler ring. It has many resemblances to octohydronaphthalene. This tricyclic terpene may be regarded as possessing a bridged ring. On inversion, the bridge disappears, and an octohydronaphthalene results. This can be best represented by the formulæ :—

$$\begin{array}{cc}
CH_2.CH_2.CH.CH.CH_2 & CH_2.CH_2.CH.CH_2.CH_2 \\
\dot{C}H_2.CH_2.\dot{C}H.\dot{C}H.\dot{C}H_2 & \dot{C}H_2.CH_2.\dot{C}\ :\ CH\ .\dot{C}H_2 \\
\text{Nor-tricylco-eksantalane} & \text{Nor-bicyclo-eksantalane} \\
C_{10}H_{16} & C_{10}H_{16}
\end{array}$$

It is suggested that santalol-*α* is tricyclo-santalol, $C_{10}H_{15}.CH : CH(CH_2)_2CH_2OH$, whilst santalol-*β* is bicyclo-santalol. As the inversion goes on during distillation, the amount of tricyclo-santalol present in crude santalol may be greater than has been supposed (see following abstract).—F. Shdn.

"*Santalol.*" F. W. Semmler and K. Bode. Ber., 1907, **40**, 1124—1145. (See preceding abstract.)

The authors give a short summary of previous investigations on East Indian sandal-wood oil. In their examinations, the authors made use of "santalol" prepared by saponification and fractionation of the oil, and looked upon as containing 100 per cent. of alcoholic constituents. "Santalal," $C_{15}H_{22}O$, was prepared by the chromic acid oxidation of santalol. The fractionated product was converted into the semicarbazone, from which santalal was isolated by means of phthalic anhydride and steam distillation. It boils at 152°—155° C. at 10 mm., has sp. gr. 0·995 at 20° C., and $n_D = 1·51066$; the rotation varies with the degree of purification of the semicarbazone, but a rotation of 13° to 14° was observed in a 100 mm. tube. The semicarbazone melts at about 230° C. This dextro-santalal is accompanied by lævo-rotatory oxidation products as well as unchanged santalol. Evidence was obtained of the presence of a lævo-santalal, although it was not purified. When *d*-santalal is oxidised with permanganate, tricyclo-eksantalic acid is produced, whilst oxidation with ozone yields tricyclo-eksantalal. The oxime of *d*-santalal melts at 104°—105° C. and boils at 182°—185° C. at 10 mm. The nitrile boils at 162°—166° C., and has sp. gr. 0·990 at 20° C. On hydrolysing the nitrile, santalic acid, $C_{15}H_{22}O_2$, is formed, boiling at 192°—195° C. at 9 mm. The authors conclude that "santalol" is a primary alcohol, and that "*d*-santalal" is a tricyclic aldehyde with one double link in the molecule. Santalol was treated with phosphorus pentachloride, and the resulting chloride reduced with sodium and alcohol. The *γ*-santalene so obtained is a sesquiterpene, $C_{15}H_{24}$, boiling at 118°—120° C. at 9—10 mm., with sp. gr 0·9355 at 20° C., and $n_D = 1·5042$. When santalol is reduced with hydriodic acid and red phosphorus, a hydrocarbon, $C_{15}H_{26}$ or $C_{15}H_{28}$, is produced, boiling at 125°—130° C. at 12 mm., with sp. gr. 0·8999, and $n_D = 1·48712$. The chief constituent of commercial "santalol" is a tricyclic, primary alcohol, $C_{15}H_{24}O$, with one double bond in the side chain ; with this is a second primary alcohol, $C_{15}H_{24}O$, which is bicyclic, and has two double bonds. Santalol consists chiefly of alcohols of the formula, $C_{15}H_{24}O$. When santalol is oxidised with permanganate, the principal product is tricyclo-eksantalic acid, $C_{11}H_{16}O_2$. This distils at 165°—167° C. at 10 mm., and then melts at 68° C., and has sp. gr. 1·071 at 25° C. After crystallising from alcohol, it melts at 71°—72° C. The rotation varies, but in alcoholic solution $[\alpha]_D = -15·87°$ was observed. When the methyl ester of this acid is reduced with sodium, tricycloeksantalol, $C_{11}H_{18}O$, is produced, boiling at 130°—132° C. at 10 mm. ; on oxidation this gives tricyclo-eksantalal, $C_{11}H_{16}O$, boiling at 125°—130° C. at 13 mm. Tricyclo-eksantalic acid is produced by the oxidation of santalol with ozone. It cannot be further oxidised by ozone, or by alkaline permanganate, even when warmed ; it is unchanged by fusion with potash. The chief product of the ozone oxidation of santalol is tricyclo-eksantalal, $C_{11}H_{16}O$, yielding a semicarbazone melting at 156° C. ; the aldehyde, when liberated from this, boiled at 112°—114° C. at 10 mm., had sp. gr. 1·01, and $n_D = 1·4976$, and α_D (in 100 mm. tube) = 3·30°. From the nitrile, tricyclo-eksantalic acid, m. pt. 68° C., was produced. Nor-tricyclo-eksantalane, $C_{10}H_{16}$, was produced by splitting off carbon dioxide in a vacuum from the acid, $C_{11}H_{16}O_2$, obtained by the decomposition of the ozonide of santalol. The first fraction gave a hydrocarbon which, after purification, boiled at 57°—59° C. at 9 mm., and at 183·5° C. at 767 mm., and had sp. gr. 0·885 at 20° C., and $n_D = 1·46856$. All the substances described above are regarded as tricyclic derivatives of eksantalane. This can be confirmed by their conversion into the corresponding bicyclic compounds. Tricyclo-eksantalic acid was dissolved in methyl alcohol and saturated with hydrochloric acid gas. On pouring into water, the chlorinated ester was produced, which can be distilled at 154°—156° C. at 9—10 mm. On hydrolysis, bicyclo-eksantalic acid was obtained, boiling at 164°—166° C., melting at 64° C., and with $[\alpha]_D = -41·81°$. This acid is immediately attacked by alkaline permanganate, with the formation of an acid boiling between 190° C. and 250° C. at 10 mm. It is also oxidised by ozone. Bicyclo-eksantalol, $C_{11}H_{18}O$, boils at 130°—134° C. at 9 mm. This on treatment with phosphorus pentachloride and reduction, gave bicyclo-eksantalane, $C_{10}H_{15}.CH_3$. This hydrocarbon boils at 72°—74° C. at 10 mm., has sp. gr. 0·871 at 20° C., and $n_D = 1·4774$. Nor-tricyclo-eksantalane was dissolved in methyl alcohol, and saturated with hydrochloric acid gas ; the resulting addition compound, on decomposition with potassium hydroxide, gave the terpene, nor-bicyclo-eksantalane, $C_{10}H_{16}$. This boils at 62°—64° C. at 9 mm., and at 186°—189° C. at 760 mm., and has sp. gr., 0·8827 at 20° C., $n_D = 1·4779$, and α_D (in 100 mm. tube) = −19°. The refraction shows this to be a compound with one double linking in its molecule. Attempts were made to invert santalol itself. The best results were obtained by the use of concentrated sulphuric acid in glacial acetic acid. On hydrolysis, a product was obtained boiling between 155° and 175° C. at 10 mm., with sp. gr. 0·981 at 20° C., $n_D = 1·5179$, and α_D (in 100 mm. tube) = −28°.—F. Shdn.

Thymol from Mosla japonica. — Hada. Oriental Drug., 1907, [5]. Pharm.-Zeit., 1907, **52**, 202.

The essential oil of *Mosla japonica* is stated to contain 58 per cent. of thymol. The plant, which has practically disappeared from Japan for many years, has been rediscovered in the Sanyo district, and will be cultivated as an industrial source of thymol.—J. O. B.

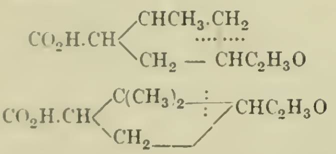
Camphor, synthetic ; Tests for ——. A. Baselli. Giorn. Farm. Trieste., 1907, 2. Répert. Pharm., 1907, **19**, 125.

One grm. of the camphor is intimately mixed with 2 grms. of pure lime ; the mixture is heated until the camphor is completely volatilised ; the residue is boiled in a little

water and filtered. The filtrate, acidified with nitric acid, should give no precipitate with silver nitrate reagent. Five grms. of the camphor are dissolved in 50 c.c. of 90 per cent. alcohol; an aqueous solution of 5 grms. of hydroxylamine hydrochloride and 8 grms. of sodium hydroxide is added, followed by sufficient alcohol to give a clear solution, which is then heated on the water-bath for 90 minutes. This solution should not then be rendered turbid by the addition of water (presence of isoborneol or camphene), and the precipitate obtained on neutralising the liquid with hydrochloric acid should be soluble in excess of that acid, and in sodium hydroxide solution.
—J. O. B.

Umbellulone; Constitution of ——. *II. The reduction of umbellulonic acid.* Frank Tutin. Chem. Soc. Proc., 1907, **23**, 28—29.

When umbellulonic acid, $C_9H_{14}O_3$, obtained by the oxidation of umbellulone (this J., 1906, 776), is reduced by means of sodium and alcohol, a *hydroxy-acid* having the formula, $C_9H_{18}O_3$, is produced. It is evident from this fact that the ring contained in umbellulonic acid has been opened by the addition of two atoms of hydrogen, and the resulting hydroxy-acid must therefore be a chain compound. This hydroxy-acid gives a *lactone* (b.pt. 246°—248°), and when oxidised with permanganate in presence of an excess of alkali yields acetic and *iso*propylsuccinic acids. In the previous communication (*loc. cit.*) it was shown that umbellulonic acid must contain either a methylpentamethylene or a dimethyltetramethylene ring. Only two keto-acids containing either of these rings are capable of giving on reduction a hydroxy-acid which, by subsequent oxidation, would yield acetic and *iso*propylsuccinic acids, namely, those possessing the following formulæ:—



A hydroxy-acid which would yield on oxidation acetic and *iso*propylsuccinic acids, could only be formed from one of the above keto-acids by the opening of the ring on reduction at the place indicated by the dotted line. The product of the reduction of umbellulonic acid will therefore be *δ-hydroxy-a-iso*propyl-n *hexoic acid*,

$$CH_3.CH(OH).CH_2.CH_2.CH.(CO_2H).CH(CH_3)_2.$$

Formula II. represents pinononic acid, and it has previously been shown that umbellulonic acid is neither identical nor stereoisomeric with this compound. Umbellulonic acid must, therefore, be correctly represented by Formula I. It follows from this that the correctness of the formula previously assigned to umbellulone cannot be doubted.

Hydroxylaminodihydroumbelluloneoxime; Reduction of ——. F. Tutin. Chem. Soc. Proc., 1907, **23**, 29—30.

Hydroxylaminodihydroumbelluloneoxime was prepared by Power and Lees in their investigation of the essential oil of *Umbellularia Californica* (this J., 1904, 559). When reduced with sodium and alcohol it gives a base (b. pt. 136°—138°/50 mm.), which is a liquid soluble in water. From the results obtained by the analysis of the *dibenzoate*, *dihydrochloride*, and *dibenzoyl* derivative of this base it is impossible to say with certainty whether it has the formula, $C_{10}H_{20}N_2$ or $C_{10}H_{22}N_2$, although it is most probable that the latter is correct. The base may therefore be designated *aminotetrahydroumbellulylamine*. *Aminotetrahydroumbellulylamine dibenzoate* crystallises in needles melting at 212°—213°; the *dihydrochloride* also forms needles, but it is infusible at 305°. *Dibenzoylaminotetrahydroumbellulylamine* crystallises in prisms or in leaflets, which melt at 194°. Although evidence was obtained of the presence of bases which are probably stereoisomeric with aminotetrahydroumbellulylamine, no derivative of them could be isolated in a state of purity.

Antipyrine; Quantitative determination of ——. J. D. Riedel. Pharm. Zeit., 1907, **28**, 290; Pharm. J., 1907, **78**, 457.

About 0·5 grm. of antipyrine or a corresponding quantity of an antipyrine mixture is dissolved in 50 c.c. of water, 5 to 6 c.c. of *N*/1 hydrochloric acid added, and the mixture heated to boiling. The hot solution is treated with a cold saturated alcoholic solution of picric acid in slight excess (about 10 c.c.). The whole is shaken two or three times and then allowed to stand. Very soon the picrate separates in fine, long needles, and the process is complete in a few hours. The precipitate is collected on a weighed filter, adhering crystals being washed out with the filtrate on to the filter, well drained by means of the filter-pump, without washing, and dried at 90° to 95°. Instead of hydrochloric acid a corresponding quantity of *N*/2 sulphuric acid may be used, but in this case the product is apt to become coloured in the drying from the presence of a trace of the non-volatile sulphuric acid.

Veronal [Diethylmalonylurea]; Characters and reactions of ——. P. Lemaire. Répert. Pharm., 1907, **19**, 104—108.

Veronal forms colourless crystals, with a slightly bitter taste; m. pt. 190°—191° C.; solubility in water less than 1 : 145 at normal temperatures, more soluble in hot water, alkaline solutions, alcohol, ether, and chloroform. The aqueous solutions are acid to litmus. It gives no precipitate with formalin, nor does it afford the murexide reaction. It is not sensibly attacked, in the cold, by sodium hypobromite, but is decomposed thereby in strongly alkaline solution on heating. It is decomposed under the influence of *Micrococcus ureæ*, at first showing an increased acid reaction, ultimately becoming alkaline, with evolution of ammonia. It evolves ammonia when heated with caustic alkali solution, and the residue, after the ammonia has been expelled, affords carbon dioxide when treated with acids. With a 5 per cent. solution of mercuric chloride it gives, in the presence of alkali or of borax, a white precipitate. Aqueous solutions of veronal blacken mercurous chloride, give a white precipitate with Millon's reagent, with acid mercuric sulphate, and also with mercuric nitrate solution, the latter precipitate being soluble in excess of the reagent. With Flueckiger's reagent (water 10 c.c., sulphuric acid 10 c.c., potassium bichromate 2 grms.) a green to bluish colour is produced on warming. With Mandelin's ammonium vanadate reagent, a green to bluish colour is produced before boiling; after boiling, a yellow to brown tint is given. Veronal decolorises permanganate in the presence of acid; with Froehde's reagent it gives a yellowish-green to greenish-brown colour on boiling; with formalin and sulphuric acid a yellow colour when heated, passing to red brown on boiling, with evolution of sulphurous acid.—J. O. B.

Monomethylamine; Separation of ammonia from ——. M. François. Compt. rend., 1907, **144**, 567—569.

Preparations of the methylamines and ethylamines are always contaminated by ammonia. This impurity can be totally eliminated, either in the dry or the wet way, by absorption by mercuric oxide which has no action on the amines. According to the dry method, a current of air, charged with the vapour of the amine to be purified, is passed at the rate of 1 litre per hour, first through a drying apparatus and then through a series of 10 tubes, 1 m. long and 2 cm. in diameter, filled with granulated yellow mercuric oxide. The purified amine is then collected either by condensation or absorption. The wet method is more rapid and nearly as thorough. By this method the solution of amine, *e.g.*, 70 grms. of amine and 7 grms. of ammonia in 2000 c.c. of water, is shaken continuously in a stoppered bottle with 200 grms. of mercuric oxide for one hour. The liquid is filtered, and the filtrate is treated with 40 c.c. of ordinary soda lye and 40 c.c. of a saturated solution of sodium carbonate, and is again shaken with 100 grms. of mercuric oxide for one hour. The liquid is now free from ammonia, and the amine is recovered by distillation of the filtrate.—J. F. B.

Chloral; New reaction for ——. E. Covelli. Chem.-Zeit., 1907, **31**, 342.

ONE c.c. of castor oil is warmed on the water-bath for ten minutes in a porcelain dish; then a fragment of antimony trichloride the size of a barley grain is carefully dropped into the middle of the liquid, producing an orange-yellow resinous mass. If a trace of chloral hydrate be allowed to fall on the mass whilst on the water-bath, a deep blue-green coloured point forms, which subsequently enlarges. The chloral may be dissolved in the castor oil, which is warmed on the water-bath, and then, on adding antimony chloride, the same deep blue-green coloration forms around the antimony after five to fifteen minutes. If the chloral be in aqueous solution, it can be extracted with ether, and the ethereal solution evaporated to complete dryness after the addition of 1—2 c.c. of castor oil.—F. SHDN.

Citrate of lime. F. Watts. West Ind. Bull., 1906, **7**, 331—337.

THE export of raw, or even of concentrated lime juice, involves expensive packages and heavy charges for freight. It has been suggested that, instead of exporting the juice, the citric acid in it should be converted into citrate of lime, the dried salt being then exported. The author describes the following process for the manufacture of citrate of lime from the juice:—To the hot juice, a creamy mixture of chalk and water is added with constant stirring until the acid is neutralised. The insoluble citrate thus produced subsides at once, and the clear, supernatant liquor is run off; the citrate is washed with hot water several times (in order to remove gummy substances), and then filtered to remove as much of the water as possible. The salt is dried at 150°—200° F. (or even up to 250° F.) in a chamber in which there is good air circulation. The citrate, thus prepared, is a white powder, free from hard lumps; it should contain over 60 per cent. of citric acid. The chalk employed for neutralisation must be free from magnesium salts and from more than traces of iron, alumina, and phosphates. The chalk may be replaced in part by slaked lime; if this is done, the lime should be added first (sufficient to neutralise, say, 9/10 of the citric acid), the process being finished with chalk; the use of lime alone is not advisable, since impurities are thereby precipitated. The manufacture of citrate of lime requires more skill and is probably more expensive than the concentration of lime juice. The process presents the following advantages, however:—The great loss of citric acid, which occurs in boiling down the juice, is avoided. A superior product is obtained. The salt can be stored without loss. (See also this J., 1902, 442.)—L. E.

Carbon dioxide; Reduction of —— to formaldehyde in aqueous solution. H. J. H. Fenton. Chem. Soc. Proc., 1907, **23**, 83—84.

THE author finds that by the action of metallic magnesium under appropriate conditions, on an aqueous solution of carbon dioxide, recognisable quantities of formaldehyde can be obtained, and that the amounts are considerably increased if weak bases, such as ammonia, aniline, phenylhydrazine or aluminium hydroxide, are also present. Further, it is found that formic acid may readily be reduced, in part at any rate, to formaldehyde by the action of magnesium, so that the desired reduction of carbon dioxide may be effected also in two stages, with formic acid as the intermediate product.

Cerium salts; New ——. G. T. Morgan and E. Cohen. Chem. Soc. Proc., 1907, **23**, 74.

ALTHOUGH in many cases the cerous salts of carboxylic acids, such as the cinnamate, are insoluble, uncrystallisable substances, it has now been shown that the aromatic sulphonates of this element are usually soluble, crystalline compounds resembling the thorium sulphonates previously described by one of the authors (Chem. Soc. J., Abstr., 1904, i., 892). A representative series of these cerous sulphonates has been prepared together with several other salts of inorganic and organic acids. F. B. Power called attention to the formula of cerium oxalate, which the authors had referred to as being $Ce_2(C_2O_4)_3,9H_2O$, and stated that an investigation of this salt, conducted some years ago by F. Shedden and himself (this J., 1900, 636), had conclusively shown that it contains 10 mols. of water. It was thus perfectly analogous in composition to the oxalates of lanthanum and didymium, which may be represented by the general formula, $R'''_2(C_2O_4)_3,10H_2O$.

Mercuric oxychloride; A new ——. J. T. Hewitt. Chem. Soc. Proc., 1907, **23**, 10.

ON allowing solutions of sodium hydroxide and mercuric chloride in sodium chloride to diffuse into one another, a layer of sodium chloride solution of intermediate density being interposed, very dark red crystals having the formula, $Hg_6O_5Cl_2$, are deposited. These were at first considered to be red mercuric oxide or mercuric hydroxide, since on solution in hot dilute nitric acid and addition of silver nitrate solution no precipitate was obtained. It has now been found that if a silver chloride precipitate is suspended in dilute nitric acid, and mercuric oxide added, not only is the latter dissolved but also the silver chloride. In the estimation of chlorine in the oxychloride, the latter was dissolved in warm dilute sulphuric acid, the mercury precipitated with sodium hyposulphite, and after oxidation of the excess of this reagent with dilute nitric acid, the chlorine was estimated in the usual way as silver chloride.

Mercuric acetate in glacial acetic acid solution; Action of —— upon unsaturated fatty acids. A. Leys. XXIV., page 436.

ENGLISH PATENTS.

Isobornyl esters; Manufacture of ——. Chem. Fabr. von Heyden, Radebeul, Saxony. Eng. Pat. 24,830, Nov. 5, 1906. Under Int. Conv., Feb. 16, 1906.

SEE Addition of June 5, 1906, to Fr. Pat. 365,814 of 1906; this J., 1906, 1116.—T. F. B.

Colloidal elements; Process for the production of ——. H. Kuzel, Baden, Austria. Eng. Pat. 25,864, Nov. 15, 1906. Under Int. Conv., Dec. 12, 1905.

SEE Fr. Pat. 371,799 of 1906; following these.—T. F. B.

UNITED STATES PATENTS.

Morphine; Process of making alkyl ethers of ——. L. H. Reuter, New York. U.S. Pat. 842,011, Jan. 22, 1907.

ANHYDROUS morphine dissolved in alcohol is treated with an anhydrous alkylating agent, which may consist of methyl oxalate and dimethyl sulphate, in presence of an anhydrous substance containing an alkali metal. A reducing agent may be present with the object of preventing the oxidation of the morphine.—J. F. B.

Boric acid esters. H. Thron, Assignor to Verein. Chininfabriken Zimmer und Co., Frankfort, Germany. U.S. Pat. 841,738, Jan. 22, 1907.

SEE Eng. Pat. 11,574 of 1906; this J., 1907, 113.—T. F. B

Vanillin; Process of making ——. E. L. Froger-Delapierre, Courbevoie, France. U.S. Pat. 841,957, Jan. 22, 1907.

SEE Eng. Pat. 4909 of 1902; this J., 1903, 439.—T. F. B.

Iodine preparation; Organic ——. E. Fischer, Berlin. U.S. Pat. 842,140, Jan. 22, 1907.

SEE Fr. Pat. 362,370 of 1906; this J., 1906, 714.—T. F. B.

Acetylene carbonic acid derivative. C. Moureu, Paris. U.S. Pats. 843,289 and 843,290, Feb. 5, 1907.

SEE Eng. Pat. 8787 of 1902; this J., 1903, 547.—T. F. B.

Alcohols and fatty acid; Process of effecting a combination between selected members of the ——. E. Twitchell, Wyoming. U.S. Pat. 844,426, Feb. 19, 1907.

SEE Fr. Pat. 371,689 of 1906; following these.—T. F. B.

French Patents.

Aminobenzoic acid alkamine esters [amino-alcohols] and their derivatives; Process of making ——. Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated Jan. 22, 1906, to Fr. Pat. 361,734, Aug. 31, 1905. (See Eng. Pat. 17,162 of 1905; this J., 1906, 607.)

In the present addition to the main patent a more detailed description of a method of preparing the compounds claimed is given, and also a slight modification of the claims. According to the modified claim, the methods include the combination of aminobenzoic acids or alkylaminobenzoic acids with alkamines according to known methods, and also heating aminobenzoic or alkylaminobenzoic esters of halogenated alcohols with ammonia or primary or secondary amines.—A. S.

Amino-acid alcohols and their derivatives; Preparation of ——. Soc. anon. des Etab. Poulenc Frères and E. Fourneau. Fr. Pat. 371,808, Feb. 1, 1906.

Processes are described for the preparation of an aminoacid alcohol of the formula, $(CH_3)_2N.CH_2.C(CH_3)(OH)COOH$, or its ester, $(CH_3)_2N.CH_2.C(CH_3)(OH)COOR$, and of the derivative, $(CH_3)_2N.CH_2.C(CH_3)(OR_1)COOR$, where R_1 is an acid residue such as C_6H_5CO. Amongst examples, the interaction of chlorodimethoxyacetic acid and dimethylamine is given.—F. Shdn.

p-Iodoguaiacol; Production of colourless and crystalline ——. E. Tassilly and J. Leroide. Fr. Pat. 371,982, Feb. 6, 1906.

Crystalline *p*-iodoguaiacol, $C_6H_3.OCH_3.OH.I(2:1:4)$, can be produced by the interaction of an acyl derivative of guaiacol, such as acetyl-guaiacol, iodine, and mercuric oxide, in the presence of a dehydrating agent.—F. Shdn.

Fatty acids; Combination of slightly volatile compounds, containing alcoholic hydroxyl, with ——. E. Twitchell. Fr. Pat. 371,689, Nov. 20, 1906.

A slightly volatile alcohol such as glycerol can be made to combine with a fatty acid in the presence of a small quantity of a fatty sulpho-acid at a temperature high enough to evaporate the water formed by the reaction. —F. Shdn.

Colloidal elements; Process for the preparation of ——. H. Kužel. Fr. Pat. 371,799, Nov. 26, 1906. Under Int. Conv., Dec. 12, 1905.

The patent relates to the preparation of colloidal solutions, in water or other liquid, of elements of high melting point, such as chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, boron, silicon, thorium, zirconium, platinum, osmium, and iridium. The element is first brought to a fine state of division by grinding and sifting, &c., or by cathodic disintegration, and is then converted into the colloidal state by repeated alternate treatments for long periods with dilute acid solutions and dilute alkaline or neutral solutions, under the influence of moderate heat and violent agitation. After each treatment the material is washed with distilled water or other solvent until completely free from the reagent employed.—A. S.

German Patents.

Anthraquinone derivatives; Process for preparing ——. F. Bayer und Co. Ger. Pat. 171,293, July 31, 1904. IV., page 405.

Arylanthranilic acids; Process for preparing ——. J. Goldberg and F. Ullmann. Ger. Pat. 173,523, Feb. 21, 1905.

Arylanthranilic acids are obtained by the interaction of anthranilic acid and bromobenzene or one of its *p*-substitution derivatives, or *a*-bromonaphthalene, in presence of copper.—T. F. B.

Quinol and its chloro-derivatives; Process for preparing thio-derivatives of ——. Badische Anilin und Soda Fabrik. Ger. Pat. 175,070, May 26, 1905.

A *p*-quinone or a chloro-derivative thereof is treated with compounds of the formula, HSR, where R represents an acid radical (the action of thiosulphuric acid on benzoquinone is excepted, being claimed in Ger. Pat. 120,560); compounds of the formula, $C_6H_3(OH)_2SR$, are obtained; oxidation of these furnishes the corresponding quinone, which can be further treated with the sulphur compound. The thio-derivatives can be converted to the mercaptans and thence to the disulphides by saponification or reduction; the latter react further with quinone to form the diquinolsulphide.—T. F. B.

Hydroxybenzoic acids from the corresponding cresols; Process for preparing ——. P. Friedländer and O. Löw-Beer. Ger. Pat. 170,230, May 27, 1905.

Cresols can be converted into the corresponding carboxylic acids by heating to a high temperature with metallic oxides or peroxides, in presence of excess of alkali; suitable oxides are manganese peroxide, lead peroxide, ferric oxide, and cupric oxide.—T. F. B.

Anethol oxide and isosafrol oxide; Process for preparing ——. P. Höring. Ger. Pat. 174,496, June 9, 1905.

The oxides of anethol and isosafrol are obtained by the action of alkali on the hydroxyhalogen compounds of the ethers, of the formula $R.CH(OH)CHX.CH_3$, where X represents a halogen, and R the radical, $CH_3O.C_6H_4.$ or $CH_2O_2:C_6H_3.$; these may be replaced by their esters with fatty or aromatic acids. The above hydroxyhalogen compounds are obtained by heating the dihalogen compounds with aqueous acetone, in presence of pieces of marble, whilst their esters are produced by the action of alkali salts of carboxylic acids on the dibromides of the requisite propenylphenol ethers.—T. F. B.

Sulphinic acids; Process for preparing aromatic ——. Knoll und Co. Ger. Pat. 171,789, Sept. 16, 1905.

Aromatic compounds are agitated with aluminium chloride, and sulphur dioxide and hydrogen chloride are passed simultaneously through the mixture, which is kept cold during the reaction; the aluminium salt of the sulphinic acid is diluted with water, decomposed by an alkali, and the concentrated solution precipitated by acid.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 344.)

Photographic image; Properties of the latent ——. E. Demole. Compt. rend., 1907, **144**, 565—567.

The treatment of an exposed photographic plate with a mild oxidising agent, *e.g.*, a 1 per cent. solution of potassium ferricyanide, has the effect, on subsequent development in red light, of correcting any ill-effects of over-exposure. If the same plate be developed in white [candle] light the image is reversed, and the reversal is sharper the greater the over-exposure. But with very prolonged exposures, a reversal of the reversal takes place on development in white light. For instance, a Lumière plate exposed behind a negative for one second gave a good positive when developed in red light. With exposures ranging from 1 to 170 seconds, followed by oxidation and development in white light, the results were negatives. When exposed for three minutes, a positive showed at first which changed into a negative on full development. With seven minutes' exposure a constant positive was obtained but with "foggy whites"; finally with fourteen minutes' exposure a constant and vigorous positive was obtained on development in white light. The author suggests that if the "latent image" be silver sub-bromide, Ag_2Br, this is oxidised by the treatment to silver hypobromite:—

$$4Ag_2Br + 4H_2O + 3O_2 = 4AgOBr + 4AgOH + 2H_2O.$$

The hypobromite would be reduced with difficulty by the developer alone, thus correcting over-exposure. It would be reduced under the combined action of the developer and actinic light, but less rapidly than the surrounding silver bromide which had not been affected by the

oxidation. Thus the latent image would be stable and the rest unstable, so that the image would be reversed.
—J. F. B.

Photographic processes; Theory of ——. *III.* S. E. Sheppard and C. E. K. Mees. Roy. Soc. Proc., 1907, A, **78**, 461—472.

The authors summarise the conclusions of their work on photographic processes as follows:—*Ripening* is due both to the formation of resonating systems in the emulsion, and to the formation of a reduction product intermediate between the silver halide and the half-halide, Ag_2X; the gelatin is of value in forming resonators, and in assisting in the reduction. In *exposure*, light is absorbed and electrons set free, the halide being ionised; the gelatin conserves the electrons. The ionisation assists the reduction, which probably results in formation of the silver half-halide in solid solution; the gelatin possibly combines with the free halogen. Destruction of the latent image may be due to (*a*) free halogen during and after exposure; (*b*) desensitisers during exposure (cupric, mercuric, ferric, and uranium salts); (*c*) oxidising agents (*e.g.*, chromic acid) after exposure, when halogen may possibly be released from the gelatin; (*d*) reversal of either reaction by the halogen. *Development* consists of reduction of the subhalide to metallic silver, and the deposition of further silver on the silver germs; the gelatin acts as a filter against germs, and thus prevents fogging. *Fixation* has been previously discussed (this J., 1906, 654).—T. F. B.

English Patent.

Silver pictures; Process for converting —— into pictures in higher oxides of manganese, and for toning silver pictures, and baths therefor. Neue Photographische Ges., Steglitz, Germany. Eng. Pat. 21,584, Sept. 29, 1906. Under Int. Conv., Oct. 12, 1905.

See Additions to Fr. Pats. 345,033 and 345,583 of 1904; this J., 1907, 280.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 344.)

United States Patents.

Nitroglycerin; Manufacture of ——. F. L. Nathan, J. M. Thomson, W. Rintoul, and A. Scott, Waltham Abbey. U.S. Pat. 841,886, Jan. 22, 1907.

See Fr. Pat. 366,593 of 1906; this J., 1906, 1068.—T. F. B.

Explosive; Waterproof metallic ——. T. A. Bayliss, King's Norton, and H. W. Brownsdon, London. U.S. Pat. 845,678, Feb. 26, 1907.

See Eng. Pat. 23,366 of 1904; this J., 1905, 1084.—T. F. B.

French Patent.

Match paste; Hygienic ——. Soc. Anon. Fabbriche Riunite di Fiammiferi. Fr. Pat. 371,535, Nov. 16, 1906.

The composition consists of:—Solid hydrogen phosphide, P_4H_2, (10 parts), zinc oxide (10), powdered glass (10), potassium chlorate (20), gum (15), and water (20 parts).
—G. W. McD.

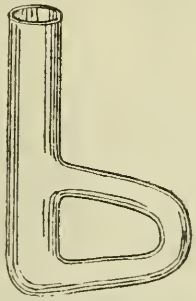
XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 348.)

APPARATUS.

Melting-points; Apparatus for determining ——. J. Thiele. Ber., 1907, **40**, 996—997.

The figure shows the apparatus; the vertical tube is about 12 cm. long and 2 cm. in diameter, and the bent connection about 1 cm. in diameter. The tube is filled with sulphuric acid above the upper communication, and heat is applied at the outer bend. The resulting circulation of the acid raises the temperature in the wide tube, (in which are placed the thermometer and the capillary containing the substance), with great regularity, and at a rate which can be regulated to a nicety by regulating the heating at the bend.—J. T. D.



Methane; Determination of —— in fire-damp. N. Gréhant. Compt. rend., 1907, **144**, 555—556.

For the determination of methane, the principal constituent of fire-damp, the author employs an apparatus which he calls a "eudiomètre-grisoumètre," consisting of a cylindrical bulb of 50 c.c. capacity, terminating in a narrow graduated tube on which the observations are made. The gaseous mixture (methane and air) is ignited by passing an electric current through a platinum spiral introduced up the tube over water, until it reaches the centre of the bulb. The ignition produced by the first passage of the current results in a very incomplete combustion. In order to obtain correct results with dilute mixtures (*e.g.*, air from coal mines) it is necessary to pass the current 200 times, and to bring the platinum spiral to a white heat. With ordinary long eudiometer tubes, the difficulty of inducing complete combustion is very much greater. The ignition-spiral is withdrawn, and the carbon dioxide is absorbed by potassium hydroxide solution.—J. F. B.

INORGANIC—QUANTITATIVE.

Zinc; Influence of iron and manganese on the determination of ——. M. Huybrechts. Bull. Soc. Chim. Belg., 1907, **21**, 121—127.

When zinc is determined volumetrically by the sodium sulphide method, low results are obtained if iron or manganese have been removed by previous precipitation. Even a double precipitation of these metals is insufficient to prevent loss of zinc. Good results are, however, obtained by adding iron and manganese to the standard solution of zinc used, in amounts equal to those present in the solution to be examined.—F. Sodn.

Sulphides; Conditions of precipitation of metallic ——. M. Padoa and L. Cambi. Atti R. Accad. dei Lincei Roma, 1906 [5], **15**, II., 787—796; Chem. Zentr., 1907, **1**, 933—934. (See this J., 1906, 138.)

The authors have determined the pressure of hydrogen sulphide required to produce precipitates of metallic sulphides in solutions containing varying quantities of metallic salts and acids. The pressures employed ranged from 15 mm. to 9 atmospheres, and the salts examined were cadmium and zinc chlorides, and zinc and ferrous sulphates. In neutral solutions of cadmium chloride, a precipitate is produced by a pressure of hydrogen sulphide of 15 mm.; in solutions of zinc salts, a higher pressure is required. In a neutral *N*/10 solution of ferrous sulphate, a precipitate is produced by hydrogen sulphide at a pressure of 200—300 mm., but in acid solutions higher pressures are required, according to the concentration of the acid, *viz.*, *N*/250, nearly 1 atmosphere; *N*/200, 2·7 atmospheres; *N*/100, 5·5 atmospheres; and in *N*/50 acid solutions, 9·2 atmospheres. Incidentally it is pointed out that the solubility of nickel and cobalt sulphides, which is frequently quite lost sight of, stands between that of zinc sulphide and that of ferrous sulphide.—A. S.

Nitrous acid in dyehouse water; [Determination of ——]. E. Ristenpart. V., page 405.

Ferrous oxide; Reduction of —— by hydrogen and carbon monoxide. W. Wyss. X., page 412.

Zinc sulphate; Determination of —— in roasted blende. H. Pommerenke. X., page 414.

Alloys rich in chromium; Electrochemical analysis of ——. G. Gallo. XI*B*., page 418.

Superphosphates; Determination of free acid in ——. J. van Dormael. XV., page 424

Manganese in drinking water; Determination of ——. H. Noll. XVIII*B*., page 429.

ORGANIC—QUALITATIVE.

Mannitol; Test for purity of ——. O. Carletti. XVI., page 425.

Sarcina; Detection of ——. W. Bettges. XVII., page 427.

Camphor, synthetic; Tests for ——. A. Baselli. XX., page 431.

Veronal [Diethylmalonylurea]; Characters and reactions of ——. P. Lemaire. XX., page 432.

Chloral; New reaction for ——. E. Covelli. XX., page 433.

ORGANIC—QUANTITATIVE.

Turpentine or abietic acid; New method for the determination of crude —— in resins of different kinds, oil- or copal-varnishes, pitch, and paper. H. Rebs. Protokoll 1. Sitzg. d. Komm. z. Bekämpf. v. Miss-ständ. in d. Herst, &c., v. Farben u. Malmaterialien in Nürnberg, 1906, 35—36. Chem. Zentr., 1907, **1**, 997—998.

Ten grms. of the substance under examination are heated with 20—25 c.c. of 10 per cent. alcoholic potassium hydroxide solution for a quarter of an hour on the water-bath under a reflux condenser, the resulting soap is decomposed with dilute hydrochloric acid, and the separated resin is filtered off, washed with cold water, and dried. It is then powdered and extracted with about 50 c.c. of hot petroleum ether. From the solution, the abietic acid is precipitated with ammonia, filtered off, dried on the water-bath, and the ammonia expelled by gentle heating. The residue represents the amount of crude turpentine.—A. S.

Paraffin; Determination of —— in ozokerite and ceresin. J. Marcusson and H. Schlüter. III., page 401.

Caoutchouc; Nitrosites of ——, and their application in the analysis of raw rubber and rubber goods. II. P. Alexander. XIII*C*., page 422.

Catechol-tannins in sumach; Determination of ——. M. Nierenstein and T. A. Webster. XIV., page 423.

Antipyrine; Quantitative determination of ——. J. D. Riedel. XX., page 432.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 348.)

Magnetic compounds of non-magnetic elements. E. Wedekind. Ber. deutsch. physik. Ges., 1906, **4**, 412—416. Chem. Zentr., 1907, **1**, 936—937.

Non-magnetic manganic arsenide, MnAs, is converted, on heating, into the magnetic compound, Mn_2As. Magnetic and non-magnetic manganese phosphides are also known. Manganese carbide, Mn_3C, prepared in the electric furnace, is magnetic, whilst the silicide, Mn_2Si, is non-magnetic. Manganese bismuthide is strongly magnetic, although bismuth is a typical diamagnetic element. Of the manganese nitrides, Mn_3N_2 and Mn_5N_2, prepared in the combustion furnace, are non-magnetic, whilst another nitride, (Mn_7N_2?), is magnetic only when it has been heated to the temperature of the oxyhydrogen blast flame, and when ammonia and not nitrogen has been used in its preparation. The magnetic properties of manganese sulphide are improved by heating. Anhydrous manganous iodide is magnetic. Aqueous solutions of manganous salts possess greater magnetic susceptibility than solutions of ferric salts.—A. S.

Argon; Preparation of —— from air by means of calcium carbide. F. Fischer. Ber., 1907, **40**, 1110—1111.

A commercial calcium carbide mixture containing 10 per cent. of calcium chloride is heated in a thick-walled iron tube in a combustion furnace to 800° C., and exhausted, till gas ceases to be evolved. Dry purified air (or nitrogen) is then caused to pass through the tube, the process being if necessary repeated (with intermediate passage through drying and purifying tubes) till all oxygen and nitrogen are absorbed. The oxygen forms with the calcium carbide lime and carbon; the nitrogen cyanamide and carbon; the remaining gas is crude argon.—J. T. D.

Radium and its transformation products; Effect of temperature on the activity of ——. H. L. Bronson. Roy. Soc. Proc., 1907, A, **78**, 494—500.

Curie and Danne have shown that the rate of transformation of the active deposit from radium was apparently permanently increased after it had been submitted to temperatures above 800° C. This has been explained by the author (this J., 1906, 140), but Makower has recently stated that the rate of decay of radium *C* is undoubtedly affected by high temperatures, a result which can be explained on the assumption of the volatilisation of radium *C*. The author now gives the results of experiments, which show no evidence whatever of any change in the activity of the transformation products of radium when they are subjected to temperatures between − 180° and 1600° C.; any change which does take place must be very small—less than 1 per cent.—for the emanation of radium *B* between − 180° and 1500° C., and for radium *C*, between − 180° and 1600° C.—T. F. B.

Mercuric acetate in glacial acetic acid solution; Action of —— upon unsaturated fatty acids. A. Leys. Bull. Soc. Chim., 1907, I., 262—268.

In a former communication (this J., 1905, 558) the author described the reactions given by certain substances containing ethylene bonds with a solution of mercuric acetate in glacial acetic acid. He now gives the results of further experiments upon fatty and other acids, 1 grm. of the substance being heated, in each case, for 15 minutes under a reflux condenser with 50 c.c. of the reagent prepared in the same way as before. In the case of unsaturated fatty acids (crotonic, oleic, elaidic, and "linoleic" acids) there is an abundant separation of mercurous acetate. The unsaturated dibasic acid, fumaric acid, gives only a precipitate of mercuric fumarate on cooling, whilst the isomeric maleïc acid gives no precipitate, though a mercurous salt can be detected in the solution. Saturated fatty acids (butyric, lauric, palmitic, stearic acids, &c.) either give no precipitate or are themselves thrown down as the respective mercuric salts; whilst monobasic acids containing hydroxyl groups (*e.g.*, lactic and glyceric acids) give no precipitate. Dibasic saturated acids behave differently with the reagent. Thus, oxalic acid is precipitated as mercuric oxalate, whilst succinic acid gives a deposit of mercurous acetate. In the case of dibasic acids containing hydroxyl groups (tartronic, malic, tartaric acids), the precipitation follows the general rule. When an unsaturated fatty acid, or its glyceride, gives a deposit of mercurous acetate, there is a simultaneous fixation of mercury at the ethylene bond. The compound thus formed of olein with mercury is a brown syrup, which on exposure to the air becomes coated with a fine layer of mercury. If it be dissolved in benzene, and a few drops of an alcoholic solution of stannous chloride added, there is an immediate black precipitate of mercury. Prolonged boiling of the olein with the mercuric acetate solution has the effect of causing the "mercurised" olein to solidify, soon after separation, into a mass of semi-transparent crystals. These melt to a brown liquid when heated, and recrystallise on cooling. Olein saturated with mercury gives a brilliant yellow coloration with nitric acid, apparently identical with that obtained in Poutet's reaction. For the determination of the mercury in these compounds, the volumetric method of Denigès (this J., 1896, 678) is recommended, the mercury being first brought into aqueous solution as follows: The solution of the substance in chloroform is treated with an excess of an alcoholic solution of iodine, which displaces the whole of the mercury After about an hour, a solution of potassium iodide is added, followed by a slight excess of sodium thiosulphate to decolorise the liquid, the whole transferred to a separating funnel, and the chloroform layer withdrawn. The aqueous solution is then concentrated on the water-bath, cautiously treated with *aqua regia*, and evaporated nearly to dryness, after which the directions of Denigès (*loc. cit.*) are followed.—C. A. M.

Amygdalin; Hydrolysis of —— by acids. R. J. Caldwell and S. L. Courtauld. Chem. Soc. Proc., 1907, 23, 71.

With the object of obtaining further evidence as to the constitution of amygdalin, the authors have systematically studied the action of acids in comparison with that of enzymes on this "bioside." The results show that, although amygdalin is ultimately resolved by acids into hydrogen cyanide, benzaldehyde, and two molecular proportions of dextrose, the separation of the dextrose is effected in two stages. The hydrolysis of the biose section of the molecule proceeds only at about one-sixth of the rate at which maltose is hydrolysed under like conditions. By carefully hydrolysing amygdalin by means of a normal solution of hydrogen chloride at 60°, the authors have prepared the mandelonitrile glucoside which E. Fischer obtained by subjecting the bioside to the action of an extract of yeast; this method of obtaining the glucoside appears to be in some respects advantageous, the product being more easily purified.—

Prulaurasin. Mandelonitrile glucosides. R. J. Caldwell and S. L. Courtauld. Chem. Soc. Proc., 1907, 23, 71—72.

In order to ascertain whether the glucoside prepared by hydrolysing amygdalin is a direct product or one which has undergone isomeric change, the authors have subjected it to the action of alkalis; they find that it is converted into a substance identical with the isomeric substance prulaurasin, isolated by Hérissey from laurel leaves. Fischer's glucoside, therefore, bears the same relation to prulaurasin as amygdalin bears to the *iso*amygdalin described by Dakin, which is to be regarded as the derivative of inactive mandelonitrile, amygdalin and Fischer's glucoside being derived from *l*-mandelonitrile. As the rotatory power of prulaurasin is intermediate between that of Fischer's glucoside and that of sambunigrin, the second isomeride of Fischer's glucoside recently described by Bourquelot and Danjou, the latter must be regarded as the β-glucoside of *d*-mandelonitrile. Characteristic acetyl derivatives have been prepared from amygdalin, *iso*amygdalin, Fischer's glucoside, and prulaurasin.

Amygdalin; Hydrolysis of —— by emulsin. S. J. M. Auld Chem. Soc. Proc., 1907, 23, 72.

Although amygdalin is generally described as the maltoside of benzaldehydecyanohydrin, since on hydrolysis it produces two molecules of dextrose, it is probable that the biose residue is an unknown α-β-disaccharide, capable of hydrolysis both by emulsin andmaltase. The hydrolysis of amygdalin by emulsin may proceed in three ways, depending on the mode of attachment of the emulsin. Either mandelonitrile glucoside and dextrose are first produced with subsequent hydrolysis of the former, or benzaldehydecyanohydrin and the α-β-disaccharride are formed, and the latter then resolves into two molecules of dextrose, or, lastly, the amygdalin may undergo fission into the three components by direct abstraction of the dextrose residue attached to the benzaldehydecyanohydrin molecule. The experiments so far carried out indicate that the second process of cleavage is the true one.

Trade Report.

Brazil; Export trade of ——.

Bd. of Trade J., April 4, 1907.

The "Brazilian Review" publishes the following statistics of the export trade of Brazil during the year 1906, with comparative figures for the preceding year:—

	Quantity.		Value.	
	1905.	1906.	1905.	1906.
	kilos.	kilos.	£	£
Carnäuba wax .	1,896,757	2,559,247	207,818	420,016
Castor seed ...	2,645,775	3,126,047	24,017	37,491
Cotton	24,081,753	31,668,400	1,157,714	1,656,730
Cotton seed ...	37,493,736	30,903,888	108,458	122,034
Flour, manioc, or cassava ..	5,276,146	6,644,103	77,859	88,863
	grms.	grms.		
Gold, bar	3,878,698	4,547,940	420,128	492,656
	kilos.	kilos.		
Herva-matte ..	41,119,930	57,796,403	1,236,550	1,856,574
Hides and skins	29,027,396	35,044,764	1,851,584	2,475,721
	tons.	tons.		
Manganese	224,377	121,331	332,827	179,380
	kilos.	kilos.		
Monazite sand	4,437,290	4.351,600	100,038	99,143
Piassava	1,287,943	1,373,528	37,875	39,074
Rubber	35,392,611	34,960,184	14,415,771	14,055,911
Scrap metal ...	3,925,796	6,104,107	29,644	42,983
Sugar	37,746,510	84,948,346	405,954	606,217

New Books.

The Twentieth Century Book of Recipes, Formulas, and Processes. Containing nearly ten thousand selected Scientific, Chemical, Technical, and Household Recipes, Formulas, and Processes for Use in the Laboratory, the Office, the Workshop, and in the Home. Edited by Gardner D. Hiscox, M.E., Author of "Mechanical Movements, Powers, and Devices," "Gas, Gasoline, and Oil Engines," &c. Crosby Lockwood and Son, 7, Stationers' Hall Court, London. 1907. Price 12s. 6d. net. The Norman W. Henley Publishing Company, New York.

8vo volume, containing 787 pages of subject matter, arranged after the fashion of a technological dictionary, and with illustrations.

Commercial Organic Analysis. A Treatise on the Properties, Modes of Assaying, and Proximate Analytical Examination of the various Organic Chemicals and Products Employed in the Arts, Manufactures, Medicine, &c. With Concise Methods for the Detection and Determination of their Impurities, Adulterations, and Products of Decomposition. By Alfred H. Allen, Past-President of the Society of Public Analysts, Public Analyst for the West Riding of Yorkshire, &c. Third Edition, rewritten and revised. Vol. II.—Part III. Acid Derivatives of Phenols, Aromatic Acids, Resins, and Essential Oils. Revised by the Author and Arnold R. Tankard. J. and A. Churchill, 7, Great Marlborough Street, London. 1907. Price 20s.

8vo volume, containing 533 pages of subject matter, and the alphabetical index. The subjects treated of in this volume are classified under the following heads:—I. Aromatic Acids.—(i.) Sulphonated Phenols and their Allies. (ii.) Benzoic Acid and its Derivatives. (iii.) Cinnamic Acid and its Derivatives. (iv.) Salicylic Acid and its Allies. (v.) Dihydroxybenzoic Acids and their Allies. (vi.) Gallic Acid and its Allies. (vii.) Phthalic Acids. II. Resins.—(i.) Chemical Composition of Resins. (ii.) General Characters of Resins. (iii.) Resins. (iv.) Oleo-resins or Turpentines. (v.) Gum-Resins. III. Volatile or Essential Oils.—(i.) Extraction of Essential Oils. (ii.) Classification. (iii.) General Characters. (iv.) Analysis of Essential Oils. (v.) Constituents of Essential Oils. (vi.) Hydrocarbons of Essential Oils. (vii.) Caoutchouc and Gutta-Percha. (viii.) Olefinic Terpene Alcohols and Aldehydes of Essential Oils. (ix.) Cyclic Terpene Alcohols of Essential Oils. (x.) Phenols, Phenolic Ethers, and Ketones of Essential Oils. (xi.) Ketones of Essential Oils. (xii.) Sulphuretted Constituents of Essential Oils. (xiii.) Special Characters of Individual Essential Oils. (xiv.) Terpeneless Essential Oils. (xv.) Table of all the better-known Essential Oils.

Monographies Industrielles—Aperçu Economique, Technologique et Commercial. XIV. Industries du Papier. Fabrication et Mise en Œuvre du Papier et du Carton. 10×6½. 200 pages. (Office de Publicité J. Lebègue et Cie., Rue de la Madeleine 46, Bruxelles.) 1906.

This is a further publication by the Belgian Government in the special Department under the Ministry of Industry and Labour. An illustration of the works at Huy, belonging to the Godin Company, serves as the frontispiece. It is pointed out that, according to the census of 1896, there were in Belgium 21 paper mills, 13 cardboard factories, 11 packing paper manufactories, four vegetable parchment works, and three wood pulp factories. The present report deals with 38 of these establishments, employing in all 2675 workpeople, conducted by private firms, and 14 limited companies with 3297 workpeople, these latter being among the largest and most important concerns of this kind in the kingdom. Complete information is furnished concerning the methods of working, the machinery employed, the raw materials, and the finished products, with illustrations of the plant and of the mode of carrying out the various operations.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

7709. Martini and Huneke. Storage and transference of inflammable liquids.* April 2.

7759. Carter. Composition for treating pipe coverings. April 3.

8253. Koeber's Eisen- und Bronzewerke. Strainer for filter presses. [Ger. Appl., Nov. 23, 1906.]* April 9.

8274. Candy Filter Co., Ltd., and Candy. Filters. April 9.

8317. Mayor, Aldermen and Citizens of Bradford, Wyld, and Shepherd. Towers or other apparatus for absorbing, eliminating, or condensing vapours. April 10.

8374. Mackenzie. Apparatus for condensing steam or other vapour and for treating and cooling vapours and fluids.* April 10.

8640. Grunow. Machines for whisking and mixing liquid or semi-liquid and pasty and dry powdery matters. April 13.

Complete Specifications Accepted.

8323 (1906). Bornett. Apparatus for filtering gases or liquors. April 17.

8744 (1906). Brewis and Allen. Extraction with volatile solvents. April 10.

12,502 (1906). Kestner. Concentration of liquids. April 17.

15,776 (1906). Meyersburg. Production of a definite mixture of gas and liquid. April 17.

23,019 (1906). Kestner. Apparatus for atomising liquids and simultaneously mixing them with air or gas. April 10.

27,247 (1906). Hess. Apparatus for purifying gases. April 19.

II.—FUEL, GAS, AND LIGHT.

Applications.

7665. Craig. Manufacture of air-gas. April 2.

7805. Lorin. Gas generators. [Fr. Appl., April 4, 1906.]* April 3.

7845. Brüner. Gas producers. April 4.

7857. Börlin. Production of solid fuel.* April 4.

7879. Renaux. Artificial fuel. [Fr. Appl., April 28, 1906.]* April 4.

8022. Dingler. Production of compressed carburetted air. April 5.

8066. Keough. Gas retorts. [U.S. Appl., April 9, 1906.] April 6.

8178. Asplund. Combustible liquid for lighting and heating. [Appl. in Denmark, Aug. 28, 1906.]* April 8.

8223. Reneaux. Agglomeration of carbon dusts. [Fr. Appl., June 19, 1906.]* April 9.

8247. Haulot. Manufacture of artificial fuel. April 9.

8293. Tully. Apparatus for the manufacture of heating or illuminating gas. April 9.

8315. Lynde. Apparatus for producing gas for illuminating from petrol or other spirit or oil. April 10.

8512. Chutter. Producer gas generators. April 12.

8563. Deuts. Gasglühlicht A.-G. Manufacture of metallic illuminating bodies for electric incandescence lamps. [Ger. Appl., Aug. 30, 1906.]* April 12.

Complete Specifications Accepted.

7357a (1906). Vivian. Manufacture of artificial fuel. April 10.

8154 (1906). Terneden and Müller. Manufacture of water gas. April 17.

8521 (1906). Allport. Coke oven plant. April 17.

11,099 (1906). Browne. Manufacture of gas from coal and carbonaceous materials. April 17.

11,409 (1906). Brit. Thomson-Houston Co. (General Electric Co.). Manufacture of incandescence bodies for electric lamps with tungsten compounds. April 10.

15,326 (1906). Sabatier. Manufacture of a gaseous mixture containing hydrogen and methane. April 10.

19,048 (1906). Deschamps. Gas producers. April 10.

24,349 (1906). Von Dulong. Apparatus for carburetting air. April 10.

3303 (1907). A.-G. f. Selasbeleuchtung. Mixture of gas and air. April 17.

3553 (1907). A.-G. f. Selasbeleuchtung. Mixing and supplying gases. April 17.

4814 (1907). Siemens und Halske A.-G. Manufacture of electric incandescence filaments. April 17.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

7932. Grossmann. Treatment of effluents from ammonia stills. April 5.

8486. Fama. Treatment of benzenes and mineral essential oils. [Ital. Appl., April 12, 1906.]* April 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

8111. Levinstein, Ltd., and Levinstein. Dyestuffs and dyeing therewith. April 8.

8162. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. April 8.

Complete Specifications Accepted.

5749 (1906). Newton (Bayer und Co.). Manufacture of azo dyestuffs. April 17.

6723 (1907). Meister, Lucius, und Brüning. Manufacture of easily reducible indigo. April 17.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

7749. Sharp, and Sharp and Sons. Apparatus for producing silk like effects on textile fabrics.* April 2.

7830. Steiner. Mercerising cotton and ramie rovings. April 3.

8078. Imray (Meister, Lucius, und Brüning). Dyeing with sulphurised dyestuffs. April 6.

8111. Levinstein, and Levinstein, Ltd. *See under* IV.

8245. Schmitz. Manufacture of oils and soaps suitable for Turkey-red dyeing.* April 9.

8288. Raw. Treatment of ramie and similar substances. April 9.

8568. Friedrich. Dyeing textile materials.* April 2.

8631. Imray (Meister, Lucius, und Brüning). Dyeing with sulphurised dyestuffs. April 13.

COMPLETE SPECIFICATIONS ACCEPTED.

10,609 (1906). Pantin, exor. of Abel (Act.-Ges. f. Anilinfabr.). Production of grey tints on furs, feathers, and the like. April 10.

16,461 (1906). Calico Printers' Association, and Gray. Ageing and steaming chambers for fabrics. April 10.

18,512 (1906). Bendel. Treatment of ramie and other textile substances. April 17.

28,021 (1906). Sefton-Jones (L'Huillier). Cop dyeing and material therefor. April 17.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

COMPLETE SPECIFICATION ACCEPTED.

6048 (1907). Feldmann and Feldmann. Accentuating the granulation of leather by dyeing. April 17.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

7775. Acheson. Manufacture of graphite. [U.S. Appl., Dec. 10, 1906.]* April 3.

7776. Acheson. Treatment of amorphous bodies. [U.S. Appl., Dec. 31, 1906.]* April 3.

8164. Hellsing. Recovering sulphur from sulphuretted hydrogen and gases containing same. [Swed. Appl., April 9, 1906.]* April 8.

8476. Johnson (Chem. Fabr. Griesheim-Electron). Manufacture of chlorine compounds of lime. April 11.

8576. Chem. Werke F. Friedlaender. Manufacture of insoluble aluminium acetate. [Ger. Appl., April 17, 1906.]* April 12.

8643. Chem. Werke F. Friedlaender. Manufacture of insoluble organic aluminium salts. [Ger. Appl., Sept. 4, 1906.]* April 13.

COMPLETE SPECIFICATION ACCEPTED.

22,525 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable hydrosulphites. April 17.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATION.

8268. Koenig. Glass furnace.* April 9.

COMPLETE SPECIFICATION ACCEPTED.

15,539 (1906). Engelhorn. Treatment of corundum for the manufacture of ceramic compositions. April 17.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

7832. Heuer. Production of plastic wall coverings.* April 3.

8084. Hahn. Bituminous solutions for preventing dust. April 6.

8161. Schnell, Mayer and Hartwich. Manufacture of a substitute for wood.* April 8.

8232. Gans. Manufacture of anhydrous alumino-silicates or artificial zeolites. [Ger. Appl., July 3, 1906.]* April 9.

8478. Auner. Substitute for wood, horn, rubber, and like materials.* April 11.

8619. Stanley. Manufacture of bricks, &c., from powdered clay and like material. April 13.

COMPLETE SPECIFICATIONS ACCEPTED.

12,353 (1906). Bougleux. Manufacture of cement. April 17.

12,713 (1906). Cass. Preventing dust and mud on roads. April 17.

19,241 (1906). Wolman. Solutions for preserving wood. April 17.

X.—METALLURGY.

APPLICATIONS.

7694. Wells and Drake. Coating steel and iron with lead. April 2.

7698. Boult (Du Faur). Separating copper from acid or neutral solutions.* April 2.

7709. Lash. Reduction of iron oxides.* April 2.

7946. Muirhead. Desiliconising or purifying cast iron. April 5.

8052. Holloway. Treatment of slags from tin smelting furnaces. April 6.

8242. Fell (Soc. Internat. de Metallurgie Nouvelle). Manufacture of plates, sheets, and leaves of steel coated with copper.* April 9.

8543. Galbraith. Production of metal for use in the manufacture of malleable iron castings. April 12.

8567. Boult (Chapman). Separation of certain non-metallic from other mineral substances. April 12.

8589. New Delaville Spelter Co., Ltd., and Shortman. Recovery of zinc vapours which usually escape from the receivers of zinc extraction furnaces. April 13.

COMPLETE SPECIFICATIONS ACCEPTED.

5479 (1906). Lebedeff and Pomeranzoff. Treatment of sulphide ores preparatory to obtaining the metals. April 10.

7277 and 7277A (1906). Betts. Making aluminium. April 10.

7892 (1906). Picaud. Manufacture of steel. April 10.

8648 (1906). Timm. Production of spongy iron. April 17.

8913 (1906). Monnot. Manufacture of compound metal ingots. April 17.

10,536 (1906). Webb, Brettell, and Adamson. Smelting, melting, and heating ores, metals, &c. April 17.

15,081 (1906). Cocking, and Kynoch, Ltd. Solvent for cupro-nickel. April 17.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATIONS.

7742. Cowper-Coles. Electric furnaces. April 2.

7757. Billitzer. Electrolysis of alkali chlorides or the like.* April 2

7791. Grönwall, Lindblad, and Stalhane. Electric transformer furnaces.* April 3.

7836. Joseph, and Ozonair, Ltd. Apparatus for ozonising air.* April 3.

8036. Craig. Electrodes for producing ozone from oxygen or air. April 6.

8255. De Ferranti. Electric furnaces. April 9.

8284. Thiellet and Denard. Accumulators. [Fr. Appl., April 12, 1906.]* April 9.

8387. British Thomson-Houston Co. (General Electric Co.). Electrical apparatus for manufacturing nitrogen compounds. April 11.

8405. Lennox. Electrolytic ozonising, disinfecting, and deodorising. April 11.

8445. Gröndal-Kjellin Co., Ltd., and Härdén. Electric furnaces. April 11.

8560. Marshall. Electroplating solution.* April 12.

8562. Paweck. Electro-deposition of zinc. April 12.

COMPLETE SPECIFICATIONS ACCEPTED.

8345 (1906). De Marçay. Accumulators. April 10.

13,731 (1906). Terry. Electric accumulator plates. April 10.

14,001 (1906). Czarnikow. Manufacture of substances having insulating properties. April 17.

21,348 (1906). Pörscke. Galvanic cells. April 17.

5345 (1907). Allmäna Svenska Elektriska Aktiebolaget. Electric furnaces. April 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

8083. Hahn. Treatment of oils and fats for manufacturing purposes. April 6.

8245. Schmitz. *See under* V.

Complete Specification Accepted.

21,086 (1906). Kock. Apparatus for purifying oil. April 17.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*B.*)—Resins, Varnishes.

Application.

7713. Defrance. Varnish or other paint vehicle. April 2.

(*C.*)—India-Rubber.

Applications.

7714. Rouxeville. Agglomeration and regeneration of india-rubber, guttapercha, and their substitutes. [Ger. Appl., April 2, 1906.]* April 2.

8026. Neufeld. Elastic substances.* April 5.

8150. Radclyffe and Olsson-Seffer. Preparation of rubber. April 8.

8478. Auner. *See under* IX.

Complete Specifications Accepted.

10,820 (1906). Arkless. Apparatus for vulcanising rubber goods. April 17.

14,896 (1906). Vincent. Recovery of benzine and other volatile products disengaged during the drying of freshly gummed fabrics in the rubber industry. April 10.

16,368 (1906). Fenton. Elastic compositions. April 17.

17,775 (1906). Foelsing. Production of pure caoutchouc. April 17.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

8381. Gevaert-Naert. Manufacture of artificial leather and similar products.* April 10.

8478. Auner. *See under* IX.

Complete Specifications Accepted.

10,083 (1906). Sargent. Depilating process. April 17.

6048 (1907). Feldmann and Feldmann. *See under* VI.

XV.—MANURES, &c.

Complete Specification Accepted.

17,878 (1906). Macdonald. Process of making manures very dry and acid free without mechanical heat. April 17.

XVI.—SUGAR, STARCH, GUM, &c.

Complete Specification Accepted.

9416 (1906). Fokanyi, De Tornyay, and Weiser. Drying molasses and molasses foodstuffs. April 17.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

8082. Hunt. Maturing or purifying potable spirits, such as whiskey, brandy, or rum. April 6.

8372. Mertens. Manufacture of beer.* April 10.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

8077. Rigaut. Manufacture of alimentary products. April 6.

8262. Okazaki. Manufacture of vegetable nitrogenous nutrient.* April 9.

8422. Bredenkamp and Christiansen. Desacidification and purification of old butter. April 11.

Complete Specifications Accepted.

9416 (1906). Fokanyi, De Tornyay, and Weiser. *See under* XVI.

26,002 (1906). Caverhill. Treatment of barley and other cereal grains for food purposes. April 10.

29,552 (1906). Ozonair, Ltd., Rogerson, and Briant. Manufacture of an aerated beverage. April 17.

(*B.*)—Sanitation; Water Purification.

Applications.

7989. Wolfsholz. Neutralising waste water containing acid, and recovering the metals.* April 5.

8273. Candy Filter Co., Ltd., and Candy. Manufactures for use in the purification of water and other liquids. April 9.

8590. Adams. Apparatus for sewage purification. April 13.

(*C.*)—Disinfectants.

Application.

8405. Lennox. *See under* XI.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

8179. Soc. Franç. de la Viscose. Manufacture of viscose. [Fr. Appl., April 9, 1906.]* April 8.

8369. Knoll und Co. Manufacture of cellulose derivatives and their solutions. [Ger. Appl., April 10, 1906.]* April 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

23,875a (1906). Weizmann, and The Clayton Aniline Co. Manufacture of isobornyl esters and obtainment of bye-products. April 10.

8375. Garin and David. Treatment of substances containing crude tartar. [Fr. Appl., April 12, 1906.]* April 10.

Complete Specifications Accepted.

8260 (1906). Dubosc. Manufacture of camphene. April 17.

8260a (1906). Dubosc. Process of oxidising camphene. April 17.

8356 (1906). Dubosc. Manufacture of camphene. April 17.

8356a (1906). Dubosc. Process of oxidising camphene. April 17.

3176 (1907). Zeitschel. Production of primary terpene alcohols from ethereal oils containing linalool or coriandrol or their ethers. April 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

7885. Newton (Lumen, Ges. m. b. H.). Photographic plates or films.* April 4.

8440. Wellington. Photographic plates. April 11.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

7837 and 7838. Ceipek. Manufacture of safety explosives. April 3.

8156. Von Schroetter. Manufacture of explosives. [Ger. Appl., April 11, 1906.]* April 8.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. Full particulars will appear later.

In accordance with the provisions of Rule 18 of the By-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir Boverton Redwood has been nominated to the office of President, under Rule 8; Prof. Percy Frankland, Mr. C. C. Hutchinson and Mr. Walter F. Reid have been nominated Vice-Presidents under Rule 8; and Mr. Eustace Carey has been nominated a Vice-President under Rule 11. Prof. W. R. Hodgkinson has been nominated an ordinary member of Council under Rule 17; and the Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Members are hereby invited to nominate fit and proper persons to fill four vacancies among the ordinary members of the Council. Forms for this purpose can be obtained, on application, from the General Secretary.

Extract from Rule 18.—"No such nomination shall be valid unless it be signed by at least ten members of the Society, who are not in arrear with their subscriptions, and by the nominee, nor unless it be received by the General Secretary at the Society's office, not later than the last day of May prior to the commencement of the Annual General Meeting, at which the election to which the nomination refers is to take place. Nor shall any such nomination be valid if the person nominated be ineligible for election under By-laws 12 or 15. No member shall sign more than one nomination form."

Liverpool Section.

Meeting held at University, on Wednesday, April 10, 1907.

DR. JAMES T. CONROY IN THE CHAIR.

THE UTILISATION OF WASTE INDIA RUBBER.

BY WALTER F. REID, F.I.C.

To the chemist there is in reality no waste; it is simply a matter of expediency whether and in what way any substance shall be utilised. The waste product of one industry forms the foundation of subsidiary industries, and it not infrequently happens that the by-product replaces its parent or becomes the mainstay of the manufacturer. In this connection, some of us can still remember the time when coal-tar was an objectionable by-product, difficult and costly to dispose of; the chlorine products of the Leblanc soda process render competition with the ammonia process possible, and we have explosives manufacturers erecting soap-works for the sake of the glycerine which was formerly poured down our sewers in enormous quantities. It is, in fact, a rare occurrence that a new industry is started without the production of some by-product for which a use has to be found.

It is not often that the industry producing the by-product is the only outlet for its own waste, as is the case with india-rubber. In this instance, practically the whole output becomes, sometimes in a very brief space of time, a waste product. In some cases, as with motor-car tyres, mechanical deterioration takes place long before chemical changes cause disintegration; but in others oxidation of the material renders it unfit for its original purpose.

For many years, especially while abundant supplies of crude rubber were obtainable at moderate prices, little attention was paid to waste rubber, although as early as 1846 it was recognised that such waste might be utilised with advantage, and Parkes laid the foundation of the alkaline method of recovery. Of late years, however, there have been remarkable developments in the india-rubber industry. The increased demand, mainly due to electrical progress and improved methods of locomotion, has more than equalled the immediately available sources of supply, and the result has been a considerable increase in price. The total production of rubber last year was about 68,000 tons, and the increase in the annual output has been about 15,000 tons in five years. As bearing upon the quality of the material, it will be interesting to ascertain the chief sources of supply. America easily leads the way with a production of 42,800 tons, of which 41,000 tons, or nearly two-thirds of the whole quantity harvested, is credited to Brazil. Much has been said and written lately about the production of rubber in Mexico, and considerable amounts of American capital have been invested in "Guayule" rubber; but last year the whole production of Mexico only amounted to 200 tons, so that the quantity of this low-class rubber is not yet of importance. It has been calculated that only about 300,000 tons of the shrub "parthenium argentatum" from which "Guayule" rubber is extracted are available, and, with a yield of 6 per cent. of rubber, this quantity would only produce about 18,000 tons of rubber.

Africa comes next as regards quantity, the output being 23,400 tons. The Congo Free State is here the largest producer, having brought 4500 tons into the market. In view of the methods by which this rubber is obtained, it can scarcely be expected that the production will be materially increased in this district. Germany is devoting much attention to rubber in her African colonies, and will soon be producing plantation rubber.

The rubber derived from Asia and Polynesia is estimated at 1800 tons per annum; but this quantity will probably increase rapidly within a few years, and no doubt "plantation" rubber will in time displace "Para" from its premier position as regards quality. Some of the rubber sent to us from plantations in the east is of excellent quality, quite equal to the best "Para," and very free from impurities; but many of those who grow the rubber are not sufficiently informed as to the requirements of the user, and there is here a wide field for the trained chemist, as compared with the chemical inventor who has not been trained. It is estimated that trees already planted should, in about 10 years' time, yield some 25,000 tons of rubber per annum; but too little is known of the influence of climate, soil, and diseases of the trees to make this a reliable estimate.

The great bulk of the rubber produced is of good quality, and, if it went into consumption in the state of purity in which it is received by the manufacturer, the average quality of the waste would also be high. Unfortunately, however, substances of the most varied properties are added during the process of manufacture. Mineral matters of various kinds sometimes make up the greater part of the weight of what is sold as india-rubber, while the rubber itself is largely replaced by substitutes, generally consisting of some form of solidified oil. One ingredient, however, is common to nearly all forms of manufactured rubber, and it is this that has proved the stumbling-block to most inventors who have endeavoured to utilise rubber waste. I refer to the sulphur used in vulcanising, part of which enters into chemical combination with the rubber, and which is very difficult to expel again without injuring the quality of the material. Vulcanisation is at present a necessity, for no other process has yet been discovered which renders rubber so inert to changes of temperature. Once the vulcanisation has taken place, however, the cut surfaces of rubber will no longer adhere to each other, and the material cannot be worked into a homogeneous mass. It is probably the sulphur that is the cause of the disintegration of rubber, because crude rubber will keep for a great number of years without deterioration. Here is a piece of crude Para rubber 65 years old. It was bought in Glasgow in 1842, weighs one ounce, and cost 2s. 6d., and is practically in the same state now as then. This other piece of raw rubber came into my possession in 1861, and is also in quite good condition. The best sample of vulcanised rubber I have met with, is a red rubber stopper now 20 years old; but, as you will observe, it has become quite brittle outside, although still soft inside. Nearly all old vulcanised articles contain traces of sulphuric acid, due to the gradual oxidation of the free sulphur, and this is probably the main cause of the deterioration. Rubber which has become brittle through age cannot be regenerated by any of the processes at present in use, and is practically valueless. In many cases, however, rubber articles have to be discarded long before chemical disintegration sets in. Motor-car tyres and shoes are worn out by attrition, sometimes in a very short time, and yield valuable material for the industry we are discussing. The inner pneumatic tubes of bicycles and motor cars are the best waste available on a large scale; but, as they can be utilised by grinding and mixing with fresh rubber without undergoing any chemical process, they command a relatively high price. Manufactured rubber contains mineral matters of various kinds, known as filling materials or compounding materials. The most frequently used are calcium carbonate, calcium sulphate, magnesium carbonate, magnesia, barium sulphate, zinc oxide, litharge, white lead, china clay, French chalk, and lithopone.

In regenerating rubber, it is not necessary to remove all of these; but their presence naturally diminishes the value of the product obtained. Perhaps the most troublesome impurity in rubber waste is fibre derived from the fabrics which so frequently form the basis of rubber goods. In a motor-car tyre, for instance, there may be 8 or 10 thicknesses of fabric in about half-an-inch. The best method of removing fibre is the mechanical one, as this does not deteriorate the quality of the rubber. The whole mass is ground into a coarse powder which is then exposed to a current of air by means of which the fibres are removed, and the rubber is left behind. The separation is only partial; but the removal of the fibre is generally complete enough for practical purposes.

There are, however, some materials in which the fibre is so intimately incorporated with the rubber that it cannot be separated by mechanical means. In such cases, the grinding is continued until the fibre is reduced to a powder which remains in the recovered rubber, or the fibre is destroyed by chemical means. The chemical reagents used differ according to the nature of the fibre. Vegetable matter is destroyed by treatment with an acid, generally sulphuric acid, or an acid salt, followed by heating. The decomposed fibre can then be washed out, together with such mineral matter as is soluble in the acid used. For the destruction of animal fibre, such as wool, an alkaline solution is preferable, followed by drying and subsequent washing. Although india-rubber is less acted upon by both acids and alkalis than the fibres with which it is mixed, yet there is always sufficient action to deteriorate considerably the quality of the recovered product. Innumerable attempts have been made to recover rubber by dissolving the waste in a suitable solvent; but most of these have failed, owing to the fact that vulcanised rubber becomes insoluble in the usual solvents for raw rubber. It will swell in many liquids; but will not dissolve until such a degree of heat is applied that the rubber itself is decomposed. Vulcanised rubber can be converted into a homogeneous mass by superheating; but this causes a decomposition of the rubber itself, and, although the product can be used in admixture with fresh rubber, and has even great cementitious powers, it is very deficient in elasticity and tensile strength. Many of the varieties of recovered or regenerated rubber in the market are in reality overheated, while some are over-worked.

There are many liquids which will lixiviate part of the free sulphur from the vulcanised material; but in most cases their use involves a permanent deterioration of the rubber, which still retains the bulk of the free and practically the whole of the combined sulphur.

Last year M. A. Tixier, a French chemist, made the interesting observation that vulcanised rubber was completely soluble in terpineol. Upon this fact, a process for the regeneration of waste rubber has been based, the patent specification for which was recently published (Fr. Pat. 370,619, Oct. 19, 1906; this J., 1907, 265). The rubber, whether vulcanised or not, is reduced to pulp and digested with twice its weight of terpineol in a closed vessel fitted with an agitator. The temperature specified is 100° to 150° C. The solution thus obtained is agitated with four times its volume of benzene. Insoluble impurities subside, the clear liquid is decanted, and the benzene distilled off. The rubber is then precipitated by the addition of alcohol or acetone. Regenerated rubber obtained in this way resembles the natural product more than any other kind that I have seen. It is very viscid, and will stand a large admixture of neutral mineral substances. It can be re-vulcanised and possesses considerable power of resistance to chemical reagents. This latter quality is probably due to the fact, that the method of preparation eliminates the resinous impurities of the rubber which are most readily attacked by acids or alkalis.

In spite of the poor quality of the rubber recovered by the old processes, the trade in this article is considerable, especially in the United States. No less than 10,600 tons of waste rubber was imported into that country last year. The recovered rubber exported amounted to 380 tons, of which Great Britain took 211 tons. Our home production of recovered rubber is considerable, but official statistics are not available.

Waste rubber is sorted into about a dozen different grades, which vary in price according to the quality of the rubber which they contain and the greater or less difficulty of extracting. For instance, white trimmed rubber is quoted at about 6d. per lb., while automobile tyres are worth about 5½d. per lb. This classification, however, is only a rough one, and on arrival at the factory the waste must be carefully sorted.

Discussion.

Mr. **Max Muspratt** said that Ceylon rubber had undoubtedly been most disappointing as compared with Para. Small supplies of Ceylon rubber came on the market, and every manufacturer wishing to try it, a rather fictitious value was given to it at one time. It was an open question what place it was going to take. The washed dried prices were appreciably below Para. Its price would have to be very considerably reduced, because it was lacking, say, in strength; whilst every chemical test would indicate its being as good as Para. There are many kinds of rubber, but when one considers the washed dried article, Para was at the top of the list. Then came the West Indian and West African. Nearly a year ago he gave the experts of the Tropical Research Department in Liverpool samples of Ceylon rubber, and asked them to examine where it was wrong, but he did not know how far the experiments had gone. With regard to this recovery process, exactly the same question arose: how did the recovered rubber compare with either Para or West Indian or West African, upon the washed dried samples? That was the problem to be faced by everyone who starts in the recovery of rubber. None had so far come upon the market which in any way approached the natural rubber in its washed dried condition. There was a large number of stages of vulcanisation, and suppose one had a rubber where 3 per cent. of the sulphur has entered into combination, and one recovers the rubber, no matter what its chemical composition is, it would still be capable of further vulcanisation with more sulphur, and still capable of combining with the sulphur.

Mr. **Reid**, in reply to questions of the Chairman, Mr. H. B. Stocks, Prof Donnan, and Mr. Collingwood Williams, said that terpineol had a boiling point of 214° C.; according to the specification it was not in contact with the rubber at all at the time it is being distilled. It was only in contact with the residues, of which there was a considerable quantity. Terpineol was very volatile in steam, and could be distilled with steam very easily. The particular sample he exhibited was clear, and it had been used about seven or eight times. The loss of the liquid was about 5 per cent. The question of combined sulphur depended, of course, upon the kind of rubber being vulcanised, and also upon the use to which the rubber was put. The percentage of sulphur must necessarily vary.

If rubber tubing were kept in water, there is no doubt it kept very much better, but his own experience was that the action of light was the great deteriorating agent. He had seen the previous year's rubber in forests in Brazil; where it had been exposed to the sun, it was brittle, and where it was protected from the light, it was quite good. It might be on the same tree but not under the same conditions of light. He used to make electrical fuses for explosive work, the wires of which were covered with rubber, in some cases 5 or 6 yards long, and if these were folded up and put on a shelf with the ends exposed to the light, the exposed parts would crumble to powder; but if kept in the dark, they remained fairly sound.

Isoprene could be produced from rubber; Prof. Tilden had published an interesting paper on the subject in the Chemical Society's Journal. He did not think any practical use could be made of it at present. He only mentioned it as being of scientific interest. It was the only instance he knew of india-rubber having been produced artificially. He could give no exact figures as to the cost of the Tixier process. He saw the work on a commercial scale, and had no doubt that the process was a paying one, because Frenchmen, like Englishmen, as a rule did not continue working processes on which they lost money.

He was glad that Mr. Max Muspratt had corroborated what he had said about Colonial rubbers. Some had been good, and some bad. What was really wanted is intimate contact between the producers and the users; that intercourse should be carried on by technical men. One should go and see in what way the Colonial rubber differs from the Para.

He did not know of any rubber substitute that could be vulcanised by itself and a good product obtained. The sample of Tixier rubber was actually india-rubber, whereas the substitutes cannot be vulcanised to produce an article which would be mistaken for rubber. All the substitutes were in practice mixed with fresh rubber.

The cost of the terpineol was the first thing that suggested itself to him as a practical man. He got an offer from one of the largest Continental chemical firms to supply him with any quantity from 1000 to 5000 tons a year at a very reasonable price for lots of not less than 5 tons at a time. That would be about double the quantity required to work up all the rubber imported into England in a year.

London Section.

Meeting held at Burlington House, on Monday, April 8, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

OBSERVATIONS ON COTTON AND NITRATED COTTON.

BY H. DE MOSENTHAL, F.I.C.

In my previous paper on this subject(1) I stated that the optical properties of cotton—the appearance in polarised light, the rotatory power and refractive index—formed a subject so large that it would have to be dealt with in another paper. I now propose to record the esults of investigations in those fields, and to add some further observations which may prove of interest.

I have for nearly three years had the assistance of Mr. M. W. Stevens, A.R.C.S., A.I.C. I am likewise greatly indebted to my friend Mr. C. O. Lundholm, the manager of Nobel's Ardeer Factory, for his great kindness and valuable advice. He was good enough to have some of the material I required specially prepared for me, and to cause all the nitrogen determinations to be made at the factory.

The nitrogen percentages given in this paper are those arrived at by the Ardeer method of using the nitrometer. This consists in preparing the solution of nitrocellulose in sulphuric acid separately and not in the nitrometer itself, and keeping it cool in ice water. The Ardeer results are on an average 0·16 per cent. higher than Schulze-Tiemann results, and 0·27 per cent. higher than those given by the Waltham Abbey and Woolwich method of using the nitrometer.

The acetone used was specially redistilled for me. The ethyl acetate was the best commercially procurable. Those of the materials at my disposal, which were specially made at Ardeer, were prepared from clean raw material, the nitration being carried out in glass or porcelain with pure acids, and the stabilising done with distilled water. The others, with the exception of two samples purchased in London, were obtained from various Continental factories, and are the nitrated cottons made by them for different technical purposes.

The nitrocelluloses examined were :—

No.	Nitrated material.	Nitrogen, per cent.	Soluble, per cent.	Relative viscosities (in 0·1 secs.)
1*	Cotton	13·50	0‡	—
2*	,,	13·20	10	—
3*	,,	12·95	80	—
4	,,	12·44	100	31
5	,,	12·37	100	36
6†	,,	12·33	98	32
7*	,,	12·30	99	155
8	,,	12·29	100	95
9†	,,	12·27	98	38
10	,,	11·96	100	35
11	,,	11·36	100	29
12*	,,	11·19	98	35
13	,,	11·10	100	41
14*	,,	10·86	98	34
15*	Wood cellulose	13·30	10	—
16*	,,	12·80	98	—
17*	,,	12·52	95	—
18*	Ramie	13·22	10	—
19*	,,	11·75	98	—
20*	Flax	13·15	10	—
21*	,,	11·76	98	—

‡ Soluble extracted.

The numbers marked with an asterisk (*) were specially made at Ardeer, and the raw material used was thus at my disposal. Those marked † were bought at wholesale chemists, the others were obtained from factories on the Continent.

The nitrated wood cellulose, Nos. 15 and 17; the nitrated ramie, Nos. 18 and 19; and the nitrated flax, Nos. 20 and 21, were prepared in the same manner as the nitrated cotton, Nos. 2 and 4. The nitrated wood cellulose, No. 16, was prepared in the same way as nitrated cotton, No. 3.

The solubility is to be understood "in ether-alcohol," *viz.*, 2 vols of methylated ether (sp. gr. 0·72) and 1 vol. of alcohol (sp. gr. 0·76).

The viscosities of the soluble nitrated cottons were determined with 1 per cent. solutions in ether-alcohol (2 vols. of ether of sp. gr. 0·72 at 15° C. and 1 vol. of alcohol sp. gr. 0·81 at 15° C.), the solutions having a density of approximately 0·76 at 20° C., at which temperature the determinations were made in a rising bulb viscosimeter.

1. *Microscopic examination and depolarisation.*—Hübner and Pope(2) have stated that the microscopic examination of cotton, and more particularly mercerised cotton, offers difficulties due to the transparency of the fibre, and further, that if mounting agents are used, more difficulty is experienced owing to the refractive index of the fibre approximating to that of the medium and to the consequent loss of definition. I cannot agree with this statement. I find that with judicious illumination the fibre can always be distinctly seen, and that, with practice, the iris diaphragm can be opened entirely without loss of definition. Permanent mounts can be made in Canada balsam, the fibre being distinctly visible provided the Canada balsam is quite hard. I obtain the best results

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(1) This J., March 31, 1904, p. 292.

(2) This J., April 30, 1904, p. 404.

when benzene is used as the solvent for the Canada balsam, and the preparations are kept for 24 hours or more at 40° C., and then allowed to stand in the air for some days so that the balsam may become hard. I have tried numerous other methods of mounting, choosing media of higher or lower refractive power, but have always returned to Canada balsam, although, as will be seen in a later section of this paper, the refractive index of cellulose only differs from that of hard Canada balsam by 0·004.

When examining the unmounted fibres the use of alcohol is very advantageous. As far back as 1847, Hartig(³) used alcohol with a few drops of acetic acid to examine guncotton under the microscope. Bokorny(⁴) recommends the use of alcohol with the subsequent addition of water, and considers that the alcohol has the effect of removing the air from the fibre. I prefer to use 50 per cent. alcohol, or, if stronger alcohol is to hand, to moisten with water either before or after applying it to such a degree as to approximate a 50 per cent. alcohol.

When examining fibres with polarised light I cannot find any advantage in the use of mica plates nor of the quartz wedge as Hübner and Pope used them, although certainly with the latter, and turning the analyser through nearly 90° so as to obtain a blue background, a very beautiful picture is seen. For the determinations of detail in structure I never use polarised light, but only to distinguish the difference between nitrated and non-nitrated fibres *inter se.*

According to Chardonnet(⁵) when examined in polarised light nitrated cotton up to 7 per cent. of nitrogen is distinguished by the presence of contracted fibres, though all still appear brilliant. As the nitration proceeds, *i.e.*, from 7 per cent. to 9 per cent. of nitrogen, contracted fibres become more abundant, and these are mixed with fibres which appear iridescent. From 9 per cent. of nitrogen upwards the fibres appear evenly grey and then pass from yellow to orange until the nitrogen amounts to 11·25 per cent. If the nitration is continued the fibres at first appear colourless, then violet, dark blue, and ultimately light blue. According to Morton Liebschütz(⁶) the tetranitrate (11·11 per cent. nitrogen) appears yellow, the pentanitrate (12·75 per cent.), blue, and the hexanitrate (14·14 per cent.), grey, in polarised light. Lunge and Weintraub(⁷) state that they cannot confirm Liebschütz, and consider it impossible to distinguish between the penta- and hexa-nitrates, having found more grey fibres in a nitrocotton of 13 per cent. nitrogen than in one with 13·85 per cent.

I find that whilst certain nitrocelluloses of the degree of nitration mentioned by Chardonnet behave in polarised light as he indicates, this cannot be said to be the rule. Nitrocelluloses of the same degree of nitration, prepared by different methods as to temperature, acid mixture, and time of immersion, show different colours in polarised light, and the appearance differs with the raw material used. Dry fibres do not present the same appearance as when moistened, and the colours not only vary with different moistening liquids, but also with the same liquid at different dilutions. The colours are, moreover, affected by the degree of magnification, and they, of course, appear differently in daylight and artificial light. That the appearance of nitrated fibres in polarised light should be a function of the method and not of the degree of nitration, and that different kinds of fibre when nitrated should not be identical, seems but natural when one considers that the change of colour is due to changes in the anisotropic condition of the fibre, brought about by physical influences, and cannot be dependent on chemical changes alone.

The following observations were made with 30 linear magnification in daylight, the fibres being moistened with 50 per cent. ethyl alcohol :—

No.	Material nitrated.	Nitrogen, per cent.	Appearance in polarised light.
1	Cotton	13·50	Light blue.
2	,,	13·20	Do. 15 per cent. yellow.
3	,,	12·95	Blue-grey, some slate-grey.
4	,,	12·44	Bright blue.
5	,,	12·37	Dark blue.
6	,,	12·33	Bluish-grey.
7	,,	12·30	Dark blue, some fibres orange or yellow.
8	,,	12·29	Dark blue, some fibres orange or yellow.
9	,,	12·27	Faint blue, some fibres dull pink.
10	,,	11·96	Red or orange, 25 per cent. dark blue.
11	,,	11·36	Does not depolarise, only an occasional colourless fibre visible.
12	,,	11·19	50 per cent. orange, 50 per cent. dark blue.
13	,,	11·10	Straw colour, an occasional fibre dark blue.
14	,,	10·86	Dull orange.
15	Wood cellulose	13·30	Silver-grey.
16	,,	12·80	Does not depolarise, only a few bright white fibres visible.
17	,,	12·52	Bluish-grey.
18	Ramie	13·22	Light blue, an occasional fibre yellow.
19	,,	11·75	Light blue, some dark blue.
20	Flax	13·15	Light blue.
21	,,	11·76	50 per cent. dark blue, 50 per cent. violet.

It will be noticed that nitrated wood cellulose appears grey in polarised light, the shades varying from blue-grey to slate-grey, and that some nitrated wood celluloses do not depolarise at all.

Mr. C. F. Cross handed me a sample of cellulose triacetate and one of cellulose monoacetate, which I examined in polarised light. The former appeared light-blue, closely resembling the highest nitrate examined. The latter appeared brilliant, like untreated cellulose fibre, but viewed with ordinary light the fibres appeared contracted, as described by Chardonnet, for the lowest nitrates.

2. *Density.*—The Chemiker Kalender gives the density of cellulose as 1·525, Cross and Bevan(⁸), 1·5, Watts' Dictionary (Second Edition), 1·25 to 1·45. In none of these cases is there any indication as to the nature of the cellulose examined, or the method of determination adopted. In some of the most recent books which refer to guncotton we still find the density given as 1·5.(⁹) Guttmann, in 1895,(¹⁰) stated it to be 1·5, whilst in 1900,(¹¹) he mentions 1·634 as the absolute density of guncotton, by which he evidently means a nitrated cotton of about 13 per cent. nitrogen. There also is to be found no mention of the method of determination.

In the course of these investigations the absolute densities of the different nitrocelluloses examined have been determined, and when the raw materials were available, their densities were likewise ascertained, and a number of check experiments were made with other samples of cotton-wool. The densities were determined in Regnault pyknometers of 100 c.c. capacity in water. It was found by experience that it was best to boil the water and to introduce it hot into the vessel after about 10 grms. of the dried material had been pushed in and weighed. The water was allowed to soak into the material, and it was then boiled again by means of the air pump. As a rule, all the air was removed thus, and only in a few instances was it necessary to mechanically assist the escape of some remaining bubbles. The failure of the water to rise in the neck of the pyknometer under the bell jar of the air-pump upon exhaustion, or to fall when air was subsequently admitted, was taken as an indication that all air had been removed.

(³) Untersuchungen über den Bestand und Wirkungen der explosiven Baumwolle, Braunschweig, 1847.

(⁴) Die mikroskopische Veränderung der Baumwolle beim Nitriren.-Chem.-Zeit, Dec., 1896.

(⁵) *See* Carl Süvern—Die Künstliche Seide, Berlin, 1900, p. 25.

(⁶) Moniteur Scientifique, 1891, 119

(⁷) Zeits. angew. Chem., May 16, 1899

(⁸) Cellulose. Cross and Bevan, London, 1895.

(⁹) Sprengstoffe, &c. F. Heise, Berlin, 1904.

(¹⁰) The Manufacture of Explosives. O. Guttmann, London, 1895.

(¹¹) Schiess-und Sprengmittel. O. Guttmann, Braunschweig, 1900.

The results obtained were as follows :—

Material nitrated.	Density of raw material.	No.	Nitrogen, per cent.	Density of the nitrated material in water.
Cotton	1·607	1	13·5	1·665
,,	1·607	2	13·2	1·659
,,	1·607	3	12·95	1·672
,,	—	4	12·44	1·642
,,	—	5	12·37	1·681
,,	—	6	12·33	1·676
,,	1·607	7	12·30	1·654
,,	—	8	12·29	1·676
,,	—	9	12·27	1·666
,,	—	10	11·96	1·658
,,	—	11	11·36	1·669
,,	1·607	12	11·19	1·675
,,	—	13	11·10	1·653
,,	1·607	14	10·86	1·669
Wood cellulose	1·575	15	13·30	1·715
,,	1·575	16	12·80	1·659
,,	1·575	17	12·52	1·673
Ramie	1·570	18	13·22	1·670
,,	1·570	19	11·75	1·667*
Flax	1·548	20	13·15	1·685*
,,	1·548	21	11·76	1·641

* In benzene.

The various materials in water behaved very differently. It is possible that in many instances air remained enclosed in the fibres, so that the errors would tend to make the values too low ; they are, however, fairly concordant. It was found impossible to get the nitrated ramie, No. 19, and the nitrated flax, No. 20, to settle in water in the pyknometer, and benzene had to be resorted to.

The values found in these determinations of densities of various nitrocelluloses are all higher than the figure given by Guttmann. The values for the celluloses themselves, *i.e.*, cotton, wood cellulose, ramie, and flax, are all higher than the figure 1·525 given in the Chemiker Kalender. The question, therefore, arose whether the high values might not be attributable to the use of water. A number of determinations were made with Johnson and Johnson's best "Red Cross" cotton-wool. The air-dried cotton in water gave a density of 1·523 to 1·525, which it will be seen agrees with the figure given in the Chemiker Kalender. The same cotton perfectly dried both in the oven for three or four days at 40° to 45° C., and for several days in a sulphuric acid desiccator, gave a density of 1·607 to 1·610. These determinations were repeated both in benzene and in alcohol. The results obtained were substantially the same in both these liquids, ranging from 1·56 to 1·58. I have in the following adopted 1·61 as the density of cotton cellulose. The densities of the various nitrocelluloses were redetermined in benzene. The results obtained were by no means concordant. They were all lower than those obtained with water—with the sole exception of the two values already referred to. The differences in some cases were not considerable. The discordance of the results may be due to the high co-efficient of expansion of the benzene, which gives rise to more considerable experimental error. Possibly, in subsequent discussion, this point may be further elucidated.

In order to see whether the density was the same when the fibre was disintegrated, a solution of nitrated cotton, containing 13·2 per cent. of nitrogen (No. 2), D=1·659, was evaporated to dryness. The horny mass thus obtained was broken into fragments of about 6 mm.², and dried at 40° C. for about 24 hours, then ground to pass a 60-mesh sieve, and again dried at 40° C. for 72 hours. The density was then found to be 1·66.

It seems strange at first sight that the densities of nitrated cottons of different degrees of nitration should have practically the same value, and that the increase in weight due to nitration should be so nearly compensated by increase in volume. The following observation may be of interest. Taking the empirical formula for cellulose and calculating the molecular volume we find :—

	M.W.	D	M.V.	dif.
Cotton cellulose	162	1·61	100·6	
Dinitrocellulose	252	1·67	151·9	$\frac{51\cdot3}{2} = 25\cdot65$
Trinitrocellulose	297	1·66	178·7	dif. 26·8

or a mean of 26·2 for NO_2—H. Of course, the multiplication of the formula does not affect this value. The atomic volumes have been determined by Kopp and others for liquids at the boiling point. Nevertheless, the most recent values,(12) $NO_2=32$, $H=5\cdot2$, gives for NO_2—H 26·8, which compares closely with the above.

I may mention for comparison with the above—

	M.W.	D	M.V.	dif.
Glycol	62	1·125	55·1	
Mononitroglycol	107	1·310	81·7	26·6
Dinitroglycol	152	1·500	101·3	19·6

and

	M.W.	D	M.V.	dif.
Glycerin............	92	1·26	73·0	
Dinitroglycerin	182	1·47(13)	124·0	$\frac{51}{2}$ 25·5
Trinitroglycerin	227	1·60	142·0	18

It will be seen that both with glycerin and glycol, the density increases regularly with nitration. The value of NO_2—H is higher for the first than for subsequent substitutions, whilst the contrary holds for cellulose.

It was thought useful to determine the densities of nitrocellulose in solution. Making up solutions of nitrated cotton, a slight amount of sediment was observed in every case. An experiment to purify the material further by filtering a solution, and regaining the nitrated cotton from the filtrate by precipitation in water, and then re-dissolving it, showed that the differences were so slight as to render this excessively troublesome precaution unnecessary. It was found, after several experiments, that the best method of determining the densities of these solutions was to use Regnault's pyknometers of 100 c.c. capacity, the solute being first introduced and then, after weighing, the solvent. The solution was allowed to stand with frequent agitation until it appeared homogeneous. The solution, during this period, was brought nearly to the mark on the neck, and then adjusted at the uniform temperature of 15° C. by adding a few drops of the solvent.

The following are the results :—

Material nitrated.	Nitrogen per cent.	Solute per cent.	D. 15 solution.	D. solute in solution (calculated).	D. solute dry (determined as above).
Cotton	13·2	5·294	0·8267	1·73	1·659
,,	,,	7·207	0·8358	1·80	,,
,,	,,	11·205	0·8540	1·75	,,
,,	,,	13·925	0·8681	1·76	,,
Wood cellulose	13·3	4·790	0·8240	1·79	1·715
,,	,,	7·569	0·8369	1·77	,,
Cotton	11·10	2·564	0·8139	1·82	1·653
,,	,,	4·695	0·8232	1·75	,,
,,	,,	6·109	0·8297	1·75	,,
,,	13·2	4·390	0·9182	1·77	1·659

Acetone (sp. gr. 0·8022 at 15°) was used for all the experiments except the last in the table, where ethyl acetate (sp. gr., 0·8983 at 15° C.) was used.

These results are very closely concordant if one considers the great difficulty of determining densities of substances in dilute solution, since the calculation—

$$D\,(\text{solute}) = \frac{D\ (\text{solvent})}{1 - 100 \times \dfrac{D\ (\text{solution}) - D\ (\text{solvent})}{D\ (\text{solution}) \times \%\ \text{solute}}}$$

depends upon the difference—here only 0·01 to 0·07—between the density of the solution and that of the solvent. The nature of the solute, and its behaviour in the presence of the solvent, made it impossible to obtain solutions of high concentration in the pyknometer, whilst, even with more dilute solutions, the high expansibility of the solvent and the viscosity of the solution make errors unavoidable.

The densities of substances in solution are, as a rule different, and mostly higher than in the solid state,(14) so that the results obtained with solutions of nitrocellulose, as compared with the densities of the material itself, do not present anything abnormal.

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(12) Ostwald, Lehrbuch der Chemie, 2te Auflage, Vol. I., pp. 367 and 374.

(13) Eng. Pat. 28,808, 1904.

(14) Walker. Introduction to Physical Chemistry, London, 1904.

3. *Refraction.*—Hitherto no attempt seems to have been made to determine the refractive index of cellulose or that of any of its esters. The direct measurement of fibres can obviously not be effected, and indirect methods have to be resorted to.

Solutions were examined in a Pulfrich refractometer at 15° C. and the refractive index of the solute calculated both according to the (n-1) and (n^2-1) formulæ(15). The results, however, were not concordant, as shown by the following series :—

Raw material.	Nitrogen per cent.	Solute per cent.	Density of solution.	n_D Solvent (acetone).	n_D Solution.	n_D Solute calculated by	
						(n—l) formula.	(n^2—l) formula.
Nitrated cotton	13·2	4·092	0·8202	1·36333	1·36695	1·5176	1·5302
,,	,,	5·693	0·8279	,,	1·36704	1·4620	1·4728
,,	,,	11·990	0·8593	,,	1·37283	1·4849	1·4748

A method which proved much more satisfactory was adopted. Films were made with the different nitrocelluloses in the following manner :—Solutions were prepared so as to have a viscosity about equal to that of a 5 per cent. solution of a photographic nitrocotton, and allowed to stand for some weeks in carefully corked cylindrical glass vessels in order to allow all undissolved particles to settle. If such a solution was poured on to a glass plate and left to spread, the film when dry detached itself spontaneously from the glass. If, however, the solution was spread out on the glass by tilting it to and fro, a point was reached at which the film was so thin that it would not detach itself, but could still be mechanically removed by liberating the edges. It was at that limit that films of the desired thickness, measuring 0·02 to 0·03 mm., were obtained. These films were thoroughly dried, leaving them for several weeks exposed to the air so as to remove all the solvent without allowing them to shrivel up. Observations were taken at varying intervals during this period until successive readings were constant.

It is well known that films prepared with solutions of nitrocellulose in ether-alcohol or amylacetate remain clear and transparent, whilst films from solutions made with acetone or ethyl acetate become opaque. Amyl acetate could not be used, as the solvent cannot be entirely removed. The soluble nitrocelluloses were therefore dissolved in ether-alcohol, and even then it was found that certain nitrocelluloses gave cloudy or milky films. It was suggested to me that the reason for this cloudiness and also for the opacity of the acetone films was that the moisture of the atmosphere causes the nitrocellulose to come out of solution. The films were therefore made in dry air as follows :—A large gas jar fitting air-tight upon a ground glass plate was furnished with an india-rubber stopper into which two suitably bent glass tubes were introduced, one reaching to the bottom of the jar, with its end bent back to the periphery. Both this long tube and the other shorter one were fitted with drying tubes. The drying tube carried by the shorter bent glass tube was connected with a water pump. A circular glass plate with a solution sufficiently spread out thereon was placed under the gas jar and the pump was allowed to act for about 10 minutes and then disconnected. It was found necessary to allow three or four days for the evaporation of the solution. It thus became possible to obtain clear transparent films of all the soluble kinds with ether-alcohol, and of the insoluble kinds with acetone. I found it impossible, however, to obtain transparent films with nitrated wood cellulose on account of the amount of suspended matter which would not settle even after the solutions had been kept for months.

The transparent films were examined with the Abbé refractometer, using the method indicated by Chwolson(16), which consists in laying a thin plate of the solid substance on to the fixed prism and bringing between it and the movable prism a drop of a highly refracting liquid such as monobromonaphthalene. Care must be taken that none of the liquid gets between the film and the fixed prism. This is more easily avoided if the film is cut of such a size as completely to cover the metallic mount as well as the prism surface. The results were in some instances checked by means of the Pulfrich refractometer according to the method indicated by Ostwald(17). As a mixture of acetone and monobromonaphthalene could obviously not be used, another mixture had to be found which would not attack nitrocellulose. After some experiments it was ascertained that carbon tetrachloride (n_D, 1·4625) is miscible with monobromonaphthalene, and that this mixture is colourless and transparent.

The results were as follows :—

No.	Material nitrated.	Nitrogen per cent.	Refraction n_D.	Dispersion $n_F—n_C$.	Reciprocal of relative dispersion $\gamma = \frac{n_D—1}{n_F—n_C}$.
1*	Cotton	13·5	1·5059	0·01070	47·29
2*	,,	13·2	1·5076	0·01060	47·83
3*	,,	12·95	1·5094	0·01014	50·02
4	,,	12·44	1·5139	0·01003	51·23
5	,,	12·37	1·5139	0·01003	51·23
6	,,	12·33	1·5141	0·01003	51·25
7	,,	12·30	1·5138	0·01003	51·23
8	,,	12·29	1·5141	0·01006	51·10
9	,,	12·27	1·5142	0·01007	51·10
10	,,	11·96	1·5145	0·01007	51·09
11	,,	11·36	1·5143	0·01007	51·07
12	,,	11·19	1·5143	0·01007	51·07
13	,,	11·10	1·5143	0·01007	51·07
14	,,	10·86	1·5143	0·01007	51·07
18*	Ramie	13·22	1·5070	0·01055	48·05
19	,,	11·75	1·5142	0·01007	51·10
20*	Flax	13·15	1·5095	0·01016	50·14
21	,,	11·76	1·5142	0·01007	51·10

(The numbers marked * are those of which the films were prepared from solutions in acetone.)

It will be noticed that the nitrocelluloses of 12·95 per cent. nitrogen and over differ from the others and that there are hardly any differences among the latter for different degrees of nitration. The refractive index is evidently not dependent on the degree of nitration as was to have been expected.

I found that the nitrocellulose films could be denitrated without losing their transparency. I did not succeed in completely denitrating the films, and with those I made I obtained $n_D = 1·5265$. I then asked one of the artificial silk factories to prepare and denitrate some films for me, and they were able to make them so that no nitrogen could be detected with the nitrometer. Those films in 20 readings gave figures ranging from 1·5287 to 1·5310. The highest reading was obtained with the thinnest and therefore no doubt the most perfectly denitrated films. The dispersion was found to be 0·012315. I therefore accepted for cellulose: $n_D = 1·5310$, $n_F — n_C = 0·012315$ $\gamma = 43·01$. In order to test the accuracy of this, I prepared a mixture of carbon tetrachloride and monobromonaphthalene having exactly the refractive index 1·5310, and I found that with transmitted light single cotton fibres are practically invisible in it. Lumps of cotton appear gelatinised. Wood cellulose, ramie, and flax all disappeared to the same extent in the said liquid. The various kinds of celluloses have, therefore, apparently the same refractive index. This test is very delicate, a difference of less than 0·003 in the refractive index of the mixture rendering the substances quite visible. A solution of phenol in benzene having the desired refractive index can likewise be used, and has the advantage of keeping more constant than the mixture of tetrachloride and monobromonaphthalene.

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(15) *See* Traube, Physicalisch Chemische Methoden, Hamburg and Leipzig, 1893, p. 171; or Physico-Chemical Methods by Traube, translated by Hardin. Philadelphia, 1898, p. 179.

(16) Lehrbuch der Physik O. D. Chwolson, übersetzt von H. Pflaum, Braunschweig. 1904, Vol. II., p. 381.

(17) Physico-Chemical Measurements. W. Ostwald, translated by James Walker, London, 1894, p. 143.

The refractive index of hard Canada balsam is 1·535(18), therefore when cellulose fibres are mounted in a concentrated solution of Canada balsam in benzene, such as is used in microscopy, they are almost invisible and reappear as the balsam hardens, being distinctly visible when the balsam is quite hard, as I stated in discussing their microscopic examination.

If with the refractive indices above given we calculate the molecular refraction according to the formulæ—

$$r = \frac{n-1}{d}, \text{ M and } R = \frac{n^2-1}{n^2+2}, \frac{M}{D} \text{ we find}$$

	M.W.	D	n_D	r	R.
Cellulose ..	162	1·61	1·5310	53·5	31·15
Dinitro ...	252	1·67	1·5140	77·6	45·46
		Half Difference =		12·05	7·15

which half differences are the values of r and R for NO_2—H. For H, Landolt gives, $r = 1·30$, and Gladstone found the r value for NO_2 ranging from 11 to 14 (19), therefore, NO_2—H $= 9·7$ to $12·7$, so that the above value, 12·05, is within the range of these determinations. If to the molecular refraction of dinitrocellulose we add the above r value for NO_2—H, we have $77·6 + 12·05 = 89·65$ as the r value for trinitrocellulose (14·14 per cent. nitrogen), which corresponds to $n_D = 1·5010$ as against 1·5059 observed for 13·5 per cent. nitrogen and 1·5076 for 13·2 per cent.

If we apply Conrady's atomic refractions, (n^2—1), for the sodium line(20) to the formulæ suggested for cellulose by Green, Cross and Bevan, and Nastukoff, distinguishing as Conrady does between O′, hydroxyl oxygen, O″. carbonyl oxygen, and O^2, ether oxygen, *i.e.*, oxygen linked, to two carbon atoms, we find :—

$C_6H_7O.O(HO)_3$ (21)	$C_5H_6CO\ (HO)_4$ (22)	$C_6H_6O\ (HO)_4$ (23)
C_6 2·501 = 15·006	C_6 2·501 = 15·006	C_6 2·501 = 15·006
H_{10} 1·051 = 10·510	H_{10} 1·051 = 10·510	H_{10} 1·051 = 10·510
$O^2{}_2$ 1·683 = 3·666	O''_1 2·287 = 2·287	$O^2{}_1$ 1·683 = 1·683
O'_3 1·521 = 4·563	O'_4 1·521 = 6·084	O'_4 1·521 = 6·084
33·445	33·887	33·283

as against 31·15 calculated above with a density of 1·61 If we take the density as low as 1·525, the value becomes 32·86, which it will be seen is still below the values calculated with the formulæ.

From these figures we may no doubt safely draw the conclusion that the cellulose molecule has no double bonds.

4. *Optical activity.*—Allen(24) says that a 1 per cent. solution of cellulose in Schweitzer's reagent shows "a specific rotation of $-20°$ for the light transmitted, which bears to the sodium ray the ratio of 1 : 1·85." I cannot understand this passage, as if one takes the figures quoted as referring to wave lengths or frequencies, the "light transmitted" would be outside the visible spectrum. It may be a printer's error for 1 : 0·85 or $[a]_D = -17°$. He proceeds to say, "the optical activity is not strictly proportional to the cellulose dissolved, increasing somewhat more slowly than the concentration of the solution," and that celluloses from different sources exhibit the same optical activity. Levallois(25) found cellulose in cuprammonium lævo-rotatory. Tollens(26) says that the rotation of the cuprammonium solution of cellulose does not seem to be due to the cellulose. Béchamp(27) concludes that the solution of the cellulose in cuprammonium is not simple. but is accompanied by progressive molecular transformations, the optical activity (dextro-rotatory) of the products increasing to a maximum corresponding to a condition of equilibrium ultimately obtained. There is, therefore, not only doubt as to whether cellulose is lævo- or dextro-rotatory, but also as to whether it is optically active or not. Professor Guye, of Geneva, in conversation with me, expressed the view that it ought to be possible to determine the rotation of cellulose by direct methods, either by passing powerful light through a thickness of superposed denitrated films, or by suspending finely divided cellulose in a liquid of the same refractive index, using a rotating polarimeter, as Landolt did in determining the rotation of sodium chlorate(28). I have not yet been able to carry out experiments in these directions. Vignon(29) states that he has examined a nitrocellulose with 10·68 per cent. nitrogen in ether-alcohol and in acetone, finding it dextro-rotatory. With a concentration of 1·4943 in ether-alcohol he obtained a reading, a_J, $+0·635°$, and with a concentration of 3·848 in acetone, $a_J + 1·625°$, and he calculates $[a]_J = +19·3°$ in the former, and $[a]_J = 21·1°$ in the latter case. These values. calculated for sodium light, give respectively $[a]_D = 17·2°$, and $[a]_D = 18·8°$(30).

The following are the results which I have obtained :—

Material nitrated.	Nitrogen. per cent.	Solvent.	Concentration (gr. in in 100 c.c.).	$[a]_D$.
Cotton	13·2	Ethyl acetate	2·31	+25·1°
,,	13·2	Acetone	1·60	+18·0°
,,	12·44	,,	1·65	+25·3°
,,	12·44	,,	4·20	+19·2°
,,	12·29	,,	3·34	+19·8°
,,	11·96	,,	1·73	+20·7°
,,	11·10	,,	2·07	+23·1°
Wood cellulose	13·2	,,	1·88	+23·4°
,,	13·2	Ethyl acetate	1·64	+23·6°
,,	13·2	,,	3·82	+23·3°
Ramie	13·2	Acetone	1·79	+18·7°
,,	13·2	,,	3·09	+24·0°

The low values are. no doubt, due to imperfect solutions My results confirm the observation of Vignon as to nitrocellulose being dextro-rotatory. but my values are somewhat higher. The range of concentrations within which transparent solutions are obtainable is too small, and the solutions not sufficiently perfect to attempt the determination of constants. Moreover, the degree of rotation and its variation with concentration is at present without stoichiometrical significance. Nitration being a symmetrical reaction, the optical activity of nitrocelluloses furnishes proof of the optical activity only—but neither of the direction nor of the degree of the rotation—of the original substance. It is therefore clear that cellulose is optically active, and hence that the molecule must contain one or more a symmetrical carbon atoms.

5. *Dialysis.*—As I mentioned in a note to my previous paper(31), I succeeded in dialysing an acetone solution of nitrocellulose, using acetone as external liquid. I have since dialysed nitrocellulose through both vegetable and animal membranes. My experiments are not yet sufficiently advanced to warrant publication. I have attempted fractional dialysis, *i.e.*, renewing the external acetone at given intervals, and evaporating the removed outer liquid to dryness, thus recovering the nitrocellulose which in a given time had passed through the membrane. An examination of the fractions so far obtained has shown

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(18) Bolles Lee. The Microtomist's Vade Mecum. London. 1900.

(19) See Ostwald, Lehrbuch, 1903, Vol. I., p. 450.

(20) Nernst, Theoretical Chemistry, London, 1904, p. 310

(21) Green, Ueber die Konstitution der Cellulose, Zeits. Farben-und Textil-Industrie, 1904, 97; also Vignon.

(22) Cross and Bevan, Researches on Cellulose, London, 1901, p. 79.

(23) Nastukoff, Ueber die Einwirkung von Benzol auf Cellulose, Zeits. Farben-und Textil-Industrie, 1902.

(24) Allen, Commercial Organic Analysis, I., p. 388.

(25) See Landolt, Das Optische Drehungsvermögen; Braunschweig, 1898.

(26) Tollens, Lehrbuch der Kohlenhydrate, II., p. 233.

(27) Compt. Rend., 100, 117, 278, 368.

(28) Optical Activity and Chemical Composition, Landolt, translated by J. McCrae, 1899, p. 5.

(29) Bull. Soc. Chim., 1904, p. 104.

(30) $[a]_D = 0·89 \times [a]_J$. See Landolt, Das Optische Drehungsvermögen, 1898, p. 187.

(31) This J., 1904, 296.

them to be identical in nitrogen content with the substance originally dissolved. I propose on a future occasion dealing with dialysis, solution pressure, and the like.

Discussion.

Sir **William Ramsay** asked if it would not be worth while to apply Traube's recent work to the question of the refractive index and the molecular volume? Traube, during the last few years, had been carrying on a remarkable series of researches, in which he suggested that each atom had its own particular volume, and inhabited a certain amount of space which was unoccupied, and which possessed a certain volume of its own; for example, in the ordinary case of liquids containing carbon, hydrogen, nitrogen, oxygen, and so on, these constituents each occupied a certain fraction of the volume; and in the same way as each element had a volume assigned to it, so the interstitial space had a certain volume. It might be interesting to see whether this space volume came out of the usual value in this case; if not, it would give some suggestion of the molecular weight of the substance. The same method was applicable to the refractive indices. The author had made a very complete series of observations, which, no doubt, would find their interpretation some day.

Mr. C. F. **Cross** said all who had to do with cellulose nitrates knew that the solubility and solution viscosity of nitrocelluloses were joint functions of the composition, *i.e.*, the percentage of nitrogen, and of the processes employed, and including the raw material (cellulose) and its previous preparation. Cellulose had the habit of taking the impress of the treatments through which it had passed, and what would ordinarily be called the physical results of the chemical treatment reflected themselves perfectly in the solution viscosity of derivatives, of which, however, they knew as yet but very little. Those who had to do with the particular application of these solutions knew that viscosity was in itself an objective test of the particular raw material with which they were dealing, which was rather an inversion of the order in which the matter was presented in the paper. With regard to the observations on polarised light, the author gave statements in the form of percentages, which he took it represented the visual or optical analyses of the fields of the particular mounts which he had under examination; these had an industrial application, and probably might be used as a means of verifying the fact that there could be introduced into the cellulose unit, apparently homogeneously, any proportion of a desired negative group up to the maximum, without relation to any assumed molecular weight, though with an invariable stoichiometrical value. An optical method of analysis, if well differentiated, might enable them to establish as a fact that the distribution of these negative groups was actually homogeneous; and that would be a point of great theoretical importance. Bearing on that, and enabling the author further to integrate his observations, he suggested observations on sections of the nitrated fibres, in search of evidence of penetration in any particular way of the esterifying groups from the outside to the inside, or whether the substance appeared to be penetrated homogeneously from the first combination of the negative groups. The densities of cellulose in water, alcohol, and benzene were necessarily variable, and the author stated that he had observed variations in the case of the nitrate esters. He should say *a fortiori* that the raw material (cellulose) would vary; but the author rather passed this over, not giving the experimental numbers, and they did not know what the variations were as between the different media in which he had made his observations. That was a matter of possibly more theoretical importance than would appear at first sight. What practical application they were to make of these density values, he would not enter into; but with the data available in text-books, he had calculated the constants—for instance, of nitroglycerin as compared with nitrocellulose—and he would suggest to the author that an extension of these molecular volume observations might enable them to throw light on the constitution of cellulose from its mode of union with these negative groups. He had arrived at an average number for the three nitrate groups in nitroglycerin of 23; the author's numbers for nitrocellulose indicating a very considerable difference. The addition of successive nitro-groups to cellulose caused small changes in density, and the molecular volumes appeared to be constant, but in nitroglycerin there was a considerable shrinkage of volume in the third nitro-group; this suggested a difference in thermal values of the ester reactions. By following up the density observations in that direction, a definite light might be thrown on the functions of the hydroxyl groups and the inner constitution of cellulose. With regard to the density of nitrocellulose in solution, he doubted whether the author was justified in ascribing the loss of volume to the solute. It was the system that lost volume, as in mixing alcohol and water. Moreover, in dealing with cellulose, it would be difficult, in his opinion, to say which was the solute. He would suggest that he should aim at determining the density of the water taken up as "hygroscopic moisture" from the atmosphere; that would furnish an important constant, probably correlated with the observed thermal phenomena. Passing on to refraction, the empirical constants might be determined for other colloids, such as gelatine and starch, which could also be obtained in transparent films. These, if also examined with reference to their dehydration, would possibly throw some light on the way in which these colloids parted with water in dehydrating. Concerning the application of these results to molecular constitution, he would point out that the author had made observations on the denitrated film, but had omitted to take into account that the cellulose in that form was partially hydrolysed, as well as hydrated. Consequently, the numbers calculated would require to be corrected in proportion as the molecular weight would be increased, and the density lowered. All round the special chemistry of the subject there was a very important physical chapter, and it was really to the physicist they looked for shaping the material which lay to hand by the methods of which they were masters, and chemists were not. He instanced the constants of density, tenacity, and elasticity; hydration, in reference to osmotic properties; and with regard to the question of heat, specific heat conductivity, and expansion, linear and cubical. Another important point was the calorimetry of the different reactions of cellulose, more particularly the ester reactions, which would immediately throw light on the constitutional questions involved. With regard to light, the author had already broken ground, and given them a number of very important constants, which would, no doubt, be made use of by those studying this question, and would lead to observations by others. The distribution of electricity, whether by static electrification and induction, the question of current, and the conductibility of cellulose, and the peculiar electrolytic phenomena involved, constituted a large chapter of problems which required a whole institution of physical chemists to attack and reduce to order, as proper material for the chemist to work upon.

Dr. R. **Robertson** said he could confirm the author's observation that preparations in Canada balsam acquire much better definition on standing for a few days; as a further help to this end he had found staining with methylene blue useful. He also agreed with him in discarding the selenite plate, having found crossed nicols sufficient, especially in the investigation of ungelatinised fibres in gelatinised mixtures. He pointed out that the viscosity experiments were performed on solutions of the nitrocelluloses in ether-alcohol, and thought that a more useful series would have been obtained by using a solvent such as acetone, which dissolved all the nitrocelluloses given in the tables. In such a series, he had found that the difference in viscosity between the acetone solutions of nitrocelluloses of high nitrogen content and the lower members was very considerable, and that a distinct transition point in the viscosity occurred exactly at the point where the nitrocellulose began to possess a considerable solubility in ether-alcohol. He found it interesting to note that the author's results for indices of refraction and dispersion were practically constant below the point at which the nitrocellulose begins to be insoluble in ether-alcohol. Above this, changes set in, and these, together with the great increase in viscosity occurring at the same point, would appear to accentuate rather than minimise the distinction between the so-called soluble and insoluble nitrocelluloses. The observations of the author in his former paper on the passage of nitrocellulose through a membrane, he could quite confirm, having found that when a 5 per cent. solution of guncotton in acetone was separated by a membrane of sturgeon's bladder from pure acetone, guncotton to the extent of 2 per cent. of the total quantity present passed into the latter in one year. From other experiments on this subject, he had thought that the molecular aggregates were larger in the case of the higher nitrocelluloses than with the lower, and would consequently have expected, if the membrane acted as a sieve, to find only nitrocellulose of low nitrogen content passing through. This, however, was not so: the dialysed nitrocellulose being to a considerable extent at least of high nitration. No doubt the author would in his promised further researches throw some light on the debated questions of the nature of colloids and the function of the semi-permeable membrane through which, according to Kahlenberg (J. Pharm. Chim., 1906, 145), contrary to the older conceptions, non-crystalline substances may be made to pass, crystalline ones remaining behind. The use of the ultra-microscope also is indicated as being of possible service in investigating solutions of nitrocellulose, especially as he had obtained well-marked examples of the Tyndall phenomenon in the case of acetone solutions that had stood for many years.

Mr. **Walter F. Reid** said he had made a number of experiments on the viscosity of nitrocellulose solutions, and generally found it had no relation to the degree of nitration. The optical results would decidedly throw a light on the constitution of cellulose and its compounds, which was very much wanted. He also had experienced a difficulty in obtaining clear films, but managed to surmount it. It was quite true that ether-alcohol and acetone absorbed moisture from the atmosphere, no matter how dry the air was. He found that by pouring the solution on to a piece of glass, and covering it with another piece of glass at a distance of about a quarter of an inch, allowing the solvent to evaporate, and covering the whole arrangement with a box, a perfectly clear film could be obtained.

Mr. **A. R. Ling**, referring to the fact observed by Allen, that cellulose dissolved in Schweitzer's reagent had a lævo-rotatory power, said that it had been shown recently by Grossmann (Zeits. Ver. Deuts. Zuckerind., 1906, 1024) that alkaline copper salts reversed the rotatory power of certain optically active bodies in solution. If it were found possible to dissolve cellulose in some neutral solvent, then it would probably be found to be a dextro-rotatory body, as its nitro-derivatives were, according to the author. He (the speaker), however, believed that in all these substances, and, indeed, in cellulose itself, they were dealing, not with homogeneous compounds, but with mixtures, possibly solid solutions. He did not think they could in such cases take the apparent stoïchiometrical relations of the nitro-groups and the cellulose residue as indicative of the existence of definite chemical entities.

Dr. **G. Lindsay Johnson** said he thought the author had hardly made enough of the value of certain columns of his lists of figures. In the first place, if one took the column of the refractive indices, and the column of the nitrated cotton, the numbers varied in a manner inversely with the amount of nitration of the cotton. The solubilities varied directly, while the refractive indices varied inversely with the nitration. These figures followed too closely and too evenly to be the result of mere chance. The author, apparently, did not regard this relation as of much importance, but to his mind, it suggested a law connecting nitration with the refractive index and the solubility. Taking the refractive indices from the top downwards, every one of the figures formed a harmonious curve with the nitration, until one came to Nos. 7 and 11. All the others also followed a regular curve. In the same way the relation of the solubilities was even more striking. Taking Nos. 1, 2, 3, 4, the value of the solubilities and the refractive indices together, formed a remarkably evenly increasing number. There were only two exceptions. Nos. 7, 8, 9, and 10 were exceedingly remarkable, if they were compared with the refractive indices. The author ought to be able to group these figures and obtain a ready means of ascertaining the amount of nitration in cotton by putting either a film, or a solution, under the refractometer, and reading off the amount of nitration straight away. To assist in that, two other methods might be used, one which was known as the Tyndall effect, since that scientist had shown that polarised light had a tendency to increase from the short wave lengths to the long. He could not help thinking that, if the author were to examine for the Tyndall effect with a Nicol prism at the top, and have the length of the tube in the axis of the light, he might get some very interesting results. Axial and uniaxial crystals were familiar to all, as well as their effect on light, producing both ordinary and extraordinary rays; but, in addition, and that is the chief point in the Tyndall effect, in all colloidal solutions, remarkable rays pass out at right angles to the axis of the tube. The second method was based on the fact that many colloidal solutions had curious absorption bands, and he believed, from some work he (the speaker) had done in this direction, that the author would find a direct relation between the strength and position of the absorption bands, and the amount of nitration of the cotton.

Mr. **L. M. Deane** drew attention to the fact that the so-called nitro-cotton containing 11·9 per cent. and 12·1 per cent. of nitrogen, when dissolved in acetone and precipitated with water for the preparation of a jelly with nitroglycerin, seemed to produce a better jelly than one formed in the ordinary way, in which nitro-cotton was stirred up with nitroglycerin at a certain temperature. That is if the nitro-cotton was dissolved first in acetone and then precipitated with water it formed a better jelly with the nitroglycerin than if the raw nitro-cotton were treated.

Mr. **W. Rintoul** said the question of the absolute density of guncotton was raised some years ago, when it was found that the figure given in the Service Treaty on Explosives, namely, 1·634, was below the truth. The average of several determinations of the density of guncotton of 13 per cent. nitrogen prepared from cotton waste gave 1·675 at 15·5°/15·5° C. as the absolute density. Several methods of determination were tested, and the most reliable was found to be by the introduction of fluid paraffins into the specific gravity tube containing a known weight of dry guncotton, which was frequently evacuated to remove the last traces of air. The guncotton used was finely pulped to avoid the possibility of air remaining behind in the long guncotton fibres. Benzene was also tried as the displacing fluid, but it appeared to have a slight action on the guncotton, and gave unreliable results. With regard to the difference in the nitrogen content of guncotton determined by the Waltham Abbey and Ardeer methods of using Lunge's nitrometer, the figure quoted by the author was considerably too high. Repeated comparisons of the two methods, using identical materials, and by the same and different operators, have proved that this difference is not greater than 0·1 per cent., the Ardeer method giving the higher result. Possibly the higher difference mentioned by the author might be due to the use of sulphuric acid containing more than 96 per cent. H_2SO_4.

The **Chairman** said the whole course of work which had been so laboriously carried out with such a number of experiments went to show that they had not yet, by any means, ascertained the constitution of the cellulose molecule, and, consequently, of the true character of the nitro-compounds formed. Everything pointed to the existence in all nitrated cottons of a number of various individuals mixed, and in no case to the existence of a single individual.

Mr. **de Mosenthal**, in reply, said that he found that Traube's atomic volumes did not apply, nor did those of Kopp. Taking Green's formula, $C_6H_7OO(OH)_3$, the figures were :—

	Traube.	Kopp.
6 C	59·4	66·0
10 H	31·0	55·0
1 O in first OH	2·3	7·8
2 O in further OH's	0·8	15·6
2 O attached to different C's	11·0	15·6
Molecular co-volume..............	25·9	—
	130·4	160·0

He did not see how sections of nitrated cotton could be examined to observe the penetration of the acids. As to the objection that the refractive indices were determined on films, he pointed out that he had confirmed his results by placing the fibrous material into a mixture of monobromonaphthalene and carbon tetrachloride, having the refractive index found by the other method, and he thought the invisibility test confirmed the results obtained with films. He quite agreed with Mr. Ling that cellulose was a type and not a chemical entity; he had in his previous paper pointed out the difference between the cuticles of a cotton fibre and the intercuticular substance, and this would, of course, apply to cellulose from different sources. It was exceedingly difficult to draw conclusions from the results obtained, and great caution had to be exercised. He had, for instance, worked out the molecular volumes of the nitro-derivatives of the aromatic series, such as benzene, toluene, and phenol, and found that the value of NO_2—H varied with the orientation of the NO_2 group, and that the relation between values of the first and subsequent substitutions was very irregular. In all cases the values were much lower than with glycerol, glycol, and cellulose. He felt inclined to deduce that cellulose was not isocyclic, and would doubt that it was heterocyclic, as assumed by Green; he thought that there was ground, on physical data, to regard it as aliphatic. Referring more particularly to the thermal data, which Mr. Cross regarded as important, he stated that the authorities on the subject all agreed as to the disappointing nature of the results to be obtained by that method. In reply to Dr. Lindsay Johnson, he had stated in his previous paper that he had failed to obtain the Tyndall effect with solutions of nitrated cotton.

Meeting held at Burlington House, on Monday, April 8, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE APPLICATION OF CHEMICAL ANALYSIS TO THE EXAMINATION OF COMMERCIAL SPIRITS.[*]

Part II.—Analysis of Brandies.

BY E. A. MANN AND T. N. KIRTON.

In a previous paper from our laboratory (this J., April 15, 1907, pp. 287—289) the analysis of spirits was dealt with in its application to the detection of the origin of different kinds of so-called whisky. The immediate object of the analyses therein described was to determine whether the samples were "pot still malt" or "patent grain" spirits. In addition, there were described a few analyses of samples of brandy and rum which were also examined as to their origin.

The analyses here recorded were obtained in an attempt to provide, by the application of recent methods of spirit analysis, more reliable evidence in prosecutions for selling brandies under false trade descriptions.

The brandy chosen for experiment was that of a well-known brand of spirit which is sold in two qualities—"Three Star" and "One Star"—and which, on account of its reputation, is very commonly replaced by inferior spirits. The work was conducted in co-operation with the Liquor Inspection Department, and altogether 67 suspicious samples were collected from hotels in various parts of the State, all of which bore the label of the brand in question. These were analysed, and some of the results given in the accompanying tables.

Before any conclusion could be drawn from these, it was necessary to establish a standard for comparison. In order to do this, samples were drawn in bond from direct shipments, obtained by certain merchants who have traded for many years in the brand in question. In the case of the "Three Star" quality only three samples from one shipment were examined, but in the case of the "One Star" two shipments were sampled. An interval of two months elapsed between these two shipments, which arrived during the period covered by the collection of the suspected samples.

The analyses of the "standard" samples disclosed a remarkable similarity in the characteristic ingredients determined, and the agreement between the samples of "One Star" taken from different shipments, was particularly satisfactory. On comparing the suspected samples with the "standard" samples, such wide divergences were apparent as led to the conclusion that none of the former were genuine. This conclusion was supported by differences in colour and aroma, and in many cases of taste, as determined by an expert taster, but none of these means of distinction was so satisfactory or decisive as chemical analysis.

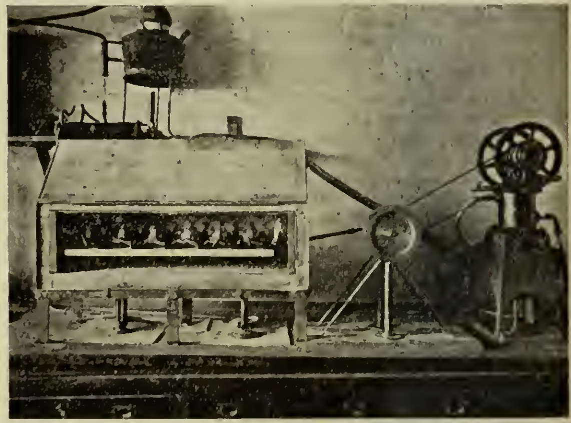
Most controversy centred round the method of establishing a standard, as to whether samples taken in the manner described could be considered as reliable specimens of the spirit legitimately sold under that particular label. So far, this evidence has been accepted by the Courts. It would appear, therefore, that the application of modern methods of spirit analysis can be successfully applied to test the identity of a particular brand of spirit. The limits of their applicability have not yet been ascertained, as these can only be determined by investigating practically all the brands on the market in a manner similar to that here described.

Methods of analysis.—These were practically the same as those described in the paper already referred to, only three modifications being introduced, as follows:—

1. *Estimation of acidity.*—Instead of estimating the "volatile" and "total" acidity, and arriving at the fixed acidity by difference, the latter was determined directly in the residue left after boiling off the volatile acids.

2. *The extract* was determined on the residue of 200 c.c. after the distillation of ethers, furfural, and aldehydes. This economises the sample, and diminishes the possibility of error, as the extract was previously estimated on one-tenth of this volume of original spirit.

3. *Estimation of higher alcohols by the Allen-Marquardt method.*—The oxidation of the higher alcohols under a reflux condenser was entirely abandoned on account of the disadvantages described in a previous paper.[*] All oxidations were conducted in pressure bottles, and this method as now applied in this laboratory has been remarkably successful.



Combination water-bath and shaker carrying six bottles and frames.

To avoid the inconveniences of the method as described by Allen and Chattaway,[†] especially the labour involved in shaking by hand, a special water bath was constructed, fitted internally with a shaking table. This table was agitated by a rod passing through a slit in one end of the bath, and operated by means of a small air engine. The arrangement is shown in the accompanying photograph. The bath was fed with hot water by means of a "geyser," and kept heated by two large Bunsen burners. The large amount of steam generated was led into a worm condenser. By these means the bath could be kept at 98° C. for several hours without difficulty, and as it could be readily started, two oxidations, occupying four hours each, could be completed in a day. The shaking table held six pressure bottles, so that altogether twelve oxidations could be completed in a day with very little trouble, as the apparatus, once started, required no supervision. The time occupied can be still further reduced, as experiments go to show that oxidation is complete in two hours with ordinary commercial spirits; the continuous shaking rendered possible in this apparatus, no doubt, greatly hastens the action. The advantage of this method over the reflux condensers working for eight hours is very great, and it is not only more convenient, but much more accurate, duplicate estimations of higher alcohols giving a concordance never attained with the other method.

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[*] Taken as read.

[*] This J., Dec. 15, 1906.

[†] Analyst, Vol. XVI., 1891.

In addition to the tables referred to above, a small table is appended, giving the result of the examination of three spirits sold as brandy, which are evidently entirely fictitious. These analyses give rather startling evidence as to the nature of some of the spirits sold as brandy.

ANALYSES OF BRANDIES.

TABLE I.—"*One Star*" *quality.*

Figures represent grammes per 100 *litres of absolute alcohol.*

Hydrometer reading. U.P.	Specific gravity.	Proof spirit. per cent.	Volatile acids.	Furfural	Aldehydes.	Ethers.	Higher alcohols (mean of two estimations).	Total secondary products.	Extract grms. per litre.	Fixed acids.
Standard samples. First shipment.										
17·8	0·9410	81·64	46·02	2·52	12·85	145·59	194·64	400·60	6·20	40·29
17·8	0·9411	81·55	45·02	2·52	11·81	145·76	185·67	390·78	6·16	37·49
18·6	0·9412	81·45	45·02	2·32	15·06	145·59	187·45	395·09	6·30	37·67
Second Shipment.										
17·8	0·9406	82·02	49·8	2·60	14·9	142·8	186·5	396·60	6·27	40·5
17·8	0·9405	82·12	49·7	2·66	14·9	142·7	187·2	397·16	6·31	37·3
17·8	0·9405	82·12	49·7	2·66	14·9	144·5	187·2	398·96	6·21	37·3
Suspected samples.										
19·3	0·9424	80·21	30·57	1·08	13·10	99·50	95·83	241·62	11·90	31·72
19·3	0·9414	81·26	47·82	0·15	10·77	70·20	73·77	202·71	8·80	62·89
16·3	0·9393	83·26	63·84	2·80	10·52	64·80	79·20	221·16	2·70	42·97
18·9	0·9424	80·21	68·82	0·98	29·05	157·30	117·35	373·50	6·70	63·73
19·8	0·9416	81·07	30·30	Nil	16·10	156·00	250·00	453·00	7·58	50·40
15·7	0·9378	84·64	48·30	0·76	10·40	65·60	91·90	217·00	1·55	30·20
18·2	0·9413	81·36	21·50	0·54	8·60	36·00	49·80	116·40	1·21	50·20
15·7	0·9386	83·92	19·40	Nil	16·70	130·40	209·30	375·80	4·29	30·50
16·8	0·9400	82·50	39·50	0·53	9·50	37·30	40·40	127·20	1·03	30·90
17·1	0·9390	83·54	24·40	0·14	27·90	148·30	222·40	423·10	4·05	18·30
19·7	0·9423	80·32	61·10	0·78	36·20	105·60	136·50	350·20	7·13	57·30
20·1	0·9435	79·04	31·00	0·22	27·50	193·90	227·60	480·20	4·28	27·80
19·3	0·9414	81·26	47·82	0·15	10·77	70·20	73·77	202·71	8·80	62·89
22·0	0·9433	79·25	72·20	0·71	31·40	143·97	160·64	408·92	7·70	25·80
20·0	0·9433	79·25	41·20	0·77	7·70	38·90	66·15	154·72	1·31	32·25
21·2	0·9443	78·18	107·34	0·95	15·68	134·10	209·96	468·03	4·82	137·30
14·4	0·9364	86·00	52·30	0·86	16·29	25·10	69·76	164·31	1·72	29·72
20·4	0·9444	78·07	52·30	0·94	21·90	88·88	34·48	198·50	8·50	52·38
19·7	0·9423	80·32	61·60	0·78	36·20	105·60	146·50	350·68	7·13	27·80
24·0	0·9466	75·70	33·30	0·50	10·40	24·44	69·26	137·90	2·85	58·50
20·3	0·9438	78·71	21·30	0·55	13·50	78·36	103·82	217·53	8·38	26·70
18·5	0·9417	80·96	40·40	0·26	16·20	228·80	144·39	430·05	4·60	25·20
16·9	0·9403	82·31	74·50	0·26	14·89	93·67	51·01	234·33	7·49	62·11
23·7	0·9469	75·37	39·00	0·93	12·70	57·00	—	—	6·00	55·70
19·6	0·9425	80·11	31·40	0·65	17·40	57·00	—	—	8·60	9·80
16·7	0·9394	83·16	63·10	2·50	25·20	39·00	—	—	10·20	88·40
7·6	0·9286	92·81	149·00	0·94	75·00	96·00	—	—	19·67	90·60
18·9	0·9416	81·07	57·00	10·80	21·60	91·00	—	—	6·80	64·80
22·3	0·9444	78·07	59·24	1·01	8·97	110·61	—	—	6·04	33·66

TABLE II.—"*Three Star*" *quality.*

Figures represent grammes per 100 *litres of absolute alcohol.*

Hydrometer reading. U.P.	Specific gravity.	Proof spirit. per cent.	Volatile acids.	Furfural.	Aldehydes.	Ethers.	Higher alcohols (Mean of two estimations).	Total secondary products.	Extract grms. per litre.	Fixed acids.
Standard samples.										
19·3	0·9429	79·68	53·78	2·63	12·15	141·21	209·71	419·48	7·45	48·00
19·3	0·9428	79·79	53·78	2·80	12·03	141·04	202·82	412·47	7·45	54·31
19·3	0·9428	79·79	52·38	2·73	12·03	141·04	215·65	423·83	7·27	55·71
Suspected samples.										
20·8	0·9443	78·18	31·25	0·27	7·80	31·50	61·14	131·61	3·60	52·31
17·1	0·9406	82·02	54·80	1·06	11·60	97·76	146·24	311·46	1·41	43·62
20·0	0·9427	79·89	30·70	0·87	27·30	58·83	97·60	215·33	5·57	63·94
18·4	0·9416	81·07	41·50	1·50	16·20	87·49	110·31	257·00	9·00	45·40
18·2	0·9427	79·68	84·40	1·50	14·30	69·00	—	—	8·39	36·80

TABLE III.—*Fictitious Brandies.*

Figures represent grammes per 100 *litres of absolute alcohol.*

Hydrometer reading. U.P.	Specific gravity.	Proof spirit. per cent.	Volatile acids.	Furfural.	Aldehydes.	Ethers.	Higher alcohols (Mean of two estimations).	Total secondary products.	Extract grms. per litre.	Fixed acids.
27·9	0·9513	71·15	28·73	Nil	4·90	49·75	38·92	122·30	9·10	35·91
30·7	0·9518	70·57	11·40	Nil	8·58	15·29	39·33	74·60	1·98	29·65
30·7	0·9518	70·57	11·40	Nil	8·58	13·11	43·70	76·79	1·96	29·65

Manchester Section.

THE ELECTROTHERMIC COMBUSTION OF ATMOSPHERIC NITROGEN.

BY F. HOWLES.

This J., 1907, 290—298.

ERRATA.

P. 294, col. 1, lines 3 and 5 and illustration:—The picture illustrates the 1000 kilowatt furnace and not the 500 kilowatt furnace, and the reference should be transferred accordingly. P. 295, col. 2, line 4 from bottom:—For "Bohrmann" read "Rohrmann."

New York Section.

Meeting held at Chemists' Club on Friday, March 22, 1907.

MR. GEO. C. STONE IN THE CHAIR.

SOLUBILITY OF POTASSIUM PERMANGANATE.

BY EDWARD C. WORDEN.

With the exception that the observations extend to higher temperatures, the present work somewhat repeats the recent determinations of the solubility of potassium permanganate in water by Baxter, Boylston, and Hubbard (J. Amer. Chem. Soc., 1906, 1336), and in a lesser degree those of Patterson (*ibid.* 1734). The investigations of Mitscherlich (Pogg. Ann., 1832, 295), Guthrie (Phil. Mag., 1878, 37), Kuntz (Zeit. Krist. Min., 1894, 374), and Herz and Knoch (Zeit. anorg. Chem., 1904, 317), are limited to a single temperature, while those of Voerman (Chem. Centr., 1906, 124) extend over a greater range.

The Merck's "reagent" potassium permanganate used, was dissolved in water and allowed to filter slowly through a ten-inch column of glass wool in a percolator, coming in contact with glass only, the solution being afterwards concentrated by evaporation with partial vacuum. A saturated solution was allowed to remain in a thermostat over night with the temperature at 85°—90° C., and next morning it was siphoned from any sediment, and the liquid slowly cooled with constant agitation. The drained crystals were freed from mother liquor in a porcelain centrifuge, washed, redissolved in water, and this process repeated seven times, a final yield of 1·8 per cent. being obtained. All the water used had been previously distilled with (1) alkaline permanganate, (2) acid bichromate, (3) a trace of phosphoric acid, and (4) alone, using a copper retort with block tin condenser.

The method of obtaining saturation was (1) by a falling temperature from supersaturation and (2) by a rise to the desired temperature from an excess of the salt. With but few exceptions, four determinations were made at each interval, usually alternating the above methods in duplicate, both giving practically the same results. Instead of using a thermostat, the tubes containing the solutions were rotated in a calorimeter of about 190 litres capacity, the water being stirred by means of a motor. This large capacity enabled a temperature of ±0·01 from that desired, to be maintained indefinitely without difficulty. Three hours' agitation at the required temperature was considered sufficient, and gave the same results as with six hours' agitation. After rotation, the tubes remained in the bath for a further period of two hours to allow any solid particles to subside, filtration being impracticable. The thermometers used were graduated in 0·02°, and had been recently compared by the Reichsanstalt and by the (U.S.) Bureau of Standards. While the tubes were immersed in the water-bath, the thermometer was tapped continuously. With the exception of the temperatures, 50° and 75°, at which stem corrections were applied, the other readings were made with total immersion of bulb and thread mercury. The room temperature was maintained at that of the water up to 35° C., after which the water was heated by means of a small flame.

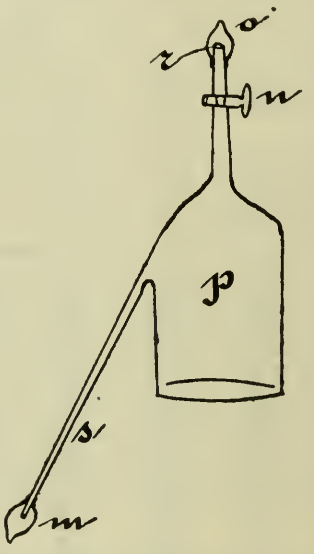

FIG. 1

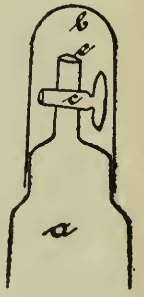

FIG. 2.

The rotating tubes consisted of heavy glass tubing, closed at one end, the other terminating in a smaller tube (Fig. 1), containing a stopcock protected by a hood. The solution was transferred to the apparatus, *p* (Fig. 2), by removing the hoods, *b*, *m*, and *o*, opening the stopcocks, *c* and *n*, inserting the tube, *s*, through the orifice, *e*, and into the liquid contained in the body, *a*, applying suction at *r*. When sufficient liquid had been withdrawn, the point of *s* was raised above the liquid in a suction being still applied, which served to empty *s*, when the stopcocks and hoods were adjusted. At temperatures above that of the room the apparatus (Fig. 1) was kept in a thermostat at within 0·1° C. of the temperature of the permanganate solution until required. The weighed (not measured) liquid was titrated against weighed quantities of oxalic acid,* by means of a gravimetric burette (this J., 1905, 178), the end reaction being obtained volumetrically by means of freshly prepared twentieth-normal oxalic acid. In rapidly cooling the hot solutions before weighing, the pressure in *p* was occasionally relieved by slightly opening the stopcock, *n*.

The 16 series of observations made are recorded in Table I. Compared with these results (Table II.) are those of Baxter (*loc. cit.*) and Patterson (*loc. cit.*), in which the interpolated values are indicated by an asterisk.

The results obtained, when plotted on co-ordinate paper, extrapolated from 4° and 75°, and interpolated between, irregularities smoothed out, and apparent inconsistencies remedied, the figures thus obtained differentiated at 2 per cent. intervals, and with the lower

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(*) The oxalic acid was purified from Kahlbaum's sublimed aid by methods to be described in a subsequent communication.

and presumably more accurate determinations a second differentiation made of the first smoothed differential figures, form Tables III. and IV. These tables perhaps summarise the results in a more easily accessible form. Table III. gives the parts (p) of potassium permanganate in 100 parts of water saturated at (t), the temperature stated. Conversely, Table IV. indicates the minimum temperature (t) which will hold in solution the amount (p) of potassium permanganate given, or it represents the temperature (t) at which the given per cent. (p) of potassium permanganate is saturated.

Table I.

° C.	Parts of permanganate		° C.	Parts of permanganate	
	Per cent.	To 100 parts of water.		Per cent.	To 100 parts of water.
4·00	3·15	3·36	40	11·14	12·53
10·00	4·21	4·40	45	12·70	14·55
15·00	5·12	5·40	50	14·35	16·75
15·56	5·22	5·51	55	16·15	19·26
20·00	6·11	6·51	60	18·03	21·99
25·00	7·11	7·65	65	19·99	24·98
30·00	8·31	9·06	70	22·24	28·60
35·00	9·62	10·65	75	24·44	32·35

Table II.

Strengths of saturated solutions as found by three investigators:

° C.	Baxter.	Patterson.	Worden.
	per cent.	per cent.	per cent.
0·0	2·75	2·84	2·68*
9·8	4·13	—	4·17*
15·0	—	5·22	5·12
15·3	—	5·30	5·20*
19·8	5·96	—	6·09*
24·8	7·06	—	7·09*
29·8	8·28	—	8·27*
30·0	—	8·60	8·31
34·8	9·64	—	9·58*
40·0	11·16	—	11·14
45·0	12·73	—	12·70
50·0	14·45	—	14·35
55·0	16·20	—	16·15
65·0	20·02	—	19·99

Table III.

t.	p.	t.	p.	t.	p.
0	2·76	26	7·94	51	17·23
1	2·90	27	8·20	52	17·71
2	3·06	28	8·48	53	18·21
3	3·22	29	8·77	54	18·71
4	3·38	30	9·07	55	19·23
5	3·54	31	9·37	56	19·75
6	3·70	32	9·69	57	20·29
7	3·86	33	10·01	58	20·83
8	4·04	34	10·34	59	21·39
9	4·22	35	10·68	60	21·96
10	4·40	36	11·02	61	22·55
11	4·58	37	11·38	62	23·15
12	4·78	38	11·74	63	23·76
13	4·98	39	12·12	64	24·38
14	5·18	40	12·51	65	25·01
15	5·38	41	12·91	66	25·67
16	5·60	42	13·31	67	26·34
17	5·82	43	13·72	68	27·03
18	6·04	44	14·14	69	27·84
19	6·26	45	14·56	70	28·56
20	6·48	46	15·00	71	29·30
21	6·70	47	15·44	72	30·05
22	6·94	48	15·88	73	30·81
23	7·18	49	16·32	74	31·57
24	7·42	50	16·77	74·5	31·95
25	7·68				

Table IV.

p.	t.	p.	t.	p.	t.
3·0	1·6	12·8	40·7	22·6	61·1
3·2	2·9	13·0	41·2	22·8	61·4
3·4	4·15	13·2	41·7	23·0	61·75
3·6	5·4	13·4	42·2	23·2	62·1
3·8	6·6	13·6	42·7	23·4	62·4
4·0	7·8	13·8	43·2	23·6	62·75
4·2	8·9	14 0	43·7	23·8	63·1
4·4	10·0	14·2	44·15	24·0	63·4
4·6	11·1	14·4	44·6	24·2	63·75
4·8	12·1	14·6	45·1	24·4	64·1
5·0	13·1	14·8	45·5	24·6	64·4
5·2	14·1	15·0	46·0	24·8	64·7
5·4	15·1	15·2	46·5	25·0	65·0
5·6	16·0	15·4	46·9	25·2	65·3
5·8	16·9	15·6	47·4	25·4	65·6
6·0	17·8	15·8	47·8	25·6	65·9
6·2	18·7	16·0	48·3	25·8	66·2
6·4	19·6	16·2	48·7	26·0	66·50
6·6	20.5	16·4	49·2	26·2	66·8
6·8	21·4	16·6	49·65	26·4	67·1
7.0	22·25	16·8	50·1	26·6	67·4
7·2	23·1	17·0	50·5	26·8	67·7
7·4	23·9	17·2	50·9	27·0	68·0
7·6	24·7	17·4	51·35	27·2	68·2
7·8	25·5	17·6	51·8	27·4	68·5
8·0	26·2	17·8	52·3	27·6	68·75
8·2	27·0	18·0	52·6	27·8	69·0
8·4	27·7	18·2	53·0	28·0	69·2
8·6	28·4	18·4	53·4	28·2	69·45
8·8	29·1	18·6	53·8	28·4	69·7
9·0	29·8	18·8	54·2	28·6	70·0
9·2	30·4	19·0	54·5	28·8	70·3
9·4	31·1	19·2	54·95	29·0	70·6
9·6	31·7	19·4	55·3	29·2	70·85
9·8	32·35	19·6	55·7	29·4	71·15
10·0	33·0	19·8	56·1	29·6	71·45
10·2	33·6	20·0	56·5	29·8	71·75
10·4	34·2	20·2	56·85	30·0	72·1
10·6	34·8	20·4	57·2	30·2	72·35
10·8	35·4	20·6	57·6	30·4	72·6
11·0	36·0	20·8	58·0	30·6	72·8
11·2	36·5	21·0	58·3	30·8	73·05
11·4	37·0	21·2	58·7	31·0	73·25
11·6	37·6	21·4	59·0	31·2	73·5
11·8	38·15	21·6	59·4	31·4	73·8
12·0	38·7	21·8	59·7	31·6	74·0
12·2	39·2	22·0	60·1	31·8	74·3
12·4	39·7	22·2	60·4	32·0	74·55
12·6	40·2	22·4	60·75		

Nottingham Section.

Meeting held at Burton-on-Trent on Thursday, April 25, 1907.

MR. F. E. LOTT IN THE CHAIR.

SOME TUNISIAN AND ALGERIAN OLIVE OILS.

BY L. ARCHBUTT, F.I.C.

Owing to the partial failure of the olive crops in European countries, consumers of olive oil have lately had to depend very largely upon oil from North Africa and the Levant. Several samples of Tunisian olive oil which have consequently passed through my hands during the past six months have given abnormal analytical results, the most noticeable being the presence of arachidic and lignoceric acids, somewhat low saponification values, and unusually high percentages of unsaponifiable matter. These samples have also given an immediate mud-brown colour when shaken with nitric acid (1·375 sp. gr.), quite different from the coffee colour characteristic of cotton-seed oil; in fact, there has been no reason to suspect the presence of cotton-seed oil in any of the samples, the specific gravities and iodine values having been normal, and the results of Halphen's and the silver nitrate tests quite negative. The oils have shown no unusual tendency to oxidise. Some samples have given faint indications of the presence of sesamé oil, which is frequently mixed with arachis oil. Ten samples which were carefully tested for arachidic and lignoceric acids by the modification of Renard's process described by me in this J., vol. 17 (1898), p. 1125, yielded amounts ranging from 0·34 per cent. to 0·80 per cent., indicating the presence of from about 7 to 17 per cent. of arachis oil. These same samples had saponification values ranging from 18·70 per cent. to 19·09 per cent., and contained from 1·4 per cent. to 2·12 per cent. of unsaponifiable matter.

That genuine olive oil may contain traces of arachidic acid is known.* Bellier (Ann. de Chim. anal., vol. 4 (1899), p. 4), who examined several samples of African olive oil, including Tunisian, found in one sample as much arachidic acid as would correspond to 1·4 per cent. of arachis oil. Bellier also examined olive oils from a number of other sources, but this was the largest amount he found in any sample. Even Sfax olive oil, which yields mixed fatty acids of very high melting point (see this J., 1889, p. 686), was found by Bellier to contain only as much arachidic acid as would correspond to 0·24 per cent. of arachis oil. Holde and Stange obtained from olive oil 1 to 2 per cent. of a mixed glyceride, which they believed to contain heptadecylic acid $C_{17}H_{34}O_2$, but Holde (this J., 1905, 447; from Ber., 1905, vol. 38, 1247) has more recently proved this to be a mixture of palmitic acid with an acid of high melting point, which he believes to be lignoceric acid. He gives no information as to the quantity, but it would appear to be very small.

On being informed that the olive oil samples examined by me contained arachis oil, the merchants and shippers denied it, and affirmed that the oil supplied was absolutely genuine. It, therefore, seemed desirable to obtain further authentic samples of Tunisian oil for analysis by Renard's process. This I have been enabled to do by the kindness of Dr. Lewkowitsch. Nine samples have been examined. The first four were commercial Tunisian and Algerian oils, the genuineness of which is vouched for by Dr. Lewkowitsch and by M. E. Bontoux, under whose personal direction they were obtained. The remaining five samples were very kindly supplied, through Dr. Lewkowitsch by M. Bertainchaud, the Director of the Government Agricultural Laboratory in Tunis. The olives from which they were obtained were gathered from the trees in the different regions by M. Bertainchaud's agents, and the oils were expressed by him personally in the laboratory. The authenticity of the varieties and the genuineness of the samples are, therefore, absolutely certain.

The description of each sample and the results of my tests are given in the following table :—

Description.	Colour.	Sp. gr. at 60° F.	Saponification Value.	Iodine value (Wijs).	Unsaponifiable matter.
			per cent.	per cent.	per cent.
1. Olive oil from Sousse, Tunis, 1906–1907 harvest. "Congealing"	—	0·9170	19·19	85·4	0·95
2. Olive oil from Sousse, Tunis, 1906–1907 harvest	Yellow	0·9175	19·16	86·2	0·81
3. Olive oil from Bône-Guelma, Algeria, 1906–1907 harvest	Golden yellow	0·9167	19·17	83·2	0·89
4. Olive oil from Medjez-Amar, Algeria, Province of Constantine, 1906–1907 harvest. "Non-congealing" †	Golden yellow	0·9173	19·03	90·5	0·97
5. Tunis olive oil. Variété, Chétui Mornag	Pale yellow (primrose)	0·9178	19·04	94·7	0·92
6. Tunis olive oil. Variété, Chemlali Sfax	Yellow	0·9162	19·06	80·2	0·88
7. Tunis olive oil. Variété, Chemlali Gatès	Pale yellow (primrose)	0·9169	19·09	86·9	0·77
8. Tunis olive oil. Variété, Chétui Bizerte	Yellow	0·9171	18·92	91·1	0·91
9. Tunis olive oil. Variété, Besbassi Rhadès-Tunis	Brownish-yellow	0·9164	19·04	82·7	1·15

By Renard's process, working on 10 grms. of oil, no arachidic acid was obtained from either of the above samples. On the first crystallisation from 90 per cent. alcohol at 15° C. of the fatty acids separated from the ether-insoluble lead soaps small quantities of crystals were obtained from Nos. 1, 2, 5, 8, and 9, a considerable quantity from Nos. 6 and 7, a trace from No. 3, and none from No. 4. After filtering and washing with 90 per cent. alcohol, the following quantities of acids remained :—

No. 1. 0·0123 grm. m. pt. 56° C.
No. 2. 0·0010 „
No. 5. 0·0014 „
No. 6. 0·0105 „ m. pt. 57° C.
No. 7. 0·0018 „
No. 8. 0·0102 „ m. pt. 54° C.
No. 9. 0·0025 „

On attempting to recrystallise from 90 per cent. alcoho the acids obtained from No. 1, nothing separated in one hour at 15° C., and in a second experiment with this oil only 0·0007 grm. of fatty acids remained after washing the crystals which separated at 15° C. The acids obtained from Nos. 6 and 8 were each separately dissolved in 5 c.c. of 90 per cent. alcohol, but no crystals were deposited on cooling the solutions to 4° C., and keeping them for more than one hour at that low temperature.

A further experiment was made with 25 grms. of No. 6 and 25 grms. of No. 8 samples, mixed together. The oil was saponified, the mixed fatty acids separated, dissolved in 90 per cent. alcohol, and precipitated with 1 grm. of lead acetate. The fraction of lead soaps thus obtained was treated with ether and the fatty acids were liberated from the insoluble portion. On dissolving these in warm 90 per cent. alcohol and cooling to 15° C., a large white crystalline precipitate separated, which, when filtered and washed with 90 per cent. alcohol, nearly all dissolved, only 0·0078 grm. being left. On dissolving this in 5 c.c. of 90 per cent alcohol and cooling, nothing separated in one hour at a temperature of 4° C.

The results of a careful examination of these samples, therefore, afford evidence that genuine Tunisian and Algerian olive oils contain at any rate no more than such traces of arachidic or lignoceric acids as are undetectable by Renard's process, and that such comparatively large amounts as I found in the commercial samples which gave rise to this inquiry must have been derived from added earth-nut oil.

Incidentally, I may call attention to the high iodine values of some of these olive oils, especially No. 5, which resemble in this respect the Morocco olive oils. The results were carefully checked and may be relied upon as accurate. It will be noticed that the unsaponifiable matter only exceeds 1 per cent. in one sample. This was re-saponified without being reduced in weight. The saponification values are not exceptionally low, but the specific gravities of some of the samples are rather high. Neither of these samples gave any immediate colour when shaken with nitric acid of 1·375 sp. gr., and they acquired only a pale brownish tint after standing for one hour.

My best thanks are due to Dr. Lewkowitsch for the trouble he has taken in obtaining these oils for me, and to the French gentlemen named above, who so kindly responded to his request for samples. Some further authentic samples of Algeria oils have been promised, but have unfortunately not yet come to hand, so that I am unable to record the results in this paper. For the analytical work I am chiefly indebted to one of my assistants, Mr. C. W. G. Halls.

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* See Lewkowitsch, Chem. Tech. of Oils, Vol. 2, p. 624

† Dr. Lewkowitsch informs me that this means that the oil has not been demargarinated.

Discussion.

Mr. F. E. Lott remarked upon the effect of seasons on the analytical constants of natural products. He was struck with the regularity of the figures given by Mr. Archbutt's samples, for it often happened that the constants of a body had so wide a range of variation as to make the detection of adulterants difficult. Had Mr. Archbutt examined known mixtures of olive and earth-nut oils? What other oils contained notable quantities of arachidic acid? Did arachis oil act deleteriously?

Mr. S. R. Trotman said that the publication of Mr. Archbutt's figures would be of much use to those who, like himself, had to deal with olive oils. He gathered from them that the common practice of sorting oils by means of such simple tests as the iodine value was in this case useless. This was unfortunate, since the separation of arachidic acid was too difficult to be applied simultaneously to a number of samples. Could the author recommend any simpler test?

Dr. H. J. S. Sand inquired whether the author had confidence in the solidification test upon which commercial samples were very often judged.

Mr. L. Archbutt, in reply, said that both rape and mustard oils contained arachidic and lignoceric acids, but the quantities present were so small (*e.g.*, not more than 1·5 per cent. in rape oil) that their presence in sufficient quantity to enable the arachidic acid to be easily detected would at once become manifest through the alteration of the other constants. He had made and analysed mixtures of olive and earth-nut oils, and found the latter could be estimated with accuracy. There was no other method of quantitatively estimating the oil. As a qualitative test, capable of detecting 5 per cent. of earth-nut oil, he could recommend Bellier's process, which was easily carried out.

The solidification point of the oil was, in his opinion, quite useless. If he had to confine himself to a "single" test he would regard that for cotton-seed oil as the most useful, as the latter oil was the most common and objectionable adulterant. The presence of earth-nut oil did not materially alter the value of olive oil, either as a lubricant or a food, but it was cheaper, and should not, therefore, be substituted without a corresponding reduction in price.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, April 8, 1907.

MR. F. W. BRANSON IN THE CHAIR.

THE STANDARDISATION OF HIDE-POWDER FOR TANNIN ANALYSIS.

(*Contribution from the Leather Industries Laboratories of the University of Leeds.*)

BY HUGH GARNER BENNETT, B.SC.

In a previous paper (this J., 1906, 1193—1200) an account was given of a very extensive comparison of the filter bell method of tannin analysis used by the I.A.L.T.C. with the shake method of the American Leather Chemists' Association, the result being very much in favour of the latter. In another paper (this J., 1906, 1203—1207) the defects of the American official method were pointed out, and suggestions made for a modified shake method, which suggestions were crystallised later into definite proposals as the "basic chloride method" (this J., 1907, 79—80).

Anticipating, therefore, a change in the method of tannin analysis by the European Association for some improved form of the shake method, the author now desires to point out that in fixing a process for the treatment of hide-powder for this method, not only does the "basic chloride method" more nearly approach concordance than the American method, but also that it goes as far as is possible for the present. The writer, therefore, desires to emphasise that in chroming the hide-powder with basic chromium chloride, and controlling the acidity thus introduced, in definitely fixing the quantity of hide-powder to be used, and also the quantity of the tannin infusion with which it is to be in contact, the chances of concordance have been placed at a maximum, and that it is impossible to prove by comparative analyses that any other method gives a better concordance. This is due to the fact that the possibility of error is well within the sources of error due to the hide-powder itself. Hence, it is desired in this present paper to point out a new departure in methods of obtaining concordance of results—by attempting to standardise the hide-powder used. If any further advance is to be made towards the general agreement, it will be not by defining more closely the conditions for treatment of the powder before use, but by defining as far as possible the qualities and chemical condition of the original untreated hide-powder, and by fixing the limits for such a standard hide-powder within as narrow a margin as possible.

It has previously been recognised that the best way of obtaining concordant results is for all chemists to use the same hide-powder, but the I.A.L.T.C. attempted to do this by defining the official hide-powder as that supplied by a certain firm, which unsatisfactory definition resulted in endless trouble, due to variations in quality in different batches. The Association, indeed, attempted to place one restriction on the official powder—the maximum amount of soluble matter it should contain—but this has led to an impossible situation, as the hide-powder supplied by the recognised firm exceeded this in its soluble content, and the I.A.L.T.C. are now, therefore, in the unfortunate position of having no official hide-powder!

It is imperative, therefore, that it should be at once recognised that the only way to keep clear of this difficulty in the future, and the only way to advance further towards the universal concordance that is so ardently desired, is to attempt some definition of a standard hide-powder, and as information at our disposal increases, to narrow down this definition. Such an attempt at definition is likely to be as yet very incomplete, but something can be done, and in the very considerable amount of attention which has been paid by the author to this question of late with various methods and many powders, he has become quite convinced that by far the most prominent factors in determining the absorptive properties of hide-powder are (1) its texture, and (2) its acidity. If, therefore, any advance is to be made towards the ideal—a standard hide-powder—it will be by first of all attempting to define these points, by determining the extent of their influence and limiting their scope.

1. *The texture of the hide-powder.*—The importance of this factor in determining the absorptive power of hide-powder was realised by the author in his attempt to prepare a satisfactory hide-powder from the picker sawdust described in an earlier paper as "Buffalo hide-powder" (this J., 1907, 79—80). This powder, as mentioned before, detannises solutions quite satisfactorily, but is of a granular consistency, and gives results different from those of the woolly powders in the direction of higher non-tans. In order to test how far the actual texture influenced the results, a granular powder was prepared, which contained the same amount of acid[*] as the most neutral woolly powder the author could obtain, and these powders were tested one against another, with typical extracts, the basic chloride shake method being used. The results are as follows, stated in percentages of soluble non-tannins:—

Extract.	Fibrous powder.	Granular powder.
Oakwood	15·5	18·2
Mimosa D.	12·0	13·4
Ordinary quebracho	8·1	10·8

(*) Determined by the method described in this paper, the actual results being: Granular, 3·5: Fibrous, 3·4.

Both these powders gave perfectly concordant results when considered separately, the above analyses being repeated several times with the same result. In each case the non-tannin residues were free from both soluble hide-substance and tannin. The non-tannin filtrates were usually more coloured in the case of the granular powder, showing qualitatively its lesser absorption of the non-tannin colouring matters of the extract.

The fact that granular powders give higher non-tannins and still absorb all the tannin is a point from which it may be argued that granular powders are better. From the standpoint of the approximation to the true value of tannin matters in an extract, this is no doubt true, and has already been claimed as a virtue for the Buffalo hide-powder.

At the same time the writer recognises that most powders in use for the shake method have a more fibrous texture, such as, for example, that used by the American Leather Chemists' Association, and thinks, therefore, that here truth may be sacrificed for the sake of general concordance. The hide-powder method is, after all, empirical, and it would not be wise at this juncture to obtain higher non-tannins than the American Leather Chemists' Association's method, if it involves the sacrifice of the possibility of a universal agreement. There are, moreover, other reasons for the use of a fibrous powder. It has been occasionally observed by the writer in his work on granular powders, that they do not take up the insoluble matters so readily when the unfiltered tannin infusion is used for the detannisation, as is usually the case. He has, indeed, for some quebrachos, been compelled to use "605" paper and kaolin to get the non-tan filtrates clear. The fibrous powders, on the other hand, gave no such difficulty, partly, no doubt, because of the greater area of surface presented, and hence the greater absorptive capacity, not only for the astringent bodies allied to tannin, but also for the difficultly soluble tannins, which we still include under the term "insoluble"; and partly also because the very fact that the powder is fibrous, causes it to act as a filtering medium. Experience has also shown that wet chromed powders are very much more convenient to handle when the powders used are fibrous. I, therefore, suggest that, as a first step towards the definition of a standard hide-powder, granular and sandy powders should be definitely excluded.

How exactly to define a fibrous powder in contradistinction to a granular powder is not an easy matter, as there is no sharp dividing line between the two classes. As yet, perhaps, the only limits one can reasonably impose are the following very rough tests:—(*a*) The powder should appear woolly in texture, should be easily compressible into less volume, and, when microscopically examined, should exhibit a fibrous structure; (*b*) When separate masses of the powder are pressed together, they should adhere; (*c*) It should not be possible to pour the powder from one vessel to another, as is possible with sand. As far as the limitation of fibrous powders is concerned, even greater difficulty will be found. But it may be questionable how far this may be necessary. The author has not been able as yet to test this experimentally, as unchromed powders unequal in fibrous texture, and equal in acidity and other qualities, are not readily attainable, and would, in all probability, have to be made specially.

Some interesting observations of Mr. H. C. Reed in the last issue of the American Leather Chemists' Journal have just come to hand. In a microscopic examination of different hide-powders he draws the following distinctions:—"——— powder shows short granular fibres, without matting; ——— powder shows long fibres, small and interlaced; ——— powder shows fairly long fibres, not interlaced; and ——— powder fairly long fibres somewhat interlaced." Some of these powders were unchromed and some were chromed, so that no conclusions could be drawn from these observations as to the influence of texture on absorptive power. It may appear that the above distinctions are rather fine, but, as indicating the desirability of a closer study of the structure of powders, it is a step in the right direction.

2. *The acidity of the hide-powder.*—There is, perhaps, some ambiguity in connection with this term, as it has been applied indiscriminately to the acid in untreated hide-powders, and also to the acid introduced by treatment with a chrome salt. The "total acidity" due to both these factors is, no doubt, what determines the absorptive power of hide-powder. The importance of the "acidity due to chroming" has been previously emphasised by the author, and its amount definitely fixed by the basic chloride method, and arranged so that there is not only an easy control, but also that the quantity of free acid formed by any further hydrolysis of the chrome salt attached to the hide-powder will be unweighable if not volatile.

It is desired here, therefore, to lay stress upon the other factor in the "total acidity," *i.e.*, the "original acidity" of the untreated powder, and to emphasise the importance of accurately fixing within what limits it shall fall. There is no doubt that the untreated powder should be acid to some degree, and that imperfectly delimed powders should be excluded; but no attempt has been made as yet to define what shall be the limit of this acidity.

The troubles of the I.A.L.T.C. with the swelling of the powder in the filter bell, and increase in soluble matter, led to some discussion on the acidity of powders, and were, no doubt, influential in causing Kopecky to suggest the use of a neutral powder with a definite amount of acetic acid added to the tannin infusion. The American Leather Chemists' Association are also beginning to notice the importance of this matter, and the writer was pleased to note that in the list of subjects upon which "the Referee regards it as desirable that work be done" occurs, near to end, "Effect of varying acidity of hide-powder on the analysis figures" (J.A.L.C.A., I., 12). The referee even suggests a method for determining the acidity of a hide-powder as follows:—"Digest 5 grms. hide-powder in 75 c.c. water for two hours; add 5 drops phenolphthalein and titrate with $N/10$ alkali until the addition of 2 drops of alkali gives a pink coloration lasting for one minute. Report the number of c.c. of $N/10$ alkali required." Such a method would be open to several very strong objections. In the first place, the variable moisture content of the air-dry powder is neglected, and would thus shatter all hope of concordance, and, in the second place, the two hours' digestion with water is utterly unnecessary, an equilibrium between the water, acid, and powder being established in a much shorter time, if, indeed, it is necessary to wait until it is established. Again, the end point proposed seems distinctly crude, and is an admission that the truth is not being obtained.

The distribution of acid between the water and the hide-substance is very closely analogous to the distribution of a substance between two immiscible solvents, and the titration of the acid is comparable to the continuous removal of the substance from one of these solvents, resulting in a fresh distribution; but in the titration it is not necessary to wait till the equilibrium is complete, as the addition of the alkali can be continued as soon as the pink disappears and fresh acid has diffused out into the water. Moreover, to get correctly the information required it is necessary to continue the titration until all the acid diffuses out, is neutralised, and a permanent pink obtained. Experiments by the author on the matter indicate that the texture of the powder would have a marked influence on the results obtained by any other method of fixing the end point, and that errors from the true result would be in some cases nearly equal to the number actually obtained.

The method used by the writer has been as follows:—The quantity of the air-dry hide-powder which corresponds to 6·5 grms. of actual dry hide (this is usually known), is digested for a short time with 100 c.c. of distilled water, 1 c.c. of phenolphthalein is added, and the liquid titrated with $N/10$ sodium or potassium hydroxide until a permanent pink colour is obtained. Results are stated in c.c. of $N/10$ alkali required.

Experiments have been made with hide-powders prepared by the author, so that the texture of the powders was as nearly identical as possible, but the acidity different. These acidities were determined by the above method, and the powders tested one against another with the following results, the basic chloride shake method being used.

Hide-powder.	Acidity.	Non-tannins.	
		Oakwood extract.	Mimosa D.
		per cent.	per cent.
I.	12·6	14·5	—
II.	6·3	15·0	11·9
III.	3·5	18·2	13·4

All these solutions were completely detannised, and these results therefore illustrate the importance of the matter, and show that the effect of such variations in acidity is very appreciable. It therefore becomes of excessive importance to make the standard hide-powder have a definitely fixed acidity.

There appears to be no reason why any considerable amount of acid is needed in a powder which is to be chromed just before use, and it is my experience that the "basic chloride method," used with the most neutral powder obtainable, will satisfactorily detannise any tanning extracts. There are strong reasons why the acidity should be kept down as far as possible. One of these is illustrated in the above results—the fact that a large amount of acid increases the absorption of matters not tannin. The experiments show clearly that the greater the acidity the lower are the "non-tannins," and hence also the farther away is the result from the true value of the tannin in the extract under examination. Again, if a large amount of acid were in the powder, it would be necessary to have some method of controlling it in the washing, for it would be useless to fix a definite acidity in the unchromed powder, if an indefinite proportion is to be washed out. The only suggestions made for greater acidity of powder have been made in connection with the treated extracts with which it has been thought desirable to have more acid, in order to estimate satisfactorily the alkaline tannates which are supposed to exist in such extracts. The argument appears at first sight to be theoretically sound, but practically it is found to be altogether unnecessary, as the basic chloride method, even with a neutral powder, will detannise these extracts quite well; that is, the non-tannin filtrates do not give a precipitate with a 1 per cent. gelatine, 10 per cent. salt solution, and give no precipitate also, if they are first acidified.

Hence it appears that the case for a hide-powder with a very low acidity is a very strong one, and I therefore propose that "the standard hide-powder shall be acid to phenolphthalein, and that for the present, the limit be fixed so that the powder shall not have an acidity greater than 5·0, as determined by the above method. Any powder which contains more than this shall be re-washed and dried out."

A further point is the nature of the acid that is to be allowed. It is quite conceivable that equal quantities of different acids will influence the absorptive power of the hide-powder to a different extent, for there is no doubt that this acidity effect is due to differences in the physical condition of the powder with respect to the degree of swelling, and it is known that molecularly equal quantities of different acids have unequal swelling effects. Hence it may be desirable eventually to fix definitely what acid shall be used in the de-liming process.

The question as to how far the degree of chroming influences the absorption is outside the scope of this paper, except that it is necessary to point out that in the discussion of the relative merits of heavily and lightly chromed powders the points at issue have been confused, no satisfactory distinction having been drawn between the effect of increased percentage of chromic oxide, the effect of "acidity due to chroming," and the effect of "free" acid, either in the original unchromed powder or that deliberately put in. Reliable and conclusive information on any of these matters cannot be obtained except by carefully eliminating or equalising the effect of every other factor.

Some observations on the possibility of a satisfactory dry-chromed hide-powder may not, however, be out of place. The only satisfactory dry-chromed hide-powder is one which need not be wet back and purified immediately before use. The writer agrees with Mr. H. C. Reed that "the *raison d'être* of a dry powder will be lost if we are compelled to soak or wash and use it with a moisture correction *; the advantage over the present conditions would hardly make it worth the while." If this be true for the American method of 24 hours' chroming and washing, how much more is it true for the "basic chloride method," in which the powder can be prepared in little over an hour?

The author regards the possibility of such a satisfactory dry powder as extremely small. It would have to contain no soluble matter, or it could never compete with wet chromed powder, in which this error is almost totally eliminated. Again, there should be no appearance of soluble matter on keeping—a more difficult matter still. The absorptive properties also should remain constant on keeping, and our experiences hitherto indicate that this is almost impossible. All heavily chromed powders yet prepared have deteriorated rapidly, even when containing a large amount of acid and soluble matter, and we may reasonably assume that the same will occur with lightly-chromed powders, to a less degree.

Moreover, not only does the possibility of a satisfactory dry-chromed powder appear beyond hope for the present, but also it is strongly undesirable, with our present knowledge, to commence using such a powder. Until we have determined the influence and limited the effect of those factors which control the absorptive power of unchromed powders, such as texture and acidity, it would be extremely unwise to prepare or use a dry-chromed powder. All such attempts would merely confuse the point at issue, and be a bar to all further advance towards a better concordance of results. Henceforth our chief hope for better concordance is, in my opinion, in standardising hide-powder, and I consider, therefore, that this hope is very much greater when the matter is considered apart from the effect of chroming. A standard dry-chromed hide-powder is an unattainable ideal if a standard unchromed powder cannot be obtained.

It has been suggested that when the I.A.L.T.C. formally settle on a shake method, they might adopt Dr. Paessler's lightly-chromed dry-powder, but from the considerations outlined above, it is evident that such a course would be extremely premature. This powder not only contains a very appreciable amount of soluble matter, necessitating a thorough washing immediately before use, but also its acidity is clearly too large, the result obtained by the author on one sample being 9·0, by the method described herewith. Moreover, this may be due to indeterminate proportions of "acidity due to chroming," and other "free acid," and for satisfactory control these factors should be considered separately. The washing "free" from sulphates has previously been shown to be an unsatisfactory end-point. It is also to be borne in mind that there is no evidence that absorptive powers remain constant for any length of time, and further, also that different batches of the powder will be equally absorptive. Doubt, in fact, has been recently thrown on both these points. It is clear, therefore, that its adoption by the I.A.L.T.C., or any section of it, would not only be an obstacle to any further advance towards concordance, but would also be unsafe, and might lead to the same awkward predicament in which we are now placed. After all, the powder was manufactured for use in the filter bell, and with no thought of the shake method, so that although its unsuitability for the latter is unfortunate, it is not to be wondered at. At the same time it is desirable that Dr. Paessler's considerable experience in the manufacture of hide-powder should not be lost to the International Association, and the author was therefore pleased when the British Section resolved to approach Dr. Paessler as to the manufacture of a cellulose free unchromed hide-powder suitable for use with the shake method.

The conclusions of the author may, therefore, be briefly summarised as follows:—

(*) The moisture correction will unfortunately be always necessary, even with an air-dry powder, but it would be possible to eliminate the trouble of it by the addition of 11·5—Q. c.c. of water and the use of a pipette delivering 52·5 c.c. for the non-tans.

(*a*) It is strongly desirable to attempt to standardise unchromed hide-powder, as with any other chemical reagent.

(*b*) The first step should be in limiting the texture and acidity of the powder, as suggested above.

(*c*) Further experiments should be made to investigate the causes of the difference in absorptive capacity, by isolating the various factors which determine this, and considering their effect separately.

(*d*) No dry-chromed powder should be adopted until these matters have been decided and fixed.

(*e*) The nearest approximation to the true value of the tannin in an extract can be obtained by the use of the basic chloride method along with a neutral, granular hide-powder.

Meeting held at Queen's Hotel, Leeds, on Monday, April 8, 1907.

MR. F. W. BRANSON IN THE CHAIR.

THE ANALYSIS OF SINGLE-BATH CHROME LIQUORS.[*]

BY PROF. H. R. PROCTER, M.SC., F.I.C., AND DOUGLAS McCANDLISH, B.SC.

(*Contribution from the Leather Industries Department of the Leeds University.*)

With the rapid development of the chrome tanning industry during recent years,there has arisen the necessity for suitable methods of chemically controlling the various operations involved in this process of leather manufacture.

One of the most important matters which a chemist has to regulate is the strength of the chrome liquors which are used in the "one-bath" and "two-bath" processes of tanning. In the former method, the skins are tanned by means of basic chrome liquors, which are prepared in various ways. The most common methods of preparation are either by the partial neutralisation of a solution of a normal chromium salt (usually chrome alum), or by the reduction of potassium bichromate with glucose in presence of a limited quantity of concentrated sulphuric acid. The basic chromium salts present in such solutions can be fixed by the skin, which thus becomes converted into leather. As long as the ratio of chromium to acid in the solution is within certain limits the tanning will proceed, but after using the liquor for a time this ratio may become altered, and consequently the tanning action will not proceed to the same extent as it did in the original liquor. In such liquors a chemist has to determine how much acid and chromium are required to restore them to their original condition.

Various methods have been suggested for arriving at the composition of used chrome liquors, and amongst the most recent contributions to the subject is a paper by F. Kopecky in the Journal of the American Leather Chemists' Association (Vol. 1, p. 261), in which a method for the analysis of single-bath chrome liquors is described, the acidity being determined by means of magnesia. This is done by boiling the chrome liquor with magnesium carbonate, filtering off the precipitated chromium hydroxide and excess of magnesium carbonate, determining the amount of magnesium salt in the filtrate, and from this calculating the amount of acid which must have been free, or combined with chromium in the original liquor. The estimation of magnesium necessitates waiting at least six hours before the result can be obtained, but otherwise the method does not appear to present any difficulties.

The authors first attempted to determine acidity by ascertaining the amount of carbon dioxide evolved from a known volume of liquor when boiled with a carbonate. It was found that the carbon dioxide evolved from a definite volume of normal acid and a carbonate could be absorbed in standard sodium hydrate solution, and the sodium carbonate found by titration with acid, using phenolphthalein and methyl orange as indicators. The carbon dioxide found in such a case agrees very closely with the theoretical quantity. When the method was applied to a solution of chrome alum, the amount of carbon dioxide found was always considerably below that required by the equation

$$K_2SO_4{,}Cr_2(SO_4)_3 + 3CaCO_3 + 3H_2O =$$
$$K_2SO_4 + Cr_2(OH)_6 + 3CO_2 + 3CaSO_4.$$

The carbonates of zinc, barium, and magnesium were substituted for calcium, but in no case was the amount of carbon dioxide near to what was expected, and consequently experiments on these lines had to be discarded. F. W. Alden (Journ. Amer. Leather Chem. Assoc., 1, 174), uses a method for estimating acidity in which the chrome liquor is added to an excess of boiling sodium carbonate solution of known strength, the precipitated hydrate filtered off and the excess of alkali titrated in an aliquot portion of the filtrate. He states that the chromium hydroxide carries down with it part of the sodium carbonate, and in order to obviate this error as far as possible, a second experiment is carried out, in this case precipitating the chromium with the amount of alkali determined in the first case. By this method Alden obtains concordant results which are sufficiently accurate for practical purposes.

The authors find that the acidity of chrome liquors can be rapidly and pretty accurately determined by titrating the boiling solution with sodium hydroxide, using phenolphthalein as indicator. This was proved by titrating solutions of chrome alum and chromium chloride under varying conditions. In the first case, 25 c.c. of a 10 per cent. solution of pure re-crystallised chrome alum were measured into a porcelain basin of suitable size, diluted to about 200 c.c., with distilled water, and 3—4 c.c. of 1 per cent. phenolphthalein solution added. The diluted solution was now boiled, and titrated whilst boiling with *N*/1 sodium hydroxide, stirring constantly. When nearing the end point, which can be readily judged by the slow disappearance of the red colour, the burner was removed from under the basin and the titration completed. When an excess of alkali is present, the red colour is easily seen round the edge of the solution in the basin, as the precipitated chromium hydroxide soon settles sufficiently for the purpose. Several titrations were carried out with chrome alum and chromium chloride, and the acid calculated as sulphuric acid and hydrochloric acid combined with chromium respectively. In the first case, the theoretical equivalent of sulphuric acid combined with the chromium in 100 grms. of chrome alum is 29·45 grms. The amount found (being the mean of three determinations) was 29·06 per cent. of sulphuric acid combined with the chromium. In the second case, the equivalent percentage of hydrochloric acid combined with chromium in $Cr_2Cl_6.12H_2O$ is 40·99 per cent. The amount found (mean of three determinations) works out to 40·5 per cent.

As dissolved hide-substance and other organic matter may be present in used chrome liquors, it was thought that they might interfere with the titration, so the effect of gelatine peptones and other organic matter upon the determination was investigated. A solution of gelatine peptones was prepared as follows:—5 grms. of gelatine were soaked in water and dissolved on the water bath to about 50 c.c.; 10 c.c. of *N*/1 sodium hydroxide solution were added, and the heating continued for 20 minutes; 10 c.c. of *N*/1 hydrochloric acid were now added, the volume made up to 100 c.c., and the solution filtered; 25 c.c. of 10 per cent. chrome alum solution were now mixed with 10 c.c. of the peptones, and boiled for one hour in a conical flask, and the contents transferred to the porcelain basin, diluted and titrated as before. The results obtained were almost the same as in the previous case—the percentage of sulphuric acid, when using chrome alum, coming to 29·20, whilst with chromium chloride the percentage of hydrochloric acid came out at 40·40. The presence of the gelatine peptones caused some frothing when the solution was boiled for the titration, which interfered with the observation of the end-point. The addition of a few drops of turpentine to the solution effectively prevented this.

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[*] In Der Gerber, Nr. 781 (published after this paper was written), an article appears on this subject by Dr. Stiasny, in which he refers to his previous paper (Der Gerber, 1903, Nr. 682), describing almost the same method as is given here for the determination of acidity of liquors. The authors were not aware of this publication at the time of writing, and must offer this as a confirmation of Dr. Stiasny's views.

A single bath liquor was now carefully prepared containing 5 per cent. of pure sulphuric acid, 6 per cent of re-crystallised potassium bichromate, and 7 per cent. of glucose. As two-fifths of the sulphuric acid will be converted into potassium sulphate, the acid in combination with chromium or in the free state should amount to 3 per cent. The amount found on titration was slightly in excess of this, due no doubt to the formation of organic acids by the oxidation of the glucose by the bichromate.

The estimation of chromium by the gravimetric method is a long process, and the washing of the precipitated hydroxide somewhat tedious. Therefore it does not commend itself when a rapid valuation of a chrome liquor is desired.

Professor H. R. Procter, in his "Leather Industries Laboratory Book," p. 145, mentions the use of sodium peroxide for the oxidation of chromium in solution. This idea has been applied by Alden (J. Amer. Leather Chem. Assoc., 1, p. 174). The authors have investigated the method under varying conditions, and find that it works very satisfactorily, but suggest the following method as being more conveniently carried out.

Such a quantity of chrome liquor as will contain from 0·3 grm. to 0·5 grm. of chromic oxide is weighed or pipetted into a beaker, and diluted to about 100 c.c. with distilled water. The beaker is covered with a clock glass and 3 grms. of sodium peroxide (approximately) is added, in portions of 1 grm. at a time to the cold solution. After each addition, the clock glass should be rapidly replaced, and when the vigorous effervescence has ceased, the solution is stirred with a glass rod. The liquor, which will now have assumed a reddish yellow colour, is heated over a bunsen flame until it boils, and the heating continued for at least 15 minutes. By this time the whole of the sodium peroxide should be decomposed, and there should be no sign of effervescence in the liquid. The solution, which has now the yellow colour of sodium chromate, is transferred to a 250 c.c. graduated flask, cooled and made up to the mark with distilled water. Portions of 50 c.c. are measured into titration flasks, and acidified with hydrochloric acid, until the yellow colour has changed to the red produced by chromic acid. 10 c.c. of a 10 per cent. solution of potassium iodide are added, and the liberated iodine is titrated with $N/10$ sodium thiosulphate. Each c.c. of thiosulphate required represents 0·0049 grm. of potassium bichromate, or 0·00173 gr. chromium, and from this the amount present in the original solution may be readily calculated.

Working by this method the chromium was determined in chrome alum and chromium chloride, adding gelatine peptones and glucose to measured volumes of solutions of these salts in order to imitate more closely a used liquor.

Chromium chloride.—20 c.c. of a 5 per cent. solution of crystallised chromium chloride mixed with 0·25 grm. gelatine peptones and 0·25 grm. glucose gave 19·07 per cent. and 19·11 per cent. of chromium; mixed with 0·3 grm. gelatine peptones and 0·3 grm. glucose, 19·11 per cent. chromium was found.

The theoretical amount of chromium in $Cr_2Cl_6 12H_2O$, is 19·50 per cent., but the mean of two gravimetric determinations of the chromium in this sample showed only 19·10 per cent.—probably due to moisture in the sample.

Chrome alum.—25 c.c. of a 10 per cent. solution of chrome alum mixed with 0·25 grm. gelatine peptones, 1 grm. glucose, gave 10·33 per cent. and 10·20 per cent. of chromium; on addition of 0·25 grm. gelatine peptones, 1 grm. glucose, and 0·25 grm. formaldehyde, 10·20 per cent. of chromium was found.

The theoretical percentage of chromium in chrome alum is 10·42.

The chromium was determined in the glucose liquor previously mentioned, which contains 6 per cent. potassium bichromate, *i.e.*, 2·12 per cent. chromium. The amount found by the above method was 2·10 per cent.

The foregoing results show that the method is quite reliable and particularly commends itself for the estimation of chromium in solution. For the determination of chromium in the ash of leather, where it exists as ignited chrome oxide, which is insoluble in most reagents, the fusion method of Procter and Searle is more convenient than the one described above.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 396.)

English Patents.

Evaporating liquids, and means or apparatus therefor. E. Shaw, London. Eng. Pat. 26,409, Dec. 19, 1905.

The evaporation is effected in a series of tubes heated externally, into which the liquid is forced, under pressure, through nozzles with spiral bores, so that the liquid describes a spiral course over the inner surface of the tubes, this surface being provided with a screw thread or groove, the pitch of which increases as it approaches the outlet end. The liquid is subjected to little or no pressure whilst flowing through the tubes, and the rate of flow is such that the particles of liquid in contact with the hot wall of the tube are not subject to any appreciable pressure by the rest, whilst the rolling motion of the liquid removes the heated portions to the surface of the current when they have received sufficient heat to convert them into vapour, their place being then taken by others.—C. S.

Exhaust steam for heating evaporators, heating, boiling, and vacuum pans, stills, and the like; Utilisation of ——. Fullerton, Hodgart and Barclay, Ltd., and A. J. Liversedge, Paisley. Eng. Pat. 9032, April 17, 1906.

The exhaust steam to be used for heating evaporators and other similar apparatus is first conducted into a receiver provided with superheating tubes, and is superheated either by a special fire or by the waste heat of the flue gases. Before entering the receiver, the exhaust steam may be passed through a grease and dirt separator. Further, the liquor to be evaporated is passed through a coil placed in the exhaust steam receiver so that it receives a preliminary heating before it enters the evaporator proper.—W. H. C.

Filter. C. C. Leclaire, Paris. Eng. Pat. 6950, March 22, 1906. Under Int. Conv., March 22, 1905.

A cylindrical tube of pervious material is mounted in an outer casing which serves to receive the filtrate passing through the pervious wall. At one end, the tube is connected to an impervious conical prolongation, which has an outlet pipe for the solid matter at the smaller end. A concentric shaft, rotated from without, passes through a stuffing-box at the other end of the tube and extends to the conical portion. That portion of the shaft which is within the cylindrical part of the apparatus is provided with discontinuous helical scrapers to detach the deposited solids from the interior surface of the filter and to carry them forward to the conical extension. The shaft is at this conical part provided with a continuous screw blade, which compresses the sludge into the cone and forces it out of the opening. The muddy liquid is fed into the tube under slight pressure, and the solids are discharged continuously from the other end, free from air and containing very little moisture.—W. H. C.

Dryers and coolers; Rotary ——. T. C. Fawcett, Ltd., and J. W. Bottomley, Leeds. Eng. Pat. 7318, March 27, 1906.

To screen out the dust and facilitate the cooling or drying of the lump material, the cylinder is fitted with a grated or perforated inner cylinder terminating a short distance from the outlet end of the outer casing. At the inlet end the annular space between inner and outer cylinder is closed by a metal plate or firebrick lining, the latter being preferred for cooling purposes.—C. S.

Aspirating, treating, and forcing fluids; Apparatus for ——. E. Richter, Zabrze, Germany. Eng. Pat. 9803, April 26, 1906.

The steam or other "working fluid" is caused to enter the injector from an annular jet so that suction is produced on both sides of the annulus. The interior and exterior suction may be made to act on the same, or on different fluids, and in the latter case they may be delivered from the jet either separately, or in admixture. Several jets may be combined into a compound injector, the annular form of the jet being maintained throughout. In the second and subsequent jets the "working fluid" and the induced fluid act together as an annular jet to draw in more of the induced fluid.—W. H. C.

Gases and vapours; Devices for separating admixtures from ——. R. Scheibe, Leipzig, Germany. Eng. Pat. 11,993, May 22, 1906.

See Fr. Pat. 365,003 of 1906; this J., 1906, 920.—T. F. B.

Separating liquids from vapours; Apparatus for ——. H. W. Aitken and W. Mackie, Glasgow. Eng. Pat. 17,612, Aug. 4, 1906.

The apparatus is shown in plan in Fig. 1, and in vertical section in Fig. 2. The mixture of vapour and liquid enters the apparatus in an approximately axial direction through the opening, B. It then passes in a more or less radial direction, as shown by the arrows, into the passage, E, which is of gradually restricted area as it recedes from the inlet, B. A swirling motion is thereby imparted to the mixture, which then enters the expansion chamber, G, where the vapour and liquid separate. The former escapes through the radial discharge pipe, H, and the latter returns to the vessel to which the apparatus is attached, by the drain pipe, J. Several modifications of the apparatus are claimed and illustrated.—W. H. C.

FIG. 1.

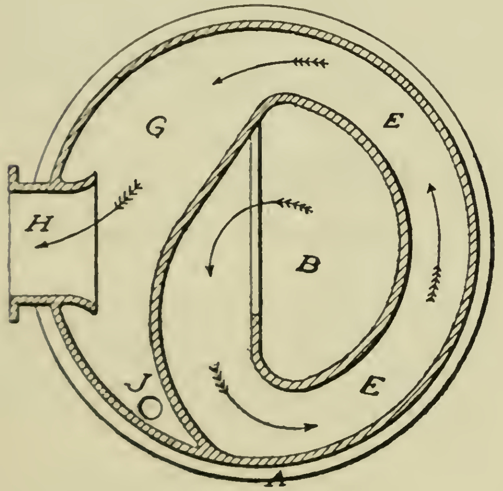
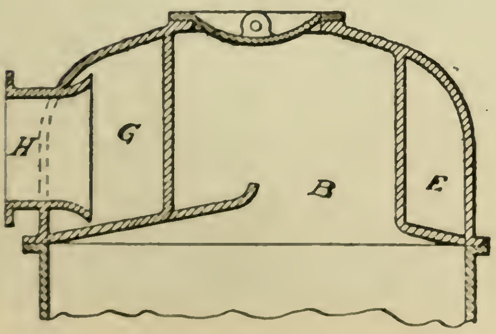


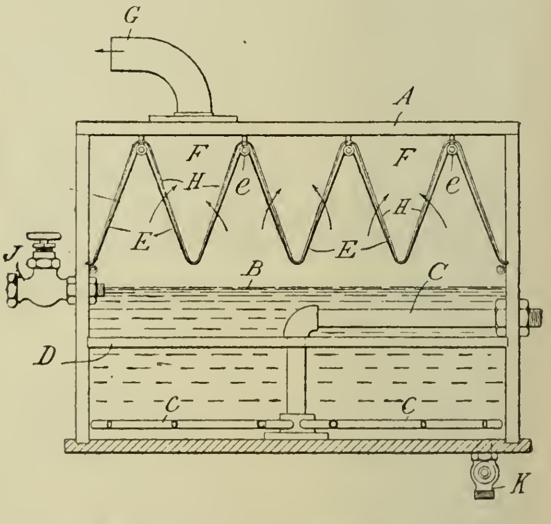
FIG. 2.



Furnaces and like combustion apparatus. W. H. Ricker, Cambridge, Mass., U.S.A. Eng. Pat. 23,313, Oct. 20, 1906. Under Int. Conv., Dec. 6, 1905.

The lower part of the furnace casing forms the "fire-pot," whilst in the upper part there is a tubular heater. Air enters above the heater and passes down and around it into the "fire-pot." Part of the air is utilised to complete the combustion of the glowing fuel, and part is drawn through the freshly-charged coal into hollow side passages by a fan and then delivered along with the gaseous products of distillation of the fuel and any dust into a flue which passes below and forms part of the hearth of the furnace. The gases and air pass through perforations into the mass of burning fuel and assist in the combustion. The products of combustion pass away through the casing of the heater and around and between the tubes, which are of oval section, their passage being retarded by baffle-plates.—W. H. C.

Washing and filtering air or other gases; Method of and means for ——. Ozonair, Ltd., London, and F. Rogerson, Streatham, Surrey. Eng. Pat. 27,124, Nov. 28, 1906.



The air is washed in the closed vessel, A, which is filled with water to the level, B. The gas, which is preferably drawn rather than forced through the vessel, enters by the pipe, C, and passes upwards through the water from fine perforations in the upper sides of the distributing branches, c, c. The fine streams of air or gas pass upwards through the water and impinge upon the lower surface of the porous partition, D, which is immersed in the liquid and may be formed of silicate cotton or other material and supported on perforated plates. This screen serves to keep back any solid impurities. The air after passing through the liquid above the partition, D, next passes through the porous filter, E, also formed of silicate cotton or other suitable material and which is hung in festoons from the rods, e. The filter is kept in position by a perforated screen, H, which prevents the air from lifting it upwards. The air is here deprived of free moisture, germs, and other impurities which had not been retained by the water, and collects in the space, F, from which it is aspirated out of the apparatus through the pipe, G. The washing liquid is by preference continuously fed into the apparatus through the tap, J, and withdrawn through K.—W. H. C.

United States Patents.

Kiln ; Rotary ——. W. C. Shiner, Assignor to J. W. Fuller, Catasauqua, Pa. U.S. Pat. 844,623, Feb. 19, 1907.

The claim is for the provision of a chamber or casing at the bottom of the stack into which one end of the rotary kiln-tube projects. Any material dropping down the stack collects in the casing and is fed into the kiln-tube by a screw-conveyor.—W. H. C.

Filter. H. Lieberich, Assignor to L. Lieberich Söhne G.m.b.H., Neustadt, Germany. U.S. Pat. 846,582, March 26, 1907.

See Eng. Pat. 13,247 of 1905 ; this J., 1905, 1055.—T.F.B.

Drying apparatus. K. Reyscher, Bielefeld, Germany. U.S. Pat. 847,694, March 19, 1907.

See Eng. Pat. 18,596 of 1905 ; this J., 1906, 873.—T. F. B.

Drying apparatus. O. Koepff, Göppingen, Germany. U.S. Pat. 847,786, March 19, 1907.

See Eng. Pat. 5748 of 1905 ; this J., 1905, 1291.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 401.)

Acetylene flame ; Action of the electric discharge on the —— C. F. Lorenz. XI*A*., page 474.

English Patents.

Fuel ; Manufacture of artificial ——. A. W. H. Vivian, London. Eng. Pat. 7357, March 27, 1906.

Carbonaceous material, such as coal, lignite, brown coal, coke, or peat, in a finely divided condition, is mixed with a magnesite cement with or without chalk, and heated to about 350° F. Oil, such as Texas fuel oil, astatki, masut, creosote oil, solar oil, or crude petroleum, is heated and mixed with 0·5 to 1·5 per cent. of commercial sulphur chloride ; the oil thus treated is mixed with water and, if desired, chalk, to form an emulsion, and is heated to about 300° F. The heated solids are incorporated with the emulsion, and the resulting mass formed into briquettes. The magnesite cement consists of calcined magnesite containing 2 to 5 per cent. of carbonic acid, with a suitable proportion of magnesium, calcium, barium, or zinc chloride. To improve the binding and non-hygroscopic qualities of the cement, various salts may be added, such as ammonium or lead chloride or carbonate, silica, sodium or potassium silicate. The amount of oil used may vary within wide limits : for example, from 7·5 to 40 per cent. by weight ; the amount of cement is usually 2 per cent.—A. T. L.

Coke ovens. O. Colle, Waterloo, Belgium. Eng. Pat. 7221, March 26, 1906.

A horizontal by-product oven is arranged to secure uniform heating and pre-heating of the air for combustion by the waste heat. The oven wall contains vertical heating flues, and is divided by vertical partitions into four equal parts passing equal amounts of gas. The gas and air meet at the bottom of the vertical flues, the products pass up the flues, and down through flues at the middle and ends of the wall into flues beneath the sole of the oven, and escape through two main flues connected to the centre of each half of the sole. The air is drawn through archways beneath the oven and receives radiated heat from the waste-gas flues, and it then circulates along the bottom and sides of the sole flues of the oven before reaching the combustion flues. —A. T. L.

Coke oven plant. H. A. Allport, Barnsley. Eng. Pat. 14,799, June 28, 1906.

The sloping retort delivery benches are provided with hinged tail-pieces of suitable width for filling trucks ; the tail-pieces can be raised by hydraulic rams to retain the coke on the sloping benches or to regulate its delivery into the trucks. The fixed part of each bench may be constructed so that part of it forms a screen, allowing the coke breeze to fall through into a hopper, which delivers it into other trucks on a parallel line of rails. —A. T. L.

Peat, brown coal, or lignite and like substances ; Purification and calcination of ——. W. S. Simpson, London. Eng. Pat. 7732, March 30, 1906.

The materials are placed in removable cases and heated in a retort, *in vacuo*, to expel the volatile products without oxidation and without appreciably oxidising the fixed carbon. The by-products are collected in a vacuum chamber connected with the retort.—C. S.

Heat exchangers used in gas-producer plant. W. Dixon and J. R. Ross, Glasgow. Eng. Pat. 13,892, June 18, 1906.

Tubular economisers, by means of which the heat of the gases leaving the producer is caused to heat the air or air and steam entering the producer, frequently break or become warped, owing to the inequality in the heating and cooling, and consequent differences in the expansion at various parts of the tubes or casing. According to this invention the inner pipes are constructed so as to be capable of expansion and contraction without causing damage ; for example, they may be corrugated at one part, or throughout their length, or they may be provided with expansion rings, "bowling hoops," or equivalent devices. The outer casing is made of such dimensions as not to be too close to any of the hot tubes, thereby avoiding the local heating and expansion of the casing. —H. B.

Gaseous mixture containing hydrogen and methane ; Process for the manufacture of a ——. P. Sabatier, Toulouse, France. Eng. Pat. 15,326, July 5, 1906. Under Int. Conv., July 7, 1905.

See Fr. Pat. 361,616 of 1905 ; this J., 1906, 975.—T. F. B.

Gas producers. J. J. Deschamps, Paris. Eng. Pat. 19,048, Aug. 25, 1906. Under Int. Conv., Aug. 25, 1905.

See Fr. Pat. 369,216 of 1906 ; this J., 1907, 85.—T. F. B.

Carburetting air ; Apparatus for —— *or for the production of gases from hydrocarbon.* W. von Dulong, Witaschütz, Germany. Eng. Pat. 24,349, Oct. 31, 1906.

See Fr. Pat. 371,005 of 1906 ; this J., 1907, 249.—T. F. B.

Air ; Apparatus for carburetting ——. H. E. Smith, Edinburgh. Eng. Pat. 26,314, Nov. 20, 1906.

The improvements consist in enclosing the pump, or other apparatus for supplying regulated quantities of the carburetting liquid, in a gas-tight chamber through which the air supply to the carburettor or the carburetted air circulates, and in providing a pipe leading from the interior of the gas-holder to the bottom of an air-tight petrol-supply tank so that the liquid consumed is replaced by carburetted air delivered at the bottom of the tank, thus agitating the liquid. In the apparatus shown, the air is supplied to the carburettor by a rising and falling bell actuated by a water-motor controlled from the gas-holder. The petrol pump is in the suction-chamber beneath the air compressor and is driven by the rise and fall of the bell. The carburettor consists of a shallow tray, on to which the petrol is delivered, in the interior of the gas-holder.—A. T. L.

Carbonic acid, hydrogen, and nitrogen; Manufacture of —— [from water-gas]. E. G. Elworthy. Eng. Pat. 10,581, May 5, 1906. VII., page 469.

Filters chiefly intended for use in connection with the purification of gas. F. D. Marshall and S. Hersey, London. Eng. Pat. 7538, March 28, 1906.

SEE Fr. Pat. 369,965 of 1906; this J., 1907, 190.—T. F. B.

Incandescence bodies of refractory metals for electric lamps; Manufacture of ——. A. G. Bloxam, London. From J. Lux, Vienna. Eng. Pat. 7188, March 24, 1906.

A SMALL proportion of aluminium or magnesium, or both, is added to the paste of metallic oxide and carbon, the mixture being then shaped in the usual way and heated to incandescence by the passage of an electric current. —C. S.

Incandescence bodies for electric lamps; Manufacture of —— from tungsten compounds. The British Thomson-Houston Co., Ltd., London. From General Electric Co., of Schenectady, N.Y., U.S.A. Eng. Pat. 11,409, May 16, 1906.

PURE tungsten trioxide is obtained from the commercial substance by first heating it to redness in the vapour of carbon tetrachloride, whereby volatile oxychlorides of tungsten are produced, and then oxidising the oxychlorides by means of *aqua regia*. The purified trioxide is reduced to metal by means of carbon at a red heat, and dry chlorine is passed over the heated tungsten to produce the hexachloride; from the latter a "nitridamide" of the approximate formula, $W_5N_6H_4$, is obtained by passing ammonia gas over it at a red heat. The "nitridamide" is mixed with a carbonaceous binder, such as glucose, and formed into filaments, which are first heated at 200°—300° C., and are then heated by means of an electric current to a white heat under reduced pressure, the resulting filament consisting of metallic tungsten containing some carbon. If desired, the carbon may be removed by alternately heating the filament in an oxidising atmosphere, to effect a superficial oxidation, and then raising it to a white heat *in vacuo*, whereby the carbon is oxidised and eliminated. The filament may also be "flashed" in an atmosphere of hydrogen and the red oxychloride of tungsten. The filaments are finally heated almost to the melting point, in order to strengthen them. Instead of the above-described "nitridamide," any nitrogen compound of tungsten capable of being decomposed at a relatively low temperature may be used.—H. B.

UNITED STATES PATENTS.

Combustion; Process of promoting ——. P. J. McNamara, Baltimore, Md. U.S. Pat. 846,338, March 5, 1907.

COAL is mixed with a substance containing silica, oxide of iron, alumina, lime, and magnesia in certain proportions, so that the fuel is enveloped in a porous non-conducting coating which becomes incandescent at a comparatively low temperature. The heat is thus concentrated to a point at which carbon has a superior affinity for oxygen than hydrogen, and the heat developed is radiated from the incandescent envelope.—A. T. L.

Coal; Process of coking ——. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 846,958, March 12, 1907.

THE coal is delivered into a pre-heating chamber at one end of the elongated oven, and is advanced continuously through the length of the chamber. The pre-heated coal is coked in the usual manner in the body of the oven, and is cooled during its passage through the delivery end by air circulated through flues in the walls, this air being used to heat the pre-heating chamber.—A. T. L.

Coking oven. L. J. Hirt, Brookline, Mass. U.S. Pat. 847,001, March 12, 1907

THE claims are for a coking chamber provided with an extension, having at its lower end a discharge opening normally closed by a cover; and cranks or arms within the extension, mounted opposite to each other on rocking-shafts actuated by worm gear outside of the said extension.—A. T. L.

Metallurgical coke and other kinds of coke; Process for utilising close-burning coal dust for making ——. G. de Velna, Paris, Assignor to A. S. Riggs, East Orange, N.J. U.S. Pat. 847,134, March 12, 1907.

SEE Fr. Pat. 357,687 of 1905; this J., 1906, 116.—T. F. B.

Peat; Process for charring or carbonising ——. M. Ekenberg, Stockholm. U.S. Pat. 847,748, March 19, 1907.

SEE Fr. Pat. 331,720 of 1903; this J., 1903, 1122.—T. F. B.

Producer-gas apparatus. H. F. Smith, Lexington, Ohio. U.S. Pat. 846,357, March 5, 1907.

THIS gas-producer is of the down-draught type. A steam and air passage is suspended in the centre of the fuel chamber, and is spaced away both from the top of the producer chamber and from the fire-grate below, and its lower end delivers into the fuel chamber below the unignited fuel and into the ignited portion. An air and steam inlet pipe discharges into the upper end of the passage, which also has a closure provided with suitably controlled passages opening into the combustion chamber. The fuel chamber is provided with an air-inlet, and with an outlet for products of combustion and volatile gases, which pass into a mixing chamber or burner, and are mixed with the air supplied to the central air-passage, and passed again, along with the commingled air, into the gas-generating portion of the fuel-bed, by means of a blast-generating device, the delivery pipe of which discharges into the air and steam passage near its lower end. The gas generated is conducted away below the fire-grate.—W. C. H.

Gas-producers; Process of handling ash in ——. H. F. Smith, Lexington, Ohio. U.S. Pat. 846,358, March 5, 1907.

THIS process of removing ash from down-draught gas-producers "consists in delivering the forming ash at a readily accessible point in the fuel bed, agglomerating the ash into relatively large masses or clinkers, and in removing these from above the fuel bed, out through the upper end of the producer."—W. C. H.

Gas; Apparatus for the manufacture of ——. F. Logan, Phœnixville, Pa. U.S. Pat. 846,489, March 12, 1907.

THIS apparatus for generating gases comprises a fire-chamber, with an air-blast pipe and a steam-supply pipe below it. Directly above, and extending throughout the length of the fire-chamber, is a retort-chamber, the chambers being separated along the whole length of each by a partition of checker-work. Oil- and steam-pipes lead into the fire-chamber. A superheating and fixing chamber is arranged adjacent to the fire- and retort-chambers, and is connected with both. Within the fixing chamber some checker-work is arranged, and the fire chamber communicates with the fixing-chamber below the checker-work, whilst the retort-chamber and the checker-work partition that separates it from the fire-chamber communicate with it above the checker-work. At the top of the fixing-chamber there is a gas-outlet. The retorts within the retort-chamber are connected by a pipe at one end. Steam- and oil-pipes lead into one of the retorts, and a coal-gas outlet leads from one retort, and is provided with a water-gas branch pipe.—W. C. H.

Producer-gas plant. P. Eyermann, Beloit, Wis. U.S. Pat. 847,054, March 12, 1907.

THE patent relates to a gas-producer, the gas-outlet pipe of which is connected to a suction fan provided with water-injecting devices and with overflow pipes for the injected water. A circulating relief pipe leads from the gas-outlet pipe of the producer (*i.e.*, the gas-inlet pipe of the fan) to the gas-outlet pipe of the fan, and also has a connection to the waste-gas pipe of the producer. By means of suitable valves, the gas from the producer may be sent to the gas-consuming plant, or a portion may be circulated by the fan through the relief pipe, or sent to the waste-gas pipe of the producer.—A. S.

German Patents.

Briquettes from coal, coke-breeze, unbriquettable lignites, or the like; Process for the manufacture of ——, with briquettable lignites or similar combustible material as binding agent. H. Trösken. Ger. Pat. 172,312, June 11, 1903.

The essential feature of the process consists in drying the binding agent before mixing it with the other materials, and then slightly moistening the mixture before compressing it into briquettes.—A. S.

Briquettes from coal, coke, and the like; Process for the manufacture of —— by means of water and quicklime. Desulfurit-Ges.m.b.H. Ger. Pat. 171,144, June 30, 1903.

The coal, coke, or the like is mixed with quicklime and ground to a fine powder, which is intimately mixed with water to a pasty mass. The latter is pressed in the usual manner to form briquettes, which are afterwards dried. —A. S.

Illuminating gas; Process for the manufacture of —— in horizontal retorts. Adolfs-Hütte vorm. Gräflich Einsiedelsche Kaolin-, Ton-, und Kohlenwerke A.-G. Ger. Pat. 172,339, April 6, 1904.

The patent relates to a process of manufacturing coal-gas in horizontal retorts in which the coal is continuously introduced in a thin layer on to the old charge in the retort. The coal is charged into the retort in such a manner that the thickness of the layer diminishes towards the walls of the retort, where the heat is strongest, and thus carbonisation of the coal proceeds rapidly.—A. S.

Illuminating gas and dense coke; Process for the manufacture of —— from coal dust. Fürstliche Bergwerksdirektion. Ger. Pats. 172,780 and 172,781, Aug. 14, 1904, and Oct. 2, 1904.

The coal dust is carbonised in the form of briquettes. According to Pat. 172,781, the coal dust is mixed with a suitable proportion of lime, before being formed into briquettes.—A. S.

Illuminating gas; Process for the manufacture of —— from a mixture of fine and coarse coal. Adolfs-Hütte vorm. Gräflich Einsiedelsche Kaolin-, Ton-, und Kohlenwerke A.-G. Ger. Pat. 170,737, Jan. 24, 1905.

In order to obtain uniform carbonisation of a mixture of fine and coarse coal, it is necessary to heat the coarse coal more strongly than the finer material. According to the present patent, the mixture of fine and coarse coal is carbonised in a retort similar to a coke oven, into which it is continuously fed in such a manner that the fine coal forms a central ridge parallel to the side walls of the retort, whilst the coarser coal rolls down the sides of the ridge between it and the walls of the retort.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 402.)

Petroleum production in Canada. Canadian Geol. Survey, Oil and Col. Tr. J., April 27, 1907. [T.R.]

In Nova Scotia oil has long been known to occur, the most promising locality being in the Lake Ainslee district, Cape Breton Island. In 1905 and 1906 boring operations for oil have been going on actively. A hole in search of oil was recently put down also at Cheverie, where a depth of over 1000 ft. has been reached. New Brunswick has a small producing field, at Memramcook, where several wells are regularly pumped, although the output is small. In Alberta County there exist large deposits of bituminous shales, which may become a feature in the Canadian oil industry. In Gaspé, Quebec, operations in search of oil have been carried on for the last ten years on a very large scale, but the results, so far, have been disappointing. More than 50 holes have been bored, one of which reached a depth of 3700 ft. Ontario is responsible for practically the total Canadian oil production. The following fields are located in the south-western peninsula between Lakes Huron and Erie. The Petrolia district has been yielding since 1862, the Oil Spring pool is about contemporaneous, and since then other oil areas have at various times been brought in, most of which are included in the counties of Lambton, Kent, and Essex. The feature of the oil industry in Western Ontario has been the discovery of the new producing areas of East Tilbury township, where a pool, which promises well, was struck in the vicinity of Bothwell. On Manitoulin Island boring operations were actively carried on during 1906 by five different companies. This field, however, has not yet contributed to the Canadian production of oil. In Manitoba, bore holes are being put down at Manitou, and at Neepawa. Deep boring operations are also being carried on in Saskatchewan and in Alberta. The latter province is more especially prominent in this direction. There are at present some 12 or 15 deep-drilling rigs prospecting various areas between the international boundary on the south and lower part of Athabaska river in the north. In South-western Alberta oil has been struck in two wells at depths slightly exceeding 1000 ft. It is reported that these wells could be pumped and made to yield; but the lack of means of transportation is a drawback at present. However, prospecting is going on very actively, and should the results obtained in this section, which lies south-west of Pincher Creek, justify it, a pipe line or a branch railway would be constructed. At Calgary and at Medicine Hat drilling rigs are in operation, and at the latter place provision has been made to reach a depth of 3000 ft. In the northern part of Alberta the search for petroleum is being carried onin the vicinity of Fort McMurray, on the Athabaska river, some 300 miles north of Edmonton. In British Columbia two companies were working in South-east Kootenay in 1906. The depths reached in this district are not yet sufficient to be conclusive. Some work was also being carried on in the Cariboo district, from where very promising indications have been reported.

Pyridine; Hydrogenation of —— by means of the catalytic action of nickel. P. Sabatier and A. Mailhe. Compt. rend., 1907, **144**, 784—786.

Pyridine vapour and hydrogen were passed over reduced nickel at temperatures from 120° to 220° C. The amount of reduction, greatest between 160° and 180°, was even at that temperature very small. The liquid obtained was not piperidine, but amylamine, in all probability the normal compound. At higher temperatures, 220° to 350° C., the pyridine is completely broken up, yielding ammonia, pentane, and lower hydrocarbons. Piperidine vapour, passed over reduced nickel at 250° C., is completely dissociated into pyridine and hydrogen. —J. T. D.

Mineral lubricating oils; Analytical constants of ——. II. R. Kissling. Chem.-Zeit., 1907, **31**, 328.

In concluding his communication on this subject (this J., 1906, 977) the author describes a method of determining the proportion of tarry, resinous, or pitch-like sulphur compounds in a mineral lubricating oil: 50 grms. of the oil are heated with 50 c.c. of alcoholic sodium hydroxide solution (50 grms. of 99 per cent. alcohol, and 50 grms. of a 7·5 per cent. aqueous solution of sodium hydroxide) in a flask with a reflux condenser to 80° C., after which the contents of the flask are vigorously shaken for five minutes, and then transferred to a separating funnel, whilst the flask itself is washed out with 10 c.c. of the alcoholic sodium hydroxide solution. The mixture is allowed to separate in a warm place, and as much as possible of the alkaline layer now containing the tarry constituents withdrawn and filtered. The clear or at most slightly opalescent filtrate is thoroughly shaken for five minutes in a separating funnel with 50 c.c. of petroleum spirit, the extract evaporated, and the residue weighed. The residual alcoholic alkaline solution is next acidified with hydrochloric acid, the tarry substances (naphthenic acids, sulphonic acids, &c.), extracted by means of benzol, and weighed after evaporation of the solvent. In the author's experiments, the residue left from the petroleum spirit extract was invariably yellowish-brown, of a viscous resinous consistency, and rich in sulphur compounds; it contained on the average 3·25 per cent. of sulphur. The substances soluble in benzol were black, and contained on the average 1·90 per cent. of sulphur. It was found that the thirteen different oils examined could be classified into two groups, *viz.*, those with a "resinification" value (see this J., *loc. cit.*) below 0·5 and a "tar" value (the sum of the petroleum spirit and benzol extraction-residues) below 0·3, and those with a "resinification" value above 1 and a "tar" value of 0·35 to 1·45. The first group included oils, such as steam-cylinder oils, prepared from Pennsylvanian mineral oils, &c., whilst the second group contained lubricating oils prepared by the newer methods of working up dark mineral oils not easily treated by older methods; they contained relatively large quantities of easily oxidisable hydrocarbons, and were therefore regarded as inferior to those in the first group, at least so far as the stability of a lubricating oil can be taken as a measure of its value. In this respect, light Pennsylvanian cylinder oil came first, and a dark cylinder oil second. As regards the significance of the two new constants ("resinification" and "tar" values), it is pointed out that in the older methods of lubricating, these factors are of less importance than in the methods of lubricating, *e.g.*, turbines, where the conditions are favourable to oxidation. Similarly in the case of steam-cylinder oils, it is essential that these values should be small. In conclusion, it is mentioned that the "tar" value of a turbine oil, which was originally 0·35, had risen to 1·01 after the oil had been in use for a long time.—C. A. M.

Oils which solidify at low temperatures [*crude petroleum*]; *Determination of the coefficients of expansion of* ——. J. Grusskiewicz and W. Bartoszewicz. XXIII., page 489.

ENGLISH PATENT.

Petroleum residues; Process of obtaining fatty acids from ——. H. Breda, Charlottenburg, Germany. Eng. Pat. 19,477, Aug. 31, 1906.

THE acids separated from the sludge alkali in refining are oxidised, *e.g.*, with potassium permanganate assisted by heat, the naphthenic acid being then distilled with steam or *in vacuo*. The purified acid can be converted into a soda soap, which will absorb up to 60 per cent. of water, and will dissolve in water to a clear solution.—C. S.

UNITED STATES PATENTS.

Petroleum; Steam-still for ——. H. Frasch, New York, Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 845,735, Feb. 26, 1907.

THE apparatus consists of a horizontal still heated by steam and a vertical fractionating column and dephlegmator. The still and column are provided with baffles, those in the former being so arranged that the depth of the layer of liquid becomes progressively less, and those in the latter so that the vapours and incoming liquid and condensate are brought into intimate contact. The still is also provided with open steam-pipes at intervals along its length. The column is connected to a vapour condenser to cause a further separation of the low- and higher-boiling liquids, and the still has a separator so that the condensed steam and treated oil are discharged by separate pipes. —W. H. C.

Petroleum; Separating low-boiling products from the burning-oil distillate of —— *to raise the fire test thereof.* H. Frasch, New York, Assignor to Standard Oil Co., Bayonne, N.J. U.S. Pat. 845,456, Feb. 26, 1907.

THE process consists in heating the mixture of low- and high-boiling hydrocarbons in contact with live steam in the still described in the preceding abstract, and in causing the vapours to come into intimate contact with the incoming oil which has been previously heated to about 60° F. below the boiling point of water, and with the oil and water condensing in the column and vapour cooler. In the still itself, the liquid passes over baffles so arranged that the depth of the liquid progressively decreases and is treated with successive supplies of live steam. The oil and water collecting in the still are discharged by separate pipes.—W. H. C.

GERMAN PATENTS.

Peat, bituminous coal, and the like; Furnace for the carbonisation or distillation of ——. A. von Dittmar. Ger. Pat. 169,574, July 30, 1903.

THE furnace consists of a closed chamber, with a central vertical pipe rising from the bottom and opening in the upper part of the chamber. The heating gases from the fireplace or combustion chamber are first led through flues below the bottom of the carbonising chamber in order to heat the latter, then pass up through the central tube, mentioned above, into the upper part of the furnace chamber, and finally escape, together with the distillation products, near the bottom of the chamber.—A. S.

Peat and the like; Retort-furnace for the carbonisation of ——. O. Wiesner. Ger. Pat. 169,924, Dec. 20, 1903.

THE furnace contains a series of vertical retorts arranged around a central axis and separated from one another by heating walls. The spaces between the retorts themselves and between the retorts and the walls of the furnace are formed into a series of superposed channels, by means of horizontal partitions with passages alternately at the centre of the furnace, and at several points at the walls of the furnace. The heating gases circulate in these channels in horizontal zones around the retorts, and pass from one zone to the next one above, either at the centre of the furnace or near the walls.—A. S.

Peat, wood, or the like; Shaft-furnace for the carbonisation of ——. M. von Hatten. Ger. Pat. 172,677, Sept. 10, 1905.

THE patent relates to a furnace for carbonising peat, wood, or the like, in which the gases evolved are utilised for heating the furnace. In order to obtain a better circulation of the gases, steam produced by the heat of the carbonising chamber, and superheated in a spiral tube passing around or through the carbonising chamber, is introduced into the gas-outlet pipe of the combustion chamber and the pipe leading the gases from the carbonising chamber to the combustion chamber.—A. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 405.)

Indigo, natural; Some constituents of ——. *Part I.*, A. G. Perkin and W. P. Bloxam. *Part II.*, A. G. Perkin. Chem. Soc. Trans., 1907, **91**, 279—288, 435—440.

PART I. is concerned with an investigation of the constituents of natural indigo, known under the name of "indigo-brown." Crude Bengal indigo was freed from "indigo-gluten" by boiling with dilute hydrochloric acid, and the "indigo-brown" extracted by boiling pyridine. The pyridine solution was evaporated to a small bulk, and treated whilst hot with twice its volume of alcohol. The precipitate was washed with boiling alcohol, freed from small quantities of indirubin by means of boiling acetic acid, and purified by re-dissolving in pyridine and precipitating with hot dilute hydrochloric acid. The substance, after drying at 100° C., was heated to 160° C. before being analysed, and thereby frequently lost 10 per cent. by weight. The composition of the compound corresponded to the formula, $C_{16}H_{12}O_3N_2$, and its properties closely resemble those of the "indigo-brown" of Berzelius and the indihumin of Schunck (Phil. Mag., 1855, [IV.], **10**, 74; 1858, **15**, 127). When treated with boiling potassium hydroxide solution, it yielded some anthranilic acid, and it is therefore probably a complex indoxyl derivative. After the removal of this compound from the pyridine solution, small quantities of two other brown compounds were isolated, corresponding to the formulæ, $C_{24}H_{22}O_5N_3$ and $C_{16}H_{14}O_4N_2$ respectively. These latter resembled the first-mentioned compound in general properties. Bloxam's statement (this J., 1904, 746) that indigo contains a non-nitrogenous red substance could not be confirmed; the only red substance detected was indirubin. The results of the experiments in general tend to support the view that the constituents of "indigo-brown" are derived from indoxyl during the manufacture of indigo from the plant. It is possible, however, that they may be formed from some substance other than indican present in the plant, since on boiling an extract of the leaves with dilute acid, a somewhat similar brown substance is produced.

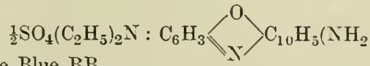
Part II. "*Indigo yellow.*" Rawson (this J., 1899, 251) has drawn attention to the existence of a peculiar yellow compound, soluble in alkalis, in Java indigos (from *Indigofera arrecta*), usually to the extent of 2—3 per cent., although in one case, as much as 20 per cent. was present. Bergtheil (Report of the Indigo Station, Sirsiah, Calcutta, 1906) detected a small quantity of the same compound in indigos made at Pusa, India, from *Indigofera arrecta*, and states that manufacturing with immature plants tends to produce this yellow substance. The author was unable to detect any yellow compound in the best Bengal indigos, but from refined Bengal indigo, stated to contain 92 per cent. of indigotin, a small quantity of a yellow oxidation product, $C_{15}H_8O_2N_2$, insoluble in alkalis, was obtained by sublimation with limited access of air. From a sample of Java indigo, a yellow compound was isolated by extracting with boiling alcohol, concentrating the solution, pouring it into ether, and evaporating the resulting ethereal solution. This yellow compound was identified as kaempferol, $C_{15}H_{10}O_6$ (this J., 1903, 600). Samples of Java indigo prepared by recent Dutch processes contained only very small quantities of kaempferol. The kaempferol is contained in the plant in the form of a glucoside, *kaempferitrin*, which was isolated in the following way:—The leaves of *Indigofera arrecta* were extracted with 10 times their weight of boiling water for six hours, the solution evaporated to dryness, and the residue incorporated with sand and digested with boiling alcohol. The alcoholic solution was concentrated, treated with water, and the mixture filtered. From the filtrate, the kaempferitrin separated in crystals. The air-dried compound has the composition, $C_{27}H_{30}O_{14},3\frac{1}{2}H_2O$; the water is evolved at 100° C. On hydrolysis with sulphuric acid, kaempferitrin yields kaempferol and rhamnose, according to the equation:

$$C_{27}H_{30}O_{14} + 4H_2O = C_{15}H_{10}O_6 + 2C_6H_{14}O_6.$$

It is thus distinct from robinin, $C_{33}H_{52}O_{20}$ (Chem. Soc. Trans., 1902, **81**, 473), another glucoside of kaempferol, which yields kaempferol, 2 mols. of rhamnose, and one of dextrose (?) on hydrolysis. A determination of the yield of kaempferol from a sample of the air-dried leaves of the plant, showed that these contain, in the air-dried condition, about 4 per cent. of kaempferitrin.—A. S.

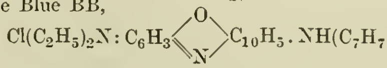
Colouring matters [dyestuffs] of the oxazine series; A reaction of certain ——. J. F. Thorpe. Chem. Soc. Trans., 1907, **91**, 324—336.

Lorrain Smith and Powell White have found that certain blue dyestuffs of the oxazine series (Nile Blue A and New Methylene Blue GG; also Nile Blue BB and Meldola's Blue, after heating with dilute acid) when used as a stain for sections containing neutral fat globules, colour the fatty matter red and the protein matter blue. The substance which causes the red coloration of the fat can be extracted from the blue solution of the colouring matter by means of xylene, in which it forms a red solution with strong yellow fluorescence, but a further quantity is produced on heating the residual solution with dilute acid. The author finds that the compounds which produce the red coloration are phenonaphthoxazones produced from the colouring matters by the action of water or dilute acid. Phenoxazine dyestuffs, under similar conditions, do not give red compounds. The phenonaphthoxazine dyestuffs which give this reaction can be divided into two classes:—(*a*) Those compounds which contain an amino- or substituted amino-group in the position, 6 (see Kehrmann and Gauhe, Ber., 1897, **30**, 2131). (*b*) Compounds which have this position free. In the case of dyestuffs of class (*a*), the red compound is produced by the replacement of the group in position, 6, by hydroxyl, and consequent formation of the corresponding phenonaphthoxazone by intermolecular change. Thus, Nile Blue A,



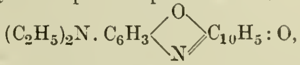
$$\tfrac{1}{2}SO_4(C_2H_5)_2N : C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_5(NH_2),$$

and Nile Blue BB,



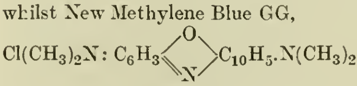
$$Cl(C_2H_5)_2N : C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_5 . NH(C_7H_7),$$

yield 3-diethylaminophenonaphthoxazone,

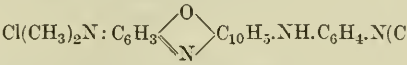


$$(C_2H_5)_2N . C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_5 : O,$$

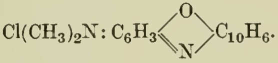
whilst New Methylene Blue GG,



$Cl(CH_3)_2N : C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_5.N(CH_3)_2$, and New Blue B,



$Cl(CH_3)_2N : C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_5.NH.C_6H_4.N(CH_3)_2$, yield 3-dimethylaminophenonaphthoxazone, which is also the product obtained from Meldola's Blue,



$$Cl(CH_3)_2N : C_6H_3\genfrac{<}{>}{0pt}{}{O}{N}C_{10}H_6.$$

These dialkylaminophenonaphthoxazones form chlorides which give deep blue stable solutions in hot dilute hydrochloric acid, but are dissociated by water, with production of the red base. The blue salts of the dialkylaminophenonaphthoxazones remain dissolved in the solutions of the oxazones from which they are derived. For example, a solution of Nile Blue A, in dilute acid can be boiled for a considerable time without any appreciable change in colour taking place, but if wool be dyed in the boiled solution, the resulting blue shade becomes markedly purple on washing with water. The weak oxazone base can be extracted from a solution of its salt by xylene. The red coloration of neutral fat globules is due to a similar action, the fat extracting the oxazone base from the solution of its salt, and becoming thereby coloured red, whilst the protein matter is coloured blue by the excess of unchanged oxazine dyestuff. The author finds that the base of Nile Blue A does not form solutions which are fluorescent in ordinary daylight, unless it is contaminated by some of the corresponding oxazone (compare Möhlau and Uhlmann, this J., 1896, 585).—A. S.

Carbinols and aldehydes; New method of formation of ——. *Action of diazo-compounds on the amino-derivatives of di- and triphenylmethane.* E. Suais. Bull. Soc. Ind. Mulhouse, 1907, **77**, 75—78.

The alkylamino-derivatives of di- and triphenylmethane, when treated with diazo solutions undergo fission with formation of a carbinol or an aldehyde, according as to whether 1 or 2 mols. of the diazo compound have been used. The amine liberated unites with the diazo residue to form an azo compound thus:

I. $C_6H_5.CH[C_6H_4.N(CH_3)_2]_2$ (leuco-base of Malachite Green) $+ R.N_2.OH$
$= C_6H_5.CH(OH).C_6H_4.N(CH_3)_2 + R.N_2.C_6H_4.N(CH_3)_2$
(carbinol);

II. $C_6H_5.CH[C_6H_4.N(CH_3)_2]_2 + 2R.N_2.OH =$
$C_6H_5.CH(OH)_2 + 2R.N_2.C_6H_4N(CH_3)_2.$

The diazo solution was prepared from sulphanilic acid, Dahl's acid No. III., and *m*-nitraniline, and the bases used were the leuco-bases of Malachite Green, Hexamethyl Violet, carbinol + ethyl-*a*-naphthylamine, tetramethyldiaminodiphenylmethane, and tetramethyldiaminodiphenylcarbinol. The base is dissolved in water or alcoholic hydrochloric acid, sodium acetate added, and then the diazo solution. It is considered that many technically important aldehydes might be advantageously prepared by this method.—J. C. C.

Dyestuffs; New —— derived from triphenylmethane. M. Prud'homme. Bull. Soc. Ind. Mulhouse, 1907, **77**, 79—81.

WHEN nitrotetramethyldiaminotriphenylmethane is reduced by zinc, the nitro group is converted into the NH.OH group. If the resulting compound is now subjected to the action of mineral acids the hydroxyl group migrates to the carbon atom in the para-position and a *p*-aminophenol derivative is formed, of the type $(A)_2CH.C_6H_3(NH_2)OH$, where A represents the group $C_6H_4.N(CH_3)_2$. On oxidation with lead peroxide the compound from *o*-nitrotetramethyldiaminotriphenylmethane gives a blue-green, whilst the compound from the corresponding *m*-nitro-derivative gives a green-yellow dyestuff. When the *o*-amino-leuco-base is diazotised, and the solution boiled, the corresponding dihydroxy-compound is formed, which, on oxidation with lead peroxide, furnishes a dyestuff giving black or grey shades on non-mordanted wool or silk. Cotton mordanted with tannin and tartar emetic is dyed the same shade.—J. C. C.

Aniline Blue; Composition of ——. E. Knecht. J. Soc. Dyers and Col., 1907, **23**, 119.

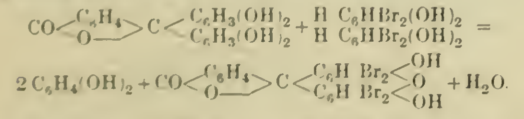
UNTIL recent years Aniline Blue was generally regarded as being the triphenylated rosaniline. In 1904, Baeyer and Villiger concluded from their investigations that the commercial product consists of almost pure diphenylated rosaniline. The author found that on reduction with a standard solution of titanous chloride, the sulphonic acid of Spirit Blue gave results which did not agree with theory, though a product prepared in the laboratory from pure pararosaniline gave almost theoretical results. These differences have been explained by Lambrecht, who has shown that in rosaniline the methyl group (from the orthotoluidine contained in the oil for red), which occupies the ortho position in relation to the amino group, presents a steric hindrance to the entrance of a phenyl group into the latter. Diphenylrosaniline is, therefore, the most highly phenylated product that can be obtained by the action of aniline on rosaniline. On the other hand pararosaniline does not contain a methyl group, and is, therefore, able to take up three phenyl groups.—P. F. C.

Catecholphthaleïn. R. Meyer and H. Pfotenhauer. Ber., 1907, **40**, 1442—1445.

THE authors have used Baeyer's method for the preparation of this substance (heating three parts of phthalic anhydride and two parts of catechol with three parts of zinc chloride to 140—150° C. for 3—4 hours), and have succeeded in obtaining it for the first time in the crystalline state. This was effected by boiling the aqueous extract of the reaction product with animal charcoal, and allowing the filtrate to cool slowly, when yellowish-white leaves separated. These do not melt when heated, but sinter between 80° and 90° C.—J. C. C.

Aromatic complexes; Interchange of ——. R. Meyer and H. Pfotenhauer. Ber., 1907, **40**, 1445—1450.

WHEN catecholphthaleïn is heated with dibromoresorcinol (in the form of dibromo-β-resorcylic acid, which very readily loses carbon dioxide) and zinc chloride to about 170° C., an interchange of groups takes place, and Eosine is formed according to the equation—



$$CO\begin{array}{l}<C_6H_4\\<O\end{array}\!\!>C<\begin{array}{l}C_6H_3(OH)_2\\C_6H_3(OH)_2\end{array}+\begin{array}{l}H\ C_6HBr_2(OH)_2\\H\ C_6HBr_2(OH)_2\end{array}=$$

$$2\,C_6H_4(OH)_2+CO\begin{array}{l}<C_6H_4\\<O\end{array}\!\!>C<\begin{array}{l}C_6H\ Br_2<\begin{array}{l}OH\\O\end{array}\\C_6H\ Br_2<\begin{array}{l}O\\OH\end{array}\end{array}+H_2O.$$

Michler's ketone (tetramethyldiaminodiphenylketone) was also heated with resorcinol for a week to 180° C. If the reaction proceeded as above, there would be formed 3:6-dihydroxyxanthone and dimethylaniline. The latter was isolated from the product, but the former could not be detected.—J. C. C.

ENGLISH PATENTS.

Monoazo dyestuffs; Manufacture of ——. C. G. Redfern, London. From Basle Chem. Works, Basle, Switzerland. Eng. Pat. 7535, March 28, 1906.

WHEN Naphthol Yellow S is carefully reduced, 1-hydroxy-2-amino-4-nitronaphthalene-7-sulphonic acid is obtained, which may be used for the production of monoazo-dyestuffs. Example: 28·4 parts of the above acid are dissolved with 10 parts of caustic soda (40° B.) in 500 parts of water, 40 parts of hydrochloric acid (20° B.) are added, and then a solution of 7 parts of sodium nitrite. The yellow diazo solution is poured into a solution of 15 parts of β-naphthol, dissolved in 300 parts of water by means of 30 parts of caustic soda solution; after stirring for some hours, the mixture is heated to 70° C., and the dyestuff salted out. It forms a shiny, bronze powder, soluble in water, or concentrated sulphuric acid, with a blue colour, and dyes wool bluish-black, which, on chroming, becomes a deep black fast to milling.—J. C. C.

Red vat dyeing dyestuff from salicylthioacetic acid; Manufacture of ——. Ges. f. Chem. Ind. in Basel, Basle, Switzerland. Eng. Pat. 24,092, Oct. 29, 1906. Under Int. Conv., Nov. 4, 1905.

THE red vat dyestuff previously described (this J., 1906, 470) may be obtained in better yield by heating salicylthioacetic acid with an aromatic nitrohydrocarbon, which acts both as a solvent and as an oxidising agent. Example: 10 parts of salicylthioacetic acid are boiled with 50 parts of nitrobenzene in a reflux apparatus for five hours. On cooling, the dyestuff is filtered off and washed with alcohol. Other nitrohydrocarbons, such as dinitrotoluene, &c., may be used, and indifferent substances, such as diphenylamine, which act as solvents, may also be present.—J. C. C.

Indigo; Manufacture of ——. C. Dreyfus and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 16,181, July 17, 1906.

INDIGO is prepared from *o*-nitrobenzoylacetic acid by treating it with excess of aqueous caustic alkali and a reducing agent. Example: 1 part by weight of *o*-nitrobenzoylacetic acid is dissolved in a solution of 2 parts of caustic potash in 50 parts of water. A solution of 2 parts of glucose in 10 parts of water is added, and the temperature gradually raised to 50° C., and maintained at that point for 10 minutes. The separation of the indigo is facilitated by blowing air through the solution for about five minutes.—J. C. C.

UNITED STATES PATENTS.

Ortho-oxy-monoazo dye [*Azo dyestuff*]. W. Schumacher, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 846,511, March 12, 1907.

BY combining diazotised 4-chloro-3-nitro-6-aminophenol with 1:8-dihydroxynaphthalene-3:6-disulphonic acid, a new monoazo dyestuff is obtained, which gives a red colour in aqueous solution and a red-blue colour in concentrated sulphuric acid. It dyes wool red from an acid bath, and on chroming, this shade becomes greenish-blue. Chrome-mordanted wool is dyed the latter shade directly. —J. C. C.

Sulphonic acids; Production of organic ——. M. Iljinskij, Crefeld, Assignor to R. Wedekind und Co., Uerdingen on Rhine, Germany. U.S. Pat. 847,078, March 12, 1907.

SEE Fr. Pat. 332,709 of 1903; this J., 1903, 1290.—T. F.B.

Dye; Halogenated red —— and process of making same. [*Halogenated Thio-indigo Red.*] G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 848,354, March 26, 1907.

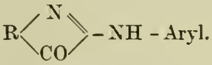
A RED vat-dyestuff is prepared by heating the meta-halogenated salicylthioacetic acid with aromatic nitrohydrocarbons. It is a reddish crystalline powder, soluble in strong sulphuric acid, with a green coloration.—A. B. S.

Vat-dyestuffs [*Thio Indigo dyestuffs*] ; *Red halogen* ——, *and process of making same.* G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 848,355, March 26, 1907.

Red vat-dyestuffs are prepared by treating with a halogen, in the presence of an indifferent diluent, the products resulting from the condensation of one molecule of thioindoxyl with one molecule of an isatin compound. They consist of brown-red to yellow-red crystalline powders, which are soluble in concentrated sulphuric acid, with brown to dirty brown-black coloration.—A. B. S.

Vat-dyestuffs [*Thioindigo dyestuffs*] ; *Red-violet to blue* ——, *and process for making same.* G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 848,356, March 26, 1907.

Red-violet to blue vat-dyestuffs are prepared by treating with a halogen, in presence of an indifferent diluent, the products obtained by the condensation of thioindoxyl with *a*-isatinarylides of the general formula—



They dissolve in concentrated sulphuric acid to blue solutions, from which a precipitate is thrown down by water.—A. B. S.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 406.)

Silk fibres ; Influence of dyeing processes on the length of ——. P. Heermann. Färb.-Zeit., 1907, 18, 113—116.

The author, as the result of a large number of experiments, arrives at the following conclusions :—(1) Generally speaking, the length of the silk fibre is diminished by the processes of dyeing and weighting. The contraction, however, is by no means proportional to the weight of the charge, but varies with the different treatments to which the silk is subjected. (2) The degumming of " organzin-silk " of itself causes a contraction in the length of the thread, amounting to about $\frac{3}{4}$ per cent. (3) Pure metallic and mineral mordants cause only a very slight contraction, and treatment with tannin-substances produces no shrinking whatever. (4) In the process of " colour-weighting " the amount of contraction increases with the weight of the charge. (5) The most marked contraction takes place when the different processes of weighting are combined, particularly when the Prussian Blue process is followed by the tin phosphate treatment.—P. F. C.

Formic acid in dyeing ; Use of ——. R. W. Rusby. J. Soc. Dyers and Col., 1907, **23**, 110—112.

It is stated that formic acid can be advantageously employed as an assistant or reducing agent along with potassium bichromate mordant, being more economical, and giving better results than either acetic acid or tartar. The chief use of formic acid, however, is for dyeing woollen goods or unions with acid dyestuffs. For this purpose it is claimed to possess the following advantages :—(1) With colours which are not easily dyed level shades with sulphuric acid, formic acid gives good results, and the bath is more completely exhausted than when acetic acid is used. (2) Formic acid gives brighter and purer shades, and ensures more complete penetration of the dye into the material than either acetic or sulphuric acids. (3) In dyeing unions, composed of wool and cotton, with acid dyestuffs, formic acid has the additional advantage that it does not injure the cotton, whilst sulphuric acid, owing to its affinity for the wool fibre, is only removed with difficulty by washing, and there is consequently great risk of tendering the cotton, apart from the tendering which takes place in the boiling dyebath. In leather dyeing formic acid is much used for leather which is intended to last for many years—such as that for bookbinding—and for that in which any trace of corrosive acid would soon cause injury.—P. F. C.

a-Naphthylamine Claret ; Function of anthraquinone in discharging —— *with Rongalite.* N. Planovsky. Z. Farben-Ind., 1907, 6, 109—111 and 128—131.

As Sünder (this J., 1907, 196) has pointed out, *a*-Naphthylamine Claret is readily discharged by " Rongalite C " (sodium sulphoxylate-formaldehyde) in conjunction with anthraquinone. The action is due to the formation of oxanthranol, which is soluble to some extent in a solution of " Rongalite," and which decomposes the Claret dyestuff, becoming, while doing so, alternately oxidised to anthraquinone and regenerated by the reducing action of the " Rongalite." Oxanthranol in a boiling aqueous solution reduces the Claret dyestuff, as it does also when printed in caustic alkaline solution, and submitted to an hour's steaming. It is noteworthy that almost all the compounds recommended as catalytic agents for employment with " Rongalite " for the purpose of effecting the discharge of *a*-Naphthylamine Claret are quinone or diketone compounds. Quinone itself, however, is without action in this respect.—E. B.

Sulphide colours on cotton ; Identification of ——. A. G. Green and F. G. C. Stephens. J. Soc. Dyers and Col., 1907, **23**, 118.

The sample of dyed cotton is first boiled for one or two minutes in a 10 per cent. solution of sodium hydroxide. This treatment removes adventitious sulphur without affecting sulphide dyestuffs. The sample is then washed and just covered with a solution of stannous chloride, obtained by dissolving 100 grms. of the pure salt in 100 c.c. of hydrochloric acid (free from arsenic), and diluting with 50 c.c. of water. The mouth of the test-tube is closed by a cap of filter paper, on the centre of which one drop of lead acetate solution is placed. The contents of the tube are slowly heated to the boiling point, when a blackish-brown stain of lead sulphide appears if a sulphide colour is present. If the cloth contain much albumin (*e.g.*, with calico prints), it is advisable, after boiling with sodium hydroxide solution, to boil also with dilute hydrochloric acid before applying the stannous chloride test.—P. F. C.

English Patents.

Fibre from peat ; Production of ——. J. T. Szek, London. Eng. Pat. 7299, March 27, 1906.

Peat is subjected to a low temperature whereby the water it contains is frozen. Owing to the expansion of the water in freezing, the fibre is separated without breaking. The loose fibre is then dried as usual, and is much stronger and more absorbent than when separated by the ordinary means.—J. C. C.

Dyeing of yarns ; Cop-tubes to facilitate the ——. J. Sträter, Aix-la-Chapelle, Germany. Eng. Pat. 21,021, Sept. 21, 1906. Under Int. Conv., May 8, 1906.

Cop-tubes are made of unsized paper in order to allow the dye-liquor to pass freely from the interior of the tubes to the outside of the yarn to be dyed, and *vice versa.* This avoids the difficulties hitherto encountered in the use of tubes made of sized paper.—J. C. C.

Printing fabrics ; Machines for ——. W. Pickup and W. Knowles, Pendleton. Eng. Pat. 9752, April 26, 1906.

See Fr. Pat. 367,837 of 1906 ; this J., 1906, 1144.—T. F. B.

United States Patents.

Cellulose ; Apparatus for forming filaments of metamorphosed ——. M. Waddell, New York, Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 846,879, March 12, 1907.

The apparatus consists essentially of a series of spinning heads, arranged at the side of a tank which can be supplied with a fixing solution from the opposite side, where also is an arrangement for winding the filaments. For the description of the many mechanical parts of the machine the original should be consulted.—J. C. C.

Thin leaf or fabric. H. R. Gregory, New York, Assignor to W. A. Ker, Brooklyn, N.Y. U.S. Pat. 848,301, March 26, 1907 (see this J., 1906, 1040).

Claim is made for a thin leaf or fabric formed by dissolving "soluble cotton" in "amyl oil," adding a colouring matter, and then pouring the solution on to the surface of a liquid heavier than the amyl oil. The solvent evaporates, leaving a thin layer of the cellulose material on the surface of the heavier liquid.—A. B. S.

Silk; Process for ungumming ——. P. Schmid, Basle, Switzerland. U.S. Pat. 848,605, March 26, 1907.

See Fr. Pat. 345,173 of 1904; this J., 1905, 24.—T. F. B.

Yarns; Apparatus for spraying and conditioning ——. G. and A. Wray, Keighley. U.S. Pat. 846,373, March 5, 1907.

See Eng. Pat. 23,651 of 1904; this J., 1905, 1168.—T. F. B.

Dyeing apparatus. P. Fontaine, Troyes, France. U.S. Pat. 846,462, March 12, 1907.

See Fr. Pat. 359,311 of 1905; this J., 1906, 373.—T. F. B.

Drying textile materials; Apparatus for ——. O. Venter, Chemnitz, Germany. U.S. Pat. 847,383, March 19, 1907.

Claim is made for an apparatus for drying textile materials. The material is placed in perforated hollow cylinders, which are connected by means of pipes with an exhaust fan. The cylinders are placed in a closed vessel into which air can be forced under pressure. This air passes through the material in the cylinders and out by the exhaust pipe.—A. B. S.

Bronze printings; Method of producing ——. C. A. R. Ludewig, Hamburg, Germany. U.S. Pat. 846,585, March 12, 1907.

See Eng. Pat. 11,951 of 1906; this J., 1906, 1040.—T. F. B.

French Patents.

Nitrocellulose solutions; Recovery of volatile solvents contained in products [artificial silk, &c.] prepared from ——. Soc. pour la Fabr. en Italie de la Soie Artif. par le Proc. de Chardonnet. Fr. Pat. 371,985, Feb. 6, 1906.

The volatile solvent contained in artificial silk, &c., prepared from solutions of nitrocellulose is displaced by a current of steam, which is subsequently condensed in cooling or condensing columns.—A. S.

Fibres, artificial; Process for the manufacture of —— *from nitrated cellulose.* Kunstfäden Ges.m.b.H. Fr. Pat. 371,544, Nov. 16, 1906. Under Int. Conv., Dec. 4, 1905.

The claim is for the use of nitrated cellulose containing 21—24 per cent. of moisture in the preparation of collodion for the manufacture of artificial silk fibres.—A. S.

Thread easily impregnated with liquids; Process for producing ——. Baumwoll-Spinnerei Brodetz Kuffler und Reichel. Fr. Pat. 371,625, Nov. 20, 1906.

Cotton fibres can be rendered capable of taking up liquids readily and uniformly by impregnating them with suitable liquids, such as solutions of Turkey-red oil, soap, sugar, or glycerin. Fibres treated in such a manner cannot, however, be spun satisfactorily. It is found that if only a part of the fibres be treated in the manner described, and then spun together with untreated fibres, satisfactory results are obtained, and the resulting thread, or woven material prepared therefrom, can be impregnated readily and uniformly with dye-liquors, &c.—A. S.

Singeing apparatus for the textile industry. C. Kaisser. Fr. Pat. 371,667, Nov. 15, 1906. Under Int. Conv., Nov. 28, 1905.

The apparatus consists essentially of a table or bar of refractory material with a longitudinal hollow or groove, in or below which is a suitable heating device (preferably an electric resistance coil), which maintains in a state of incandescence that portion of the refractory material over or through which the textile material passes. Several modified forms of the apparatus are described.—A. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 317.)

Leather blacks. H. G. Crockett. J. Soc. Dyers and Col., 1907, **23**, 112—115.

The various blacks employed on leather may be divided into three classes:—(1) Grain (or hair side) blacks; (2) flesh side blacks; (3) japanned or patent leather blacks. The grain dyeing of leather is usually carried out in trays. The skins are paired flesh to flesh, treated with an alkaline logwood solution, and then entered into the "striker" or iron solution, which usually contains iron sulphate, copper sulphate, and small proportions of such materials as nut galls to deepen the shade. For greasy leathers, the grain is first well scrubbed with an alkaline logwood solution, and the striking ink is then applied with a brush. Harness leather is rubbed with hard tallow, which deepens the black and prevents cracking. Dry leathers, *i.e.*, leathers not impregnated with grease, are coated with a filling material usually containing mucilage. In the preparation of flesh side blacks, the leather is painted on the flesh side with a carefully prepared mixture of lampblack and cod oil, which sometimes contains a little sodium carbonate and tanning liquor. This mixture is rubbed on with a stiff brush, the resulting "smut" is carefully removed, and the surface is polished with a glass sleaker. The leather is then finished by sizing and polishing. Patent leather blacks are prepared by treating the leather with a varnish containing a black dyestuff. The varnish, which usually is a mixture of boiled linseed oil, Prussian blue, lampblack, and shellac, is spread evenly on the surface of the stretched leather, which is stove-dried on the frames. This operation is repeated several times, the leather being carefully rubbed with fine pumice stone between the treatments.—P. F. C.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 408.)

Alkali monoxides; Some properties of ——. E. Rengade. Compt. rend., 1907, **144**, 753—756.

Monoxides of the alkali metals were obtained by the method used for the preparation of cæsium monoxide (Compt. rend., 1906, **143**, 592). Rubidium monoxide is pale yellow when cold, golden yellow when hot; potassium monoxide is white at the ordinary temperature and bright yellow at 200° C.; sodium monoxide is faintly yellow when hot; these oxides are less strongly coloured than cæsium monoxide. When heated to 400° C. they decompose into dioxide and metal. With liquid ammonia a mixture of hydroxide and amide is formed in a few minutes from rubidium or cæsium oxides, in several days from sodium oxide. The monoxides are reduced when warmed with hydrogen. Water reacts violently on them. Anhydrous carbon dioxide has no action in the cold, but towards 300° C. it is absorbed with the formation of the carbonate. The relative densities of the monoxides determined at 0° C. in dry toluene, are:—Sodium, 2·25; potassium, 2·32; rubidium, 3·72; cæsium, 4·78.—F. Sodn.

Thiosulphates. J. Meyer and H. Eggeling. Ber., 1907, **40**, 1351—1363.

The double thiosulphates of lead, copper, and silver with the alkali-metals, are for the most part unstable, only the silver- and lead-salts with the stronger alkali-metals being less so. The silver-alkali salts, prepared by adding to the alkali thiosulphate ammoniacal silver nitrate, contain ammonia, the potassium salt, for example, having the formula, $K_2S_2O_3.Ag_2S_2O_3.NH_3$; and these salts can be prepared in two forms, a white and a yellow, which are in all probability isomeric in the sense of being respectively $KS.SO_2.OAg$ and $KO.SO_2.SAg$. —J. T. D.

Aluminium sulphide; Compounds of ——, with manganese and iron sulphides. M. Houdard. Compt. rend., 1907, **144**, 801—804.

Aluminium sulphide, heated to whiteness in an atmosphere of hydrogen sulphide with manganese sulphide or ferrous sulphide, forms compounds, Al_2S_4Mn, and Al_2S_4Fe, analogous to the aluminates. These are crystalline compounds, without action on polarised light, and nearly insoluble in water. When excess of manganese sulphide is used in the process, the product contains two crystalline compounds, a yellow one, through which green crystals extend, the green body remaining behind unaltered on treatment of the mixture with acetic acid, and consisting of manganese sulphide. (See also this J., 1907, 98.) —J. T. D.

Fluorine; New quantitative determination of ——, and composition of iron fluoride. E. Deussen. XXIII., page 490.

English Patent.

Carbonic acid, hydrogen, and nitrogen; Manufacture of —— [from water-gas]. E. G. Elworthy, St. Albans. Eng. Pat. 10,581, May 5, 1906.

Water-gas is passed through a centrifugal gas separator, which removes the bulk of the hydrogen, almost free from other gases. The impure oxides of carbon are then blown through furnaces containing copper oxide, which converts the carbon monoxide into carbon dioxide, and burns away the remaining hydrogen. Pure carbon dioxide is obtained by absorption of the gas in water under pressure, and subsequent release of the pressure, the small proportion of nitrogen being thus got rid of. Regeneration of the copper oxide, by heating in a current of air, furnishes nitrogen, which is purified from oxygen by passage over heated metallic surfaces.—F. Sodn.

United States Patents.

Sulphuric acid; Purification of ——. V. C. Driffield and F. W. Wright, Assignors to The United Alkali Co., Ltd., Liverpool. U.S. Pat. 846,288, March 5, 1907.

See Eng. Pat. 7916 of 1905; this J., 1906, 477.—T. F. B.

Ammonia from gas; Recovery of ——. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 846,035, March 5, 1907.

See Fr. Pat. 356,600 of 1905; this J., 1906, 63.—T. F. B.

Alumina and alkali compounds of sulphur [thiosulphates]; Manufacture of ——. A. Clemm, Mannheim, Germany. U.S. Pat. 845,854, March 5, 1907.

See Fr. Pat. 363,893 of 1906; this J., 1906, 884.—T. F. B.

Alumina and alkali sulphur salts [thiosulphates]; Manufacture of ——. A. Clemm, Mannheim, Germany. U.S. Pat. 848,612, March 26, 1907.

See Fr. Pat. 363,893 of 1906; this J., 1906, 884.—T. F. B.

Bisulphite liquor; Apparatus for making ——. J. C. Murray, Bangor, Me., Assignor to G. C. Crafts, Bangor, Me., and G. W. Fortier, Orono, Me. U.S. Pat. 846,499, March 12, 1907.

The apparatus consists of a tower provided with a suitable gas inlet and a liquid outlet at the base, and a liquid inlet and a gas outlet at the top. A non-perforated partition extends completely across the tower near its upper end, but below the liquid inlet and gas outlet, thus constituting the whole of the upper portion of the tower a liquid reservoir. Below this partition is placed a vertical series of inclined overlapping baffle-plates filling the lower part of the tower. A liquid conduit leads from the reservoir at a point considerably above the partition, and discharges on to the baffle-plates below, whilst a siphon-shaped conduit leads the gas from a point close to and below the partition to an opening into the reservoir at a point below the upper end of the liquid conduit. A vertical wall rises from the top baffle-plate to a point above the discharge end of the liquid conduit, extending from wall to wall of the tower, parallel to the free edge of the plate and facing the end of the conduit.—A. G. L.

Calcium peroxide; Process of making ——. O. Liebknecht, Frankfort-on-the-Maine, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 847,670, March 19, 1907.

Calcium peroxide is produced by causing hydrogen peroxide to react "with a solution containing calcium oxide in a non-precipitated state," such as, for instance, an ammoniacal solution of a calcium salt.—E. S.

Lithia; Process of treating silicious ores containing ——. W. E. Wadman, Bayonne, N.J., Assignor to Hygienic Chemical Co., New Jersey. U.S. Pat. 847,856, March 19, 1907.

Silicious lithia ores, such as lepidolite, are heated with an alkali sulphate, such as potassium sulphate, the soluble lithium sulphate produced is extracted with water from the resulting solution, and lithia is precipitated by suitable reagents as a commercially marketable salt. The insoluble residue is treated with sulphuric acid, whereby potash alum is obtained, together with potassium sulphate as a by-product.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 410.)

Glass; Causes of the "running" of ——. E. Bauer. Chem.-Zeit., 1907, **31**, 329.

The term "running" (*Anlaufen*) is applied to an extraordinarily adherent fine bluish deposit which is frequently formed upon the surface in the manufacture of crystal glass, destroying the transparency. Samples of such glass were examined by the author, who found that the deposit gave none of the reactions for metals, and was not soluble in acids or sublimable, but that it could be easily removed by means of concentrated potassium hydroxide solution. The conclusion arrived at was that the deposit consisted of sublimed silica, and was caused through the use of too wet material and probably also through the use of an insufficient quantity of basic substance. Under such conditions the superheated steam would volatilise the silica (for which the amount of potash was insufficient) and the latter would condense upon the glass undergoing the after-heating (*Nachwarmen*). The trouble may be prevented by the use of previously-dried materials which are carefully mixed, and above all by the use of a sufficient quantity of potash. The hygroscopic and consequently more or less aqueous potash of high percentage used in the manufacture of crystal glass will lose far more by evaporation, than the ordinary 80 or 90 per cent. potash.—C. A. M.

English Patents.

Glass melting pot. H. C. Fry, Rochester, U.S.A. Eng. Pat. 17,779, Aug. 7, 1906.

See Fr. Pat. 368.771 of 1906; this J., 1907, 18.—T. F. B.

Glass melting pot; Divided ——. A. Miller, P. Filler, and W. Rottmann, Berlin. Eng. Pat. 1241, Jan. 17. 1907. Under Int. Conv., Feb. 2, 1906.

The melting pot described consists of an upper and a lower part. The upper part is divided by a transverse wall into two compartments, which communicate with one another by an opening. The raw material is charged from above into the front compartment, and the molten material flows through the opening, in a thin layer, into the rear compartment. The lower part of the pot is divided by a transverse wall into a rear and clearing chamber, and a front working chamber; into the former of these the molten material is received from the rear upper compartment, and passes through an opening into the working chamber. This chamber is divided by a longitudinal wall into two compartments, which communicate by an opening in the wall; both are accessible from the outside, and one is used for working the glass, whilst solid glass residues, that are to be re-melted, are put into the other. The arrangement is adapted to shorten the time occupied in melting, and to effect complete clarification and produce uniformity of the molten glass. —W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 412.)

English Patents.

Kilns; Arched —— for burning bricks. J. Hamblet, Sevenoaks. Eng. Pat. 16,012, July 16, 1906.

A central longitudinal fireplace extends the whole length, or thereabouts, of each kiln and by means of casing walls, the hot gases are made to pass up towards the arch of the kiln, and then down on either side, through the bricks to be burnt, to two longitudinal flues in the floors The gases can pass away to chimney stacks or, by adjusting dampers, through a number of side flues to the central fireplace of the next kiln of the series. The waste heat is thus utilised for drying purposes.—F. Sodn.

Magnesium cement; Manufacture of ——. W. Clark, London. From The American Hydrolit Co., Inc., Hoboken, U.S.A. Eng. Pat. 14,173, June 20, 1906.

See U.S. Pat. 827,286 of 1906; this J., 1906, 886.—T. F. B.

United States Patents.

Cement; Process of burning ——, and apparatus therefor. H. L. Doherty, Madison, Wis. U.S. Pat. 846,555, March 12, 1907.

This process of burning cement-clinker in rotary kilns consists in directly impinging on a travelling stream of cement material a "tempered" flame of powdered coal carried by an air-jet, and containing an amount of water-vapour sufficient to "temper" and confine the temperature within the limits of safe clinkering temperatures, and in periodically varying the amount within those limits to avoid "ring formation." The apparatus comprises a rotary inclined kiln, provided with means for feeding raw material into and removing finished clinker from it. The flame is produced by a burner, arranged to impinge the flame directly upon the advancing material in the kiln, and provided with a device for supplying it with powdered fuel, which is transported to and through the burner by an air-supplying arrangement. In proximity to the means for removing the clinker is a device for vaporising water, which has a pipe connection with the burner, whereby undue heat of the impinging flame may be "tempered."—W. C. H.

Cements; Manufacture of waterproof and non-exuding ——. R. Liebold, Berlin. U.S. Pat. 847,015, March 12, 1907.

See Addition of Oct. 5, 1905, to Fr. Pat. 345,421; this J., 1906, 267.—T. F. B.

Cement-kiln; Rotary ——, and fuel-feeder therefor. C. A. Matcham, Allentown, Pa. U.S. Pat. 847,257, March 12, 1907.

The apparatus described comprises a substantially horizontal kiln, and means for feeding cement material into one end. The material is discharged from the other end, where powdered fuel is also fed in, together with a volume of air, and the flame produced is drawn in a substantially straight path through the kiln, in contact with the cement material, and so exerts a minimum disintegrating action on the lining. The direction is given to the flame by the draught produced in the kiln from the discharge to the inlet end, by means of a chimney at the inlet end. In this way, a relatively large quantity of heated air is drawn into the kiln, through a passage directly under the opening, or "burner," by which powdered fuel and air are supplied. The large quantity of air is heated by being drawn through the clinker-pit. Means are provided for supplying a relatively dense mass of powdered fuel along a shoot, into the discharge end of the kiln by gravity, without air under pressure. Air-spaces are arranged on each side of and directly below the point of discharge of the fuel. From the shoot the fuel falls on to a fixed plate that extends beyond the mouth of the shoot, and below which is a plate adjustable longitudinally, that can be extended below the fixed plate. (See also U.S. Pat. 842,848, of 1907; this J., 1907, 410.)—W. C. H.

French Patent.

Pectic acid; Process of manufacture of ——, and its application to the preservation of wood. A. M. Effendi. Fr. Pat. 371,759, Nov. 23, 1906.

According to this invention, pectic acid is obtained by first boiling wood shavings with dilute nitric acid. The deposited insoluble matter obtained, is mixed with water, an excess of a solution of an alkali carbonate is added, and the mixture brought to the boiling point. The liquid is filtered whilst hot, and the filtrate is freed from impurities by treatment with hydrochloric acid. The liquid is decanted off from the precipitated impurities, and may be freed from any fibres in suspension by a small addition of a hot solution of sodium carbonate; this operation is conducted out of contact with air. Wood that is to be impregnated is immersed in a bath containing a mixture of wood-tar, some of the pectic acid prepared as above, and alkali carbonate and silicate, and is then withdrawn and subjected to considerable pressure for some time. The strength of the impregnating solution, which is diminished by the process of impregnation of the wood, is restored by the addition of fresh quantities of liquid pectic acid and of alkali carbonate.—W. C. H.

X.—METALLURGY.

(*Continued from page* 416.)

Mineral production of New Caledonia. For. Office Ann. Ser. No. 3759. (T.R.]

The following figures show the quantity and value of the minerals exported from New Caledonia in the last two years:—

Minerals.	1905.		1906.	
	Tons.	Value.	Tons.	Value.
		£		£
Nickel	125,289	225,520	130,688	156,825
Chrome	51,374	88,363	57,367	98,671
Cobalt	7,919	38,011	2,487	9,948
Total	184,582	351,894	190,542	265,444

Nickel-steel alloys. M. Rudeloff. Verhandl. des Ver. zur Beförd. des Gewerbfleisses, Berlin, Beiheft. Proc. Inst. Civ. Eng., 1906–7, **167**, 71—72.

The author reports on the seventh series of experiments and tests on steel alloys conducted at the Royal Testing Laboratories at Gross-Lichterfelde, to determine the influence of manganese on the strength of iron alloyed with varying proportions of carbon and nickel. The experiments included tests for tensile and compressive strengths as well as resistance against shear and deformation under repeated loads. The test-pieces were made either as flat bars cut direct from the castings or as rolled bars of flat and round sections when the alloys were too hard to permit the cutting. They were tested unannealed, after annealing, and after being suddenly cooled. The results may be summarised as follows:—(1) It was found impossible to obtain manganese alloys free from carbon when smelted in magnesite-lined crucibles. Although similar proportions of carbon and manganese had originally been added, the total amount of carbon varied considerably, the combined carbon decreasing with the increase of nickel. The presence of nickel with an increased addition of carbon appears to lessen the loss of manganese and assist the absorption of silicon. (2) The test-pieces cut from the alloys containing a higher proportion of carbon show more uniform results in point of strength. (3) An increase of carbon up to about 0·3 per cent. in alloys containing 3 per cent. of nickel, increases the strength and diminishes the deformation under the hammer-tests. The influence of sudden cooling was especially noticeable in the cast test-pieces with 0·48 per cent. and more of carbon; the rolled pieces only showed an increase of strength up to 0·3—0·35 per cent., and an elongation decreasing in proportion to the increase of carbon. (4) The influence of nickel was demonstrated by the fact that the cast test-pieces with 0·5—0·6 per cent. of manganese, 0·20—0·30 per cent. of carbon, and about 16 per cent. of nickel had the greatest strength with the least elongation, and those with 4·5—5 per cent. of manganese, 0·5—1 per cent. of carbon and 16 per cent. of nickel the least strength and the greatest elongation, whilst the rolled test-pieces showed similar results with less percentages of nickel. (5) The influence of manganese was shown in both cases by the increasing strength of alloys containing only 0·08 per cent. of nickel and 1 per cent. of carbon. The rolled bars became unworkable in the presence of 4·5 per cent. of manganese, and in respect to this property it was found that alloys containing 8—16 per cent. of nickel and less than 2 per cent. of manganese increased in strength on annealing and slowly cooling, whereas sudden cooling had no appreciable effect. The report is accompanied by complete details of the tests, diagrams and plates of metallography.

Copper ores and matte; McMurtry process for desulphurising ——. T. C. Cloud. Inst. Min. and Metall., April 18, 1907. [Advance proof.]

Ore:—The ore, which should preferably consist of one-third of 1—1¼ inch gauge and two-thirds of fine ore, and should contain 15—35 per cent. of silica and 15—25 per cent. of sulphur, is wetted sufficiently to make it cohere when slightly pressed, and treated in "converters." These are iron vessels holding 8—9 tons, with false bottoms pierced with holes for the blast, which enters at the rear from a pipe below the false bottom. The bottom is first covered with 3—4 inch pieces of a former charge; a small fire is then lighted on this, and urged by a slight blast, and ore is charged till the vessel is half full. The blast is now increased and the pot gradually filled. The best material for the fire is sawdust, and throughout the operation the charging and pricking of holes for gas escape are regulated so as to keep as far as possible a horizontal hot zone which gradually rises till the operation is finished. The issuing gases are carried off by a hood to a flue. The converter is finally inverted, and the cake (which is sintered, not fused), allowed to fall out upon cast-iron cones, which break it into four or five pieces; these are then cooled on the outside with water, and broken up further for smelting. The product is ferrous silicate containing shots of rich copper regulus and free silica, and is very suitable for blast-furnace treatment. The water used in the process prevents dust, and also seems to facilitate the burning out of the sulphur; the product from an ore containing about 20 per cent. of sulphur and 10—12 per cent. of copper contains only about 5 per cent. of sulphur.

Regulus or mattes.—These should be crushed to pass ½ or ¾-inch mesh, and then be mixed with any sort of silicious material to bring the silica up to 15—25 per cent. The fire need be only small, and the blast-pressure should not be too heavy. The product after breaking up may be melted down in any suitable furnace and will yield a regulus containing 64—70 per cent. of copper.

"*White metal*" or "*Regule.*"—This is crushed to ⅝-inch gauge and wetted. It is treated in much smaller converters (2-ton), and the temperature must be carefully watched and not allowed to rise too high, as the substance melts so readily. Better results, in the elimination of nickel and bismuth, were obtained by this process than by either the ordinary Welsh process or the so-called "direct" process of Nicholls and James.—J. T. D.

Copper; A study in refining and overpoling electrolytic ——. H. O. Hofman, R. Hayden, and H. B. Hallowell. Bi-monthly Bull. Amer. Inst. Min. Eng., 1907, 275—299.

The authors studied the refining of electrolytic copper in a reverberatory furnace, and the "overpoling" of electrolytic copper in a crucible by means of charcoal. It was found that in the refining of electrolytic copper in a reverberatory furnace, the percentage of copper rises quickly at first and at about the same rate as the cuprous oxide is reduced; later, it increases more slowly. The sulphur-content of electrolytic copper remains practically unchanged in fire-refining. In the experiments on the "overpoling" of electrolytic copper in a crucible by means of charcoal, the whole of the oxygen was eliminated from the copper. The appearance of a ridge or crown on the surface of overpoled copper is due to the expulsion of dissolved gases during the cooling. The solubility of gases (hydrogen, carbon monoxide, and sulphur dioxide) in copper increases with the temperature, and decreases as the percentage of oxygen is greater; it is at a minimum in "set" copper. The authors conclude that the "level set" or proper pitch of "tough-pitch" copper "appears to be the resultant of the hollow pitch of set copper and the crowned pitch of overpoled copper and to vary, independently of small admixtures of sulphur and iron, with the size of the casting."

Copper alloys; Age cracks in ——. C. Diegel. Verhandl. Ver. zur Beförd. des Gewerbefleisses, Berlin, 1906, 177—184; Proc. Inst. Civil Eng., 1906–7, **167**, 70—71.

The author describes a series of preliminary experiments carried out in order to ascertain the causes and remedies of age-cracking of cold-drawn copper-alloy bars. Cold-drawn bars of copper alloys, although never subjected to any strain, show deleterious surface cracks after a certain period of time. Such phenomena are of the greatest importance in the manufacture of cartridge cases, and the standard German Army specifications require that the alloys should consist of 72 per cent. of copper and 28 per cent. of zinc, with a minimum of lead, as the latter is supposed to be the chief cause of deterioration. The experiments refer to two different copper alloys, *viz.*:—(*a*) copper, 89·3; aluminium, 8·9; iron, 1·3; and other metals, 0·2—0·5 per cent.; (*b*) copper, 88·1; aluminium (including 1·5 per cent. of combined silica), 8·6; iron, 2·8; and other metals, 0·5 per cent. The bars were cold-drawn ½ in. to 2¾ in. in diameter, and hot-rolled (932° F.) bars of 1¼ in. to 3½ in. in diameter. The results of the investigation were (1) that only the hot-rolled bars did not suffer from age cracks; (2) that the cold-drawn bars, although they had a greater elastic limit than the rolled bars, suffered from age cracks; (3) that the formation of cracks is the consequence of the density of the material not being uniform throughout the whole cross-section, the tests showing that the limit of elasticity decreased rapidly from the periphery to the centre of the bars; (4) that the density varied in the inverse proportion of the cross-section, the larger diameters being more liable to crack, the average density of the whole cross-section and the elasticity of the metal apparently having less influence on the formation of cracks than the extreme variations of the density from the periphery to the centre; and (5), that the formation of longitudinal or cross-cracking depended on the methods used for drawing the bars.

Manganese-copper alloys. S. Wologdine. Metallurgie, 1907, **4**, 115; Chem.-Zeit., 1907, **31**, Rep., 145.

The curve showing the solidifying points of manganese-copper alloys, exhibits two minima, which occur with 40 and 89 per cent. of manganese, respectively, and a maximum with 78 per cent. of manganese, the latter alloy corresponding with the formula, MnCu. Alloys containing from 0 to 40 per cent. of manganese form a homogeneous crystalline mass on solidifying; with from 40 to 78 per cent., crystals having the composition, MnCu, separate out on cooling the alloy, whilst alloys containing from 78 to 89 per cent. of manganese deposit primary crystals of MnCu from the surrounding eutectic mixture. With a higher percentage of manganese than 89, the crystals consist of manganese. The hardness of the alloys reaches a maximum with 78 per cent. of manganese.—W. P. S.

Alloys rich in nickel and tin; Nature of a substance isolated from ——. E. Vigouroux. Compt. rend., 1907, **144**, 712—714.

By treating nickel bronzes, containing 73·54—91·72 per cent. of tin, with hot nitric acid and fused potassium hydroxide alternately, the author isolated the compound, NiSn, in the form of a silver-white, non-magnetic crystalline powder, with the sp. gr. 8.44. Since the calculated sp. gr. is 7·93, the formation of the substance is accompanied by contraction. The entity of the substance is confirmed by the circumstance that a mixture of nickel and tin in the same proportions (1:2), when heated to the fusing point of tin, bursts into incandescence and melts at once, the mass yielding very lustrous crystals when attacked by hot nitric acid.—C. S.

Nickel-tin alloys. L. Guillet. Compt. rend., 1907, **144**, 752—753.

The author has studied the microstructure and the equilibrium-diagram of these alloys with the following results. Nickel and tin can form four solid solutions and one compound. The solutions are:—α, magnetic, containing 0—5 per cent. of tin; α, non-magnetic, of the same composition; β, containing 38—41 per. cent. of tin; γ, containing 55—60 per cent. of tin. The compound has the composition, NiSn; it forms fine crystals visible to the naked eye. The alloys containing less than 38 per cent. of tin, are only magnetic at the ordinary temperature; they contain the α solution in the free or eutectic state. There are transformation points corresponding to the passage from the magnetic to the non-magnetic state. The useful alloys are those formed from the α solution, and those formed of tin and the eutectic, Sn—γ. They are ductile and can be treated mechanically in the same way as nickel or tin. The other alloys are extremely hard or else fragile.—F. Shdn.

Tin, lead, bismuth, cadmium; Binary and ternary alloys of ——. A. Stoffel. Z. anorg. Chem., 1907, **53**, 137—183.

Lead and tin form, within certain limits, mixed crystals, as do also tin and cadmium. The same phenomenon has not been observed with certainty with the other binary alloys of these metals. The tin-cadmium alloy has a eutectic point at 177° C. (70·6 atoms per cent. of tin); but on cooling below this temperature, molecular change occurs at 125° C., consisting, probably, in the formation of the compound, Sn_4Cd. The tin-lead-cadmium alloys show a ternary eutectic point at 145° C. (tin : lead : cadmium :: 57 : 21 : 22 atoms). These also, on cooling, below this temperature, show a change at 118°—112° C., which decreases in intensity as the lead increases, and which is possibly due to the formation of the same tin-cadmium compound. In the tin-cadmium-bismuth alloys the eutectic point is much lower, *viz.*, 103° C. (tin : bismuth : cadmium :: 33·2 : 39·3 : 27·5 atoms), below the temperature of formation of Sn_4Cd. Increase of bismuth, however, seems continuously to lower this temperature, almost to 100° C., probably by formation of mixed crystals of bismuth and the compound. Thus the alloys rich in bismuth show no eutectic point; they probably solidify to a mixture of cadmium, bismuth, and mixed crystals of bismuth and Sn_4Cd. Most of the solidified alloys show indications of another change between 78° and 68° C.
—J. T. D.

Aluminium; So-called passivity of —— towards nitric acid C. M. Van Deventer. Chem. Weekblad, 1907, **4**, 69—72; Chem. Zentr., 1907, **1**, 1017.

Aluminium is slowly attacked by nitric acid of 20—25 per cent. strength at a temperature of 25°—30° C., for the most part according to the equation—

$$Al + 4HNO_3 = Al(NO_3)_3 + NO + 2H_2O.$$

A small quantity of free nitrogen is also produced. At atmospheric pressure a small quantity of ammonia is formed, but practically none at higher pressures. With nitric acid of a given concentration, the rapidity of the action on the metal is proportional to the surface of the metal. With acid of different concentrations, the rapidity with which the metal is attacked is proportional to the concentration of the acid.—A. S.

Tinol; A new solder. M. Corsepsius. Verhandl. des Ver. zur Beförd. des Gewerbfleisses, Berlin, 1906, 237—244; Proc. Inst. Civil Eng., 1906-7, **167**, 72.

The author reports on a new solder, tinol, its conductivity and strength. Tinol consists of a soft solder metal, containing tin and lead in varying proportions. This composition is disintegrated to a very fine powder, and mixed with dry-powder soldering fluxes. It is then worked up into a paste or viscous fluid with glycerin, alcohol, or other such media. This paste was spread over the test joints, and the joints made either by simply warming or by passing over the hot soldering irons. It was found possible to join all sorts of junctions, which otherwise would have had to be made by other methods, such as screw-clamps, &c. The conductivity experiments show a 4- to 5-per-cent. higher value for tinol, while a strength-test gave similar results to the older methods of soldering.

English Patents.

Steel; Manufacture of ——. H. J. B. Picaud, Firminy, France. Eng. Pat. 7892, April 2, 1906.

See Fr. Pat. 364,837 of 1906; this J., 1906, 990.—T. F. B.

Metals from liquids; Reclaiming or recovery of ——. C. E. Holland, New York. Eng. Pat. 6937, March 22, 1906.

See U.S. Pat. 818,174 of 1906; this J., 1906, 485.—T. F. B.

Silver alloys. J. H. W. Rolason, Birmingham. Eng. Pat. 7195, March 26, 1906.

The claim is for an alloy, said to be much more ductile than ordinary standard silver, containing not less than 925 parts of silver and 50 parts of zinc per thousand, the remainder being any other metal except manganese.
—O. F. H.

Aluminium; Making ——. A. G. Betts, Troy, U.S.A. Eng. Pats. 7277 and 7277a, March 26, 1906. Under Int. Conv., April 1, 1905.

See U.S. Pat. 795,886 of 1905; this J., 1905, 932.—T. F. B.

Furnaces; Smelting ——. E. Bosshardt, Cologne, and H. Garda, Leipzig. Eng. Pat. 15,015, July 2, 1906.

The claim is for an open-hearth tilting furnace, mounted on trunnions and having a fireplace at each end of the hearth. The air, under pressure, is admitted through one of the trunnions to the space beneath the hearth, and is warmed by being made to pass round three sides of the ash-pits. The air thus heated may be admitted to the incandescent zone of each fireplace or direct to the hearth.—O. F. H.

United States Patents.

Steel; Tempering bath for ——. J. Churchward, New York. U.S. Pat. 845,755, March 5, 1907.

See Fr. Pat. 369,684 of 1906; this J., 1907, 207.—T. F. B.

Iron and steel; Self-hardening alloy of ——. J. Churchward, New York. U.S. Pat. 845,756, March 5, 1907.

Two self-hardening alloys are claimed, one containing steel (with 0·2 to 0·6 per cent. of carbon), 90 to 95 parts; nickel, 1 to 3·5; chromium, 0·5 to 2; manganese, 0·15 to 0·7; and vanadium, 0·05 to 0·25. The other alloy consists of steel (with 0·6 per cent. of carbon), 94·6 parts; nickel, 3; chromium, 1·5; manganese, 0·25; tungsten, 0·05; and vanadium, 0·15.—A. G. L.

Steel; Self-hardening alloy of ——. J. Churchward, New York. U.S. Pat. 845,757, March 5, 1907.

Two self-hardening alloys are claimed. The first contains steel (with 0·2 to 0·6 per cent. of carbon), 90 to 95 parts; nickel, 1 to 3·5; chromium, 0·5 to 2; manganese, 0·15 to 0·7; tungsten, 0·15 to 0·50; and vanadium, 0·05 to 0·25. The second alloy is identical with the second alloy claimed in U.S. Pat. 845,756 (see preceding abstract). —A. G. L.

Iron castings; Process of converting —— *into steel or malleable iron.* M. A. Hunter, Philadelphia. U.S. Pat. 846,031, March 5, 1907.

See Fr. Pat. 365,159 of 1906; this J., 1906, 991.—T. F. B.

Steel alloy and its manufacture. J. Churchward, New York. U.S. Pat. 846,979, March 12, 1907.

A titanium steel alloy is produced by melting titanium and mixing manganese with it, and then adding to the molten mixture a molten alloy of nickel and steel, the latter being at as high a temperature as is possible without volatilisation of the metals taking place.—A. G. L.

Case hardening. A. W. Machlet, Elizabeth, N.J. U.S. Pat. 847,588, March 19, 1907.

See Fr. Pat. 366,245 of 1906; this J., 1906, 1051.—T. F. B.

Gold; Process of separating —— *from silver and other metals.* D. Clark, Bairnsdale, Victoria, Australia. U.S. Pat. 845,853, March 5, 1907.

The patent relates to a process for the recovery of gold and silver from residual slimes. The slimes are treated with dilute hydrochloric acid, washed with water to remove soluble calcium compounds, then treated with dilute sulphuric acid, and dried with the addition of sulphuric acid and a soluble sulphate. The dried and caked material is next heated with an alkali pyrosulphate (nitre cake) until the base metals and silver are converted into sulphates. The soluble sulphates are removed by washing with water, and the silver by treatment with sulphuric acid; the gold is recovered from the residue by amalgamation.—A. S.

Gold; Extraction of ——. J. W. Worsey, St. Helens, and E. Hoal, Liverpool. U.S. Pat. 846,768, March 12, 1907.

See Eng. Pat. 14,398 of 1903; this J., 1904, 1031.—T. F. B.

Ores; Process of treating ——. J. E. Greenawalt, Denver, Colo. U.S. Pat. 839,065, Dec. 18, 1906.

The ore is treated in a furnace with a porous bed, and air is introduced above the ore, and at a distance from the source of heat, being drawn downwards through the bed, afterwards passing, together with the fumes, to a condensing apparatus. Claim is also made for the use of a catalytic agent (platinised asbestos, ferric oxide, &c.) in the porous bed, whereby sulphur dioxide is converted into sulphuric anhydride.—O. F. H.

Alloys; Treatment of —— *to alter their composition.* J. L. Roberts, Assignor to J. T. Morehead, New York. U.S. Pat. 845,819, March 5, 1907.

The composition of an alloy or mixture is varied by fusing it with a flux composed of calcium and sodium fluorides, together with a compound of a metal less basic than the element to be removed from the alloy or mixture. The process is applied specially to the production of an alloy of aluminium and magnesium by melting a mixture. of aluminium and sodium with a flux containing magnesium fluoride.—A. S.

[Zinc] Ores; Process of treating sulphide ——. O. Fronek, Assignor to The General Laboratory Co., Cleveland, Ohio. U.S. Pat. 845,868, March 5, 1907.

The ores are mixed with sodium chloride, and subjected to the action of a chlorinating agent in a bath containing chlorides of zinc and sodium.—O. F. H.

Lead product. J. W. Bailey, New York, Assignor to United Lead Co., New Jersey. U.S. Pat. 846,384, March 5, 1907.

The patentee claims as a new article of manufacture an impalpable powder produced by pulverising metallic lead in a dry state, and of such fineness that it may be conveyed in opposition to the force of gravity by a moderate current of air.—A. S.

Lead and copper ores; Process of smelting ——. A. Lotti, Marseilles, France. U.S. Pat. 847,017, March 12, 1907.

See Fr. Pat. 346,527 of 1904; this J., 1905, 200.—T. F. B.

Nickel ores, &c.; Process of treating ——. R. W. E. MacIvor, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 846,492, March 12, 1907.

See Eng. Pat. 10,869 of 1905; this J., 1906, 588.—T. F. B.

Sulphide ores; Process of smelting ——. C. W. Munson, Toledo, Ohio. U.S. Pat. 846,498, March 12, 1907.

In this process of smelting sulphide ores, a confined air-space is maintained between the walls of the furnace and the sides of the low conical heap of ore on the hearth. Hot air, under pressure, is uniformly distributed in this space by means of a blast, so as to force back into the mass on the furnace-hearth the gases produced by the melting of the sulphur in portions of the charge. During the smelting, fresh ore is simultaneously fed in.—A. G. L.

Apparatus for treating materials [Roasting furnace]. C. E. Mark, Chicago, Ill. U.S. Pat. 846,588, March 12, 1907.

In a mechanically rabbled roasting furnace, air under pressure is introduced through the hollow arms of the rabbles, into the midst of the ore. Means are also provided for making the air supply intermittent.—O. F. H.

Copper; Process of extracting ——. O. Frölich, Berlin. U.S. Pat. 846,657, March 12, 1907.

The ore or other material is heated, with exclusion of air, to a temperature high enough to expel the free sulphur, and is then treated with gaseous chlorine, hydrochloric acid, and ferric chloride at a temperature between 0° and 350° C. Air is next allowed to act on the material at a temperature above the boiling point of ferric chloride, and the "chlorinating gases" evolved, are collected. The mass is next leached with water, and the solution introduced into a rotating apparatus containing iron, in order to deposit the copper. After the copper is deposited, the solution in the rotating apparatus is oxidised by an air-blast, evaporated, heated to expel water of crystallisation, and subjected to the action of a limited quantity of air in order to generate "chlorinating gases." The residual ore after removal of copper and iron, is heated above the boiling point of sulphur to expel the sulphur previously combined with the copper and iron. —A. S.

[Copper-smelting] Furnace gases; Apparatus for removing impurities from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 846,815, March 12, 1907.

The apparatus described, is for removing impurities from copper-smelter gases, and comprises a chamber into which the gases from the smelter are led, and a vertical column of screening material interposed across the path of the gases. The vertical screen in the chamber consists of parallel vertical walls which have unobstructed inner surfaces, and are provided with perforations or openings directed upwards and outwards. Means are provided for supplying fresh granular screening material to the top of the column, which passes down between the vertical walls into an enlarged chamber below them, from which it is removed by a conveyor with sufficient rapidity to prevent "scaffolding." Means are also provided for spraying the column.—W. C. H.

Furnace; Copper-refining ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 846,891, March 12, 1907.

The furnace, which can be turned over on its longitudinal axis, has, at its upper part, a combined feed and pour-out opening, and a "burner" or blast-pipe projecting through one end, at its lower part, for heating the interior of the furnace. The furnace has a metal body, thick enough to retain the heat of the furnace, and an acid lining, which is comparatively thin, so as to reduce the amount of copper required to saturate it.—O. F. H.

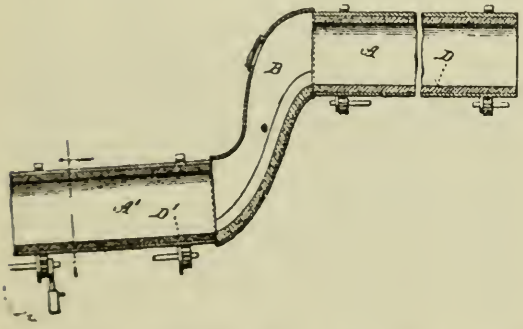
Steam ; Method of generating —— from waste heat of slag. R. Baggaley, Pittsburg, Pa. U.S. Pat. 846,817, March 12, 1907.

THE molten slag from copper-smelting furnaces is utilised by passing it through a closed steam-generator, but out of direct contact with the water contained therein. The feed-water for the steam-generator is preheated to a relatively high temperature in an open vessel by the spent slag from the generator, and also by a portion of the molten slag from the furnace.—A. S.

Flue-dust ; Method of recovering values from ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 846,818, March 12, 1907.

THE flue-dust is introduced into a converter, and covered with a layer of coarser fusible material to keep it in place. Molten material is then introduced on to the surface of the charge, and the converter oscillated to distribute it over the whole of the surface, after which a blast of air is forced in through the tuyères in order to cool the molten material and cement the charge. A bath of molten matte is then introduced, the converter heated, and the blast turned on, the converting process being continued until the cemented charge is taken up by the bath.—A.S.

Pyrites-cinder, &c. ; Apparatus for desulphurising and agglomerating ——. R. F. Hill, Assignor to General Chemical Co., New York, N. Y. U.S. Pat. 847,410, March 19, 1907.



Two inclined rotary kilns, AD and A^1D^1, are arranged as shown in the figure. The lower kiln has a non-acid lining, and is connected to the upper kiln by the movable pipe, B, so pivoted as to be capable of swinging towards and away from the adjacent ends of the kilns.—E. S.

Pyrites-cinder, &c. ; Process of desulphurising and agglomerating ——. R. F. Hill, Assignor to General Chemical Co., New York, N.Y. U.S. Pat. 847,664, March 19, 1907.

PYRITES-CINDER is subjected to rotary agitation, and to a gradually increasing heat, but kept below the fusing point, in a desulphurising atmosphere, in the upper of the two connected rotary kilns shown in the preceding abstract. The desulphurised cinder is then transferred to the lower, non-acid lined kiln, in which, with rotary agitation, it is subjected to a heat sufficient to fuse it and cause it to form coherent masses or nodules.—E. S.

GERMAN PATENTS.

Gold ; Process for the extraction of —— by cyanide solution in a conical tank. A. H. Rasche. Ger. Pat. 175,883, Dec. 4, 1904. Addition to Ger. Pat. 170,566, March 8, 1904 (this J., 1907, 156).

ACCORDING to the main patent, circulation of the ore was effected by means of a conveyor inside the lixiviation tank. According to the present patent, the ore is withdrawn through an opening in the bottom of the tank, and is transferred by a conveyor, outside the tank, to the top of the latter, where it is again introduced into the cyanide solution.—A. S.

Zinc ; Process for tapping off —— directly into moulds. O. Unger. Ger Pat. 175,488, June 11, 1905.

THE moulds are so disposed on a revolving platform, that on the one hand they do not interfere with the working of the muffle, and, on the other, one and the same mould can receive the molten metal from several receivers.—A. S.

Zinc furnace ; Connection between the receiver and dust-chamber of a —— which will be gas-tight in all positions and which can be easily opened. R. Kessler. Ger. Pat. 175,692, Aug. 1, 1905.

THE mouth-piece of the dust-chamber is made conical, whilst the portion of the receiver into which it fits is of globular form, so that the joint remains gas-tight even when the dust-chamber is not quite perpendicular.—A. S.

Air blast for blast-furnaces or other furnaces ; Process of drying the —— by means of hygroscopic salts or the like. J. A. Elsner. Ger. Pat. 175,812, Nov. 21, 1905.

THE hygroscopic salt used for drying the air is caused to pass continuously through two rotating drums, in one of which the air is dried, whilst in the other the moisture is expelled from the salt.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 420.)

(*A.*)—ELECTRO-CHEMISTRY.

Copper cathodes in nitric acid. J. W. Turrentine. Trans. Amer. Electrochem. Soc., 1906, **10**, 49—53.

THE author made experiments with a view to ascertain why copper, on being dissolved in nitric acid, only reduces the latter to nitric oxide, whereas nitric acid can be electrolytically reduced quantitatively to ammonia. Experiments on the electrolytic reduction of nitric acid with a copper cathode, showed that when a current is passed of such cathode density that no copper is dissolved, the acid is reduced to ammonia, but with a smaller current-density, so that some copper is dissolved, nitric oxide is evolved. The presence of copper ions in solution thus appears to prevent reduction of nitric acid to ammonia. In another experiment, it was so arranged that the copper ions dissolved by the chemical reaction between nitric acid and copper were immediately reprecipitated electrolytically. It was found that copper on dissolving in nitric acid under these conditions, *i.e.*, in absence of copper ions, reduces nitric acid to ammonia. The author concludes that when copper dissolves in nitric acid, the anode reaction is the formation of copper nitrate, and not of copper nitrite, whilst the cathode reaction is the reduction of nitric acid. When copper ions are present in solution, the chief reduction product is nitric oxide, but when there are practically no copper ions in solution, ammonia is produced.—A. S.

Acetylene flame ; Action of the electric discharge on the ——. C. F. Lorenz. Physik. Zeits., 1906, **8**, 20—23. Chem. Zentr., 1907, **1**, 1080—1081.

A COAL-GAS flame and, to a greater extent, an acetylene flame, becomes whiter and brighter if an alternating current be passed through it. A large quantity of soot is formed, but this is avoided if the electrodes are placed in the outer, non-luminous cone of the flame. At each passage of the discharge the flame becomes shorter and brighter. In one case the brightness of the flame was increased from 7·5 to 38 candle-power. The bright light is very rich in violet rays. It is suggested that an acetylene flame would prove useful as an indicator in a telephone receiving office.—A. S.

Metals ; Rapid electro-analytical deposition and separation of ——. I. The metals of the silver and copper groups and zinc. H. J. S. Sand. XXIII., page 490.

Tin ; Quantitative separation of —— from manganese, iron, and chromium by electrolysis. N. A. Puschin. XXIII., page 491.

ENGLISH PATENTS.

Incandescence bodies of refractory metals for electric lamps ; Manufacture of ——. A. G. Bloxam. From J. Lux. Eng. Pat. 7188, March 24, 1906. II., page 462.

Incandescence bodies for electric lamps ; Manufacture of —— from tungsten compounds. The British Thomson-Houston Co. From General Electric Co. Eng. Pat. 11,409, May 16, 1906. II., page 462.

Accumulators. E. de Marcay, Paris. Eng. Pat. 8345, April 6, 1906. Under Int. Conv., Jan. 24, 1906.

SEE Fr. Pat. 362,909 of 1906 ; this J., 1906, 766.—T. F. B.

Compounds of oxygen and nitrogen ; Process for producing —— by aid of electric discharges. W. P. Thompson. From Westdeutsche Thomasphosphat-Werke, G.m.b.H., Berlin. Eng. Pat. 7829, March 31, 1906.

NITROGEN and oxygen are made to combine together by means of electric discharges in a secondary current circuit created by a high-tension transformer. A primary energy of less than 200 watts is used for the spark gap, and a minimum tension of 100,000 volts is produced in the secondary circuit. By thus diminishing the current strength in the secondary circuit, the temperature of the discharge is lowered, and the conversion of the higher into the lower oxides of nitrogen is avoided, the yield of higher oxides being thus considerably increased.—B. N.

UNITED STATES PATENTS.

Body to be heated electrically. E. Haagn, Assignor to W. C. Heraeus, Hanau, Germany. U.S. Pat. 847,065, March 12, 1907.

THIS invention relates to a method of producing vessels which are to be heated electrically. An internal form is covered with a fabric of organic material, and a resistance of wire, strip, or wire net is sewed on to the fabric in the desired position, with yarn of organic fibre. The internal form, together with the fabric and resistance, is introduced into an external form, and the space between them is filled up with a fire-proof insulating material. The latter is allowed to harden, the fabric above the external form cut off, and the internal form with the rest of the fabric is removed from the external form. The vessel thus produced is heated a little in order to destroy the organic matter, and a layer of fire-proof insulating material is applied to the inside. This second layer is allowed to harden, and the body is finished by burning it at a high temperature, after which it is enamelled.—B. N.

Insulating material for electrical purposes ; Process for the production of an ——. J. Meyenburg, Baar, Switzerland. U.S. Pat. 848,117, March 26, 1907.

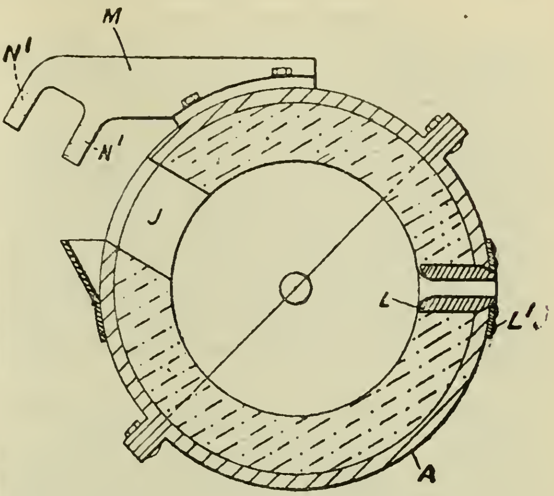
SEE Eng. Pat. 12,105 of 1905 ; this J., 1905, 1312.—T. F. B.

(B.)—ELECTRO-METALLURGY.

ENGLISH PATENTS.

Furnaces ; Electric [metallurgical] ——. P. R. Kuehnrich, Sheffield. Eng. Pat. 6283, March 15, 1906.

THE invention relates to an electric arc furnace, the molten contents of which may be transferred directly to moulds or other receptacles without using an intermediate ladle. A form of the furnace is shown in cross-section in the accompanying figure, but the interior of the furnace is preferably of elliptical cross-section. The furnace, A, is mounted so that it can be rotated, and the electrodes are introduced either through the hollow supporting trunnions, or through the roof of the furnace. The charge is introduced through the opening, J, which can be closed by a door (not shown) ; opposite the charging opening is a tapping nozzle, L, closed by a plug, and held in position by a plate, L^1. When it is desired to remove the slag, the door closing the opening, J, is opened, and the furnace is rotated until the slag flows out through J. When it is desired to tap off the molten metal, a slightly bent stopper-rod is passed through the openings, N^1, in the bracket, M, and through the charging opening, J, until its end closes the tapping nozzle, L, the plug in which is removed. The furnace is then rotated until the tapping nozzle is on the underside, the stopper-rod is withdrawn, and the molten metal is received in moulds or other receptacles.—A. S.



Furnaces ; Electrical ——. F. A. Kjellin, Stockholm, Sweden. Eng. Pat. 21,416, Sept. 27, 1906. Under Int. Conv., March 5, 1906.

THIS invention relates to electrical resistance furnaces, in which the material to be treated (for instance, a metal), acts as the heating resistance. Owing to the relatively small specific resistance of the material, it is necessary to give the conductor a relatively small cross-section, in order to produce the required heat, though at the same time it is advisable to treat large quantities of material. This is accomplished by providing the furnace with heating channels with enlarged portions, or the channels may communicate with separate receptacles for containing the material to be treated, the latter being forced continuously, or at short intervals, through the heating channels by mechanical means. This movement of the material along the channels may be obtained by giving the furnace an oscillating or rocking movement, or a refractory body may be intermittently forced down into the molten material, or may be immersed in the molten material, and have a movement imparted to it along the channel, the heating channel proper being in this case formed of the space between the body and the walls and bottom of the channel, or the material in the enlargements or receptacles may be intermittently subjected to a varying gas pressure. An alternative form of furnace is described, in which "the bottom of the channel is inclined, making the depth of the channel or channels least in the places where the bottom is highest." By imparting a rotary movement around an inclined axis to the furnace, portions of the material are continuously forced through the shallowest parts of the channels. Partitions of refractory material are arranged between the heating channels and the enlarged portions or receptacles, these partitions dipping down into the molten material, and thus preventing the slag from passing from one receptacle to the other, or entering the heating channels.—B. N.

Metals from ores ; Process of electrolytically extracting ——. M. Perreur-Lloyd, La Tréport, and A. M. Gardner, Paris. Eng. Pat. 25,489, Nov. 12, 1906.

SEE Fr. Pat. 371,251 of 1906 ; this J., 1907, 328.—T. F. B.

United States Patents.

Furnace ; Electric ——. Le Roy W. Stevens, Syracuse, N.Y., Assignor to Advance Furnace Co., Utica, N.Y. U.S. Pat. 846,521, March 12, 1907.

A movable electrode projects through the top of the furnace chamber, the upper portion of the electrode being surrounded by a stuffing-box, which is mounted on the upper part of the chamber. A movable sleeve, connected to the electrode, is mounted in the stuffing-box, the bottom of the sleeve being closed by a wall of non-conducting refractory material, which fits tightly on the electrode, whilst the upper portion of the sleeve is enlarged, thus providing a space for granular refractory material between the inner wall of the sleeve and the electrode. Water is circulated through an interior chamber in the sleeve, and through an outer chamber in the stuffing-box.—B. N.

Electrotyping ; Solution for use in ——. A. Gerstner, Brooklyn, N.Y. U.S. Pat. 838,977, Dec. 18, 1906.

A solution containing silver nitrate, 1 oz., sodium chloride, 2 oz., graphite, 2 lb., and water, 1 gal., is applied to the mould, in order to form on the latter a thin coating of silver chloride, which will react with copper in the electroplating bath, and form a coating of metallic silver. Nitric acid is also mentioned as one of the constituents of the solution, though no proportion is given.—B. N.

Metallic sulphides ; Process of [electrolytically] reducing ——. E. L. Anderson, St. Louis, Mo., Assignor to H. Atchisson, St. Louis, Mo., and J. H. Miller and C. S. Coud, McLeansboro, Ill. U.S. Pat. 846,642, March 12, 1907.

The ore is subjected to the action of an electric current in an acid electrolyte capable of dissolving the metal constituent of the ore with the formation of a soluble salt. The current is passed from an anode to an undecomposable primary cathode, whilst the ore itself acts as a secondary cathode, and is decomposed. The metal dissolved from the ore acting as secondary cathode is reprecipitated by the current on the primary cathode. —A. G. L.

Silicide ; Producing metallic ——. T. L. Willson, Ottawa, Canada. U.S. Pat. 847,300, March 12, 1907.

A compound containing iron, nickel, and sulphur (iron-nickel sulphide) is smelted with lime, or other basic body, silica and carbon, in an electric furnace, nickel silicide (or ferro-nickel silicide) and a basic sulphide slag being produced.—A. G. L.

Tantalum or other metals ; Production of homogeneous bodies from ——. M. von Pirani, Wilmersdorf, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 848,600, March 26, 1907.

See Fr. Pat. 371,207 of 1906 ; this J., 1907, 328.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 421.)

Fat ; Source of error in the determination of —— *by means of carbon tetrachloride.* F. Vollrath. XXIII., page 489.

English Patents.

Petroleum residues ; Process of obtaining fatty acids from ——. H. Breda. Eng. Pat. 19,477, Aug. 31, 1906. III., page 464.

Soaps, detergents, lubricants, batching, candle-stock, and the like ; Manufacture of ——. M. R. A. Samuel, London. Eng. Pat. 7380, March 27, 1906.

Fats or oils are heated and introduced in small quantities at a time, and preferably in a finely-divided state, into a solution of caustic soda or potash, and the mixture heated until the saponified product separates on the surface. A suitable proportion of a mineral oil, such as petroleum, may be mixed with the saponifiable substances. It is stated that soap prepared in this way throws out its excess of alkali and the glycerol.—C. A. M.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*Continued from page* 423.)

(*A.*)—PIGMENTS, PAINTS.

Boron-ultramarine. J. Hoffmann. Z. angew. Chem. 1907, 20, 568—570. (See also this J., 1906, 697.)

A further study of boron-ultramarine has shown that potassium compounds may be used for its preparation instead of sodium compounds, and that alkali thiosulphates or sulphites may take the place of sulphides, since they decompose, yielding these at the temperature necessary. For the production of ordinary ultramarine many hours' heating are necessary, but boron-ultramarine may be prepared in a few minutes in the muffle at 800°—1000° C. The alkaline earth boron-ultramarines are never of a pronounced blue colour, on account of the difficulty of fusing them. Anhydrous borax fused with a certain quantity of boron sulphide gives a reddish ultramarine, and the mass darkens in colour with a further quantity of the sulphide, becoming blue on the addition of boric acid. Reasons are given for supposing that the colour of boron-ultramarine is due to the replacement of part of the oxygen in the boric acid by sulphur. Thus, in the triborate mass there is probably present the compound, $SO_2B_2.O_3B_2.O_3B_2.ONa_2$, and the tetraborate blue would contain $SO_2B_2.O_3B_2.O_3B_2.O_3B_2.ONa_2$. The introduction of more sulphur deepens the tint, owing to a second boric acid molecule being attacked, with the formation of the compound, $SO_2B_2.SO_2B_2.O_3B_2.O_3B_2.ONa_2$. The author regards the boric acid as corresponding partly to the alumina and partly to the silicic acid present in ordinary ultramarine.—F. Sodn.

Lithopone ; Analysis of ——. Coppalle. Ann. Chim. anal. appl., 1907, 12, 62—65. Chem.-Zentr., 1907, 1, 1157—1158.

Qualitative examination.—The sample is boiled with hydrochloric acid, hot water is added, and portions of the solution are tested on the one hand for barium, and on the other for zinc, aluminium, calcium, and magnesium. *Soluble salts.*—Two grms. of the pigment are extracted with hot water, and the solution evaporated. *Insoluble matter.*—Two grms. of the substance are treated with strong nitric acid, the mixture heated, some hydrochloric acid added, the whole slowly evaporated to a small bulk, water added, the solution filtered, and the residue dried and weighed. It should consist of barium sulphate, and corresponds to the total baryta. If the percentage of baryta be from 66 to 68, kaolin should be tested for. *Total zinc.*—The filtrate from the barium sulphate is treated with sodium carbonate, and the precipitated zinc carbonate weighed. If very accurate results be desired, the zinc is determined volumetrically in a portion of the precipitate. *Zinc sulphide.*—The filtrate from the zinc carbonate is acidified with hydrochloric acid, and treated with barium chloride. From the quantity of sulphur in the barium sulphate precipitate, the amount of zinc sulphide is obtained by multiplying by 3·03. *Zinc oxide.*—The difference between the total zinc and the zinc as sulphide gives the amount present as oxide. *Barium carbonate.*—Two grms. of substance are extracted with dilute hydrochloric acid, and the barium in the solution determined as sulphate. *Barium sulphate.*—The difference between the barium present as carbonate and the total barium gives the barium present as sulphate.—A. S.

English Patents.

Distemper paints ; Manufacture of ——. A. T. Hall, Hull. Eng. Pat. 8513, April 9, 1906.

Some or all of the following ingredients :—Calcium carbonate, glue, linseed oil, oak varnish, and pigment—

are heated with water, and the resulting mass mixed with a disinfectant, such as carbolic or cresylic acid, with chromic acid or potassium or sodium bichromate, and with boric acid, sodium borate, or other salt capable of rendering it fire-proof. The mixture is then incorporated into a homogeneous stiff paste by means of rollers and is diluted with water to the required consistency before use. Claim is also made for a mixture of this kind in approximately the following proportions:—Glue, 1½ lb.; linseed oil, 2 lb.; varnish, ½ lb.; water, 6 lb.; cresylic acid, 1 oz.; potassium bichromate, ¼ lb.; iron oxide, 4 oz.; sodium borate, 2 lb.; calcium carbonate, 10 lb.; and lithopone, 4 lb.—C. A. M.

Zinc in the form of oxide; Process for utilising inferior calamines by extracting their ——. F. S. Moyano, Aguilas, Spain. Eng. Pat. 24,526, Nov. 2, 1906. Under Int. Conv., June 12, 1906.

The calcined ore is finely crushed, thoroughly stirred into a freshly prepared solution of calcium chloride, and heated to 100° C. for about three hours. Zinc chloride is formed according to the equation—

$$CaCl_2 + ZnO + H_2O = ZnCl_2 + CaH_2O_2,$$

and the solution after settling is drawn off and magnesium carbonate added, zinc carbonate being precipitated and magnesium chloride formed, thus—

$$ZnCl_2 + MgCO_3 + H_2O = ZnCO_3 + MgCl_2 + H_2O.$$

The zinc carbonate is allowed to settle, the solution is drawn off to crystallising vats, and the magnesium chloride recovered for the regeneration of hydrochloric acid. The zinc carbonate is finally heated in muffle furnaces and zinc oxide obtained.—O. F. H.

United States Patents.

Pigments; Process and apparatus for the production of ——. C. P. Townsend, Washington, Assignor to E. A. Sperry, Cleveland. U.S. Pats. 846,526 and 847,032, March 12, 1907.

See Fr. Pat. 349,001 of 1904; this J., 1905, 627.—T. F. B.

[*Lead*] *Metallic oxides; Process of making* ——. J. W. Bailey, Jersey City, N.J., Assignor to United Lead Co., N.J. U.S. Pat. 846,444, March 12, 1907.

The metal (lead) is reduced to an impalpable powder and oxidised by heating it to a temperature below its melting point in a closed vessel (muffle) through which a current of heated air or air and steam is passed. The powder may be agitated so as to be completely exposed to the oxidising agent, and the heat may be gradually increased as oxidation proceeds. Or else, the powdered metal may be fed in regulated quantities, together with steam, into a heated muffle, where it is exposed to the action of a current of air.—A. G. L.

Paint remover, and process of making the same. P. T. Austen and F. J. Maywald, New York. U.S. Pat. 846,080, March 5, 1907.

This consists, in the main, of two or more volatile solvents (which may include a petroleum hydrocarbon) of different chemical nature, incorporated into a cream-like emulsion with water containing a dissolved proteid (*e.g.*, ammonium caseinate), with or without also a colloidal carbohydrate. The aqueous part of the emulsion may be alkaline, and the mixture free from caustic or corrosive constituents or free acids.—C. A. M.

(*B.*)—RESINS, VARNISHES.

Abietic acid; Constitution of ——. F. Koritschoner. Z. angew. Chem., 1907, 20, 641—645.

Two samples of abietic acid, melting respectively at 153°—154° C. and 179° C., were examined by the author. The results of elementary analysis corresponded more closely with Mach's formula, $C_{19}H_{28}O_2$, in the case of the first, and with the formula, $C_{20}H_{30}O_2$ (Fahrion, this J., 1907, 264; Levy, this J., 1906, 1057), in the case of the second, though the neutralisation values of both agreed with the higher formula. To obtain further evidence the author determined the electrical conductivity of both samples after fractional neutralisation with $N/10$ potassium hydroxide solution, the method of Kohlrausch being employed. This method is based upon the fact that the hydrogen- and hydroxyl-ions surpass all other ions in their velocity of migration. Hence in the neutralisation process in the case of stronger acids, the conductivity must fall to a certain point owing to the combination of the hydroxyl-ions of the alkaline lye with the hydrogen ions of the free acid, whilst the ions of the neutral salt have a much smaller velocity of migration. When the neutralisation point is reached, hydroxyl ions are set free on the addition of more alkali solution, and the conductivity rises again. On the other hand, in the case of weak acids the ions of the neutral salt have an influence owing to the smaller concentration of the hydrogen ions of the acid, and the conductivity rises regularly from the beginning, whilst the neutralisation point is marked by a sudden increase. The two samples of abietic acid showed, as was anticipated, a steady increase in the conductivity values throughout the stages of neutralisation. In parallel experiments 0·302 grm. of the first acid (one millimol, *i.e.*, 1/1000th of the molecular weight in grms., of $C_{20}H_{30}O_2$) and 0·288 grm. (one millimol of $C_{19}H_{28}O_2$) of the second acid were tested in this way. With the first the sudden increase in the conductivity took place when 10 c.c. of the $N/10$ alkali had been added, whereas with the second acid this point occurred after the addition of 9·5 c.c. instead of 10 c.c., which it would have been if Mach's formula had been correct. The true molecular weight and the formula of this acid were then calculated from the difference ($288 : 9·5 = x : 10$), which gave 303, in close agreement with the theoretical value (302) for $C_{20}H_{30}O_2$. In further experiments the author showed that abietic acid must be regarded as a carboxylic acid with the formula, $C_{20}H_{30}O_2$. (See also this J., 1903, 1250; 1904, 989.)—C A. M.

(*C.*)—INDIA-RUBBER, &c.

English Patent.

Benzine and other volatile products which are disengaged during the drying of freshly gummed fabrics in the rubber industry; Process for the recovery of the ——. A. E. Vincent, Paris. Eng. Pat. 14,896, June 30, 1906. Under Int. Conv., July 3, 1905.

See Fr. Pat. 361,603 of 1905; this J., 1906, 996.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 423.)

Blackwattle bark; Export of —— *from Natal.* Bd. of Trade J., April 25, 1907. [T.R.]

In the annual report of the Durban Chamber of Commerce it is stated that the quantity of blackwattle bark exported from Natal in 1906 was 14,756 tons, of a declared value of £89,856, compared with 17,513 tons in 1905, of a declared value of £102,666. Prices in 1906 averaged £6 0s. 8d. per ton, as against £5 17s 3d. in 1905. The decrease in the quantity exported is explained by the fact that many of the old plantations had been cut down, and the young plantations were not ready for stripping in sufficient quantity to keep up the supply, and by the temporary stoppage of transport in some parts of Zululand during the native disturbances.

Gelatin [*in solutions of gums, sugar, &c.*]; *Nessler's reagent for the identification of* ——. Vamvakas. XXIII., page 491.

United States Patents.

Hides; Machine for carrotting ——. C. and E. Pichard, Paris. U.S. Pat. 846,944, March 12, 1907.

See Fr. Pat. 355,121 of 1905; this J., 1905, 1227.—T. F. B.

Proteids; Method of treating —— [*for preparing adhesive compounds*]. M. R. Isaacs, Philadelphia, Pa. U.S. Pat. 845,790, March 5, 1907.

A composition is claimed consisting of casein, 100 parts; lime, from 5 to 20 parts; sodium fluoride, from 2 to 12 parts; and water.—W. P. S.

Adhesive compound, glue, &c. M. R. Isaacs, Philadelphia, Pa. U.S. Pat. 845,791, March 5, 1907.

The composition, which may be used as glue, size, or for adhesive purposes, consists of casein, 100 parts; an alkali solvent, from 5 to 15 parts; sodium silicate, from 2 to 15 parts; and sodium fluoride, from 2 to 10 parts. —W. P. S.

XV.—MANURES, &c.

(*Continued from page* 424.)

Nitrogenous fertilisers; Manurial experiments with the new ——. J. Sebelien. Biedermann's Zentr. Bl. für Agrik., 1907, **36**, 149—154.

In the case of mustard, cut whilst in full bloom, basic calcium nitrate gave results 30 per cent. better than sodium nitrate. Calcium cyanamide crippled the growth of the plant. With oats the increase of yield with calcium cyanamide was about 77 per cent. of that with an equivalent amount of sodium nitrate, whilst calcium nitrate only gave results superior to the latter in the case of sandy soil (poor in lime). For barley, scarcely any difference could be detected between the effect of sodium nitrate and calcium nitrate, and still better results as regards yield of corn were obtained by using the former in conjunction with calcium carbonate. In field trials with oats and barley on moorland soil, calcium cyanamide proved unsatisfactory, whereas calcium nitrate and sodium nitrate gave almost identical results, the former being superior in one instance. In the case of hay the two were about equal, but with potatoes the calcium salt was somewhat inferior. In these latter trials, calcium cyanamide proved about equivalent to ammonium sulphate. —C. S.

Calcium cyanamide; Storage of ——. H. von Feilitzen. Chem.-Zeit., 1907, **31**, 385.

The nitrogenised product prepared from calcium carbide, calcium chloride, and nitrogen according to the process of Polzeniusz (this J., 1903, 420) is now used extensively as a manure. The use of this substance is accompanied by some disadvantages. Some of the calcium chloride used in its preparation remains in the product, which is therefore very hygroscopic. The substance tends to cake together into hard lumps and bursts the containing sacks. There is also a considerable loss of the nitrogen as ammonia, this amounting to over 5 per cent. of the total nitrogen in four months.—C. E. F.

United States Patent.

Fertiliser and process of making same. C. Ellis, White Plains, N.Y. U.S. Pat. 847,749, March 19, 1907.

A granular absorbent, such as peat, is impregnated with a solution of fertilising materials, and is then dried and "superficially sealed" by closing the surface pores with an insoluble material.—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 425.)

Raffinose; Splitting of —— *into sucrose and d-galactose.* C. Neuberg. Z. Ver. deut. Zucker-ind., 1907, 440—453.

In the case of melibiose the open carbonyl group belongs to the dextrose residue and not to the galactose. It therefore follows that in the non-reducing trisaccharide, raffinose, the carbonyl groups of the dextrose and lævulose residues are mutually locked up. Hitherto raffinose had not been split up so as to retain the dextrose and lævulose residues in combination in the products. The author finds, however, that emulsin readily effects such a change, but that several days are necessary to complete the resolution into galactose on the one hand and sucrose on the other. Both sugars have been isolated and characterised. The occurrence of raffinose in the beet is very irregular, and the raffinose contents of molasses may range from traces up to 16—22 per cent. It is suggested that the production of raffinose is a pathological process effected by a reversed enzyme action, bringing about a condensation of the sucrose with galactose split off from the gums. Industrially it may be possible to convert the raffinose of beet molasses, which has very little sweetening power, into sucrose by the action of crude emulsin or almond meal.—J. F. B.

Raffinose; Detection of small quantities of ——. C. Neuberg and F. Marx. Z. Ver. deut. Zucker-ind., 1907, 453—456.

The observation that raffinose is split up by the action of emulsin whilst sucrose is absolutely unattacked affords a test by which small quantities of raffinose can be detected by the production of a cupric-reducing sugar. Naturally the presence of reducing sugars in the sample prevents the application of this test, as does also the presence of glucosides, &c., which are attacked by emulsin. In performing the test, 1 c.c. of the sugar solution is digested with a small quantity of emulsin in presence of toluene at a temperature of 38° C. for forty-eight hours, and the solution is then tested with Fehling's solution. One part of raffinose can be detected in admixture with 250 parts of sucrose. The purity of the emulsin employed must be carefully controlled by blank experiments, since some samples will produce substances when merely digested with water. The test-mixture should not show any appreciable degree of alkalinity towards phenolphthalein.—J. F. B.

Calcium; Use of metallic —— *for the reduction of sugars.* C. Neuberg and F. Marx. Z. Ver. deut. Zucker-ind., 1907, 456—461.

The use of metallic calcium or calcium amalgam for the reduction of sugars has an advantage over that of sodium amalgam, because the elimination of the hydroxide produced is easily effected by the simultaneous passage of a current of carbon dioxide through the solution. Metallic calcium is best employed in the form of turnings from the commercial rods; calcium amalgam can be prepared from the powdered calcium by dissolving it in mercury in a mortar previously heated to 100° C. By means of these reducing agents the authors have prepared sorbitol from dextrose, dulcitol from galactose, glucosamine from dextrose-oxime, and a new alcohol, *lactobiotitol*, $C_{12}H_{24}O_{11}$, from milk sugar. This alcohol is crystalline, but has no definite melting point; it is hydrolysed by acids with the production of galactose and sorbitol.—J. F. B.

Gelatin [*in solutions of gums, sugar, &c.*]; *Nessler's reagent for the identification of* ——. Vamvakas. XXIII., page 491.

United States Patents.

Sugar juices; Process of purifying and concentrating ——. J. A. Besson, Caen, France. U.S. Pat. 846,543, March 12, 1907.

See Addition of Feb. 19, 1903, to Fr. Pat. 308,384; this J., 1904, 554.—T. F. B.

Beetroot, &c.,; Process for the treatment of ——. C. Steffen, Vienna. U.S. Pat. 847,126, March 12, 1906.

See Fr. Pat. 348,494 of 1904; this J., 1905, 507.—T. F. B.

Starch; Process of treating ——. F. Drittler, Rutherford, N.J., Assignor to The Arabol Manufacturing Co., New York. U.S. Pats. 847,658 and 847,985, March 19, 1907.

See Eng. Pat. 7705 of 1905; this J., 1906, 601.—T. F. B.

German Patents.

Beet slices or bagasse; Process for the continuous diffusion of ——. H. Steckhan. Ger. Pat. 170,307, Nov. 5, 1903.

The juice coming from one of the cells of a diffusion battery (*e.g.*, No. 8) is divided into two portions, of which one is passed to the measuring vessel or to the saturation apparatus, whilst the other is introduced into a cell (No. 9) freshly charged with beet slices.—A. S.

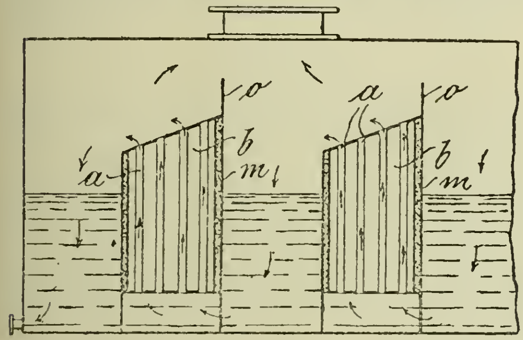
Diffusion battery ; Method of heating a ——. O. Koehler. Ger. Pat. 171,197, Feb. 17, 1905.

In order to keep the first diffusion cell at a uniform high temperature, the juice used for the diffusion is passed through more than two juice-warmers in succession before being admitted from below to the cell containing fresh beet slices ; the juice is afterwards passed to the measuring vessel. Whilst the diffusion is proceeding in the cell freshly charged with beet slices, the other cells containing material which has already been treated with juice, are heated by hot air or superheated steam.—A. S.

Sugar juice from fresh or dried beet slices or sugar-cane chips, &c. ; Process for obtaining ——. H. Müller. Ger. Pat. 168,634, March 1, 1905.

The juice is extracted from the raw material (beet slices, &c.) under diminished pressure, in a vessel connected to an air-pump, and having in its lower part a system of vertical heating tubes, covered by a perforated plate. Steam is supplied to the lower compartment of the vessel, containing the heating tubes, and the juice passes up through the tubes into the upper compartment, wherein the extraction of the sugar is effected. It is stated that the juice is obtained in a shorter time, and of a higher degree of concentration than by the usual method.—A. S.

Evaporator especially intended for use in the sugar industry. R. Thonke. Ger. Pat. 174,167, Nov. 1, 1903.



The evaporator is provided with several heating chambers, *b*, of the form shown in the figure. The outer walls, *o*, of the heating chamber are protected from the action of the heating agent (steam) by a layer, *m*, of non-heat-conducting material or the like, and the heating chamber itself projects above the level of the liquid in the evaporator, so that the liquid issuing from the heating tubes, *a*, is freed from steam bubbles in falling.—A. S.

Liquoring process for sugar by the use of a centrifugal apparatus with two concentric perforated drums. A. Wernicke, Maschinenbau A.-G. Ger. Pat. 170,297, Dec. 8, 1904.

The two concentric perforated drums of the centrifugal machine are both charged with sugar, but the liquoring agent (steam, water, or thin juice) is only admitted to the inner drum.—A. S.

Adhesive from gluten ; Process for the preparation of an ——. E. Donath. Ger. Pat. 172,610, March 8, 1905.

For the preparation of an adhesive from gluten, the latter is dried, powdered, and submitted to a preliminary treatment, in the cold, with gaseous sulphur dioxide for about 10 minutes.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 428.)

Brewing industry of India. Bd. of Trade J., April 25, 1907. [T.R.]

The quantity of beer brewed in India in 1905 amounted to 5,994,955 galls., of which 45 per cent. was bought by the Army Commissariat. There are 27 breweries, of which one at Delhi did not work. Twenty-one are private property and six are owned by five joint-stock companies with nominal capital of Rs. 24,80,000, of which Rs. 23,89,110 was paid up at the end of 1905-06. Twelve of the breweries are situated at stations in the Himalayas from Murree to Darjeeling, and much of the beer is brewed there. A large quantity is also brewed at Lucknow, Rawalpindi, Poona, Bangalore, Jubbulpore, at and near Ootacamund, and at Quetta and Mandalay. More than one-third of the whole production is brewed in the Punjab. The beer brewed in Indian breweries is sold for the most part at prices varying from 12 annas to one rupee a gallon. The quantity of beer brewed in India and imported is as follows :—

Year.		Brewed in India. galls.	Year ended 31st March.		Imported. galls.
1901	..	5,554,453	1901–02	..	3,673,852
1902	..	6,474,860	1902–03	..	3,820,938
1903	..	6,067,041	1903–04	..	4,062,016
1904	..	6,219,761	1904–05	..	4,607,530
1905	..	5,994,955	1905–06	..	5,002,448

Alcoholic fermentation ; Influence of manganese salts on ——. E. Kayser and H. Marchand. Compt. rend., 1907, **144**, 714—716.

Yeast grown for several generations in a medium containing manganese salts acquires an increased attenuating power, which it retains for some generations when used as a ferment under ordinary conditions. The quantity of alcohol formed increases in proportion to the amount of manganese to which the yeast has been habituated, the volatile acids and glycerol being diminished. The authors consider that yeasts treated in this manner can be advantageously employed for the more complete fermentation of highly saccharine grape-juice, to furnish wines better able to resist antagonistic organisms ; and that in brewing it will be possible by the same means to vary the attenuative power of the same race of yeast, according to the time of year and the class of beer to be produced. (See also this J., 1907, 427.)—C. S.

Beer wort ; Decrease of the attenuability of ——. F. Černý. Oesterr. Brauer u. Hopfenz., 1907 ; Z. ges. Brauw., 1907, **30**, 173—176.

The maximum degree of attenuation which can be attained in a beer wort by a particular yeast may be termed the "attenuability" of the wort for that yeast. A process for the reduction of attenuability, called the "spring" mashing process, was recommended by Windisch in 1904 (see this J., 1904, 198), with the object of increasing the palate-fulness of the beer. The author shows that the adoption of this process, indeed, affords a ready means for reducing the attenuability of the worts by as much as 10 per cent. This reduction results in improved quality, in most cases, of beers brewed from pale, highly diastatic malts, but in the case of dark malts of low diastatic power, the decrease of attenuability was accompanied by a serious falling-off in the quality of the beer. A modified restriction of attenuability, amounting to 3—6 per cent. as compared with the ordinary two-mash decoction process, was obtained by reserving larger proportions of mash in the decoction-copper, and increasing the temperatures in the mash tun at the various stages, as well as the rapidity with which these temperatures were attained. The author concludes, however, that the power of modifying the composition of the wort in the direction of reduced attenuability should be used with great caution, and only after full investigation to ascertain whether the result is suitable to the class of malt employed, and to the local conditions of fermentation. A simple reduction in the degree of attenuability is not in itself a guarantee of greater palate-fulness or head-retaining qualities, and may, indeed, lead to a lowering of the quality and stability of the beer.—J. F. B.

Fusel oil ; Conditions of production of ——, and their connection with the albumin synthesis of the yeast. F. Ehrlich. Ber., 1907, **40**, 1027—1047.

In a previous paper (this J., 1905, 683) it was shown that *l*-leucine and *d*-isoleucine are converted by yeast during the process of alcoholic fermentation into *i*- and *d*-amyl alcohols respectively. These and other higher alcohols are the unassimilated residues from the synthesis of albuminoids by the yeast from the amino-acids. The ammonia which constitutes the nitrogenous residue of these acids can never be detected as such in the liquids ; it must, therefore, be converted, in proportion as it is split off, into insoluble nitrogenous yeast-substance, whilst the higher alcohols are excreted in equivalent quantities. In the ordinary fermentation of pure sugar by yeast, the percentage of fusel oil, calculated on the total yield of alcohol, varies from 0·4 to 0·7 per cent. A yeast poor in nitrogen takes a longer time to ferment a given quantity of sugar, and produces a larger quantity of fusel oil than a yeast rich in nitrogen, with a higher fermentative power. When leucine is added to the sugar solution, the quantity of fusel oil produced, may rise to 3 per cent. under similar conditions. The highest proportion of fusel oil is obtained when a relatively small quantity of yeast is caused to act on a large quantity of sugar, proportions of 1 : 5 being very favourable to the production of fusel oil. On the other hand, when fermentation is effected rapidly, with a large quantity of yeast rich in zymase, the decomposition of the leucine present, is relatively small. In industrial fermentations the composition of the fusel oils varies according to the nature of the amino-acid constituents of the worts. Fusel oil is also produced from amino-acids excreted by the yeast, but this factor only comes into play to any serious extent when, in consequence of deficient nitrogenous nutrition, high temperature, or other unfavourable conditions, a partial autolysis of the older yeast cells takes place to afford nutrition to the younger ones. The highest yields of fusel oil are obtained by the fermentation of pure sugar by yeast poor in nitrogen, with or without the addition of leucine. The presence of other nitrogenous substances, as in natural worts, decreases the production of fusel oil. The production of fusel oil is decreased almost to nothing, even in presence of leucine, if a sufficient quantity of some other readily assimilable nitrogenous compound be added, especially if that compound be readily susceptible to hydrolysis. Asparagine and particularly ammonium carbonate can be used to suppress the production of the higher alcohols. The yield can be increased by the addition of crude leucine prepared by the evaporation of the products of the hydrolysis of albumin by acids, but it is decreased if these hydrolytic products be added direct without evaporation. The synthesis of albumin from its amino-acid decomposition products does not take place by simple condensation, as in Fischer's synthesis of polypeptides, but involves a complete degradation of the nitrogenous residue into ammonia, with an elimination of the non-nitrogenous portion comparatively unchanged. The "alcoholic fermentation of the amino-acids" would appear to be an important general biological phenomenon accompanying the synthesis of albumin. Its bearing on the production of odorous principles in plants is illustrated by the fact that the author has obtained *o*-hydroxyphenylethyl alcohol by fermentation in presence of tyrosine, phenylethyl alcohol similarly from phenyl-alanine, and benzyl alcohol and benzaldehyde from phenylaminoacetic acid.
—J. F. B.

Wine analysis ; Determination of sucrose, reducing sugars, and dextrin in ——. H. Pellet. Bull. Assoc. Chim. Sucr. et Dist., 1907, **24**, 1213—1215.

In the method of wine analysis adopted by the Permanent Technical Commission (France), the sample is treated with sodium bicarbonate, then with basic lead acetate solution, and filtered. The filtrate is again treated with a little sodium bicarbonate and again filtered. If this second filtrate is not sufficiently decolorised, it is treated with a little animal charcoal. The reducing sugar is then determined with Fehling's solution. The author objects to this process on the grounds that the method of clarification renders it impossible for different workers to obtain comparable results, and that basic lead acetate is an unsuitable clarifying agent for liquids containing reducing sugars. He recommends the following process :—*Reducing sugars.*—The sample (unclarified) is heated on the water-bath (see this J., 1906, 1122) with Fehling's solution (or preferably with Violette's solution), the precipitate being filtered off, washed, ignited, and weighed as cupric oxide. The amount of the sample taken for analysis should be sufficient to reduce about half the copper in the quantity of Fehling's solution employed ; the whole should be diluted with water to twice the volume of the Fehling's solution. *Sucrose.*—The sample (100 c.c.) is heated for five minutes (or longer, in the case of wines containing a considerable amount of sucrose) on a boiling water-bath, with 2·5 c.c. of 10 per cent. hydrochloric acid. The difference between the reducing sugar-contents of the sample before and after inversion, represents the amount of reducing sugar corresponding to the sucrose. *Dextrin.*—To a known volume of the sample an equal volume of 8 per cent. sulphuric acid is added, the mixture being heated on a boiling water-bath for 2—3 hours ; the flask in which the mixture is heated should be provided with a reflux tube. The reducing sugar content is then determined ; the difference between this amount and the reducing sugar content of the sample after inversion with hydrochloric acid, represents the amount of reducing sugar corresponding to the dextrin. For polarimetric examination of wine, the author recommends decolorisation of the sample with calcium or sodium hypochlorite.
—L. E.

English Patents.

Malting apparatus [stirring drum]. W. Jordan, London. From International Malt Machine Co., New York. Eng. Pat. 12,898, Sept. 4, 1906.

The apparatus consists of a number of malting floors placed side by side on the same level, each floor being provided with guide-beams at the side. A travelling carriage is mounted on these beams, the carriage carrying a hose-reel and a stirring drum, the latter being fitted with reversible buckets. The reel carries a length of hose, one end of which is in connection with the hollow shaft of the drum, and the other with a stand-pipe, so that hot or cold fluid may be applied to the malt through outlets in the shaft of the drum. The stirring buckets are automatically reversed as the carriage reaches each end of the floor, means being also provided for operating the carriage backwards and forwards. The carriage may be raised and transported from one floor to another.—W. P. S.

Yeast ; Manufacture of a food or stimulant for ——. R. Paul, Ipswich, and J. S. Remington, Grange-over-Sands, Lancs. Eng. Pat. 28,695, Dec. 15, 1906.

The process consists in heating the germ of an unmalted grain, such as wheat, barley, rye, oats, maize, rice, wild rice, buckwheat, sunflower, &c., with about three times its weight of water to a temperature of from 110° to 160° C., the operation being carried out in an autoclave. The liquid portion is then filtered off, and evaporated until its specific gravity is 35° Tw. In applying this yeast food in brewing, about 1 kilo. is added, together with every 20 kilos. of yeast, to the fermenting vat.—W. P. S.

XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 429.)

(*A.*)—FOODS.

United States Patent.

Butter-milk substitute ; Process of preparing a ——. A. Sauer, Zwingenberg, Germany. U.S. Pat. 846,697, March 12, 1907.

A mixture, consisting of 200 parts of skimmed milk and 20 parts of full milk, is pasteurised at a temperature of

176° F.; after cooling to a temperature of from 77° to 86° F., the mixture is subjected to the action of 6·6 parts of a culture of bacteria for developing lactic acid and aroma. When the acidity of the mixture reaches "3·5 to 3·6," the temperature is lowered rapidly to 57° F., and the acidification allowed to proceed.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Sewage debris in contact beds; Disposition and analysis of ——. W. J. Dibdin. Analyst, 1907, **32**, 108—115.

Analyses are given of two series of samples of the deposit on slate bacteriological beds, one from those at Devizes and the other from those at High Wycombe. The Devizes sewage is of an exceptionally foul character, whilst that of High Wycombe is probably the weakest in England. In each case, the deposits were free from offensive odour and, when "weathered," became friable and odourless. The results obtained show that it is important, in collecting a mass of the deposit, to differentiate between the respective layers of the deposit. For instance, the surface layer from Devizes contained 10·8 per cent. of nitrogen, calculated on the dry organic matter, which would indicate that the deposit was more foul than fæces, according to the limits laid down by the late Sir E. Frankland. The average amount of nitrogen for the middle and bottom layers was 5·17 per cent. Again, the ratios of nitrogen to carbon in the Devizes samples were from 1 : 3·4 to 1 : 6·4, the first ratio thus indicating a more highly nitrogenous substance than the strongest sewage. The high nitrogen values are due to the enormous numbers of living organisms of various types, including worms, &c., the nitrogen value being, therefore, unreliable when taken alone. The carbon ratios in samples of "weathered" deposit were from 8·5 to 13·0, as against Frankland's figures, 8·8 to 9·6, for unpolluted mud, showing the high degree of purification effected. The bacteriological examination of the deposits brought to light the fact that, instead of the few millions of bacteria per grm. supposed formerly to be present in sewage mud, the total number is far greater; in the Devizes deposit, the number varied from 725 millions in the surface layer to 240 millions in the bottom layer, whilst in the case of the High Wycombe deposits, the surface layer contained 160 millions, and the bottom layer 50 millions per grm.
—W. P. S.

Water; Separation of manganese from drinking ——, *by means of aluminium silicate.* R. Gans. Chem.-Zeit., 1907, **31**, 355—356.

It is found that manganese can be removed from water by filtration through a layer of granular aluminium silicate prepared by fusing clay with an alkali carbonate, and adding to the molten mass sufficient quartz to combine with almost the whole of the alkali. After extracting the mass with water, the silicate is obtained in a granular or flaky form. When foul, the filtering layer may be cleansed by washing with calcium chloride or calcium-sodium chloride solution, the active properties of the silicate being thus regenerated.—W. P. S.

English Patents.

Clinkers and other materials used for filtering sewage and other impure liquids; Apparatus for washing ——. J. Hughes, Hampton, Middlesex. Eng. Pat. 13,265, June 8, 1906.

The dirty material, such as clinkers which have been used for filtering sewage, is fed into the larger end of a horizontal drum, preferably of the form of a polygonal pyramid. The drum is rotated by suitable means and is provided with internal blades so that the material is propelled towards the smaller end of the drum, where it is discharged. During its passage through the drum, the material is washed by a stream of water introduced at the smaller end, and perforations are provided at the larger end of the drum, through which the dirty water and particles of solid matter removed from the clinker are discharged. Below the drum is situated a tank fitted with a sludge-valve and an overflow for the water.
—W. P. S.

Manufacture [Filtering material] for use in the purification of water and other liquids. F. Candy, London. Eng. Pat. 16,890, July 26, 1906.

The material is prepared by stirring pieces of moist "basalt scum" or "basaltic lava" in coal-dust or ordinary sawdust; the pieces thus coated are next heated in closed retorts to a bright red heat until gases cease to be given off, and are then suddenly cooled by the aid of a jet of water, &c. If tar, oil, or a saccharine solution be used for coating the lava, the latter must be previously washed and dried. It is preferable to employ a mineral containing not more than 10 per cent. of lime or alkalis. The product, termed "oxidium," is suitable for use in filter-beds.
—W. P. S.

Water; Apparatus for purifying ——. F. W. Dünkelberg, Wiesbaden, Germany. Eng. Pat. 18,806, Aug. 22, 1906.

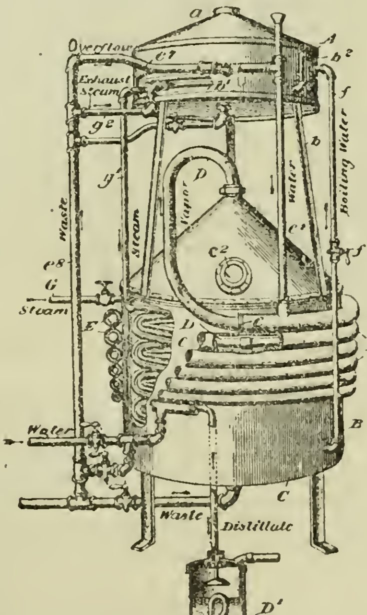
See Ger. Pat. 165,414 of 1904; this J., 1906, 492.—T. F. B.

Water-purifying apparatus. J. J. Krüger, Copenhagen. Eng. Pat. 2166, Jan. 28, 1907.

The water-measuring device, as, for instance, a tilting bowl, is mounted on an axis which is extended on either side of the water tank. The vessels containing the chemicals used for purifying the water are placed in such positions that the extended shaft passes through them, and eccentrics fitted on the shaft actuate valves, which allow definite quantities of the chemicals to flow out, the shaft itself being worked by the oscillations of the tilting bowl. The outlets of the water tank and chemical tanks discharge into a common channel. (See also Eng. Pat. 24,435 of 1905; this J., 1906, 333.)—W. P. S.

United States Patents.

Distilling [water]; Apparatus for ——. J. F. Wittemann, Brooklyn, N.Y., Assignor to Wittemann Bros., New York. U.S. Pat. 845,285, Feb. 26, 1907.



The apparatus consists of a boiler, B, an annular coil condenser, E, and a heating pan, A, arranged as shown in the figure. Cold water enters by the pipe, c^2, and passes through the annular space of the coil, E, where it serves to condense the vapour and becomes warm. From the upper end of the coil, the warm water rises by the pipe, e^4, into the heating-pan, A, which is provided with an overflow, e^7, a gauge, b^2, and a return main, f, by which boiling water flows from A to B. Steam from the pipe, G, passes through the coils, c, in the boiler, B, and then passes through the coil, b^1, in the pan, A. The exhaust steam escapes by the pipe, g^2, to the waste-pipe, e^8. The water is boiled in the pan, A, the dissolved gases escape through the opening, a, and a stream of boiling purified water, regulated by the tap, f^1, flows into the boiler, B, where it is vaporised. The vapour passes by the pipe, D, into the condenser, E, from which the condensed distillate flows into the receiver, D^1.—W. H. C.

Distilling [*water*]; *Method of* ——. J. F. Wittemann, Brooklyn, N.Y., Assignor to Wittemann Bros., New York. U.S. Pat. 845,286, Feb. 26, 1907.

The claim is for the process of continuously distilling water carried out in the apparatus described in the preceding abstract. The water, first heated by its passage through the condenser, is boiled in the vessel, A, and the dissolved gaseous impurities expelled, along with any gaseous decomposition products formed, during the boiling, from organic matter dissolved in the water. The purification may be assisted by blowing air into the water during the boiling. The boiling purified water is then distilled in the boiler, B.—W. H. C.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 430.)

Wood-pulp paper with a satin face. A. Klein. Monit. Papeterie franç.; Paper Making, 1907, 26, 180—181.

Two types of machine are employed for making machine-glazed papers, *viz.*, the Schauffelen and the Oechelhauser. In the Schauffelen machine the paper is first partially dried on one or two ordinary drying cylinders and is then transferred to the large glazing cylinder, which may be 10 ft. in diameter. The roll which presses the paper on to the polished glazing cylinder must be elastic and is preferably made of india-rubber or of metal wound round with several layers of felt. The proportion of moisture in the paper when it is pressed against the polished cylinder is of the utmost importance, and the paper must be perfectly dry when it leaves the cylinder; for this reason the pulp must not be beaten too "wet." In the Oechelhauser type of machine the paper is carried by a felt direct from the wet-press to the polished glazing cylinder without preliminary drying, and must retain sufficient moisture to enable it to adhere to the felt. In this case the evaporation to be performed by the glazing cylinder is much greater and the escaping steam "lifts" the fibres, giving the paper a spongy texture; for this reason the pulp is generally beaten "wetter" than with the other type of machine.—J. F. B.

Paper; Free acid in ——. L. Kollmann. Papier-Zeit., 1907, 32, 1100.

The author considers that the presence of free acid in paper as the result of the manufacturing operations is practically impossible, and that in the few cases where acid is found, it has been produced by secondary decomposition of chlorides by the alum in the paper, during storage. When acid is present it causes a rapid deterioration of the colour, strength, and sizing. Since the acid, when present, is nearly always hydrochloric acid, it is a mistake to digest the paper with hot water when carrying out the test. 100—200 sq. cm. of the paper are torn to shreds and treated with 75 c.c. of water at the ordinary temperature for one or two hours, with frequent stirring. Paper containing acid retains the acid very firmly against washing, and the titration must therefore be made in presence of the paper. The mixture is titrated with $N/10$ potassium hydroxide solution in presence of Congo red. A very small quantity of indicator should be used, and the neutral point should be compared with the colour of a blank experiment. Aminoazobenzene can also be used as an indicator, but methyl orange and violet are too sensitive to aluminium sulphate, which, however, has no appreciable effect on Congo red when the above quantities are employed.—J. F. B.

Pulp and paper mill effluents. II. J. H. Vogel. Papier-Zeit., 1907, 32, 961—962, 1010—1012, 1054, 1098—1099. (See also this J., 1906, 555.)

When once a mill has begun to discharge effluents, even if reasonably pure, into a stream, there is a tendency for landowners below the mill to throw the responsibility of keeping the bed of the stream clean upon the paper mill and to discontinue their previous periodical cleaning operations. As a consequence of this neglect, the mud which accumulates becomes full of living organisms, whose movements so change its consistency that it cannot be dug out with spades, and a swamp is formed. In such cases and in cases of the destruction of crops by floods the inevitable presence of paper fibres in the deposits is often sufficient to decide a case against the paper mill without further inquiry into the efficiency of the purification of the effluents. The organic matters in the effluents from sulphite wood pulp mills afford nutriment to enormous quantities of fungi; these effluents are, however, far less dangerous to health than the sewage which is frequently discharged into the rivers without hindrance. The masses of fungi serve as food for aquatic insects and animals, which in their turn provide food for fishes. In swift-running rivers the fungi are swept away and the only trouble is the fouling of fishing nets and of water which is taken for industrial uses without filtration. In small sluggish rivers the whole bed of the stream may become coated with the growth and the fish driven elsewhere; in such cases, too, sulphuretted hydrogen may be developed by putrefaction. The presence of small proportions of copper sulphate has a destructive action on fungi and incidentally also on algæ, but to be effective the copper must be added to the stream itself. This is only possible when the stream is both small and sluggish, and since these are the only conditions under which a serious nuisance is to be feared, experiments in this direction might afford relief. The author is conducting experiments on the purification of effluents from a soda wood-pulp mill by the biological process. He effects the removal of 85 per cent. of the suspended matter which remains in the liquid after mechanical purification; also a decrease of 66 per cent. in colour, and the elimination of at least 50 per cent. of the dissolved putrescible (oxidisable) matter. Three septic tanks in series, having a total capacity of 1740 cb. m. are provided for treating 576 cb. m. of effluent per day. The liquor from these goes to continuous oxidising towers of 864 cb. m. capacity, in which 1·5 cb. m. of coke is provided per 1 cb. m. of liquor. The "self-purification" of large rivers into which the sulphite wood liquors are discharged, presents no difficulties. If the liquors contain large proportions of free sulphurous acid, the immediate neighbourhood of the discharge is fatal to fish. In the swift-flowing Maine, the growth of fungi was observed to extend only 300 m. down the stream; in sluggish rivers, like the Spree, the aquatic animals have an equivalent effect. In small streams the rate of the discharge must be regulated to suit the volume and velocity of the water and, of course, in all cases a preliminary removal of suspended fibres is essential.—J. F. B.

Cellobiose; Acetyl derivatives of ——. E. R. v. Hardt-Stremayr. Monatsh. Chem., 1907, 28, 63—72.

Skraup and König (this J., 1901, 740; 1902, 144) obtained from cellulose, by heating it with acetic anhydride and concentrated sulphuric acid, a crystalline acetyl compound, melting at 227°—228° C., which on saponification yielded a biose, cellobiose. By the action of hydrochloric acid on the acetyl compound, an acetochloro-compound was produced, from which, on replacing the chlorine by acetyl, a new acetyl compound was obtained of m. pt. 200° C., isomeric with the compound mentioned above. Geinsperger (Monatsh. Chem., 1905, 1459), who prepared the acetochloro-compound directly from cellulose, was unable to obtain a biose from the acetyl compound of m. pt. 200° C. Subsequently, Maquenne and Goodwin (Bull. Soc. Chim., 1904, 31, 854) obtained an acetyl compound melting at 196° C. by heating cellobiose with sodium acetate. This compound was easily saponified, with reproduction of the biose, and on warming with concentrated sulphuric acid was converted instantaneously into the acetyl compound melting at 228° C. The author has repeated some of the experiments mentioned, and finds that Geinsperger's acetate (m. pt. 200° C.) and Maquenne and Goodwin's acetate (m. pt. 196° C.) are identical. The true melting point is 198° C., and the compound is easily saponified, with formation of cellobiose. Attempts to convert the acetate melting at 228° C. directly into its isomeride melting at 198° C. proved unsuccessful. —A. S.

Oxycelluloses ; Acetylation of some ——. E. R. v. Hardt-Stremayr. Monatsh. Chem., 1907, **28**, 73—78.

By treating different oxycelluloses, prepared by the action of oxidising agents on wood, cotton, paper, &c., with acetic anhydride and sulphuric acid, according to the method of Skraup and König (this J., 1901, 740), the author obtained the same cellobioseoctoacetate (m. pt. 228° C.) as is produced by the acetylation of cellulose (see preceding abstract). The yields of acetyl compound from the different oxycelluloses varies, however. Pure cellulose yields about 25 per cent. of acetyl compound, as also does hydralcellulose (this J., 1899, 940). The oxycelluloses prepared by the action of nitric acid and of potassium chlorate and hydrochloric acid respectively on cellulose (this J., 1899, 1014 ; 1901, 739), yielded 16 per cent. and 10 per cent. of acetyl compound. Acid cellulose (this J., 1899, 940) yielded only 7 per cent. of acetyl compound. The author concludes that oxycelluloses contain cellobiose groups, but in less quantity than ordinary cellulose.—A. S.

English Patent.

Loading or filling substances for use in the manufacture of paper. A. Monin, Lent, France. Eng. Pat. 14,177, June 20, 1906.

See Fr. Pat. 366,112 of 1906 ; this J., 1906, 1064.—T. F. B.

United States Patent.

Pulp ; Production of white [*paper*] ——. A. Gagedois, Don, France. U.S. Pat. 848,361, March 26, 1907.

See Fr. Pat. 360,158 of 1905 ; this J., 1906, 441.—T. F. B.

French Patents.

Nitrocellulose solutions ; Recovery of volatile solvents contained in products (*artificial silk, &c.*) *prepared from* ——. Soc. pour la Fabr. en Italie de la Soie Artif. par le Proc. de Chardonnet. Fr. Pat. 371,985, Feb. 6, 1906. V., page 468.

Fibres, artificial ; Process for the manufacture of —— *from nitrated cellulose.* Kunstfäden Ges.m.b.H. Fr. Pat. 371,544, Nov. 16, 1906. V., page 468.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 434.)

Ergot ; Alkaloids of ——. G. Barger and F. H. Carr. Chem. Soc. Trans., 1907, **91**, 337—353.

The authors abandon the formula previously given for Tanret's crystalline ergotinine (this J., 1906, 906), and now suggest the formula, $C_{35}H_{39}O_5N_5$. The amorphous alkaloid, ergotoxine, $C_{35}H_{41}O_6N_5$, is identical with Kraft's hydroergotinine (Arch. Pharm., 1906, **244**, 336), and the authors confirm Kraft's statement that ergotinine is the anhydride of ergotoxine (hydroergotinine). Ergotoxine, which is strongly active physiologically, is contained in most commercial specimens of ergotinine and also in Tanret's so-called "amorphous ergotinine." Ergotinine crystallises in long needles, which when placed in a bath at 210° C. and heated further, sinter, darken, and melt at temperatures up to 229° C. (corr.). At 18° C. it is soluble in 292 parts of alcohol, 1020 parts of absolute ether, 91 parts of ethyl acetate, or 26 parts of acetone ; it is also dissolved by 77 parts of boiling benzene, 52 parts of boiling ethyl alcohol, or 56 parts of boiling methyl alcohol, and is very soluble in chloroform, moderately so in amyl alcohol, methylal, and xylene, and insoluble in light petroleum. Ergotoxine is a light white powder, which begins to soften at about 155° C., and melts gradually at 162—164° C. It is more soluble in organic solvents than ergotinine, notably so in cold alcohol. It is but slightly soluble in ether. On attempting to acetylate ergotoxine with acetic anhydride, a molecule of water is split off, and ergotinine is produced. The reverse change is produced when a solution of ergotinine in dilute phosphoric acid is boiled, ergotoxine phosphate being formed. Towards most alkaloidal reagents, ergotinine is less sensitive than ergotoxine.—A. S.

Rhubarb ; Determination of the value of —— [*by means of diazotised paranitraniline solution*]. A. Tschirch and J. Edner. Arch. Pharm., 1907, **245**, 150—153.

Since the active principles of rhubarb are hydroxymethylanthraquinones of a phenolic character, these may be precipitated quantitatively by means of diazotised paranitraniline solution. The reagent is thus prepared: Five grms. of paranitraniline are treated with 25 c.c. of water and 6 c.c. of strong sulphuric acid ; after agitation, another 100 c.c. of water and a solution of 3 grms. of sodium nitrite in 25 c.c. of water, are added ; the whole is then made up to 500 c.c. with water. The reagent should be protected from the light. From 0·5 to 1·0 grm. of powdered rhubarb is boiled with successive quantities of dilute alcoholic potassium hydroxide solution until thoroughly extracted. The bulked filtered solutions are then distilled, and the alcohol-free residue diluted with water ; the solution is then acidified with hydrochloric acid, and the precipitate formed on standing is collected, washed with acidified water, and dried. The dry filter and precipitate are then extracted with boiling chloroform for several hours in a Soxhlet's apparatus ; this removes only the hydroxymethylanthraquinones, leaving rheotannic acid insoluble. The chloroform is distilled off, and the residue dissolved by heating with 10 c.c. of 5 per cent. sodium hydroxide solution and diluted with 50 c.c. of water. Twenty c.c. of diazotised paranitraniline solution are then added, and hydrochloric acid, drop by drop, with thorough agitation, until the colour of the solution is discharged and an acid reaction obtained. After standing for a few hours, the precipitate formed is collected on a tared filter, washed free from acid, dried at 70° C., and weighed. The weight of hydroxymethylanthraquinones obtained is conveniently expressed in terms of chrysophanol (chrysophanic acid), the molecular weight of the chrysophanol azo-compound being 447 and of that body itself 254 ; the ratio being therefore, in round numbers, 4·5 : 2·5. The reaction may be expressed by the following equation, taking chrysophanol as the example—

$$C_6H_4(NO_2)N : NCl + C_{15}H_8O_2(OH)_2 + 3NaOH =$$
$$[C_6H_4(NO_2)N : N.C_{15}H_7O_2(ONa)_2] + NaCl + 3H_2O.$$

The following are the mean percentages of chrysophanol found by this method in different kinds of commercial rhubarb :—Shensi, 3·2 ; Canton, No. 2, 2·67 ; Canton, round, 4·24 ; Canton, flat, 3·35 ; Shanghai, flat, 2·7 ; Shanghai, 4·14 ; English, 2·07 ; French, 1·58. By the colorimetric method, Austrian rhubarb gave 1·6 per cent. and Swiss rhapontic rhubarb 1·2 per cent. of chrysophanol. Experiments with known quantities of emodin have shown that the method gives accurate results.—J. O. B.

Alkaloidal drugs, extracts, and tinctures [*Nux vomica, hydrastis, and jaborandi*] *: Application of dinitrophenylmethylpyrazolone* [*picrolonic acid*] *to the determination of the value of* ——. H. Matthes and O. Rammstedt. Arch. Pharm., 1907, **245**, 112—132.

Since strychnine, brucine, hydrastine, and pilocarpine are quantitatively precipitated by picrolonic acid, a *N*/10 solution thereof is recommended for the alkaloidal valuation of nux vomica, hydrastis, jaborandi, and their galenical preparations.

Nux vomica extract.—1 grm. is dissolved in 5 grms. of absolute alcohol and 5 c.c. of water ; the solution is well shaken with 50 grms. of ether and 25 grms. of chloroform; 10 c.c. of sodium carbonate solution (1 : 2) are then added, and the whole is shaken up for ten minutes. After standing for twenty minutes, 50 grms. of the ether-chloroform solution (=0·66 grm. of original extract) are filtered through a double filter paper; the filtrate is evaporated to one-half, and 5 c.c. of *N*/10 alcoholic solution of picrolonic acid are added to the warm liquid, which is then set aside in a cool place for twenty-four hours. The precipitated strychnine-brucine picrolonate is collected on a tared Gooch crucible, washed with 2 c.c. of ether-alcohol (ether, 3 c.c.; alcohol, 1 c.c.), dried for thirty minutes at 110° C., and weighed. The mean molecular weight of brucine-strychnine being 364·32 and that of the brucine-strychnine picrolonate 628·32, the weight of the latter obtained × 0·5798 gives the equivalent of the mixed bases.

Nux vomica tincture.—An approximate and rapid determination of the amount of alkaloids may be made by the direct addition of the picrolonic acid reagent to the tincture, previously diluted with an equal volume of water; the mixture is heated for thirty minutes on the water-bath, and then treated as above. The exact determination is made by evaporating 50 grms. of the tincture to 10 grms.: adding to the residue 5 grms. of absolute alcohol, 50 grms. of ether, and 20 grms. of chloroform, and proceeding as in the case of the extract, the 50 grms. of ether-chloroform filtered off representing 33·3 grms. of the original tincture.

Nux vomica powder.— Fifteen grms. of powdered nux vomica, dried at 100° C. are treated with 100 grms. of ether and 50 grms. of chloroform; after well shaking, 10 c.c. of a mixture of 2 parts of 15 per cent. sodium hydroxide solution and 1 part of water are added, and the whole is well shaken for 10 mins. Then 15 c.c. of water or a sufficient quantity to cause the drug to aggregate when shaken, are added and the whole set aside until the ether-chloroform separates as a clear liquid; after twenty or thirty minutes 50 grms. of the solution are filtered off (=5 grms. of the original powder), evaporated to one-half, to which 5 c.c. of the *N*/10 picrolonic acid solution is added; the process is then completed as described under the extract.

Liquid extract of hydrastis.—Fifteen grms. of the liquid extract are evaporated to 5 grms., and the residue is dissolved in 10 c.c. of water; 10 grms. of light petroleum spirit, 50 grms of ether, and 5 grms. of solution of ammonia are added, the whole being thoroughly shaken up for ten minutes. After standing for twenty minutes, 40 grms. of the ethereal solution (=10 grms. of the original extract) are filtered off, evaporated to one-half, and treated with 10 c.c. of *N*/10 picrolonic acid solution. The process is then continued as described under extract of nux vomica. The molecular weight of hydrastine picrolonate is 647. The amount of hydrastine found in eighteen specimens of the fluid extract ranged from 2·0564 to 2·3625 per cent.

Tincture of hydrastis.—Fifty grms. of tincture are evaporated to 10 grms., then treated as described for the fluid extract; 40 grms. of the ethereal solution (=33·3 grms. of original tincture) being filtered off and treated with 5 c.c. of *N*/10 picrolonic acid solution. The percentage of hydrastine in six specimens of tincture ranged from 0·1671 to 0·1734 per cent.

Hydrastis rhizome.—Six grms. of powdered hydrastis are macerated for thirty minutes with thorough shaking, in a mixture of ether, 50 grms.; light petroleum spirit, 10 grms.; and solution of ammonia, 6 grms; 6 c.c. of water are added, and the whole is shaken up until the drug aggregates, leaving the supernatant liquid clear. Fifty grms. of this (=5 grms. of drug) are quickly filtered off, then treated as described under the fluid extract, using 5 c.c. of *N*/10 picrolonic acid to precipitate the base. The percentage yield of hydrastine in ten samples of the rhizome ranged from 2·2410 to 2·424.

Jaborandi leaves.—Fifteen grms. of the moderately finely powdered drug are macerated for thirty minutes in a mixture of chloroform, 150 grms., and solution of ammonia, 10 grms; 100 grms. of the chloroform solution (=10 grms. of drug) are then filtered off, and evaporated to about 20 c.c.; 3 c.c. of *N*/10 picrolonic acid solution and 60 c.c. of ether are next added, the mixture is set aside for twenty-four hours, and the precipitated pilocarpine picrolonate collected and treated as described above. Its molecular weight is 472, and its m. pt. 200°—205° C. with decomposition. Six samples of jaborandi leaves gave from 0·2688 to 0·2931 per cent. of pilocarpine by this method.—J. O. B.

Kola seeds; Preservation of ——. A. Goris and L. Arnould. Bull. des Sci. Pharm., **14**, 159. Pharm J., 1907, 527.

THE therapeutical value of fresh kola seeds is well known to be far superior to that of the dried seeds. The difficulty of procuring the fresh seeds and the facility with which their active constituents are changed by an oxydase contained in the seeds, have, up to the present, stood in the way of their employment. Bourquelot has proposed to extract the fresh seeds by boiling them with 95 per cent. alcohol, by which the oxydase (koloxydase) is destroyed and a tincture free from it obtained. It does not, however, permit of the preparation of a powdered kola suitable for use in pharmacy. The method now proposed of effecting this is by sterilising the seeds as follows:—The fresh seeds, entire or separated into their cotyledons, are spread in thin layers on wire baskets; these are introduced into an autoclave previously heated to 100° C.; the temperature is then raised to 105°—110° for five to ten minutes, after which the seeds are taken out, cut into small pieces, and dried either by exposure to the air or in a drying cupboard. White seeds remain white with the exception of a slight pink tinge on the surface, but red seeds turn violet. It is essential that the temperature of the seeds be rapidly raised from 15° to 100°. The powder thus obtained gave an excellent yield of kolatin.

Odorous compounds; Migration of —— in plants. E. Charabot and G. Laloue. Compt. rend., 1907, **144**, 808—810.

IN *Verbena triphylla*, at the time of inflorescence, the leaves are richer in essential oil than are the flowers, and the proportion in the stems is very small (respectively 0·195, 0·132, and 0·007 per cent. of the weight of the fresh organs, or 0·579, 0·544, 0·015 of the dry material). After formation of the fruit, the proportion in the leaves and flowers, especially the latter, has diminished, and that in the stems has increased (figures, calculated on the dry plants, 0·486, 0·239, 0·029). The total amount in the whole plant has lessened during fecundation. The authors' views are confirmed by this investigation, that the stems form only a kind of canal, connecting the leaves, where the essential oil is produced, with the flowers, where it is consumed.—J. T. D.

Manila elemi; The terpene oils of ——. A. M. Clover. Philipp. J. Sci., 1907, **2**, 1—40.

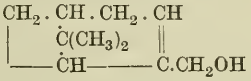
THE resin, Manila elemi, examined by the author was collected from the tree *Canarium luzonicum.* This is widely distributed in the Philippines, and is known to the natives as *pili.* The resins obtained were collected from twenty-one different trees of this species and examined separately. The work was confined to the volatile portions of the resin, obtained by distillation, for the most part in a vacuum. The oil was separated into two fractions, a low-boiling portion containing terpenes, and a high-boiling one containing oxygenated substances. The author isolated in a pure condition *d*-limonene, *d*-phellandrene, terpinene, and terpinolene. The high-boiling portion is a mixture of at least three different substances, but those obtained from different samples varied in their composition. At a pressure of 10—15 mm. most of the heavy oil passes over below 230° C., a temperature not high enough to bring about changes in the oils themselves. The terpene oil from one sample had a practically constant boiling point lying between those of phellandrene and limonene. After standing over potassium hydroxide and redistilling, the oil was identified as terpinolene with the following constants:—B. pt., 173·5°—175° C.; sp. gr., 30°/4° C., 0·8360; $[\alpha]_D$ at 30° C. = +1·7°; n_D at 30° C. = 1·4701. The recrystallised tetrabromide obtained, melted at 116° C. with decomposition. On standing, the optical rotation of the terpinolene changed continuously, until after several weeks, there was obtained, on distilling with steam, an oil having a rotation $[\alpha]_D$ at 30° C.

$= -38°$. This change was due to the conversion of the terpinolene into dipentene, a small amount of *d*-phellandrene, and an unknown lævo-rotatory terpene. A table is given showing the agreement in the physical constants of samples of pure limonene isolated from different specimens of elemi. Limonene is unchanged by heating to 220° C. for several hours, nor is it greatly changed by being heated to over 200° C. with water, benzoic acid, acetone, or aniline. Limonene is almost completely polymerised by heating with dilute sulphuric acid in acetic acid. Sulphuric acid in absolute alcohol converts it into inactive terpenes with a higher boiling point. If the alcohol contains water, hydration takes place. The hydrochloric acid addition product boils at 89°—91° C. at 12 mm. If the hydrochloric acid be split off, the limonene is partly converted into dipentene. Whenever phellandrene was found in these oils, it was proved to be the α-modification by means of the α-nitrite. When α-phellandrene α-nitrite was crystallised from hot ethyl acetate, it melted at 113°—115° C., but when dissolved in ethyl acetate at 30° C. and re-precipitated by a freezing mixture, it melted at 120°—121° C. The change observed in the rotation of solutions of the α-nitrite is not due to the change of the dextro- into the lævo-α-nitrite. When phellandrene is heated above 200° C. for several hours, it becomes converted into an isomeride with a lævo-rotation. The rotation of phellandrene slowly diminishes even on standing. Phellandrene hydrochloride is more or less decomposed on distillation at reduced pressure. The dibromide could not be obtained in a crystalline form. When phellandrene is allowed to stand, a crystalline oxidation product is formed, probably dihydroxyphellandrene, $C_{10}H_{18}O_2$. On crystallising from ethyl acetate, it forms large, colourless hexagonal prisms, melting at 164·5°—165·5° C. A table of the physical constants of different samples of phellandrene is given. One oil gave inactive terpinene boiling at 174°—175·5° C., without evidence of the presence of any other terpene. Of the twenty-one samples of oil examined, ten gave pure *d*-limonene. Nine of the remaining oils contained phellandrene. The variation in the rotation of these oils containing phellandrene was due to the presence of small amounts of *l*-limonene. When the presence of *l*-limonene is suspected, it can be confirmed by the addition of a small amount of *d*-limonene and the subsequent isolation of dipentene tetrabromide. In the high-boiling oil from one sample, the presence of a sesquiterpene alcohol was indicated, whilst another afforded evidence of the presence of a di-oxygen terpene derivative. Amyrin in a pure condition was not isolated from any of the oils.

—F. Shdn.

Myrtenol, a primary alcohol, $C_{10}H_{16}O$, from the essential oil of Myrtus communis L. F. W. Semmler and K. Bartelt. Ber., 1907, **40**, 1363—1377.

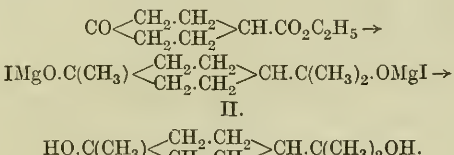
The essential oil of myrtle (*Myrtus communis* L.) contains in the high-boiling portion the ester of an alcohol, $C_{10}H_{16}O$, which is called myrtenol. This is a bicyclic primary alcohol, with one double linking in the molecule; the arrangement of the carbon atoms is the same as in pinene. The high-boiling portion of the oil of myrtle was treated with potassium hydroxide, and the alcohol separated by means of the phthalic acid ester (m. pt. 114°—115° C.). Myrtenol boils at 102·5° C. at 9 mm., at 222°—224° C. (corr.) at ordinary pressure, has sp. gr. 0·9763 at 20° C.; $n_D = 1·49668$; and α_D (in 100 mm. tube) $=$ 45° 45′. Myrtenyl chloride, $C_{10}H_{15}Cl$, was formed by the action of phosphorus pentachloride on myrtenol. It boils at 90° C. at 12 mm. and has sp. gr. 1·015 at 20° C. On reduction with sodium and alcohol, *d*-pinene is formed. This was identified by means of its physical constants, the *bis*-nitrosochloride (m. pt. 114° C.), and the nitrolbenzylamine (m. pt. 123° C.). On oxidation with chromic acid, myrtenol yields an aldehyde, myrtenal, $C_{10}H_{14}O$, the semicarbazone of which melts at about 230° C. Myrtenal boils at 87°—90° C. at 10 mm.; has sp. gr. 0·9876 at 20° C.; and $n_D = 1·50420$. It forms an oxime melting at 71°—72° C. and a nitrile boiling at 100°—102° C. at 10 mm., and with sp. gr. 0·967 at 20° C. On hydrolysing the nitrile, myrtenic acid, $C_{10}H_{14}O_2$, is formed, boiling at 148° C. at 9 mm., and melting at 54° C. when crystallised from water. When it is reduced with sodium and amyl alcohol, dihydromyrtenic acid, $C_{10}H_{16}O_2$, is formed, boiling at 142°—144° C. at 8 mm. When myrtenol is oxidised with alkaline permanganate, *d*-pinic acid, $C_9H_{14}O_4$, is formed. This boils at 212°—216° C. at 10 mm., and the methyl and ethyl esters are dextro-rotatory. The constants of this acid and its esters agreed with those of pinic acid prepared from pinonic acid. Oil of myrtle contains in its high-boiling fraction small quantities of other constituents besides myrtenol. The following formula is assigned to myrtenol:—



—F. Shdn.

Terpenes; Synthesis of the ——. I. Direct synthesis of terpin from ethylcyclohexanone-4-carboxylate. F. W. Kay and W. H. Perkin, jun. Chem. Soc. Trans., 1907, **91**, 372—373.

In the method previously described (Chem. Soc. Trans., 1904, **85**, 658) for the synthesis of terpin from ethylcyclohexanone-4-carboxylate, the latter is converted successively into 1.1-methylcyclohexanol-4-carboxylic acid, 1-bromo-1-methylcyclohexane-4-carboxylic acid, 1-methyl-Δ^1-cyclohexene-4-carboxylic acid, terpineol, and terpin. It is now found that in the first stage of this process, in which ethylcyclohexanone-4-carboxylate is treated with magnesium-methyl iodide, a considerable quantity of terpin is produced directly, and remains in the aqueous solution, when the reaction product is treated with hydrochloric acid, and the ethereal solution removed. For the preparation of terpin (II.) by this method, 50 grms. of ethylcyclohexanone-4-carboxylate (I.) are treated with magnesium-methyl iodide (containing 12 grms. of magnesium) in the usual manner (*loc. cit.*), and after decomposing the reaction-product with hydrochloric acid, the ethereal layer is removed, and the aqueous solution is saturated with ammonium sulphate, and extracted repeatedly with large quantities of ether. *Bis*-terpin hydrate gradually crystallises from the evaporation residue of the ethereal extract, and is purified by boiling with water and animal charcoal; yield, 7 grms. The mechanism of the reaction is as follows:—



I.

$$CO{<}^{CH_2.CH_2}_{CH_2.CH_2}{>}CH.CO_2C_2H_5 \rightarrow$$

$$IMgO.C(CH_3){<}^{CH_2.CH_2}_{CH_2.CH_2}{>}CH.C(CH_3)_2.OMgI \rightarrow$$

II.

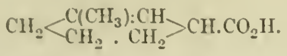
$$HO.C(CH_3){<}^{CH_2.CH_2}_{CH_2.CH_2}{>}CH.C(CH_3)_2OH.$$

—A. S.

Terpenes; Synthesis of the ——. X. Synthesis of carvestrene and its derivatives. W. H. Perkin, jun., and G. Tattersall. Chem. Soc. Trans., 1907, **91**, 480—504.

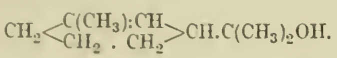
Starting from *m*-hydroxybenzoic acid, the authors have succeeded in effecting the synthesis of carvestrene, which occupies the same position in the *m*-cymene group of terpenes as dipentene does in the *p*-cymene series. On reduction with sodium and alcohol, *m*-hydroxybenzoic acid yields cyclohexanol-3-carboxylic acid, and the latter on oxidation with chromic acid mixture is converted into cyclohexanone-3-carboxylic acid. The latter was obtained in the form of small glistening prisms, melting at 75°—76° C., very soluble in water, alcohol, and benzene, but sparingly soluble in light petroleum. The ethyl ester of cyclohexanone-3-carboxylic acid was treated with magnesium-methyl iodide in the usual manner, and the product submitted to hydrolysis, whereby methylcyclohexanol-3-carboxylic acid was obtained, together with a considerable quantity of a neutral oil (A). The former was distilled under reduced pressure, water being eliminated, with production of the lactone of *cis*-1-methyl-1-cyclohexanol-3-carboxylic acid. The latter was converted, by treatment with hydrobromic acid, into *cis*-1-

bromo-1-methylcyclohexane-3-carboxylic acid, and this, by digestion with pyridine, into 1-methyl-Δ^1-cyclohexene-3-carboxylic acid (b. pt. 142° C. at 20 mm.)—



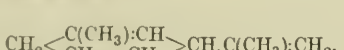
$$\mathrm{CH_2}{<}\begin{matrix}\mathrm{C(CH_3){:}CH}\\ \mathrm{CH_2\,.\,CH_2}\end{matrix}{>}\mathrm{CH.CO_2H.}$$

The ethyl ester of this acid on treatment with magnesium-methyl iodide is converted into dihydrocarvestrenol or Δ^1-*m*-menthenol—



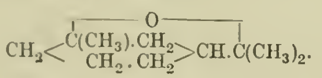
$$\mathrm{CH_2}{<}\begin{matrix}\mathrm{C(CH_3){:}CH}\\ \mathrm{CH_2\,.\,CH_2}\end{matrix}{>}\mathrm{CH.C(CH_3)_2OH.}$$

Dihydrocarvestrenol is the alcohol in the *m*-cymene series corresponding to terpineol. It is colourless syrup boiling at 105°—108° C. (30 mm.), and has a powerful odour of menthol and terpineol. On digestion with potassium hydrogen sulphate, it is converted into the corresponding hydrocarbon, which is identical with the carvestrene of Baeyer. This synthesis proves the correctness of Baeyer's formula for carvestrene—



$$\mathrm{CH_2}{<}\begin{matrix}\mathrm{C(CH_3){:}CH}\\ \mathrm{CH_2\,.\,CH_2}\end{matrix}{>}\mathrm{CH.C(CH_3){:}CH_2.}$$

Carvestrene boils at 178—179° C. (750 mm.). It has a pungent odour of lemons. It oxidises in the air, but not so readily as dipentene does. On adding a drop of sulphuric acid to its solution in acetic anhydride, a deep methylene-blue coloration is produced. The neutral oil (A) mentioned above was found to contain dihydrocarvestrenol, *trans*-tetrahydrocarvestrenediol, and the anhydride of tetrahydrocarvestrenediol—



$$\mathrm{CH_2}{<}\begin{matrix}\overbrace{\mathrm{C(CH_3).CH_2}\qquad\qquad}^{\mathrm{O}}\\ \mathrm{CH_2\,.\,CH_2}\end{matrix}{>}\mathrm{CH.C(CH_3)_2.}$$

The last-named compound, which the authors name *m*-cineol, corresponds in the *m*-cymene series with cineol in the *p*-cymene series. It has a pungent odour of camphor, and has properties resembling those of cineol.
—A. S.

Acetanilide and phenacetin in pharmaceutical preparations; Determination of ——. J. L. Turner and C. E. Vanderkleed. Amer. J. of Pharm., April, 1907. Pharm. J., 1907, 521.

No reliable method has been so far known for the determination of acetanilide and phenacetin in complex mixtures. The following method, however, is said to give good results. It is based on the saponification of acetanilide by an alkali, distillation of acetic acid from the resulting acetate by means of a phosphoric acid solution, and titration of the distillate. It is carried out as follows: One grm. of acetanilide is saponified by heating to boiling under a reflux condenser, for one and a half to two hours, with 3 grms. of sodium hydroxide, 20 mgrms. of alcohol, and 10 mgrms. of water. The solution is transferred to an evaporating dish, and the alcohol driven off on the water-bath. The residue is transferred to a separator and shaken out once with ether in order to remove the aniline separated from the acetanilide. The ethereal solution is shaken out twice with water to remove traces of sodium acetate, which is somewhat soluble in ether, and the washings added to the original aqueous residue. The aqueous solution is then transferred to a flask of 1 litre capacity, acidified with about 25 mgrms. of 85 per cent. phosphoric acid, and the acetic acid completely distilled off with steam, this being shown when no further reaction is given with litmus. The distillate is then titrated with *N*/1 sodium hydroxide, with the addition of 1 mgrm. of 1 per cent. solution of phenolphthalein. One mgrm. of *N*/1 sodium hydroxide = 0·13409 grm. of acetanilide. Phenacetin being closely allied to acetanilide, is determined in exactly the same way, 1 mgrm. of *N*/1 sodium hydroxide being equivalent to 0·17779 grm. of phenacetin. The two substances, however, cannot be determined when present in the same preparation. Acetates, nitrates, and nitrites interfere with the method. These salts are removed by means of chloroform extraction; but when they are present in the phosphoric acid, or in the alkali used for saponification, they must first be removed. Chlorides do not interfere, but if carbonate be present in the alkali used for saponification, the carbon dioxide formed on the addition of phosphoric acid would be distilled over with the acetic acid and vitiate the result of titration; it is therefore advisable to heat the acidified solution to boiling under a reflux condenser, before distillation, in order to drive off the carbon dioxide.

Hydroxyaldehydes; Method for obtaining aromatic ——. P. Chuit. Bull. Soc. Ind. Mulhouse, 1907, **77**, 72—74.

In order to avoid the low yield due to the action of the hot alkalis on the aldehydes formed in carrying out Reimer's method of preparation (action of alkalis on phenol and chloroform), the author operates in the cold and in aqueous solution, effecting an intimate mixing of the reacting substances by energetic and continuous agitation. Thus from guaiacol, 20 per cent. of its weight of vanillin was obtained and only traces of *m*-methoxysalicylic aldehyde were formed. In a report on this process, J. Demant states that he carried out two experiments on guaiacol. The one was performed as described by Tiemann (Ber., 1881, **14**, 2021), and after five to six hours' heating, 33·7 per cent. of aldehyde was obtained and 47·5 per cent. of guaiacol regained. A second experiment carried out in the cold with violent agitation for 168 hours furnished 22·5 per cent. of aldehyde and 50 per cent. of guaiacol. The conclusion is drawn, therefore, that the foregoing process gives no improvement in yield.—J. C. C.

Catechol; Iodo derivatives of the methyl ethers of ——. E. Tassilly and J. Leroide. Compt. rend., 1907, **144**, 757—759. (See Fr. Pat. 371,982, Feb. 6, 1906; this J., 1907, 434.)

Acetyl-guaiacol is treated with iodine and mercuric oxide in carbon bisulphide, a dehydrating agent such as acetic anhydride being present at the same time. After washing with water, and evaporating, acetyl-iodo-guaiacol, $C_6H_3(OCO.CH_3)(OCH_3)I[1:2:4]$, is obtained. This, after crystallising from alcohol, melts at 74° C. Benzoyl-iodo-guaiacol melts at 80°—81° C. Iodoguaiacol is obtained by treating either of these substances with potassium hydroxide and then with acids. This crystallises from dilute alcohol in colourless crystals, melting at 87°—88° C. On methylation, iodoveratrol, $C_6H_3(OCH_3)_2I$, is obtained, which melts at 34°—35° C. Iodoguaiacol is soluble in most organic solvents and slightly soluble in water. Iodine is set free when the substance is treated with nitric or sulphuric acid. On attempting to remove the methyl group, the iodine was displaced, and catechol resulted. The sodium salt of iodoguaiacol forms fine silky needles which are not stable.—F. Shdn.

Ether vapour and air; Limit of inflammability of mixtures of ——. J. Meunier. Compt. rend., 1907, **144**, 796—798.

Into a tube holding 250 c.c. and having an orifice which can be closed by the thumb, a little mercury is placed as an agitator, and a drop of ether introduced. After shaking the mixture is tested by a light. The air is renewed, two drops of ether are introduced, and the observation repeated, and so on. The author found that each drop weighed 11 mgrms., and the result showed that no explosion occurred with less than about 75 or more than 200 mgrms. of ether per litre of air (98 mgrms. are required for complete combustion). To ascertain, then, the proportion of ether in a sample of air contaminated with it, the author proposes to measure in this manner the proportion of ether, or the amount of dilution with air, which is required to bring it to the limit of inflammability.—J. T. D.

Thorium ; New intermediate [radioactive] product from ——. O. Hahn. Ber., 1907, **40**, 1462—1469.

From the examination of a number of thorium preparations of various ages, and comparison with thorium minerals, the author concludes that radiothorium is not a direct product of disintegration of the thorium atom, but arises from an intermediate substance formed in the first place from thorium. This intermediate substance appears to have a longer life (and is consequently formed more slowly) than radiothorium, and emits no *a*-particles. In thorium minerals or very old thorium preparations, the rate of decay of activity is regular, a state of equilibrium between the production of the new substance from thorium and its disintegration into radiothorium having been reached. In freshly obtained thorium preparations, however, the new substance is eliminated in the process of preparation, and the radiothorium retained ; hence the activity, normal at first, decreases abnormally rapidly, for the decay of the radiothorium is not balanced by its production from the intermediate substance, the rate of formation of which is relatively slow. As the new substance is formed, however, and begins to disintegrate, the abnormal rapidity of falling off of activity gradually lessens (indeed, the activity may for a time actually increase), till ultimately the normal state of things is reached.—J. T. D.

Russian tartaric acid. Chem. and Drug., April 27, 1907. [T.R.]

The manufacture of tartaric acid in Russia is encouraged by the large quantity of raw material obtained from the extensive vineyards in South Russia and the Caucasus. Again, the great appreciation in the price of citric acid has stimulated the tartaric acid industry so far that the makers have determined to establish new factories in the Caucasus in order to produce 10,000 poods per annum in place of the present 500 poods. And in Odessa, where most of the Russian tartaric acid is produced, makers have determined to extend their plants so as to deal with all the crude tartar of the wine-industries of Southern Russia, including the Crimea. The present production in Odessa is about 25,000 poods per annum, and is mostly in the hands of Messrs. Levin and Schestopal. They produce mostly for home consumption, the surplus going to Siberia and the Far East.

Organic acids ; Volumetric determination of combined ——. R. Duchemin and G. Criquebeuf. XXIII., page 491.

English Patents.

Sulphonic chlorides, sulphonic bromides, and sulphonic amides and their derivatives ; Manufacture of ——. C. Dreyfus, and the Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 13,056, June 5, 1906.

Sulphonic chlorides or bromides can be produced by treating sulphinic acids or their salts with a hypochlorite or a hypobromite in the absence of ammonia. If ammonia is present, the sulphonic amides are produced. This method can be applied to imino compounds of the type of saccharin.—F. Shdn.

Animal serum ; Method of obtaining ——. R. Deutschmann, Hamburg. Eng. Pat. 17,825, Aug. 8, 1906.

Animals are subjected to treatment with ordinary yeast, administered along with the ordinary food. The serum subsequently extracted is of a general non-specific nature by reason of the blood of the animal having been saturated with bactericidal, but non-specific preventative substances. If at the same time the animal is infected with suitable pathogenous substances, a serum with the desired curative properties can be obtained.—F. Shdn.

Aminoacid alcohols and their derivatives ; Process for the preparation of ——. Soc. Anon. des Etabl. Poulenc Frères, and E. Fourneau, Paris. Eng. Pat. 2586, Feb. 1, 1907. Under Int. Conv., Feb. 1, 1906.

See Fr. Pat. 371,808 of 1906 ; this J., 1907, 434.—T. F. B.

United States Patent.

Fatty acids ; Bromine derivative of ——. E. Fischer, Berlin, Assignor to Farbenfabr. vorm. F. Bayer und Co,. Elberfeld, Germany. U.S. Pat. 848,230, March 26, 1907.

See Addition of June 21, 1906, to Fr. Pat. 362,370 of 1906 ; this J., 1906, 1173.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 435.)

Photographic plates ; Action of light on ——. P. H. Eykmann and A. P. H. Trivelli. Wied. Ann. der Physik, 1907 ; Chem.-Zeit., 1907, **31**, Rep., 163—164.

The film (of gelatin and silver bromide) on a photographic plate is more sensitive to light if rough than if smooth. Also, if a given amount of the film material is poured on to a plate in portions so that a layer solidifies before the next is poured on, the plate is more sensitive than if the whole emulsion is poured on at once. A film when wetted is less sensitive to light rays than when dry, but the sensitiveness to Röntgen rays is not altered by wetting. —C. E. F.

Photographic plates ; Nature of film on —— *after exposure.* B. Homolka. Phot. Korr., 1907, **44**, 55. Chem.-Zeit., 1907, **31**, Rep. 164.

It is shown that an undeveloped exposed photographic plate has an oxidising action on other substances than developers. Indoxyl in contact with the plate is converted into indigo and thioindoxyl into thioindigo. By adding indoxyl or thioindoxyl to a solution of sodium sulphite and then using this as developer, the resulting negative (after fixing) is blue or red respectively.—C. E. F.

Photographic plates ; Development of fog on ——. A. and L. Lumière and A. Seyewetz. Phot. Wochenbl., 1907, **33**, 89. Chem.-Zeit., 1907, **31**, Rep. 164.

The authors have developed a series of plates by allowing the developer to act for different periods on unexposed, under-exposed, correctly exposed, and over-exposed plates. The developers employed were diaminophenol, *p*-aminophenol, and quinol (hydroquinone). Fog effect appears in less than two minutes with unexposed plates, and in 10 minutes with exposed plates. If as much potassium bromide as can be produced from the silver bromide be added to the developing solution for unexposed plates, the fogging appears after 10 minutes. The retardation caused by the potassium bromide is thus very marked.—C. E. F.

United States Patent.

Photographic prints ; Process of treating ——. P. Schumacher, Assignor to Klimsch und Co., Frankfort-on-Maine, Germany. U.S. Pat. 846,954, March 12, 1907.

See Fr. Pat. 360,697 of 1905 ; this J., 1906, 560.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 435.)

Explosion of nitroglycerin; Circumstances attending an —— which occurred near one of the Separating Houses of the Factory of Nobel's Explosives Co., Ltd., at Ardeer, near Stevenston, Ayrshire, on Feb. 5, 1907. By Captain J. H. Thomson, H.M. Chief Inspector of Explosives.

The explosion took place just outside the mound protecting a building licensed for "separating acid from, and washing nitroglycerin." In carrying out this operation, it was necessary that the freshly nitrated charge of nitroglycerin, together with the acids of manufacture, should be run down from the nitrating house by means of a lead gutter provided with a wooden cover. The distance between the buildings was considerable and necessitated a gutter unusually long and circuitous. Part of the charge of nitroglycerin and acid got spilt over the edge of the gutter, owing to the freezing of the nitroglycerin from the cold weather which prevailed, and the consequent choking of the channel. The foreman in charge proceeded to thaw the frozen explosive by throwing buckets of warm water on the under side of the lead gutter. This water mixing with the nitrating acid on the ground developed sufficient heat to cause the explosion of the nitroglycerin admixed with the acid. On the spot where the explosion occurred, a crater was formed about 14 feet in diameter and 4½ feet deep. The explosion wave, fortunately, did not travel to the adjoining building, which contained some 2,000 lb. of nitroglycerin. Captain Thomson raises the question whether it is wise to carry on the operations of nitrating and separating in different buildings, and whether any manufacturing advantage which is gained thereby is not more than counterbalanced by the extra danger involved in running down the acid nitroglycerin from one building to the other. The combination of the two operations in one building is the more modern system. Assuming that the older practice is adhered to, it is suggested that the following precautions should be taken to prevent the possibility of the freezing of the acid charge of nitroglycerin in passing from one building to the other during cold weather. The temperature of the charge should not be allowed to fall below 16° C. before running it down to the separating house. In the case under investigation the temperature of the charge was only 12° C., which is evidently not sufficiently high to prevent a serious amount of freezing in a long gutter. As an alternative it is suggested that a steam or hot water pipe of small diameter should be led alongside the gutter in such a manner as not to be in contact with the latter, and so placed that no portion of the charge can fall upon it in case of a leakage or a spill. The pipe should be coated with acid-proof paint. No difficulty need arise as to freezing of nitroglycerin in the gutter when the charge is separated and prewashed in the nitrating house, as it can be sent down warm, and with a portion of the warm wash-water.—G. W. McD.

Explosion and fire in the explosives industry and their prevention. Klocke. Z. ges. Schiess- und Sprengstoffwesen, 1907, 2, 151—153.

A description is given of the disastrous fire and the explosion of picric acid at the Griesheim factory in 1901. The initiating cause of the explosion is considered by the author to be the falling-in of a roof, during the course of the fire, on to the molten picric acid contained in some large stone vessels. An account is also given of the fire and explosion at the Roburite factory at Witten in 1906. The fire started originally owing to the spontaneous ignition of some roburite while being incorporated in a mixing machine. The reason of this is ascribed to the action of an impurity of free sulphuric acid remaining in the trinitrotoluene, which decomposed the potassium permanganate contained in the explosive, liberating permanganic acid, thus causing the guaiacum wood meal, another of the constituents, to ignite spontaneously. The fire spread to the cooling room containing some 10 tons of finished roburite, which, after burning some time, exploded. Later, a store containing 50 tons of ammonium nitrate and 10 tons of trinitrotoluene also took fire and exploded. Suggestions are made as to the necessity of having automatic sprinklers in danger buildings to check outbursts of fire, and the buildings themselves should be constructed, as far as possible, of uninflammable material.—G. W. McD.

Explosives; Photographing the flame produced by ——. Wilkoszewski. Z. ges. Schiess- und Sprengstoffwesen, 1907, 2, 141—144.

The explosives experimented with, were fired in the form of ordinary cylindrical mining cartridges. They were suspended in the air opposite the camera, and maintained in a rigid position by two wires, the one passing across, and the other along, the length of the cartridge. The photographs were taken at night, the camera standing 2·3 metres away from the explosive. A series of photographs are reproduced which show very clearly the diminished photographic effect produced by the flame from a safety explosive, as compared with blasting gelatin, dynamite, &c. The author draws the following conclusions: All "safety explosives," *i.e.*, those which are safe for use in fiery mines, give only a small flame photograph, and the size of the latter may be considered as a test of the safety of such an explosive in actual practice. The effect of the addition of various substances to an explosive can very conveniently be studied in this way. The method, owing to the rapidity with which the work can be carried out, can be very usefully employed for the purposes of a preliminary test for a safety explosive, before submitting it to the somewhat lengthy and costly gallery testing, by which various numerical data are obtained as to the safety factor of explosives. —G. W. McD.

Denitration of mixed acids in explosives factories ——. J. Rudeloff. Z. ges. Schiess- und Sprengstoffwesen 1907, 2, 144—147.

A description is given of the Evers' system of denitration of mixed sulphuric and nitric acids. The denitration tower is divided into three compartments increasing in size from below upwards. Each compartment is filled at its upper portion with pieces of earthenware or other filling material, space being left at the bottom, in each case, for collecting the acid, which is then passed on to the next compartment below by an acid distributor. A hot air and steam injector is also fixed at the base of each compartment. At the top of the tower is the supply chamber, similarly fitted with injector and distributor. Air and steam are introduced at a temperature of not less than 400° C., and the rate of flow is so regulated that they travel with the greatest speed in the lowest compartment and slowest in the top chamber. All organic compounds in the acid are oxidised and a water-white sulphuric acid of 60° B. obtained, containing only a trace of nitrogen compounds. The condensed nitric acid consists of 80 per cent. of an acid of 40° B., and 20 per cent. of 36° B., containing only 0·2—0·3 per cent. of nitrous acid. A special apparatus, containing bundles of small tubes, precedes the main condensing apparatus, and is said to yield good results in preliminary condensation. In the case of denitrating the acids received from the manufacture of nitrotoluene, a special vessel, U-shaped in cross-section, is placed in the system immediately after the tower, to condense any nitrotoluene carried over, and thus prevent a block in the condensing pipes.—G. W. McD.

Match factory of Messrs. Moreland & Sons, Gloucester, with special reference to a recent fatal case of phosphorus necrosis. Report to the Secretary of State for the Home Department by H. H. S. Cunynghame, C.B., Assist. Under-Sec. of State, and B. A. Whitelegge, C.B., M.D., H.M. Chief Inspector of Factories. Wyman and Sons, Ltd., Fetter Lane E.C. Price 1*d.*

In October, 1903, a man whose leg had been amputated was set to work at the dipping-table, removing splints with the fork. He had contracted the habit of chewing tobacco, and his lame condition made it difficult for him to leave the dipping-table even to wash his hands when soiled. It became thus probable that phosphorus had reached the mouth by the hands. The writers express regret that such employment should have been given to such a man. No rule existing that abstinence from tobacco chewing shall be enforced, and only a rule that washing of hands be undertaken on leaving work, the writers state that these omissions ought to be remedied. The firm now undertakes the adoption of the following rules:—(1) To employ none but adult males at the dipping-tables. (2) To provide gloves for the workers at the dipping-tables. (3.) To improve the character of the fork with which the stray splints are removed from the table. (4) To cause sawdust to be spread on the floor, and to be removed and renewed as required, (5) To forbid the chewing of tobacco in the works. (6) To arrange for the inspection of the hands of the operatives so that they may be kept scrupulously clean during work as well as on leaving the factory. The writers state that "short of the abolition of the use of white phosphorus or of making the machines completely automatic," they cannot see that there is anything else that can be done.

English Patent.

Matches; Igniting composition for tipping ——. C. Castiglioni, Milan. Eng. Pat. 3, Jan. 1, 1907.

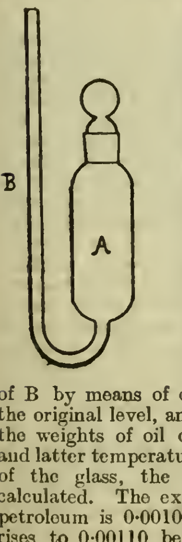
See Fr. Pat. 371,535 of 1906; this J., 1907, **435**.—C. S.

XXIII.—ANALYTICAL CHEMISTRY.

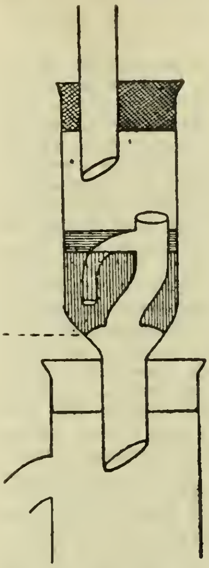
(*Continued from page* 436.)

APPARATUS.

Oils which solidify at low temperatures [*crude petroleum*]; *Determination of the coefficients of expansion of* ——. J. Gruszkiewicz and W. Bartoszewicz. Petroleum, 1907, **2**, 525—526.



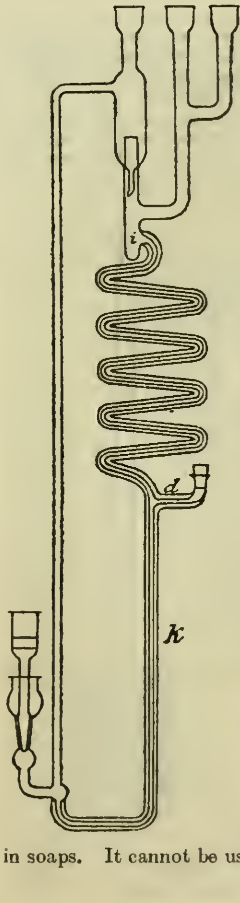
In order to determine the coefficient of expansion of petroleum at temperatures below its solidifying point, the authors use a pyknometer consisting of a weighing bottle, A, of about 20 c.c. capacity sealed to a U-tube, B, of 3—4 mm. bore, which may be graduated in millimetres. A having been filled with liquid oil free from bubbles, the vessel is brought to the required temperature in a thermostat. By passing a rod wrapped with cotton wool down B, the inside of the tube is cleaned and the excessively concave meniscus is flattened. The level of the oil in B is noted, and the pyknometer is weighed, whereupon it is brought to the desired higher temperature. As much oil is then drawn out of B by means of cotton wool as is required to restore the original level, and the vessel is again weighed. From the weights of oil contained in the vessel at the former and latter temperatures, with a correction for the expansion of the glass, the expansibility of the oil is readily calculated. The expansibility of Tustanowice (Boryslaw) petroleum is 0·00108—0·00109 between 0° C. and 10° C., rises to 0·00110 between 10° C. and 20° C., and then gradually decreases with rising temperatures.—W. A. C.



Fat; Source of error in the determination of —— *by means of carbon tetrachloride.* F. Vollrath. Chem.-Zeit., 1907, **31**, 398.

In the ordinary method of extracting fat, any water condensing with the carbon tetrachloride falls upon the substance in the extractor and prevents the proper penetration of the solvent, with the result that the amount of fat obtained is too low. This source of error may be obviated by the use of the apparatus shown in the figure, in which the condensed liquids are caught in the vessel above the extractor, and the carbon tetrachloride passes on as soon as it reaches a certain level, whilst the water, which forms an upper layer, remains behind. In a typical analysis of linseed oil cake, the amount of fat extracted when this apparatus was employed was (1) 7·6 per cent., and (2) 7·6 per cent.; whilst without the water-catcher, the quantities of fat varied from 7·1 to 7·5 per cent.
—C. A. M.

German Patent.



Mercury pump; Modified Sprengel ——. A. Beutell. Ger. Pat. 178,136, Jan. 19, 1906.

The ordinary Sprengel pump frequently becomes useless after a short time owing to fracture of the fall tube. In order to avoid this difficulty, the patentee provides the fall tube, *k*, with a small air-inlet tube, *d*, so that the mercury will always fall on to an elastic cushion of air. The air-inlet tube, *d*, may be closed with an air-filter.—A. S.

INORGANIC–QUANTITATIVE.

Alizarin Red I.W.S. as an indicator in volumetric analysis. G. E. Knowles. J. Soc. Dyers and Col., 1907, **23**, 120.

Alizarin Red I.W.S. (Höchst) in dilute solution has a yellow colour, which is turned violet by excess of sodium hydroxide. Excess of acid restores the original colour. Excess of alkali carbonate turns the indicator violet, but on adding acid, the colour gradually changes from violet to orange, and when the end point appears, there is a very decided change from orange to yellow. It is stated that this indicator can be used for the direct estimation of the total alkali in soaps. It cannot be used in the presence of borates.
—P. F. C.

***Fluorine*; *New quantitative determination of* ——, *and composition of iron fluoride*.** E. Deussen. Monatsh. Chem., 1907, 28, 163—172.

THE author has obtained satisfactory results in the determination of fluorine in fluorides by a method devised by W. Lenz. The substance is weighed into a small platinum crucible and mixed therein with a small quantity of pure calcium oxide. The remainder of the crucible is then filled with calcium oxide, and the whole is inverted in a larger platinum crucible, the annular space between the two being also filled with calcium oxide. The whole is then heated gradually to incipient red heat, cooled, the contents of the crucibles cautiously slaked with water, and dilute acetic acid added so long as evolution of gas occurs. The liquid is now treated with one-tenth of its volume of alcohol, and after several hours the calcium fluoride is filtered off and washed with dilute acetic acid containing some alcohol, until the washings no longer give an immediate precipitate with ammonium oxalate. The calcium fluoride is then dried and weighed, and may afterwards be converted into calcium sulphate and again weighed. Check experiments with pure sodium fluoride and ammonium fluoride showed that the method uniformly gives results about 0·8 per cent. too low, which, considering the difficulty of fluorine determinations, represents but a comparatively small error. Commercial ammonium fluoride was found to consist of the normal fluoride, NH_4F, and not, as is frequently assumed, the acid salt, NH_4FFH. The author has also examined the iron fluoride obtained by dissolving metallic iron or ferric oxide or hydroxide in hydrofluoric acid in presence of nitric acid, and finds that instead of being ferric fluoride, $Fe_2F_6,9H_2O$, as is usually stated, it is a ferro-ferric compound of the composition, $(FeF_3)_2,FeF_2,10H_2O$.—A. S.

***Metals*; *Rapid electro-analytical deposition and separation of* ——. *I. The metals of the silver and copper groups and zinc*.** H. J. S. Sand. Chem. Soc. Trans., 1907, 91, 373—410.

THE author describes apparatus and methods for the electrolytic deposition and separation of metals by graded potential with rapid stirring of the electrolyte. The electrodes are shown in the accompanying figures. When in operation, the inner rotating electrode (Fig. 1*c*), is surrounded on all sides except the bottom by the outer electrode (Fig. 1*a*). The two are kept in position relatively to each other by the glass tube (Fig. 1*b*), which fits tightly in the collar, A, and loosely in the ring, B, of the outer electrode. The hollow platinum-iridium stem, A, of the inner electrode rotates freely in the glass tube. The inner electrode has a vertical partition, P, inside the platinum gauze, which has a mesh of 14^2 per sq. cm. The platinum gauze of the outer electrode almost completely stops the rotation of the liquid, and thus, when the electrolyte is ejected rapidly from the centre of the inner electrode, it is continually replaced by liquid drawn in from the top and bottom. The circulation is stated to be practically independent of the size of beaker employed. The space between the surfaces of the two electrodes when they are in position is about 3 mm. Fig. 3 shows the apparatus in position. In the case of solutions containing metals which readily pass from one stage of oxidation to another, such as copper in ammoniacal liquids, iron, tin, &c., the inner electrode shown in Fig. 2, which has a much smaller surface, is employed. For measuring the potential of the electrodes, a special auxiliary mercury—mercurous sulphate—$2N$ sulphuric acid electrode is employed. In effecting separations by graded potential, the electrical connections must be made as shown in Fig. 4. In carrying out a determination, the metal is usually deposited on the outer electrode. The current is generally started at about 3—4 ampères, and the potential of the auxiliary electrode noted. Details are given of the determination and separation of silver, mercury, copper, bismuth, lead, cadmium, and zinc. Silver can be successfully deposited as amalgam in an adherent form if the cathode be previously coated with a quantity of mercury at least 10 times that of the silver. For the separation of silver and mercury, the metals are deposited together, and converted into their cyanides, and these separated in the usual way by means of their different behaviour to acids. The silver is then deposited from the solution of pure silver cyanide. Adherent deposits of bismuth can be readily obtained if the potential of the cathode be kept low enough to prevent the formation of hydride. In determinations of mercury, the cathode with its deposit can be dried quickly, without loss of weight, in a current of dry air saturated in the cold with mercury vapour. A description of the separation of the seven metals mentioned above from one solution is given. Slightly less than 1 c.c. of concentrated nitric acid is added to the solution, and for the first deposition of metals, the potential of the auxiliary electrode is taken to 0·15 volt. in a boiling solution. Silver and mercury are deposited on the cathode (previously plated with mercury), and hardly any lead is separated on the anode. The silver and mercury are separated as described above. For the second deposition of metals, the potential of the auxiliary electrode is taken to 0·55 volt., nearly all of the lead and part of the bismuth being deposited on the anode, and all of the copper and the remainder of the bismuth on the cathode. The cathode deposit is dissolved in a boiling solution of nitric acid, and after addition of sodium tartrate, sodium hydroxide, potassium cyanide, and formaldehyde, the bismuth is determined electrolytically. The anode deposit is dissolved in a solution of nitric acid, tartaric acid added, and the bismuth and lead deposited in succession by graded potential. The lead deposit is weighed, dissolved in nitric acid, and redeposited as peroxide. After the deposition of the copper, bismuth, and lead, the residual solution is evaporated almost to dryness with 3 c.c. of concentrated sulphuric acid in order

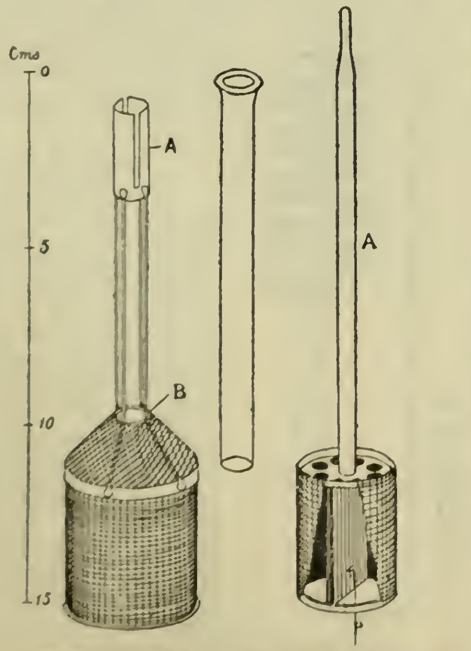


Fig. 1*a*. Fig. 1*b*. Fig. 1*c*.

FIG. 1*a*.—Outer electrode. FIG. 1*b*.—Glass tube. FIG. 1*c*.—Inner electrode with part of gauze removed.

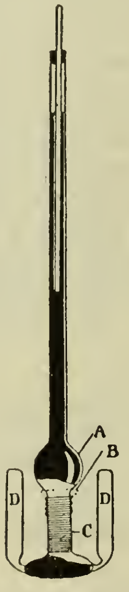


FIG. 2.—Inner electrode, No. 2. Stem and mercury as in Fig. 2. *A*, bulb to spread out gas bubbles. *B*, gauze fused into glass to make connection. *C*, wire forming metal surface of electrode. *D*, *D*, vanes for stirring.

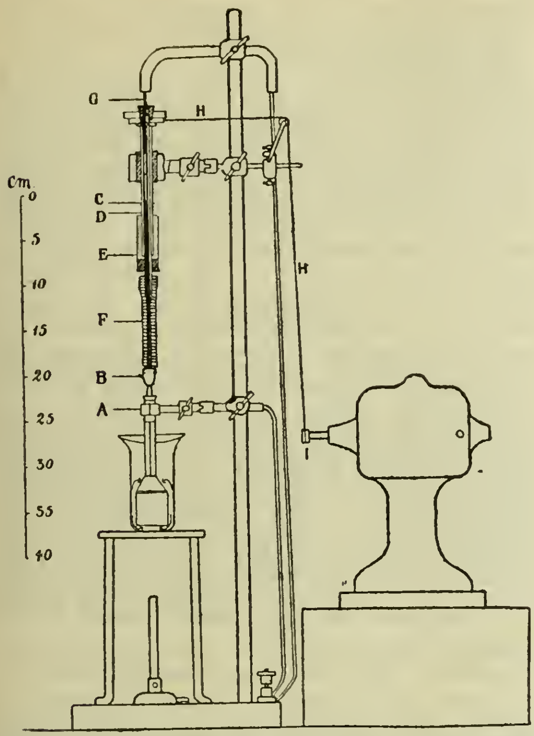


FIG. 3.—*A*, Clamp to grip outer electrode. *B*, Chuck to grip inner electrode. *C*, Glass tube rotating in glass tube *D*. *E*, Oil trap on *C*. *F*, Thick rubber tube. *G*, Amalgamated copper wire dipping into mercury contained in *C* and *F*. *H*, Cord made of violin string. *I*, Pulley made of rubber tube.

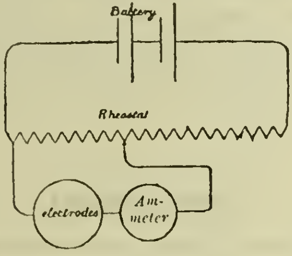


FIG. 4.

to expel nitric acid, and cadmium and zinc determined electrolytically by graded potential in a weak acetic acid solution of the residue. The times of deposition of the different metals were: silver *plus* mercury, 10 minutes; silver, 8; lead and part of the bismuth on anode, copper and the rest of the bismuth on cathode, 15; separation of bismuth from copper, 15; separation of bismuth from lead, 10; lead as metal, 7; lead as peroxide, 10; cadmium, 15; and zinc, 15 minutes. The following results were obtained, the quantities given being in grms.:—

	Ag + Hg.	Ag.	Cu.	Bi.	Pb.	Cd.	Zn.
Taken .	0·2244	0·1078	0·3682	0·1554	0·1424	0·0938	0·1287
Found .	0·2249	0·1098	0·3682	0·1548	{ 0·1455 } { 0·1441 }	0·0935	0·1311

—A. S.

Tin; Quantitative separation of —— from manganese, iron, and chromium by electrolysis. N. A. Puschin. Z. Elektrochem, 1907, **13**, 153—154.

THE method depends on the fact that manganese and chromium are not precipitated by the electric current from solutions made acid with oxalic acid. With certain modifications, the method applies also to the separation of tin from iron. To a neutral solution, containing about 0·5 grm. of ferrous iron (or manganese), 25 c.c. of a boiling saturated solution of ammonium oxalate are added, then 100 c.c. of a similar solution of oxalic acid. The double oxalate of ammonium and iron (or manganese) is allowed to settle, and the tin deposited from the solution by electrolysis at boiling temperature, the E.M.F. at the terminals being 3—4 volts, and the current density 2·5—4 ampères per sq. dcm. Tin may be separated from manganese salts by a similar method, but the voltage must not exceed 3 volts, or the current-density 3—4 ampères per sq. dcm. The soluble ferric ammonium oxalate is, however, reduced to the insoluble ferrous salt, which is partly precipitated on the cathode and affects the results. In a similar way, using an E.M.F. of 2·5—4·0 volts and current-density of 1·2—5 ampères per sq. dcm., tin may be completely precipitated from chromium solutions in a pure state.—C. A. W.

Lithopone; Analysis of ——. Copalle. XIII*A*., page 476.

ORGANIC—QUALITATIVE.

Gelatin [in solutions of gums, sugar, &c.]; Nessler's reagent for the identification of ——. Vamvakas. Ann. Chim. anal. appl., 1907, **12**, 58—59. Chem. Zentr., 1907, **1**, 1158.

ON adding Nessler's reagent, to which some tartaric acid has been added, to a 10 per cent. solution of gelatin (sp. gr. 1·032), there forms gradually in the cold, or immediately on boiling, a lustrous precipitate—in dilute solutions a very dull lead-grey precipitate. This reaction is stated to be characteristic of gelatin, which can by this means be detected in solutions of gums, sugar, &c.—A. S.

Sulphide colours on cotton; Identification of ——. A. G. Green and F. G. C. Stephens. V., page 467.

ORGANIC—QUANTITATIVE.

Organic acids; Volumetric determination of combined ——. R. Duchemin and G. Criquebeuf. Bull. Assoc. Chim. Sucr. et Dist., 1907, **24**, 1216—1220.

FOR the analysis of salts of formic, acetic, propionic, and butyric acids, the authors propose a method which depends on the fact that methyl violet is not affected by these acids, whereas it is turned blue by mineral acids. The process is as follows:—

Acetates, propionates, and butyrates.—One hundred c.c. of a solution of the salt (previously neutralised, if necessary, in presence of phenolphthalein) are treated with five drops of a 0·1 per cent. solution of methyl violet and then titrated with N/2 sulphuric acid, the production of a blue colour indicating the end of the reaction. The amount of acid necessary to produce the same blue colour in distilled water containing methyl violet is deducted from the amount required for titration. In the case of empyreumatic products, the methyl violet should be used as an outside indicator, the analysis being controlled either with a dilute solution of pyroligneous acid, or by the phosphoric acid method of determination (in the latter case, the correction is made once for all). *Formates.*—Owing to the fact that formic acid has a slight action on methyl violet, the latter must be used as an outside indicator. The analysis is controlled by a blank experiment in which 0·5—1·0 c.c. of *N*/2 sulphuric acid is added to 150 c.c. of a 5 per cent. aqueous formic acid solution in the presence of the indicator. The method, as the authors show, is fairly accurate, and has the advantage of being very expeditious.—L. E.

Tobacco; Determination of the non-volatile organic acids in ——. J. Tóth. Chem.-Zeit., 1907, **31**, 374.

OXALIC, citric, and malic acids were estimated separately and together in a number of samples of tobacco. The percentage of oxalic acid varied from 0·42—2·57, that of citric acid from 0·92—2·49, and that of malic acid from 1·56—7·81. The sum of the acids determined separately is not always in agreement with the total amount determined by titration. With an increase in the amount of acid, the combustion number decreases, that is, the burning quality of the tobacco improves.—E. F. A.

Mineral lubricating oils; Analytical constants of ——. R. Kissling. III., page 463.

Wine analysis; Determination of sucrose, reducing sugars, and dextrin in ——. H. Pellet. XVII., page 480.

Rhubarb; Determination of the value of —— [*by means of diazotised paranitraniline solution*]. A. Tschirch and J. Edner. XX., page 483.

Alkaloidal drugs, extracts, and tinctures [*Nux vomica, hydrastis, and jaborandi*]; *Application of dinitrophenylmethylpyrazolone* (*picrolonic acid*) *to the determination of the value of* ——. H. Mattheo and O. Rammstedt. XX., page 483.

Acetanilide and phenacetin in pharmaceutical preparations; Determination of ——. J. L. Turner and C. E. Vanderkleed. XX., page 486.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 437.)

Catalytic reactions at high temperatures and pressures. [*Reductions by metallic iron and nickel.*] W. Ipatiew. Ber., 1907, **40**, 1270—1281.

Acetone, heated alone in an iron vessel to 400° C., is but slightly altered. Above 420° C. it is decomposed to a greater extent (about one-third of the total quantity disappears), with formation of very small quantities of methane and carbon monoxide, and production of an oil, insoluble in water, boiling between 60° and 200° C., but not further investigated. In presence of hydrogen at 100 atmospheres pressure, and at a temperature of 400° C., the acetone is transformed into isopropyl alcohol, but the reaction is reversible, and equilibrium is established when about 25 per cent. of the acetone has been thus reduced. Starting from isopropyl alcohol, the same position of equilibrium is attained. Isobutyraldehyde in contact with hydrogen at an initial pressure of 85 atmospheres, and heated to 400° C. in a phosphor-bronze apparatus, undergoes no noticeable reduction; when iron is substituted for phosphor-bronze, however, the aldehyde is almost completely reduced, isobutyl alcohol equivalent to about three-quarters of the original aldehyde being obtained, and the remainder being condensation products of isobutylene, involving the previous formation of isobutyl alcohol. Isovaleraldehyde is similarly reduced, while isoamyl alcohol is practically unchanged when heated under these circumstances. The temperatures at which these reductions are effected by iron are higher than the corresponding temperatures in the case of nickel. With nickel, similar changes occur. Isopropyl alcohol is partly converted into acetone at 250° C., the reaction being, however, reversible; a certain proportion of the alcohol is also decomposed with production of paraffin hydrocarbons. As the temperature rises, so does the proportion of acetone before equilibrium is reached; but so also does the amount of paraffins. Acetone at 210° C. is rapidly converted in the apparatus into isopropyl alcohol, but as the temperature rises, the conversion is less complete, and the proportion of paraffins formed greater. Nickel thus is not a very suitable agent for the preparation of aldehydes or ketones from alcohols. Methyl-ethyl-carbinol, and isoamylalcohol behave similarly to isopropyl alcohol, save that the formation of paraffins occurs only at higher temperatures, and that the equilibrium point under similar circumstances occurs with a much greater proportion of alcohol and smaller proportion of aldehyde than in the three-carbon series. Methyl alcohol, heated in contact with nickel to a high temperature with hydrogen at high pressure, yields gaseous products, chiefly hydrogen and methane. The hydrogen, however, is always present in greater proportion relatively to the methane than would be expected. Benzene, heated under these circumstances in contact with iron, undergoes no alteration much below 600° C., at which temperature it yields hydrogen and diphenyl. On the other hand, with nickel as the catalytic agent, it is converted almost completely at 255° C. into hexahydrobenzene. Above 300° C., hexahydrobenzene dissociates, partly into benzene and hydrogen, but chiefly into carbon and methane.—J. T. D.

Catalytic reactions at high temperatures and pressures. [*Reductions in presence of metallic oxides.*] W. Ipatiew. Ber., 1907, **40**, 1281—1290.

Nickel oxide (Ni_2O_3) in the author's apparatus, at a temperature of 250° C., and an initial hydrogen pressure of 100 atmospheres, reduces many organic substances very much more rapidly than metallic nickel. Benzene is in about 1½ hours (for 25 grms.) completely converted into pure hexahydrobenzene. Nickelous oxide is intermediate in this respect between the metal and the higher oxide. The speed of reaction is greatly affected by temperature, being three times as great at 250° as at 200° C. At 290° C. considerable decomposition of the hexahydrobenzene occurs. The reaction is more rapid when the oxide is introduced after the benzene than when the opposite is the case; a fact, the cause of which is to be found in the larger surface exposed. Increasing or diminishing the amount of the catalytic agent (about 2 grms. were ordinarily used with 25 grms. of benzene) affects the speed correspondingly, though not proportionately. In a similar way the author has converted acetone, phenol, diphenyl, naphthalene, dibenzyl, α- and β-naphthol, and benzophenone respectively into isopropylalcohol, hexahydrophenol, dicyclohexyl, decahydronaphthalene, dicyclohexylethane, α- and β-decahydronaphthol and diphenylmethane. In many of these cases the transformation is complete, and the new substance quite pure. The mode of action of the nickel oxide is not yet understood; but it is certainly not reduced, or is only in very minute proportion reduced, to metallic nickel.—J. T. D.

Mannitol; Presence of —— *in the Jasmineæ.* J. Vintelesco. J. Pharm. Chim., 1907, **25**, 373—377.

The twigs of white jasmine, *Jasminum officinale* L., gathered whilst flowering in May, were extracted with water, and the residue left on evaporating completely dried. This was extracted with alcohol, the alcohol distilled off, and the residue extracted several times with warm ethyl acetate containing water. On cooling, a crystalline substance was deposited. This proved to be mannitol by its melting point, 165°—166° C., and by the comparison of its optical rotation in borax solution with that of commercial mannitol. Mannitol, together with syringin, was found by a similar process in *Jasminum nudiflorum* L., gathered during May.—F. Shdn.

Trade Report.

Chemical Patents in Switzerland.

The Swiss National Council has passed the new Patent Bill which was considered by the Standerat last December. As now adopted, the Act provides that no patents will be granted for inventions of chemical materials, but rather for inventions of chemical processes, excepting those which relate to the production of materials which are mainly intended for the nourishing of human beings or animals. In the same way patents will not be issued for inventions of medicines, food products, and beverages for human beings or animals, when these are produced other than by chemical methods; neither will such processes be given protection.

German Chemical Industry.

Chem. and Drug., April 29, 1907.

The number of chemical works operating in Germany last year, as well as the number of permanent workers insured and the amounts paid in wages, have increased in the same ratio. The export movement in chemicals, crude and manufactured, also shows a large increase. Among the articles which were more especially affected by the new tariff duties, the exports of aniline oils increased from 27,000 to 78,000 double centners, tar colours from 55,000 to 104,000, zinc ash from 24,000 to 42,000, and sulphate of ammonia from 37,000 to 105,000 double centners. The increasing prosperity of the chemical industry during the last two years has shown no sign of abating. The balance-sheets so far only available for 1905 of 142 operating concerns, with a paid-up capital of 460 million marks, show that for that year 69½ million marks have been paid in dividends and in interest on loans and mortgages. This corresponds to an average return of 10·12 per cent., against 9·52 per cent. for the previous year. The percentage in the case of manufactured tar colours rose from 11·68 to 13·54 per cent., which is the most striking feature, but for chemico-pharmaceutical preparations the average return of earnings declined from 9·67 to 9·35 per cent. owing to keen competition and adverse duties.

New Books.

Coal Exports, &c. Board of Trade Return No. 124. Wyman & Sons, Fetter Lane, London, E.C. Price 4d.

This return contains statistics showing the quantity of coal exported from the various ports of the United Kingdom to countries abroad during each quarter of the years 1905 and 1906, as well as the quantity shipped at each port for the use of vessels on foreign voyages during the same periods. The return also contains a summary statement, showing the export of coal from the principal districts of the United Kingdom to various groups of foreign countries and British Possessions during each quarter of 1905 and 1906.

Alcoholic Beverages, 1905. Board of Trade Return No. 401. Wyman & Sons, Fetter Lane, London, E.C. Price 9d.

A memorandum and statistical tables showing the production and consumption of alcoholic beverages (wine, beer, and spirits) in various countries of Europe, in the United States, and in the principal British Colonies; and the revenue derived therefrom in recent years.

Theories of Chemistry, being Lectures delivered at the University of California, in Berkeley. By Svante Arrhenius, Director of the Nobel Institute, Stockholm. Edited by T. Slater Price, D.Sc., Ph.D. Longmans, Green and Co., 39, Paternoster Row, London. 1907. Price 5s. 6d. New York, Bombay, and Calcutta.

8vo volume, containing 203 pages of subject matter, with 23 illustrations and the alphabetical index. The matter is arranged under the following heads:—I. Introduction. The Use of Theories. II. Old Hypotheses in Chemistry. III. Existence of Hydrates in Solution. IV. Validity of Dalton's Law. V. and VI. Electrical Forces between the Atoms. The Law of Faraday. VII. Development of the Doctrine of Valency. VIII. Composition of the Atoms. Electrons. IX. Theory of Gases. X. Chemical Kinetics and Statics. XI. Influence of Temperature and Pressure. Dissociation. XII. Osmotic Pressure. General Laws for Dissolved Substances. XIII. Electrolytic Dissociation. XIV. Problems to be Solved.

The Electrolytic Dissociation Theory. By Prof. R. Abegg, Ph.D. Authorised Translation from the German, by C. L. von Ende, Ph.D., Assist. Professor of Chemistry, State University of Iowa. First Edition. John Wiley and Sons, New York, U.S. America. 1907. Price 5s. 6d. Chapman and Hall, Ltd., London.

Small 8vo. volume, containing 164 pages of subject matter and the alphabetical index. The volume is dedicated to Sv. Arrhenius. The subdivisions of the entire subject are as follows:—I. Fundamental Conceptions. II. Mobility of the Ions. III. Equilibria among Ions. IV. The Dissociation Constant. V. Equilibria among several Electrolytes. VI. Hydrolysis. VII. Avidity. VIII. Indicators. IX. Heterogeneous Equilibria. X. Anomaly of Strong Electrolytes. XI. Influence of Pressure and Temperature on Dissociation. XII. Non-aqueous Solutions. XIII. Chemical Nature and Ionisation Tendency of the Elements.

Inorganic Chemistry for Schools and Colleges. By Jas. Lewis Howe, Washington and Lee University. Being a Second Edition of "Inorganic Chemistry according to the Periodic Law." By F. P. Venable and J. L. Howe. The Chemical Publishing Co., Easton, Pa., U.S.A. 1907. Price 12s. 6d. net. Williams and Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

8vo volume, containing 409 pages of subject matter, with 70 illustrations, and the alphabetical index. The chapters of this work are classified as follows:—I. Hydrogen, Oxygen, and Water. II. Salt, Sodium, and Chlorine. III. Classification of the Elements. IV. The Elements. V. Compounds of Hydrogen. VI. The Halides. VII. Oxides and Sulphides. VIII. Binary Compounds of Group V. IX. Binary Compounds of Groups IV. and III. X. Alloys. XI. Outlines of Metallurgy.

Electrochemistry. I. Theoretical Electrochemistry and Its Physico-Chemical Foundations. By Dr. Heinrich Danneel, of the Royal Technical High School of Aachen. Translated from the Sammlung Göschen by Edmund S. Merriam, Ph.D., Assoc. Professor of Chemistry in Marietta College, Ohio. First Edition. John Wiley and Sons, New York, U.S.A. 1907. Price 5s. 6d. net. Chapman and Hall, Ltd., London.

Small 8vo volume, containing 172 pages of subject matter and 18 illustrations, and followed by the list of works and periodicals recommended for collateral study, and the alphabetical index. The subject matter is arranged under the following heads:—I. Work, Current and Voltage. II. Chemical Equilibrium, Statics, and Kinetics. III. Theory of Electrolytic Dissociation. IV. Conductivity. V. Electromotive Force and the Galvanic Current. VI. Polarisation and Electrolysis. VII. Electron Theory.

The Value of Pure Water. By George C. Whipple. First Edition. John Wiley and Sons, New York, U.S.A. 1907. Price 4s. 6d. Chapman and Hall, Ltd., London.

This book contains 77 pages of subject matter, with many tables, and the alphabetical index. It is of small 8vo size. The matter is classified as follows:—I. Pure and Wholesome Water. II. Sanitary Qualities. III. Attractiveness. IV. Hardness. V. Temperature. VI. Summary of Formulæ. VII. Application of Formulæ, as Effects of: (i.) Contamination; (ii.) Turbidity, Colour, and Odour; (iii.) Hardness. VIII. Benefits of Filtration. (Sanitary Quality, Physical Quality, Water Softening.) IX. Cost of Filtration. X. Summary. XI. What is Pure and Wholesome Water? XII. Disadvantages of Hard Water.

A Handy Book for Brewers. Being a Practical Guide to the Art of Brewing and Malting. Embracing the Conclusions of Modern Research which bear upon the Practice of Brewing. By Herbert Edwards Wright, M.A. Third Edition. Revised and Enlarged. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London. 1907. Price 12s. 6d.

Contains 548 pages of subject matter and Appendix and the alphabetical index, and is of 8vo size. The subject matter is arranged under the following heads:—Introduction, with Notes on Chemical Changes and Outlines of Brewing Processes. I. Barley, Malting and Malt. II. Water for Brewing. III. Hops and Sugars. IV. The Brewing Room. V. Chemistry as Applied to Brewing. VI. The Laboratory. VII. Mashing, Sparging, and Boiling. VIII. Ferments in General. IX. Fermentation with Commercial Yeast, its Science and Practice. X. Culture from a Single Cell, Wild Yeasts. XI. Treatment of Beer. XII. The Brewery and Plant. XIII. Synoptic List of Enzymes (Unorganised Ferments). XIV. Plan of Arrangement of Large Brewery on Skimming Principle. XV. Synoptic Table of the Various Processes in Malting and Brewing, &c.

Patent List.

Where a complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

8856. Reeves. Apparatus for altering the weight and composition of air and liquids. April 16.

9156. Davidson. Drying apparatus. April 19.

9169. Legg and Boby. Apparatus for mixing liquids. April 19.

9285. Rossée, and Unionwerke A.-G. Fabr. f. Brauerei-Einrichtungen. Filter presses. April 22.

9307. Feldhoff and Manns. Apparatus for the consumption of smoke and dust.* April 22.

9389. Vallat. Plates for alcohol, benzine, petroleum, and like distilling columns. April 23.

9741. Imray (Soc. Chem. Ind. in Basle). Apparatus for drying and grinding materials. April 26.

Complete Specifications Accepted.

9305 (1906). Szek. Centrifugal dryers. April 24.

21,022 (1906). Bouvier and Collon. *See under* II.

22,187 (1906). Burt. Filters. May 1.

28,767 (1906). Bevenot. Extraction and desiccation of the solids in solutions or fluids, particularly milk and saccharine juices. May 1.

1595 (1907). Douge. Recovery of vapours of solvents in factories, especially applicable to artificial silk factories. April 24.

II.—FUEL, GAS, AND LIGHT.

Applications.

9701A (1906). Cox. Gas-making plants. April 20.

8841. Allgem. Elektricitäts Ges. Incandescence bodies for lighting and heating. [Ger. Appl., April 17, 1906.]* April 16.

8975. Dixon. Treatment of bituminous coal. April 18.

9100. Atkinson. Incandescent mantles. April 19.

9136. Hassman and Puterbaugh. Artificial fuel.* April 19.

9385. Laycock. Apparatus for abstracting ammonia and naphthalene from gas. April 23.

9859. Love. Gas retorts. April 27.

Complete Specifications Accepted.

11,004 (1906). Hersey. Gas washer scrubbers.

21,022 (1906). Bouvier and Collon. Apparatus for mixing, measuring, and carburetting gaseous bodies. May 1.

6820 (1907). Bouland. Manufacture of agglomerate fuel. May 1.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

9180. Hellsing. Deodorising and desulphurating mineral oils. [Swed. Appl., April 30, 1906.]* April 19.

9389. Vallat. *See under* I.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

8729. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of red azo dyestuffs and of intermediate products. April 15.

9011. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. April 18.

9266. Levinstein, and Levinstein, Ltd. Dyestuffs and dyeing therewith. April 22.

9546. Imray (Soc. Chem. Ind. in Basle). Manufacture of chlorinated derivatives of indigo. April 24.

9547. Imray (Soc. Chem. Ind. in Basle). Manufacture of a bromo-derivative of indanthrene. April 24.

9548. Meister, Lucius, und Brüning. Manufacture of substantive red dyestuffs. [Ger. Appl., April 25, 1906.]* April 24.

9657. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. April 25.

9742. Imray (Soc. Chem. Ind. in Basle). Manufacture of azo dyestuffs. April 26.

Complete Specifications Accepted.

14,921 (1906). Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 1.

19,322 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. April 24.

4159 (1907). Ges. f. Chem. Ind. in Basle. Manufacture of yellow sulphine dyestuffs of the quinophthalone series. May 1.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

8934. Denison and Preussner. Method and apparatus for treating textiles. April 17.

9120. Jardin. Bleaching flax, hemp, and like textile material. April 19.

9241. Denison and Preussner. Imparting a permanent finish to cloths, and apparatus therefor. April 20.

9266. Levinstein, and Levinstein, Ltd. *See under* IV.

9300. Wilkins. Solution for rendering cotton, wool, and like substances capable of resisting fire.* April 22.

Complete Specifications Accepted.

6992 (1906). Beresin. Treatment of cotton fabrics or yarns to improve their texture and render their dye more permanent. May 1.

9457 (1906). Duckworth and Hall. Machines for dyeing, scouring, washing, and bleaching fabrics. April 24.

9881 (1906). Bontor. Apparatus for printing yarns. May 1.

15,542 (1906). Merck and Merck. Manufacture of hygienic textile fabrics. April 24.

19,276 (1906). Briggs. Apparatus for conditioning yarn. May 1.

22,422 (1906). Crumière. Manufacture of artificial silk or horse-hair. April 24.

1595 (1907). Douge. *See under* I.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

8653. Bender. Making compounds of oxygen from the elements at a high temperature.* April 15.

8997. Evans. Process for obtaining red oxide of iron and zinc liquor. April 18.

9047. Raschen, Wareing, and United Alkali Co., Ltd. Treatment of ores containing lead sulphate for the obtainment of lead chloride therefrom. April 18.

9385. Laycock. *See under* II.

9407. Krauss, and Ges. f. Stickstoffdunger. Production of ammonia from nitrogen compounds. April 23.

9553. Efford and Dabner. Lime kilns.* April 24.

9636. Chem. Fabr. Buckau. *See under* XI.

Complete Specifications Accepted.

11,565 (1906). Imray (Meister, Lucius, und Brüning). Dehydration of sodium hydrosulphite containing water of crystallisation. April 24.

3692 (1907). Fischer. Ozonising oxygen or gases containing oxygen. May 1.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

8687. Lovatt, Lovatt, and Lovatt. Decorating or finishing earthenware or pottery. April 15.

8704. Lindemann and Lindemann. Production and use of glass or vitreous substances. April 15.

8855. Wieltschnig. Glass furnaces. April 16.

9394. Schöfl, Trautmann, and Mayer. Manufacture of fire-resisting porcelain. April 23.

Complete Specifications Accepted.

15,292 (1906). Chambers. Combined glass tank and pot furnace. May 1.

21,721 (1906). Oppermann. Pouring pots for use in the manufacture of plate glass. April 24.

29,427 (1906). Mayer. Furnaces for burning glass, porcelain, stoneware, and like articles. May 1.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

28,199A (1906). Dunbar (Isolatoren-Fabr. "Pulvolit"). Manufacture of artificial stone or the like.* April 15.

8760. Morgan. Cement kilns.* April 15.

9314. Tochum. Manufacture of cement. April 22.

9316. Marmetschke and Brüning. Impregnating wood and the like with heavy-metal salts and aluminium combinations under hydraulic pressure. April 22.

9375. Flynt and Brownhill. Substitute for natural rock asphalt. April 23.

9633. Thom. Manufacture of stone or marble artificially. April 25.

Complete Specifications Accepted.

3755 (1906). Jacobs. Preservative for wood, metal, &c. April 24.

10,900 (1906). Ali-Cohen. Artificial marble and other stone. April 24.

15,631 (1906). Altena. Apparatus for treating wood with preservative compositions. May 1.

18,851 (1906). Barnett and Hadlington. Brick kilns and the like. April 24.

X.—METALLURGY.

Applications.

9073. Twynam. Treating slags from steel and iron making processes. April 19.

9559. Lake (Strout, Bassett, and Parker). Manufacture of fluxes for brazing.* April 24.

9645. Becker. Annealing and tempering metals. April 25.

9740. Sang. *See under* XI.

Complete Specifications Accepted.

994 (1906). Gillies. Apparatus for leaching ores or metallurgical products and subsequently separating the liquids from the solids. April 24.

1004 (1906). Gillies. Treatment of zinciferous ores and products. April 24.

9210 (1906). Malden and Malden. Consolidating finely divided ore material. April 24.

9339 (1906). De Bechi and Rucker. Treatment of complex sulphide ores. May 1.

9426 (1906). Savelsberg. Treatment of ores preliminary to smelting. May 1.

26,934 (1906). Baker. Treatment of complex sulphide ores. April 24.

28,342 (1906). Thirot and Mage. *See under* XI.

28,354 (1906). Cowper-Coles. Uniting aluminium. May 1.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

13,949A (1906). Electric furnaces. April 18.

9029. Borgnet. Electrolytic apparatus.* April 18.

9397. De Pont. Manufacture of insulating materials for electrical purposes. April 23.

9636. Chem. Fabr. Buckau. Electrolytic recovery of chromic acid from solution of sulphate of chromium. [Ger. Appl., May 8, 1906.]* April 25.

9637. Chem. Fabr. Buckau. Increasing the durability of carbon electrodes in aqueous solutions. [Ger. Appl., May 8, 1906.]* April 25.

9740. Sang. Method of depositing metallic coatings on metal surfaces.* April 26.

Complete Specifications Accepted.

1716 (1906). Finlay and Finlay. Batteries of electrolytic cells. May 1.

10,161 (1906). Hartenstein. Lining for electric or other furnaces. May 1.

13,972 (1906). Cowper-Coles. Electrodeposition of copper. April 24.

22,519 (1906) Frick. Electric transformer furnaces. May 1.

22,658 (1906) Weichert. Apparatus for the electrolysis of fluids. April 24.

26,929 (1906) Roach. Electric furnaces. April 24.

28,342 (1906) Thirot and Mage. Electrolytic production of pure tin. April 24.

1658 (1907). Grönwall, Lindblad, and Stalhane. Electric smelting furnaces. May 1.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

8731. Faiga and Webster. Oils, greases, fats, bituminous substances, and the like. April 15.

9563. Marter. Removal of smell from oils and rendering them non-inflammable. April 24.

9733. Phillips. Extraction of palm oil from the chaff of palm nuts.* April 26.

9766. Dreymann. Treatment of oils. [Ger. Appl., May 1, 1906.]* April 26.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

9811. Henry. Preparing revived and toned colouring matters.* April 27.

(*B.*)—Resins; Varnishes.

Application.

8868. Wright. Manufacture of linoleum. April 17.

(*C.*)—India-Rubber.

Complete Specifications Accepted.

9290 (1906). Wilderman. Manufacture of rubber. April 24.

16,084 (1906). Ormandy. Manufacture of vulcanised rubber or other sheets. April 24.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

9271. Morris. Preservative materials for leather belting, patent leather, &c. April 22.

Complete Specifications Accepted.

9893 (1906). Lake (Barron). Machines for treating hides, skins, &c. May 1.

16,348 (1906). Lake (Lederfabrik Hirschberg). Chrome tanning process. April 24.

16,443 and 16,450 (1906). Heintz. Process of chrome tanning. April 24.

24,189 (1906). Thompson (Kelk). Tanning, tawing, or curing hides or skins. April 24.

29,661 (1906). Norris. Treatment of hides and skins. May 1.

XV.—MANURES, &c.

Complete Specification Accepted.

8727 (1906). Stringfellow. Treatment of excreta, waste, &c., and obtaining manure therefrom. April 24.

XVI.—SUGAR, STARCH, GUM, &c.

Complete Specification Accepted.

28,767 (1906). Bevenot. *See under* I.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

8682. Breker. Continuous beer-production with four chief vessels.* April 15.

8848. Guillaume. Rectification of alcohol or other product similarly treated. [Fr. Appl., April 19, 1906.]* April 16.

9444. Watt. Process of distilling fermented liquors.* April 23.

Complete Specifications Accepted.

13,523 (1906). Adlam. Chilling and carbonating beer, stout, and other liquids. May 1.

17,909 (1906). Ozonair, Ltd., and Rogerson. Brewing beer and other liquors. May 1.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

8708. Aktiebolaget Baltic-Separator. Manufacture of butter. [Swed. Appl., April 20, 1906.]* April 15.

8823. Kuhn. Treatment of liquids for preventing fermentation.* April 16.

9015. Mitscherlich. Manufacture of margarine. [Ger. Appl., April 19, 1906.]* April 18.

Complete Specifications Accepted.

10,136 (1906). Robinson and Backhouse. Manufacture of flour or meal. April 24.

28,767 (1906). Bevenot. *See under* I.

(*B.*)—Sanitation; Water Purification.

Applications.

8747. Schneible. Apparatus for treating refractory water.* April 15.

8899. Girerd. Purification of water.* April 17.

Complete Specification Accepted.

8727 (1906). Stringfellow. *See under* XV.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

9537. Lederer. Manufacture of products resembling celluloid.* April 24.

9568. Tortelli. Utilising celluloid residua. [Ital. Appl., April 24, 1906.]* April 24.

9696 and 9697. Hutchinson, and The United Railway and Trading Co., Ltd. Manufacture of paper. April 25.

Complete Specification Accepted.

11,632 (1906). Coale. Manufacture of artificial cork. May 1.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

9725. Houghton. Process of forming monobasic organic peroxides.* April 26.

9857. Basler Chem. Fabrik. Manufacture of camphor from isoborneol. [Ger. Appl., April 28, 1906.]* April 27.

Complete Specifications Accepted.

19,868 (1906). Bergell. Bacteria toxins. April 24.

5013 (1907). Imbert. Production of chloracetic ether and chloracetic acid. May 1.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

9855. Schwartz. Production of an emulsion of silver phosphate.* April 27.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

9170. Cornaro. Manufacture of explosives. [Ital. Appl., April 21, 1906.]* April 19.

Complete Specifications Accepted.

9791 (1906). Vender. Making plastic horny explosives. May 1.

16,453 (1906). Stange. Manufacture of matches and igniting surfaces therefor. April 24.

16,882 (1906). Bichel. Production of a plastic explosive from trinitrotoluol. April 24.

22,783 (1906). Quinan. Drying guncotton, nitro cellulose, and similar bodies. April 24.

Journal of the Society of Chemical Industry.

No. 10, Vol. XXVI. MAY 31, 1907. No. 10, Vol. XXVI.

Official Notice.

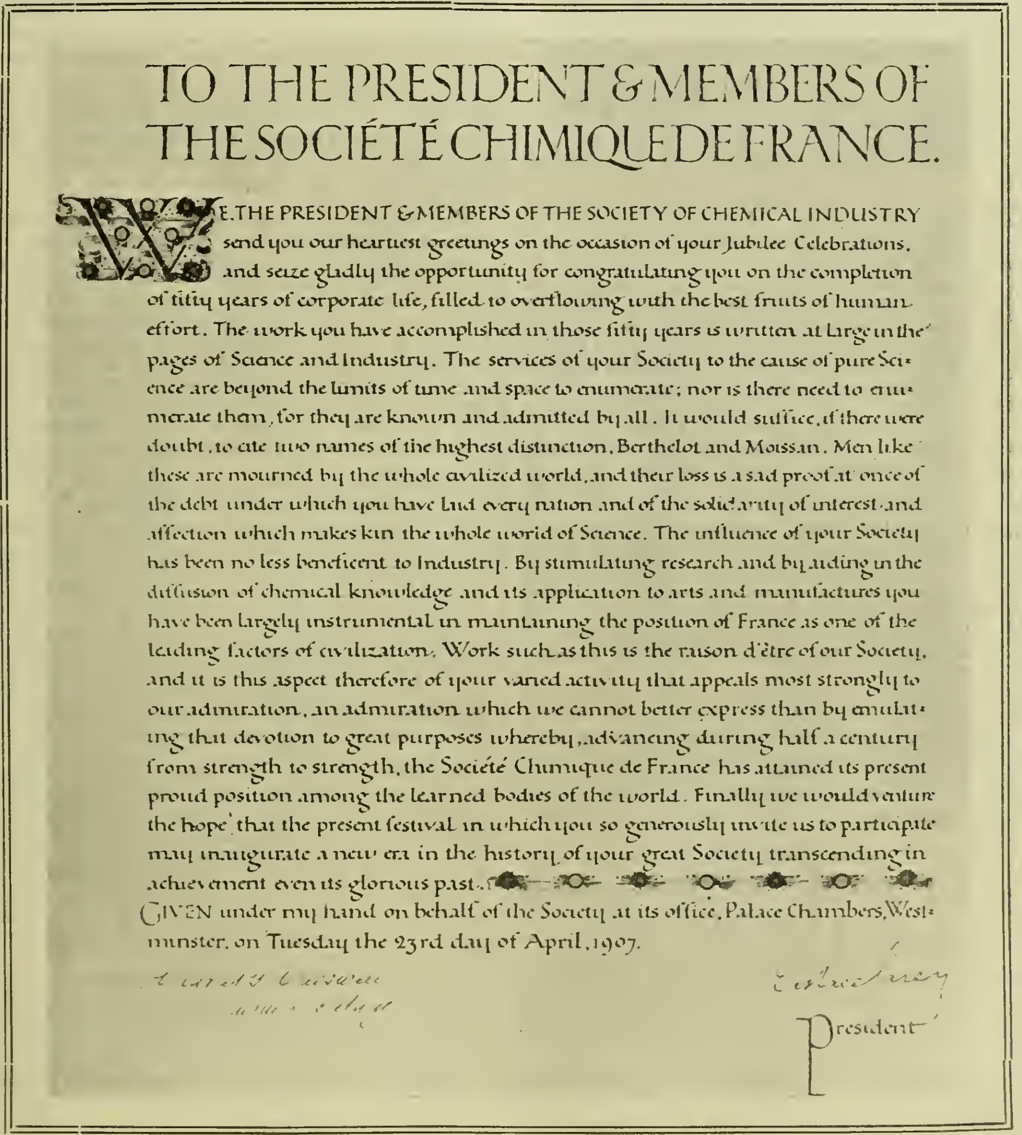
ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. A programme is contained in this number.

In accordance with the provisions of Rule 18 of the By-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir Boverton Redwood has been nominated to the office of President, under Rule 8; Prof. Percy Frankland, Prof. R. Meldola, and Mr. Walter F. Reid have been nominated Vice-Presidents under Rule 8; and Mr. Eustace Carey has been nominated a Vice-President under Rule 11. Prof. W. R. Hodgkinson has been nominated an ordinary member of Council under Rule 17; and the Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Dr. Charles A. Keane, Mr. C. T. Kingzett, Mr. F. H. Tate, and Dr. L. T. Thorne have been nominated, under Rule 18, to fill four vacancies among the ordinary members of Council. No ballot will be required.



TO THE PRESIDENT & MEMBERS OF THE SOCIÉTÉ CHIMIQUE DE FRANCE.

WE, THE PRESIDENT & MEMBERS OF THE SOCIETY OF CHEMICAL INDUSTRY send you our heartiest greetings on the occasion of your Jubilee Celebrations, and seize gladly the opportunity for congratulating you on the completion of fifty years of corporate life, filled to overflowing with the best fruits of human effort. The work you have accomplished in those fifty years is written at large in the pages of Science and Industry. The services of your Society to the cause of pure Science are beyond the limits of time and space to enumerate; nor is there need to enumerate them, for they are known and admitted by all. It would suffice, if there were doubt, to cite two names of the highest distinction, Berthelot and Moissan. Men like these are mourned by the whole civilized world, and their loss is a sad proof at once of the debt under which you have laid every nation and of the solidarity of interest and affection which makes kin the whole world of Science. The influence of your Society has been no less beneficent to Industry. By stimulating research and by aiding in the diffusion of chemical knowledge and its application to arts and manufactures you have been largely instrumental in maintaining the position of France as one of the leading factors of civilization. Work such as this is the raison d'être of our Society, and it is this aspect therefore of your varied activity that appeals most strongly to our admiration, an admiration which we cannot better express than by emulating that devotion to great purposes whereby, advancing during half a century from strength to strength, the Société Chimique de France has attained its present proud position among the learned bodies of the world. Finally we would venture the hope that the present festival in which you so generously invite us to participate may inaugurate a new era in the history of your great Society transcending in achievement even its glorious past.

GIVEN under my hand on behalf of the Society at its office, Palace Chambers, Westminster, on Tuesday the 23rd day of April, 1907.

President

JUBILEE OF THE SOCIÉTÉ CHIMIQUE DE FRANCE.

The proceedings to celebrate the 50th Anniversary of the founding of the Société Chimique de France took place in Paris, May 16th to 18th. Dr. J. Lewkowitsch, Dr. K. E. Markel, and Mr. Walter F. Reid, the delegates appointed by the Council to represent the Society of Chemical Industry on this occasion, in response to an invitation from their French colleagues, were most cordially received and presented an Address, of which the above is a copy. In return, the Council of the Société Chimique de France have sent to the Council of this Society a medal, struck in celebration of the event.

Liverpool Section.

Meeting held at the University on Wednesday, March 13, 1907.

DR. JAMES T. CONROY IN THE CHAIR.

SOME ANALYSES OF GENUINE JAMAICA RUMS.

BY W. COLLINGWOOD WILLIAMS, B.SC., F.I.C.

Having recently received direct from Jamaica a number of samples of rum produced on various estates in the Island, it appeared to me that the results of their analysis would be worth placing on record, especially as very few such analyses have been published hitherto. The samples were sent to me by Mr. Charles Allan, B.Sc., late Fermentation Chemist to the Sugar Experiment Station of the Jamaica Board of Agriculture, and their genuineness is authenticated by him. I am further indebted to Mr. Allan for information as to the process of manufacture, which I will briefly describe before discussing the analytical results.

Jamaica rums are broadly classified for trade purposes in two distinct groups, *viz.*, (*a*) "common clean," or ordinary drinking rum; (*b*) "flavoured" or "German" rum, used solely for blending.

The raw materials employed in making common clean rum consist of molasses, "skimmings," and "dunder." The first named needs no special description. "Skimmings" consist of the scum which rises during the boiling of the cane juice. Before use they are allowed to undergo acid fermentation, either alone or in presence of the crushed canes (or "trash"). "Dunder" is the spent wash from the stills. The unfermented wash when set up contains from 10 to 15 per cent. of sugars, and, owing to the use of the sour skimmings and dunder, a considerable amount of organic acids (principally acetic, propionic, butyric, and lactic) is also present.

Fermentation is very slow, occupying five or six days. Alcoholic fermentation results from the action of yeasts from the cane rind, but as fermentation proceeds acid-forming bacteria multiply at the expense of the yeasts, ultimately entirely supplanting them.

The still used in Jamaica is invariably of the pot-still type, heated sometimes by direct fire heat and in other cases by steam coils.

After leaving the still, the vapours pass through one or two rectifiers, which are charged with "low wines" and "high wines" respectively. Should there be only one rectifier, the high wines are returned to the still itself. The first portion of the distillate constitutes rum, and is of about 40° O.P. when collected. The second portion is the high wines (about 20° O.P.), and the final fraction, low wines.

In making flavoured or German rum, the same materials are used as in the case of common clean rum, with the addition of what is technically termed "acid" and "flavour." "*Acid*" is produced by fermenting cane juice and allowing it to acidify by standing in contact with cane trash and sludge from the fermenting vats. "*Flavour*" is prepared by fermenting cane juice in contact with cane trash, dunder sediment and sludge from the fermenting vats being added at various stages of the process. The fermentation of this product is largely anaërobic, and butyric acid is a characteristic ingredient.

The skimmings are also subjected to a preliminary fermentation in contact with cane trash, lasting some days, and the final fermentation after the wash is set up lasts 14 or 15 days. Distillation is then conducted as in the case of the common clean rum. The development of bacterial action, in addition to yeast fermentation, appears to be an essential feature of the manufacture of Jamaica rum, and the former is especially encouraged in making flavoured rums. In this respect the Jamaica process differs essentially from that employed in Demerara and Trinidad, whereby what is known commercially as "Demerara rum" is produced. In this case the fermentation is *rapid*, and due solely to yeast action, bacteria having no time to develop. The Demerara fermented wash is also in many cases distilled in patent stills, though by no means invariably so.

The Demerara process is undoubtedly better amenable to scientific control as an alcohol industry, but the product is much inferior to most rums of the Jamaica type. I shall recur to the analytical differences between Jamaica and Demerara rums at a later stage.

Analyses of the samples.—The alcoholic strength varied from 21° to 44° O.P., the majority lying between 35° and 43° O.P. Three of the samples (Nos. 9, 18, and 26) were uncoloured, and consequently practically devoid of solid matter. In the rest of the samples, the solids varied from 0·14 to 1·16 grms. per 100 c.c., the average being 0·4 for the whole series. The remaining items of the analyses are expressed as grms. per 100 litres of alcohol (*i.e.*, parts per 100,000), in terms of a typical compound of each class, in accordance with the usual practice.

In the "common clean" rums, total acidity (as acetic acid) varied from 30 to 155, with an average of 78·5, while volatile acidity varied from 21 to 146, averaging 61. In the "flavoured" rums, the acidity is rather higher, averaging 102·5 for total and 95·5 for volatile acid. The total acidity was determined by direct titration, volatile acidity by deducting the acidity of the dried solids from the total.

For the estimation of volatile esters, higher alcohols, furfural and aldehyde, the spirit was first diluted so as to contain about 50 per cent. alcohol by volume, and in the case of coloured samples 200 c.c. of the diluted spirit was distilled until 180 c.c. had passed over. The distillate was made up to 200 c.c., and the exact alcoholic strength taken. In the case of uncoloured samples, distillation was dispensed with, the analysis being at once proceeded with after ascertaining the exact strength of the diluted spirit. I have found by repeated trials on many occasions that the simple distillation of 9/10 is sufficient to bring over the whole of the volatile esters, higher alcohols, and furfural, and it is in my opinion both unnecessary and undesirable to complicate the analysis of spirits by employing more elaborate methods of distillation.

The volatile esters were estimated in the distillates by saponification with caustic soda in the usual manner, employing a soda solution of which 1 c.c. = 0·025 grm. of ethyl acetate. In the "common clean" rums the esters, expressed as ethyl acetate, were found to vary from 88 to 1058 grms. per 100 litres of alcohol, averaging 366·5. The sample No. 20, showing 88 parts, is quite exceptional, and this sample, as well as Nos. 4 and 12, were remarkably poor specimens of Jamaica rum, possessing but little of the characteristic aroma and flavour of that spirit. In the "flavoured" rums, the esters varied from 391 to 1204, with an average of 768·5.

The relatively high proportion of esters in Jamaica rum as compared with other spirits is due to the acidity of the fermented wash and of the "dunder" mixed therewith. The samples are tabulated in the order of their ester content. It is not suggested, however, that this is an absolute index of quality, though it appears to be the case that, broadly speaking, rums containing the higher proportions of esters command higher prices—provided of course that the esters have been produced in a legitimate manner.

The "higher alcohols" were estimated by the Allen Marquardt process, and are expressed in terms of amyl alcohol. The proportion found varied from 46 to 150 grms. per 100 litres of alcohol, with an average of 98·5 in the common clean rums; and from 80 to 144 with an average of 107 in the flavoured rums. This proportion is relatively low, being on an average less than half that usually present in pot-still whiskey.

Furfural and aldehyde were estimated colorimetrically by comparing the tints produced with aniline acetate and Gayon-Schiff reagent respectively, with standard solutions of furfural and aldehyde in 50 per cent. alcohol. The proportions found were extremely variable, and it does not seem possible to base any very definite general conclusions upon them; but a high figure for aldehyde seems often to be associated with a less satisfactory rum. For example, samples 15, 16, and 17 are, in my judgment, not worthy of the relatively high position they occupy in the classification on the ester basis; while, conversely, Nos. 5 and 13 are, in my opinion, better rums than the ester value, taken alone, would indicate.

From the description of the manufacture already given, it will be gathered that the term "flavoured," as applied to Jamaica rum, does not imply that any flavouring material is added, but merely that a special method of fermentation is employed with a view to the development of flavour in the finished product. Haphazard as the process is, it is not surprising that the desired result does not seem to be attained with certainty, and as a matter of fact there appears to be no hard and fast distinction between the two classes.

Both in chemical composition and in strength and quality of flavour, I find they overlap—the best samples of "common clean" of this series being, in my opinion, superior to some of the "flavoured" rums. As already mentioned, the flavoured rums are not used for drinking as such. They command a relatively high price, and are mainly exported to Germany (hence the name German rum), where they are used for flavouring neutral spirit in imitation of genuine Jamaica rum.

I have already referred to Demerara rum. This article, produced as it is by the distillation of fermented cane molasses, is undoubtedly entitled to the name of rum, but is of relatively poor quality and considerably cheaper than Jamaica rum.

A few samples of Demerara rum from bond which I examined a year or two ago gave the results set out in Table C, and, from a detailed report by Prof. Harrison, of Demerara, published in 1904, I find that he gives the mean proportion of esters in Demerara rum as 70 parts per 100,000 of alcohol for vat stills, and 45 parts for continuous stills.

In Demerara rum it appears that one has a most suitable material for blending with flavoured Jamaica rum. The former, though approaching plain spirit in many cases, is of a clean and wholesome type, and is prepared from a legitimate source of rum in a British Colony. In order to give Demerara rum the character which it lacks, flavoured Jamaica rum is the very thing required, and it would seem preferable that such an employment should be found for it rather than that it should be sent to Hamburg to flavour potato or beet spirit, and thus illegitimately compete with the Jamaica planters in their own market.

In conclusion I desire to express my thanks to Messrs. W. H. Roberts, E. G. Jones, E. Garratt, and H. E. Gresham for their assistance in connection with the analytical work described in this paper.

TABLE A.—"*Common Clean*" *Rums.*

Reference No.	Alcoholic strength (per cent. by vol.).	Total solids (grms. per 100 c.c.).	Grms. per 100 litres of alcohol.					
			Total acids (as acetic).	Volatile acids (as acetic).	Esters (as ethyl acetate).	Higher alcohols (as amylic).	Furfural.	Aldehydes.
21	80·4	0·43	83	75	1058	—	3·6	12·5
10	82·1	0·38	77	74	565	106	3·5	7·5
3	79·4	0·36	88	76	557	82	1·8	7·5
16	80·2	0·88	78	52	516	110	6·0	15·0
9	82·0	0·01	55	55	480	79	7·0	5·0
17	81·7	0·52	51	38	388	100	4·5	17·5
15	78·3	0·14	130	76	372	150	4·5	18·0
2	78·2	0·19	70	55	370	79	3·3	9·0
14	78·8	0·34	81	72	355	145	2·3	12·5
19	76·5	0·64	80	61	351	79	4·0	17·5
6	78·8	0·25	30	21	332	147	1·0	20·0
18	79·3	0·02	41	41	321	73	4·5	6·0
11	81·3	0·48	82	60	308	89	9·0	20·0
7	79·5	0·60	82	63	303	122	2·7	25·0
13	77·5	0·21	155	146	297	70	3·7	10·0
8	81·8	0·38	59	46	266	128	11·5	20·0
5	80·4	0·39	90	62	216	62	6·3	15·0
12	79·9	0·20	110	56	211	107	3·2	25·0
4	78·6	0·34	76	61	181	46	4·6	30·0
28	78·7	0·43	76	61	164	—	—	—
20	68·6	1·16	47	27	88	—	—	—
Average ...	79·1	0·43	78·5	61	366·5	98·5	4·5	15·3
Maximum	82·1	1·16	155	146	1058	150	11·5	30·0
Minimum	68·6	0·01	30	21	88	46	1·0	5·0

TABLE B.—"*Flavoured*" *Rums.*

Reference No.	Alcoholic strength (per cent. by vol.).	Total solids (grms. per 100 c.c.).	Grms. per 100 litres of alcohol.					
			Total acids (as acetic).	Volatile acids (as acetic).	Esters (as ethyl acetate).	Higher alcohols (as amylic).	Furfural.	Aldehydes.
1	79·5	0·26	133	122	1204	124	2·9	13·0
25	77·3	0·29	145	137	981	—	—	—
26	66·1	none	109	109	866	103	4·1	—
23	77·7	0·22	104	93	787	80	2·7	17·5
22	80·6	0·22	45	39	599	144	4·5	37·5
24	79·9	0·61	127	116	552	83	12·0	15·0
27	80·0	0·55	55	53	391	—	—	—
Average ...	77·3	0·31	102·5	95·5	768·5	107	5·2	20·7
Maximum	80·6	0·61	145	137	1204	144	12·0	37·5
Minimum	66·1	none	45	39	391	80	2·7	13

TABLE C.—*Demerara Rums.*

Reference No.	Grms. per 100 litres of alcohol.			
	Total acids (as acetic).	Volatile acids (as acetic).	Esters (as ethyl acetate).	Furfural.
1	121	75	53	2·7
2	123	71	48	1·6
3	71	34	37	0·6
4	75	33	96	2·6
Prof. Harrison's Report—				
Vat stills (average)	—	33·1	69·9	—
Continuous do. (average)......	—	18·4	44·9	—

DISCUSSION.

The CHAIRMAN said that it was satisfactory to learn that Mr. Williams was able to trace a connection between his figures and the qualities and values of the various samples. He had not said, however, whether he was able to trace any connection between rums of low acidity and ester values and individual factories. Did any given factory produce a particular grade of rum, or was it more or less chance whether a high or a low grade product appeared? Had Mr. Williams any information on that point?

Professor DONNAN thought the existence of a bacterium in rum of considerable alcoholic strength had been recently investigated. Did the author think it would be possible in the case of a liquid so rich in alcohol?

Mr. COLLINGWOOD WILLIAMS said that he thought the actual production of the esters would occur almost entirely after the heat was applied to the stills. The nature of the esters was a very interesting question, but one that could be determined only if sufficient material were at command. The highest of the figures for the flavoured rums would represent about 1 per cent. of esters in the sample. The amount is not large absolutely, and when one had only small quantities of material to deal with, one could not conduct a very extended investigation into the nature of the actual bodies themselves. He had, however, ascertained the mean combining weights of the acids combined as esters in four of the samples and had obtained the following results:—

No. 1, 66; No. 9, 71; No. 18, 69; No. 22, 68; in all cases indicating that the esters were not merely ethyl acetate. From the flavour and aroma there was no doubt that esters of the higher fatty acids were present.

As to the possibility of any bacillus living in the rum itself, he did not think that anything happened to the rum from bacterial action after it was once distilled.

No doubt by the addition of suitable cultures to the unfermented wash, rums of different flavours might be produced almost at will, but he was quite certain that the Jamaica planter had not reached that stage. It seemed that some estates can make these flavoured rums, while others cannot. Judging from the descriptions, a very complex mixture of organisms must exist in the fermentation stages, and it was quite impossible to say what particular bacillus produced the observed results. *Bacillus butyricus* and allied forms producing butyric acid certainly existed in the tanks and cisterns, and were especially found in the material used in making flavoured rum.

The question of the chairman as to the variations on the estates was sufficiently answered by the enormous variation in the figures obtained. The planters were only beginning to learn how to control their manufacture. A great deal remained to be done, and no doubt could be done by careful supervision.

TREATMENT OF THE PAN SCALE OF SALT PANS, AND OF ITS PRODUCTS.

BY FRED BALE.

The subject is one of some importance to the salt-making industries of this country, and relates to recent improvements in the treatment of the pan-scale of salt pans and of its products, whereby the salt in the scale, which is now mostly thrown away, is recovered, its gypsum converted into excellent plaster, and other important economies effected, not the least of which will be the abolition of the present process of "picking" in most works.

This pan-scale varies somewhat in composition, and at Droitwich consists approximately of 88 per cent. of common salt, 10 per cent. of gypsum, and 2 per cent. of the sulphates of sodium and magnesium. The quantity of this scale formed in salt works is considerable, and although it varies slightly at different works, it is approximately 3/44ths of the fine and broad salt manufactured, or about 100,000 tons per year in the United Kingdom. Its presence in the salt pan is a difficulty, as it forms a hard coherent mass on the pan's pottom, and interferes considerably with the passage of heat into the superincumbent brine, and causes the pan to be overheated and often burnt.

This scale is now removed from the pan at intervals by the process known as "picking." Two buckets are floated upon the hot brine, and into these the workman, stripped to the waist, steps, pick in hand, and shuffles through the pan, digging at the scale to loosen its hold on the pan's bottom, while another workman, with a long iron lever, prizes it up, and a third rakes it to the side and removes it from the pan. It is then stacked in the yard where, by exposure to the air and rain for the greater part of the year, much of it is lost. In the Worcestershire salt districts much of it is ground up for agricultural purposes. In the North, and elsewhere, most of it is thrown away, or carted away as useless.

In this process of "picking," the destructive action of the pick upon the pan and its brickwork is considerable. Where the brine is confined between the scale and the pan's bottom, the force of the blow delivered by the pick upon the scale causes the iron plates of the pan to be twisted and bent before the scale gives way. This process, not without danger to the workman, also increases the amount of iron rust in the salt pan.

It has been found that if the fine salt scale is boiled with four times its weight of water, or with this amount of water mixed with a certain amount of brine, its dissolution is completely effected, leaving a saturated solution of salt and a deposit of gypsum, of the consistency of mud.

The simplest process is to effect the dissolution of the fine salt-scale in its own pan, without breaking it up.

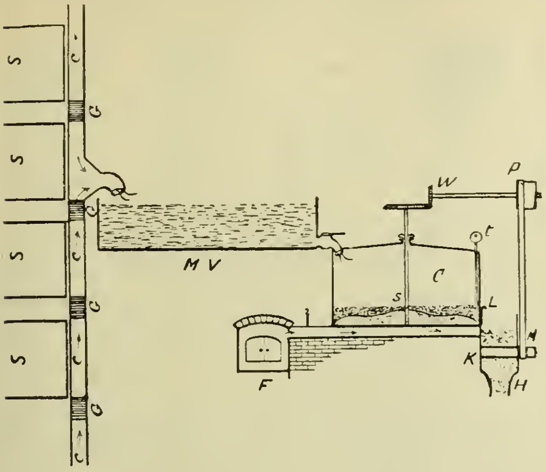
If too much scale is treated at a time there is a difficulty in removing readily the precipitated gypsum mud, but if the dissolution of the scale is effected twice per week about 2 tons of scale will be the quantity dealt with at a time. The brine is then evaporated down to a height of about 3 in. in the pan and the salt removed. Four inches of water are then run rapidly into the pan (1 in. weighing 2 tons in the Worcestershire salt pans). This amount of water is sufficient for the dissolution of all fine salt scale, containing from 5 to 10 per cent. of gypsum, whether the scale is broken up or not. While the water is running into the pan the scale in those parts of the pan where the liquor does not boil is broken up and removed down to the boiling area of the pan, as described in my Patent Specification No. 10,722 of 1905 (this J., 1906, 315). After the removal of the gypsum sludge the brine is again admitted to the pan, and the working continued as usual.

The plant necessary for carrying out this first part of the process is already at most of the salt works.

On account of its hardness and high percentage of gypsum, the broad salt scale is best treated outside its pan. It is ground to powder, washed with water, the solution of salt run off, and the gypsum mud treated as hereafter described for plaster.

For carrying out the second part of this process, for the conversion of the gypsum mud into plaster, all that is required is to dry and heat the mud to about 200° C.

The mud from the salt-pans, S, S, S, is thrown upon the grating in the catchpit, G, and washed through the conduit, C, C, C, leading to the mud vat, M V. Here it is drawn off, as required, to the converter, C, allowed to settle, and its water syphoned off, and then dried and



heated, when it becomes friable. The sluice, L, is then opened, the scraper, S, set in motion, and the plaster worked out into the pocket, K, where it is ground by the mill, M, and passes out by the hopper, H, as the finished product. A new and paying industry will thus be added to the salt manufacture. Between 8 and 9,000 tons per year could be manufactured in the United Kingdom, at a cost in labour and fuel of about 1d. per cwt.

Products.	Stoke works.	(Tons per year).	United Kingdom (per year).
Salt (fine and broad)	1. Fine salt = 70,000 2. Broad salt = 40,000	110,000	Do. 1,466,000
Scale	1. Fine salt scale $\frac{1}{10} \times 70,000 = 7,000$ 2. Broad salt scale $= \frac{1}{80} \times 40,000 = 500$	7,500	Do. 100,000 (most of which is now thrown away).
Gypsum	1. From the fine salt scale $= \frac{1}{20} \times 7,000 = 350$ 2. From the broad salt scale $= \frac{80}{100} \times 500 = 400$	750	Do. 10,000
Salt recovered from scale....	—	6,750	Do. 90,000
Plaster produced	$= \frac{4}{5}$ the gypsum	600	Do. 8,000

From the above table it appears, that at any salt works the approximate amounts of scale produced is 3/44ths; the salt recovered from the scale is 1/16th; the gypsum is 1/146th; and the plaster producible is 1/183rd of the amount of fine and broad salt, made at any salt works.

At the present prices of coal, salt, and plaster, the cost of treating 1 ton of scale containing 10 per cent. of gypsum for recovering its salt and converting its gypsum into plaster, works out at 10s. 6d., on the assumption that 9s. is the cost of making 1 ton of salt from brine, and the value of these products from 1 ton of scale will be 18 cwt. of salt at 1s., and 1⅗ cwt. of plaster at 2s. = 21s. 2d., or a gain of 10s. 8d. per ton of scale treated.

There will also be a saving in pan-smithing and repairs to pans of about 2s. 6d. per ton of scale treated; the time spent in picking and repairs to pans will be saved; the production of rust in the pan considerably reduced; the cost of carting away the scale saved; and the uneven and irregular character of the pan's bottom, through "picking," will disappear.

Discussion.

The **Chairman** said that as so much of the profit mentioned would depend on the quality of the plaster of Paris obtained, he would like to know whether it was pure white in colour, or otherwise suitable for its intended use.

Prof. F. G. **Donnan** asked how much water of crystallisation the deposited sulphate of lime contained? He suggested that some of the difficulties might be due to the fact that the substance deposited was not gypsum, but the hemihydrate.

Mr. **Verdin-Cooke** asked at what period the solution of the scale takes place. He understood the author to say that he ran the brine down to a few inches, and then ran in fresh water, and again boiled.

Mr. W. **Roscoe Hardwick** said that the matter which Mr. Bale had brought before them was of interest in all manufacturing processes where a deposition of gypsum caused an insulation of heat. Generally speaking, gypsum was more soluble at high temperatures than at lower temperatures. Consequently, this hard scale of which Mr. Bale had spoken had probably been formed by a saturated solution at a comparatively low temperature, impinging momentarily on the heating surface at a much higher temperature. If this were not so, and the deposition occurred from all parts of the liquid, the deposit would be of a softer nature. In the vacuum pan of a sugar refinery one always found any deposition of gypsum to occur on the worms (the source of heat), and not on the bottom of the pan.

Mr. **Bale** said that the plaster produced was beautifully white, and it contained less than 1 per cent. of common salt when made by the process which he had described. It set very hard. He found no sodium sulphate in it after washing. The lower temperature at which the brine was evaporated, the larger the crystals of salt, and it was necessary to have slower evaporation to produce the large crystals. The broad salt scale formed a very small quantity indeed, compared with the fine salt scale. It was only about a fifteenth of the fine salt scale, or one-eightieth of the broad salt made in the Worcestershire district. The dissolution of the scale did not take place at all in cold water, otherwise most of the scales exposed to the rain and air would disappear altogether. Only when the scale was boiled dissolution was effected, and the more rapid the boiling, the quicker the dissolution. He could not answer Prof. Donnan's question as to whether the deposit was gypsum or the hemihydrate.

Manchester Section.

Meeting held at Manchester on Friday, February 8th, 1907.

DR. G. H. BAILEY IN THE CHAIR.

THE EXAMINATION OF COMMERCIAL STARCHES.

BY W. F. A. ERMEN, M.A.

The usual method adopted for the comparison of starches is to boil equal weights of each of the samples to be compared, with equal volumes of water, and, after cooling, to grade the resulting pastes according to the stiffness, as determined by the sense of touch. As the tactile sense is not always very reliable, I endeavoured to find some means of expressing the stiffness of the pastes numerically, and at the same time to standardise the conditions under which the pastes should be made.

Pastes were made by mixing 10 grms. of starch with 25 c.c. of water, and 75 c.c. of boiling water stirred in. I attempted to measure the stiffness by running mercury in a fine stream into a vessel supported by a disc resting on the surface of the paste, but the results were very unsatisfactory. As the concentration of the paste is reduced, it gradually assumes the consistency of a fluid, and will no longer support any weight, if care be taken to prevent the formation of a skin on the surface while cooling.

Measurements of the viscosity of such weaker starch solutions seemed to offer a solution of the difficulty. The most regular results were obtained, not by pouring boiling water on to the starch cream, but by pouring the starch suspended in 25 c.c. of cold water into 225 c.c. of boiling water, and removing the flame after further heating the solution for a definite period, usually until the solution had come to the boil again, and boiled for one minute. The solution thus made was poured into a stoppered bottle and allowed to stand over night.

At first sight this process looked promising. A number of solutions were prepared from the same sample of starch, the viscosities determined in a Redwood viscometer, and the results plotted to a curve.

Whilst the weight of starch (farina) in 250 c.c. of solution varied from 1 grm. to 2·5 grms., the curve was quite regular. With solutions of higher concentration this was no longer the case. A solution containing 2·8 grms. gave 140 seconds for the first determination. When the same solution was returned to the apparatus, 50 c.c. ran through in 133 seconds, the next time in 129 seconds, and even after 10 trials the viscosity was still falling (Fig. 1). These boiled solutions are very sensitive to a rise in temperature, as is shown by the next diagram (Fig. 2). The curves show the effect of a rise in the temperature of two usable solutions, and of two which gave a variable viscosity (Fig. 3). The variability disappears above a certain temperature which is peculiar to each strength of solution. More extended experiments showed that these boiled solutions are liable to give variable results even when the tests are carried through with the greatest care. It is not possible to pour out the same amount of the cold starch suspensions every time, and there is also a tendency to the formation of solid films of starch in the boiling beaker, which block up the viscometer. Also the size of the gas flame used and the shape and thickness of the beaker affect the results, and thus no conclusions as to the comparative value of two starches can be based on this method. Solutions of starch made in the cold with the help of caustic soda are free from the many causes of variation inherent in the boiling method. The process I employ is as follows:—230 c.c. of cold water are placed in a washbottle, and the weighed quantity of starch is washed with this water into a 250 c.c. graduated flask, and shaken till an even suspension results.

Fifteen c.c. of a 10 per cent. solution of caustic soda are then quickly run in from a burette, the flask filled with cold water up to the mark, and shaken continuously till the solution begins to thicken. The solution is generally ready for use in a couple of hours, but it is safer to let it stand till next morning, after which interval I have found that all starches have reached a stationary condition. A large number of experiments have shown that this method gives concordant results with the same starch, whilst different starches, and different brands of the same kind of starch, are easily differentiated (Figs. 4, 5, 6).

The points to be observed in making the solutions are:—

1. The volumes of water and of the caustic soda solution used must be accurately measured.

2. The strength of the caustic solution used must always be the same, and must be determined by titration, as very small differences in the strength seriously affect the results.

3. Solutions to be compared must be at the same temperature.

I do not mean by this that the amounts given above are the only ones yielding correct results, but that the same amounts must always be used throughout one series of experiments, in order to obtain comparable results.

There are two rather interesting properties of these solutions which I may be allowed to mention. A solution obtained by diluting a stronger one has a much lower viscosity than one made up directly at the lower strength.

The table gives in the second column the viscosity of five solutions of farina made up to contain from 1 to 5 grms. in 250 c.c. The fourth column shows the viscosity of some of these same solutions after being diluted by the addition of water only, so as to contain the amounts of farina in 250 c.c. given in the third column.

Thus, a solution containing 5 grms. of farina in 250 c.c. has a viscosity of 1345 seconds; 225 c.c. of this solution, diluted with 25 c.c. of water, so as to contain 4·5 grms. in 250 c.c., has a viscosity of only 195, which is about the viscosity of a solution of half the strength made up directly.

When a solution is warmed, its viscosity falls regularly, but does not rise again on cooling.

Influence of dilution on viscosity.

Grms. of farina in 250 c.c. solution.	Viscosity.		Dilution (in grms. per 250 c.c.)	Viscosity of diluted solution.	
	min.	secs.		min.	secs.
5	22	25	5 to 4·5	3	15
4	11	52	—	—	
3	4	26	—	—	
2	1	35	3 to 2·5	1	27
1		38	4 to 2	1	30

Influence of heating on viscosity.

Grms. of farina in 250 c.c.	Viscosity at				After cooling to 18° C.
	18° C.		55° C.	85° C.	
	min.	secs.	min.	secs.	secs.
2·5	2	52	1	30	32

In the above notes I have not touched upon the relation between the stiffness of starch pastes made by boiling and the viscosities of my solutions in alkali. Neither have I as yet worked out the connection between the viscosity and sizing properties of starch solutions. I hope to make these points the subject of a communication at some future date.

DISCUSSION.

The CHAIRMAN said Mr. Ermen's contribution had given them the means of comparing the values of these different starches, but he should like to know if there was any saving of time effected as compared with a microscopical examination. Probably, as a quantitative method, it might be found extremely useful. Something might be deduced from this work with regard to the nature of the physical changes taking place in the same starch, and it might be worth while to follow up the experiments from that point of view.

Dr. G. J. FOWLER said the method might show different results if a certain amount of hydrolysis had taken place in the starch. He had noticed, when working in Calcutta, that starch solution for titration purposes had to be made up fresh every few hours, and he would like to know whether Mr. Ermen's method might not be liable to error under similar conditions.

Mr. JULIUS HÜBNER said that the author had pointed out that the temperature should be kept constant. Had slight differences in the temperatures of the pastes a marked effect in the viscosity?

Mr. ERMEN said he had not used the microscope in connection with these tests, but in the case of farinas which he had examined under the microscope, he had not found much difference. Two mixtures of similar starches would be very difficult to differentiate under the microscope. With regard to the permanence of starches, his general practice was to make them up in the afternoon and let them stand over-night. They remained reliable for several days. If the solutions were heated, and then allowed to cool, it was found that the viscosity fell regularly as the temperature rose, but did not recover with the fall of temperature, remaining very nearly at the value obtained at about 80° C. He had not yet investigated the change which had taken place. In reply to Mr. Hübner, the two curves (Diagrams 2 and 3) showed the effect on the viscosity produced by such small changes. The change was not very serious, but the temperature was observed during the whole of the time, and kept within 1° C. Diagram No. 3 showed the rather peculiar effect when higher concentrations were reached. In testing the solutions, the viscosity could not be got constant. The viscosity at ordinary temperature, at a concentration of 2·8 grms. per 250 c.c., was 112 seconds. If the same liquor were put through the viscometer again, the viscosity was found to have fallen, and this fall continued as often as the test was repeated, till it reached a value of 105 seconds. As the temperature of the liquor was raised, the extent of this variability gradually diminished, until at a certain temperature it disappeared. He had tried to show this effect by the thickened tops of the curves.

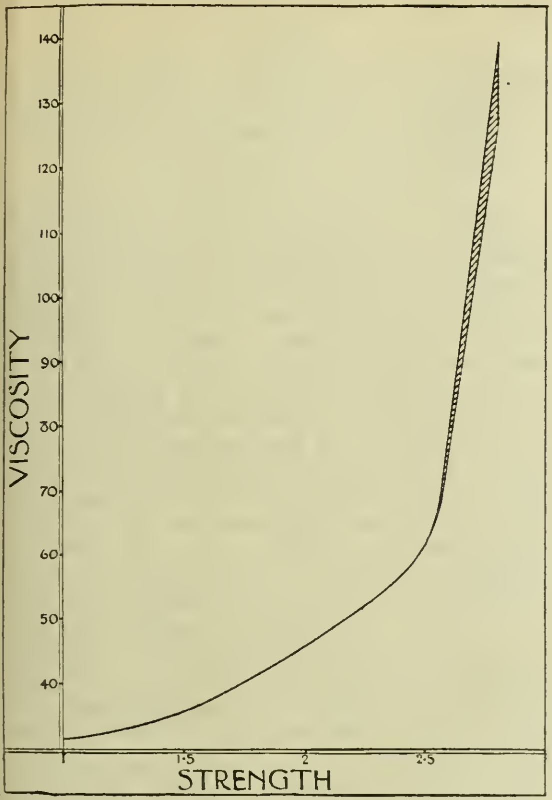


FIG. 1.—*Farina curve.*

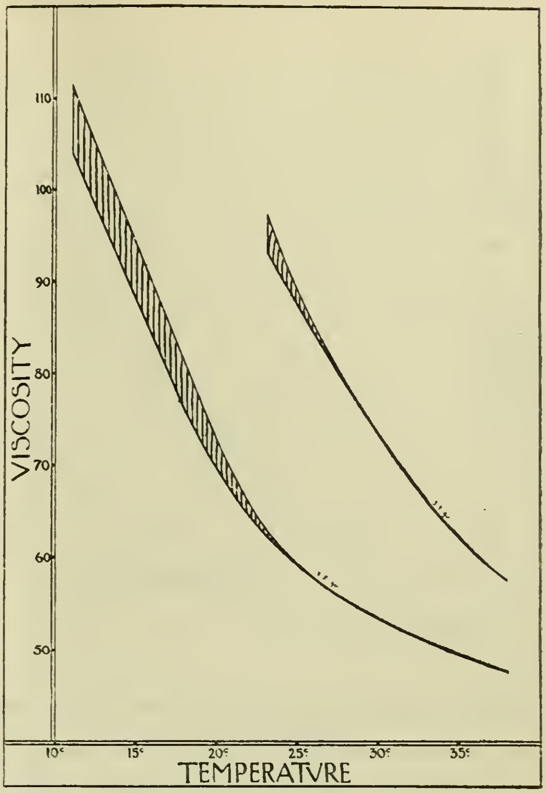


FIG. 3.—*Effect of temperature on viscosity.*

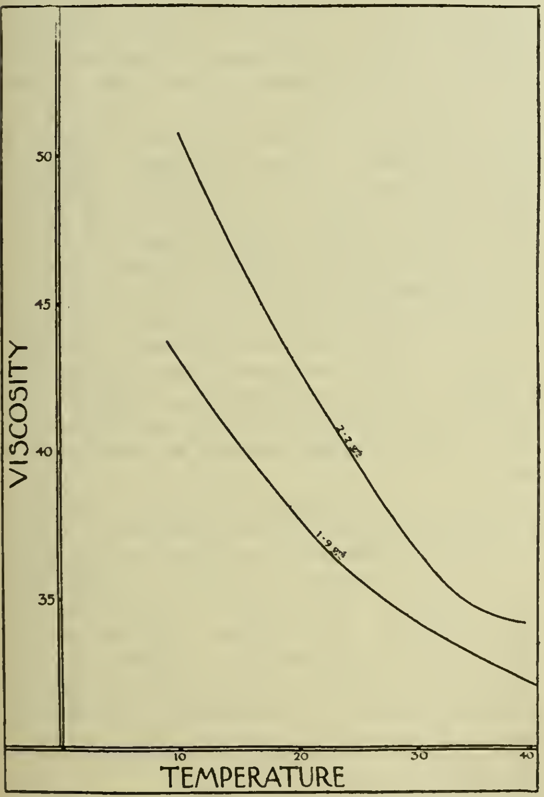


FIG. 2.—*Effect of temperature on viscosity.*

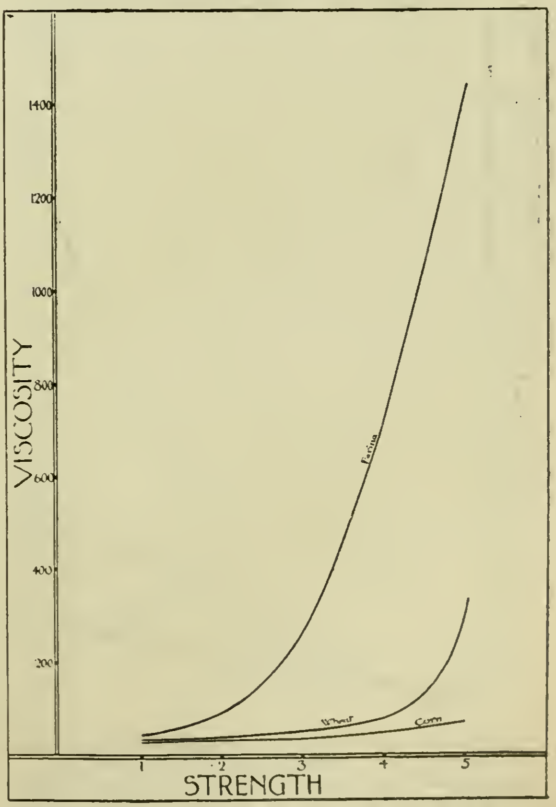


FIG. 4.—*Farina B. K. M. F., wheat starch, corn starch.*

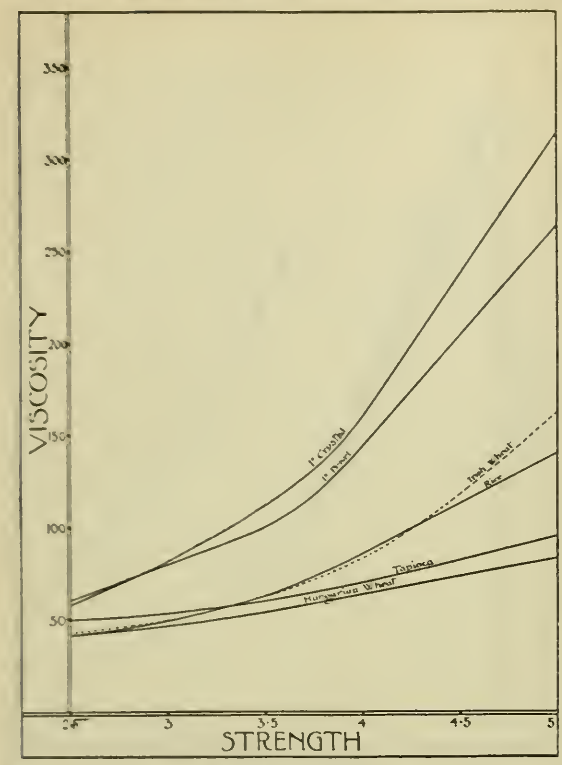


FIG. 5.—*Corn starch, rice flour, tapioca flour, wheat starch.*

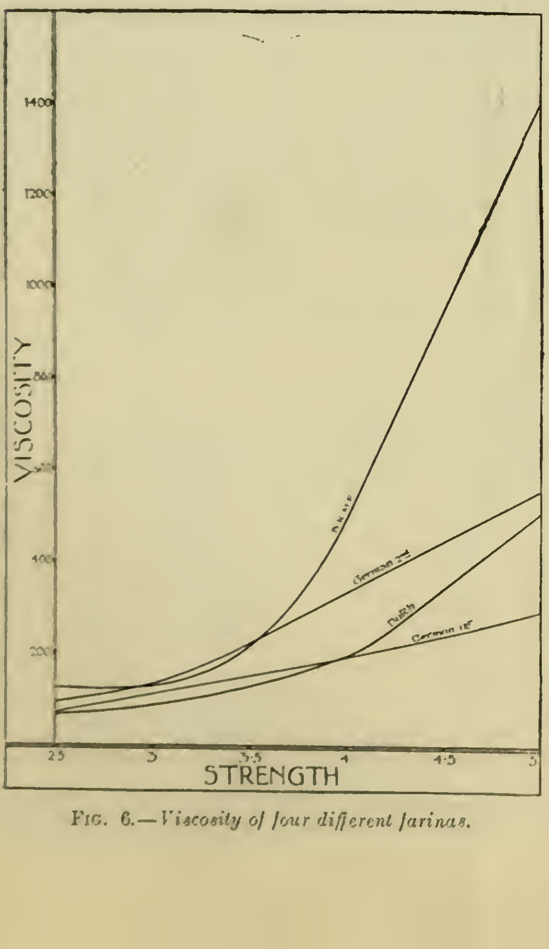


FIG. 6.—*Viscosity of four different farinas.*

Meeting held at Manchester on Friday, April 5, 1907.

DR. G. H. BAILEY IN THE CHAIR.

THE INFLUENCE OF PHYSICAL CONDITION AND CHEMICAL COMPOSITION OF COMMERCIAL LEAD ON ITS DURABILITY FOR PAN-CONCENTRATION OF SULPHURIC ACID.

BY WM. BEAMONT HART, F.I.C.

Lead is used in a variety of ways in the construction of apparatus for chemical manufacturing operations, and especially as such for sulphuric acid production. In the concentration of this acid to 1·760 sp. gr., the manufacturer is practically confined to the use of lead pans, which are generally fired by under-heat and protected below by tiles or iron plates according to their use, singly or in series, and, in the latter case, according to position as strong or weak pan. In some instances a copper sheet is used, or has been advocated, between the lead and the iron plates, for better conduction and equalisation of the heat. As is well known, these pans sooner or later need renewal; in certain cases, through bad setting, over-firing, or bad management generally, renewal is required oftener, but in such examples the cause is readily understood. On the other hand, there are cases where no definite reasons can be assigned, but from some cause very indistinctly understood, the pan, in the language of the workman, "goes milky" or "breaks down"; no fault can be found in its construction, nor in the working of the pan as regards temperature and strength of the acid contained, these latter being below the factor of safety. The melting point of lead is 326° C., whilst acid of 1·755 sp. gr. has a boiling point of only 218° C., but, as a matter of fact, the temperature of well-managed pans never exceeds 200° C., so that the factor of safety may be considered a fair one.

The conditions, as regards strength and temperature of acid, under which the "break-down" occurs, may vary, but from observations taken at the time, this sudden action generally occurs when the acid has reached a strength of 1·650 to 1·675 sp. gr., and at a temperature a little below the boiling point of such acid. In some few instances, leakage has occurred even when the concentration has attained 1·630 sp. gr. only, after constant use for a long period.

The course of a "break down" varies; sometimes the pan becomes "milky" with violent action, evolution of hydrogen sulphide, sometimes accompanied by sulphur dioxide, and production of lead sulphate in quantity; leakage occurs according to the extent of the action. In other cases the action is slow, and is only recognised by pan leakage, neither hydrogen sulphide nor sulphur dioxide being evolved in appreciable amount.

On examining the pan, the extent and character of the destructive action is also seen to vary. Occasionally the whole of the pan covered by acid has been evenly affected; in other cases the action has been confined to patches or local areas, more or less in holes, whilst here again a difference can be noted. In some, the holes produced are of countersunk shape, with irregular walls; others show the peculiarity of regular and vertical periphery, as though the lead had been cut through with a sharp tool.

Some few years ago, a quality of lead made from a non-argentiferous Derbyshire ore was used with great success in this district; pans stood remarkably well for a long period and wore evenly, but after a time this brand was quite as untrustworthy as others; for draught-pipe use in connection with the platinum pan hoods, it was equally unreliable. Experimentally, a piece of this same lead was placed in the shoot from the strong lead pan to the platinum pans, and here a striking action was observed. At one moment the lead appeared dark, then white, again dark, these changes taking place in rapid succession, probably due to formation of lead sulphide, with rapid conversion into sulphate, which dissolved in the hot acid or was washed away, these reactions then proceeding *de novo*.

Small-scale trials of lead for such and similar use have repeatedly been made by treating the lead with cold strong sulphuric acid and observing the evolution of gas therefrom, or by determination of loss of lead thereby, but such trials are worthless for the purpose. Even laboratory trials, under conditions as near as possible to those that obtain under pan concentration, in most cases give misleading results, and probably for two reasons, *viz.:* (1) A small piece of lead cannot be representative of the whole sheet, in which subsequent local destructive action takes place in actual use; and (2) the action of mass cannot be imitated, since in practice, the quantity of acid and the lead in contact with it are far larger, and thus the possibility of the initial start of this sudden action is far greater than in small-scale trials on the same materials. At some works, when such trouble has repeatedly occurred, practical trials have been made of three or four pans, each constructed of lead supplied by a different manufacturer, so as to obtain a satisfactory brand of lead. On these results, under actual working conditions, a certain lead has been chosen. Many analyses of pan-lead have been made, generally after break-downs, but only in a few instances have any direct results been obtained that point to the actual cause. Such analysis requires care and attention, and even in the hands of outside experts the results are often very unsatisfactory from the manufacturer's point of view, as will be seen from the following analysis: Lead, 99·84 per cent.; iron, 0·03 per cent.; zinc, traces; antimony, traces; silver, 0·0015 per cent.; loss, 0·1285 per cent. It may be fairly safely concluded that such an analysis, where 80 per cent. of the impurity is regarded as loss, was absolutely useless.

By practical trials, a firm in Manchester succeeded in obtaining a good quality of lead, and work proceeded evenly and regularly for a long time, when again the trouble asserted itself. In a set of pans in connection with the platinum rectifying plant, the strong lead pan was quite new, the lead supplied being stated to be specially-prepared Pattinson lead, thrice through the refining pots. The pan was set, as usual, on 6-in. tiles, when, within five days of the start, without any known cause and without any observed evolution of gas, the pan started to leak, its contents became "milky," and a gradual slow action was observed. From the run-off a large sample of the pan-contents was obtained, of a grey-white colour with darker particles among it. On cleaning out the pan the chief action seemed to have been confined to three areas at the side further away from the fire, the "scoring" action at these places increasing from a periphery of an area of about 18 ins., in a downward direction, to a central point or series of points where holes occurred.

This seemed to me to present an opportunity of investigating, from another point of view—by the examination of pan-contents—the impurities in the lead, and of comparing the result with that obtained from the examination of the lead near the area of action. Certain difficulties would arise, but it seemed reasonable to believe that some minimum percentage composition of the impurities would be obtained. A careful analysis of 400 grms. of this sample was made, from which result the composition of the liquid and solid portions were then calculated, the impurities being regarded as soluble. The liquid portion consisted of sulphuric acid, H_2SO_4, 63·8790 per cent.; antimony, traces; arsenic, 0·0064 per cent.; bismuth, 0·2247 per cent.; cadmium, 0·0010 per cent.; copper, 0·0941 per cent.; iron, 0·0256 per cent.; lead, 0·0031 per cent.; silver, 0·0471 per cent.; tin, traces; zinc, 0·0759 per cent.; water (by difference), 35·6431 per cent. The specific gravity of the liquid was 1·551 at 15° C., whilst a sample taken from the pan an hour or so before was 1·630 sp. gr.

The solid portion consisted of lead sulphate, 99·822 per cent.; lead sulphide, 0·104 per cent.; and free sulphur, 0·072 per cent. As a fair quantity of the acid in the pan had been lost by leakage, the amount of this acid in the pan, at the time the sample was taken, may be taken as 2325 lb. as a minimum, and as the weight of the lead pan was 4200 lb. we can now calculate out the *minimum average* percentage composition of the original lead, which works out as follows: Antimony, traces; arsenic, 0·0035 per cent.; bismuth, 0·1250 per cent.; cadmium, 0·0005 per cent.; copper, 0·0523 per cent.; iron, 0·0142 per cent.; silver, 0·0262 per cent.; tin, traces; zinc, 0·0422 per cent.; and lead (by difference), 99·7361 per cent. Exception may be taken to this method of arriving at the composition of the lead, since it may be urged that these impurities may be present in the original acid. This may be true to a very slight extent, but it must be remembered that most of the possible metallic impurities carried over from the kilns are deposited in the dust chambers or washed out by passage of the kiln gases through the Glover tower. Further, this acid, previous to concentration, has all passed through the de-arsenication plant, so that of all metals, only traces of iron and zinc could possibly remain in the acid.

An analysis of 300 grms. of drillings, taken from the lead near the area of damage, gave the following result:—Antimony, traces; arsenic, traces; bismuth, 0·0030 per cent.; cadmium, traces; copper, 0·0014 per cent.; iron, 0·0021 per cent.; silver, 0·0003 per cent.; tin, traces; zinc, 0·0031 per cent.; lead (by difference), 99·9902 per cent. This result is certainly indicative, from considerations of composition, of a good quality of lead, and shows that either the impurities have, for the most part, dissolved in the acid, or that these impurities were local. This pan was patched with new lead and re-started, and again the action occurred locally at other parts of the pan, on the original lead, though not at the hottest part in every case. It was again patched, and now is still in use, with no change in the setting, coal, or method of firing, acid, working conditions, or workmen. The above illustration is not an isolated case, but in general terms is indicative of many, the cause of which is still to be satisfactorily explained. The formation of lead sulphide and sulphate, with evolution of hydrogen sulphide and sulphur dioxide, may be explained, but why such action should take place at a certain stage in the concentration has not been satisfactorily investigated.

When a lead has given good results in the past and suddenly, under the same or similar usage, shows such erratic effects, a thorough diagnosis of the conditions under which it is produced seems necessary, such as method of refining and purity of metal obtained, presence of dross, oxide, or other matter, method of re-melting and casting, including temperature of, and time in furnace, and the conditions of the rolling of the lead sheet.

Lead extraction, desilverisation, and purification.—As a starting-point in this inquiry, a short and concise description of the methods of lead extraction, desilverisation, and purification may here be given, particularly pointing out how the foreign impurities enter in and how eliminated.

Galena is the chief lead ore used, associated with which are antimony, arsenic, bismuth, cadmium, cobalt, copper, iron, nickel, silver, tin, and zinc. The ore is smelted by three general methods, according to its nature: (1) Air reduction, in reverberatory furnaces; (2) roasting and reduction with carbonaceous matter or iron; (3) draught and blast furnaces. In some cases the ore is subjected to a preliminary roasting, as at Tarnowitz, where the ore used contains a fair proportion of zinc. The Huntingdon-Heberlein process is said to be specially suited to low-grade ores, with non-interference of such metals as zinc.

As an instance of the difficulty of tracing the source of lead in England, it is on record (this J., 1898, p. 83) that ore from Australia is smelted in Spain and the pig-lead from this then shipped to England. An interesting example of the disposition of the impurities of crude lead has been published by Schertel, showing that nickel, sulphur, copper, iron, zinc, and bismuth separate more or less into the upper layers, whilst antimony, arsenic, and silver practically remain stationary, antimony actually increasing somewhat in the bottom layer. The crude lead is submitted to an improving process, based on the fact that most of the impurities have a greater affinity for oxygen than lead itself. Copper and bismuth alone have less affinity, and are, therefore, very incompletely oxidised; if copper is present in large quantity, it is removed by a previous liquation.

The processes for the desilverisation of lead are:—

1. The Pattinson method, by which cobalt, nickel, and copper, and to a less extent arsenic and antimony, are removed as scum. The bismuth collects with the lead-silver alloy, whilst the other impurities remain in the desilverised

lead, since the temperature necessary for their oxidation is never attained. Above a certain limit, antimony, arsenic, copper, and nickel hinder the proper separation.

2. The zinc process, by which the bismuth wholly, antimony, arsenic, and tin for the most part, and zinc to saturation point, remain in the desilverised lead, whilst cobalt and nickel pass into the alloy. Since zinc has a greater affinity for copper than for silver, the lead must only contain a small quantity of copper, and with this precaution, a very complete separation of this metal from the lead is thus effected.

3. The Rössler-Edelmann process, in which 0·1 to 0·5 per cent. of aluminium (on the zinc used) is added, as a zinc-aluminium alloy, to prevent excessive oxidation of lead and zinc, and for production of a richer alloy, poorer in lead.

After desilverisation, or in the case of a non-argentiferous lead, the metal requires a final purification, carried out in fore-hearths and furnaces by oxidation, or even in pots, often as a combined desilverisation and refining process with the aid of steam and air, as in the Rozan method, or by the use of indifferent gases, as in the Rössler method, for the expulsion of zinc as oxide. Antimony, even in small quantity, protracts the oxidation of the lead, whilst in the oxidation of zinc by air or steam, antimony must be removed before the zinc can be eliminated.

Electrolytic reduction and refining.—Many processes have been devised for the electrolytic reduction and refining of lead ore or the crude lead. The Electric Lead Reduction Co., of Niagara, U.S.A., have plant for the direct production of the metal from galena, with formation of hydrogen sulphide. Incomplete reduction is the chief difficulty, 92 to 95 per cent. being obtained in 1903. Of electrolytic methods for the refining of crude lead, the processes of Lyte, Lorenz, Tommasi, Burleigh, and Keith may be mentioned, all differing generally in the particular electrolyte adopted. Of all electrolytic methods for this purpose, the Betts process seems to be the only one brought to a practical issue. Lead fluosilicate is used as the electrolyte, with the aid of a restrainer, such as glue, &c., and in this way a dense deposit of a specific gravity equal to cast lead is obtained, with no formation of lead dioxide. Crude lead, which may contain all or any of the usual impurities, is used as anode, whilst the cathode consists of pure lead specially prepared. Tin and lead have about the same electromotive force of solution, so that they behave as one metal, and dissolve or deposit together. Tin is therefore found in the resultant metal, generally from 0·02 to 0·03 per cent., which needs removal by poling before casting. A strong point in favour of this process is the complete removal of bismuth. The method is in use at the Canadian Smelting Works, Traill, B.C., where now 25 tons of refined lead are produced per day, and it is about to be introduced at Newcastle-on-Tyne.

The following results have been obtained in practice by this process :—

—	Crude.	Refined.	Crude.	Refined.	Crude.	Refined.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent
Antimony	0·8700	0·0066	0·5400	0·0066	0·6832	0·0000
Arsenic	0·2260	0·0000	0·1460	0·0000	0·9360	0·0025
Bismuth	—	—	—	—	1·2200	0·0037
Copper	0·1400	0·0005	0·1700	0·0004	0·7500	0·0027
Gold	0 0124	—	0·0085	—	—	—
Iron	0·0120	0 0016	0·0075	0·0013	—	0·0022
Silver	0·6082	0·0010	1·0962	0·0004	1·0982	—
Tin	0·0432	0·0140	0·0118	0·0035	—	—
Zinc	—	—	—	—	—	0·0018
Lead (diff.)	98·0882	99·9763	98·0200	99·9878	95·3126	99·9871

Crystallisation of metals and effects of impurity.—A mass of cooled metal consists of grains composed of crystallites, these constituting the true crystalline structure of the metal. This structure depends to a large extent on the manner of solidification, apart from purity and other considerations. Sudden cooling delays or prevents the crystalline formation, as in the case of lead, which, when broken hot, or allowed to fall from a height when molten, assumes the columnar structure, whilst slow cooling facilitates the crystalline structure. Crystallisation often serves to show the quality of a metal or the presence of impurities. The effect of the addition, in appreciable amount, of another element to a metal can be readily understood, but if this addition is present in traces only, its effect is far more complex, and is out of all proportion to the mass in which it is distributed. It may combine with a part of the metal to form a definite compound, which then diffuses through the mass; it may remain in isolated patches or areas, or it may envelop the crystals of the pure metal. On the other hand, it may diffuse evenly through the metal when in liquid state, but on solidification, it may be rejected as an extrusion in the pure condition or as an alloy, and travel through the mass to the crystal boundaries, and, in certain cases, this ejectment is seen by a line of demarcation.

In the formation of alloys by fusion, most metals have the property of blending with one another to form a homogeneous fluid when heated to such a temperature that the whole mass is in liquid condition.

In general, the solid mass may be regarded as a mixture of solidified solutions of metals in each other. After fusion and cooling, homogeneity may disappear, the pure metal or an alloy or series of alloys may fall out, and finally, the most fusible alloy or eutectic remains, and which finally solidifies with a fairly constant S. Pt.

Hallock, in 1888, showed that the union of two metals can be produced by heating them, in contact, to a little above the fusing point of the alloy to be formed. Spring, by compression, Odling, by reciprocal precipitation, Mylius and Fromm (Ber., 27, 630), by electrolysis, and Roberts-Austen, by electro-deposition, have all shown the interpenetration of metals and production of true alloys.

Wiedermann (Wied. Ann., 1878, 237), in the case of lead-bismuth alloys, and Spring (Bull. de l'Acad. Roy. Belg., 1886, 355), in the case of lead-tin alloys, have shown that active atomic movement continues after solidification. Matthiessen obtained evidence that many metals, in the formation of alloys, pass from the natural to an allotropic state, even by the addition of a minute quantity of another element. Bolley prepared lead by electrolysis, which, though similar to the ordinary form in appearance, rapidly oxidised in the air and became thus converted into a yellow powder. Allotropic forms of copper and tin have also been recorded. Vogel (N. Rep. Pharm., 22, 471) mentions a case of spontaneous change in a lead-bismuth alloy, in which decomposition had proceeded from a centre and then spread through the mass, the whole result being attributed to the tendency of bismuth to assume the crystalline or more likely an allotropic form.

Physical effect of impurity.—In the metallurgy of lead, by systematic and careful working, it is evident that the refined lead should be practically free from impurities, at least to the third place of decimals. But there are reasons for the assumption, in some cases, that the impurities in the crude lead, or the metals added during the desilverisation processes, have not been properly or completely removed in the various operations to which the lead has been subjected, or, finally, some impurity has entered into the refined metal during the manufacture of the lead sheet.

Copper is fairly easily removed. Hiorns (this J., 1906, 621) has shown that no alloy is formed between lead and copper when the former metal is present from 80 to 99·9 per cent., either cooled slowly or quickly, but that the results are simply mixtures.

When bismuth is present in the crude lead, and is not removed by the combined Pattinson-zinc desilverisation method (the Pattinson process being stated to be too costly alone), or by careless working of this process, or the lead is not refined by the electrolytic method, then the bismuth will remain in the lead, as also in the case of a non-argentiferous lead containing bismuth. Since bismuth up to 1·9 per cent. does not interfere with the malleability or rolling of the lead, Jünge states that it is scarcely necessary to consider its separation as important, unless for economic reasons or special uses. It can happen that the bismuth accumulates at certain parts and may exhibit itself in certain shapes in the sheet, rolled or cast, the fractured surface of which is sometimes covered with a black coating, or the bismuth-lead alloy may exude from the metal, in fluid condition.

The following are the known alloys of lead and bismuth :—

	Composition per cent.		Formula.	M.Pt.	S.Pt.
	Pb.	Bi.		° C.	° C.
(1)	27·2	72·8	$Pb.Bi_{2 \cdot 66}$	125·3	—
(2)	33·2	66·8	$Pb.Bi_2$	—	143
(3)	42·7	57·3	$Pb_3.Bi_4$	127	—
(4)	49·8	50·2	Pb.Bi	—	146
(5)	59·8	40·2	$Pb_3.Bi_2$	—	163—171
(6)	66·0	34·0	$Pb_2.Bi$	166	—

Authorities.—(1) Bresch's Chem. Tech. Lexicon. (2) Watts' Dict. of Chem. (3) Biedermann Chem. Kalen., 1906. (4) Watts' Dict. of Chem. (5) Watts' Dict. of Chem. (6) Thorpe's Dict. of App. Chem.

This last alloy is very ductile.

Tin is not commonly found associated with lead in its ores, yet as it is occasionally met with in commercial lead it should be considered. The alloys of lead and tin are numerous, and in general it may be said that their melting points vary between 175° to 197° C., with composition from Pb_5Sn to $Pb.Sn_5$.

Antimony is difficult to remove completely, and though its alloys have high melting points generally, still it is important to note that Stead, in his work on antimony-lead alloys (this J., 1897, 203), obtained a eutectic Pb_4Sb. with a solidifying point of 247° C.

An alloy of zinc and tin, of the formula, $Zn.Sn_6$, has a solidifying point of 204° C.

Oxide and oxygen theory.—Schmidt, in conjunction with Lunge, found that commercial lead contained only 0·0024 per cent. of oxygen, and slightly more if alloyed with copper or antimony, and proved that this slight difference in contained oxygen is not connected with any perceptible difference in the action of sulphuric acid (this J., 1893, 150). Davis, on the other hand, states that he obtained direct evidence of a minute film of oxide on lead of fibrous or crystalline structure, it being Pattinson lead of otherwise exceedingly good quality (this J., 1889, 227).

Casting temperature.—In the case of alloys for steam and high pressure use, it has been established, by micrographic examination, that by the use of a fair casting temperature the best results have been obtained, giving a distinct yet interlocked structure with only slightly marked crystal junctions ; a high temperature favours a large ill-developed type of crystallisation and loose structure, whilst a low temperature gives a pronounced type with sharply defined crystal junctions, forming routes along which the fracture can readily travel. It seems reasonable to infer that similar conditions may prevail, to some extent, in the casting of lead, although no investigations having a direct bearing on this question have been published. A loose crystalline structure would then allow the acid to ooze through the minute interstices of adjacent crystals, at least early on in the concentration of the acid, and by such leakage descending to the hotter zones, the usual action of the concentrated acid on even pure lead would then take place. The use of a high-casting temperature would also tend to promote the formation of oxide, with possible partial re-absorption of impurities, especially if the molten metal is kept at this temperature for any length of time. This may be the explanation of Davis's observations, and may clear up the apparently different opinions on the oxygen theory.

Action of sulphuric acid on lead and its alloys.—The action of sulphuric acid, pure and commercial, on lead and its alloys, has been examined by many, chiefly with acid of sp. gr. 1·84, such as the observations of Calvert and Johnson (Compt. rend., **56**, 140), Cooke and Sanderson (Chem. News, **45**, 105), Hasenclever, Bauer (Ber., 1875, 210), and Pitkin (Analyst, 1884, 119, *ex* Amer. Chem. Soc.); but information as to this action under pan-concentration conditions is scanty. Pitkin's results with acid of sp. gr. 1·84 on lead-bismuth alloys at 100° C. are of special interest, as showing that the action is far greater on such alloys containing 0·5 to 1·0 per cent. of bismuth than on those containing from 2 to 10 per cent. of this metal. The objection to most of the published results is that no account is taken as to which particular metal has been dissolved, the measure of the action being determined from the loss in weight and not from the lead sulphate formed. Lunge has given much attention to this subject, and concludes that although antimony raises the temperature of sudden action, this temperature would never be reached in properly constructed pans. Copper to the extent of 0·2 per cent. in the lead is useful by giving protection, but only above 200° C., or in exceptional cases, when the lead has the defect of being suddenly converted into lead sulphate, far below 200° C., probably owing to the presence of bismuth. This protective action of antimony and copper was made the subject of an English patent in 1901 by Lezendecker. As an accidental commercial product, a lead is (or was) produced from a non-argentiferous ore of South-Eastern Missouri, and finds a ready market for sheet and pipe use to withstand acid action. This is due to the presence of copper or antimony, or both, not removed by the method of refining used in the district.

That good lead can be obtained, and that it is capable of withstanding the action of acid above sp. gr. 1·76 is proved by the fact that there are cases where, by error on the part of the man in charge, the concentration has been allowed to proceed too far, even to sp. gr. 1·82, and yet the pan has stood undamaged. As a further instance of the capability of lead in this direction, my father's notebook contains a copy of a letter from Mr. Seddon, dated Sept. 14, 1877, giving the results of a testing of vitriol pans at Barnsley, in which the acid was concentrated from 150° Tw. (at 60° F.) to 164° Tw., in six hours ; the acid was perfectly clear, and when cold stood 168° Tw. The pan was $\frac{3}{4}$ in. thick, and stood three years with only moderate action.

As an instance of the slow action of sulphuric acid on lead, the following may be given in this connection. In August, 1894, a grey deposit was found on the outside of a lead pan, on the lead, during working, just below the top edge of the pan. Whether due to running over or capillary action is not known, but by daily observation it was seen to slowly increase. An analysis gave the following result :—Lead sulphate, 72·23 per cent. ; lead sulphide, 14·71 per cent. ; free sulphur, 2·34 per cent. ; free sulphuric acid, 3·39 per cent. ; loss at 100° C., 3·93 per cent. ; water held by sulphuric acid (by difference), 3·40 per cent. Impurities in the lead were not looked for, the object of the analysis being to determine the products formed under such conditions, the formation being probably at a much lower temperature than that of the pan contents.

Physical condition.—Cookson, in speaking of the non-durability of lead for acid concentration, expressed the opinion that the action was to a great extent a physical one and depended largely on the condition of the lead rather than on its composition. Examining some lead, after a few hours' use, he found that the action had proceeded "in lines parallel to the direction of rolling," whilst chemical analysis showed it to be commercially pure lead. (Chem. News, **45**, 105.)

At one works in this district, an investigation was made into the conditions under which the lead sheets were rolled, since although no change in the quality of the lead had been made by the makers, yet after a period of time, when good durable sheets had been obtained from them, suddenly their same quality gave bad results. It was eventually found that the lead manufacturers had put down specially hard rolls at their mills, with the probable result that whilst the number of rollings of the sheet, for a given thickness, were reduced, the pressure per rolling was increased, or the rolling operation carried out on the lead sheet at a higher temperature than previously.

When a metal is rolled and subjected to pressure beyond its limit of elasticity, a strain or permanent stretch is effected, with breakdown of molecular arrangement, probably being a physical record of the condition of constraint, and may point to a change of the metal into an allotropic state. Any minute variation in its composition is sufficient to vary this property and to cause an originally viscous substance to break down close to its elastic limit. By straining beyond this limit, the crystal grains composing the metal are marked by a system of lines which become more numerous as the strain increases. According to Ewing and Rosenheim (Proc. Roy. Soc., 1899, **65**, 172), these lines are slips along the cleavage or gliding planes in the crystals. By straining a piece of cast lead, they observed a slow change of structure at the ordinary temperature, with production of a fine crystalline grain, the change being facilitated by increase of temperature, whilst lead cast in chilled moulds and not strained, though of as minute a crystalline structure, remained unchanged. Other metals, such as tin, zinc, and cadmium, gave similar results. Humfrey (Proc. Roy. Soc., 1902, **70**, 462), by examination of test pieces of pure lead, found that heat will produce a recrystallisation in cases which showed no such sign after strain. Osmond has shown that the entire structure of certain alloys can be changed by heating to as low a temperature as 225° C. As Spring suggests that the property of regelation is not wholly wanting in many metals, though it is only exhibited by bismuth, as shown by Wrightson, this may possibly be an explanation of such observations. It may be concluded then that, after severe strain by rolling, fracture and breakdown of structure follow—Stead maintaining that there is a fixed relation between the lines of fracture and the direction of rolling—and that the metal then attempts to effect a rearrangement of its grains in course of time, hastened by increase of temperature, thus constituting an annealing action.

According to Beilby's theory (Electrochem. and Metall., 1904, 806, and earlier papers), metals as usually met with appear in two forms, C, the annealed or crystalline, and, A, the amorphous or vitreous form, these phases occurring in the brittle and highly crystalline metals, such as bismuth, antimony, and zinc, as well as in the more malleable metals, such as copper, silver, and lead. The A phase is transformed into the C phase by heat, whilst the C phase is converted into the A phase by mechanically produced flow, such as by rolling or hammering on the metal surface, the molecules of which behave as a liquid and subject to surface tension, by which crystalline force is checked or even overpowered. Molecular freedom can also be conferred to the metal surface by heat under certain conditions, and also by solvents or partial solvents such as mercury.

Ewing (Brit. Assoc., Eng. Sect., 1906) and Rosenhain (Iron and Steel Inst., May, 1906) agree in general with this theory, the latter being of opinion that the mobile layer in time, hastened by heat, is again absorbed into the crystalline layer, when recovery takes place; this mobile layer only retaining its amorphous condition when deformation has been extremely severe.

Preferential solvent action in relation to physical condition.—As far as I am aware, no direct experiments have been made on the preferential action of solvents in relation to the physical condition of lead. In a general way, Beilby has shown that in the etching of metals the amorphous phase is first attacked. Ewing conjectures that the unstable form may differ in electrolytic quality, and therefore more readily attacked by etching reagents. Fawsitt (this J., 1906, 1133), has found, in the case of gold, silver, and iron, that when the surface of the metal is in the crystalline condition, its solution pressure is less than when in the amorphous state. By analogy, then, it seems rational to infer that the amorphous condition can be produced in lead by severe rolling pressure, and that this form would be preferably attacked by the acid.

Experimental.—The presence of certain metallic impurities in lead having been regarded by many as the probable cause of sudden action, and since little work has been attempted with acid of sp. gr. 1·56 to 1·76, beyond that of Lunge, and that really confined to antimony and copper, it seemed to be of interest to observe the action of acid of and between these strengths on lead in connection with other metals likely to be present as impurities. Many difficulties presented themselves, the chief being the prevention of concentration of the acid. It was found useless to allow the experiments to proceed for any length of time on this account, and at present, in general, quantitative results have not been attempted.

The acids for these experiments were made from pure arsenic-free sulphuric acid of sp. gr. 1·84, by dilution with distilled water, and the percentage of acid determined by titration with normal sodium hydroxide. The acids used are as follows:—

No.	H_2SO_4 per cent.	Sp. gr.	B.Pt. ° C.	Molecular formula $H_2SO_4 : H_2O$.
1	82·63	1·762	221·2	1 : 1·144
2	81·25	1·746	214·2	1 : 1·257
3	80·00	1·732	207·0	1 : 1·360
4	78·25	1·712	200·0	1 : 1·512
5	76·64	1·694	192·2	1 : 1·659
6	73·76	1·661	179·3	1 : 1·935
7	71·44	1·633	173·0	1 : 2·176
8	70·96	1·627	172·2	1 : 2·227
9	69·53	1·611	169·6	1 : 2·386
10	68·13	1·596	163·7	1 : 2·546
11	67·01	1·583	160·4	1 : 2·680
12	65·48	1·565	158·7	1 : 2·870

The metals used in these experiments were: aluminium, antimony, arsenic, bismuth, copper, mercury, silver, tin, and zinc, obtained as pure; no hydrogen sulphide evolution by pure hydrochloric acid was detected with any of them. The lead was pure lead foil, examined in the same way. Since sudden action in lead pans has been observed, due to breakage of the thermometer or hydrometer, it appeared useful to include the study of mercury in these investigations.

The action of these acids on each metal was examined by adding 20 c.c. of the particular acid to 0·5 grm. of the metal in a small long-necked flask, so that the contents could be quickly heated with as slight concentration of the acid and loss of water as possible, and the following points noted:—Initial, fair and strong action; evolution of gas by alkaline lead paper in case of hydrogen sulphide, and by odour in case of sulphur dioxide, since there is no direct rapid test for its detection. On cooling, the colour of the acid, the deposit from it, and any sublimation (of sulphur) were noted; finally, the deposit by dilution of the liquid for lead sulphate, metals in solution, its state of oxidation, and the appearance of residual metal were observed.

RESULTS.

Lead.—Hydrogen sulphide, 1 to 3, some; 4 to 6, slight; 7 to 12, traces or none; sulphur dioxide, probably traces in 1 to 2 only; sulphur, trace in 1; lead sulphate, fair in 1, slight in 2 to 4, then traces; reaction—none strong; lead blackened according to strength of acid.

Zinc.—Hydrogen sulphide, 1 to 5 in quantity, warm and at boil, 6 to 12 less, dependent on acid used; sulphur dioxide, 1 to 2 some at boil, others none; sulphur, 1 to 4 fair, less in 5 others none; all contain zinc in solution; reaction, 1 to 5 strongest.

Tin.—Hydrogen sulphide, 1 to 5 in quantity, less from 6 to 12, but all show more than in corresponding trials with zinc; sulphur dioxide, 1 to 2 strong, falling off to slight in 6, then *nil*; sulphur, in quantity from 1 to 3, to traces in 7, then *nil*; soluble tin, most in 3, then 2 and 4, 1 and 5, 6, and least in 7 to 12, but even weakest shows fair quantity, the state of oxidation of the dissolved tin following the same direction, 3 showing *ic* only, 2 and 4 chiefly *ic*, 1, 5, and 6 chiefly *ous*, others *ous* only: residual tin, 1 to 4 blackened, 5 slight: reaction, 1 to 2 vivid, then diminishes; deposit, 1 to 2 and 11 to 12 in quantity, trace in 3, slight in 4 to 10.

Aluminium.—Hydrogen sulphide, 1 to 4 in quantity, less in 5, slight in 6 only at boil, others, *nil;* sulphur dioxide, probably trace in 1 only; sulphur, trace in 1 and 2; soluble aluminium in quantity; reaction, 1 to 3 vivid, 4 to 6 fair, others slight; deposit, 1 to 3 much white crystalline, 4 slight, others *nil.*

Antimony.—Hydrogen sulphide, 1 to 3 quantity, down to traces in 7 and even in 12; sulphur dioxide, 1 to 2 quantity, to slight in 5, none in 6 to 12; sulphur, fair in 1, slight in 2 and 3, then *nil;* soluble antimony, 1 quantity, then according to acid, to traces in 7 and even in 12; reaction, 1 and 2 strong; deposit, 1 to 3 much white crystalline, slight in 4, others *nil.*

Bismuth.—Hydrogen sulphide, slight at boil in 1 to 3; sulphur dioxide, fair 1 and 2, trace in 3; sulphur deposit, none; soluble bismuth, fair in 1, down to traces in 6; residual bismuth, not blackened; reaction, slight; no deposit; acid blackened in 1, slight in 2 and 3.

Copper.—Hydrogen sulphide, none; sulphur dioxide, 1 to 3 quantity, to slight in 6, then *nil;* sulphur, *nil;* soluble copper, 1 to 2 quantity, down to traces; residual copper, 1 to 5 blackened, 6 slight, then *nil;* 1 to 5 residues, all evolved hydrogen sulphide by hydrochloric acid; no strong reaction.

Mercury.—Hydrogen sulphide, none; sulphur dioxide, slight in 1 only; sulphur, none; soluble mercury, slight in 1 only; reaction, slight.

Arsenic.—Hydrogen sulphide, none; sulphur dioxide, slight in 1 to 3; sulphur, none; soluble arsenic, fair in 1, slight in 2 to 6, traces in 7 to 12, all in *ous* condition; residual arsenic, no change; reaction, slight.

Silver.—Similar to mercury.

The following experiments were then made with a combination of the lead and each of the other metals, the latter being placed in fine powder on the lead foil, 2 per cent. being used on the weight of the lead, and then folded up so as to keep good contact during the trials. The proportion of added metal is higher than is usually found in impure lead, but much less than this could scarcely be used in such experiments, *viz.*, 0·010 grm.

Results.

Lead-zinc.—Initial action at 100° C.; hydrogen sulphide, 1 to 8 from 140° to boiling point, then less from 8 to 12, but even detected in 12; sulphur dioxide, probably in 1 only; lead sulphate, most in 4 to 6, less in 1 to 3 and 7 to 9, then trace; sulphur, most in 3 to 4, then less in 1 to 2 and 5 to 8, then *nil;* soluble zinc, most in 1 to 3, then 4 to 5 and 10 to 11, less still in 6 to 9 and least in 12; residual zinc, none blackened; lead, none blackened; reaction, strong in 4 to 6.

Lead-tin.—Initial action, 110° to 120°; hydrogen sulphide, as with lead-zinc; sulphur dioxide, 1 to 5 from 180° up to boiling point, none after 6; lead sulphate, most in 1 to 3, then less, but none after 8; sulphur, most in quantity in 1 to 4, none after 8; soluble tin, 1 to 3 all dissolved, chiefly *ic*, whilst *ous* in 10 to 12 only, but all contain tin in solution; residual tin, black in 4 and 5, others slightly black, 11 and 12 as original; lead, blackened according to acid, 12 as original; reaction, 1 to 6 violent at about 180° C.

Lead-aluminium.—Initial at 85° C.; hydrogen sulphide, 1 to 6 fair at 140° increasing to boiling point, also with 7 to 12, but less, traces only in 12; sulphur dioxide, probably in 1 to 2; lead sulphate, 4 to 8 most, less in 1 to 3 and 7 to 10, trace or none in 11 and 12; sulphur, quantity in 1 to 5, less in 6 to traces in 9; soluble aluminium, 1 to 4 most, then decreasing to slight in 12; residual aluminium, darkened in cases 6 to 8, but only little left; lead, 1 to 4 blackened in contact with aluminium, others slight or none; reaction, violent in 4 to 6, even when removed from flame.

Lead-antimony.—Initial action at 120°; hydrogen sulphide, 1 to 3 slight at 130°, fair at 170°, and diminishes near boil less from 4 onwards to traces in 12; sulphur dioxide, 1 to 3 appears at 170°, and increases up to boil, in 4 and 5 appears at 175°—180° and to boil, but less in quantity, others *nil;* lead sulphate, quantity in 3, less in 1 and 2, 4 and 5, others traces; sulphur, 1 to 3 most, then slight to 5, *nil* afterwards; soluble antimony, 3 to 5 most, slight in 6, and traces in 9 to 12; residual antimony, 1 to 5 blackened, 5 most, others *nil;* lead, 3 to 5 dark, less in 1 and 2; reaction, fair in 3 to 5.

Lead-bismuth.—In the early trials with these two metals, the bismuth being only roughly powdered, no violent reaction was obtained; hydrogen sulphide was obtained slightly in 1 to 5 near boil; sulphur dioxide, at boil in same cases with none after; no sulphur; some lead sulphate, most in 1 to 2, less in 11 and 12, but others trace or none, but no unusual result could be obtained even by repeated trails, though it was noted that in case of 12, the lead seemed soldered up at the folded edge. Finally, the bismuth was finely ground and the trials repeated with the following results:—During agitation, no other result was noted with acids 1 to 5, whilst in the case of 6 to 12, a rattling sound was heard as though the metal had become more solid; much lead sulphate and some evolution of hydrogen sulphide was found in 6, 7, and 8, and even 9 and 10; soluble bismuth in quantity in 1 to 5, slight in 6 to 8, and traces in 9 to 12. No violent action was observed in any. The metallic contents in each case were then washed and examined:—1 and 2, no cementation of lead, though blackened and slightly attacked, easily opened; 3, 4, and 5 slightly cemented, but easily opened, blackened and striated; 11 as 3 to 5, but not blackened; 6 and 8 much striated, blackened and fused on edges; 7, blackened most of all, of such molten appearance as though previous striations had been fused over, resulting in a shapeless mass, with greatest attack; 9, less attacked than 7, striations smoothed over, not blackened, but production of one large and numerous small globules; 10, less action than 9, not blackened, large globule formed; 12, similar to 10, still less action; 11, slight action, no globule. Nos. 1 to 5 were again repeated, but no alloying action could be obtained. Analyses were made of the outer half of the globules in 9, 10, and 12 with following results:—

No.	Pb.	Bi.	Formula.
	per cent.	per cent.	
9	49·7	50·2	Pb.Bi
10	53·8	46·2	$Pb_{1·17}Bi$
12	34·8	65·2	$Pb.Bi_{1·86}$

Lead-copper.—Initial action, 1 to 4 at about 80° C., to 140° C. in others; hydrogen sulphide, fair in 1 to traces in 3 then *nil;* sulphur dioxide, observed in 1 and 2 then *nil,* even at boil; sulphur, trace in 1 to 2 only; lead sulphate, traces; residual copper, blackened in 1 to 5, which by further examination evolved hydrogen sulphides; lead, 1 to 5 blackened. 6 to 12 all showed deposit of copper.

Lead-mercury.—In this case a minute amount of the mercury was smeared over the lead. Hydrogen sulphide, 1 to 4 slight at 120°, quantity at 150°, and increasing to boil, less in 5 to 7, 8 to 12 traces at boil; sulphur dioxide, quantity near boil, in 1 to 3 and none after 4; lead sulphate, much in 1 to 4, traces after 6; sulphur as in lead sulphate formation; soluble mercury, slight in 1 only, where all lead had dissolved; lead, all more or less blackened, and by microscopic examination mercury is seen in globular state on lead surface, the lead in cases 2 and 3 being perforated with lace-like appearance, whilst in 4 the acid attack can plainly be seen, by the different thickness of metal; reaction, violent in 1 to 4, with lead sulphate formation in 1 to 3 at 140° C., and in 4 at 160° C.

Lead-arsenic.—Hydrogen sulphide, none; sulphur dioxide, 1 to 5 from 175°, and increasing to boil, none in others; lead sulphate, slight; sulphur, none; soluble arsenic, fair in 1 to 5, and in *ous* condition; reaction, slight.

Lead-silver.—Initial action, 1 to 6 at 140° to 150° C.; hydrogen sulphide, 1 to 3 slight at 150° C., fair at 190° C., and increasing to near boil, 4 to 10, slight to traces near boil, none with 11 and 12; sulphur dioxide, none; lead sulphate, 1 to 4 slight, 5 to 10 traces, others, none; sulphur, none; residual silver, 1 not blackened with evidence of slight action, 2 to 5 blackened, 2 most; soluble silver, trace in 1 only; lead, 1 to 4 blackened which by further examination evolved hydrogen sulphide; 5 to 12 not blackened, but showed reddish patches resembling an allotropic modification of silver: reaction, slight.

By using zinc drillings containing 99·81 per cent. of zinc, in the proportion of 3 per cent. on the lead foil, as much as 14 per cent. loss has been obtained in the case of acid 1·633 sp. gr. Since the impurity in the zinc only amounts to 0·0057 per cent. on the lead, this increased action seems to be due to the physical condition rather than chemical composition of the zinc. This part of the experimental work, as well as an investigation of the action on lead itself in different physical conditions, are still in progress.

These results show that aluminium, tin, and zinc, in contact with lead, give rise to sudden action and production of lead sulphate with acid of as low a sp. gr. as 1·630, the greatest action occurring with acid of 1·661 to 1·712 sp. gr.; mercury causes similar sudden action, whilst in the case of bismuth, it is a slow action, with acid of as low a specific gravity as 1·596, the greatest action occurring with acid of 1·633 sp. gr. With antimony the action is fair, whilst in the case of arsenic, silver, and copper, the action is very slight or *nil*. The fact that bismuth and lead will alloy in presence of sulphuric acid of 1·565 to 1·661 sp. gr. was something quite unexpected, and may be explained by the fact that acid of about these strengths has little action on the metals, even when in contact. I do not suggest that this alloy is formed suddenly in pan concentration, but this method of experiment has been of much service in showing how bismuth does act when present in pan lead, practically no action taking place until the alloy is formed.

The energetic action in presence of mercury may be accounted for in three ways, *viz.*:—1. By amalgamating with the lead, the two metals would be in a fine state of division, and, therefore, offer far more surface for acid action; 2. Any mercury entering into solution would be reduced by the lead, and also by the sulphur dioxide evolved, in the latter case as mercury powder, which, according to Nernst's experiments, develops more heat than the dense liquid form when entering into reactions; 3. The mercury could produce a mobile and amorphous condition of the lead, more readily attacked by the acid. These phenomena may occur in the case of other metals, such as bismuth and tin—which form alloys with lead at comparatively low temperatures—at least as regards the production of the finely divided state, such reactions taking place in small quantities and, therefore, requiring the elements of time and mass influence.

Mass action has much to do with the subject, both as regards quantity and selection. In small experiments, the selective action does exert itself, as to which metal will enter into solution. The commoner elements, as regards electrode-potential and their relation to hydrogen, can be placed in the following order:—Aluminium, manganese, zinc, cadmium, iron, cobalt, nickel, tin, lead, hydrogen, copper, arsenic, bismuth, antimony, mercury, silver. From the above experiments with lead in contact with elements of less electrode-potential than hydrogen, some of these elements have entered into solution with the higher strength acids, and it would appear that with such metals as bismuth and antimony, the sudden action, strong or slow, asserted itself with that particular acid in which these metals begin to dissolve, probably by the normal electrode-potential being overcome by mass action.

Of the metals that can cause sudden action, aluminium and zinc are added in the desilverisation process, the latter metal being retained by the desilverised lead to the extent of 0·7 per cent., and which is not easily removed in the subsequent refining operation, except by excessive oxidation of lead, especially in presence of antimony. Bismuth is costly and difficult to remove, and in non-argentiferous lead its separation is not attempted; possibly also the lead refiners are indifferent to its extraction. Tin stands exceptionally; it occurs least of all metals in lead, and is not difficult of oxidation; perhaps its presence may be accounted for by the fact that it is used for general commercial purposes in connection with lead piping, &c., and enters into the composition of the molten lead at the lead mills thus inadvertently. Evidently an ideal and yet economical process of lead refining has still to be found, since all methods yet adopted seem to be imperfect in relation to some particular impurity; even the electrolytic process fails to remove tin, which must be separated by further treatment.

The question as to why, when sudden action occurs, it should happen at an intermediate and not at the final stage of concentration, in most instances, may be answered by another query. In the dilution of sulphuric acid with water, it has been observed that, based on Thomsen's determinations, the maximum contraction, heat evolution, and rise of temperature, from a definite volume of resultant solution, correspond with an acid of about 73 per cent., H_2SO_4. Water is not always expelled with equal facility, and during the concentration of sulphuric acid, the force, acting in solution, is of varying intensity. Is it possible to presume that, during concentration and the preferential attack on some of the impurities of the lead or on the state of the lead itself, an opportunity of increased attack is offered, at least locally, when the concentration approaches to about 73 per cent. H_2SO_4, corresponding to a sp. gr. of about 1·655, by the evolution of heat at its maximum limit? This hypothesis is somewhat in agreement with the statement already made, that, in practice, sudden pan action has generally been observed with acid of about this concentration.

Conclusions.—To sum up, it appears then that lead failure can originate from two main sources, *viz.*: 1. chemical composition, and 2, physical condition of the metal, each of these being capable of sub-division. Failure from chemical composition may be due to imperfect desilverisation or final refining of the lead, or in the case of a non-argentiferous lead, to the presence of bismuth, or even to the presence of dross or oxide. The effects of impurities from these sources and the conclusions therefrom being summarised as follows:—

1. Physically, by the formation of alloys of low fusibility and consequent local perforation of the lead, most likely to arise owing to the presence of bismuth and also of tin. In such cases, by leakage and its subsequent concentration, the effect can be followed and enhanced by chemical action even on the lead itself.

2. Chemically, at certain stages of the concentration, by strong sudden action due to the presence of aluminium, tin, or zinc, and by slow sudden action in the case of bismuth.

3. Chemically, by the increased action, owing to the physical condition of the impurity in the lead, such as zinc.

4. Slow electrolytic action may set in with deposition of certain impurity, which though insufficient in the early use of the pan, yet by continuation may gradually accumulate, and then set up physical and chemical action.

5. Chemically, the presence of antimony can cause a strong and harmful action, whilst copper, arsenic, and silver have little effect; indeed, copper can exert a corrective effect under certain conditions. It can also be understood that, by constant use, an impurity such as copper will be slowly dissolved and its corrective effect on other impurities diminished or lost entirely, when these more injurious impurities, such as bismuth—lower in the electrode-potential scale—can exert themselves more freely. This may explain the failure of lead pans that have given good results for a previous long period.

6. Pure lead, under normal pan conditions, is undoubtedly less affected than the impure metal.

Failure from physical condition may be due to faulty remelting of the lead by use of unsuitable casting temperature, and by severe pressure during the rolling operation, the effects of which and the conclusions therefrom being summarised as follows:—

1. Production of a loose crystalline structure with well-developed crystal joints, by casting the metal at too high a temperature, with consequent leakage and concomitant results, as in case of local perforation.

2. Altered physical condition by severe pressure during rolling, with consequent breakdown of molecular arrangement and production of lead surface more susceptible to acid attack. This alteration may be either (1) temporary, where the mobile layer in time, hastened by heat, is again absorbed into the crystalline layer; or (2) constant, when the deformation has been extremely severe, with permanent retention of the amorphous condition.

3. Strong acid action on the temporary physically altered form of lead before the annealing effect can take place, would be an explanation of the failure of pans which have been in use for a limited period.

4. The effect of altered physical condition will apply even to lead of exceptionally pure chemical composition.

Discussion.

The Chairman said some time ago he was working on some condenser tubes of copper lined with tin which had perforations a quarter-inch deep as though the lead had been drilled, though there was very little general corrosion. After making careful experiments, he came to the conclusion that the perforations were due to the tinned lining having minute perforations in certain parts, and assuming this to be the case, and also assuming there should be the minutest capillary action, that was a condition which might account for the difference. The current density as between sea water and condensed water was very small, but being concentrated on a very minute point, as compared with the extensive metal surface, the perforation of the tubes had been brought about very rapidly. This possibly had some bearing on the lead question. The source of the action might be very slight in itself, but it would be accentuated owing to the large surface over which it was exerted, and concentrated on the point of attack.

Mr. H. L. Terry said it was possible that zinc might be introduced into the lead by the Parke's desilverising process. Galena was by no means uniform; even in the same mining field it varied in its physical properties, and there were many varieties noticeable, besides Potter's ore and silver ore. Perhaps a close investigation of the different galenas might reveal the existence of certain impurities in some which were absent from others. At the mine no attempt at separation was made; at any rate, in the districts with which he was familiar, cerussite when it occurred was sold with the galena. He did not suppose that the demand for chemical lead was great enough to lead the mine owner or smelter to take a close interest in the subject, but the paper would probably have the effect of stimulating assayers to go somewhat beyond their ordinary routine. Now that the complex ore problem had, to a great extent been solved, a good deal of lead would be coming upon the market derived from the intercrystallised sulphides which had for so long been the bug-bear of the metallurgist. Although in this case there was no difficulty in separating the galena from the blende by hydraulic means, it was conceivable that the galena derived from such a source might itself contain impurities to an extent not met with in the more common sources of supply.

Mr. W. H. Coleman said he agreed with the reasons given for sudden breakdowns. He once had an experience with a pan which seemed to settle the point, so far as bismuth was concerned. In this case, the pan had been working satisfactorily for about two years, and the middle of the pan gave way and had to be relined with 20 lb. of lead from another maker. It was set to work again, and within 48 hours of starting the pan had gone entirely. The pan was then again lined with lead belonging to the same delivery, and this time the pan was destroyed within 36 hours of starting. He had an analysis made of the original lead which had stood so well, together with the lead which had given way, and he found the proportion of bismuth was considerably greater in the faulty lead. The pan was relined with lead reported to contain no bismuth, and it was worked for two years afterwards. When lead was used for saturation, he had noticed that the seams were attacked first. He was of opinion that that possibly might be due to an alloy of lead and arsenic. He had found that lead burnt with coal gas and oxygen lasted much longer than when burnt with hydrogen from zinc. He had been informed that similar trouble had occurred with lead pans used in making nitro-glycerin. The seams were rough, and were attacked first; they overcame the difficulty by planing them down, after which they had no further trouble.

Mr. Hart in reply said that bismuth had been assumed by many to be the sinner in the action of the acid on the lead, but no proof had been established previously. The tin was not removed in the electrolytic process; the lead ore generally only contained a small quantity of that metal.

New York Section.

Meeting held at Chemists' Club on Friday, March 22, 1907.

MR. GEO. C. STONE IN THE CHAIR.

TREATMENT OF CHROME SORES.

BY HERMAN S. RIEDERER, PH.D.

As everyone who manufactures or uses chromates or bichromates in quantity knows, the workmen who handle these chemicals are usually afflicted with chrome sores, which are caused by a small amount of the chromate or bichromate getting into a scratch or other wound and then eating along under the skin, often for a considerable distance from the place of initial infection. A watery excretion, generally more or less green, is usually present. A scab which forms at times is no indication of healing. The pains are very severe, occasionally interrupting and even preventing sleep. If the workmen could be kept out of the influence of these chemicals for regular periods, their condition might not be so serious, but such a procedure would usually be quite out of the question. Where a chrome plant is in connection with the production or use of lead salts, men have been relieved by being employed for a time in the lead department. Probably lead chromate is formed in the sore, and being inactive, gives a chance for healing. This treatment does not seem ideal, for to get away from one poison the victim exposes himself to another.

The principle of the following treatment is chemical, as was the last, but it does away with the main objection. A 5 per cent. solution of sodium bisulphite is employed as a wash. The following equations seem to explain the reactions:—

$$Na_2Cr_2O_7 + 3NaHSO_3 + 2H_2O = NaHSO_4 + 2Na_2SO_4 + 2Cr(OH)_3;$$

$$2Na_2CrO_4 + 4NaHSO_3 + H_2O = 3Na_2SO_4 + Na_2SO_3 + 2Cr(OH)_3.$$

In this treatment the chromic acid radical, which is the cause of the trouble, is permanently decomposed, and no poison is introduced into the body.

Practical demonstration of the treatment bears out the theory completely. A workman had a sore for eight or nine months, as it could not be bandaged to keep it clear of continuous infection by chrome compounds. Sodium bisulphite solution was applied twice each day, but the bandaging was no more effective than before treatment. About the second or third day the pains disappeared, and whereas before treatment the whole region of the sore was very sensitive, it could now be manipulated so as to work the solution into all parts of the sore, which had spread about three-quarters of an inch from the original point of infection, and extended a considerable distance under the skin beyond the opening of the wound. This sore was completely healed in about three weeks. Incipient sores put under treatment healed naturally without any unusual scar. Workmen in a chrome plant were given this solution to use as a supplementary wash after work, and a decided improvement in their condition was immediately apparent. Few sores appeared, and these were easily checked and cured, giving the men a possibility of attending to their work regularly and efficiently.

Nottingham Section.

Meeting held at Nottingham on Tuesday, March 26, 1907.

THE GROWTH OF SUGAR-BEET IN THE MIDLANDS.

BY J. GOLDING, F.I.C., AND DR. H. B. HUTCHINSON.

ABSTRACT.

The following results were obtained from trials carried out at various centres in the counties contributing to the Midland Agricultural and Dairy College. They were organised in order to ascertain whether the sugar-beet could be cultivated in these districts in such a manner that the quantity and quality of the same would approach those of the Continental averages. The trials varied not only in the character of the soil on which they were carried out, but also in the manurial treatment, the conditions of planting, and the variety of roots cultivated.

Scheme A.—Of the three distinct series of experiments made, the first consisted of eight plots at each of five centres. The soils were of a different nature at each centre, and included a clay loam, a carr soil, warp, stiff loam, and a gravelly loam. Each sub-series of eight plots was again divided, and four of the plots received farmyard manure and artificial manures, while the remaining four received farmyard manure alone. At each centre, again, four varieties of sugar-beet were tested, *viz.*, Kleinwanzleben (original), Kleinwanzleben (Dippe's), Victrix (Jaensch's late), and Victrix (Jaensch's early).

The artificial manures applied contained nitrogen, both as ammonium salts and as nitrates, phosphates as superphosphate, and potash as potassium sulphate. Each plot dressed with artificial manure received, in addition, common salt, which has a favourable influence on the growth of the sugar-beet. The quantities applied per acre were as follows:—100 lb. of ammonium sulphate, 130 lb. of sodium nitrate, 715 lb. of superphosphate, 127½ lb. of potassium sulphate, 280 lb. of common salt. As general cultural experience has shown that the application of phosphatic and potassic manures tends to raise the quality of the crop, it was hoped in this case that a better quality of crop would be produced, or that, while the quality remained practically the same, there would be an increase in the total yield, and this has been shown to be the case.

As regards the varieties of roots, it is well known that seeds obtained from certain districts, or those derived from plants selected for their richness in sugar, possess an inherent capacity of utilising plant food supplied, and while producing a minimum of cell and fibrous tissue, produce a maximum amount of sugar. The maximum productive capacity of a plant is only exercised when necessary nutrient substances are present, and when climatic conditions approach those of the country in which its predecessors have for some time been cultivated. Accordingly, the four above-mentioned German varieties were tested, and show among themselves decided differences.

The cultivation of the land and the cultural treatment of the crop varied at the different centres, and on the valuation of the farmers on whose land the experiments were carried out, the cost per acre ranged from £6 13s. to £16 18s. 6d. with artificial manure, and £3 19s. to £12 14s. with farmyard manure alone.

The plants were lifted from Oct. 23 to Nov. 22, so that the intervening period offered opportunity to the last lifted plants to mature to a greater degree than the first lifted.

The influence of the manurial treatments on the sugar-beet.—The following table has been compiled to facilitate a comparison of the effects of an application of artificial manures. It gives the averages of the results obtained at the five centres, and serves at the same time to show the differences in the variety of beet cultivated.

TABLE I.—*Averages of the analyses of sugar-beet grown at five centres.*

Variety.	Roots.				Juice.			Total yield of sugar. per acre.
	Yield per acre.	Average weight.	Dry matter.	Sugar.	Total solids.	Sugar.	Purity coefficient.	
	tns. cwt.	grms.	per cent.	per cent.	per cent.	per cent.		lbs.
Farmyard and artificial manure—								
Kleinwanzleben (original)	18 7¼	503·5	23·05	15·69	20·52	18·08	88·54	6480
Kleinwanzleben (Dippe's)	15 19	480·4	22·56	15·65	20·56	18·26	88·83	5614
Victrix (Jaensch's late)	17 8¼	455·9	22·47	15·14	20·30	17·58	86·75	5951
Victrix (Jaensch's early)	16 11	399·7	21·60	14·86	19·61	17·31	88·17	5555
Farmyard manure alone—								
Kleinwanzleben (original)	16 11¾	499·5	22·31	15·75	19·89	17·83	89·57	5928
Kleinwanzleben (Dippe's)	16 4¾	492·8	22·12	15·86	20·11	17·94	89·13	5861
Victrix (Jaensch's late)	16 6	482·6	21·43	15·16	19·47	17·68	90·60	5610
Victrix (Jaensch's early)	15 9	446·4	22·04	15·23	19·63	17·49	88·95	5370

From this table it will be seen that, although the quality of the beets treated with artificial manures is lower than those grown with farmyard manure alone, there is, on the other hand, a decided increase in total yield per acre. This is quite uniform in three of the four varieties tested, but is not borne out by Dippe's Kleinwanzleben variety.

Owing to the uneven quality of the soil on the trial ground of one of the centres, the plot receiving no artificial manure gave a higher yield of sugar per acre than the artificially treated plot; this was sufficient in itself to disturb the averages of the other plots. It will also be seen that the application of artificial manures had the effect of lowering the purity of the juice of the sugar-beet.

The cultivation of different varieties of roots (Table I.).—Of the four varieties tested, the best results have been given by Kleinwanzleben (original). In the lots receiving artificial manures there is a gradual fall in the quality of the sugar-beet, and, with the exception of Dippe's variety, a fall in the weight of crop per acre. The two Jaensch's varieties were of much poorer quality and in addition to containing a large amount of woody fibre, possessed irregular shapes, and the roots were much forked.

Influence of variety of soil.—The effect of the soil on the quantity and quality of crop produced has been well demonstrated in these experiments. Taking, for the purposes of illustration, four different types of soil on which the sugar-beets were cultivated, it will be seen from the following table that those grown on a stiff loam gave the best results :—

Table II.—*Showing the influence of the soil on the quality of the sugar-beet. Variety—Kleinwanzleben (original).*

Soil.	Roots.				Juice.			Total yield of sugar per acre.
	Yield per acre.	Average weight.	Dry matter.	Sugar.	Total Solids.	Sugar.	Purity coefficient.	
	tns. cwt.	grms.	per cent.	per cent.	per cent.	per cent.		lbs.
Stiff loam	18 11¼	463·5	25·02	17·42	22·11	19·88	89·91	7240
Gravelly loam	18 1	471·4	23·54	16·32	20·30	18·21	89·70	6599
Clay loam	18 8	493·5	22·24	15·84	19·52	16·99	87·04	6528
Carr land	16 8½	542·6	20·96	13·15	18·10	16·73	92·43	4838

Not only is the total yield per acre higher in this case, but the roots are much superior in quality to those grown on bog or carr land. From the stiff loam to gravelly loam, clay loam, and bog soil, there is a gradual fall in the quality as regards dry matter in the root, sugar in the root, and sugar in the juice.

A second series of experiments (*Scheme B*) was carried out in order to ascertain the quality of sugar-beet which would probably be produced under ordinary farm cultivation. The plots were situated at eight different centres, and the results obtained showed great variation in the quantity and quality of roots grown per acre. The sugar-content of the roots varied from 15·28 per cent. to 12·31 per cent., and the total sugar per acre from 6316 lb. to 4480 lb. Taking the average of the results from the eight centres, we find the percentage of sugar in the roots to be 14·26 per cent., which is sufficiently low to indicate that without a good soil and liberal manurial treatment, the cultivation of the sugar-beet could not be profitably carried out.

A third series of experiments (*Scheme C*) was intended to show the influence of distance in planting on the quality of the beet. Only one variety of sugar-beet was cultivated, *viz.*, Kleinwanzleben (original), and the cultural treatment was the same in each case, with the exception of the distance between the plants in the rows. This ranged from 9 in. to 18 in., and produced decided differences in the roots when lifted. Table III. gives the analyses of the roots from each plot ; of the four distances tried, it would seem that 9 in. apart in planting yields the greatest amount of sugar per acre. At this distance, however, the assimilative power of the plant is already seriously affected, and in addition, the task of cultivation in the field is rendered very difficult. From 2—4 there is a gradual increase in the average weight of the roots and a corresponding decrease in the quality of the root. As, however, the total yield of sugar per acre in Nos. 2 and 3 is approximately the same, 12 in. to 16 in. would be advisable for ordinary farm practice.

Table III.—*Showing the influence of planting on the quality of the sugar-beet.*

Distance of plants apart in rows.		Roots.				Juice.			Total yield of sugar per acre.
		Yield per acre.	Average weight.	Dry matter.	Sugar.	Total solids.	Sugar.	Purity coefficient.	
	in.	tns. cwt.	grms.	per cent.	per cent.	per cent.	per cent.		lbs.
No. 1	9	20 10	385·8	21·23	15·91	20·82	17·89	85·92	7306
,, 2	12	18 7	350·0	25·73	16·63	21·09	19·61	92·90	6836
,, 3	15	18 6	447·9	22·91	16·50	20·79	18·27	87·78	6764
,, 4	18	17 19	505·9	21·97	15·86	20·34	17·74	82·21	6377

Conclusions.—(1) That artificial manures containing nitrogen potash and phosphates, whilst they maintained the quality of the root, tended also to increase the total yield of sugar per acre.

(2) That, of the four varieties tested, Kleinwanzleben (original) gave the highest yield of sugar per acre.

(3) That stiff to medium loams were most suitable to the cultivation of the sugar beet, whilst carr land (bog soil) was unsuitable.

(4) That the best distance of planting in the rows was 12 in. to 16 in., being at the same time compatible with ordinary farm practice.

The general cultural part of these experiments was carried out under the supervision of Dr. T. Milburn, under the direction of Principal J. F. Blackshaw.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, April 8, 1907.

MR. F. W. BRANSON IN THE CHAIR.

A TEMPERATURE CORRECTION APPLICABLE TO THE SPECIFIC GRAVITIES OF ALL OILS, FATS, AND WAXES.

BY C. HAROLD WRIGHT, B.A.(CANTAB.), A.I.C.

Allen (this J., V. (1886), 67, and *Commercial Organic Analysis*, Vol. II., Pt. I. (1889), 33), proposed a temperature correction for *oils liquid at the ordinary temperature*, varying for 15 oils from 0·000615 to 0·000665, whilst the corresponding figure for whale oil is 0·000697. Allen took the correction as 0·00064 for each degree Centigrade for any oil, except whale oil. Hence, with this exception,

$$S_{15\cdot5} = S_T + (T - 15\cdot5)\,0\cdot00064, \qquad \text{(i.)}$$

where $S_{15\cdot5}$ and S_T are the specific gravities of the same oil at 15·5° and T° C. respectively (water at 15·5° C. = 1). The difference between the observed specific gravities and those calculated by this method are very small.

For 16 fats and waxes solid at the ordinary temperature the correction for 1° C. varied from 0·000617 to 0·000750 (I have omitted Carnaüba wax, which is "only a rough determination").

Mendeléeff (Ann. Chim. Phys., 1884, 271) has shown that the expansion of a liquid when heated can be expressed by the equation,

$$V_t = \frac{V_0}{1 - kt}, \qquad \text{(ii.}$$

where V_t and V_0 are the volumes of a liquid at $t°$ and 0° C. respectively, and k is the modulus of expansion. If D_t and D_0 are the densities of a liquid at $t°$ and 0° C. respectively; then, since the density of a liquid is inversely proportional to its volume,

$$D_t = D_0\,(1 - kt). \qquad \text{(iii.)}$$

The modulus of expansion is approximately the same *for all liquids*. Mendeléeff calculated the numerical value of k for all the liquids studied by Thorpe (J. C. S., 1880, Trans., 141 and 327), and found it to vary from 0·0008 to 0·00155.

In fact, equations (ii.) and (iii.) correspond to the expansion of an ideal liquid, but suffice for most calculations involving liquids.

Though K varies for different liquids, it would probably be the same (within the limits of experimental error) for one class of substances.

I have therefore calculated the numerical value of the approximate modulus of expansion from Allen's experimental data. If S_0, S_t, and S_T are the specific gravities of the same oil, fat, or wax at 0°, $t°$, and T° C. respectively (water at 15·5° C. = 1), I have taken

$$S_t = S_0\,(1 - mt) \qquad \text{(iv.)}$$
$$\text{and } S_T = S_0\,(1 - mT). \qquad \text{(v.)}$$

Dividing (iv.) by (v.), we have

$$\frac{S_t}{S} = \frac{1 - mt.}{1 - mT} \qquad \text{(vi.)}$$

whence

$$m = \frac{S_t - S_T}{S_tT - S_Tt}. \qquad \text{(vii.)}$$

Since the specific gravity of a liquid is proportional to its density, m in the above equations might be considered as identical with Mendeléeff's k. This is not, however, the case, owing to the method generally adopted for determining specific gravities of oils, fats, and waxes. The weight of water, w, contained by a specific gravity bottle at 15·5° C. is determined once and for all. If the same specific gravity bottle holds w' grms. of an oil at 15·5° C., its specific gravity at that temperature is, of course, $\frac{w'}{w}$. Similarly, if a Westphal plummet displaces w grms. of water at 15·5° C., and w' grms. of an oil at that temperature, the specific gravity of the oil at 15·5° C. is $\frac{w'}{w}$; if, however, the specific gravity bottle holds—or the Westphal plummet displaces—w'' grms. of an oil at T° C., then the specific gravity of the oil at T° C. (water at 15·5° C. = 1) is taken by Allen as $\frac{w''}{w}$. This is not quite correct, for the volume of the specific gravity bottle or Westphal plummet depends upon the temperature.* The specific gravities determined by Allen were presumably determined as described above. Rather than correct these for change of volume of the specific gravity bottle or Westphal plummet, it is more convenient for my purpose to find the value of m, which I will call the *approximate modulus of expansion*. The following are the values of m for 16 oils liquid at the ordinary temperature:—Arachis oil, 0·000675; rape oil, 0·000675; neatsfoot oil, 0·000671; cottonseed oil, 0·000677; sesamé oil, 0·000687; cocoanut olein, 0·000710; Niger seed oil, 0·000684; linseed oil, 0·000690; castor oil, 0·000690; whale oil, 0·000745; porpoise oil, 0·000703; seal oil, 0·000654; cod liver oil, 0·000685; menhaden oil, 0·000698; sperm oil, 0·000720; bottlenose oil, 0·000722. Maximum = 0·000745; minimum = 0·000654; difference = 0·000091. The mean is 0·000693.

Following are the values of m for 14 fats and waxes solid at the ordinary temperature (I have omitted "butterine" and Carnaüba wax for the reason given above):—palm oil, 0·000727; cacao butter, 0·000772; Japan wax, 0·000734; tallow, 0·000727; lard, 0·000703; butter fat, 0·000664; cocoanut stearin, 0·000720; cocoanut oil, 0·000686; palm nut oil, 0·000701; spermaceti, 0·000815; beeswax, 0·000838; stearic acid (commercial), 0·000830; oleic acid (commercial), 0·000719; paraffin wax, 0·000815. Maximum = 0·000838; minimum = 0·000664; difference = 0·000174. The mean is 0·000747.

The mean value of m for the 30 oils, fats, and waxes examined by Allen is 0·000718. Hence, we may assume that m is the same for all oils, fats, and waxes, and for purposes of calculation it can be taken as 0·0007. Hence, equation (vi.) becomes

$$S_t/S_T = 1 - 0{\cdot}0007\,t/1 - 0{\cdot}0007\,T,$$

or, if $t = 15{\cdot}5$, then

$$S_{15\cdot5}/S_T = \frac{1 - 0{\cdot}0007 \times 15{\cdot}5}{1 - 0{\cdot}0007\,T} = \frac{0{\cdot}98915}{1 - 0{\cdot}0007\,T}$$

whence

$$S_{15\cdot5} = S_T \times \frac{0{\cdot}98915}{1 - 0{\cdot}0007\,T}$$

This shows that if the specific gravity of an oil is determined at any temperature T° C. (water at 15·5° C. = 1), it is possible to calculate the specific gravity at 15·5° C. I have calculated the value of the factor,

$$\frac{0{\cdot}98915}{1 - 0{\cdot}0007\,T}$$

for each degree Centigrade from 10 to 25, as shown in the following table:—

At °C.	Factor =
10	$\frac{1}{1{\cdot}00389}$
11	$\frac{1}{1{\cdot}00318}$
12	$\frac{1}{1{\cdot}00248}$
13	$\frac{1}{1{\cdot}00177}$
14	$\frac{1}{1{\cdot}00106}$
15	$\frac{1}{1{\cdot}00035}$
16	1·00035
17	1·00106
18	1·00177
19	1·00248
20	1·00319
21	1·00391
22	1·00462
23	1·00534
24	1·00605
25	1·00677

Hence, if the specific gravity of any oil is determined at any temperature other than 15·5° C., its specific gravity at 15·5° C. can be found by multiplying the observed specific gravity by the factor opposite the observed temperature. For example, I found the specific gravity of a cottonseed oil at 20° C. (water at 15·5° C. = 1) to be 0·9230. Therefore, specific gravity at 15·5° C. = 0·9230 × 1·00319 = 0·9259. I find this a very convenient method of determining specific gravities of oils. A great deal of time is saved by not having to bring the oil to 15·5° C., and by not having to keep the oil at this temperature whilst the final adjustment is made. The specific gravity of an oil at 15·5° C. can be determined in this way in less time than in the ordinary way. It only remains to show that an accurate value is obtained.

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* At 15·5° C. the volume is $\frac{w}{d}$ c.c., where d = the density (*i.e.*, the weight of 1 c.c.) of water at 15·5° C. At T° C. this volume becomes $\frac{w}{d}\,[1 + (T - 15{\cdot}5)\,a]$ c.c., where a = the coefficient of cubical expansion of glass. Hence at T° C. 1 c.c. of oil weighs $\frac{w''}{\frac{w}{d}\,[1 + (T - 15{\cdot}5)\,a]}$ grms. Hence the specific gravity at T° C. (water at 15·5° C. = 1) = $\frac{w''}{\frac{w}{d}\,[1 + (T - 15{\cdot}5)\,a]\,d} = \frac{w''}{w\,[1 + (T - 15{\cdot}5)\,a]}$

The difference between the specific gravity at a temperature other than 15·5° C. determined in the ordinary way, and the true value is perhaps not always realised. Thus Allen found the specific gravity of a rape oil at 98·5° C. (water at 15·5 C. = 1) 0·8632. The true specific gravity would be 0·8632/1 + 83 × 0·0000258 = 0·8614.

I determined the specific gravities of oils at temperatures other than 15·5° C. as follows:—A Westphal plummet (with thermometer), displacing 5 grms. of water at 15·5° C., was hung from a hook on the left-hand scale pan of an ordinary chemical balance. Before each experiment, the plummet was washed in ether, drained, and wiped with cotton-wool; I found it necessary to weigh it each time, as its weight varied slightly (about 3 mgrms.). The oil was now poured into a 100 c.c. Nessler cylinder, and warmed if necessary. The cylinder was placed on a balance bridge ("specific gravity stool") spanning the scale pan, so that the plummet was freely suspended in the oil. Weights were placed on the right-hand scale pan to restore equilibrium; immediately this was done, the thermometer in the plummet was read.*

An example will make the calculation clear. I found weight of plummet in air = 14·9978 grms.; weight of plummet in oleine = 10·4866 grms.; temperature of oleine = 11·5° C. Specific gravity of oleine at 11·5° C.

$$\text{(water at } 15·5° \text{ C.} = 1) = \frac{14·9978 = 10·4866}{5} = 0·9022.$$

It might be thought that the viscosity of the oil would seriously affect the sensitiveness of the balance, but in most cases I did not find this to be the case—except at temperatures below 15·5° C. Allen found that a difference of 1° C. corresponds to a difference of 0·00064 in the specific gravity of an oil; with a plummet displacing 5 grms. of water at 15·5° C., this means a difference of 0·00064 × 5 = 0·0032 grms. in the weight of the plummet in oil, and this difference I was generally able to detect. This is shown by some experiments in which I determined the specific gravity of the same oil at temperatures differing by 1° or 2° C. Having adjusted the balance at the higher temperature, I waited till the oil had cooled 1° or 2° C., and quickly adjusted again. In determining the specific gravity of an oil, this second determination forms a useful check on the first.

The specific gravities at 15·5° C. were in all cases determined with a pear-shaped specific gravity bottle, with a mark on the neck (Regnault's), holding 50 grms. of water. This was compared with the calculated value. The experimental results are given in the following table:—

Sp. gr. with Westphal plummet. (Water at 15·5° C. = 1.)		Sp. gr. at 15·5° C.	
		Calculated.	Found.
	° C.		
Olive oil	at 12 = 0·9176 ...	0·9153	0·9156
	23 = 0·9107 ...	0·9156	
	25 = 0·9093 ...	0·9155	
Cottonseed oil	20 = 0·9230 ...	0·9259	0·9259
	21 = 0·9225 ...	0·9261	
Rape oil	11 = 0·9167 ...	0·9138	0·9142
	21 = 0·9106 ...	0·9141	
Oleine	11·5 = 0·9022 .	0·8997	0·9000
	24 = 0·8944 ...	0·8997	
"Sperm" oil	24 = 0·9222 ...	0·9277	0·9275
	25 = 0·9212 ...	0·9274	

The difference in no case exceeds 0·0004; in most cases it is about the same as the error in determining the specific gravity by one method. It is noteworthy that the differences are greater at lower than at higher temperatures. It is known that the viscosity of an oil decreases rapidly with rise in temperature (see Redwood, this J., 1886, 128), and I think the closer agreement at higher temperatures is due to the lower viscosity. Hence, it seems advisable to determine the specific gravity at a temperature above 15·5° C.; as the thermometer in the plummet did not go above 25° C., I did not work above that temperature, but with a very viscous oil it would perhaps be necessary to do so.

I have applied Allen's temperature correction to the specific gravities determined at temperatures other than 15·5° C.; the results are given in the following table:—

Oil.	Temp.	Sp. gr. at 15·5° C., calculated.
	° C.	
Olive oil	12	0·9154
	23	0·9155
	25	0·9154
Cottonseed oil	20	0·9259
	21	0·9260
Rape oil	11	0·9138
	21	0·9141
Oleine	11·5	0·8996
	24	0·8998
"Sperm" oil	24	0·9276
	25	0·9273

In conclusion, I offer my thanks to Mr. T. Fairley, F.R.S.E., for his kindness in allowing me to carry out the above experiments in his laboratory.

Discussion.

The Chairman asked if the oils used had been tested to see if they were genuine. Some of the specific gravities given appeared to be different from those of genuine samples. The acidity of genuine olive oil varied enormously.

Dr. E. M. Chaplin said he had noticed that thermometers on Westphal plummets were not always accurate. Had Mr. Wright checked the thermometer on the plummet used, since this was a very important point?

Mr. W. McD. Mackey said he had always succeeded in getting his oils to a temperature of 15·5° C. without trouble, but could see the advantage of a method such as the one suggested in the paper, especially in summer. He would like to have heard about the application to solid fats, and thought this was where the method would be of most use. He had come across what he believed to be a genuine olive oil with acidity up to 28 per cent.

Mr. T. Fairley said the differences between Mr. Wright's experimental and calculated specific gravities were shown by very careful work which he had done some years ago to be within the limits of experimental error. There was a difficulty in taking the temperature of oils. A thermometer placed in the middle of a flask containing such a liquid might easily indicate a temperature which was not the average of the whole mass of liquid unless sufficient time was allowed in the water-bath to secure uniform temperature throughout the liquid. This was the case with more mobile liquids than oils. It was advantageous to be able to make experiments under the most convenient conditions, and apply corrections to bring these results within the bounds of comparison. The results thus obtained could always be checked experimentally.

Mr. G. W. Slatter thought the sperm oil given in the table could not be pure, but was probably adulterated with blown cottonseed oil, or other oil of high specific gravity.

Mr. C. H. Wright, in reply, said he had compared the thermometer in the Westphal plummet with an accurate thermometer, and found them to agree. This thermometer was used in determining the specific gravities at 15·5° C.; hence, the error in temperature (if any) was the same in both cases. He hoped to do some more experimental work, to find whether this temperature correction would apply to molten fats and waxes. He was not certain of the purity of the oils used, and did not think it necessary to use genuine oils; for if this temperature correction only applied to genuine oils it would be of very little use in the examination of commercial samples. The sample of sperm oil was certainly adulterated; it was used because it was desirable to test the method with a viscous oil.

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* A delicate hydrostatic balance could be used instead of the above apparatus, if preferred.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

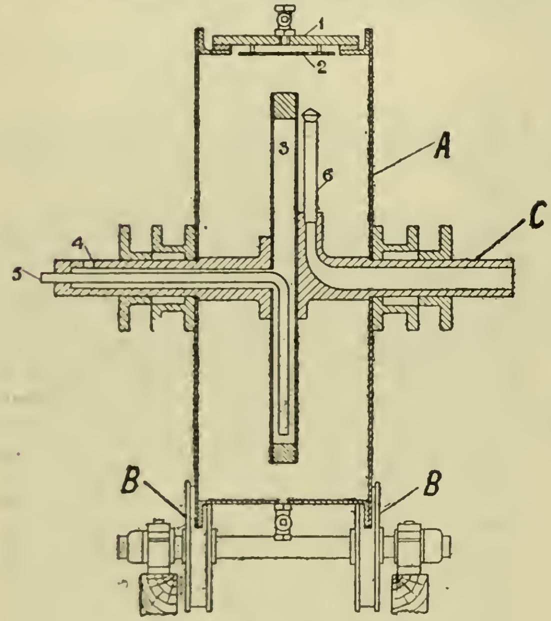
(*Continued from page* 461.)

English Patents.

Pipes for use when immersed in chemical liquids. G. R. Judson, Leeds. Eng. Pat. 7917, April 2, 1906.

The metal pipes are covered with lead, and nozzles of suitable material are screwed through the lead into tapped holes in the metal pipe.—W. H. C.

Extraction with volatile solvents. E. T. Brewis and G. S. Allen, London. Eng. Pat. 8744, April 11, 1906.



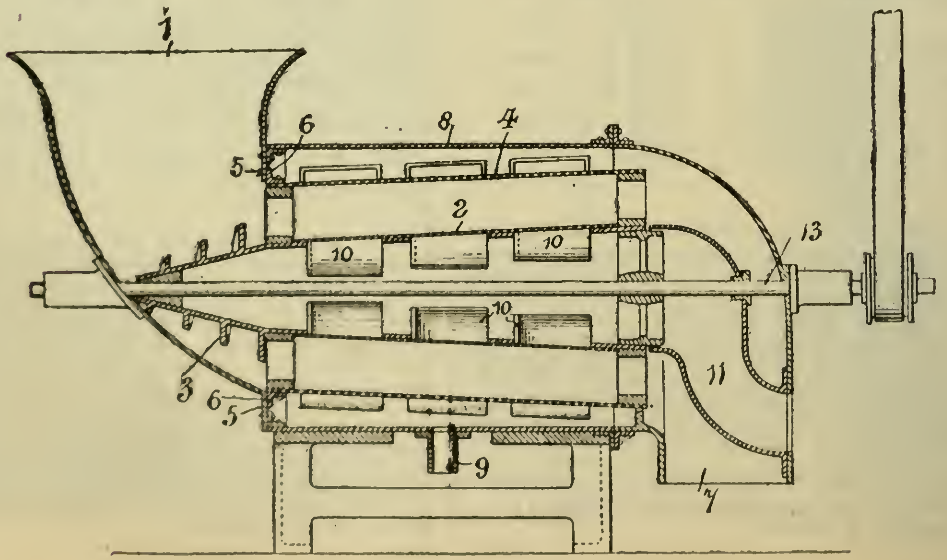
A drum, A, is mounted on a hollow shaft or trunnions, C, and on friction-rollers, B. The material to be extracted is charged into the drum through the door, 1, the cover of which is provided, on the inside, with a perforated plate, 2, the solvent is admitted through one of the taps on the periphery of the drum, and the latter is rotated. The material is thus shaken up and stirred by being thrown against the stationary hollow disc, 3. The latter is provided with steam inlet and outlet pipes, 4 and 5, so that the contents can be heated. When the drum is stationary, with the door, 1, in the lowest position, the solvent percolates through the mass and escapes through the grid, 2, and the tap. The drum is from time to time revolved to stir up the material, and when completely extracted, the residual solvent is distilled off from the "marc" or residue by heating the disc, 3, and escapes to a condenser by the hooded pipe, 6.—W. H. C.

Dryers; Centrifugal ——. J. T. Szek, London. Eng. Pat. 9305, April 20, 1906.

In the accompanying figure, which represents a central longitudinal section of the apparatus, 1 is the receptacle supplied with the material to be dried, 2 is a tapered tube carrying a screw conveyor, 3, and rotating on the same axis as the conical container drum, 4, which is made of some perforated material. The receptacle, 1, carries a stationary ring-plate, 5, against which the ring, 6, carried by the container, 4, rotates. The material to be dried is fed from the receptacle, 1, into the container, 4, by means of the conveyor, 3. Rotation causes the material to fly outwards, and to work its way gradually to the outer end of the conical container, where it is discharged at 7. The expressed liquid is collected within the exterior casing, 8, and escapes through the pipe, 9. To induce a flow of air through the apparatus, a series of scoops, 10, which project inwards from the tube, 2, gather the air which is admitted to its interior through the supply pipe, 11. The invention is particularly applicable to the treatment of peat.—O. R.

Concentration of liquids; Process and apparatus for the ——. J. F. P. Kestner, Lille, France. Eng. Pat. 12,502, May 29, 1906. Under Int. Conv., May 29, 1905.

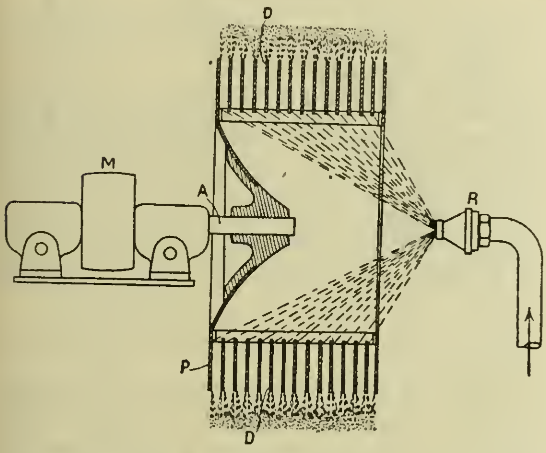
See Fr. Pat. 361,524 of 1905; this J., 1906, 874.—T. F. B



Mixture of gas and liquid; Method of and apparatus for the production of a definite ——. G. Meyersberg, Berlin. Eng. Pat. 15,776, July 12, 1906.

See Fr. Pat. 368,235 of 1906; this J., 1906, 1209.—T. F. B.

Atomising liquids and simultaneously mixing them with air or gas; Apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 23,019, Oct. 17, 1906. Under Int. Conv., Oct. 18, 1905.



The liquid is sprayed from the jet, R, on to a number of parallel discs, D, mounted on the hub, P, and the shaft, A, rotated by the pulley, M. The discs are enclosed in a cylindrical casing having an axial opening facing the jet, R, for the entrance of the air (or gas) and spray, which mix, and then escape through a tangential pipe in the periphery of the casing.—W. H. C.

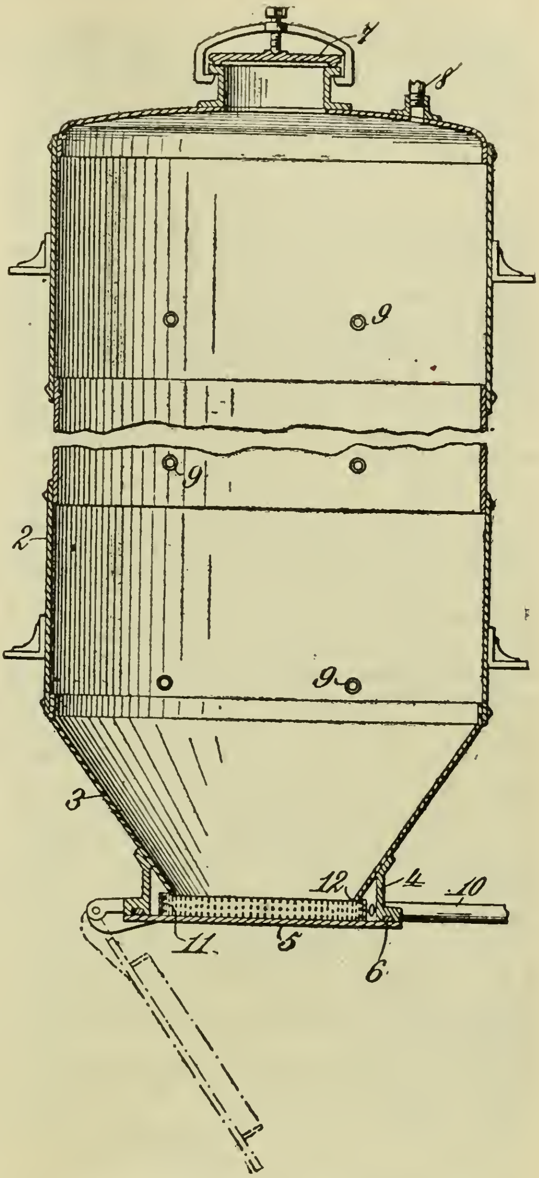
United States Patents.

Chemical apparatus [*for extracting oils, &c., from sawdust*]. H. B. Snell, Jacksonville, Fla. U.S. Pat. 840,391, Jan. 1, 1907.

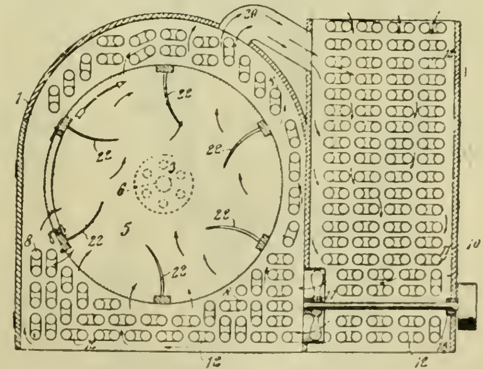
The apparatus is specially suitable for treating such materials as sawdust with steam, and consists of a cylindrical vessel, 2, having a tapered lower portion, 3, a charging-door, 7, and steam admission pipes, 8, 9. At the lower part of the tapered portion there is a flanged ring, 4, which can be closed by a door, 5, (of the drop-down type), and through which the residues are discharged. The claim relates to the provision of a perforated ring, 11, of less diameter than the flange, 4, and into which the end, 12, of the conical portion, 3, projects as shown. When the lower door is closed, the steam and vapours escaping from the vessel through the pipe, 10, are forced to pass through the perforations. These are of such a size that although they allow vapour to pass easily, they retain the fine solid particles of the material treated.
—W. H. C.

Dryer. J. Weintz, Cleveland, Ohio. U.S. Pat. 845,833, March 5, 1907.

The apparatus comprises a drying chamber and an air chamber for supplying heated air; an intermediate flue, conveying the furnace gases, and divided into two connected portions, the one heating the air chamber and the other the drying chamber, but without communicating with either. The air chamber and drying chamber are connected by a vertical flue, and one end of the latter chamber discharges into a trough forming part of the means for enclosing the said end.—C. S.



Drying-machine. J. M. Spencer, Assignor to C. L. Hills, Cincinnati, Ohio. U.S. Pat. 849,581, April 9, 1907.



The materials to be dried are placed in the cylinder, 5, provided with the "teeth," 22, and rotated by the shaft

6. The cylinder is enclosed in an outer casing, 1, which is connected to the heating-tower, 10, and in both of which a number of steam heating coils, 8, 12, are arranged as shown. Air is drawn through the heating tower by the fan, 17, and after passing over the coils in the casing, 1, and through the cylinder, 5, it returns by the pipe, 29, to the tower, 10, to be "superheated" and used again. —W. H. C.

Pyrometer. J. F. Hammond, Brewster, N.Y., Assignor to The S. S. White Dental Manufacturing Co., Philadelphia, Pa. U.S. Pat. 846,998, March 2, 1907.

The pyrometer, which is mounted within and forms part of a muffle-furnace, consists of a thermo-couple of two dissimilar metals, each provided with a "contact extension" of the same metal, and a carrier actuated by a spring, for supporting the extension in yielding and separable contact with the corresponding member of the couple. At a point beyond the radiant heat zone, the extensions are connected to conductors, which are of a different metal from the extensions and are connected to a galvanometer. The extensions are surrounded by non-conducting tubes.—C. S.

Kiln; Rotary ——. W. R. Warren, New York, N.Y. U.S. Pat. 847,859, March 19, 1907.

The claim is for a rotary kiln provided with an intake chamber at one end, which rotates with and extends into the interior of the kiln, and communicates with a supply chamber for the material to be treated.—W. H. C.

Kiln; Rotary ——. W. R. Warren, New York, N.Y. U.S. Pat. 847,860, March 19, 1907.

A number of "shells" are arranged concentrically within a rotary kiln and are rotated with it. The material to be treated is fed at one end into each of the shells, so that it is subdivided and can be rapidly heated. The material is caused to travel in one direction through the kiln, and to meet the air or other heating medium which travels in the contrary direction.—W. H. C.

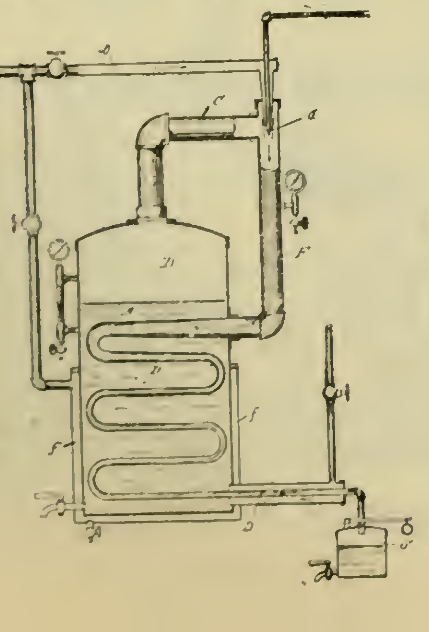
Kiln; Rotary ——. W. R. Warren, New York, N.Y. U.S. Pat. 847,861, March 19, 1907.

The outlet and inlet of the kiln are protected and regulated by rotary shields mounted detachably on the kiln, and surrounded by outer non-rotary shields mounted independently from the kiln.—W. H. C.

Kiln; Rotary ——. W. R. Warren, New York, N.Y. U.S. Pat. 847,862, March 19, 1907.

A rotary kiln has a rocking support at the supply end which is kept at a uniform level. The inclination of the remaining portion of the kiln can be adjusted by means of screws.—W. H. C.

Distilling, concentrating, and evaporating liquids; Art of ——. J. E. Siebel, Chicago, Ill. U.S. Pat. 849,579, April 9, 907.



The liquid contained in the vessel, B, is raised to its boiling-point by passing a heating medium through the jacket, *f*, and the vapours are abstracted by the injector, *a*, through the pipe, C. The pressure of the vapours is increased, and they are saturated with liquid spray through the pipe, *o*, and then caused to pass by the pipe, F, through the coil, D, immersed in the liquid contained in B, to the receiver, S, where they are collected. The latent heat of the compressed liquid is almost entirely transferred by conduction to the liquid in the vessel, B.—W. H. C.

French Patents.

Separation of vapours of volatile liquids contained in air or gas; Recuperative process for ——. A. Barbezat. Fr. Pat. 372,524, Feb. 20, 1906.

The vapours are recovered with the expenditure of but a small amount of energy by causing the air or gas containing them to pass down a tube or conduit into a cooling and separating chamber. The condensed vapours are separated, and the cold air is caused to return through a duct which surrounds the inlet pipe and is itself protected from external heat by an insulating covering. The incoming vapour-laden air is by this means precooled by the treated air, and only a little heat requires to be abstracted by the fresh cooling medium.—W. H. C.

Vapours of volatile liquids; Recovery of ——. H. Diaminti and C. Lambert. Fr. Pat. 372,888, March 3, 1906.

According to this invention, the vapours of the volatile liquids are brought into contact with cold suitably arranged surfaces from which the condensed liquid drops into a tube or other form of receiver, which is kept at a very low temperature. In this way the condensed liquid, as it forms, is removed from contact with the vapour-laden air, and thus re-evaporation of such condensed liquid is avoided. The cold surfaces consist of a copper pipe containing a liquid having a temperature of —10° C. The condensed vapours fall into a channel-receiver placed directly underneath it, and kept at a temperature of —20° C.—P. F. C.

Rectifying mixtures of vapours; Apparatus for —— J. Ponomarew. Fr. Pat. 372,974, Nov. 19, 1906.

The mixture of vapours is caused to pass upwards through the tubes of a succession of tubular condensers. The liquid condensed in the tubes of one chamber passes into the space surrounding the tubes in the chamber below, and serves to cool the vapours passing through the tubes in this chamber. The condensed liquid is either drawn off from each chamber, or passes by an overflow to the chamber below.—W. H. C.

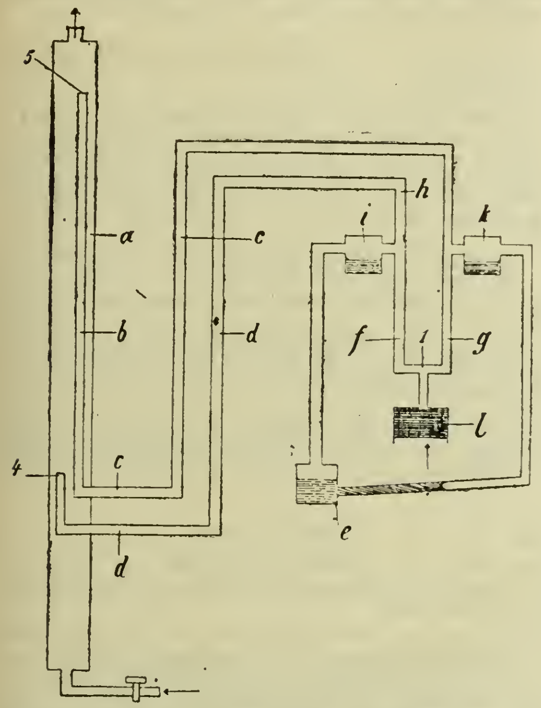
Mixture of water vapour and gaseous products of combustion free from salt [for motors for ships]; Production of ——, by means of sea water. P. Winand. Fr. Pat. 372,067, Dec. 3, 1906. Under Int. Conv., Dec. 6, 1905.

A mixture of water vapour, obtained from salt water, and of gaseous products of combustion is obtained, free from particles of salt, by bringing the gases into intimate contact with fresh water.—B. N.

Density of gas currents; Process for the determination of the —— by a manometer. A. Kröner. Fr. Pat. 372,929, Dec. 27, 1906.

If the gas which fills the tube, *b*, is of a different density to that which fills the tube, *a*, and both are at the same temperature and pressure, the difference in density will be indicated by the liquid manometer, *c*. The indications will only be exact if the tubes, *b*, *c*, *d*, are filled with gas of constant composition and uniform temperature. This is attained by causing a slow current of air or gas to be drawn in through the cotton-wool filter, *l*, to pass through the T-piece, 1, and the branches, *f*, *g*, and to issue slowly from the ends, 4, 5, of the tubes, *b*, *d*. In order to prevent the manometer liquid from being evaporated, two chambers, *i*, *k*, are interposed in the branches and filled with the same kind of liquid as that used in the manometer,

e, so that the air entering through b, will become saturated with vapour from i, k, rather than from c. The tube, a, is connected to the source of gas to be tested, and the influence of variation in speed, and consequently of pressure, on the indications of the manometer, is avoided by reducing the bore of the tubes at the parts f and g, and by introducing a tap at h, so that the friction of the gas in the tubes compensates for any variation in pressure. —W. H. C.



II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 463.)

Explosion limits in gaseous mixtures ; Determination of ——. N. Teclu. XXIII., page 553.

Explosions ; Recording calorimeter for ——. B. Hopkinson. XXIII., page 554.

English Patents.

Fuel ; Manufacture of artificial ——. A. W. H. Vivian. London. Eng. Pat. 7357A, March 27, 1906.

The claim is for the manufacture of artificial fuel briquettes, formed of a mixture of coal dust, water, a "magnesite cement" and oil, with or without lime and (or) chalk. The oil may be previously "sulphurised" by any suitable agent other than sulphur chloride, or it may be previously treated in any way "otherwise than by the use of barium superoxide, or nitric acid, or other oxydising agent."—W. H. C.

Gas and air ; Mixture of ——. A.-G. für Selas-Beleuchtung, Berlin. Eng. Pat. 3303, Feb. 9, 1907. Under Int. Conv., Feb. 22, 1906.

In the production of a mixture of gas and air, by means of apparatus in which a rotary or other suction-and-delivery motor draws separate streams of gas and air into a mixing chamber, and delivers the mixture into the service pipe, the automatic regulation of the supplies of gas and air has hitherto been effected by the co-operation of two devices, one of which (*e.g.*, a membrane) is influenced by the variations of pressure within the pipes, whilst the other (*e.g.*, a piston slide-valve) is operated by the first, and opens or closes the admission ports correspondingly. In the present specification a piston slide-valve is arranged so as to perform both these functions ; the slide-valve moves more or less within its casing, in accordance with the variations of suction within the pipes, and it simultaneously uncovers more or less the admission ports for the gas and air supplies. Various forms of slide-valve, operating on this principle, are described.—H. B.

Gases ; Process for mixing and supplying ——, *and apparatus therefor.* A.-G. für Selas-Beleuchtung, Berlin. Eng. Pat. 3533, Feb. 12, 1907. Under Int. Conv., March 3, 1906.

Apparatus of the type described in the preceding abstract is provided with a branch pipe connecting the service pipe with the admission regulator, so that the regulator (*e.g.*, a piston slide-valve) is adjusted automatically in proportion to the difference of pressure for the time being between the suction-pipe pressure and the service-pipe pressure.—H. B.

Water-gas ; Manufacture of ——. L. J. Terneden and J. M. Müller, Amsterdam. Eng. Pat. 8154, April 4, 1906.

See Fr. Pat. 364,661 of 1906; this J., 1906, 919.—T. F. B.

Coal gas and the like ; Compressing of ——. J. Gore, Sutton, Surrey. Eng. Pat. 8486, April 9, 1906.

A horizontal drum, provided on its periphery with spiral or annular passages, is caused to rotate within a casing into which the gas is admitted. The casing is partly filled with oil, and the apparatus works on the meter-drum principle, the gas entrapped in the peripheral passages by the oil being delivered into an adjoining compartment in the casing, whence it passes to the place of consumption.—H. B.

Electric glow lamps and the manufacture of same. P. M. Justice, London. From Deutsche Gasglühlicht- A.-G. (Auerges.), Berlin. Eng. Pat. 8499, April 9, 1906.

See Fr. Pat. 365,188, April 12, 1906 ; this J., 1906, 921. —H. B.

Electric incandescence filaments from tungsten or mixtures thereof with other metals ; Manufacture of ——. Siemens und Halske A.-G., Berlin. Eng. Pat. 4814, Feb. 27, 1907. Under Int. Conv., March 10, 1906.

Tungsten powder, or a mixture of tungsten powder and the powder of other metals, is stamped uniformly into a pipe composed of ductile metal, such as tantalum or iron, care being taken to expel all traces of air from the stamped material. The pipe with its contents is then drawn or rolled into thin filaments, sheets, or strips, and the skin of metal, which formed the original pipe, is then removed chemically, mechanically, or by fusion. —H. B.

United States Patents.

Briquettes ; Manufacture of ——. A. Exbrayat, Levallois, France. U.S. Pat. 849,058, April 2, 1907.

See Addition of March 11, 1905, to Fr. Pat. 350,258 of 1904 ; this J., 1906, 115.—T. F. B.

Briquettes ; Apparatus for coking ——. B. Wagner, Stettin, Germany. U.S. Pat. 849,947, April 9, 1907.

See Addition of Nov. 9, 1905, to Fr. Pat. 350,536 of 1905 ; this J., 1906, 422.—T. F. B.

Coke-furnace. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 847,614, March 19, 1907.

The coal is fed through an opening in the top of a receiving chamber placed in front of the furnace, and is continuously pushed forward by a reciprocating plunger through a tapered passage into a preheating chamber placed between the passage and the oven proper. The coal is thus compressed and preheated, and a number of horizontal perforations parallel with the floor of the oven are made in the mass of compressed coal by rods which pass through the plunger to the reciprocating head which actuates

it. The preheated and compressed coal is pushed forward from the preheating into the coking chamber, from the other end of which the coke is discharged through a vertical chamber provided with double doors to form an air-lock to prevent access of air to the coking chamber.
—W. H. C.

Gas; Apparatus for manufacture of ——. J. T. Paris, Chicago, Ill. U.S. Pat. 847,362. March 19, 1907.

The essential part of the apparatus described is a carburetter, the interior of which is divided into alternate superposed layers of multicellular chambers and absorbent material. Each of the cells is composed of a reticulated wire body covered with cloth which can be saturated with hydrocarbons held by the absorbent layers. The cells of each chamber are connected together in series with each other and with the cells of the other chambers to form a continuous passage for air through the carburetter from the bottom to the top.—W. C. H.

Gas; Process of generating ——. G. Cothran, Chicago, Ill., Assignor to the Chicago Title and Trust Co. U.S. Pat. 847,733, March 19, 1907.

This process consists in first vaporising "commingled liquid hydrocarbons and superheated steam," and drawing the vapour produced, together with the heavier residuum of the hydrocarbon, down into a mass of incandescent fuel. Superheated steam, "and air for disintegrating the steam," are drawn up into the same mass of incandescent fuel, in the upper portion of which the hydrocarbon vapour and the "disintegrated steam" combine. The gaseous mixture formed is withdrawn laterally from the mass of fuel and finally fixed and transformed into a permanent gas.—W. C. H.

Gas; Process of producing ——. H. L. Doherty, Madison, Wis. U.S. Pat. 848,729, April 2, 1907.

The process claimed consists in transmitting through a deep bed of hot fuel a current of air mixed with products of combustion, with such velocity that the reactions are not completed in the first layers of fuel, and so that the first layers are heated sufficiently to fuse the ash, and the subsequent layers are kept at a gasifying temperature lower than that of the first layers. The components of the blast may be in exothermic and endothermic balance, the blast may be heated by the gas produced, and several of the claims relate to the operation of a down-draught producer by the process described.—A. T. L.

Gas-manufacturing apparatus. J. J. Busenbenz, Assignor to Industrial Gas Construction Co., Chicago, Ill. U.S. Pat. 848,963, April 2, 1907.

The apparatus is for carburetting air with a volatile liquid without the use of heat, and comprises one or more mixing-chambers to which the air and the liquid are supplied at one end and from which the gas passes to a gas-holder. The liquid is led from the supply-tank to a nozzle at the end of each mixing chamber, and is atomised by compressed air from a reservoir; the nozzles also draw atmospheric air into the chambers by injector action, the supply of atmospheric air to all the chambers coming from a branched conduit controlled by a single valve regulated by the movement of the gas-holder. The movement of the gas-holder also controls a valve between the compressed-air reservoir and the spraying nozzles, and a valve between the liquid-supply tank and the spraying nozzles. A branch between two valves on the compressed-air pipe leads to a water tank which is in communication with the liquid-supply tank.—A. T. L.

Gas generator. R. Reid, South Yarra, Victoria. U.S. Pat. 849,162, April 2, 1907.

See Fr. Pat. 357,647 of 1905; this J., 1906, 116.—T. F. B.

Gas generator. M. J. Lackner, Dortmund, Germany. U.S. Pat. 849,247, April 2, 1907.

The generator comprises a stationary upper portion provided with feeding hopper and gas outlet, a rotatable cylindrical body portion, and a lower conical portion rotatable independently of the body portion, tapering downwards so that ashes and clinker are forced automatically towards the axis of the generator. The walls of the rotatable portions of the generator are provided with vertical ribs projecting inwards.—A. T. L.

Gas producer. W. R. Miller, Assignor to Foster Miller Engineering Co., Pittsburg, Pa. U.S. Pat. 849,848, April 9, 1907.

The claims are for a wind-box consisting of a number of superposed hollow rings of triangular section. The air-blast is admitted by pipes connected to the flat bottom of the lowest ring, and circulates through all the rings, being delivered to the interior of the producer through perforations in the sloping sides of the rings.—A. T. L.

Acetylene gas; Process of purifying ——. G. F. Jaubert, Paris. U.S. Pat. 850,010, April 9, 1907.

See Fr. Pat. 350,356 of 1904; this J., 1906, 116.—T. F. B.

Gas [Acetylene]; Process of purifying ——. G. G. Smith, Florence, Italy. U.S. Pat. 850,680, April 16, 1907.

See Eng. Pat. 20,073 of 1900; this J., 1901, 1102.—T. F. B.

Vacuum; Means for creating a —— *[in mercury vapour lamps, &c.].* P. H. Thomas, Assignor to Cooper Hewitt Electric Co. U.S. Pat. 845,671, Feb 26, 1907. XI*A*., page 534.

French Patents.

Briquettes; Manufacture of —— *from coal, peat, and moor-coal.* J. Buss and C. Fohr. Fr. Pat. 372,744, Dec. 17, 1906.

Briquettes of good colour, which do not disintegrate while burning, are prepared by treating the coal-dust, &c., mixed with a small quantity of tar and suitable quantities of naphthalene, with superheated steam at 200° to 400° C., the higher temperatures being used for the more moist fuels. The process is carried out in a vertical cylindrical chamber, having a central rotating spindle with arms for thoroughly mixing the material, and a feeding hopper and outlet for steam at the top. The pasty mass formed is taken immediately to the press. The quantity of naphthalene used is from 1½ to 3 per cent. for good lignite, 3 to 5 per cent. for bad lignite, 1 to 3 per cent. for coal, and 3 to 8 per cent. for peat, &c.—A. T. L.

Gas suitable for power purposes; Process for producing ——. F. W. Barker and T. L. White. Fr. Pat. 372,916, Dec. 26, 1906. Under Int. Conv., Sept. 12, 1906.

See U.S. Pat. 839,798 of 1906; this J., 1907, 248.—T. F. B.

Gas washers. F. E. Bachman. Fr. Pat. 372,592, Dec. 15, 1906.

See U.S. Pats. 844,312 and 844,313 of 1907; this J., 1907, 399.—T. F. B.

Incandescence electric lamps; Process of making conductive connections, of metallic character, between the filaments and current leads of ——. H. Kuzel. First Addition, dated Nov. 21, 1906 (Under Int. Conv., Jan. 20, 1906), to Fr. Pat. 366,267, May 16, 1906 (this J., 1906, 1035).

In addition to the carbides of the metals mentioned in the principal patent, *viz.*, manganese, chromium, molybdenum, tungsten, uranium, vanadium, tantalum, niobium, titanium, thorium, zirconium, nickel, cobalt, and iron, the carbides of aluminium and of silver may also be used, either alone, together, or mixed with the carbides previously mentioned. The process may be carried out with these metals in either of the three ways previously described. For the third method, by which the carbide is formed during the process of soldering, the following metals, which do not form well-defined carbides, may be used either alone or in addition to the metals previously mentioned: copper, gold, platinum, iridium, osmium. This process is recommended for soldering filaments of the three last metals. Arsenic or antimony, or their compounds with oxygen or sulphur, may be added to the materials to raise the fusing points of the solders.—A. T. L.

Metallic filaments for incandescent electric lamps; Manufacture of ——. Deutsche Gasglühlicht-A.G. (Auerges). Fr. Pat. 372,537, Dec. 13, 1906. Under Int. Conv., March 27, 1906.

In the process in which the filaments are heated to whiteness by an electric current in an atmosphere of reducing gases, it is found that water vapour is formed, because the metallic leads become oxidised when exposed to the air after having been once used. The harmful effects due to this cause may be avoided by using non-oxidisable metals, the leads may be cooled so that they are not oxidised when withdrawn from the apparatus, or they may be reduced before being again used. The same current of reducing gases may be passed over several filaments in succession, the filaments being in separate chambers, and the gas being dried between each pair of chambers. An apparatus for treating a number of filaments successively with the same current of gas, comprises a revolving plate carrying a number of chambers, each of which is connected by tubes to the casing of a distributing valve, which casing revolves with the plate, so that the gas passes through each chamber in succession. The electric circuits are connected in parallel, and the alternating or direct current passing through the several filaments is automatically regulated by the introduction of inductances or resistances into the circuits as the plate revolves.—A. T. L.

Incandescence electric lamp filaments. A. Bourdos and R. Rotschild. Fr. Pat. 372,666, Dec. 18, 1906. Under Int. Conv., Dec. 23, 1905.

See Eng. Pat. 26,855 of 1905; this J., 1907, 83.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 464.)

Petroleum mining in Japan. Ch. of Comm. J., May, 1907. [T.R.]

The consumption of kerosene oil in Japan has increased with remarkable rapidity of late years. One of the principal causes of this is attributed to the development of means of communication throughout the country. Japan draws her supply of kerosene mainly from abroad, but there has been a great development in the domestic petroleum industry during the last few years, the production in 1904 amounting to 1,240,341 koku,* and in 1905 to 1,311,629 koku, of which Niigata-ken contributed 1,236,763 koku in 1904, and 1,298,667 koku in 1905. The petroleum industry in Niigata-ken has made a six-fold progress during the last 10 years. This is largely due to the improved methods of mining adopted and the gradual consolidation of smaller into larger companies employing a large amount of capital. The establishment of iron works at Niigata for the manufacture of iron pipes and other appliances necessary for oil mining has done much towards the rapid development of the industry in the prefecture. The Nippon Sekiyu, Hoden Sekiyu, and International Oil Companies are the principal concerns engaged in oil mining in the prefecture, and those oil fields that have hitherto been left unamalgamated are being fast absorbed by one or other of these companies. From the following table will be seen the amount of light oil supplied by Niigata-ken and that imported from abroad:—

	Niigata oil.	Foreign oil.
	koku.	koku.
1898	152,400	1,426,015
1900	299,700	1,424,689
1902	408,221	1,585,083
1904	509,275	1,715,108
1905	562,338	1,232,769

* Koku = 39·7 galls.

English Patent.

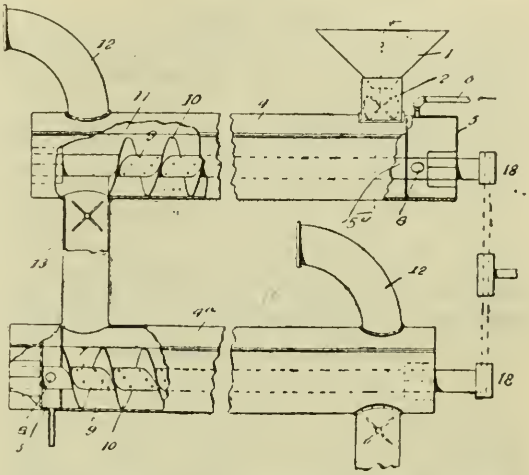
Oil; Apparatus for purifying ——. A. Kock. Eng. Pat. 21,086, Sept. 22, 1906. XII., page 537.

United States Patents.

Solvent and process of preparing same. H. O. Chute, Cleveland, Ohio. U.S. Pat. 845,616, Feb. 26, 1907.

The solvent consists of a mixture of methyl acetate and acetone. It is prepared by fractionating wood-spirit, reserving the low-boiling portion, converting the residue into methyl acetate, and mixing this with the low-boiling fraction in the desired proportions.—J. F. B.

Wood-distilling apparatus [*for sawdust*]. A. A. Macket-han, Fayetteville, N.C. U.S. Pat. 847,676, March 19, 1907.



The sawdust is fed from the hopper, 1, provided with a controlling valve, 2, into one end of the casing or retort, 4. The latter is of U-shaped cross-section, and has a perforated shaft, 9, on which is mounted a screw propeller blade, 10, arranged in the lower half of the casing, and driven by the pulleys, 18. A space, 11, is left above the material in the retort. Steam enters by a pipe, 6, into the chamber, 5, formed at one end of the casing by the partition, 5*a*, and passes into the perforated shaft through the opening, 8. The sawdust is forced along the retort by the propeller, and is heated by the steam from the perforated shaft. The vapours escape by the pipe, 12, to the condenser, and the sawdust passes to the second retort, 4*a*, by the valved pipe, 13, placed directly below the vapour pipe, 12. Several retorts may be placed in a vertical series, and the residual material is discharged from the lowest.—W. H. C.

By-products from wood; Apparatus for extracting ——. T. Newnham, White Springs, Fla. U.S. Pat. 848,484, March 26, 1907.

The wood is fed from a bin into a cylinder and compressed therein by a screw conveyor blade mounted on a hollow shaft. The chamber is surrounded by a steam jacket, and has perforated walls to allow the steam to penetrate the mass of wood. The residue is delivered from the end of the cylinder through an opening, the size of which can be regulated by a conical valve, the gases and vapours given off being withdrawn through the hollow shaft. A vacuum can be produced within the latter to assist in withdrawing the vapours, which are then mixed with compressed air and delivered to a condenser.—W. H. C.

Distilling [*petroleum*]; *Art of* ——. H. Hirzel, Leipzig-Plagwitz, Germany. U.S. Pat. 848,903, April 2, 1907.

The liquid to be distilled is caused to flow down a tower or column, provided with horizontal partitions having overflow pipes, so that the liquid is separated [into a number of superposed layers. Each of these layers is heated separately by a coil or other suitable means to a temperature which approaches but does not quite reach the boiling point of the product which it is desired to recover. A current of heated gas, caused to pass through the column in an opposite direction to that taken by the liquid, carries off those constituents which have a high vapour tension at the temperature employed. The vapours are subsequently recovered by passing the current of air or gas through a condenser. In order to recover products of different boiling points, the petroleum is passed in succession through a series of similar columns. The first is maintained at a temperature of from 108° to 115° C. to recover gasoline; the second at from 150° to 160° C. to recover kerosene; and the last at from 175° to 180° C. to recover lubricating oils by means of the current of heated gas.—W. H. C.

French Patents.

Distillation products of wood; Portable apparatus for the treatment of the ——. H. de Vallandé. Fr. Pat. 372,903, Dec. 26, 1906.

The apparatus is designed for the production, in the forest, of commercial acetic acid (45 to 50 per cent.), commercial acetate of lime (80 to 82 per cent.), anhydrous wood-tar, oil of turpentine, and methyl alcohol (85 per cent.) from the crude products of distillation. It comprises three heating vessels mounted on a wheeled carriage: the first is heated direct by the fire, the second is between the fire and the chimney, and the third is placed beyond the chimney and receives still less heat. These vessels are connected by pipes and cocks, arranged so that the vapours distilled from the first two can be led into the bottom of the third vessel, whilst the vapours from the first may be caused to pass through the liquid in the second vessel. The third vessel carries a rectifying column which may communicate either with the atmosphere, to allow the escape of water vapour, or with a condensing coil for the collection of methyl alcohol. When desired, milk of lime is placed in the third vessel, for the preparation of acetate of lime, or to hold back acid vapours in the preparation of methyl alcohol. —A. T. L.

Lubricating oil; Process of making a ——. T. O. Kent. Fr. Pat. 372,546, Dec. 14, 1906.

See Eng. Pat. 24,319 of 1905; this J., 1907, 86.—T. F. B.

Lubricating oil; Process for making a ——. T. O. Kent. Fr. Pat. 372,547, Dec. 14, 1906.

See Eng. Pat. 24,318 of 1905; this J., 1907, 86.—T. F. B.

IV.—COLOURING MATTERS AND DYESTUFFS.

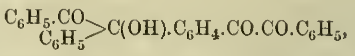
(*Continued from page 467.*)

Aromatic amino- and hydroxyl compounds; Action of sulphites on ——. H. T. Bucherer and F. Seyde. J. prakt. Chem., 1907, 75, 249—293.

The method described in former papers for the preparation of aromatic amines has been extended. Benzylamine was obtained by condensing benzyl chloride with α-naphthylaminesulphonic acid in aqueous alkaline solution and boiling the product with bisulphite. Piperazine was prepared by heating the sulphonic acid of di-α-naphthylpiperazine with 15 mols. of bisulphite in a sealed tube for three days to 140°—160° C. The yield was very small. The method was also applied to the preparation of a large number of secondary bases by condensing β-hydroxynaphthoic acid with primary amines in presence of bisulphite. On account of the relatively low temperature employed, this process may be used where former methods have failed owing to the high temperature which is necessary. By heating nigrotinic acid (2:8-dihydroxynaphthalene-6-sulpho-3-carboxylic acid) with bisulphite, a 2:8-dihydroxynaphthalene-6-sulphonic acid is obtained which is identical with that derived from G salt by fusion with alkali; thus proving the constitution of the latter. Further, by treatment with ammonium sulphite and ammonia, nigrotinic acid is converted into 2-amino-8-hydroxynaphthalene-6-sulphonic acid identical with γ-acid, the constitution of which is thus confirmed.—J. C. C.

Benzil reaction; The ——. A. Hantzsch and W. H. Glover. Ber., 1907, 40, 1519—1523.

The authors have investigated the cause of the production of the violet solution when benzil is acted on by alcoholic potash. A compound was isolated which is considered to be benzil-aldol,



$$\left.\begin{matrix}C_6H_5.CO\\C_6H_5\end{matrix}\right>C(OH).C_6H_4.CO.CO.C_6H_5,$$

but the composition could not be exactly determined owing to the small yield (0·3 grm. from 25 grms. of benzil). The substance, which was obtained as a yellow powder, m. pt. 65°—67° C., gives a violet solution with alcoholic alkalis.—J. C. C.

Indican. A. G. Perkin and W. P. Bloxam. Chem. Soc. Proc., 1907, 23, 116—117.

Indican, first described by Schunck (Phil. Mag., [iv.], 10, 74, 1855, and *ibid.*, 15, 122, 1858), has recently been shown by Hoogewerff and Ter Meulen (this J., 1900, 1100) to be a well-defined, crystalline substance. As the result of experience gained by a study of the process of the latter chemists, the authors have devised a comparatively simple method for the isolation of this glucoside, by which a largely increased yield of the compound is obtained. The air-dried leaves of *Indigofera Sumatrana* are extracted with acetone, the extract partially evaporated, and diluted with light petroleum, which precipitates impure indican as a syrup; this after treatment with water is filtered, and the filtrate on concentration in a vacuum deposits the glucoside in a crystalline condition. The yield approximates to about 50 per cent. of that extracted by the acetone, although certain precautions are necessary. This process can be carried out entirely in the cold, and the contention of Schunck (Chem. News, 1900, 82, 176) that his compound was distinct from the crystalline variety is thus evidently untenable. Experiments by Hoogewerff and Ter Meulen's method (*a*) and the acetone process (*b*) have shown that the leaves of *Indigofera errecta* also contain the same indican, but in this case the preparation is more troublesome owing partly to the presence of kaempferitrin (this J., 1907, 465), but more especially to that of a colourless sugar-like compound, m. pt. 186°—187°, deposited in prisms from its alcoholic solution by means of ether. It resembles dulcitol, but probably has the formula $C_6H_{12}O_5$ (found, $C=43·56$; $H=7·44$). Numerous air-dried preparations of indican melted at 57°—58°, so that the m. pt. 51° of Hoogewerff and Ter Meulen may be a clerical error. When dried in a vacuum, indican fuses at about 100°—101°, as stated by these chemists, but this appears to be due to the presence of water, for on further heating, re-solidification ensues, the product finally melting at 176°—177°. Analysis of indican dried at 100° was in agreement with the formula $C_{14}H_{17}O_6N$ (H and t. M) (found, $C=56·83$; $H=5·83$), and when dried in a vacuum and allowed to regain a constant weight in moist air, the figures approximated to $C_{14}H_{17}O_6N,2\frac{1}{2}H_2O$ (found, $C=49·89$; $H=6·67$; $N=4·38$; $H_2O=13·80$).

English Patents.

Azo dyestuffs; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5749, March 9, 1906.

See Fr. Pat. 361,004 of 1906; this J., 1906, 923.—T. F. B.

Anthracene series; Manufacture of compounds of the ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 19,322, Aug. 29, 1906.

See Fr. Pat. 372,261 of 1906; following these.—T. F. B.

Indigo; Manufacture of easily reducible ——. Farb. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 6723, March 20, 1907. Under Int. Conv., April 4, 1906.

THE object of this invention is to obtain pure, dry indigo in such a form as to be easily transformed into a paste with water, without previous grinding or other preliminary manipulations. The desired result is obtained by drying indigo paste on a coarse-meshed sieve, which is kept moving in a current of hot air. On leaving the sieve, from which it is easily removed, the product is obtained as a porous, spongy mass, which forms a readily reducible paste with water in a few minutes.—O. R.

UNITED STATES PATENTS.

Dyestuff; Yellow wool ——. A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 849,690, April 9, 1907.

DIAZOTISED paratoluidinemetasulphonic acid is combined with pyrazolone derivatives having the general formula, $COOH.C_3H_2ON_2.C_6H_4X$, wherein X may represent either a hydrogen or a sulphonic acid group. The dyestuffs thus produced are said to be only slightly affected by sodium hydroxide solution and hydrochloric acid. —P. F. C.

Dyestuff; Yellow monazo ——, *and process of making same.* A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Greisheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 849,739, April 9, 1907.

THE diazotised chlorine derivatives of *o*-anilinesulphonic acid are combined with pyrazolone derivatives of the general formula, $COOH.C_3H_2ON_2.C_6H_4X$, wherein X may represent either a hydrogen atom or a sulphonic group. The dyestuffs thus prepared are said to be only slightly affected by sodium hydroxide solution and by hydrochloric acid.—P. F. C.

Indigo; Process of making ——. A. Rahtjen and C. Stephan, Hamburg, Germany. U.S. Pat. 850,444, April 16, 1907.

SEE Fr. Pat. 365,109 of 1906; this J., 1906, 923.—T. F. B.

Thioindoxyl derivative and process of making same. P. Friedlaender, Vienna, Assignor to Kalle und Co., Akt.-Ges., Biebrich, Germany. U.S. Pat. 850,827, April 16, 1907.

SEE Fr. Pat. 359,398 of 1905; this J., 1906, 424.—T. F. B.

FRENCH PATENTS.

Sulphide dyestuffs; Process of making pure Bordeaux-red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 372,277, Feb. 15, 1906.

SEE Eng. Pat. 2797 of 1906; this J., 1907, 15.—T. F. B.

Azine derivatives of the anthraquinone series [Indanthrene dyestuffs]; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 372,261, Dec. 6, 1906.

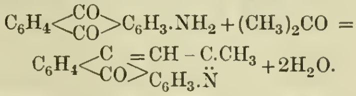
BY heating 1-aminoanthraquinone with dilute acids or with metallic salts in a closed vessel at 230°—260° C., azine dyestuffs belonging to the indanthrene group are produced. (See also Second Addition of Dec. 6, 1901, to Fr. Pat. 309,503 of 1901; this J., 1902, 911.)—J. C. C.

Dyestuffs which dye from the vat similarly to indigo; Production of halogenated [thioindigo] ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 372,627, Dec. 17, 1906.

SEE U.S. Pats. 848,354, 848,355, and 848,356 of 1907; this J., 1907, 466-467.—T. F. B.

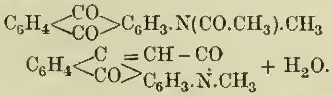
Anthracene derivatives; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 372,676, Dec. 18, 1906. Under Int. Conv., June 25, 1906.

BY treating 1-aminoanthraquinones or their derivatives with ketones of the type $CH_3.CO.R$ (R being a radical such as CH_3, C_6H_5, $CH_2.CO_2H$, &c.) in presence of alkalis, condensation takes place in accordance with the equation



$$C_6H_4\left<\begin{array}{c}CO\\CO\end{array}\right>C_6H_3.NH_2+(CH_3)_2CO=$$
$$C_6H_4\left<\begin{array}{l}C\quad=CH-C.CH_3\\CO>C_6H_3.\ddot{N}\end{array}\right.+2H_2O.$$

The product of condensation of 1:4-diaminoanthraquinone and acetone dyes tannin-mordanted cotton yellowish-brown, and that from 1:5-diaminoanthraquinonedisulphonic acid and acetone dyes wool brown. Similar products are obtained by treating the acetyl derivatives of secondary alkylamino- or arylamino-anthraquinones with alkalis, thus:



$$C_6H_4\left<\begin{array}{c}CO\\CO\end{array}\right>C_6H_3.N(CO.CH_3).CH_3=$$
$$C_6H_4\left<\begin{array}{l}C\quad=CH-CO\\CO>C_6H_3.\dot{N}.CH_3\end{array}\right.+H_2O.$$

The sulphonic acid derivative of the condensation product obtained in this way from 1-acetylmethylamino-4-*p*-tolylaminoanthraquinone dyes non-mordanted wool or chromed wool violet red. The condensation product from 1-acetylmethylamino-4-dimethylaminoanthraquinone dyes wool or tannin-mordanted cotton reddish-violet.—J. C. C.

Lakes; Red —— *from monoazo dyestuffs.* Akt.-Ges. f. Anilinfabr. Fr. Pat. 372,681, Dec. 18, 1906. XIIIA., page 537.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page 468.*)

Cotton fibre; Structure of the —— *as affected by bleaching, mercerisation, and dyeing.* R. Haller. Z. Farben-Ind., 1907, **6**, 125—128.

THE cotton fibre, being a seed-hair, has only one end naturally closed, the other being broken off at the point of attachment. The outer wall is covered with a waxy substance, cutin (cuticular cellulose), whilst dried-up residues of protoplasm coat the wall of the central canal. The peculiar swelling of the cellulose and the bursting and partial breaking-away of the cuticle under the action of cuprammonium has been described by Wiesner; the protoplasmic inner wall, like the cuticle, also resists the solvent action of the reagent. The author has observed that both the cuticle and the protoplasmic layer resist the severe alkaline treatments of the industrial bleaching process, at all events in the great majority of the fibres. The cuticular and protoplasmic layers absorb basic dyestuffs, such as Safranine, and retain the colour when washed with boiling alcohol, whereas the cellulose remains unstained. The retention of dyestuff under these conditions is considerable in the case of raw cotton, but decreases in proportion as the fibre is purified; in all cases, however, the cellulose itself remains colourless. The cutin of the cuticular cellulose is completely removed by treatment for half an hour with caustic soda lye of mercerising strength. When the mercerised fibre is dyed with a substantive dyestuff, the cellulose itself is deeply coloured, and on treatment with cuprammonium it swells uniformly and ultimately dissolves, leaving the protoplasmic wall of the central canal as a coloured line. The unmercerised fibre, when similarly dyed and treated with cuprammonium, shows a strongly coloured cuticle and lumen, and only a slightly coloured cellulose. It would appear that the cuticle and the protoplasmic wall of the lumen, besides possessing a mordanting property towards basic dyestuffs, constitute layers which also have a strong affinity for substantive dyestuffs, and which, being penetrated by these dyestuffs only with difficulty, hinder the access of the colour to the cellulose between them. In this way the author is inclined to explain the darker shades obtained with substantive dyestuffs on mercerised fibres deprived of their cutin. If an unmercerised cotton fibre be treated with cuprammonium, and then washed, and dyed with a substantive dyestuff, those places from which the cuticle has broken away are intensely coloured, whilst those parts which are still protected by the cuticle are only slightly stained. Cuprammonium swells and dissolves the cellulose, leaving the cuticular cellulose unchanged in the form of flakes, whereas strong soda lye dissolves the cutin from the cuticular cellulose, leaving the cellulose portion of the cuticle as part of the normal cellulose of the fibre.—J. F. B.

l-Serin in silk; Presence of ——. E. Fischer. Ber., 1907, **40**, 1501—1505.

The author has succeeded in isolating from the hydrolytic products of silk, an optically active substance which is identical with synthetic *l*-serin anhydride. As this is formed from the ester of *l*-serin, the presence of the latter in silk is proved. The *l*-serin anhydride separates from the mother liquor obtained after crystallising the inactive serin anhydride by adding alcohol. On complete hydrolysis with aqueous hydrobromic acid, *l*-serin is produced. This possesses all the properties of the synthetic substance except that the specific rotation is slightly less, due, no doubt, to the presence of some of the racemic compound.—J. C. C.

English Patents.

Textile fabrics; Manufacture of hygienic ——. W. L., E. A., and C. E. Merck, Darmstadt, Germany. Eng. Pat. 15,542, July 9, 1906. Under Int. Conv., July 7, 1905.

See Fr. Pat. 367,726 of 1906; this J., 1906, 1145.—T. F. B.

Artificial silk, artificial horse-hair, and the like; Process for the manufacture of ——. E. Crumière, Paris. Eng. Pat. 22,422, Oct. 10, 1906. Under Int. Conv., Nov. 27, 1905.

See Fr. Pat. 361,048 of 1905; this J., 1906, 691.—T. F. B.

Solvents distributed in the form of vapour in a factory; Process for recovering volatile ——, *particularly applicable to factories for the manufacture of artificial silk.* J. Douge, Besancon, France. Eng. Pat. 1595, Jan. 21, 1907. Under Int. Conv., Jan. 22, 1906.

See Fr. Pat. 362,611 of 1906; this J., 1906, 745.—T. F. B.

Ramie and other textile substances; Treatment of ——. J. Bendel, Paris. Eng. Pat. 18,512, Aug. 17, 1906. Under Int. Conv., Dec. 14, 1905.

See Addition of Dec. 14, 1905, to Fr. Pat. 338,752 of 1905; this J., 1906, 754.—T. F. B.

Dyeing, scouring, washing, sizing, and bleaching fabrics; Machines for ——. F. Duckworth, St. Annes-on-Sea, and C. Hall, Eccles, Lancs. Eng. Pat. 9457, April 23, 1906.

This patent relates to machines of the "jigger" type. A vat is provided with two series of rollers, one of which rotates in, and the other out of the liquor. In the upper part of the vat, perforated pipes are arranged, which are used to squirt the liquor into the fabric, and in order to ensure thorough penetration, the machine is provided with squeezing rods or rollers. The perforated pipes are fed with liquor which is pumped from the bottom of the vat by a centrifugal pump. In this circulating system a vessel, provided with a filtering medium, is inserted, in which the dye solution or other liquor can be prepared and filtered. It is claimed that the insertion of such a vessel prevents the spotting of the fabric.—P. F. C.

Furs, feathers, and the like; Grey tints on ——, *and production thereof.* H. Pantin, Executor of C. D. Abel, London. From Actien-Ges. fur Anilin-Fabr., Berlin, Germany. Eng. Pat. 10,469, May 5, 1906.

Fur, feathers or the like are treated with a solution of a salt of *p*-aminodiphenylamine or *p.p*-diaminodiphenylamine, a suitable oxidising agent being added to the dye-bath. The material to be dyed may be previously mordanted and well washed. Example: The fur to be dyed is first treated with soap or a suitable alkali; after this treatment the soap or alkali must be washed out very completely, the water being preferably mixed with some acetic acid towards the end of the washing. The fur thus treated is then brought into a mordanting bath, consisting of 10 parts of alum in 1000 parts of water; after about 12 hours, the fur is removed from the bath and well washed with water. The dye-bath is then prepared by dissolving two parts of *p*-aminodiphenylamine hydrochloride in 1000 parts of water. Every thousand parts of this solution are mixed with 40 parts of a commercial solution of hydrogen peroxide of about 3 per cent. strength. The dyeing operation is carried out at ordinary temperature, and lasts about 4—6 hours. There is thus obtained a grey colour of natural appearance and of good fastness to light and weather.—P. F. C.

Cop dyeing and material therefor. H. Sefton-Jones, London. From H. L'Huillier, Paris. Eng. Pat. 28,021, Dec. 8, 1906.

See Fr. Pat. 361,999 of 1905; this J., 1907, 253.—T. F. B.

Sodium hydrosulphite containing water of crystallisation; Process for dehydrating ——. O. Imray. From Meister, Lucius, und Brüning. Eng. Pat. 11,565, May 17, 1906. VII., page 527.

Hydrosulphites; Manufacture of stable ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,525, Oct. 11, 1906.

See Addition of Nov. 3, 1906, to Fr. Pat. 341,718 of 1904; this J., 1907, 407.—T. F. B.

Ageing and steaming chambers for fabrics. Calico Printers Assoc. Ltd., Manchester, and J. E. Gray, Rawtenstall, Lancs. Eng. Pat. 16,461, July 21, 1906.

The object of this invention is the automatic closing of the opening through which the cloth enters and leaves the chamber. The top and bottom of the opening are provided with steam chests, which form part of the front wall of the chamber. The bottom edge of the top chest is curved for the cloth to work against, and the joint with this curved edge is made by means of a copper steam pipe, floating in mercury, or other metal, or any suitable alloy, which is contained in a trough, formed in the top edge of the bottom steam chest. This steam pipe is coupled up to the steam and exhaust connections by flexible pipes. The cloth is passed between the steam pipe and the bottom curved edge of the top steam chest. The top steam chest is also provided with a lip which projects inside the chamber, to catch and evaporate any condensed water that may run down the inside wall.—P. F. C.

Worsted warp sizing and drying machine combined. W. R. Disley, Stacksteads, and A. R. Disley, Bacup. Eng. Pat. 7844, April 2, 1906.

The warp is divided into two or three sections, which are tied at intervals in order to prevent any loose ends from wrapping round the rollers. It is then sized in an ordinary size box and carried over rollers to allow the size to harden before entering a chamber, which is heated by steam coils, between which the warp travels to the back of the machine. The machine is fitted with guides which direct the passage of the warp and prevent twisting. The warp enters at the bottom of the machine, passes under a roller, and then travels to the top of the machine, over a roller, down again, and so on until the whole of the machine has been traversed. The passage is then repeated until the warp is dry. The drying machine is heated by coils of steam piping, which extend the whole width of the machine and are parallel to the path of the warp. These coils are made of sufficient height to enable one to readily obtain a temperature necessary for quick drying purposes.—P. F. C.

United States Patents.

Filaments [Artificial silk]; Apparatus for forming ——. M. Waddell, New York, Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 849,822, April 9, 1907.

This spinneret is a combination of two concentric delivery tubes, which are both rotatable about the same axis.

The viscose or cellulose solution is forced through the outer delivery tube, whilst the corresponding coagulating solution is forced through the inner tube. The nozzle of the spinning-tube is immersed in a liquid in order to exclude air, and as soon as it is tilted up so that the ends of the delivery tubes are no longer covered, the spinneret is automatically thrown out of gear. The machine is also provided with a filtering device.—P. F. C.

Viscose [Artificial silk]; Manufacture of filaments and films from ——. C. N. Waite, Lansdowne, Pa. Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 849,823, April 9, 1907.

Liquid viscose is subjected to the coagulating action of a solution containing sodium bisulphite. Impurities such as sulphur or sodium hydroxide are then removed by steaming the fibres in presence of sulphurous acid. During the steaming process the fibres are kept in a state of tension.—P. F. C.

Filaments [Artificial silk]; Apparatus for forming ——. M. Waddell, New York, Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 849,870, April 9, 1907.

According to this patent, the end of the spinneret is immersed in a spinning trough containing the coagulating solution. The filaments thus formed travel horizontally along the trough and are taken up by one of two independently removable winding-spools, which are mounted upon a common shaft. In order that the filaments may be thoroughly coagulated, this shaft is so arranged that the spools are partially immersed in the coagulating solution. The trough is provided with a guiding device to deliver the filaments to either of the spools.—P. F. C.

Threads, films, and the like; Manufacturing artificial ——. E. W. Friedrich, Blaton, Belgium. U.S. Pat. 850,571, April 16, 1907.

See Eng. Pat. 27,727 of 1906; this J., 1907, 405.—T. F. B.

Textile fibres; Apparatus for treating —— with liquids and gases. J. O. Obermaier, Lambrecht, Germany. U.S. Pat. 849,635, April 9, 1907.

This apparatus consists of a drum which is mounted upon a hollow horizontal shaft, round which it can rotate as a centrifuge. The drum, into which the material to be treated is packed, is situated in a dye-vat which is provided with a removable air-tight cover. This vat is connected to a reservoir placed at a lower level than itself. By means of a pump, the solution of the dyestuff is pumped from this reservoir, through the hollow shaft of the quickly rotating drum, then forced through the material, and finally runs back into the reservoir. Both the dye-vat and the reservoir are connected to a vacuum apparatus, so that, if desired, the dyeing operation may be performed under a vacuum.—P. F. C.

Sizing or finishing media; Manufacture of ——. G. Morpurgo, Assignor to Erste Triester-Reisschäl-Fabriks Akt.-Ges., Trieste, Austria. U.S. Pat. 849,413, April 9, 1907.

See Fr. Pat. 349,074 of 1904; this J., 1905, 617.—T. F. B.

French Patents.

Artificial threads, films, or similar products; Process of making ——. E. W. Friedrich. Fr. Pat. 372,002, Nov. 30, 1906. Under Int. Conv., Dec. 11, 1905.

See Eng. Pat. 27,727 of 1906; this J., 1907, 405.—T. F. B.

Volatile solvents used in the manufacture of artificial silk. Recovery of ——. H. Diamanti and C. Lambert. Fr. Pat. 372,889, March 3, 1906.

This invention has for its object the application of the process described in Fr. Pat. 372,888 (page 518) to the recovery of alcohol and ether used in the preparation of artificial silk. The filaments formed by forcing the nitrocellulose solution through capillary tubes, travel up a passage down which a current of air is being forced. The partially dried filaments are then united into threads and wrapped round bobbins which are enclosed in a bonnet. A jet of dry air at a temperature of 40° C. is made to fall upon the bobbins in order to carry the drying of the threads as far as is necessary. The air, loaded with the vapours of alcohol and ether, is removed by an aspirating tube placed inside the bonnet. This tube is connected to the apparatus for the condensing and recovery of the vapours.—P. F. C.

"Sulphonated hydrocarbons"; Preparation of —— and their use in cleansing and removing grease [from textiles]. E. de Grousseau and E. Saint-Hilaire. Fr. Pat. 372,276, Feb. 15, 1906.

Instead of being treated with caustic alkali or soap, the grease, &c., in fabrics is removed by means of hydrocarbons or hydrocarbon derivatives (*e.g.*, oil of turps, toluene, carbon bisulphide, carbon tetrachloride), rendered soluble in water by previous admixture with the alkali salts of sulphonated fatty acids in the proportion of, say, 30 per cent. The sulphonates may be acid, alkaline, or neutral according to the proportion of alkali used in their preparation, but acid sulphonates are preferred, as they yield less viscous products and revive the colour of the fabric. The term "sulphonated hydrocarbons" is applied to such mixtures.—C. A. M.

Wool scouring; Process of ——. J. Dantzer. Fr. Pat. 372,757, Dec. 20, 1906.

Wool-suint consists of a water-soluble and a water-insoluble variety. It is stated that water-soluble suint has the property of removing the insoluble suint from raw wool, and that the ease with which the removal is effected increases with the purity of the solution of the soluble suint. The process consists in washing the wool in baths of soluble suint which are purified (by filtration, treatment in a centrifugal machine, or the like) as soon as they become excessively charged with the insoluble suint.—P. F. C.

Carbonising wool; Stove for ——. H. Thaon. Fr. Pat. 372,965, Oct. 29, 1906.

The wool is carried by a number of endless bands made of netting and driven by drums. These bands are so arranged that the wool, which is placed upon the top band through an opening in the wall of the stove, is carried along the machine and is then automatically dropped on to the second band, which is moving in the opposite direction. This in turn carries the wool along the stove again, and drops it on to the third band, and so on. The wool eventually leaves the stove by an opening in the lower part of the wall. The necessary heat is supplied by a number of steam pipes laid along the floor of the stove. The stove is also provided with a ventilating shaft.—P. F. C.

Felting animal fibres; Process for —— by using an acid fulling liquor. G. Ita. Fr. Pat. 372,405, Dec. 11, 1906.

An aqueous solution of lactic acid is used in the process of felting animal fibres. The addition of formic acid as an antiseptic is recommended.—J. C. C.

Silk; Process for weighting ——. E. Barrillot. Fr. Pat. 372,279, Feb. 15, 1906.

The method consists in replacing the usual solution of a tin salt by a mixture of this with salts of other metals such as zinc, aluminium, manganese, magnesium, &c. By this means a concentrated solution of the tin salt may be used. Treatment of the silk with a bath of phosphates, silicates, &c., follows as in the ordinary process.—J. C. C.

Silk; Process of weighting ——. C. Simon. Fr. Pat. 372,837, Dec. 22, 1906.

See U.S. Pat. 840,264 of 1907; this J., 1907, 316.—T. F. B.

Claret shades which can be easily discharged; Production of ——. L. Cassella und Co., G. m. b. H. Fr. Pat. 372,884, March 2, 1906.

It is stated that if part of the β-naphthol used in the preparation of a-Naphthylamine Claret, be replaced by one of its monosulphonic acids, a claret is obtained which can be easily discharged. The 2.7-naphtholmonosulphonic acid gives the best results. Example :—The cloth is impregnated with an alkaline solution composed of three parts of β-naphthol and one part of 2.7-naphthol monosulphonic acid, and dried ; it is then passed through a solution of diazotised α-naphthylamine, washed, and dried. It is next printed with a discharge paste containing "400 grms. of Hyraldite C extra, 140 grms. of glycerin, and 560 grms. of thickening for each kilogramme." The printed cloth is rapidly steamed at a temperature of about 104° C., in the small Mather-Platt, washed, and dried.—P. F. C.

Dyeing cross-wound bobbins ; Apparatus for ——. R. B. Robyns. Fr. Pat. 372,456, Sept. 13, 1906.

The apparatus consists of a rectangular wooden vat, in the interior of which is a hollow cylinder, made of copper or iron according to the class of dye which is to be used. The surface of the cylinder is covered with a number of tubes into which the bobbins are placed, and the ends of which can be closed by perforated covers. The cylinder rotates upon a horizontal axis. When the machine is in operation, the dye solution is sucked by a centrifugal pump through the bobbins into the interior of the cylinder, by means of a centrifugal pump, and then up the hollow axle of the cylinder, and is finally run back into the dye vat. It is claimed that very uniform dyeings can be obtained with this machine.—P. F. C.

Dyeing fabrics ; Process of ——. E. Spatz. Fr. Pat. 372,815, Dec. 21, 1906. Under Int. Conv., Dec. 26, 1905.

See U.S. Pat. 842,122 of 1907 ; this J., 1907, 406.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 468.)

English Patent.

Gelatin colours ; Process of printing in —— *with oiled formes.* O. Imray, London. From J. Livingston, Frankfort a/M., Germany. Eng. Pat. 18,562, Aug. 18, 1906.

The addition of fatty material to the liquid gelatin colour renders it possible to remove, uniformly, the excess of colour from the oiled forme before the printing process, and the oil or fat used may be rendered more miscible with the colour solution by previous saponification or emulsification. A suitable mixture for the purpose consists of 10 grms. of gelatin, 10 grms. of water, 20 grms. of linseed oil, 5 grms. of soap, and 1 to 3 grms. of colouring matter. A further advantage of adding oil is that the gelatin picture is made softer and the necessity of rolling eliminated.—C. A. M.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 469.)

Caustic-soda process ; Scheele's ——. E. Berl and G. Austerweil. Z. Elektrochem., 1907, **13**, 165—172.

The process, discovered by Scheele in 1773 and worked in England at the end of the 18th and early in the 19th century (see this J., 1890, 160), consists in decomposing sodium chloride by lead oxide in aqueous solution, and regenerating lead oxide from the solid oxychloride of lead by means of milk of lime. The author finds that in dilute solutions of salt, up to a concentration of normal, the reaction proceeds according to the equation :—$2NaCl + 5PbO + H_2O \leftrightarrows 4PbO.PbCl_2 + 2NaOH$; whereas at higher concentrations of salt, the reaction is represented by :—$2NaCl + 4PbO + H_2O \rightleftarrows 3PbO.PbCl_2 + 2NaOH$. The solubility of the lead oxychloride in water and of lead oxide in caustic soda solutions has been studied. In the latter case, in dilute solutions, a plumbite, $NaHPbO_2$, is formed, and in concentrated solutions, Na_2PbO_2. The reaction between lead oxide and sodium chloride according to the first equation has been found to proceed at 18° to 50 per cent., at 48° to 43 per cent., and at 74° to 37 per cent. of the chloride ; under these conditions, for each grm. of caustic soda produced, 40 grms. of lead oxide are required. The regeneration of the oxychloride by lime was also studied and found to proceed satisfactorily.—R. S. H.

Calcium carbonate and chlorine water ; Reaction between ——. Arthur Richardson. Chem. Soc. Proc., 1907, **23**, 118—119.

The author finds that cold chlorine water decomposes calcium carbonate with formation of calcium chloride and hypochlorous acid until one part of carbonate is dissolved in 30 parts of water, as shown by Williamson ; $CaCO_3 + 2Cl_2 + H_2O = CaCl_2 + 2HClO + CO_2$. At a later stage, calcium chloride, chlorate, and hypochlorite are formed, together with hypochlorous acid. This process goes on until from 40 to 50 per cent. of calcium chloride is obtained ; beyond this point calcium carbonate is insoluble in chlorine water. When chlorine water containing calcium carbonate in suspension is heated, oxygen is evolved, and calcium chloride and chlorate are formed. In this case also, hypochlorous acid appears to be first produced, a part being then oxidised to calcium chlorate, another part reduced to chloride, and a third part further reduced to free chlorine, whilst the hydrogen and part of the oxygen combine to form water, and the remainder of the oxygen is liberated.

Cupric nitrite. P. C. Rây. Chem. Soc. Proc., 1907, **23**, 117.

A dilute solution of cupric nitrite slowly absorbs oxygen from the air and is converted into nitrate, following the law of mass-action. When a concentrated solution of cupric nitrite, however, is evaporated over sulphuric acid, even under diminished pressure, it partially decomposes according to the equation, $3Cu(NO_2)_2 = Cu(NO_3)_2 + 2CuO + 4NO$.

Ferrous and ferric sulphides. H. N. Stokes. J. Amer. Chem. Soc., 1907, **29**, 304—307.

The author used zinc hydroxide, or a solution of zinc chloride in ammonia, for distinguishing between ferrous and ferric sulphides. With ferrous sulphide the reaction products are ferrous hydroxide and zinc sulphide, and the mass is white. With ferric sulphide, on the other hand, ferric hydroxide is produced, and the reaction product is brown or red. It was found that precipitated ferrous sulphide does not react with zinc hydroxide in the cold, or at 100° C., and only slowly at 160° C., the products being ferrous hydroxide and zinc sulphide. The statement in most text-books that ferric salts give a mixture of ferrous sulphide and sulphur when precipitated by an alkali sulphide in alkaline solution, is incorrect. The reaction product is ferric sulphide, which on treatment with zinc hydroxide yields ferric hydroxide and zinc sulphide. Alkali polysulphides precipitate ferric sulphide from solutions of ferrous salts. Ferric sulphide is readily hydrolysed into ferric hydroxide and hydrogen sulphide on heating at 100° C.—A. S.

Barium and strontium carbides ; Temperature of formation of ——. M. Kahn. Compt. rend., 1907, **144**, 913—915.

Mixtures of baryta and strontia with the theoretical amount of sugar charcoal were heated in graphite crucibles, which fitted exactly into protecting casings of lime, in a lime furnace by the oxyhydrogen flame. Previous experiments showed that platinum was melted in these crucibles in 10 minutes. After 20 or 25 minutes' heating, the crucible contained a fritted mass, which gave off acetylene on treatment with water. Thus, at the temperature of melting platinum, barium and strontium carbides are formed, though calcium carbide is not similarly formed, as Moissan has shown, at this temperature.—J. T. D.

Chlorides and bromides ; Direct quantitative separation of ——. L. W. Andrews. XXIII., page 554.

Chlorates and hypochlorites ; Experiments on the [electrolytic] manufacture of —— *with a view to high current efficiency.* A. G. Betts and R. H. Sherry. XIA., page 533.

Aluminium in silicates ; Determination of ——. F. W. Hinrichsen. XXIII., page 555.

ENGLISH PATENT.

Sodium hydrosulphite containing water of crystallisation; Process for dehydrating ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 11,565, May 17, 1906.

SODIUM hydrosulphite crystallises from a concentrated aqueous solution with 2 mols. of water of crystallisation. By heating the crystals thus obtained to 60—70° C. for a short time, preferably while stirring, water is set free, and the mass becomes a granular magma. From this, the solution of sodium hydrosulphite may be separated by pressing or draining, and the salt may be dried in a vacuum, or else the magma may be quickly dried in a vacuum without separating the solution. The crystallised sodium hydrosulphite may also be dehydrated by simple heating in the presence of indifferent liquids, such as benzene, toluene, and xylene, which are insoluble in water, and have no dehydrating properties.—P. F. C.

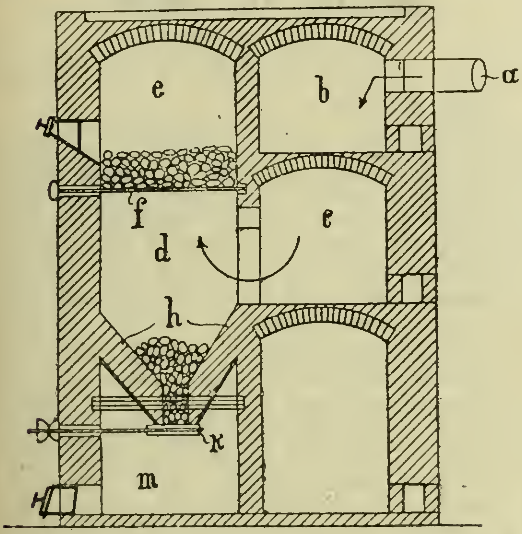
UNITED STATES PATENTS.

Cuprammonium solutions; Process of manufacturing ——. J. J. M. A. Vermeesch, Schaerbeek, Belgium. U.S. Pat. 850,695, April 16, 1907.

SEE Fr. Pat. 369,973 of 1906; this J., 1907, 319.—T. F. B.

FRENCH PATENTS.

Sulphuric acid; Separation of the dust produced in furnaces for the manufacture of ——. O. Carlson, jun., E. Hartmann, and F. Benker. Fr. Pat. 372,644, Dec. 17, 1906.



As an accessory to furnaces in which pyrites, zinc blende, or the sulphide residues resulting from the purification of lighting gas, are burned to produce sulphur dioxide for application in the manufacture of sulphuric acid, filtering chambers are provided, in which the gas enters at *a*, and after traversing the chambers, *b*, *c*, and *d*, passes through the perforated support, *f*, sustaining a quantity of fragments of pumice, or of any suitable refractory material, which arrest all dust, the gas finally passing on to the lead chambers. The perforated support, *f*, is arranged to rotate a quarter of a turn, to allow the dust-charged pumice to fall into the hopper-shaped receptacle, *h*, below, the neck of which is closed by the register, *k*, whereby the material can be discharged at intervals into the chamber, *m*, without leakage of gas.—E. S.

Sewage and ammoniacal liquids; Treatment of ——. [*Recovery of ammonia*]. J. Jean et Cie. Fr. Pat. 372,171, Feb. 13, 1906. XVIII*B*., page 547.

Alkaline-earth cyanides; Hydrolysis of —— *for the production of pure ammonia.* Badische Anilin und Soda Fabrik. Fr. Pat. 372,714, Oct. 30, 1906. Under Int Conv., April 18, 1906.

CYANIDES of the alkaline-earth metals are treated with water or water vapour under pressure at a temperature below 300° C., to produce ammonia. For example, 400 kilos. of barium cyanide are placed in an autoclave having a double jacket and an agitator, with 600 litres of water. The temperature is slowly raised to 150° C., and so maintained for five hours, when the process, as indicated by a steady pressure, will be completed.—E. S.

Potassium carbonate of high percentage; Process for obtaining —— *from beet-root salts.* E. Bauer. Fr. Pat. 372,415, Dec. 11, 1906.

THE lye obtained by lixiviation of beet-root salts, after deprivation by ordinary means of the greater part of the impurities, is concentrated to about 58° to 62° B., when, at a temperature exceeding 90° C., a carbonate precipitates, having approximately the composition $5K_2CO_3 + Na_2CO_3 + 4H_2O$, which represents the greater part of the sodium carbonate contained in the lye. This precipitate is removed from the lye, cooled to about 90° C., to be worked up with other portions of lye. The mother liquor, slowly cooled to about 50° C., gives a finely-crystallised precipitate having the composition, $3K_2CO_3 + 5H_2O$, which is separated by centrifugal action or otherwise. By suitable dilution and cooling, potassium chloride may be crystallised from the mother liquor, which may be then further treated according to the described system.—E. S.

Alums; Process of manufacturing ——. E. Strohbach. Fr. Pat. 372,809, Dec. 21, 1906.

THE invention relates to the manufacture of sodium, potassium, and ammonium alums, in microcrystalline form, and free from iron, and in particular to that of the first-named. Excess of an alkali sulphate or a bisulphate (or of a solid powdered double sulphate) is added to a slightly acid lye of aluminium sulphate, of 1·25 sp. gr. at least, and at a temperature of from 25° to 50° C., and the mass of crystallised alum produced is separated from the mother liquor at a temperature near that of the maximum saturation of sodium sulphate. According to one modification, aluminium sulphate is added to an excess of an acid solution of an alkali sulphate or double sulphate. For the manufacture of potassium or ammonium alum, free from iron, from materials containing iron, the aluminium sulphate is used in excess. It is stated that the described crystallisations are effected in hours, instead of requiring days, as in the processes ordinarily conducted. Sodium alum, obtained as described, may be purified by cooling the hot and concentrated solutions, stirring being maintained until crystallisation is complete.—E. S.

Sodium chloride; Extracting —— *from brine.* Marcheville-Daguin et Cie. Fr. Pat. 372,854, Dec. 22, 1906.

IN order to obtain pure sodium chloride from brine containing calcium sulphate, the patentee proposes to make use of the fact that whereas sodium chloride is more soluble in hot than in cold water, the reverse is the case with calcium sulphate. The brine is allowed to drop in the form of a fine rain on to a coil heated by steam, and thence into a shallow pan. The coil becomes coated with calcium sulphate, which can be removed by scraping, whilst pure sodium chloride separates in the shallow pan. The mother liquor from the pan is returned to the supply tank.—E. S.

Oxygen; Production of —— *for effervescent baths and other purposes.* L. Sarason. Fr. Pat. 372,233, Nov. 29, 1906.

IN preparing a bath intended to evolve oxygen at a steady rate for hygienic purposes, a perborate, such as a perborate of sodium or ammonium, is added to it in preference to a solution of hydrogen peroxide, and a substance that may act catalytically to cause evolution of oxygen from the perborate, is introduced. Manganese borate is recommended for this purpose, followed by addition of boric acid. Generally, the process consists in adding to the water which is to constitute the bath (or to be otherwise utilised in generating oxygen) a substance containing or capable of yielding hydrogen peroxide, followed by the addition of manganese borate, and eventually of boric acid. A dry mixture of a perborate and manganese borate may be prepared, which only reacts to yield oxygen in presence of water.—E. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(Continued from page 470.)

Potter's clay in New Zealand; Discovery of ——. Bd. of Trade J., May 2, 1907. [T.R.]

According to the "Canterbury Times" an important discovery of clay has been made on a farm about three miles from New Plymouth. A specimen analysed by the Government analyst contains 39·4 per cent. of silica and 33 per cent. of alumina, and the report states that "the clay is of excellent quality. With the exception of the iron, which is slightly high (1·5 per cent.), its composition is equal to that of the best kaolin. If found in quantity, it should prove of great value for pottery purposes." A large seam has been exposed, and similar clay has been found a considerable distance away. It is overlaid by first-class brick clay.

Glazes; The sulphuring and feathering of ——. J. W. Mellor. Trans. Eng. Ceramic Soc., 1906–7, 6, 71—73. (See also this J., 1907, 151.)

In continuation of his previous work, the author finds that the surface of glazes which have partially crystallised is more or less covered with dull patches which lack the brilliant surface characteristic of good glazes. The defect increases with the thickness of a glaze, and glazes rich in lime and low in alumina are particularly liable to it. The minute acicular crystals that permeate such a devitrified glaze appear to be *wollastonite*, or calcium metasilicate, $CaSiO_3$. These are readily attacked when a polished section is etched with dilute hydrochloric or hydrofluoric acid, and in this respect are unlike *sillimanite*. Crystalline separations may also be produced on glazes by the action of sulphur dioxide or sulphur trioxide on certain constituents of the glaze, such as alkalis, lead, calcium, &c., with the production of sulphites or sulphates. The oxides of sulphur are derived from the coal employed in heating the pottery oven, and even a good sample of coal used for such purpose may yield enough "volatile sulphur" to form 104 lb. of calcium sulphate for 1 ton of coal used. The ratio of the sulphur dioxide to trioxide depends upon the conditions of firing of the oven. Any sulphites formed are unstable and readily decomposed, and do not appear to cause any trouble with the glaze, whereas any sulphates that form on the surface and do not diffuse into the rest of the glaze may cause crystals of sulphates to appear on the surface of the ware. Glazes exhibiting such defects were produced by firing glazed tiles in an atmosphere intentionally charged with sulphur trioxide, and also in an oven fired with "brassy" coal. If the sulphur trioxide is present in great excess, the surface of the glaze may be quite matt, and the same effect may be produced by re-firing glazed tiles in a muffle with alum, or iron pyrites, to supply the sulphur trioxide. The conditions that appear to be most favourable for the production of a surface film of sulphates are an oxidising atmosphere and a temperature near to that of the congealing point of the glaze. This commonly occurs when the upper part of the oven is being "held back" in order to raise the temperature of the lower part, by allowing an extra current of cold air to enter at the regulating holes and fire-mouths; at this stage, therefore, only coal as free as possible from sulphur should be used. In conclusion, reference is made to the suggestion that the addition of a small quantity of lime water to the coal before burning, may diminish the amount of sulphur oxides evolved during combustion.—W. C. H.

Clays, &c.; Determination of the amount of soluble salts in ——. J. W. Mellor. IX., next column.

English Patents.

Glass; Pouring pots having slot discharge openings for use in the manufacture of plate ——. F. M. Oppermann, Namur, Belgium. Eng. Pat. 21,721, Oct. 2, 1906.

See Fr. Pat. 369,986 of 1906; this J., 1907, 203.—T. F. B.

United States Patents.

Glass-melting furnace. W. O. Amsler, Pittsburg, Pa. U.S. Pat. 847,632, March 19, 1907.

This invention relates to the combination with a regenerative glass-melting tank-furnace of regenerators, all situated on one side or end of the furnace, and connected with it by means of throats or passages, which are supported by columns and cross-pieces that are independent of the tank. When connected with an end of the tank, a central charging opening is arranged in the end wall between the throats of the regenerators. The tank is divided into two compartments by a bridge-wall, upon which a checker-work baffle-wall is built, which extends to within a short distance of the roof of the furnace. —W. C. H.

Corundum; Treatment of ——. M. Buchner, Mannheim-Waldhof, Germany. U.S. Pat. 848,439, March 26, 1907.

The method described of treating corundum for the manufacture of ceramic masses consists in mixing corundum with a cementitious binding material that hardens with water, such as Portland cement, and in shaping and burning the mass obtained.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 470.)

Clays, &c.; Determination of the amount of soluble salts in ——. J. W. Mellor. Trans. Eng. Ceramic Soc., 1906–7, 6, 54—56.

In determining the amount of soluble salts in clays, &c., too high a figure is very easily obtained owing to the difficulty of excluding very minute clay particles from the liquid used to dissolve out the salts. It is not always practicable to mix dry and finely-divided clay with water, and allow the mixture to stand until the supernatant liquid is clear, because even after standing for some months the liquid may not become clear, and it is impossible to clear such liquids by filtration through paper. According to some authorities such filtrates can, however, be clarified by evaporating them to dryness, heating, and treating the residue with water, and then filtering again. In place of any of these methods the author recommends the use of a small biscuit-ware crucible, glazed inside and outside to within half a centimetre from the bottom. The sizes are: Outside diameter at the top, about 2¾ cm.; at the bottom, 1½ cm.; outside height, 4 cm. This is connected up with a filter pump in the ordinary way. About 5 grms. of finely-divided clay, dried at 100° C., are boiled in 150 c.c. of water for about half an hour. The "slip" thus obtained is filtered through the biscuit-ware crucible, and the filtrate evaporated to dryness, and the residue weighed. The whole time occupied in the operation is about 7½ hours. To determine the "soluble salts" in filter-press water, about 100 c.c. may be filtered, and the filtrate evaporated and the residue weighed. The following results are quoted to show the differences that may arise with the different methods:—

	Amounts of soluble salts.
Clear after standing 4 days..........	0·205 per cent.
After filtering through six filter papers	0·177 „
After filtering through biscuit crucible	0·128 „

The same difficulty may occur in the Government process for determining the soluble lead in frits. After the frit has been shaken for one hour, it is very difficult to separate all the minute solid particles, which may pass through the filter paper and thus increase, in an irregular manner, the apparent amount of lead sulphate. —W. C. H.

English Patents.

Marble ; Artificial —— and other stone. E. S. Ali-Cohen, Singapore. Eng. Pat. 10,900, May 9, 1906.

Magnesite is mixed with zinc oxide or carbonate, and the mixture calcined at a temperature between 600° and 1000° C. Immediately after calcination, the product is incorporated with the desired filling material, and the whole intimately mixed with a solution of pure magnesium chloride, to which is preferably added the purest "silicic acid" obtainable by "washing, precipitation, or dialysis." The following proportions, by weight, may be adopted : magnesia, 100 ; zinc oxide, 30 ; silicic acid, 20 ; "magnesium chloride, 50" ; filling material, 300.—O. R.

Wood and other fibrous material ; Solutions for preserving ——. K. H. Wolman, Idaweiche, Germany. Eng. Pat. 19,241, Aug. 28, 1906.

The use of solutions of metallic salts (usually sulphates of iron, copper, or aluminium) for impregnating wood, has the drawback that these compounds tend to decompose into basic salts and free acid, the latter acting injuriously on the fibre to be preserved. In order to overcome this defect, the present patent refers to methods of neutralising the acid liberated by such solutions, by adding to them substances which shall at the same time possess antiseptic properties. The neutralising substances proposed are : (1) the alkali compounds of hydroxyhydrocarbons of the cresol or naphthol type, derived from the washing waters obtained in refining petroleum, resin oils, or the like ; (2) metallic fluorides or silicofluorides. —O. R.

Cement ; Manufacture of ——. E. Bougleux, Pisa, Italy. Eng. Pat. 12,353, May 28, 1906.

See Fr. Pat. 365,869 of 1906 ; this J., 1906, 986.—T. F. B.

United States Patents.

Wood substitute. F. Schnell, Gutenstein, Austria-Hungary. U.S. Pat. 848,133, March 26, 1907.

According to this invention a wood substitute is obtained by making a thick pulp of cereal flour and water ; with this a suitable fibre is mixed, and an alkali silicate is added. The mass is kneaded into a homogeneous dough, from which the desired articles are formed ; the objects are dried preparatory to finishing and polishing. The fibrous material may be animal or vegetable (*e.g.*, wood-dust). The proportions given are : 40 per cent. of cereal flour, 40 per cent. of vegetable fibre, 2 per cent. of animal hair, and 18 per cent. of water-glass.—W. C. H.

Cement, and process of manufacturing same. M. Toch. New York. U.S. Pat. 848,328, March 26, 1907.

This invention relates to the production of a new composition of matter by the combination of the "lime resinate" of an acid resin (*e.g.*, Manila copal) with aluminium silicate. This composition, when added to Portland cement, gives a cement-concrete, free from voids and pores, and from which carbon bisulphide extracts resinous matter. The claims also include the new cement obtainable from ordinary cement, in combination with the new composition of matter described above.—W. C. H.

X.—METALLURGY.

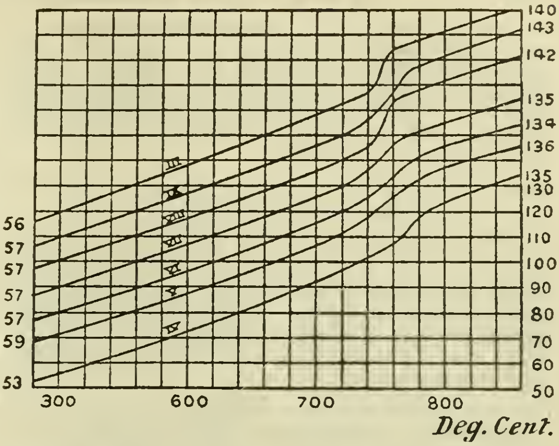
(*Continued from page* 474.)

Steel ; Latent heat of recalescence in ——. F. K. Bailey. Phys. Rev., 1907, **24**, 129—151 ; Science Abstracts, 1907, **10A.**, 240.

The curves show the results of calorimetric determinations upon steels having the following percentage compositions :—

Steel ……	III.	IV.	V.	VI.	VII.	VIII.	IX.
Carbon ….	0·97	0·08	0·18	0·26	0·28	0·40	0·79
Manganese .	—	0·82	0·77	0·42	0·83	0·49	0·40

The ordinates are total cals. per grm. from the temperatures plotted as abscissæ to 20° C. The evolutions of heat at recalescence thus determined are given in the following table, with those determined by the heating and cooling curve method :—



Steel.	Latent heat by calorimeter, Grm.-cals	Latent heat from heating and cooling curves.		Temperature of		Rise of temp. at recalescence.
		Heating.	Cooling.	Absorption.	Evolution.	
				°	°	°
IV.	8·6	--	2·8	729	669	0
V.	11·4	3·6	3·6	720	663	2
VI.	9·7	8·2	6·5	728	691	4
VII.	9 7	7·8	8·5	727	661	10
VIII.	16·0	10·9	18·0	733	705	8
IX.	15·4	10·3	16·0	735	713	7
VIII.*	—	—	18·2	729 733	708 698	9

* After hardening.

Incidentally, support is found for the views that the specific heat is lower above the critical range than below it, and that the critical change does not occur completely at one temperature, however long the specimen be held at that temperature, but a definite proportion of the change only takes place.

Platinum amalgam ; Property of ——. P. Lebeau Compt. rend., 1907, **144**, 843—845.

A study of the emulsion which platinum amalgam forms with water and many other liquids (this J., 1907, 413) furnishes no evidence of chemical action during its formation, but shows that it is due rather to the surface tensions between the amalgam, mercury, and water or other liquid, for it must be noted that the amalgam is insoluble in mercury. When the surface tension of the metal is altered by dissolving it in an equal volume of a liquid amalgam of zinc, calcium, lead, or tin, the power of emulsifying with water is lost. Furthermore, amalgams of other metals of the platinum group do not emulsify with water, and the results with platinum amalgam itself depend very much on the state of division of the platinum used. Also it is found that by substituting a warm 5 per cent. solution of gelatin for water in obtaining the emulsion, sections may be prepared and photographed, and a cellular structure is revealed. —F. Sodn.

Copper ; Constitution of the alloys of ——. L. Guillet. Compt. rend., 1907, **144**, 845—848.

An investigation of the binary alloys of copper with zinc, tin, antimony, cadmium, aluminium, magnesium, manganese and nickel, shows that all these alloys exhibit great brittleness over a range corresponding to the presence of one constituent, behaving similarly towards reagents in each case. They are susceptible of rolling or hammering, however, when they consist (1) only of the solid solution termed *a* ; (2) of two solid solutions, one of which is solution *a* ; these alloys can only be rolled hot. When very rich in copper, each consists of a single solid solution except in the case of the copper-cadmium alloys, which show a separation of the compound, Cu_2Cd, for the smallest percentages of cadmium. The alloys of copper with even a small proportion of cadmium cannot be rolled, therefore. In the copper-nickel alloys, on the other hand, solution *a* only is present, and consequently they may all be rolled cold.—F. SODN.

Copper; Limit of "siliciuration" of ——. E. Vigouroux. Compt. rend., 1907, **144**, 917—920.

COPPER and silicon were heated to 1200° C. in presence of excess of metallic lead, bismuth, and antimony respectively. In all cases a copper silicide was formed, which floated on the lead or the bismuth, but was uniformly mixed with the antimony. The silicide contained close upon 10 per cent. of silicon corresponding to the formula, Cu_4Si, even where excess of silicon was present in the original mixture.—J. T. D.

Copper; Hardening of —— by potassium ferrocyanide. E. S. Sperry. Brass World, 1906, **2**, 418—499; Chem. Abstracts (Amer. Chem. Soc.), 1907, **1**, 406—407.

POTASSIUM ferrocyanide is capable of hardening copper to such an extent that it will take a cutting edge and become as resonant as bronze. The reason is the introduction of iron, and possibly carbon. To use the process the copper is melted in a graphite crucible, and the ferrocyanide used as a flux, 2 per cent. being added after melting. After standing until the moisture has been driven off, the powder is stirred into the melt, allowed to stand a few minutes, and again stirred. In five or ten minutes the metal is ready for pouring. The colour of the copper is not affected by the flux.

Zinc dross and its refining. E. S. Sperry. Brass World, 1906, **2**, 409—411. Chem. Abstracts (Amer. Chem. Soc.), 1907, **1**, 407.

ZINC dross is the alloy of zinc and iron which settles to the bottom of the galvanising tank. Analyses given show an iron content of from 2·02 per cent. to 4·45 per cent. A process for the recovery of the zinc from this dross was discovered many years ago by J. Richards, never patented, and until now kept secret. It consists in introducing into the bath a mixture of potassium cyanide and sulphur in a moist condition. This converts the iron into a sulphide which sank to the bottom of the pot and left the zinc unchanged. The expensive potassium cyanide may be replaced by leather scraps. For furnishing the steam necessary to the operation, raw potatoes were introduced with the mixture. The operation lasted half an hour, and there resulted a zinc practically free from iron.

Iron oxide; Action of —— with zinc blende. C. A. Graumann. Metallurgie, 1907, **4**, 69—77; Science Abstracts, 1907, **10A**, 241.

IT is found that in a nitrogen atmosphere there is a weak reaction between ferric oxide and zinc sulphide. The ferric oxide is, however, quickly reduced in part to ferrous oxide, and the reaction then practically ceases. In a feeble oxidising atmosphere sulphur dioxide and zinc are liberated. When the mixture is heated, the reaction: $ZnO + FeS \rightleftarrows ZnS + FeO$, tends to take place in the direction zinc sulphide + ferrous oxide. The author proposes to replace the process, which depends on the combined action: $2ZnS + Fe_2O_3 + 3CO = 3CO_2 + 2Fe + 2ZnS = 3CO_2 + 2FeS + 2Zn$, by mixing the zinc blende with finely-divided iron. At 1300° C., zinc sulphide is practically completely reduced by this means. The presence of ferric oxide is prejudicial to this process, but that of ferrous oxide is not. The heating must be carried out in the absence of all gas but zinc vapour, and an electrical method is preferred.

Nickel; Production of malleable ——. E. S. Sperry. Metallurgie, 1907, **4**, 155—156; Science Abstracts, 1907, **10A**, 241.

THE nickel should be as free as possible from carbon, in order to arrive at a good degree of malleability. Any of the usual forms of nickel is melted in a carbonless crucible with about 1 per cent. of manganese; no flux nor stirring is necessary. Further procedure is as usual, the metal being worked either in the hot or cold state.

Zinc ore analysis; Report of the sub-committee on ——. G. C. Stone and W. G. Waring. J. Amer. Chem. Soc., 1907, **29**, 262—269.

THE following method is recommended for the determination of zinc in ores. The weighed sample of ore is decomposed by acids alone or aided by fusion, and the zinc is brought into solution as sulphate. Any nitric acid present is expelled by evaporation with hydrochloric and sulphuric acids in succession, or by two evaporations with sulphuric acid, finally until fumes of sulphur trioxide are copiously evolved. The mass is then dissolved in 25—40 c.c. of water, and sufficient sulphuric acid added until the content of free acid is 10—15 per cent. A piece of heavy sheet aluminium is next placed in the solution, which is boiled for 10 minutes, or until reduction is complete. After filtering and washing through a filter containing a piece of aluminium, into a beaker containing a stirring rod of the same metal, the solution is cooled, a drop of methyl orange solution introduced, and then sodium bicarbonate (or, first sodium or potassium hydroxide, and afterwards bicarbonate) added till the liquid acquires a light straw colour. A 20 per cent. solution of formic acid is next added until a faint pink colour appears, after which a further 5 drops of formic acid are added. (If much iron be present, dilute hydrochloric acid (1 : 6) may be used in place of formic acid.) The solution is now diluted to 100 c.c. for each 0·1 grm. of zinc present, from 2 to 4 grms. of ammonium thiocyanate are added if much iron be present, the strip of aluminium removed, and the solution heated nearly to boiling, and saturated with hydrogen sulphide. The zinc sulphide is allowed to settle, collected on a filter, and washed with hot water. The precipitate and filter are next heated with 8—10 c.c. of strong hydrochloric acid and 30—40 c.c. of water, and the zinc determined as pyrophosphate, or by titration with ferrocyanide. In the latter case the use of a 1 per cent. solution of ammonium heptamolybdate as indicator is recommended, provided the solution contain no free hydrogen sulphide.—A. S.

Chromium; New modification of ——. B. du Jassoneix. Compt. rend., 1907, **144**, 915—917.

COPPER, at a temperature near its boiling point, dissolves about 1·6 per cent. of chromium. On cooling, this chromium separates out in very fine filaments and crystallites, which remain behind as a moss or sponge when the copper is dissolved away by nitric acid.—J. T. D.

Wolfram and hübnerite; Analysis of ——. P. Nicolardot. Compt. rend., 1907, **144**, 859—861.

THE coarsely powdered mineral is heated with three times its weight of sodium hydroxide in a silver crucible over a spirit lamp. Half the alkali is first melted and allowed to cool. The substance is then added, and afterwards the remaining alkali. Fifteen seconds suffice to complete the reaction, and the mass is then taken up with water and filtered. The alkaline liquid is oxidised by bromine and acidified with nitric acid. Sulphur is then determined by adding barium nitrate, the excess of barium is removed by sulphuric acid, and the acid liquid evaporated to dryness to remove most of the silica. Arsenic, molybdenum, and tin are next removed by sulphuretted hydrogen. The liquid is rendered ammoniacal, again treated with sulphuretted hydrogen, and the tungsten precipitated as sulphide by cautious addition of hydrochloric acid, the precipitate being calcined and weighed. Iron and phosphorus are determined in the filtrate. The residue remaining unattacked by the sodium hydroxide is readily decomposed by hydrochloric acid. It contains iron, manganese, cassiterite, and gangue (quartz), but never tungsten. The freedom of the barium sulphate precipitates from silica, and tungstic, columbic, and tantalic acids must be ascertained, as also that of the silica from these acids and that of the tungstic anhydride from silica.—F. SODN.

Mineral discoveries in Ireland. Times Financial Suppl., May 13, 1907. [T.R.]

THE development of the coalfields in county Antrim have revealed the presence of large quantities of coal in a district where the supply was supposed to be exhausted, and now inquiries reveal the presence of enormous quantities of iron ore and other profitable minerals. Bog iron ore has been raised in Donegal in Queen's County for some years, but the only other iron ore mines regularly worked in Ireland in recent years are those found interbedded among the Antrim basalts.

Everything points to the fact of new mines being developed further north in Antrim and at three or four points in the neighbouring county of Londonderry. The districts in question have been found to be richly mineralised, and to contain hæmatite, bauxite, manganese and, gannister. The most recent investigations more than confirm the description which Mr. Philip Argall gave some years ago of these inter-basaltic iron ores of the north of Ireland. The richest ore is pisolite, and is at times a bright red earthy hæmatite, at times brown and limonitic, and again black and magnetic, with from 5 to 10 per cent. of titanium dioxide. Intermixed with these strata is bauxite, of which a considerable quantity has been raised. The tests which have been made show that the hæmatites constitute the chief mineral wealth of Antrim and Londonderry. They vary from a low grade, which can be easily calcined, to the rich red and purple hæmatites containing 60 and 70 per cent.

The following is an analysis of a sample of iron ore taken from the Dunluce district in the North of Antrim :—

	per cent.		per cent.
Ferric oxide	45·84	Carbonic acid	nil
Manganese dioxide ..	trace	Silica	10·70
Titanium dioxide ...	5·90	Combined water	9·90
Alumina	18·50		
Lime	1·40		100·00
Magnesia	6·68		
Alkalis	0·97	Metallic iron	32·09
Sulphuric acid......	0·11	Metallic titanium ...	3·54
Phosphoric acid	trace		

Close to Portrush large bodies of bauxite have been found varying in quality up to 56 per cent. of alumina. In the same locality aluminous, pisolitic ores, and yellow and red ochre have been found in considerable quantities. In the neighbourhood of Castlerock, in Londonderry, hæmatite and enormous quantities of low-grade ore suitable for calcining have been found.

It is in the Draperstown district in the southern portion of Londonderry that the most important discoveries have been made. The ores of this neighbourhood are rich hæmatite veins among a series of pyroxenic rocks, which are considered to be pre-carboniferous. The prospecting appears to prove a very large body of ore to exist in these rocks, and traces of a variety of other valuable metals have been found. The district was recently visited by some of the most experienced mining experts in the United Kingdom, and they are convinced that there is an almost inexhaustible deposit of hæmatite which will compare favourably with any hæmatite deposits in the world. The ores contain upwards of 49·5 per cent. of iron.

Queensland ; Mineral production of ——. Bd. of Trade J., May 9, 1907. [T.R.]

The "Queensland Government Mining Journal" publishes the following statistics of the mineral output of Queensland for the year 1906, with comparative figures for the preceding year :—

—	1905.		1906.	
	Quantity.	Value.	Quantity.	Value
		£		£
Antimony,...tons	24	174	530	6,917
Coal .... ,,	529,326	155,477	606,772	173,282
Copper ...... ,,	7,221	503,547	10,077	916,546
Gems	—	5,255	—	18,110
Gold, fine ... oz.	592,620	2,517,295	544,636	2,313,464
Ironstone....tons	4,342	3,600	31,401	14,114
Lead .. ,,	2,422	33,212	2,809	49,884
Limestone .. ,,	25,057	15,863	61,856	23,364
Molybdenite . ,,	63·3	8,496	106·2	15,275
Silver .... oz.	601,712	69,176	783,087	101,693
Tin .... tons	3,945	297,454	4,823	490,283
Wolfram..... ,,	1,409	99,873	768	64,136
Other..........	—	16,853	—	11,579
Total value .	—	3,726,275	—	4,198,647

Tasmania ; Mineral production of ——. Bd. of Trade J., May 2, 1907. [T.R.]

The "Journal of Commerce" (Melbourne) publishes the following official statistics of the output of minerals in Tasmania in 1905 and 1906 :—

—	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Gold fine oz.	73,540	312,380	60,025	254,963
Silver lead, tons	75,270	246,888	87,117	462,443
Blister copper ,,	6,610	704,287	8,708	862,444
Copper ore ,,	1,151	52,939	2,221	72,480
Tin ore ,,	3,891	362,670	4,473	557,266
Wolfram ,,	32	2,371	20	1,465
Bismuth ,,	2½	800	$\frac{6}{20}$	24
Iron .... ,,	6,300	2,600	2,600	1,100
Coal .... ,,	51,993	44,194	52,895	44,962
Total value .	—	£1,729,129	—	£2,257,147

Mineral production of Germany. Eng. and Min. J., April 27, 1907. [T.R.]

The preliminary statement of the mineral production of Germany, as given by "Gluckauf," from official data, gives the production of coal as below, in metric tons :—

—	1905.	1906.
Coal	121,298,607	137,117,926
Brown coal	52,512,062	56,415,333
Total	173,810,669	193,533,259

The output of other non-metallic minerals was as follows, also in metric tons :—

—	1905.	1906.
Graphite	4,921	4,055
Asphaltum	103,006	117,413
Petroleum	78,869	81,419
Rock-salt..................	1,165,495	1,235,030
Kainite	2,387,643	2,679,264
Other potash salts	2,655,845	2,803,732
Kieserite, &c...............	706	7,356
Boracite...................	183	161

The production of various salts, in their marketable forms, was as follows :—

—	1905.	1906.
Salt	612,062	632,922
Potassium chloride	373,177	403,387
Magnesium chloride	29,017	38,468
Sodium sulphate	68,455	81,175
Potassium sulphate.........	47,994	54,490
Pot.-mag. sulphate	34,222	34,239
Magnesium sulphate	58,568	43,013
Aluminium sulphate	52,892	55,969
Alum	4,127	4,494

The output of various ores is reported as follows, in metric tons :—

—	1905.	1906.
Gold and silver ore	10,286	8.066
Copper ore	793,488	768,523
Lead ore	152,725	140,914
Zinc ore	731,271	704,596
Iron ore	23,444,073	26,734,560
Manganese ore	51,463	52,485
Arsenic ore	4,913	6,259
Pyrites	185,368	196,571
Aluminium ore	636	1.120
Miscellaneous ores	11,017	8,044

The production of metals other than iron is reported below, gold and silver being in kilograms :—

—	1905.	1906.
Gold, kilos	3,933	4 202
Silver, kilos	399,775	393,442
Copper, tons	33,352	33,032
Tin, tons	6,044	7,134
Lead, tons	156,376	154,878
Zinc, tons	198,208	205,691

Metals from imported ores are included. The copper for 1906 includes 32.275 tons of refined copper, 193 tons of black copper, and 564 tons in copper matte. The lead in 1906 includes 4137 tons litharge.

There were made as by-products in the metallurgical work the following materials, the quantities being in metric tons :—

—	1905.	1906.
Arsenic	2,535	3.052
Sulphur	205	178
Sulphuric acid	1,228,211	1,305,065
Copperas	12,949	13,376
Copper sulphate	6,988	6,757
Mixed sulphates	159	158
Zinc sulphate	5,896	6,092
Nickel sulphate	220	187
Metallic pigments	3,910	4,363
Miscellaneous	6,139	6,764

The sulphuric acid reported last year included 1.184,438 tons ordinary acid, and 120,627 tons of concentrated acid.

The iron production for the year is reported as follows :—

—	1905.	1906.
Foundry iron	1 797,680	2,003,883
Direct castings	61,320	60,027
Bessemer pig	410,963	491,086
Basic pig	7,032,322	8,039,808
Steel pig	580.344	755,678
Forge iron	976,986	929,122
Scrap and cinder pig	15,446	14,221
Total	10,875,061	12,293,825

The iron figures differ slightly from those reported by the German Iron and Steel Union, compiled from the monthly blast-furnace returns. Steel pig includes spiegeleisen, ferromanganese, and all similar alloys.

Canadian iron and steel bounties. "Times" Financial Suppl., May 13, 1907. [T.R.]

Encouragement of electrical smelting.—At the last stage of the Tariff Bill in the Canadian House of Commons an important addition was made to the bounty clauses. As these were introduced on November 29, 1906, they provided for a continuance of the bounties—which were first enacted in 1883—from June, 1907, when, under then existing legislation, they were to expire, to the end of December, 1910. The continuation was at the instance of the iron and steel companies of Ontario, Quebec, and Nova Scotia. It was pleaded that there had been initial difficulties in installing and getting to work the plants which came into existence under the legislation of 1899 and 1902-3, especially in regard to the largest of all the Canadian plants—that of the Dominion Iron and Steel Company at Sydney, Nova Scotia. The Government therefore continued the bounties on pig iron and puddled bar iron, on ingots, and wire rods. It put the bounties back on a scale higher than that in operation in 1905-6; and to aid in the development of iron ore mines in Nova Scotia and Ontario it was enacted that all the bounties should be higher on pig iron, puddled bars, and steel ingots made from Canadian ore than from ore imported from Newfoundland or the American mines at the head of Lake Superior, from which two sources of supply most of the ore used at the Canadian furnaces has so far been obtained.

No bounties are to be paid in respect of electrically smelted ores until the end of 1908. It would not be practicable to get the plant at Welland to work at which the new processes could be used before then, and the bounties are to run until the end of 1912. During these four years the rates are to be as follows :—

On pig iron manufactured from Canadian ore by the process of electrical smelting during the calendar years—1909, $2.10 per ton ; 1910, $2.10 per ton ; 1911, $1.70 per ton ; 1912, $0.90 per ton.

On steel ingots manufactured by electrical process direct from Canadian ore and on steel ingots manufactured by electrical process from pig iron smelted in Canada by electricity from Canadian ore during the calendar years—1909, $1.65 per ton ; 1910, $1.65 per ton ; 1911, $1.05 per ton ; 1912, $0.60 per ton.

Assuming that all the bounties come to an end in 1912, the Canadian iron and steel industry will by 1912 have had the advantage of bounties for nearly 30 years. The system as applied to the iron and steel industry alone has already cost the Dominion Treasury over eleven million dollars ; and by 1912 the call on the Treasury in respect of these bounties will not have been less than thirty million dollars.

English Patents.

Iron ; Process for the production of spongy ——. F. C. W. Timm, Hamburg, Germany. Eng. Pat. 8648, April 10, 1906. Under Int. Conv., April 10, 1905.

See Fr. Pat. 365,878 of 1906 ; this J., 1906, 991.—T. F. B.

Compound metal ingots and other bodies ; Manufacture of ——, *and apparatus to be used in such manufacture.* J. F. Monnot, New York. Eng. Pat. 8913, April 12, 1906.

Iron or steel is coated with a firmly adhering film of copper by placing it for a few seconds in molten copper heated to a temperature considerably above its melting point, say, to 1400° C. or 1500° C. The iron may be subjected to a preliminary heating, and its surface must be perfectly clean and free from scale, &c. Arrangements are made for surrounding the iron with a non-oxidising atmosphere during its preliminary heating and immersion in the molten copper, and after its withdrawal. The thickness of the coating may be increased by subsequently dipping the iron into copper at the normal melting temperature, the coating of copper, it is claimed, remaining continuous and firmly adherent after rolling, hammering, drawing, &c. In a similar way iron may be coated with silver, aluminium, aluminium bronze, &c., and copper with aluminium.—O. F. H.

Metals, ores, or similar substances ; Smelting, melting, or heating of ——. W. H. Webb, W. G. Brettell, and A. J. Adamson, Liverpool. Eng. Pat. 10,536, May 5, 1906.

The air supply for furnaces is heated or cooled to a constant temperature of about 40° F. and saturated with moisture at that temperature by passing it through a chamber filled with hurdles, brushwood or the like, over which flows water, previously heated or cooled.—O. F. H.

Cupro-nickel ; Solvent for —— [*cleaning rifle barrels*]. A. T. Cocking, Four Oaks, Warwickshire, and Kynoch, Limited, Birmingham. Eng. Pat. 15,081, July 3, 1906.

The claim is for a solvent for the metallic fouling of rifle barrels which will not injure the barrel itself. The solvent consists of a solution of a mixture of 54 per cent. of potassium bichromate and 46 per cent. of chromic anhydride in water, 6 grms. of the mixture dissolved in 40 c.c. of water being sufficient for cleaning one rifle barrel.—O. F. H.

Soldering tin paste and process for the production thereof ; Soft ——. J. W. Bagger, Riga, Russia. Eng. Pat. 25.498, Nov. 12, 1906.

See Fr. Pat. 370,706 of 1906 ; this J., 1907, 260.—T. F. B.

United States Patents.

Blast-furnaces ; Drying air for ——. N. T. Bacon. Peace Dale, R.I. U.S. Pat. 847,273, March 12, 1907.

Moisture is extracted from the air or gas by chilling it below the freezing point with a refrigerating liquid (*e.g.*, mercury) immiscible with water.—C. S.

Ore roasting and treating apparatus. M. Dings and A. Dings, Milwaukee, Wis. U.S. Pat. 849,465, April 9, 1907.

The apparatus consists of a furnace connected with a chamber containing a series of horizontal rotating shafts arranged in zig-zag fashion, one above the other. The shafts are provided with buckets, which receive and discharge the ore intermittently, each shaft rotating in a direction opposite to those above and below it. The furnace-gases enter the chamber at a point nearly half-way up, so that the lower part of it constitutes a cooling chamber. A current of air enters at the bottom of the chamber and is drawn off below the point at which the furnace-gases enter, the air thus heated, after passage through a dust chamber, being used either in the furnace, or in the upper or heating portion of the chamber, or allowed to go direct to the stack.—O. F. H.

Ore-roasting apparatus. R. McKnight, Philadelphia, Pa. U.S. Pat. 850,039, April 9, 1907.

A vertical cylindrical chamber containing a series of inverted cones is mounted on a vertical rotating shaft. Each cone is separated by a conical ring or cup, so arranged as to leave a continuous passage way between the cones and rings. The ore is charged in at the top of the chamber, and travels downwards through the passage between the cones and the rings to a trough below the edge of the lowest cone which carries scrapers for the discharge of the ore from the trough to the outlet. The gases are drawn off at the top through perforations in the top-most ring. —O. F. H.

Alloy. A. H. Smith, Philadelphia, Pa., Assignor to American Bronze Company. U.S. Pat. 849,927, April 9, 1907.

A mixture of an alkali chloride and hydroxide, *e.g.*, ammonium chloride and potassium hydroxide, in the proportion of 16 : 1 is added to an alloy of four parts of tin and one of zinc. The alloy of tin and zinc so treated is added to molten copper in the proportion of 1 : 12·8. —O. F. H.

French Patents.

Steel ; Process of reduction and recarburisation for use in the manufacture of ——. R. de Moya. Fr. Pat. 372,633, Feb. 24, 1906.

During the Bessemer or open-hearth process, borax and calcium sulphate are added to the metal, which is subsequently recarburised.—O. F. H.

[*Zinc*] *Metallic vapours which are to be converted into oxides ; Process for separating from ores or metallurgical products* ——. B. Oettinger. Fr. Pat. 372,567, Dec. 14, 1906. Under Int. Conv., Jan. 3, 1906.

The finely-crushed ore is mixed with the requisite quantities of finely-powdered charcoal and fluxes, and made into briquettes. The briquettes are heated in a furnace through which passes a rapid current of air, the volatilised metals being at once converted into oxides and carried out of the furnace as such with the waste gases. The non-volatile portions of the charge form a fluid slag, which flows out continuously from the lower part of the furnace.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 476.)

(A.)—ELECTRO-CHEMISTRY.

Metallic and electrolytic conduction ; On the nature of ——. R. von Hasslinger. Monatsh. f. Chem., 1907, **28**, 173—207.

The electrical resistance of carbon which at first decreases with the temperature, is found by the author to reach a minimum and then to increase at still higher temperatures. Molten sulphur which has a small conductivity exhibits polarisation phenomena when an electric current passes through it ; moreover, it can serve as an ionising solvent for other substances. Iodine behaves both as a metallic and as an electrolytic conductor. Silver sulphide at ordinary temperatures has an electrolytic conductivity, but at low temperatures possesses only metallic conducting power. Copper sulphide and magnetic oxide of iron at ordinary temperatures behave as metallic conductors, but at higher temperatures as electrolytic conductors.—R. S. H.

Hydroxylamine and nitrous acid ; Electrolytic reduction of ——. O. Flaschner. Monatsh. f. Chem., 1907, **28**, 209—246.

In the author's experiments the indications of the decomposition-potential curves were confirmed in the actual electrolysis. On the other hand, the application of a graded potential to the reduction of nitrous acid does not yield any results of value, since ammonia as the final product of the reduction is set free even at very low cathode potential. The influence of the cathode metal upon the velocity of the reduction is great; platinised platinum acts catalytically, greatly increasing the speed of the reduction. With copper cathodes ammonia is the sole product both from nitrous and nitric acids. Throughout the research the current efficiency was low, although no hydrogen was evolved ; this is ascribed to the depolarisation by dissolved oxygen.—R. S. H.

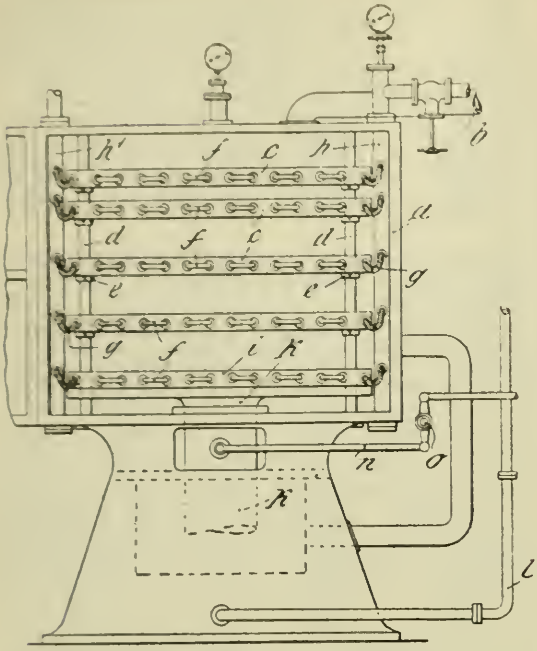
Chlorates and hypochlorites ; Experiments on the [*electrolytic*] *manufacture of* —— *with a view to high current efficiency.* A. G. Betts and R. H. Sherry. J. Amer. Chem. Soc., 1907, **29**, 340—345.

In order to increase the current efficiency in the electrolytic manufacture of chlorates and hypochlorites, the addition of alkali chromate to the electrolyte has been proposed. This has proved satisfactory in the manufacture of chlorate, but is of little use in the preparation of hypochlorites for bleaching purposes, owing to its strong colour. The authors carried out experiments with electrodes of various kinds, and with the addition of various substances to the electrolyte, with a view to increasing the current efficiency. It was found that a cathode of magnesium wire gave an efficiency nearly equal to that produced by the addition of alkali chromate in the manufacture of chlorate. The loss of weight of the magnesium amounted to 1 part per 50 parts of chlorate produced. Magnesium cathodes also gave a high current efficiency in the preparation of hypochlorites, and was less attacked. It was found best to use several cells, with graphite electrodes in the first, and graphite anodes and magnesium cathodes in the others. In one experiment with three cells, a 12·5 per cent. solution of sodium chloride was passed through at the rate of 200—250 c.c. per hour. The temperature was kept below 25° C. The results showed that in this way it is possible to convert from 35 to 50 per cent. of the sodium chloride into hypochlorite with a current efficiency of 60 per cent. The power required is equivalent to 450 h.-p.-hours per 100 lb. of available chlorine, with a loss of 0·2 lb. or less of magnesium. The addition of traces of sodium hydroxide to the electrolyte was found to diminish the loss of magnesium from the cathode.—A. S.

English Patents.

Isolating or insulating properties ; Manufacture of substances having ——. C. Czarnikow, Berlin. Eng. Pat. 14,001, June 19, 1906.

Substances, possessing insulating properties, are prepared by treating suitable material in a vacuum, whilst simultaneously heating and pressing, the process being specially applicable in the case of insulating materials composed of layers of hygroscopic substances, such as asbestos fibre, covered by layers of waterproof substances, such as copal. The drying oven, *a*, is provided with a row of plates, *c*, and, by means of set-rings, *e*, on the guiding rods, *d*, the plates may be adjusted at a



convenient distance apart. Heating pipes, *f*, pass through the plates, the flexible tubes, *g*, connecting the pipes with the steam conduits, *h* and h^1, respectively. By means of the conduit, *b*, the oven may be exhausted. A piston, *k*, is connected by a conduit, *l*, to an accumulator, the piston being also attached to the lower plate, *i*, for pressing the material. The piston is also connected to the accumulator valve by means of a rod, *n*, and the crank lever, o, so that the pressure may be automatically regulated in accordance with the shrinking of the material. —B. N.

Cells; Galvanic ——. H. P. R. L. Pörscke, Hamburg, Germany. Eng. Pat. 21,348, Sept. 26, 1906.

A CONTAINING vessel, made of a suitable metal, such as zinc, is used as the negative electrode, and this contains a solution of zinc chloride, or other similar substance, as the electrolyte, arabic acid, metarabic acid, or gum arabic being added to the electrolyte, together with bone meal, or other suitable pulverised substance, in order to form a paste. The positive electrode consists of a carbon rod embedded in a depolarising mixture of manganese peroxide, ferric chloride, ferrous hydroxide, and graphite, the compressed mixture being preferably wrapped in canvas.—B. N.

Electrolysis of fluids; Apparatus for the ——. E. Weichert, Augsburg, Germany. Eng. Pat. 22,658, Oct. 13, 1906.

SEE Fr. Pat. 370,718 of 1906; this J., 1907, 261.—T. F. B.

Furnaces; Electric ——. F. E. Roach, Chicago. Eng. Pat. 26,929, Nov. 27, 1906.

SEE U.S. Pat. 838,647 of 1906; this J., 1907, 208.—T. F. B.

Electric incandescence filaments from tungsten or mixtures thereof with other metals; Manufacture of ——. Siemens und Halske A.-G. Eng. Pat. 4814, Feb. 27, 1907. II., page 519.

United States Patent.

Vacuum; Means for creating a —— [*in mercury-vapour lamps, &c.*]. P. H. Thomas, East Orange, N.J., Assignor to Cooper Hewitt Electric Co., New York, U.S. Pat. 845,671, Feb. 26, 1907.

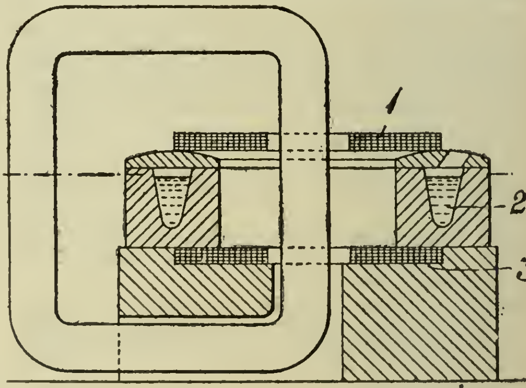
ALUMINIUM and certain other metals, although not acted upon by air or other gases when in the solid state, have been found to enter into combination with them when amalgamated. This phenomenon is utilised in the following way. Some mercury and a piece of aluminium or other suitable metal are placed in the lamp, or vessel in which the vacuum is to be created, in such a way that they are not in contact. The lamp is then exhausted as far as possible by the ordinary means, and sealed off. The mercury is then brought into contact with the metal by inclining the lamp or in any other suitable way, and an amalgam is formed. The latter absorbs the remaining portion of the gas and a very complete vacuum is obtained. Magnesium has been found to be equally suitable and has the advantage that both oxygen and nitrogen are absorbed by it.—W. H. C.

French Patents.

Incandescence electric lamps; Process of making conductive connections, of metallic character, between the filaments and current leads of ——. H. Kuzel. First Addition, dated Nov. 21, 1906, to Fr. Pat. 366,267, May 16, 1906. II., page 520.

Metallic filaments for incandescent electric lamps; Manufacture of ——. Deutsche Gasglühlicht- A.-G. (Auerges.). Fr. Pat. 372,537, Dec. 13, 1906. II., page 521.

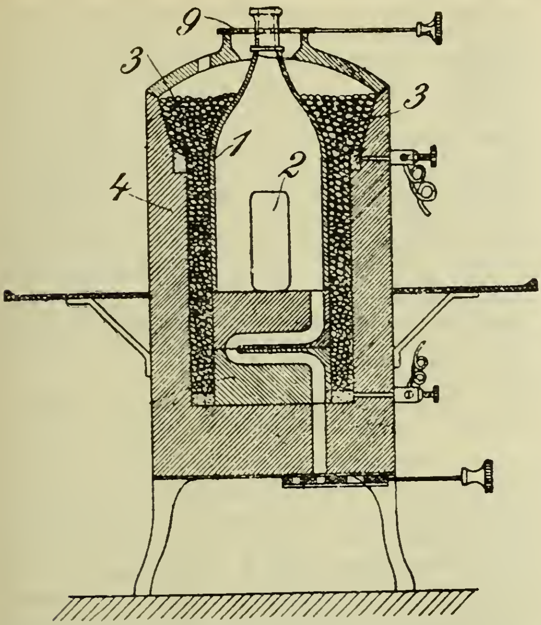
Furnace; Electric induction ——. O. Frick. Fr. Pat. 372,801, Dec. 21, 1906. Under Int. Conv., Dec. 27, 1905.



THE primary winding is in two portions, 1 and 3, placed above and below the channel of fusion, 2. The tension of self-induction of the primary winding is thus diminished, as the iron core does not pass through the two separated fields of dispersion. Alternative forms are described in which several primary windings entirely surround the fusion channel, or are placed on two or three sides only of the fusion channel.—B. N.

Furnace; Electric ——, *provided with a muffle and ventilation for the same.* A. Voelker. Fr. Pat. 372,829, Dec. 22, 1906. Under Int. Conv., Dec. 23, 1905.

A BOTTLE-SHAPED muffle, 1, closed by a wedge fitting into the opening, 2, is surrounded by resistance material, 3. The upper portion of the outer receptacle, 4, is funnel-shaped, in order to accommodate a large mass of resistance material, thus preventing access of air and loss of heat, whilst providing against loss of material by combustion. Air or other suitable gas is admitted to the base of the



muffle through a channel in which the gas is heated, the current of air and also the escaping gas being regulated by the slides, 9.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Nickel-zinc alloys ; Electrolytic deposition of ——. E. P. Schoch and A. Hirsch. J. Amer. Chem. Soc., 1907, **29**, 314—321.

The authors have found that although zinc has a greater electrolytic solution tension than nickel, a bath which contains much more nickel than zinc yields an alloy containing much more zinc than nickel. In carrying out the experiments, the thin sheet-lead cathodes were usually rotated at a rate of 160 revolutions per minute, and anodes of nickel and zinc were used so that these metals were supplied to the electrolyte in approximately the same amounts as they were deposited. With electrolytes containing different relative proportions of nickel and zinc, the alloys obtained with current densities above 2 ampères, were practically of constant composition for a given electrolyte, the ratio of zinc to nickel (equivalents) in the deposit being 5·3—5·4 times the ratio in the electrolyte. —A. S.

Tungsten ; New silicide of ——. E. Defacqz. Compt. rend., 1907, **144**, 848—850.

Ninety parts of silicide of copper, containing 50 per cent. of silicon, heated with 10 parts of amorphous tungsten, for a minute and a quarter, in an electric furnace, with a current of 800—900 ampères at 50 volts, gives a silicide of tungsten having the formula, Si_2W. The metallic mass obtained is purified by successive treatments with dilute hydrochloric acid (10 per cent.), dilute sodium hydroxide solution (10 per cent.), concentrated hydrofluoric acid, and methylene iodide to remove the lighter particles. Another method of preparation consists in reducing a mixture of silica (180 grms.) and tungstic anhydride (45 grms.) by aluminium powder (200 grms.) in presence of sulphur (250 grms.). The mixture is covered with magnesium powder, which is fired in the usual way. The resulting metallic button, freed from slag, is treated alternately with hydrochloric acid, and sodium hydroxide solution of increasing strengths, and with hydrofluoric acid. The compound consists of brilliant needles of a grey colour of sp. gr. 9·4. It is unaltered when heated in the air, and unaffected by acids, excepting a mixture of nitric and hydrofluoric acids, but is decomposed by fused alkalis or alkali carbonates, although not by potassium bisulphate. Chlorine attacks the compound readily at 450°, a fact which has been utilised for its analysis. Crystalline silicides of molybdenum are obtained by similar methods.—F. Sodn.

English Patents.

Furnaces ; Electric ——. Allmänna Svenska Elektriska Aktiebolaget, Westeras, Sweden. Eng. Pat. 5345, March 5, 1907. Under Int. Conv., March 7, 1906.

This invention relates to the type of electric furnace constructed on the principle of electric generators, the melting chamber forming a short-circuited inducted conductor, which encloses an iron core, and in the latter is created a periodically variable flux of lines of force by means of a rotating field magnet. The field magnet rotates round a vertical shaft, instead of a horizontal shaft, as in existing types of furnace. The stationary iron core may be annular, and be provided with radial slots through which the melting channel passes, the rotating magnet being placed above or below the iron core. The magnet is provided with horizontal pole surfaces, the pole pieces being so shaped in relation to the iron core that the magnetic circuit remains unbroken during the rotation of the magnet. Alternative forms are described in which the furnace is constructed as a multi-pole electric generator, the melting channel being arranged either in the form of so-called "short coils," or as a short-circuited armature winding.—B. N.

Tin ; Electrolytic production of pure ——. A. J. M. Thirot, Bourges, and L. A. Mage, Avignon, France. Eng. Pat. 28,342, Dec. 12, 1906. Under Int. Conv., March 26, 1906.

See Fr. Pat. 364,589 of 1906 ; this J., 1906, 892.—T. F. B

United States Patents.

Electrolytic apparatus. A. G. Betts, Troy, N.Y. U.S. Pat. 850,127, April 16, 1907.

A tank, lined with lead, is provided with compartments, which are separated from one another by walls pervious to the electric current but practically impervious to the electrolyte. The anode compartments contain anodes of carbon, which are fixed to a frame above the tank, the frame imparting a reciprocating movement to the electrodes. The anode electrolyte consists of a peroxidised compound of a metal, such as a mixture of ferric and ferrous sulphates. The other compartments contain the cathodes on which metal (copper) is to be electro-deposited, and the cathode electrolyte consists of a compound of the metal to be deposited, and also one of the same metal as in the anode electrolyte, in a lower state of oxidation, *e.g.*, a mixture of cupric and ferrous sulphates. Horizontal troughs are arranged outside of the compartments, at an angle to the diaphragms. The troughs contain the anode liquid, which may move from one to the other, and communication is also provided between the troughs and the anode compartments by means of siphons.—B. N.

Metallic coating : Producing a —— *on a non-vitreous surface.* S. Heller and C. Baumgartl, Teplitz, Austria-Hungary. U.S. Pat. 850,753, April 16, 1907.

A mixture of enamel, calcined borax, and "gilt-enamel tombac" [a bronze powder] is fused on to the surface to be coated, and the metallic base thus obtained is plated by electro-deposition.—B. N.

French Patents.

Furnace ; Electric ——. Soc. Anon. Electrométallurgique (Procédés P. Girod). Second Addition, dated Dec. 7, 1906, to Fr. Pat. 350,524, Jan. 4, 1905 (this J., 1905, 739, and 1179).

This relates to a cover for the furnace described in the main patent. A central piece of cast iron is surrounded by refractory bricks, the parts being held in position by an iron ring. The cast-iron centre-piece is provided with suitable openings for the electrodes, and the latter may thus be accurately adjusted in position. Openings are also provided for the escape of gas, these being closed by plugs or valves which may be operated automatically or not. Water is circulated through a system of passages, produced during the casting of the iron.—B. N.

Metallic deposit; Process for preparing metallic articles to receive a ——. A. Lévy. Fr. Pat. 372,842, March 1, 1906.

THE articles are suspended from the cathode of a bath consisting of a solution of two alkali salts such as chloride, bromide, fluoride, &c., and cyanide, the anodes being some substance insoluble in the solution. The bath may also be made strongly alkaline by the addition of potassium or sodium carbonate.—O. F. H.

Printing plates; Preparation of —— *by electrolytic etching.* H. Strecker-Aufermann. Fr. Pat. 372,294, Dec. 7, 1906.

THE plates, of any suitable metal, which carry an image produced by means of a layer of "bichromated" gelatin, glue, albumin, isinglass, gum arabic, or similar material, or a mixture of these, are used as anodes in a concentrated solution of a tannin-substance. The current may be produced by using the plate as one pole of a known primary battery, or may be introduced from outside.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(Continued from page 476.)

Fats; Synthesis of ——. [*I.*]. A. Grün and P. Schchta. Ber., 1907, **40**, 1778—1791.

CONTINUING their work on the lines described in a previous communication (this J., 1905, 851), the authors have prepared a series of symmetrical di- and tri-glycerides, which they describe in detail. They find that the lower the molecular weight of the fatty acids used, the smaller the yield of diglycerides in the reaction with glycero-disulphuric acid. This appears to be due to the glycerides immediately combining with the free acids to form addition compounds (acid esters) so that further esterification is prevented. Thus the main product of the action of glycero-disulphuric acid upon myristic acid is the compound, $[C_3H_5(OH)(O.COC_{13}H_{27})_2 + 2C_{13}H_{27}.COOH]$. Duffy and Heintz considered that "isomeric modifications" were the cause of glycerides having double melting points, whilst Lehmann concluded that such glycerides were mixtures of stable and unstable modifications. Guth, however (this J., 1903, 427), regarded a double melting point as a physical phenomenon, whereas Knövenagel (Ber., 1907, 515) pointed out the possibility of moto-isomerism in the case of tristearin. Now the authors have found that in the preparation of β-lauro-*α*-distearin, β-myristo-*α*-distearin, and β-myristo-*α*-dilaurin (from the *α*-*α*-diglycerides), each compound is produced in two forms, one of which with lower melting point is readily soluble, whilst the other with a higher melting point is less soluble (the substance shows the phenomenon of double melting point). The form with the lower melting point can be repeatedly recrystallised from different solvents without change, but on introducing into the solution a trace of the higher melting modification, there is a gradual transformation into that substance. The converse change of the modification of higher melting point into that of lower melting point does not take place, and the authors therefore term the former the stable modification, and the latter the unstable modification. After final solidification, triglycerides with double melting point show only one melting point, *e.g.*, the higher one in the case of lauro-distearin and myristo-dilaurin and the lower one in the case of oleo-distearin and myristo-distearin. Yet in the last two instances there is no lasting transformation into the unstable modifications, since myristo-distearin, for example, after one recrystallisation of the fused substance again shows both melting points. A cryoscopic determination showed the stable modifications of lauro-distearin and myristo-distearin to have double the molecular weight, whilst the unstable forms had the simple molecular weight. The results of the boiling point method, however, were inconclusive. The occurrence of the two modifications was also observed in the case of diglycerides. Thus *α*-dilaurin prepared from lauric acid and glycerodisulphuric acid was fluid at the ordinary temperature, whereas the same diglyceride prepared from *α*-,*α*-dichlorhydrin and potassium laurate melted at 55° C. On adding a trace of the solid modification, the fluid modification slowly crystallised. Unsymmetrical triglycerides showed the same phenomenon. Thus, *α*-laurodimyristin was obtained in two forms, one fluid at the ordinary temperature and the other melting at 46·5° C., and the introduction of a trace of the latter into a solution of the former caused crystals to separate with a melting point only slightly lower than 46·5° C.—C. A. M.

Fats; Synthesis of ——. [*II.*]. A. Grün and E. Theimer. Ber., 1907, **40**, 1792—1801.

Unsymmetrical glycerides and their decomposition products.—Unsymmetrical mixed triglycerides are readily prepared from the fatty acid esters of *α*-monochlorhydrin, but it is not easy to obtain them by way of chlorhydrin-disulphuric acid, since in the preparation of the reagent some glycerosulphuric acid is invariably formed, and this reacts with the respective fatty acids with the formation of diglycerides. The latter are produced in the proportion of 3 to 5 per cent. of the fatty acids used, and can only be separated with difficulty from the esters of chlorhydrin. The phenomenon of double melting point was very seldom observed in the case of these di- or triglycerides, but the melting point of pure compounds often became higher or lower after standing for a long period after recrystallisation. Thus the melting point of both symmetrical and unsymmetrical dimyristin fell about 2° C. in a few weeks, whilst that of laurodimyristin rose about 1·5° C., and that of aceto-distearin about 4° C. It has not yet been determined whether here, as in the case of β-oleodistearin (see preceding abstract) there is a slow transformation into a more stable form. These irregularities in the melting points and the formation of the glycerides in two modifications makes it impossible to determine the constitution of glycerides solely by comparison with synthetical glycerides. An additional insight is obtained by breaking down the glycerides in such a way that the acyl group in the *α*-position is first split off, whilst the third acyl group (in the β-position of the glycerol) is not eliminated. Sulphuric acid appears to act in this way, and decomposes, *e.g.*, distearo-chlorhydrin, to yield stearic acid, monostearin, and monostearo-chlorhydrin. The last is the main product of the reaction, but cannot be completely separated from unaltered distearo-chlorhydrin owing to the similarity in the solubility of the two. The monostearin is apparently the symmetrical β-compound, and its formation is a proof that even under conditions in which chlorine is partially split off, a fatty acid group can remain in combination with glycerol. Monostearo-chlorhydrin and analogous decomposition products may be used as starting points in the preparation of triple mixed triglycerides.—C. A. M.

Reversible enzyme action; Formation and decomposition of fatty esters under the influence of the pancreatic enzyme. H. Pottevin. Ann. de l'Inst. Pasteur, 1906, **20**, 901; Woch. f. Brau., 1907, **24**, 205—206.

THE maximum synthetic action of the enzyme of pancreas is obtained when the proportion of water in the system is reduced as low as possible. All alcohols do not behave alike towards oleic acid in presence of the pancreas-tissue. The alcohols from C_1 to C_5 are esterified very rapidly, with the exception of isobutyl alcohol. The same holds good for the three secondary alcohols: isopropyl, secondary butyl, and glycerol, whilst tertiary butyl alcohol is not esterified at all. The esterifying action of the pancreatic tissue is also manifested in dilute alcoholic solutions, *e.g.*, in an 8 per cent. solution of methyl alcohol 40 per cent. of the oleic ester was obtained; in 50 per cent. glycerol, 20 per cent. of oleic acid was esterified, but in 20 per cent. glycerol, only 5 per cent. of oleic acid reacted. If mono-olein, which is formed easily and rapidly, be dissolved in excess of oleic acid and the solution kept for one month at 35° C. with 10 per cent. of pancreas powder, tri-olein is produced. Lactic acid is not esterified, but slowly destroys the enzyme. Stearic acid is esterified almost as readily as oleic acid. The temperatures most favourable for esterification lie between 18° and 35° C.: the enzyme is destroyed by boiling for ten minutes with water. Unlike the ordinary hydrolytic lipase of the pancreas, the enzyme is not soluble. Taylor (Publication of the University of California, 1904, **1**, 33) has studied the synthetic action of the castor oil seed. The seed freed from oil preserves its synthetic activity for some time, it will resist heating at 100° C. for a short time, but loses its activity when heated with water at 65° C. With this product Taylor only succeeded in producing esterification (in presence of water) in the case of glycerol and oleic acid, tri-olein being obtained. His experiments with lipase of animal origin gave negative results.—J. F. B.

English Patent.

Oil; Apparatus for purifying ——. A. Kock, Hamburg. Eng. Pat. 21,086, Sept. 22, 1906.

This apparatus, which is specially intended for the purification of lubricating oil on board ship, consists of a vessel with two inner annular walls, the intermediate spaces being divided into compartments connected with each other by means of pipes. The impure oil enters the apparatus through a flexible tube, and passes through a hopper and sieve and down a pipe to the bottom of the central chamber, where the heavier impurities subside. The supernatant oil passes through a pipe at the top of this chamber to the bottom of one of the outside compartments, where the same process of separation by gravity takes place, the lighter oil passing on to the next compartment, and so on until it reaches the last one in a clear state. The vessel may be suspended on a universal joint to prevent the motion of the ship scattering the oil and to allow the oil to be heated if required. The hopper may also be suspended from the edge of the central chamber.—C. A. M.

United States Patent.

Carbon tetrachloride preparation, and process for its production. J. Stockhausen, Crefeld, Germany. U.S. Pat. 845,322, Feb. 26, 1907.

Sulphonated rosin oil is saponified by heating with at least 6 per cent. of its weight of sodium hydroxide, and the gelatinous soap is dissolved in carbon tetrachloride. —J. F. B.

French Patents.

Saponification; Method of ——. P. A. Barbe, F. Garelli, and G. de Paoli. Fr. Pat. 372,341, Dec. 8, 1906. Under Int. Conv., May 28, 1906.

The oils or fats are heated in an autoclave with an aqueous solution of ammonia under a pressure varying with the circumstances, and the glycerol is subsequently recovered. The ammonium soaps may be gradually hydrolysed by boiling with water and a current of steam, so as to obtain free fatty acids, and recover the ammonia, whilst a partial separation of solid from liquid fatty acids may be meanwhile effected through the more rapid hydrolysis of ammonium palmitate and stearate than of ammonium oleate. The difference of solubility in cold water also affords a means of separating the oleate from the ammonium salts of the solid fatty acids. The ammonium soaps may be converted into potassium or sodium soaps by double decomposition with a solution of potassium or sodium chloride and sulphate. Claim is also made for a special apparatus in which these several operations may be carried out. The autoclave is constructed of iron or other material capable of resisting the action of ammonia under pressure, and is provided with a mechanical agitator.—C. A. M.

Fats; Process for purifying ——. J. Harris. Fr. Pat. 372,946, Dec. 27, 1906. Under Int. Conv., Oct. 10, 1906.

See Eng. Pat. 22,430 of 1906; this J., 1907, 102.—T. F. B.

Feeding cakes; Process of manufacturing —— from olive residues. M. Hicguet and A. Bengesco. Fr. Pat. 372,782, Dec. 20, 1906. XVIII*A*., page 546.

"*Sulphonated hydrocarbons*"; *Preparation of —— and their use in cleansing and removing grease* [*from textiles*]. E. de Grousseau and E. St.-Hilaire. Fr. Pat. 372,276, Feb. 15, 1906. V., page 525.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 477.)

(*A*.)—PIGMENTS, PAINTS.

United States Patent.

Oxides; Method of manufacturing metallic —— [*red lead*]. J. H. Montgomery, Assignor to F. H. Ludington and F. Orff, St. Louis, Mo. U.S. Pat. 849,555, April 9, 1907.

The molten metal is "atomised," the particles are then agitated in a current of air and in the presence of water. The oxidised particles are finally conveyed to a chamber, where they are agitated in the presence of heated air under pressure.—O. F. H.

French Patents.

Paint and mastic that can be used as substitutes for paint and mastic with a base of white lead. J. Teisset. Fr. Pat. 372,643, Dec. 17, 1906.

The residue left in the manufacture of aluminium sulphate by treating bauxite with sulphuric acid is ground up with, say, 40 per cent. of a drying oil, or a similar base may be obtained directly by adding infusorial silica to a mixture of red and white bauxite. For use as a paint the preparation is mixed with oil, siccative, and ochre to give the required shade, whilst a mastic may be prepared by incorporating 40 per cent. of the paint with 60 per cent. of *blanc de meudon*.—C. A. M.

Lakes; Red —— from monoazo dyestuffs. Akt.-Ges. f. Anilinfabr. Fr. Pat. 372,681, Dec. 18, 1906.

The monoazo-dyestuffs produced from diazotised *o*-chloroanisidinesulphonic acid ($OCH_3:Cl:NH_2:SO_3H = 1:2:4:5$) or *o*-chlorophenetidinesulphonic acid ($OCH_3:Cl:NH_2:SO_3H = 1:2:4:5$) and β-naphthol are converted into lakes by the addition of barium chloride. When the formation of the barium salt is complete, freshly-precipitated aluminium hydroxide is stirred in, and the whole filtered. The product gives brilliant scarlet lithographic prints which are fast to light and slaked lime.—J. C. C.

(*B*.)—RESINS, VARNISHES.

United States Patent.

Chemical Apparatus [*for extracting oils, &c., from sawdust*]. H. B. Snell. U.S. Pat. 840,391, Jan. 1, 1907. I., page 517.

Pastes and varnishes; Alcohol denaturant for ——. XVII., page 544.

(*C*.)—INDIA-RUBBER, &c.

Rubber cultivation (*with special reference to parts of the British Empire*). Herbert Wright. J. Soc. Arts, 1907, **55**, 614—643.

The text of this paper is arranged under the following heads:—I. Sources of rubber. II. Distribution of important caoutchouc plants. III. Rubber species. IV. African rubber plants. V. African rubber trees. VI. Eastern rubber plants. VII. Wild rubber. VIII.

Differences between wild and plantation areas. IX. Distribution of rubber plants and the Eastern industry. X. Plantation rubber. XI. Indo-Malayan plantation rubber. XII. Planting of rubber trees. XIII. Importance of plantation supplies. XIV. Plantation and wild rubber supplies. XV. Future plantation output. XVI. Purity and constancy of plantation rubber. XVII. Rubber consumers and producers. XVIII. Effect of rubber on other cultivations. XIX. Laticiferous and caoutchouc plants. XX. The laticiferous system. XXI. Collecting latex. XXII. Methods on Eastern plantations. XXIII. Systems and frequency of tapping. XXIV. Frequency and response. XXV. Coagulation. XXVI. Yields. XXVII. Future yields from renewed cortex. XXVIII. Yields from young and old trees. XXIX. Yield according to system. XXX. Latex from different sections. XXXI. Labour and yields on small and large plantations.

Athie rubber. E. Marckwald and F. Frank. Gummi-Zeit., 1907, **21**, 709.

Under this name a rubber comes from the Ivory Coast (French West Africa) in balls of about 200 grms., much adulterated with pieces of wood and stones. The loss on washing is about 25 per cent., and the air-dried sheets contain :—Moisture, 0·46 : ash, 0·89 ; albuminoids, 0·37 ; acetone extract, 8·53 ; and rubber (by diff.), 89·75 per cent. The resin extracted by acetone is exceedingly soft ; to this may be ascribed the circumstance that the rubber becomes fluid at 100° C. The washed sheets show a moderate degree of toughness and are greatly improved in this respect by deresinification.—W. A. C.

Caoutchouc nitrosites and their employment for the analysis of raw rubbers and rubber goods. P. Alexander. Gummi-Zeit., 1907, **21**, 653—656. (See also this J., 1907, 422.)

The paper deals more particularly with the use of the "nitrosate" method (Alexander *loc. cit.*) for the analysis of vulcanised rubber, and especially for the determination of coefficients of vulcanisation. It is pointed out that the formula attributed to the "nitrosate," $C_9H_{12}N_2O_6$, still contains one of the original double-bonds of the caoutchouc molecule, and that therefore with "soft" vulcanised rubber it is quite possible for the whole of the combined sulphur to still be present in the "nitrosate" derived from it. The conversion of vulcanised rubber into a "nitrosite c" would necessitate the elimination of the combined sulphur, since the molecule, $C_{10}H_{15}N_3O_7$, does not contain either of the original double linkages. That the whole of the sulphur of vulcanisation does pass over into the "nitrosate" is shown by the results of a large number of experiments, the more important of which are given in the following table, where Column I. shows the kind of rubber under examination, Column II. the percentage of sulphur used for vulcanisation (calculated on the weight of rubber used), Column III. the sulphur-content of the vulcanised acetone-extracted sample, Column IV. the ash-content of this sample, Column V. the percentage of pure caoutchouc (by difference), Column VI. the percentage of pure caoutchouc from weight of nitrosate *minus* sulphur (2·4 grms. of sulphur-free nitrosate = 1 grm. of caoutchouc), Column VII. the coefficient of vulcanisation calculated from Columns III. and V., and Column VIII. the coefficient calculated from sulphur-content of nitrosate.

I	II.	III.	IV.	V.	VI.	VII.	VIII.
Fine Para	7·5	6·78	0·55	92·67	96·06	7·32	6·96
	15	12·06	0·39	87·55	95·61	13·77	11·94
Fine Para, 1903	7·5	5·81	0·73	93·46	95·41	6·22	6·10
	15	10 56	0·65	88·79	93·47	11·89	11·57
Bolivian Para	7·5	6·26	1·00	92·74	95·00	6·75	6·91
	15	11·10	0·77	88·12	93·61	12 59	11·83
Bolivian Para, 1903	7·5	6·27	0·20	93·53	85·95	6·70	6·81
	15	10·81	1·00	88·19	80·68	12·26	12·89
Mollendo, 1903	7·5	5·54	0·46	94·00	82·12	5·89	5·20
	15	11·72	0·14	88·14	87·91	13·30	11·73
Rio Negro, 1903	7·5	6·63	0·20	93·17	73·33	7·12	7·35
	15	12·66	0·40	86·94	76·16	14·39	15·13
Guayaquil strips	7·5	5·29	6·20	88·51	97 68	5·98	5·78
	15	8·00	5·32	86·68	84·46	9·23	12·02
Gambia balls	7·5	4·16	0·99	94·85	93·75	4·39	4·35
	15	10·05	1·38	88·57	89·51	11·34	11·86
Lomé niggers	7·5	3·18	0·20	96·62	90·20	3·29	6·02
	15	6·02	0·60	93·38	85·68	6·45	9·98
Loanda niggers	7·5	4·98	0·38	94·64	91·80	5·26	5·48
	15	10·71	0·63	88·66	87·97	12·08	11·07
Mozambique spindles	7·5	4·85	0·24	94·91	88·54	5·11	5·29
	15	8·32	0·22	91·46	86·16	9·10	10·81
Madagascar niggers	7·5	6·37	2·06	91·57	92·41	6·95	7·04
	15	11·03	1·75	87·22	89·97	12·64	12·73
Penang	7·5	4·98	1·06	93·96	95·40	5·30	5·05
	15	8·28	1·10	90·62	94·84	9·12	9·80

Similarly satisfactory results were obtained on applying the method to the case of vulcanised rubber mixings after extraction with acetone and alcoholic soda in the usual way. Six different mixings were employed, and the agreement between the coefficient of vulcanisation, (1), as calculated from the amount of sulphur in the extracted sample, and the (known) percentage of rubber in the mixing, and, (2), as determined from the percentage of sulphur in the "nitrosate," is shown in the following table :—

Mixing.	Co-efficient of vulcanisation.		Mixing.	Co-efficient of vulcanisation.	
	(1)	(2)		(1)	(2)
No. 1....	4·38	4·63	No. 4...	1·80	2·08
„ 2....	5·71	5·72	„ 5...	4·13	5·72
„ 3....	6·54	5·55	„ 6...	2·62	1·74

Details of the method of analysis are given, stress being laid upon the use of nitric acid of sp. gr. 1·4 for the production of the nitrous gases.—E. W. L.

Rubber goods ; Determination of sulphur in ——. A. Wagner. Gummi-Zeit., 1907, **21**, 657.

Appreciable quantities of sulphuric acid are driven off during the evaporation of the excess of nitric acid after oxidation in the Henriques process and its modifications. A rubber mixing containing 28·87 per cent. of total and 18·40 per cent. of free sulphur was used for the purposes of experiment. When the evaporation was conducted by heating a small Erlenmeyer flask containing the acid liquid over a flame covered with wire gauze, and the vapours absorbed in water contained in a receiver, 3·83 per cent. of sulphur, calculated on the original substance, was found to have been driven off. Only 0·77 per cent. escaped when potassium nitrate was added before evaporation. By evaporating in a shallow porcelain crucible on a water-bath, without the addition of potassium nitrate, 2·12 per cent. of sulphur was found in the receiver. This loss of sulphur is avoided by rendering the liquid alkaline before evaporation in a nickel crucible.—E. W. L.

India-rubber; Reclaimed ——. P. Alexander. Gummi-Zeit., 1907, **21**, 708—709.

It is pointed out that in all the known processes of rubber recovery, heat is applied in one form or another. By this means the desired effect of rendering the material plastic is obtained, owing, no doubt, to depolymerisation of the rubber molecule. Excess of heat goes further and breaks down the rubber molecule, yielding substances which do not polymerise again on revulcanisation. The property of rapid vulcanisation attributed to reclaimed rubber is probably due to the presence of litharge in very many commercial specimens.—W. A. C.

English Patents.

India-rubber goods; Manufacture and repairing of ——. T. Gare, New Brighton. Eng. Pat. 12,454, May 29, 1906.

Waste vulcanised rubber, preferably very finely ground, is placed in moulds and subjected to a pressure varying from half a ton to a ton per square inch. The mould is then locked and heated at about 400°—420° F. for a length of time varying from 20 minutes to an hour and a half according to the size of the article and the thickness of the mould. Under this treatment the rubber waste becomes plastic and "thoroughly fuses," and on subsequent cooling, a solid article is obtained. The process may be applied to the repairing of damaged rubber goods, or to the re-shaping of vulcanised rubber goods, and also to the welding together of pieces of vulcanised rubber. —E. W. L.

Elastic compositions; Impts. in ——. F. Fenton, Mitcham. Eng. Pat. 16,368, July 20, 1906.

The "elastic composition" consists of a gelatinous, elastic material, and is prepared by heating sulphur with a cereal oil or a mixture of cereal oils, particularly maize oil. The oil is heated until it appears to boil, and flowers of sulphur, in quantity varying from one-fourth of the weight of oil to an equal weight, are then cautiously added, and the heating continued for half an hour.—E. W. L.

Caoutchouc; Process for the production of pure ——. A. Foelsing, Offenbach on Maine, Germany. Eng. Pat. 17,775, Aug. 7, 1906.

See Fr. Pat. 368,958 of 1906; this J., 1907, 59.—T. F. B.

United States Patent.

Benzine [in rubber factories]; Apparatus for recovering ——. A. E. Vincent, Paris. U.S. Pat. 849,645, April 9, 1907.

See Fr. Pat. 361,603 of 1906; this J., 1906, 996.—T. F. B.

French Patents.

Rubber products; Composition for preserving the elasticity of ——. E. Granier and E. L. Froger-Delapierre. Fr. Pat. 372,771, Feb. 28, 1906.

See Eng. Pat. 6183 of 1906; this J., 1907, 59.—T. F. B.

Rubber solutions; Process of making aqueous —— *and of regenerating rubber.* P. Alexander. First Addition, dated Nov. 15, 1906, to Fr. Pat. 358,018, Sept. 25, 1905.

See U.S. Pat. 844,077 of 1907; this J., 1907, 423.—T. F. B.

Elastic material; Manufacture of an ——, *and its applications.* L. C. G. Lesage. First Addition, dated Nov. 17, 1906, to Fr. Pat. 359,183, Nov. 6, 1905 (this J, 1906, 384).

In the main patent a process was described for the preparation of an elastic material by treating with compressed air, a mixture of a solution of gelatin in glycerin with formaldehyde, a solution of rubber or gutta-percha, and a vulcanising agent. According to the present additional patent, other substances are added to the mixture in order to render the product insoluble and imputrescible. The substances mentioned are tannin, ferric chloride, a mixture of a neutral tallow soap and alum, ammonium sulphate, magnesium sulphate, and sodium hyposulphite.—A. S.

Elastic material similar to rubber, and process for the manufacture of the same. L. Roland. First Addition, dated Dec. 5, 1906, to Fr. Pat. 364,075, March 13, 1906 (this J., 1906, 895).

The elastic material described in the main patent was prepared by the action of chromic acid or a chromate on a mixture of gelatin and glycerin. It is now found that if a portion of the glycerin be replaced by sugar, with or without the addition of molasses, the resulting product has a greater tensile strength. Further, by heating the finished material for several hours in a stove at 100° C., partial dehydration takes place, and the elasticity of the product is improved.—A. S.

Plastic masses from leather, wood-meal, cork, wool, hair, and cellulose; Process for the manufacture of ——. L. Collardon. Fr. Pat. 372,584, Dec. 15, 1906. Under Int. Conv., Dec. 16, 1905.

The plastic masses claimed are prepared by mixing wood-meal, cork, wool, hair, &c., with an acid or neutral solution of cellulose (or viscose), together with a certain proportion of an adhesive such as starch or glue. The elasticity of the product may be modified by the addition of acetin, glycerin, Turkey-red oil, or similar substances.—A. S.

XXIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 478.)

Tannin solutions; Behaviour of —— *towards some inorganic colloids.* E. Stiasny. Der Gerber, 1907, **33**, 108—109, 123—125.

The author criticises Earp's statement (this J., 1907, 330) that the precipitation of tannin by gelatin in very dilute solutions is prevented by small quantities of chromium salts. This has already been contradicted by Procter (this J., 1907, 330). The author shows that the precipitation must be considered from the point of view of two colloidal bodies changing from the soluble to insoluble condition. He has studied the action of colloidal solutions of oxide of iron, thorium hydroxide, metaphosphoric acid, and arsenic sulphide on tannin solutions. The colloidal solutions of iron and thorium cause complete precipitation of tannin under certain conditions, but with a sufficient excess of the reagent, clear solutions are obtained which are very sensitive to reagents. Metaphosphoric acid behaves differently; only in the case of moderately dilute solutions of certain tannins are any precipitates produced. With most tannins no precipitation takes place and the solution differs from those obtained with iron and thorium in the greater readiness with which it is precipitated by gelatin, in which it resembles strongly basic colloidal chromium solutions. Arsenic sulphide solution gives a precipitate with nearly all tanning materials. Gambier and pinewood do not, however, give any precipitates until a considerable quantity of the reagent has been added. The prevention of precipitation is brought about in a very marked degree by acetic acid; thus, in the case of oak wood, no separation of arsenic sulphide appears even after standing for 24 hours, although arsenic sulphide itself is extremely sensitive to the acid. A strongly basic dialysed solution of chromium gave precipitates or turbidity with nearly all tannins, and the solutions ultimately obtained, showed as with metaphosphoric acid, a greatly increased sensitiveness towards gelatin solution, giving precipitates in a solution of tannin incapable of reacting with gelatin alone. This result is entirely opposed to Earp's observations. Many similar cases of protection from precipitation of colloids, caused both by electrolytes and colloids, are known.—S. R. T.

Chrome liquors; Analysis of one-bath ——. E. Stiasny. Der Gerber, 1907, **33**, 77—78, 91—92.

The author suggests a method for the estimation of acid in one-bath chrome liquors which is based on the action of acids on an iodide-iodate mixture, according to the equation $3H_2SO_4 + 5KI + KIO_3 = 3K_2SO_4 + 3H_2O + 3I_2$ To 10 c.c. of a fresh solution of potassium iodide (10 per cent.), 0·5 grm. of potassium iodate is added in solution, and 10 c.c. of the chrome liquor are introduced. A known quantity of sodium thiosulphate solution (30 c.c.) is added, the solution diluted to 150 c.c., and boiled for 5 minutes. It is then made up to 250 c.c., filtered, and to 150 c.c., 10 c.c. of $N/10$ iodine solution are added and the excess titrated with sodium thiosulphate solution. Then, from the formula, $\left\{30 - \frac{5}{3}(10 - x)\right\} 0{\cdot}0048$, the quantity of acid is obtained, calculated as grms. "SO_4," in 10 c.c. of the chrome liquor. The results compare very favourably with those of the gravimetric estimation and also with results obtained by Alden's and Kopecky's methods (this J., 1907, 213).—H. Br.

English Patents.

Chrome tanning process. H. H. Lake, London. From Lederfabrik Hirschberg vorm. H. Knoch und Co., Hirschberg, Germany. Eng. Pat. 16,348, July 19, 1906.

See Fr. Pat. 368,122 of 1906; this J., 1906, 1227.—T. F. B.

Chrome tanning; Process of ——. A. C. Heintz, Freiberg, Saxony. Eng. Pats. 16,443 and 16,450, July 20, 1906. Under Int. Conv., Sept. 13, 1905, and March 13, 1906.

See Fr Pat 368,122 of 1906; this J., 1906, 1227.—T. F. B.

Leather; Process for accentuating the granulation of —— by dyeing. G. Feldmann and W. Feldmann, Berlin. Eng. Pat. 6048, March 13, 1907.

Naturally or artificially granulated leather is treated, preferably by hand, with a semi-solid or highly viscous material rich in fat, in such a way that the raised parts of the granulation are covered or impregnated with the material, whilst the hollows and crevices remain untouched by it. By subsequently dyeing with a suitable colour, the accentuation is produced, the protected raised portions remaining of a lighter shade, or of another shade or colour than the hollows and crevices.—E. W. L.

Composition of matter [Horn substitute]. H. Schwarzberg, Berlin. Eng. Pat. 25,637, Nov. 13, 1906.

See Fr. Pat. 358,172 of 1905; this J., 1906, 190.—T. F. B.

United States Patent.

Leather [coated with nitrocellulose], and process of making the same. L. Feval, Newark, N.J., Assignor to Guardian Trust Co., New York. U.S. Pat. 848,357, March 26, 1907.

The process consists in coating the leather with a solution containing nitrocellulose and a non-drying oil, the proportion of oil being from 3·25 to 6·0 lb. to each pound of nitrocellulose. Further coatings are then applied, these coatings consisting of a solution of nitrocellulose containing a small proportion of oil. Leather thus treated does not crack when bent.—W. P. S.

French Patent.

Extracts from bark and other vegetable matter; Process and apparatus for obtaining soluble ——. The Bakau Co., Ltd. Fr. Pat. 372,543, Dec. 14, 1906. Under Int. Conv., Dec. 20, 1905.

See Eng. Pat. 26,550 of 1905; this J., 1907, 106.—T. F. B.

XV.—MANURES, &c.

(Continued from page 478.)

English Patent.

Manures; Process for making —— dry and acid free, without mechanical heat. T. Macdonald, Driffield, Yorks. Eng. Pat 17,878, Aug. 9, 1906.

The raw material, such as ground phosphatic rock, with or without the addition of nitrogenous or ammoniacal refuse, is thoroughly incorporated with sulphuric acid of a strength of from 70° to 100° T., at a temperature of about 120° F. This temperature is attained by diluting concentrated acid with water immediately before adding the solution to the raw material. The mixture is then allowed to fall into a pit, where it is allowed to dry and mature, the heat resulting from the chemical action serving to dry the whole mass.—W. P. S.

French Patents.

Distillery vinasses, or waste waters from sugar factories; Preparation of a dry nitrogenous product [fertiliser] from ——. A. E. Vasseux. First Addition, dated Nov. 27, 1906, to Fr. Pat. 330,423, March 20, 1903 (this J., 1903, 1099).

The waste liquors from distilleries or sugar factories are treated with crude basic salts, such as the scums occurring in the defecation of syrup, &c., until all acidity is destroyed, and are then concentrated as highly as possible in iron pans. Peat-moss or woollen waste is then incorporated with the liquor to form a paste, which is dried in stoves at a temperature of about 180° C.—E. S.

Sewage; Treatment of —— to obtain a humic sewage manure. J. Dumont. Fr. Pat. 372,497, Dec. 12, 1906. XVIII*B*., page 547.

XVI.—SUGAR, STARCH, GUM, &c.

(Continued from page 479.)

Diffusion water; Loss of pulp in ——. H. Claassen. Z. Zuckerind. Böhm., 1907, **31**, 462—463.

In their study of the Hyross-Rak press diffusion process, Andrlik, Stanek, and Urban calculate that there must be a loss of 17·5 to 20 per cent. of pulp in the ordinary diffusion process (see also this J., 1907, 215). The author shows that this calculation is erroneous, for if allowance be made for the sugar and non-sugar left in the pressed pulp, the usual 65·6 per cent. containing 8 per cent. of solids is obtained, instead of 82·5 per cent. calculated by them. He also deprecates such calculations, based on uncertain data, when direct determinations can be made. At most 1 to 3 per cent. of pulp passing away in the waste and press waters is retained by a fine sieve. When greater pressure is resorted to, a pulp catcher is indispensable.—L. J. de W.

Sucrose in osmose water; Determination of ——. K. Andrlik and V. Stanek. Z. Zuckerind. Böhm., 1907, **31**, 417—440.

The determination of sucrose in low sugar products by the method of inversion can only be exact when made with solutions of equal acidity before and after inversion, the influence of optically active amino-acids being thereby eliminated. As the hydrochloric acid used, quickly inverts the sugar in solution, betaine or urea is added as a retarding agent. If the polarisation is made within 10 minutes of the acidification, the alteration in rotation due to inversion is too small in amount to affect the result. The following method is therefore proposed: Twice the normal weight of molasses or osmose water is washed with water into a 200 c.c. flask, 20 c.c. each of lead nitrate and sodium hydroxide solutions are added, of the prescribed strength for the clarifying agent of Herles (this J., 1897, 67), and the solution filtered. Two portions of, 50 c.c. each, of the clear filtrate are measured into 100 c.c. flasks, one for polarisation direct, the other for inversion. For the polarisation in hydrochloric acid solution, betaine, or better still, urea, must be added. For molasses, 5 grms. of urea are dissolved in 6·5 c.c. of hydrochloric acid (sp. gr. 1·19) in a 50 c.c. flask, the solution diluted with water to 49 c.c., and poured into the 50 c.c. of clarified filtrate, which is then made up to 100 c.c. with water, quickly filtered through a dry filter, the first portion of the filtrate being rejected, and polarised. Not more than 7 to 10 minutes should elapse between the mixing of the sugar and acid solutions and reading off. For osmose water, 5 grms. of urea in 7·5 c.c. of hydrochloric acid are used. Molasses requires 1·4 to 1·5 c.c. of hydrochloric acid to neutralise the ash of the half-normal weight, and osmose water 2·5 c.c., hence the amounts used, $5+1{\cdot}5=6{\cdot}5$, and $5+2{\cdot}5=7{\cdot}5$ c.c., respectively. The second portion of 50 c.c. of clarified filtrate is acidified with a like portion of hydrochloric acid, 25 c.c. of water added, and Herzfeld's method of inversion followed. From the polarisations before and after inversion the sucrose is calculated by the formula of Herles: $S=\frac{100\ (P-I)}{143{\cdot}5-0{\cdot}5t}$. The sucrose found is 0·9 to 2·0 per cent. higher for molasses, and 1·6 to 3·2 per cent. higher for osmose water than by the Clerget inversion method, but is lower than that given by the gravimetric determination from reducing sugars, the latter probably showing more sucrose than is really present, since reducing sugars are produced not only from sucrose and raffinose, but from the products formed by the action of heat on sugar, and especially from the so-called optically-inactive sugar. The acid polarisation before and after inversion appears to give results most nearly approaching the truth.—L. J. de W.

Glucose [dextrose]: its phenylhydrazone and oxime. R. Behrend. Annalen, 1907, **353**, 106—122 (see this J., 1904, 388).

β-Glucose.—The author obtained β-glucose by dissolving α-glucose in boiling pyridine, boiling the solution for ten minutes, then subjecting it to prolonged agitation, and finally allowing it to stand. The crystals which separated had a strong odour of pyridine, in spite of the fact that they were washed with alcohol and ether; on exposure to air, the crystals lost weight considerably, and the pyridine odour disappeared; it may be that β-glucose yields an unstable pyridine compound on crystallisation from this solvent. β-Glucose was found to melt at 148°—150° C.; a partial conversion into the α-isomeride occurs when β-glucose is melted. Two samples of β-glucose obtained by crystallisation from pyridine were found to have initial (by extrapolation) rotations of $[\alpha]_D = +20{\cdot}7°$ and $+20{\cdot}9°$ respectively. By treating β-glucose with acetic anhydride in presence of pyridine in the cold, the author obtained the corresponding β-pentacetate (m. pt. 130°—131° C.).

Glucose phenylhydrazone.—By treating 3 grms. of ordinary solid (*i.e.*, α-) glucose with 6 grms. of phenylhydrazine, afterwards adding 20 c.c. of absolute alcohol, and then agitating the mixture, the author obtained the β-hydrazone in the form of needles. This substance, when heated, was found to sinter slightly at about 100°—103° C., and to melt at 106°—107° C. The same isomeride was obtained by dissolving the glucose (3 grms.) in half its weight of boiling water, and after cooling the solution, adding an alcoholic solution of phenylhydrazine (6 grms.). The α-hydrazone was obtained by treating 3 grms. of ordinary, solid glucose with a mixture of 3 grms. of phenylhydrazine, 25 c.c. of absolute alcohol, and 2 grms. of glacial acetic acid, the mixture being agitated; the compound separated in thin plates. The α-isomeride was also obtained by dissolving 3 grms. of glucose in half its weight of boiling water, cooling the solution, and adding an alcoholic solution of 3 grms. of phenylhydrazine. In about 5 per cent. solution the initial rotations of the α- and β-hydrazones were approximately $[\alpha]_D = -70°$ and $-2°$ respectively; the constant end-rotation was the same for both solutions, *viz.*, about $-50°$; this lævorotation was found to increase with diminution of temperature. Acetic acid was found to accelerate the formation of the equilibrium mixture in alcoholic solutions of the two isomerides. The relation of the two hydrazones to α- and β-glucose is not yet clear.

Acetates of glucosoxime.—The hexacetate was obtained by digesting glucosoxime with pyridine and acetic anhydride in the cold; the compound, purified by recrystallisation from dilute alcohol, melts at 110°—111° C. By dissolving glucosoxime in hot water, evaporating the solution to a syrup at 45°—50° C. under reduced pressure, and acetylating the syrup with acetic anhydride in presence of pyridine, the deca-acetate of a product of condensation of 2 mols. of glucosoxime was obtained:—

$$2C_6H_{13}NO_6 - H_2O = C_{12}H_{24}N_2O_{11}.$$
$$C_{12}H_{24}N_2O_{11} + 10CH_3COOH = C_{32}H_{44}N_2O_{21} + 10H_2O.$$

The condensation between a molecule of the oxime and an isomeride is probably effected. By acetylating glucosoxime with acetic anhydride in presence of pyridine, on the water-bath, pentacetylgluconic nitrile was obtained together with the above-mentioned acetates.—L. E.

Basic lead acetate; Influence of —— on the rotation of sucrose in water solution. F. Bates and J. C. Blake. J. Amer. Chem. Soc., 1907, **29**, 286—293.

Careful comparative experiments as to the effect of basic lead acetate solution on the optical rotation of sucrose were carried out, using a modified Josef and Jan Fric double quartz wedge compensation saccharimeter of such sensitiveness that a difference in rotation of 0·02° Ventzke could be detected with certainty. The results obtained, show that basic lead acetate first causes a lowering of the polariscopic reading of the dissolved sugar amounting to more than 0·1° Ventzke for normal concentration, and that further addition of the same reagent causes a continuous rise in the polarisation up to the limit investigated. The numerical results are shown in the following table:—

Basic lead acetate added.	Difference in polarisation readings.	Basic lead acetate added.	Difference in polarisation readings.
c.c.	°Ventzke.	c.c.	°Ventzke.
0·5	−0·09	10·0	+0·19
1·0	−0·13	12·0	+0·29
1·5	−0·10	15·0	+0·29
2·0	−0·13	18·0	+0·45
2·5	−0·06	20·0	+0·45
3·0	−0·08	25·0	+0·58
4·0	−0·06	30·0	+0·62
5·0	−0·03	35·0	+0·77
6·0	0·00	40·0	+0·77
7·0	+0·05	63·0	+0·95
8·0	+0·09	—	—

The effect of basic lead acetate appears to be due to the formation of soluble lead saccharates having rotatory powers different from that of sucrose.—A. S.

Sugars in honey; Polarimetric determination of ——. P. Lehmann and H. Stadlinger. XXIII., page 555.

English Patent.

Molasses and molasses foodstuffs; Process for drying ——. L. Tokányi, R. T. S. de Tornyay, and S. Weiser. Eng. Pat. 9416, April 21, 1906. XVIIIA., page 546.

French Patents.

Water; Heating —— for diffusion batteries. L. Lemoine. Fr. Pat. 372,315, Dec. 8, 1906.

The apparatus consists of a primary and secondary barometric condenser, and is suitable for use in cases where the supply of condenser water is limited. The water supplied to the primary condenser (which is fed with the waste vapours from a steam conduit) is cooled after it has passed through the condenser and used again. The water supplied to the secondary condenser passes with the condensed steam to the diffusion-battery direct; its amount is regulated according to requirements. The secondary condenser is supplied with steam by means of a branch pipe leading from the steam conduit. Non-condensable vapours are withdrawn from the apparatus by an air-pump common to both condensers. With this apparatus, a supply of relatively pure water for diffusion is insured, since the water only passes through the secondary condenser once.—L. E.

Sugar manufacture; Purification of raw juice in ——. M. Kowalski. Fr. Pat. 372,770, Dec. 20, 1906.

Improvements in the process of treating beetroot juice with lime and carbon dioxide are claimed. A sample of the juice which has been subjected to the preliminary cold treatment with lime is filtered through filter paper; if the liquor filters readily and yields a clear filtrate, the requisite quantity of lime has been added; if the liquor filters slowly, or yields a turbid filtrate, insufficient lime has been added; if the filtrate is decidedly yellow, too much lime has been added. To determine the quantity of lime necessary for the hot defecation, a known quantity of lime water, in excess, is added to a sample of the juice; the liquor is then heated to 80°—90° C., filtered, and cooled, the excess of lime being determined by titration (the amount of lime required for the cold defecation may also be determined by titration). The juice is then treated with an excess of lime sufficient to produce an alkalinity of 0·2. The carbonatation is controlled by treating samples of the juice with lead acetate: the absence of a precipitate indicates that the carbonatation has been carried far enough; if the carbonatation has been either insufficient or excessive, a precipitate is formed.—L. E.

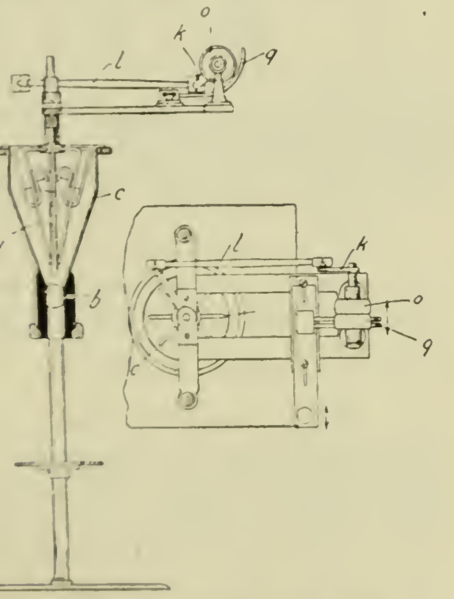
Distillery vinasses or waste waters from sugar factories; Preparation of a dry nitrogenous product [fertiliser] from ——. A. E. Vasseux. First Addition, dated Nov. 27, 1906, to Fr. Pat. 330,423, March 20, 1903. XV., page 540.

Potassium carbonate of high percentage; Process for obtaining —— *from beet-root salts.* E. Bauer. Fr. Pat. 372,415, Dec. 11, 1906. VII., page 527.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 480.)

Malt; The "sinker" test in the evaluation of ——. P. Bauer. Woch. f. Brau., 1907, 24, 177—181.



The possibilities of the "sinker" test for the rapid determination of the degree of modification of malt have long been recognised, but this test has suffered from the drawback that the results obtained by different observers were never concordant, and high or low values could be obtained at will according to the manner of stirring. A machine has now been devised by Haase by which this test can be carried out with certainty, and which yields results in perfect accordance with those obtained by the very tedious optical test for translucency. This apparatus (see figure), consists of a funnel-shaped vessel, *c*, provided with a stirrer, *d*, of special form. An oscillating rotary motion is imparted to this stirrer by means of the connecting rod, *l*, the crank, *k*, and the fast and loose pulleys, *o* and *q*. The speed of the stirrer is of the utmost importance, and the crank-shaft should make 225—230 revolutions per minute. The vessel is filled with a 5 per cent. (by volume) solution of methyl alcohol up to the top edge of the stirrer, 500 corns are then put in, and the stirrer is set in motion at once. After half a minute, the stirrer is stopped, the liquid is allowed to remain at rest for another half-minute, and the sinker corns are then drawn off through the tap, *b*, in the stem of the funnel. A high percentage of sinkers not only indicates a steely malt, but corresponds with a high bushel-weight, small percentage of flour in the grinding and sifting test, low yield of extract, and high content of soluble albumin. The test is said to enable any irregularity in the malting process, *e.g.*, excessive temperatures in the couches or too rapid rise of temperature in kilning, to be detected in a few minutes. The machine is also said to enable any sample of malt to be split up into two constituents: swimmers and sinkers, which are different in composition and constitution, and which can then be studied separately for the elucidation of the causes of these differences.—J. F. B.

Yeast; Glycogen, and some observations on the sporulation of ——. F. G. Kohl. Ber. deut. botan. Gesellsch., 1907; Woch. f. Brau., 1907, **24**, 206—207.

The author holds that glycogen plays the part of a regulator of the sugar supply to the fermenting cell. It is adapted for this purpose because it is non-diffusible. It appears to be not exclusively a reserve material, but rather to play an important part as an intermediate stage in the process of alcohol production, the hexoses not being fermented directly, but being first converted into glycogen. Added glycogen, being non-diffusible, is not fermented by yeast, but yeast cell-juice ferments it readily. This juice not only breaks down glycogen, but, by reversion, will also synthesise it from dextrose or lævulose. The author has observed that in the same yeast-cell some vacuoles remain free from glycogen, whilst others are filled with it. The "albumin-crystalloids" can be observed in the cytoplasm by staining a glycogen-vacuole faintly with iodine; they then appear as white specks on a brown ground. The author thinks that the spores, before the membrane is formed, are surrounded by a large number of refractive granules (albumin-crystalloids) which diminish and disappear as the membrane grows. The fat-content of the mother-cell is generally very high before sporulation; during the process a little fat appears in the young spores; the glycogen disappears during the process of sporulation. When the cell is treated with Soudan III. and Löffler's Methylene Blue, the fat is stained orange-red and the albumin-crystalloids, violet. During the formation of the spores the fat spreads as a layer enclosing the young spores; later, the fat returns to the spaces between the spores. Spores vary greatly in their affinity for stains; in ripe spores the membrane generally stains faintly, and the nucleus and crystalloids of the cytoplasm strongly. In order to study the nucleus during sporulation it is necessary to purify the cell from fatty substances by means of chloroform before staining. The division of the nucleus during sporulation takes place directly, as in budding. When three spores are formed, one sub-nucleus is larger than the other, and subsequently splits into two others. When two spores are formed, each sub-nucleus is of equal size, as also where four spores are formed, but in this case each sub-nucleus divides again. Thus with two spores both are of equal age, with three spores one is older than the others, and with four spores two are older.—J. F. B.

Yeasts; Influence of oxalic acid on brewery and pressed ——. S. Lebedeff. Woch. f. Brau., 1907, **24**, 182—184, and 197—199.

Oxalic acid in very small quantities (up to 0·05 per cent.) acts as a stimulant towards yeast in wort; in larger quantities it cripples the zymase of the yeast and the reproductive power. In presence of 0·4—0·5 per cent. of oxalic acid, all the yeast cells are killed in two hours. In sugar solutions oxalic acid has an injurious action on the yeast at concentrations from 0·001 per cent. upwards, and at a concentration of 0·1—0·2 per cent. all the yeast cells are killed. Combined oxalic acid (calcium oxalate) is injurious to fermenting yeast at a concentration of

0·25 per cent., but its action is much weaker than that of free oxalic acid. Gypsum and asparagine diminish the injurious action of oxalic acid; they both increase the vitality and power of setting up fermentation far more than the ultimate fermentative effect of the yeast. Oxalic acid up to a concentration of 0·03 per cent. has no effect on the zymase in Buchner's yeast cell-juice, but at a concentration of 0·04—0·05 it entirely destroys the zymase. —J. F. B.

Yeast; Action of very dilute solutions of various substances on —— in presence or absence of nutrient material. T. Bokorny. Zentr. Bakt., 1907, **18**, II., 173; Z. ges. Brauw., 1907, **30**, 234—235.

WHEN dissolved in pure water in the proportion of 1 : 100,000, mercuric chloride does not act as a poison towards yeast, but in the presence of 0·2 per cent. of peptone, 2 per cent. of cane sugar, and 0·1 per cent. of nutrient salts, 1 part of mercuric chloride in 200,000 is poisonous. In presence of peptone, yeast is poisoned by 0·0025 per cent. of formaldehyde, but not by 0·001 per cent. In absence of peptone, the reproduction of yeast is prevented by 0·01 per cent. of the aldehyde, but not by 0·005 per cent. The poisonous properties of both mercuric chloride and formaldehyde are hence increased by the presence of nutrient material. The author is of the opinion that, by the nutritive activity of yeast, the albumin of the protoplasm assumes a transitory, more labile condition, and thus becomes susceptible to poisonous substances in dilutions which would otherwise be ineffective. It may be, however, that the poison combines with the peptone and, when the latter is rapidly absorbed by the yeast, is set free within the cells in harmful quantities. The nature both of the food material and of the poison are found to have some influence on this action. Moulds assimilate even in presence of 20 per cent. of alcohol, while 0·01 per cent. of sulphuric or phosphoric acid favours the absorption of nutrient substances by yeast. On the other hand, 0·01 per cent. of hydrofluoric acid or 0·1 per cent. of caffeïne prevents yeast from assimilating the best food materials, and rapidly proves fatal to it.—T. H. P.

Enzymes. W. Schneidewind, D. Meyer, and F. Münter. Arb. d. agrik.-chem. Versuchsanstalt Halle a.S., 1906, **2**, 67; Z. ges. Brauw., 1907, **30**, 235.

ALCOHOL and ether have a marked injurious effect on the action of diastase. Freshly-prepared diastase solutions exhibit a far more vigorous action than the precipitated enzyme, no matter whether the latter is rich or poor in nitrogen. Hence it appears quite impossible, by chemical precipitants, to obtain enzyme preparations from the action of which conclusions can be drawn regarding the composition of the enzyme. Albumins, peptones, and asparagine have a favourable influence on the activity of enzymes. In very small quantities (0·001 per cent.), weak acids such as acetic and citric acids accelerate the action of diastase, but the presence of 0·01 per cent. of one of these acids has a marked deleterious effect. The presence of alkali chloride increases in a high degree the activity of diastase, and to this action the beneficial effect of these salts, especially of sodium chloride, on the growth of plants is partly attributable. The monophosphates and aluminium phosphate also augment the activity of enzymes, but 1—2 per cent. of monocalcium or aluminium phosphate destroy all enzyme action.—T. H. P.

Steeping and brewing water. H. Seyffert. Z. ges. Brauw., 1907, **30**, 199—202, 214—217.

THE composition of the water comes into play at two stages, *viz.*, the steeping of the barley and the brewing of the malt. In the steep, the tannin may be fixed in the form of its insoluble calcium compound; the bitter principle of the barley husk, which is practically insoluble in pure water, is readily soluble in waters containing carbonates. The extraction of this principle is, therefore, complete in the case of hard Munich water, but incomplete in the case of soft Pilsen water, and the flavour of the malt is influenced accordingly. During drying and kilning the water in the grain is evaporated, and the salts are concentrated. The presence of alkali carbonates in the water may exert a very dangerous influence at this stage, owing to the high temperature; the colour may be darkened and the enzymes crippled. The bicarbonates of calcium and magnesium are not harmful; the latter especially can play a useful part. Munich water owes much of its special character to its richness in magnesium carbonate, which in its basic form possesses all the advantages of the soluble alkalis without their disadvantages. It extracts the bitter principle from barley, giving a sweet flavour to the malt; on the kiln it imparts a dark colour and a malty aroma. In the case of the brewing water the reactions which take place on boiling are highly complex; the salts in the water influence the extraction, the precipitation, and the flavour of the beer; they have a special influence on the extraction of the hops. Calcium bicarbonate, when present in the brewing water, is entirely removed, in combination with organic matters, during brewing and fermentation. Some breweries, with waters rich in earthy carbonates, can prepare even pale beers from barleys very rich in protein, whilst other breweries, with waters poor in carbonates, are unable to work such barleys. The author describes his experience in the manufacture of imitation English beers, which shows that the character of these beers depends not only on the organisms of primary and secondary fermentation, but also on the water. He found that it was necessary to prepare artificially London water for porters and Burton water for bitter ales. Moreover, until the water was thus adjusted, the English character of the beers was not quite right, nor could the secondary yeasts, necessary for the aroma, be cultivated for any great length of time. The three main types of German malt are fundamentally determined by the composition of the steep water. Pilsen malt requires a very soft water, with total residue not exceeding 20 per 100,000, with little bicarbonate, and very little gypsum. The Munich type requires a fairly hard water, with a residue from 35 to 85 per 100,000, rich in calcium and magnesium bicarbonates, but poor in sulphates. The Dortmund type requires a hard water in which gypsum strongly predominates, with moderate quantities of bicarbonates, and fairly rich in sodium chloride. Unless these conditions as regards water are fulfilled, it is impossible to prepare malts true to type and full of "character" by manipulation of the grain alone. The brewing water does not exert so powerful an influence on the type of the beer as the steeping water. The quality of the barley and hops has very little connection with the type or "character" of the beer, though, of course, it determines its quality. Type or "character" is best judged after the beer has remained in a glass for a few hours in a warm room.—J. F. B.

Ropiness of Berlin "Weissbier." F. Schönfeld. Jahrb. Versuchs- u. Lehranstalt f. Brau., Berlin, 1906, **9**, 415; Z. ges. Brauw., 1907, **30**, 250—251. (See also this J., 1906, 771.)

TRUE ropiness of "Weissbier" is caused by *Pediococci*, which are almost always present, but which, in many cases, give rise to acids of a pleasant flavour. The capacity of the ropy *Pediococci* to produce ropiness, and also the appearance of the mucilaginous deposit, vary considerably with the different organisms. In general, the latter grow very rapidly, but here, too, differences occur. Neither the conversion of a non-ropy *Pediococcus* into a ropy one, nor the reverse change, has been observed. Beer *Pediococci*, which produce the so-called sarcina odour in lager beer, yield only small proportions of acid, but ropy *Pediococci* generally give rise to more than 0·6 per cent. of acid, calculated as lactic acid. These ropy organisms produce a pleasant, vinous bouquet, and there is no finer "Weissbier" than one from which the mucilage has separated. Two varieties of these organisms have been characterised, namely, *Pediococcus viscosus major* and *Pediococcus viscosus minor*, the former producing a greater degree of ropiness than the latter. A possible third variety exists to which the name *Pediococcus viscosus varians* is given, and which readily loses its power of yielding mucilage. To one of the *Pediococcus* forms which does not produce ropiness, but confers a pleasant vinous taste on the beer, the author gives the name *Pediococcus acidulefaciens*, whilst another, which gives rise to an unpleasant, honey-like smell, is termed *Pediococcus odoris melisimilis.* The production of acid and bouquet in "Weissbier" may be favoured by such *Pediococci*, if they occur in relatively large proportion along with the rod bacteria, and if sufficient time be allowed for them to give rise to pleasant tasting, flavouring substances. The same may be said of maturation in bottle, but here it is of importance that the organisms should settle with the yeast cells and not render the beer turbid. One of the best preventatives of ropiness is lactic acid or lactic acid bacteria. The resistance of "Weissbier" to the action of ropy organisms may also be heightened by heavy hopping or by vigorous acidification during the primary fermentation.—T. H. P.

Carbon bisulphide ; Use of —— in the determination of salicylic acid in wine. W. L. Dubois. XXIII., page 555.

Spirit ; Imports of plain —— into the United Kingdom. Oil and Col. Trades J., May 4, 1907. [T.R.]

The Chancellor of the Exchequer has supplied the following statement of the quantities of "plain" spirit imported into the United Kingdom during the last seven years, and the quantities on which duty has been paid in each of those years :—

Years.	Imports.	Quantities entered for Home Consumption.		
		Not for methylation.	For methylation and for Art or manufacture on which the differential duty has been paid.	Total.
	proof galls.	proof galls.	proof galls.	proof galls.
1900	1,429,910	1,225,614	61,708	1,287,322
1901	2,001,994	1,456,184	380,555	1,836,739
1902	3,184,729	1,622,260	1,422,809	3,045,297
For Arts or Manufactures	—	—	228	
1903	1,907,099	1,476,712	411,949	1,890,425
For Arts or Manufactures	—	—	1,764	
1904	465,713	417,016	15,145	434,962
For Arts or Manufactures	—	—	2,801	
1905	239,265	203,176	24	206,777
For Arts or Manufactures	—	—	3,577	
1906	451,108	383,791	—	387,224
For Arts or Manufactures	—	—	3,433	

Alcohol denaturant for pastes and varnishes. Oil, Paint. and Drug Rep., April 29, 1907. [T.R.]

In accordance with section 80 of regulations No. 30, the following formula has been authorised as a special denaturant for use in the United States in the manufacture of pastes and varnishes from soluble cotton : To 100 galls. of alcohol shall be added 2 galls. approved wood alcohol and 2 galls. of benzol. The wood alcohol shall be held subject to the same specifications as are imposed upon the methyl alcohol used in completely denatured alcohol, which are set forth in circular No. 680. The benzol shall be subject to the following specifications :—

Solubility in water.—When 10 c.c. of benzol are shaken with an equal volume of water in a glass-stoppered cylinder and allowed to stand five minutes to separate, the upper layer of liquid must measure not less than 9·5 c.c.

Boiling point.—When 100 c.c. of benzol are subjected to distillation in the same manner as prescribed for the determination of the boiling point of wood alcohol in circular No. 680, not more than 1 c.c. should go over at 77° C., and not less than 90 c.c. at 100° C.

Methylated spirit ; The laboratory use of ——. Proc. Inst. Chem., 1907, Pt. 2, 22–23.

Some professional chemists having been served with a notice to the effect that they must not recover or purify methylated spirit, a letter on the subject was addressed by the Secretary of the Institute of Chemistry to the Board of Inland Revenue, and the following reply has been received :—"In reply to your letters of the 8th and 14th ultimo, I am directed by the Board of Inland Revenue to inform you that, whilst they must reserve to themselves the right to insist in every case in which it should appear to them to be necessary to do so in the interests of the Revenue, on a strict observance of the regulations under 43 and 44 Vic., c. 24, 53 Vic., c. 8, and 6 Edw. 7, c. 20, in regard to the use of methylated spirit, they do not propose to exercise this right in such a way as to interfere unduly with the ordinary practice of an analytical and consulting chemist. The Board would, however, be glad if the official form of application could be filled up in every case."

Whisky ; Labelling of —— in the United States. Bd. of Trade J., May 2 and 9, 1907. [T.R.]

The U.S. Board of Agriculture have decided (Food Inspection Decision, No. 65) that the labelling of whisky, and blends, compounds, and imitations thereof, under the Food and Drugs Act of June 30, 1906, will be governed by the opinion of the U.S. Attorney-General, dated April 10, 1907, which has been approved by the President. In substance, the opinion of the Attorney-General is as follows :—

1. Whisky is to be regarded as a *natural* spirit, *i.e.*, as the resultant of the process of distillation alone, requiring no addition to furnish its characteristic qualities.

2. A mixture of two or more different whiskies as above defined, whether their differences arise from the character of the substances from which they are distilled, or from the method of distillation used in each case, or from their several ages, would be appropriately termed a "blend of whiskies," or "blended whisky" or "blended whiskies."

3. The mixture of a spirit, properly designated as "whisky," with another spirit which, standing alone, would not be properly designated as "whisky," such as ethyl alcohol, must, in the Attorney-General's opinion, be labelled or branded as a "compound" or as "compounded," and not as a "blend" or as "blended." Such a mixture, however, may only properly be called "compound *whisky*" or "compounded *whisky*," provided that there is enough whisky in it to make it a real compound and not the mere semblance of one, and that a statement of the presence of another spirit is included in substance in the title.

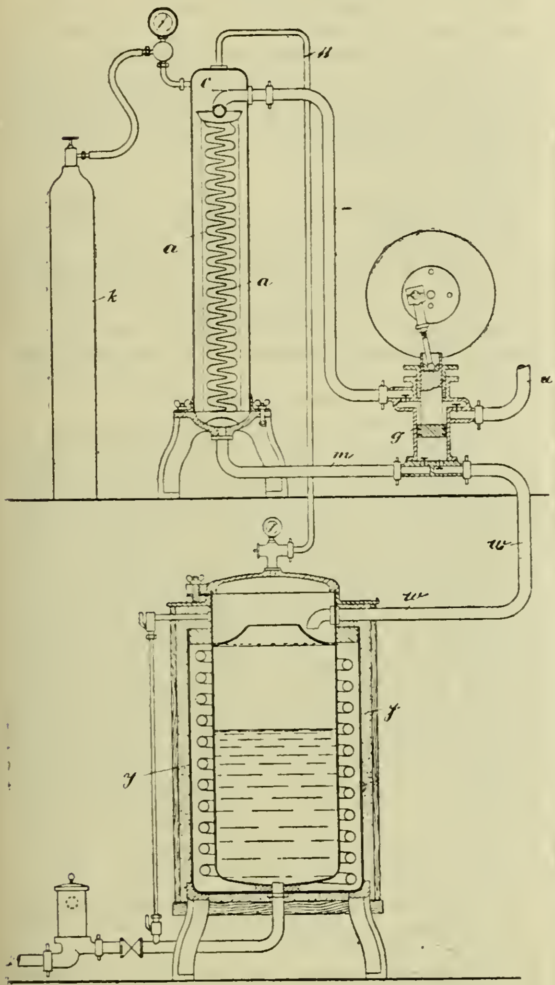
4. If ethyl alcohol, either pure or mixed with distilled water, were given, by the addition of harmless colouring and flavouring substances, the appearance and flavour of whisky, it is not possible to find any other name for the product, in conformity with the law, than "imitation whisky."

The full text of the Attorney-General's opinion may be consulted at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Absinthe ; Action of water on [alcoholic] essences of ——. Sanglé-Ferrière and L. Cuniasse. XX., page 550.

English Patent.

Beer and other beverages; Process and apparatus for chilling and carbonating ——. L. Chew and H. J. West and Co., London. Eng. Pat. 12,242, May 25, 1906.

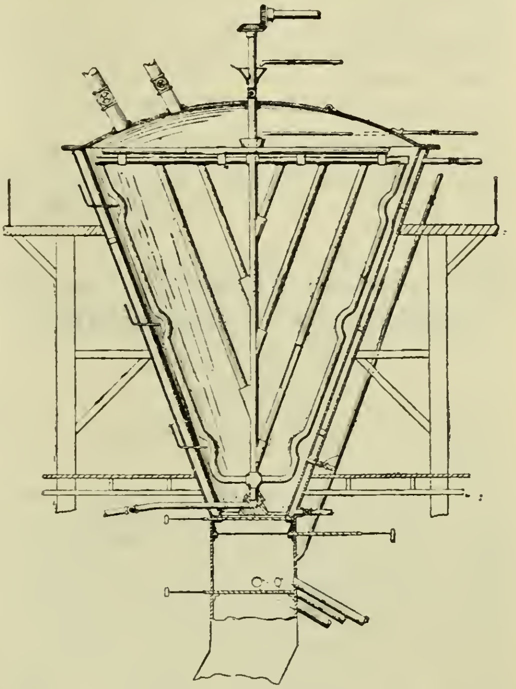


The apparatus consists of a gas supply, *k*, and a beer supply pipe, *u*, a gas receiver and beer refrigerator, *a*, a compressor pump, *g*, and a cooled storage reservoir, *y*. The beer is first cooled and partially saturated with gas (also cooled), in the refrigerator, *a*. Gas and beer together are then forced by the pump into the storage reservoir in which a higher pressure exists than in the refrigerator. The beer trickles down the cooled walls of the reservoir, *y*, and the saturation with gas is completed under a pressure of 25—30 lb. per sq. in. The pump cylinder is divided into two chambers by the piston, the lower chamber being of larger capacity than the upper one. In the upper chamber the piston pumps beer from the supply pipe, *u*, and delivers it at *c* at the top of the refrigerator; in the lower chamber the piston withdraws beer and gas from the bottom of the refrigerator through the pipe, *m*, and delivers them through *w* into the vessel, *y*. The ratio between the capacities of the upper and lower chambers of the pump cylinder can be varied by adjusting the length of the connecting rod, and is chosen so that the difference in capacity shall be equal to the quantity of gas required to saturate the beer delivered at each stroke.
—J. F. B.

United States Patents.

Grain; Apparatus for the rapid determination of moisture in ——. E. Brown and J. W. T. Duvel. U.S. Pat. 848,616, March 26, 1907. XXIII., page 554.

Brewing; Apparatus (tun) for use in ——. C. B. Davis, New York. U.S. Pat. 846,187, March 5, 1907.



The apparatus consists of a tun in the form of an inverted cone-frustrum, provided with a hollow rotary rake, through which liquid can be passed, conforming generally to the shape of the tun and carrying a series of arms adapted to agitate the contents of the tun on different lines. A horizontal spiral sparging pipe is attached to the upper part of the rake-shaft and revolves with it. The tun is surrounded by a jacket, and there is an extension below the main body of the tun, with a removable sieve-gate, protected by a solid gate, interposed between the tun and its extension so that only liquid can pass into the extension. Lastly, there is another gate, controlling the outlet at the lower end of the extension, and a pipe leading from the extension to a point above the level of the material in the tun.—J. F. B.

Beer and ale packages; Pitch for coating the interiors of ——. H. C. Dippel, Assignor to Busch-Freund Brewers' Supply Co., St. Louis, Mo. U.S. Pat. 847,282, March 12, 1907.

The pitch is made by mixing oil distilled from melted resin with melted resin in specified proportions and then adding water to the mixture.—J. F. B.

French Patents.

Wort; Process of manufacturing ——. V. Lapp. Fr. Pat. 372,878, Dec. 24, 1906.

Barley is mixed with water at 40°—45° C. (28° C. if the grain is to be subsequently germinated), the mixture being subjected to a pressure of 25—30 atmospheres, whereby the grain absorbs 40—45 per cent. of water in, at the most, 10—20 minutes. The pressure is then suddenly released, thus causing the withdrawal of a large amount of water from the grain. If required, the grain is allowed to germinate for not more than two days. It is then heated *in vacuo* for some hours at a temperature not exceeding 50° C.; the temperature is subsequently raised to 100° C. The grain is next cooled and subjected to the action of compressed air (*e.g.*, 10 atmospheres) for 30—50 minutes, mixed with a certain proportion of malt, and the whole steeped in water under pressure in a vessel, the lower part of which is provided with a vertical conical roller. The steeped grain is crushed between the roller and the surrounding wall of the vessel. The mash thus obtained is saccharified under pressure at a low initial heat.—L. E.

Brewery vats; Process for heating ——. L. Nathan. Fr. Pat. 372,270, Dec. 6, 1906. Under Int. Conv., Dec. 29, 1905.

See Eng. Pat. 28,261 of 1906; this J., 1907, 427.—T. F. B.

Distillery vinasses or waste waters from sugar factories: Preparation of a dry nitrogenous product [fertiliser] from ——. A. E. Vasseux. First Addition, dated Nov. 27, 1906, to Fr. Pat. 330,423, March 20, 1903. XV., page 540.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(Continued from page 482.)

(A.)—FOODS.

Milk; Mercuric chloride as a preservative of —— *for analysis.* P. Grélot. J. Pharm. Chim., 1907, **25**, 423—428.

Mercuric chloride in the proportion of 0·05 grm. to each 250 c.c. of milk is found by comparative tests to be the most satisfactory preservative for samples intended for analysis. For convenience, it may be employed in the form of compressed tablets, each containing 0·05 grm. of mercuric chloride and 0·0125 grm. of ammonium chloride, the latter salt being added to increase the solubility of the corrosive sublimate. This treatment enables the milk to be kept, without change, for at least ten days; does not appreciably affect its physical or chemical "constants," nor interfere with the detection of such preservatives as are generally employed. It is, in these respects, preferable to the addition of potassium bichromate, or chloroform, or to sterilising the sample by heat. —J. O. B.

Sugars in honey; Polarimetric determination of ——. P. Lehmann and H. Stadlinger. XXIII., page 555.

English Patents.

Molasses and molasses foodstuffs; Process for drying ——. L. Fokányi, R. T. S. de Tornyay, and S. Weiser, Budapest, Hungary. Eng. Pat. 9416, April 21, 1906.

From 8 to 10 per cent. of calcium hydroxide or calcium oxide are mixed with the molasses or with the foodstuff prepared with the latter. When the lime has combined with the water present, the mixture is treated with carbon dioxide, preferably under pressure, until the whole of the calcium hydroxide has been converted into calcium carbonate. The molasses foodstuff produced according to the present process consists of molasses, calcium carbonate, and bran, malt-dust, beetroot slices, and the like.—W. P. S.

Barley and other cereal grains; Processes of treating —— *for food purposes.* J. A. Caverhill, Tillonsburg, Ontario. Eng. Pat. 26,002, Nov. 16, 1906.

The grain is first steeped in water at a temperature of 70° F. for from 10 to 12 hours, and is then heated at a temperature of over 90° F. for 30 hours, but not long enough to cause the germs to protrude from the grain. The germination is then stopped by heating the grain to a temperature of 120° F. until it is thoroughly dried. The husks are now removed by the aid of a scouring machine, and the kernels are submitted to the action of steam under pressure, the cooked product being, finally, passed over heated rollers, or ground. The husks may be used as a cattle food.—W. P. S.

Aerated beverage; Manufacture of a new ——. Ozonair, Ltd., F. Rogerson, and L. Briant, London. Eng. Pat. 29,552, Dec. 28, 1906.

Water, spirituous liquor, or other liquid, is charged with ozone either alone or mixed with other gases such as carbon dioxide. The ozone employed is free from oxides of nitrogen and is prepared by means of the apparatus described in Eng. Pat. 16,392 of 1905 (this J., 1905, 1115). —W. P. S.

United States Patents.

Butter; Method of treating ——. A. Fay, Louisville, Ky. U.S. Pat. 847,562, March 19, 1907.

The butter is placed in a liquid containing milk constituents, and the mixture is agitated while a current of air at a low temperature is forced through it. The temperature of the mixture is then increased, and the butter collected.—W. P. S.

Cream or milk and butter; Method of treating ——. A. Fay, Assignor to W. N. Arterburn, Louisville, Ky. U.S. Pat. 847,563, March 19, 1907.

The butter is removed from fresh cream or milk by agitation at a temperature of about 60° F., while air is blown through; it is then mixed with the "residue" at a temperature below the melting point of the butter, the mixture being, finally, subjected to a lower temperature. —W. P. S.

French Patents.

Coffee extract; Process and apparatus for making a dry ——. C. Duimich. Fr. Pat. 372,185, Oct. 9, 1906.

An aqueous extract is first prepared by treating ground, roasted coffee with boiling water in a closed vessel; this extract is drawn off from the bottom of the vessel, and, after being passed through a filter, is conducted through a pipe to the evaporating part of the apparatus. The latter consists of a globular closed vessel provided with an external heating pipe round its lower part, a steam pipe entering at the bottom, and a pipe leading from the top. The vessel is, to commence with, filled with steam, air being expelled through a branch on the upper pipe. The taps on the steam and outlet pipes are then closed, and, as steam condenses, the coffee-extract is drawn into the vessel. The pipe at the top of the vessel is extended downwards and into a tank of water, the length of the pipe being sufficient to hold a column of water equivalent to 1 atmosphere of pressure; cold water is supplied to an enlargement on this pipe to accelerate the condensation of the vapours produced in the evaporator. The evaporation is continued until the residue is perfectly dry, and the product is then ground and packed.—W. P. S.

Organic substances [foods]; Method of preserving ——. H. C. Empis. Fr. Pat. 372,683, Dec. 19, 1906. Under Int. Conv., Dec. 20, 1905.

The organic substance, such as meat, fish, &c., is placed in a closed vessel from which air is exhausted. A small quantity of alcohol, and acetic acid; propylic, butylic, and amylic alcohols and their corresponding aldehydes and acids; lactic acid; or eugenol and cinnamic alcohol, are admitted in the form of vapour or as solutions. When these vapours have impregnated the substance, the interior of the vessel is again exhausted, and sterilised air or carbon dioxide is admitted. The sterilised substance may be kept in the open air or surrounded by an antiseptic covering. Meats may be submitted to a preliminary freezing with liquid carbon dioxide, before being preserved.—W. P. S.

Feeding cakes; Process of manufacturing —— *from olive residues.* M. Hieguet and A. Bengesco. Fr. Pat. 372,782, Dec. 20, 1906.

The residues from the olive presses are boiled with about one-third of their weight of water, and the mixture obtained, is passed through a sieve to remove the stones. The pulp is then allowed to cool, oil and water are removed, and the residue is pressed into cakes. If desired, other materials may be added.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Arsenic; Proportion of —— *in the "Maxquelle" at Dürkheim.* E. Ebler. Ber., 1907, **40**, 1804—1807.

In examining the sediment of this spring for radio-active substances the author found it to contain a large proportion of arsenic, corresponding on the average to 10·7 per cent. of arsenic trioxide. This is in excess of the arsenic content in the sediment of any known spring, that from the Ulrichs and Conradinsquelle in Val Sinestra coming next with 6·9 per cent. The fresh water exposed in the laboratory gave a daily deposit of 1 grm. of sediment from 5 litres, which would correspond to a deposit of about 20 kilos. per day (containing about 2 kilos. of arsenic) from the water in the spring. The sediment was only produced after the water had been in contact with the air, the water otherwise remaining clear. Analysis of the water showed it to contain on the average 17·4 mgrms. of arsenic (as As_2O_3) per litre, all of it being in in the trivalent condition. The water contained little iron, although arsenic is usually accompanied by a large proportion of iron sulphate, as, *e.g.*, in the case of the Roncegno Spring in South Tyrol, which contains 42·6 mgrms. of arsenic (as As_2O_3) per litre.—C. A. M.

ENGLISH PATENT.

Water; Apparatus for simultaneously producing supplies of hot and distilled ——. B. T. Taylor, Albert Park, Victoria, Australia. Eng. Pat. 21,473, Sept. 28, 1906.

THE apparatus consists of a cylindrical boiler which is separated into two parts by means of a horizontal partition. The upper part is supplied with a current of cold water, such as that returning from the heating pipes of a building, and contains a steam coil. The water which condenses in the coil is conducted into the lower part of the boiler, whence it is drawn off and either pumped, or forced by the pressure of the steam, to a tank situated at a higher level than the boiler. This tank may also be provided with an internal heating coil to maintain the temperature of the condensed water at any desired degree, and a portion of the hot water may be led to a third tank containing a coil supplied with cold water, in order to provide a supply of cold condensed water. The water in this latter coil, as it becomes heated, is led to the upper part of the boiler, so that as little heat as possible is lost. Other modifications of the plant are described, including one which may be used in connection with some existing circulating systems.—W. P. S.

UNITED STATES PATENTS.

Distillation [of water]; Process of ——. E. A. Le Sueur, Sault Ste. Marie, Canada. U.S. Pat. 838,195, Dec. 11, 1906.

THE liquid to be distilled is passed, at about atmospheric pressure, through a passage in a counter-current apparatus, thus raising the temperature to boiling point. The liberated vapour is drawn off, compressed, and returned into contact with one side of the chamber or pipe system, on the other side of which ebullition is proceeding, thus producing re-condensation and a transference of the latent heat of vaporisation to the boiling liquid. The re-condensed liquid is sent through a passage in the counter-current apparatus, so as to give up heat to the same, prior to removal. Loss of heat is prevented by "lagging" the apparatus.—C. S.

Water; Means for purifying and sterilising —— *by ozonised air.* J. H. Bridge, Philadelphia. U.S. Pat. 850,416, April 16, 1907.

SEE Fr. Pat. 368,620 of 1906; this J., 1907, 30.—T. F. B.

Sewage disposal; Apparatus for ——. B. J. Ashley, Chicago. U.S. Pat. 848,279, March 26, 1907.

THE plant consists of a receiving tank provided with a baffle-wall to check the rate of flow of the sewage. The inlet pipe, supplying the sewage, pierces the wall of the tank and ends in two branches, one extending downwards below the normal level of the outlet pipe, and the other reaching upwards to above the surface of the liquid. The outlet pipe also pierces the wall of the tank, but at a lower level than the inlet pipe, and has two branches, the one extending downwards into the liquid, and the other upwards through the tank cover. The outlet pipe delivers the sewage to a series of perforated pipes or passages buried below the surface of the soil, and surrounded by beds of purifying and filtering material, such as clinker, crushed stone, &c. Each pipe or passage is situated at a lower level than the preceding one as they progress outwards from the tank. Ventilating shafts are provided on the perforated pipes, and the tank is supplied with a flushing pipe.—W. P. S.

FRENCH PATENTS.

Sewage and ammoniacal liquids; Treatment of ——. [*Recovery of ammonia*]. J. Jean et Cie. Fr. Pat. 372,171, Feb. 13, 1906.

THE sewage, or other liquid, is passed on to a fan rotating at a high speed, the latter being such that each part of the sewage is mixed with 1400 times its volume of air at a velocity of 30 metres per second. Sewage and air are thus converted into a dense mist, which is immediately passed through baffle-plates on which the water condenses, and the air laden with ammonia is brought into contact with an acid solution so that the ammonia is retained. An alkali may be added to the sewage to liberate any combined ammonia present.—W. P. S.

Sewage; Treatment of —— *to obtain a humic sewage manure.* J. Dumont. Fr. Pat. 372,497, Dec. 12, 1906.

THE sewage is treated in large reservoirs, having movable covers, and provided with emptying siphons, with from 10 to 15 per cent. by weight of peat, free from lime, or of organic refuse capable of fixing ammoniacal nitrogen. The liquid, thus deodorised, may be clarified by addition of a compost of clay, dissolved superphosphate, or aluminium sulphate. The deposit is collected, drained, filter-pressed, and dried, after addition of rich superphosphate, to constitute a phospho-nitrogenous manure. The liquids from the preceding operations are received in open precipitation basins, and a concentrated solution of humates, obtained by treating peat with a caustic alkali or alkali carbonate, is added, as well as nitrogenous waste matters that have been previously heated in an autoclave with an alkali or acid. To effect the precipitation of "humo-phosphates" a phosphatic solution is added, and a salt of magnesium, iron, aluminium, or calcium, or a mixture of these. If the liquid has an acid reaction, this is neutralised, say, by milk of lime. The precipitation is complete after some days, and the drained product is utilised as a manure, or is incorporated with the product obtained by the first-described process. In case the residuary liquors are not sufficiently purified for discharge, they are passed successively through beds of peat, animal charcoal, and sand or cinders. The peat thus used is afterwards utilised in the main processes.
—E. S.

Sewage; System and apparatus for the purification of ——. E. Bohon. Fr. Pat. 372,544, Dec. 14, 1906.

THE sewage is first passed through a hopper-shaped settling tank and then through tanks provided with baffle-plates; thence it is conducted to the bottom of a number of tanks containing layers of iron shavings supported on perforated false bottoms. After passing upwards through these layers, the liquid falls from a height of about 2 metres into the reagent tank, where it is mixed with lime and clay; these are themselves introduced in automatically regulated quantities in the proportion in which they are employed in the manufacture of cement. The treated sewage is now passed through a further series of settling and aërating tanks, and, finally, through a filter composed of slag and gravel.
—W. P. S.

Separation by atomisation of gases dissolved in a liquid; Process for —— *and for the purification of water.* P. Kestner. First and Second Additions, dated Feb. 8, 1906, to Fr. Pat. 371,486, Jan. 24, 1906.

THE biological purification of water is effected by atomising the water in a large volume of air containing vapours of a volatile antiseptic. The latter, although soluble in water, is not dissolved under these conditions. Sewage effluents containing the gaseous products of fermentation in solution, have these gases expelled, and replaced by oxygen, by atomising the liquid in the presence of a large current of air.—W. H. C.

Water from iron mines; Process for clarifying and purifying turbid ——. C. Lenormand. Fr. Pat. 372,371, Dec. 10, 1906.

THE turbid water is conducted to a tank containing a quantity of finely-divided metallic iron, such as shavings, turnings, &c., and is kept in this tank for at least one hour, air being excluded as far as possible. At the end of this time, the water is run off into a settling tank; sedimentation takes place rapidly, and after about 10 hours the water is sufficiently clear to be drawn off. The ferruginous sediment in the settling tank is removed from time to time.—W. P. S.

Water; Process and apparatus for sterilising —— [*by means of ozone*]. A. Charbonneau and A. Malaquin. Fr. Pat. 372,752, Dec. 19, 1906.

AFTER passing through a sand and charcoal filter situated at the top of a vertical tower, the water collects in a chamber below the filter and then falls through a finely-perforated distributor on to glass balls packed in four compartments at the lower part of the tower. These compartments are superimposed and separated from each other by perforated glass partitions. As it falls through the glass balls, the water is subjected to the action of ozonised air injected at the bottom of the tower, and the treated water is collected in a channel, whence it runs over a cascade into the collecting tank.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 483.)

Cotton fibres; Paper-making qualities of short ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **95**, 193—196.

THE authors have made experiments on the paper-making value of the short cotton fibres left on the seed-hulls after the ginning operation and subsequently partially removed by delinters. The fibrous material so recovered was boiled in a digester for four hours at a pressure of about 45 lb. per sq. in. with 10 per cent. of its weight of caustic soda. The boiled material was then bleached with 2·5—5·0 per cent. of its weight of bleaching powder, the yield of bleached half-stuff amounting to 66—70 per cent. of the raw material. The cotton fibres varied in length from 0·5 to 5 mm., with an average length of 2·25 mm. The pulp contained a large proportion of fibres without collapsed walls and twists, and with no central canal. The half-stuff was converted into paper-pulp in two ways, *viz.*: (*a*) without appreciable reduction of the length of the fibres by the beater-roll, average fibre-length 2·20 mm., and (*b*) with a reduction of the average length of the fibres to 1·65 mm. under the action of the roll. Both pulps gave papers of excellent quality, well adapted for sizing with gelatin; these papers were, in the authors' opinion, equal to those made from cotton rags of good quality.—J. F. B.

Paper; Influence of acidity of —— *on the fading of ink.* Vandevelde. Nat. Drugg., 1907, **32**, 138.

THE fading of ink in certain documents has been traced to the presence of free acid in the paper. To determine the amount of this, 10 grms. of the paper, cut small, are macerated for 24 hours, with frequent agitation, with 100 c.c. of water. The liquid is then decanted, the pulp washed with 25 c.c. of water, and the whole is rubbed down with N/10 barium hydroxide solution, using phenolphthalein as indicator. The number of c.c. of N/10 solution used, calculated for 100 grms. of dry paper, is termed the "acid coefficient." This was found to vary, in a number of papers examined, from 0 to 280. In paper intended for documents, this figure should not exceed 50. The most permanent ink for documents is an iron and nutgall preparation, containing 5·5 grms. of iron to the litre, with the addition of 6 to 7 grms. per litre of lamp-black.—J. O. B.

Parchment paper containing magnesium chloride; Action of weak alkaline solutions on ——. C. Bartsch. Papier-Zeit., 1907, **32**, 1272.

IN a previous note (this J., 1906, 863) it was shown that weak alkaline solutions, such as soap solutions, had a deleterious effect on the mechanical properties of parchment paper. The author now shows that such papers can be made resistant to soaps and weak alkaline solutions by steeping them in a solution of magnesium chloride. Such treatment is recommended when the paper is to be used for packing soap.—J. F. B.

Cellulose; [Cupric] Reducing power of various kinds of ——. C. G. Schwalbe. Ber., 1907, **40**, 1347—1351.

IF performed under rigidly defined conditions, a determination of the cupric-reducing power affords a useful measure of the free carbonyl groups in cellulose and hence of the chemical condition of the sample. The conditions established by the author are as follows:—Two portions, of about 3 grms. each, of the cellulose are weighed out; one portion serves for the determination of the absolute dry substance, whilst the other is reduced to a fine state of division, without drying by heat, and is mixed with 200 c.c. of water and 100 c.c. of Fehling's solution. The liquid is boiled for 15 minutes, under a reflux condenser, with frequent agitation, the time being calculated from the moment when full ebullition sets in. The liquid is then filtered hot by the aid of the pump, and the residue containing the cuprous oxide is washed with boiling water. The cuprous oxide is then dissolved in nitric acid and the amount of copper determined, preferably by the electrolytic method. The "copper value" represents the percentage of metallic copper calculated on the dry cellulose. The "copper values" of various normal and chemically altered celluloses are recorded in the following table:—

Material.	Copper values.	
1 Surgical cotton wool	1·64	1·8
2 Mercerised bleached Egyptian cotton yarn	1·9	1·6
3 Artificial silk "Glanzstoff"	1·1	—
4 Hydrocellulose	5·2	5·8
5 Parchment paper	4·2	—
6 Bleached sulphite wood pulp	3·9	3·9
7 Imitation ("Greaseproof") parchment paper	3·5	3·0
8 Over-bleached sulphite wood pulp	19·3	—
9 Oxycellulose from filter-paper and bleaching powder..........................	7·9	7·6
10 Bleached cotton rag pulp (half-stuff)....	6·5	5·6

—J. F. B.

UNITED STATES PATENTS.

Paper; Loading or filling substance for use in the manufacture of ——. A. Monin, Lent, France. U.S. Pat. 848,916, April 2, 1907.

SEE Fr. Pat. 366,112 of 1906; this J., 1906, 1064.—T. F. B.

Wood fibre; Digester for ——. G. H. Mallam, Kansas City, Mo. U.S. Pat. 850,384, April 16, 1907.

THE construction and operation are claimed of a wood-fibre digester consisting of an upright cylinder having a lateral discharge pipe opening at the bottom, a grating for supporting the fibre, steam-pipe connections for admitting steam to the space just above the grating, a spiral conveyor feeding towards the lateral discharge opening, and a valved water supply into the cylinder for maintaining a supply of water under pressure during discharge.—G. W. McD.

Cellulose [*from maize-stems*]; *Method of obtaining* ——. F. L. Stewart, Murrysville, Pa., Assignor to S. E. Gill, Pittsburg, Pa. U.S. Pat. 845,378, Feb. 26, 1907.

CELLULOSE is obtained from the stems of maize and similar plants by removing the water-soluble constituents, leaving the stalks in a divided and absorptive condition, and then treating the material when moist, either with nitric oxide and steam or with a mixture of nitric oxide and chlorine, subsequently washing, neutralising, and again washing the cellulose obtained.—J. F. B.

Leather [*coated with nitrocellulose*], *and process of making the same.* L. Feval, Assignor to Guardian Trust Co. U.S. Pat. 848,357, March 26, 1907. XIV., page 540.

Filaments [*artificial silk*]; *Apparatus for forming* ——. M. Waddell, Assignor to S. W. Pettit. U.S. Pat. 849,822, April 9, 1907. V., page 524.

Viscose [*artificial silk*]; *Manufacture of filaments and films from* ——. C. N. Waite, Assignor to S. W. Pettit. U.S. Pat. 849,823, April 9, 1907. V., page 525.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(*Continued from page* 487.)

Lead and arsenic in citric and tartaric acids. Local Government Board. Report of Inspector of Foods, No. 2.

THE Local Government Board has issued a report by Mr. A. W. J. MacFadden on lead and arsenic in tartaric acid, citric acid, and cream of tartar. Representations had been made to the Board that certain manufacturers and importers refuse to give any guarantee of purity in respect of lead and arsenic in tartaric acid, and as a result acid containing excessive amounts of these impurities is finding its way into the market for food and drug purposes, and the inquiry was accordingly instituted. About 1800 tons of tartaric acid is imported annually, and two firms who manufacture the bulk of the acid made in this country turn out 1300 tons a year, so that the total consumption is upwards of 3000 tons. Of citric acid about 200 tons is imported annually and 800 tons is made in home factories, while about 3000 tons of cream of tartar is imported annually. The report proceeds to describe the manufacture and impurities of tartaric acid, showing that lead is liable to be present from the use of lead-lined vessels in the course of manufacture.

Eight different samples of wine-lees were found to contain from 0·0025 to 0·004 grain of arsenic (as arsenious acid) per pound. Arsenic is also introduced from the sulphuric acid used in the process of manufacture. Iron is not infrequently present in small amounts in tartaric acid, and copper is also an occasional impurity. It is the usual practice of manufacturers of tartaric acid to make only one quality, namely, that which is suitable for food and drug purposes; but sometimes the acid is turned out containing a considerable amount of impurity, yet of good appearance, and, rather than incur the expense of re-purifying this, they put it on the market as "commercial tartaric acid," this cheaper acid being preferred for calico-printing and in dye-works. Samples of tartaric acid and cream of tartar were collected from consignments received during June and July, 1906. Of these, 73 samples of tartaric acid and 38 of cream of tartar were examined in the Government laboratories, with the following results: (N.B. 0·001 per cent. equals 0·07 grain per lb.).

Tartaric Acid.

Italy consigned 5,532 cwt. to the United Kingdom in 1904. Ten samples were analysed, of which three were in powder. Lead to the extent of 0·217, 0·084, 0·049, 0·161, 0·350, 0·084, 0·140 gr. per lb. was found in the crystal acid, and in the powders 0·308, 0·273, 0·266 gr. per lb. Three of the samples only contained arsenic; they were crystalline, and showed 0·006, 0·008, and 0·055 gr. of arsenious acid per lb.

Spain consigned 976 cwt. to the United Kingdom in 1904. Six samples of powder and four samples of crystal acid were taken. The lead found in the powder amounted to 0·126, 0·112, 0·385, 0·420, 0·098, 0·203 gr. per lb., and in the crystal 0·070, 0·182, 0·350, and 0·140 gr. per lb. Only four of the samples were free from arsenic—namely, two crystals, and two powders. The others contained in the powder 0·050, 0·060, 0·025, and 0·050 gr. of arsenious acid per lb., and in the crystal 0·040, 0·030 gr. per lb.

The *United States* consigned 4000 cwt. of acid to the United Kingdom in 1904. One sample only was analysed. It was a powder, and contained 0·035 gr. per lb. of lead, but was free from arsenic.

France exported 1908 cwt. to us in 1904. One sample of crystal acid was analysed, and contained 0·007 gr. per lb. of lead, but was free from arsenic.

Germany consigned 13,955 cwt. to the United Kingdom in 1904. Six samples were analysed, four in powder, and they showed 0·252, 0·343, 0·063, and 0·434 gr. of lead per lb., and two contained 0·004 gr. of arsenious acid per lb. Two samples of crystal were analysed, and were found to contain 0·098 and 0·028 gr. of lead per lb., and one of them contained 0·005 gr. of arsenious acid per lb.

Austria consigned 2115 cwt. of tartaric acid to the United Kingdom in 1904. Two samples were analysed, and showed 0·427 and 0·098 gr. of lead per lb. and 0·02 gr. of arsenious acid each per lb.

Home-manufactured acid.—Three samples were analysed and were free from arsenic. One was free from lead and the others contained 0·021 and 0·078 gr. per lb.

Cream of tartar.

Spain sent to the United Kingdom 4360 cwt. of cream of tartar in 1904. Two samples of powder were analysed, and one showed traces of arsenic and the other was free. The lead content was 0·217 and 0·189 gr. per lb.

The *United States* consigned 1651 cwt. to the United Kingdom in 1904, and the sample examined contained 0·028 gr. of lead per lb. It was free from arsenic.

France exported 43,988 cwt. to us in 1904. Seven samples were analysed, three in crystal and four in powder. All were free from arsenic, except one crystal sample, which showed 0·010 gr. of arsenious acid per lb. The lead contained in the crystal was 0·126, 0·056, and 0·112 gr. per lb., and in the powder 0·189, 0·231, 0·028, 0·028 gr. per lb.

Germany's exports to us amounted to 5173 cwt. in 1904. Five samples analysed were in powder, and all but one were free from arsenic (a second showed traces), and 0·02 gr. of arsenious acid per lb. was the amount determined in the contaminated sample. One was free from lead and the others contained 0·021, 0·070, 0·119, and 0·126 gr. per lb.

Home-made cream of tartar showed in each of the two samples analysed 0·140 gr. of lead per lb., but was free from arsenic.

In 15 out of the 30 foreign samples tested, the amount of lead present did not exceed 0·002 per cent., the highest figure was 0·062 per cent.; notable quantities of arsenic were found in several samples of Spanish tartaric acid. The Arsenic Commission placed a limit on arsenic of 0·00014 per cent., or $\frac{1}{100}$ (0·01) gr. per lb., and this, in the case of cream of tartar, was exceeded by one sample only. The freedom of British-made products from arsenic is most satisfactory. The report also deals with present standards in regard to lead and arsenic in tartaric and citric acids and cream of tartar, reference being made to the British Pharmacopœia requirements, and to the report presented to the Pharmacopœia Committee of the General Medical Council in May, 1904, by Dunstan and Robinson, and to the paper on "The Detection and Estimation of Lead," by Warington. Dr. MacFadden also examined the forms of guarantee in use for these products and the standards adopted, and concludes with the following remarks:

In view of the uses to which tartaric and citric acids and cream of tartar are put, recognised definitions of objectionable impurities are needed for application by manufacturers, chemists, and analysts, and for use by importers and merchants selling these materials for food and drug purposes.

The requirements for this purpose of the 1885 and 1898 editions of the British Pharmacopœia, for the reasons given above, do not in the case of either tartaric or citric acid serve this purpose as regards contamination by lead and arsenic.

General adoption of definite numerical limits of impurity as regards lead and arsenic in tartaric and citric acid would seem to offer a more satisfactory basis for trade guarantees and for analytical practice. Of such a character is the "cream-of-tartar standard" already adopted by traders and analysts, in which the limit of impurity in cream of tartar is fixed at amounts not exceeding 0·002 per cent. (approximately $\frac{1}{7}$ grain per lb.) of lead and 0·00014 per cent. ($\frac{1}{100}$ grain per lb.) of arsenic (arsenious oxide).

The same degree of purity has been shown to be attainable in practice not only in cream of tartar, but also in tartaric and citric acids, and is, at the present time, reached by a large proportion of these commodities of different origins analysed in this country.

Lead and arsenic are two substances in which the deleterious effect of continued ingestion of small doses has been clearly shown. It should be the aim of the manufacturer to exclude both these substances from articles of food and food ingredients. Looking to all the circumstances, however, and having in view the quantities in which tartaric and citric acids and cream of tartar are consumed in food, drinks, medicines, &c., it is reasonable to conclude that minute amounts of lead or arsenic (arsenious oxide) below 0·002 per cent. and 0·00014 per cent. respectively, would not be sufficient to justify their condemnation.

The report is published by the official booksellers (Messrs. Wyman and others) at 3d.

Caffeine and its derivatives; Action of phenyl-magnesium bromide upon ——. H. Schulze. Ber., 1907, **40**, 1744—1754.

PHENYL-MAGNESIUM bromide and bromo-caffeine were allowed to interact in ethereal solution, when a crystalline substance, $C_{20}H_{20}N_4O$, separated out. On recrystallising from alcohol, this was obtained in the form of colourless short crystals, melting at 249°—250° C. This substance is moderately soluble in alcohol and benzene, insoluble in water and ether, soluble in chloroform and acetic acid. Phenyl-magnesium bromide and 8-methylcaffeine, similarly treated, gave traces of phenol and diphenyl, together with considerable quantities of triphenylcarbinol. Ethoxycaffeine dissolved in benzene was added to a solution of phenyl-magnesium bromide, the mixture heated, and allowed to stand. A substance, $C_{26}H_{24}N_4O$, was isolated. It crystallised from alcohol in colourless rectangular tablets melting at 235° C., soluble in benzene, acetic acid, and chloroform, but insoluble in ether and water. By dissolving in sulphuric acid, and then making alkaline with sodium carbonate, a base, $C_{20}H_{22}N_4$, was precipitated. This crystallises from dilute alcohol in bright yellow, long needles, melting at 152°—153° C. The compound is soluble in alcohol, benzene, acetic acid, and chloroform, but soluble with difficulty in ether and water. Its hydrochloric acid solution, after extraction with chloroform, was evaporated till an oil separated out. This was taken up with ether, which was shaken with dilute hydrochloric acid, and the aqueous portion evaporated. A crystalline substance, $C_{12}H_{13}N_2O_2$, separated. Methoxycaffeine and phenyl-magnesium bromide similarly yielded a substance melting at 235° C., identical with that obtained from ethoxycaffeine.—F. SHDN.

Ipomœa turpethum; New rhamnoside from ——. E. Votoček and J. Kastner. Z. Zuckerind. Boehm., 1907, 367. Apoth.-Zeit., 1907, **22**, 259.

BESIDES turpethin, the resinoid body insoluble in ether, the rhizome of *Ipomœa turpethum* contains a previously undescribed glucosidal resin, now named turpethein, soluble in pure ether. This is separable by light petroleum spirit into a soluble glucoside, α-turpethein, and a sparingly soluble body, β-turpethein. α-Turpethein is soluble in baryta water, and yields, when hydrolysed, the non-volatile fatty hydroxy-acid, $C_{16}H_{32}O_3$, identical or isomeric with jalapinic, ipomeolic, and tampicolic acids. It also yields a volatile fatty acid of the C_5 series, probably one of the valeric acids. The sugar formed is rhamnose. β-Turpethein, when hydrolysed, gives a non-volatile, higher fatty acid, rhodeose, and dextrose.—J. O. B.

Cousso; Active principles of ——. F. Reeb. J. Pharm. Elsass.-Lothring., 1906, 286. Pharm. Centralh., 1907, **48**, 91.

THE powdered drug was extracted with ether, the solvent distilled off, and the residue extracted with chloral hydrate solution (6 : 4). The extract thus obtained was shaken out with light petroleum spirit, until the latter was uncoloured. The petroleum spirit solution was distilled, and the residue treated with hot 95 per cent. alcohol. On cooling, crystals were obtained, which after recrystallisation from alcohol had the m. pt. 170° C. This body is identical with Leichsenring's protocosin and is non-toxic. The alcoholic mother liquor was evaporated, the residue dissolved in water and shaken out with sodium carbonate solution (1 : 4); the alkaline extract was acidified with acetic acid and again shaken out with ether. On evaporating the solvent an amorphous yellowish substance was obtained, m. pt. 65° C., which was toxic. The residue insoluble in chloral hydrate solution, when treated as above with ether and sodium carbonate, gave a similar toxic amorphous substance, m. pt. 72° C. This body is considered to be identical with Leichsenring's cosotoxin. It follows from the above results that protocosin exists, as such, in the plant, but cosotoxin is formed as a decomposition product by the action of the alkali carbonate.—J. O. B.

Methyl alcohol as an extraction fluid for drugs [*Relative value of ethyl and methyl alcohol as extraction media*]. L. Rosenthaler. Suedd. Apoth.-Zeit., 1907 [22]. Pharm.-Zeit., 1907, **52**, 291.

COMPARATIVE experiments with methyl and ethyl alcohol as extraction menstrua for the preparation of solid extracts show that in many instances the former gives a better yield. Cases occur, however, in which the products are not similar. Sometimes the one solvent, sometimes the other, gives a better result. Thus, with rhubarb, ethyl alcohol gave 32 and methyl alcohol 28 per cent. of extract. With jalap resin, ethyl alcohol yielded 12·8 and methyl alcohol 16 per cent. With cinchona bark, ethyl alcohol gave 20·6 per cent. of extract containing 14·8 per cent. of alkaloids; methyl alcohol, 20·1 per cent. of extract with 14·5 per cent. of alkaloids. Nux vomica with ethyl alcohol, gave 9·2 per cent. of extract containing 20·75 per cent. of alkaloids, and with methyl alcohol, 8·8 per cent. of extract containing 16 per cent. of alkaloids. One advantage of methyl alcohol for the purpose is its greater volatility.—J. O. B.

American pennyroyal; Constituents of the essential oil of ——. *Occurrence of a dextro-menthone.* M. Barrowcliff. Chem. Soc. Proc., 1907, **23**, 114.

THE oil used in this investigation possessed the following characters: sp. gr. at 15°/15° = 0·9297; $\alpha_{D22} = +25°44'$ in a 1 dcm. tube; soluble in twice its volume of 70 per cent. alcohol. It has been found to consist of: (1) an undetermined phenol, in very small amount; (2) *l*-pinene (nitrosochloride, m. pt. 103°—104° C.; nitrolbenzylamine, m. pt. 122°); (3) *l*-limonene (tetrabromide, m. pt. 104°); (4) dipentene (tetrabromide, m. pt. 124°), all of these terpenes being present in only small amount; (5) 1-methyl-3-cyclohexanone (oxime, m. pt. 41°—43°; semicarbazone, m. pt. 182°—183°), about 8 per cent.; (6) pulegone (semicarbazone, m. pt. 171°), about 30 per cent; (7) *l*-menthone (oxime, m. pt. 58°—59°; semicarbazone, m. pt. 184°—186°), and (8) *d*-isomenthone (semicarbazone, m. pt. 125°—126°), identical with the dextrorotatory constituent of Beckmann's "inverted menthone"; the amount of these two menthones constituting about 50 per cent. of the oil; (9) a sesquiterpene alcohol, about 2 per cent.; (10) esters of formic, acetic, octoic, decylic, and salicylic acids, and the ester of a dibasic acid of the probable formula, $C_8H_{14}O_4$, together with formic, butyric, octoic, and decylic acids in the free state; all these esters and acids being present only in small amount.

Absinthe; Action of water on [*alcoholic*] *essences of* ——. Sanglé-Ferrière and L. Cuniasse. J. Pharm. Chim., 1907, **25**, 428—430.

IN view of preventing the consumption of "absinthe," it has been proposed to prohibit the sale of liqueurs which give more or less turbidity on dilution with water. Experiment has shown, however, that it is not the alcoholic solutions of the essential oils of wormwood and tansy, the toxic ingredients in "absinthe" liqueur, which give, when diluted, the greatest opacity, but the harmless oils of fennel, star-anise, and aniseed. A solution of 3 grms. of each oil in 1 litre of 70 per cent. alcohol was made, 1 vol. of which was then diluted with 2 vols. of distilled water, and the degree of turbidity determined in a diaphanometer. The following figures express the height of the liquid in millimetres at which the lines on the screen of the instrument were obscured, the oils employed being those which are the usual ingredients in absinthe liqueurs: Wormwood, 40·4; tansy, 53·0; hyssop, 34·0; coriander, 34·0; fennel, 12·0; star-anise, 3·4; aniseed, 2·2. Obviously any test for wormwood or tansy oils based on the degree of turbidity would be fallacious.—J. O. B.

Di-iodocamphor. J. E. Marsh and R. de Jersey Fleming Struthers. Chem. Soc. Proc., 1907, **23**, 119.

In a former paper (Chem. Soc. Trans., 1905, **87**, 1882), the authors stated that alkaline mercury cyanide did not form a derivative with camphor similar to that which it gives with certain other ketones. When, however, camphor is acted on by an alkaline solution of mercuric iodide containing potassium iodide, a mercury derivative of camphor is obtained. This substance is insoluble in water, but soluble in alcohol, and when treated with iodine gives mercuric iodide and di-iodocamphor. The latter substance forms brittle, yellow crystals melting at 108° and soluble in alcohol, benzene, chloroform, or light petroleum. Its solution in chloroform is dextrorotatory. It is stable in the crystalline form, but its solution is decomposed by the action of light, with separation of iodine.

Forgenine (*tetramethylammonium formate*). — Vanzetti. Boll. Chim. farm., 1906, 593. Nouveaux Remèdes, 1907, 23, 63.

Forgenine is obtained by the action of strong solution of tetramethylammonium iodide on freshly precipitated silver formate. Any trace of the latter salt taken into solution is removed from the filtrate, after separation of the silver iodide, by means of a trace of hydrochloric acid. The liquid is then evaporated to a syrupy consistence and crystallised; the salt obtained is very hygroscopic; it forms neutral aqueous solutions which may be boiled without undergoing decomposition. It is employed as a medicinal agent, and in large doses is toxic, resembling curare in its effects.—J. O. B.

Ether vapour and air; Limit of inflammability of mixtures of ——. O. Boudouard and H. Le Chatelier. Compt. rend., 1907, **144**, 910—911.

Referring to Meunier's recent paper (this J., 1907, 486), the authors point out that they used in 1897 (this J., 1898, 651) a similar method on a larger scale, and extended the work to a number of other inflammable liquids. They found the limit of inflammability of ether vapour in air to be 60 mgrms. per litre.—J. T. D.

Melting points; Determination of —— *at low temperatures.* L. F. Guttmann. Chem. Soc. Trans., 1905, **87**, 1037—1042, and J. Amer. Chem. Soc., 1907, **29**, 345—348.

For the determination of melting points at low temperatures, the author uses a constantan-copper thermo-couple, one junction being placed in the substance of which the melting point is to be determined, and the other in melting ice. The free ends of the wires are connected to a D'Arsonval plane mirror galvanometer, arranged in series with a manganin resistance of about 700 ohms, the resistance of the galvanometer being about 800 ohms. The thermo-couple was calibrated by means of ice, chloroform, a mixture of carbon dioxide and absolute alcohol, ether, and liquid air. In carrying out a determination, the substance is placed in a test-tube closed by a cork carrying a tube through which the thermo-junction is passed. The test-tube is then placed in liquid air till the liquid around the junction has frozen, and afterwards in a Dewar vessel containing a mixture of equal parts of ether and ethyl bromide cooled to about 5°—10° below the melting point of the substance under examination. The galvanometer is now read every half minute during fusion the temperature remains constant for about 1·5—3 mins. The results obtained were as follows:—Pentane, — 147·5° C.; hexane, — 93.5°; octane, — 98·2°; *o*-xylene, — 27·1°; *m*-xylene, — 54·8; ethyl-benzene, — 92·8°; toluene, — 92·4°; methyl alcohol, — 97·8°; ethyl alcohol, — 117·3°; ether, — 117·6°; acetaldehyde, — 124·6°; acetone, — 94·6°; methylethyl ketone, — 85·9°; ethyl chloride, — 141·6°; ethyl bromide, — 117·8°; methyl iodide, — 64·4°; ethyl iodide, — 108·5°; N-propyl iodide, — 98·8°; isopropyl iodide, — 89° to — 91·8°; isobutyl iodide, — 90·7°; methyl acetate, — 98·7°; ethyl formate, — 78·9°; ethyl acetate, — 82·8°; ethyl propionate, — 72·6°; ethyl butyrate, — 93·3°; propyl acetate, — 92·5°. Pure ethyl alcohol to which 2 per cent. of isobutyl alcohol had been added, only crystallised partially on refrigeration, the remainder setting to a hard transparent glass in which crystalline nuclei were interspersed.—A. S.

Cerium sesquioxide. [*Preliminary notice.*] A. Burger. Ber., 1907, **40**, 1652—1655.

Cerium dioxide was reduced by means of metallic calcium, and the product treated with a solution of ammonium chloride at — 10° C., in order to remove calcium oxide and excess of calcium. The residue was washed with ice-water, alcohol, and ether, and dried in a vacuum. The substance so obtained, cerium sesquioxide (Ce_2O_3), is a yellowish-green powder which absorbs oxygen even at the ordinary temperature. When heated to 200° C. it glows slightly and becomes converted into dioxide. The amount of oxygen absorbed, is slightly less than that calculated from the formula, the difference being due to a slight decomposition of the sesquioxide. The reduction by means of calcium goes no further than the production of the sesquioxide.—F. Shdn.

Lactic acid; New reaction for ——. W. Thoms. XXIII., page 555.

English Patents.

Camphene; Manufacture of ——. O. L. A. Dubosc, Rouen, France. Eng. Pats. 8356, April 6, 1906 (Under Int. Conv., April 6, 1905), and 8260, April 5, 1906.

See Fr. Pat. 361,333 of 1905; this J., 1906, 952.—T. F. B.

Camphene; Process of oxidising ——. O. L. A. Dubosc, Rouen, France. Eng. Pats. 8356a, April 6, 1906 (Under Int. Conv., April 6, 1905), and 8260a, April 5, 1906.

See Fr. Pat. 361,333 of 1905; this J., 1906, 952.—T. F. B.

Pharmaceutical compounds [*Soluble silver-nucleic acid compounds*]; *Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 8407, April 7, 1906.

Nucleic acids of animal or vegetable origin and formonucleic acids, produced from them by the action of formaldehyde, are converted into salts, and the solutions of these salts are treated with silver nitrate so that a precipitate of a pulpy consistency is formed. This precipitate is redissolved by the gradual addition of a neutral salt, such as sodium chloride, potassium bromide, sodium acetate, &c., and the readily soluble silver nucleic acid compound is isolated either by precipitation by alcohol or by evaporation *in vacuo*. The soluble silver compounds contain 15—25 per cent. of silver, and possess antiseptic properties.—J. F. B.

Bacteria toxins suitable for immunifying purposes; Process for making ——. P. Bergell, Berlin. Eng. Pat. 19,868, Sept. 6, 1906.

See U.S. Pat. 842,612 of 1907; this J., 1907, 429.—T. F. B.

Primary terpene alcohols of the formula, $C_{10}H_{17}OH$; *Production of* —— *from ethereal oils containing linalool or coriandrol or their ethers* [*esters*]. F. O. Zeitschel, Hamburg. Eng. Pat. 3176, Feb. 8, 1907. Under Int. Conv., Feb. 9, 1906.

The ethereal oil is treated in the cold or at a low temperature with a halogen hydro-acid, such as hydrochloric acid, preferably in the gaseous state, and the resulting halogen compound saponified in the presence of water to form the alcohol or treated with the salts of organic acids to form the corresponding esters, which are then saponified.—C. A. M.

United States Patents.

Pyrimidine derivative. L. Weber, Darmstadt, Germany. U.S. Pat. 848,791, April 2, 1907.

See Fr. Pat. 346,188 of 1904 ; this J., 1905, 151.—T. F. B.

Camphor from isoborneol ; Process of making ——. C. Philipp, Assignor to Chem. Fabr. von Heyden A.-G., Dresden, Germany. U.S. Pat. 849,018, April 2, 1907.

See Fr. Pat. 365,974 of 1906 ; this J., 1906, 1002.—T. F. B.

Formaldehyde preparations ; Process of producing ——. P. Rosenberg, Berlin. U.S. Pat. 849,815, April 9, 1907.

See Eng. Pat. 2682 of 1906 ; this J., 1906, 1067.—T. F. B.

Fatty acids ; Bromine derivative of ——. E. Fischer, Berlin, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 850,111, April 9, 1907.

See Addition of June 21, 1906, to Fr. Pat. 362,370 of 1906 ; this J., 1906, 1173.—T. F. B.

Self-luminous body. L. Vanino, Munich, Germany. U.S. Pat. 850,860, April 16, 1907.

See Fr. Pat. 359,038 of 1905 ; this J., 1906, 336.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 489.)

Bobbinite ; Report of the Departmental Committee on ——. Cd. 3423. Price 2s. Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W., London ; or Oliver and Boyd, Edinburgh ; or E. Ponsonby, 116, Grafton Street, Dublin.

The report contains the findings of the committee which was formed "to inquire into certain ignitions of gas by the explosive, Bobbinite, and to report whether the continued use in coal mines of bobbinite and explosives of a kindred nature is desirable." Bobbinite consists of a high-grade gunpowder containing but little sulphur, mixed with starch and paraffin wax, and pressed into a pellet which is coated with paraffin wax. In the Woolwich test for explosives intended for use in coal mines, a stemmed shot is fired from a cannon into a mixture of gas and air, so arranged as to present the most explosive mixture that can be produced. On the Continent, instead of using stemming, the shots are fired unstemmed from a gun into a gallery similar in character but considerably larger in diameter than the one used at Woolwich. The maximum charge is determined, which in a series of ten shots fails to ignite the explosive mixture of gas and air in the gallery. This charge is termed the "charge limite" for that explosive. The Continental plan of firing unstemmed shots into gas or dust, excludes many explosives and classes of explosives which the Woolwich test would let through ; and, on the other hand, there are explosives which the Continental test would pass, but which the Woolwich and other tests would condemn. The points claimed in favour of bobbinite were that in practice it is safer to handle, and that not requiring detonators, it is not so likely to be accidentally exploded. Further, there are several detonants which are more likely to miss fire than bobbinite, and in the nitroglycerin group there is a danger of freezing, from which bobbinite is free. The committee, however, were unable to resist the conclusion that both the ignitions which have occurred in practical working and the results of experiments have distinctly indicated that bobbinite and several other explosives, when insufficiently confined, are more likely to explode gas than those explosives which give a high "charge limite," when tested without stemming. The conclusion has been drawn that where a great explosion is to be feared, the existing standard for the admission of explosives to the Permitted List is not sufficiently high ; but that where there is no risk of such a disaster, the casualties due to small local gas explosions may be set off against the additional other risks attaching to the use of detonants. As a coal-getting explosive bobbinite has certain advantages, and for this reason its elimination, in cases where a widespread disaster is not to be feared, appears to be undesirable. A consideration of the details of all great modern explosions has shown that no widespread explosion is at all likely to occur in a mine except by the agency of coal-dust. Modern ventilation renders impossible, except locally, the existence of an inflammable mixture of gas and air, unless dust is also present ; but it has, by assisting in spreading fine dust throughout the mine, and in rendering it drier than it would otherwise be, considerably increased the danger of a dust explosion. The committee, therefore, recommend that for the purposes of the Explosives in Coal Mines Order, explosives should be divided into two classes :—

Class 1.—Such explosives as shall have passed both the existing Woolwich test and the further tests to be hereafter settled.

Class 2.—Such explosives as shall have passed the Woolwich test alone.

The use of explosives of Class 2, in mines and seams, where the Explosives in Coal Mines Order applies, should only be permitted for the exclusive purpose of coal-getting, in mines and seams which are (*a*) naturally wet throughout ; (*b*) effectively watered or damped artificially wherever coal dust is present ; (*c*) divided into small districts by zones of 100 yards which are effectively damped ; (*d*) in which all blasting operations are carried out when all workmen have been removed from the seam in which the shot is to be fired. It is proposed that the tests used by the Department should no longer consist of the single test, known as the Woolwich test, but should include a more severe test, possibly on the lines used on the Continent. It may be necessary to build a large gallery similar to those in use in Germany and Belgium. It may also be necessary to try experiments, particularly on coal-dust, in a disused mine. Coal gas has succeeded well with the Woolwich test, but it may perhaps be essential that the more severe test should be carried out with natural gas rather than with artificial gas. At the same time it would probably be desirable to add to this testing station another installation for testing coal dust and safety lamps.—G. W. McD.

Explosion limits in gaseous mixtures ; Determination of ——. N. Teclu. XXIII., page 553.

Explosions ; Recording calorimeter for ——. B. Hopkinson. XXIII., page 554.

English Patents.

Cupro-nickel ; Solvent for —— [*cleaning rifle barrels*]. A. T. Cocking and Kynoch, Ltd. Eng. Pat. 15,081, July 3, 1906. X., page 532.

Explosive from trinitrotoluol ; Process for producing a plastic ——. C. E. Bichel, Hamburg, Germany. Eng. Pat. 16,882, July 26, 1906.

See Fr. Pat. 369,661 of 1906 ; this J., 1907, 224.—T. F. B.

Guncotton, nitrocellulose, and similar bodies ; Method of and apparatus for drying ——. K. B. Quinan, Somerset West, Cape Colony. Eng. Pat. 22,783, Oct. 15, 1906.

The apparatus is a shallow basket some 4 ft. in diameter, with the bottom of fine wire gauze. On this is laid a sheet of cheese-cloth on which is spread a layer, about 2½ in. thick, of wet nitrocellulose, which has been made as granular as possible by being rubbed through a sieve. A cover of silk cloth of fine mesh is placed in position over the nitrocellulose, to prevent any material being carried away by the current of hot air. This drying basket fits tightly on top of a circular support, into which a current of hot air is led, and thus passes through the nitrocellulose. When drying has been completed, a current of cold air is passed through the apparatus, to cool the charge before removal.—G. W. McD.

Matches and igniting surfaces therefor; Manufacture of ——. L. Stange, Aachen, Germany. Eng. Pat. 16,453, July 20, 1906. Under Int. Conv., Jan. 3, 1906.

The invention consists in the employment of certain diazo compounds as a substitute for phosphorus and its compounds in compositions either for friction ignition matches or for producing friction surfaces for safety matches. The following are given as examples of compositions for these two purposes respectively: Diazobenzenesulphonic acid (30 parts), potassium bichromat (30), dextrin (10), potassium chlorate (20), and powdered glass (10 parts). Tetrazobenzidinesulpho-disulphonic acid (30 parts), powdered glass (5), antimony sulphide (5), potassium chlorate (30), sulphur (5), glue (15), and potassium bichromate (10 parts).—G. W. McD.

United States Patents.

Explosive powder; Process of producing ——. F. I. du Pont and F. Sparre, Assignors to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 836,704, Nov. 27, 1906.

The process consists in agitating with nitrocellulose, suspended in a liquid in which it is insoluble, an emulsion of a solvent of nitrocellulose diluted by a substance which is insoluble in the liquid in which the nitrocellulose is suspended, and which is not a solvent of nitrocellulose, but is soluble in the nitrocellulose solvent. As an example: 1 part of nitrocellulose suspended in 8 parts of water is agitated with 1 part of amyl acetate diluted by 0·25 part of a liquid, such as amyl alcohol or benzene. (See also this J., 1893, 1057, 1058.)—J. F. B.

Explosive. O. Silberrad, Blackheath. U.S. Pats. 849,925 and 850,119, April 9, 1907.

See Eng. Pat. 18,692 of 1905; this J., 1907, 114—T. F. B.

Explosives; Waterproof composition for ——. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,266, April 16, 1907.

A composition consisting of nitrocellulose 1 to 15 per cent., of a normally solid nitro-compound less than 15 per cent., and of a liquid nitro-compound 60 to 95 per cent. in which the solid nitro-compound and nitrocellulose are dissolved.—G. W. McD.

Explosive; Ammonium nitrate metallic ——, *and process of making same.* F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,267, April 16, 1907.

A process consisting in incorporating "ammonium nitrate metallic powder" with a solution of guncotton in a liquid nitro-compound, the latter forming a coating ingredient. The mixture is then further incorporated with ungelatinised nitrocellulose.—G. W. McD.

Explosive. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,268, April 16, 1907.

An explosive consisting of ammonium nitrate (65—85 per cent.), a metallic ingredient (5—20 per cent.), trinitrotoluene (5—20 per cent.), and ungelatinised nitrocellulose less than 12 per cent.—G. W. McD.

Explosive; Ammonium nitrate ——. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,325, April 16, 1907.

A non-hygroscopic powder of ammonium nitrate (50—85 per cent.), coated with mononitrotoluene (3—30 per cent.), trinitrotoluene (less than 7·5 per cent.), and nitrocellulose (less than 4·5 per cent.).—G. W. McD.

Explosive, and process of making same. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,326, April 16, 1907.

A waterproof coating mixture containing a liquid nitro-compound of a hydrocarbon (less than 5 per cent.), and a solid nitrocompound of a hydrocarbon (5—15 per cent.), ammonium nitrate (less than 65 per cent.), and a mixture containing a nitrated organic sensitising agent (5—25 per cent.), ferrosilicon (5—25 per cent.). and a solid, uncoated non-hygroscopic, inorganic, oxidising agent (10—40 per cent.).—G. W. McD.

Explosive. F. Sparre. Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,502, April 16, 1907.

An explosive containing nitrocellulose, ferrosilicon, sodium nitrate, sulphur, and charcoal.—G. W. McD.

Explosive, treated with non-hygroscopic compound. A. La Motte, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 850,589, April 16, 1907.

An explosive consisting of ammonium nitrate, a nitronaphthalene, and a nitrotoluene.—G. W. McD.

French Patents.

Explosives [*non-freezing*], *with a low temperature of explosion; Method of manufacture of* ——. V. Vender. Fr. Pat. 372,267, Dec. 6, 1906. Under Int. Conv., Dec. 9, 1905.

Nitrocellulose can be gelatinised by the nitroacetins and nitroformins without the aid of a solvent, and this property is made use of for the production of a plastic or a gelatinised explosive. The method of preparation is as follows:—Glycerol (100 kilos.) and anhydrous oxalic acid (50 kilos.) are heated together at 140°—150° C. for 20 hours. The product, consisting of 125 kilos. of a mixture of glycerol and monoformin, is nitrated at 25° C. with a mixture of 275 kilos. of strong nitric acid and 90 kilos. of fuming sulphuric acid containing 25 per cent. of sulphuric anhydride. The oil which separates is washed with water and a dilute solution of sodium carbonate. It is pale yellow in colour, has a specific gravity of 1·57 and contains 15·7 per cent. of nitrogen. This corresponds to a mixture of nitroformin (33 per cent.) and nitroglycerin (67 per cent.). One hundred kilos. of this mixture will gelatinise from 1 to 400 kilos. of nitrocellulose, and an explosive of any required degree of plasticity or hardness can thus be obtained. The dinitroacetin compound is obtained in a similar manner to that already described. It has a specific gravity of 1·45 and contains 12·5 per cent. of nitrogen. Gelatinisation of nitrocellulose can also be effected by the addition to moist nitrocellulose of a basic acetin soluble in water. If the water is then evaporated, gelatinisation of the nitrocellulose takes place, and the resulting plastic mass can be formed into grains or flakes as desired.—G. W. McD.

Matches and friction surfaces; Manufacture of ——. Chemical Industrial Syndicate, Ltd. Fr. Pat. 372,852, Dec. 22, 1906. Under Int. Conv., Jan. 3, 1906.

The invention relates to the use of diazobenzenesulphonic anhydride as a substitute for phosphorus in the composition for matches and friction surfaces. For a match paste the following composition is suitable:—Potassium chlorate (47 parts), powdered glass (20), sulphur (4), gum (13), diazobenzenesulphonic anhydride (10), resin (6), and water (60 parts). For friction surfaces for safety matches the following example is given:—Powdered glass (20 parts), antimony sulphide (20), diazobenzenesulphonic anhydride (40), gum arabic (10), and water (60 parts). The temperature during the mixing of the constituents should not be allowed to rise above 30° C. —G. W. McD.

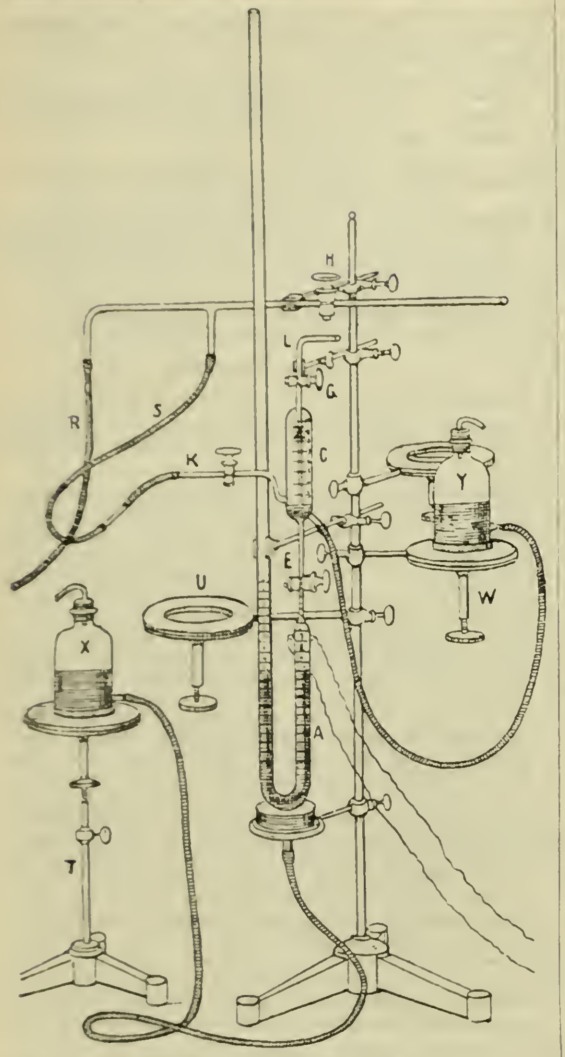
XXIII.—ANALYTICAL CHEMISTRY.

(Continued from page 492.)

APPARATUS.

Explosion limits in gaseous mixtures; Determination of ——. N. Teclu. J. prakt. Chem., 1907, 75, 212—223.

The mode of experimenting is easily seen from the diagram of the apparatus, regarding which it need only be said that all stopcocks are single save E, which is a three-way cock by means of which the eudiometer, A, and the vessel, C, can be either put into communication with one another,



or separately with the outer air. The tube, Z, is a continuation of the tube above E, and reaches nearly to the cock, G, so that communication with the eudiometer is not from the bottom but from the top of C. A being open to the air, the mercury reservoir, X, is raised on its stand, T, till the desired volume of A is unoccupied by mercury, and T is then fixed. X is then placed on U, and the eudiometer and cock filled with mercury, and the cock closed. C being now open to the air by both G and E, the reservoir, Y, is raised by raising W till the required volume of C is unoccupied by mercury, and W is fixed. In order to discover the limits of explosion, a current of hydrogen (coal-gas, acetylene, &c.) is passed by means of the tube, R, H being closed, and K open, through C till the air is completely displaced. X is now placed on T, G closed, E turned to join A and C, and finally H opened to allow the gas still passing through to escape at atmospheric pressure. E is now closed and the required quantity of hydrogen is thus shut off in A. The gas supply is disconnected, the rubber tube, S, slipped off K, G opened, E made to connect C with the air, and dry air passed through from L, till all hydrogen is driven out; G, E, and K are closed, and the required volume of air is now shut off in C. A and C are now made to communicate, the hydrogen driven into C by raising X, till the mercury reaches the top of Z; X is lowered and raised again gradually till mixture of the gases is assured, and a portion of the mixture is drawn down into and shut off in A, and the spark passed to explode it. When explosion has occurred, any water formed is removed before the next experiment by removing the mercury from the eudiometer by lowering X till the bend is clear, and then drawing air through by suction at L. The author's results are as follows, for mixtures of various gases with air :—

Gas.	Lower limit of explosion (air in excess).	Upper limit of explosion (gas in excess).
	per cent. of gas in mixture.	per cent. of gas in mixture.
Hydrogen	9·73—9·96	62·75—63·58
Coal gas	4·36—4·82	23·35—23·63
Methane	3·20—3·67	7·46— 7·88
Acetylene	1·53—1·77	57·95—58·65

Thus, with mixtures of hydrogen and air, only those will explode which contain as lower limit, 9·73—9·96, and as upper limit, 62·75—63·58 per cent. of hydrogen.
—J.T.D.

Explosions; Recording calorimeter for ——. B. Hopkinson. Proc. Roy. Soc., 1907, **A 79**, 138—154.

THE explosion chamber, the internal surface of which was covered as completely as possible with wood and cork, is lined with a continuous band of copper strip. The increase of resistance of the copper during the progress of the explosion and the subsequent cooling, is recorded, the pressure of the explosion being simultaneously recorded upon the same moving photographic film. From these indications the quantity of heat conveyed to the copper is calculated. Corrections for loss of heat to the backing (20 per cent.), and for the uncovered portion of the explosion vessel (6 per cent.), are introduced. As a test of the accuracy of the calorimeter, calculations were made at points so far down the cooling curve that the specific heat of the gas may be considered as known. From the calorific power and specific heat of the gases, on the one hand, and the corrected calorimetric values on the other, results are obtained which in two experiments recorded, differ by 2 and 10 per cent. respectively. This discrepancy may perhaps be accounted for by some of the mixture remaining unburnt.—R. S. H.

UNITED STATES PATENT.

Grain; Apparatus for the rapid determination of moisture in ——. E. Brown, New York, and J. W. T. Duvel, Ohio. U.S. Pat. 848,616, March 26, 1907.

THE grain is mixed with oil and introduced into a distillation flask which is placed in an asbestos-lined chamber. The bottom of this chamber is formed of wire-gauze, on which the flask rests, and below the gauze partition is a second chamber to which heat is supplied. A thermometer is fitted in the neck of the flask, and projects through the cover of the chamber. The neck of the flask is also provided with a side tube connected with a condenser, and the distillate is collected in graduated cylinders. A number of the flasks may be fitted up in adjacent chambers.—W. P. S.

INORGANIC—QUANTITATIVE.

Succinic acid; Use of —— as a standard in alkalimetry and acidimetry. I. K. Phelps and J. L. Hubbard. Amer. J. Sci., 1907, **23**, 211—213.

EXPERIMENTS with succinic acid prepared in four different ways showed that this substance serves admirably as a standard in alkalimetry and acidimetry. For ordinary purposes, succinic acid of sufficient purity can be prepared by crystallising the commercial acid from boiling water, or preferably from boiling water containing nitric acid. For extremely accurate work, however, the acid prepared by hydrolysis of the pure ethyl ester is most satisfactory.
—A. S.

Chlorides and bromides; Direct quantitative separation of ——. L. W. Andrews. J. Amer. Chem. Soc., 1907 **29**, 275—283.

FOR the quantitative separation of chlorides and bromides, the author finds that the most accurate results are obtained by the following modification of Bugarszky's method (Z. anorg. Chem., 1895, **10**, 387), based upon the use of iodic acid as an oxidising agent. In carrying out the method, the quantities of potassium iodate and nitric acid, employed as oxidising agent, are so regulated that the excess of iodic acid left after the oxidation is approximately constant. Also, the quantity of substance taken, should be greater the higher the proportion of bromide present. For example, in the case of the determination of chloride in crude potassium bromide, the following quantities will prove satisfactory:—

Percentage of KCl in the crude KBr.	Weight of crude KBr taken.	$N/5$ KIO_3 solution.	$2N$-Nitric acid.
	grm.	c.c.	c.c.
5 —10	0·6	36	20
1·5— 5·0	1·8	96	26
0·25—1·5	3·6	186	35

The mixture of chloride and bromide is treated with the potassium iodate and nitric acid in a 500 c.c. Kjeldahl flask having a neck 20—25 cm. long, and the solution is diluted to 200—250 c.c. The flask is then supported at an angle of 30° from the vertical, and the contents boiled gently, until the volume is reduced to about 90 c.c. in about 30—40 minutes. 100 c.c. of water are then added, and the boiling is continued until 50 c.c. have passed off. The escaping vapour is now tested by means of a piece of fluorescein paper held across the mouth of the flask for five minutes. When the test paper is no longer coloured orange, the escaping steam is passed through 10 c.c. of a 2 per cent. solution of potassium iodide rendered faintly acid with hydrochloric acid, until the solution becomes hot. This test is stated to be extremely delicate, and when the iodide solution shows no yellow colour on viewing it against a white background, it may be accepted that all the bromine has been expelled. From 1 to 1·5 c.c. of a 25 per cent. solution of phosphorous acid are now added to the solution in the flask, without interrupting the boiling, and the boiling continued for 5 minutes after all the iodine has been expelled. The solution is then cooled, a moderate excess of $N/20$ or $N/50$ silver nitrate solution added, together with a piece of filter paper, and the whole shaken until the paper is reduced to pulp. After filtering and washing, the excess of silver nitrate is titrated with ammonium thiocyanate in presence of ferric nitrate according to Volhard's method, and then back again with silver nitrate solution.

For the determination of chlorine in crude bromine, about 3 grms. of the sample (or more, if the chlorine content is below 0·5 per cent.) are added to a solution of 2 grms. of potassium iodide in 50 c.c. of water contained in a stoppered flask. After well shaking, the contents are introduced into a 400 c.c. Kjeldahl flask, 60 c.c. of $N/5$ potassium iodate solution and 24 c.c. of nitric acid added, and the chlorine determined as described above. The author draws attention to the need of precautions in taking samples of crude bromine, as the chlorine content is appreciably altered even by pouring from one vessel to another. The sample should be withdrawn by means of a special pipette from beneath the level of the crude bromine.
—A. S.

Aluminium in silicates; Determination of ——. F. W. Hinrichsen. Ber., 1907, **40**, 1497—1501.

The amount of aluminium found in silicates after treatment with sulphuric and hydrofluoric acids to remove the silica, is considerably lower than that expected, the loss varying from 10 to 30 per cent. Although aluminium fluoride is volatile, this is not sufficient to account for the loss. If a solution of aluminium sulphate be made acid with hydrofluoric acid, and then treated with ammonia whilst hot, no precipitate is formed, but crystals of the double salt, ammonium aluminium fluoride, $(NH_4)_3AlF_6$, separate out on cooling. A solution of aluminium sulphate was prepared. Gradually increasing amounts of ammonium fluoride were added to separate portions of this, and the amount of alumina that could be precipitated by the addition of ammonia whilst hot, was determined. The quantitative precipitation of alumina under these circumstances is not possible. Alumina with sulphuric and hydrofluoric acids was heated till white vapours of sulphur trioxide were evolved; hydrofluoric acid was detected in the residue. The amount of hydrofluoric acid retained depends upon the manner of the heating, being lessened if the crucible is heated uniformly all over. Hence the treatment of silicates with sulphuric and hydrofluoric acids should be avoided wherever possible. Where it is unavoidable, owing to the presence of alkali metals, the sulphuric acid must be completely evaporated, and the residue heated to gentle ignition to remove all fluorine.
—F. Sodn.

Lead sulphate; Method for washing precipitates of ——. L. L. de Koninck. Bull. Soc. Chim. Belg., 1907, **21**, 141—149.

When lead is determined as sulphate, the precipitate may be washed with a solution containing 0·7 per cent. of ammonium sulphate, instead of using alcohol, as is customary, or dilute sulphuric acid followed by alcohol. The small quantity of ammonium sulphate retained, in no way interferes with the subsequent incineration of the filter-paper.—F. Sodn.

Clays, &c.; Determination of amount of soluble salts in ——. J. W. Mellor. IX., page 528.

Zinc ore analysis; Report of the sub-committee on ——. G. C. Stone and W. G. Waring. X., page 530.

Wolfram and hübnerite; Analysis of ——. P. Nicolardot. X., page 530.

ORGANIC—QUALITATIVE.

Lactic acid; New reaction for ——. W. Thoms. Apoth.-Zeit., 1907, **22**, 206.

A few c.c. of the liquid are treated with three or four drops of a 30 per cent. solution of chromic acid or sufficient to impart a bright yellow tint. The mixture is then warmed on the water-bath. In the presence of a trace of free lactic acid, a reddish-brown colour is produced in 10 mins. Hydrochloric acid, acetic acid, acetone, and alcohol do not alter the original yellow tint imparted by the chromic acid solution.—J. O. B.

Absinthe; Action of water on [alcoholic] essences of ——. Sanglé-Ferrière and L. Cuniasse. XX., page 550.

ORGANIC—QUANTITATIVE.

Sugars in honey; Polarimetric determination of ——. P. Lehmann and H. Stadlinger. Z. Unters. Nahr. u. Genussm., 1907, **13**, 397—419.

The authors state that the formulæ given by Haenle in his "Chemie des Honigs," III. Auflage, 1895, for the polarimetric determination of starch syrup and sucrose in honey, are based upon incorrect principles, and lead to false conclusions. An accurate polarimetric determination of sucrose in honey is possible only by the inversion method. For calculating the percentage of sucrose from the polarimetric results, the following formulæ are given:—For 10 per cent. solutions of honey, $y = 5{\cdot}725 \times \Delta$, where $\Delta =$ the difference in the rotation of the solution in a 200 mm. tube before and after inversion. For solutions of honey of any concentration, $y = [a]\Delta \times 1{\cdot}1448$, where $[a]\Delta =$ the difference in the specific rotatory power of the solution before and after inversion.—A. S.

Carbon bisulphide; Use of —— *in the determination of salicylic acid in wine.* W. L. Dubois. J. Amer. Chem. Soc., 1907, **29**, 293—294.

The author finds that carbon bisulphide is the most satisfactory solvent for extracting salicylic acid from the dried ether extract of a wine.—A. S.

Rubber goods; Determination of sulphur in ——. A. Wagner. XIIIC., page 538.

Caoutchouc nitrosites and their employment for the analysis of raw rubbers and rubber goods. P. Alexander. XIIIC., page 538.

Chrome liquors; Analysis of one-bath ——. E. Stiasny. XIV., page 540.

Sucrose in osmose water; Determination of ——. K. Andrlik and V. Staněk. XVI., page 540.

Basic lead acetate; Influence of —— on the rotation of sucrose in water solution. F. Bates and J. C. Blake. XVI., page 541.

Milk; Mercuric chloride as a preservative of —— for analysis. P. Grélot. XVIII.A., page 546.

Methyl alcohol as an extraction fluid for drugs [Relative value of ethyl and methyl alcohol as extracting media]. L. Rosenthaler. XX., page 550.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 492.)

Zinc; Triboluminescence of substances containing ——. A. Karl. Compt. rend., 1907, **144**, 841—843.

When zinc sulphide is heated with a variety of substances, the products exhibit the phenomenon of triboluminescence, emitting light when crushed. Such mixtures as one part of manganese nitrate to five parts of zinc sulphide, or 0·5 part of silica or tin oxide to five parts of zinc sulphide, or 0·75 part of manganese silicate, stannate, &c., to five parts of zinc sulphide, are suitable, and a temperature of about 1200° C. maintained for 20—30 minutes. Although these bodies do not phosphoresce in an appreciable degree, the light which they emit when crushed is visible even by day. The presence of air is not necessary. —F. Sodn.

Rare earths; Phosphorescence of the ——. J. de Kowalski and C. Garnier. Compt. rend., 1907, **144**, 836—839.

Very small quantities of the rare earths incorporated with the sulphides of the alkaline-earth metals form mixtures exhibiting a relatively intense phosphorescence when excited by the ultra-violet rays. For example, 1 part of samarium to 25,000 parts of strontium sulphide or 6,000 parts of calcium sulphide is sufficient to give the maximum luminosity: a much smaller proportion of this rare earth than is necessary when mixed with oxide, instead of sulphide, and excited by the cathode rays. The luminosity of the phosphorescence is augmented by the addition of sulphates and other salts of the alkali metals. For the preparation of the sulphide mixture, a solution containing the alkaline-earth and rare earth as nitrates is precipitated by ammonium carbonate, and the carbonate heated with sulphur and then suddenly cooled. Preparations of praseodymium, neodymium, erbium, and samarium have been studied. The colour of the light is found to depend on the flux used, and it also varies with the temperature.—F. Sodn.

Radium emanation; Chemical action of the ——. Part I. Action on distilled water. Sir William Ramsay. Chem. Soc. Proc., 1907, **23**. 132.

A qualitative confirmation of the fact noticed by Rutherford that the emanation from radium, in decaying, evolves a large amount of heat, has been obtained; the relative amounts of hydrogen and oxygen produced by the action of radium bromide on water, amounting to 32 c.c. of explosive gases per gram of radium per 100 hours, have been measured, and also the excess of hydrogen, of which the mean value is 5·5 per cent., reckoned on the total gas. Reasons were adduced to show that hydrogen is not one of the products of degradation of radium, and other hypotheses to account for the excess of hydrogen were considered. The action of the emanation alone on water also decomposes it into explosive gas, mixed with excess of hydrogen; it has been shown that the emanation, when mixed with explosive gas, causes recombination, and the rate at which the decomposition of water takes place has been measured. The reason of the production of excess of hydrogen has not yet been elucidated.

The emanation is an inactive gas, in the sense of not forming compounds; but at the same time, a most active gas, inasmuch as it decomposes or disintegrates into a series of other bodies, some of which, at least, are capable of chemical combination.

Suspensions in dilute alkaline solutions. W. R. Whitney and A. Straw. J. Amer. Chem. Soc., 1907, **29**, 325—329.

The authors examined the effect of additions of sodium hydroxide to aqueous emulsions or suspensions of turpentine, carvene, carvol, terebene, safrol, terpineol, lampblack, china clay, and colloidal silver. In all cases it was found that the stability of the emulsion or suspension was increased by addition of a definite, very small quantity of alkali, but diminished by addition of larger quantities. The maximum stability with certain of the emulsions or suspensions was obtained with the following concentrations of alkali:—Turpentine, 0·008 N; carvene, 0·0002 N; lampblack, 0·001 N. These results are in accord with those of Bredig, who found that a trace of alkali had a markedly favourable effect on the stability of colloidal solutions of gold and platinum prepared by cathodic disintegration. For example, a colloidal gold solution rendered alkaline to a concentration of 0·001 N was found to be remarkably stable.—A. S.

Methyl oxide [methyl ether] and sulphur dioxide; Compressibilities and vapour-pressures of mixtures of ——. Formation of a compound of the two. E. Briner and E. Cardoso. Compt. rend., 1907, **144**, 911—913.

A mixture of equal volumes of methyl ether and sulphur dioxide has a vapour-pressure much below that of either of the gases separately (and hence much below the mean of those values), at 56°, 77°, and 109° C., whence the authors infer that a compound of the formula, $(CH_3)_2O.SO_2$, is formed. The critical temperature and pressure of this compound are respectively 152°·5 C., and 62 atmospheres. The compound is analogous to Friedel's compound, $(CH_3)_2O.HCl$; it is formed by combination of its constituents in the gaseous phase, and probably contains tetravalent oxygen.—J. T. D.

Magnetic rotation of hexatriene, $CH_2{:}CH.CH{:}CH.CH{:}CH_2$, *and its relationship to benzene and other aromatic compounds, also its refractive power.* Sir W. H. Perkin. Chem. Soc. Proc., 1907, **23**, 110—112.

In a paper on the magnetic rotatory power of aromatic compounds (Chem. Soc. Trans., 1896, **69**, 1025) the very high rotations they possess have been pointed out; the cause of this has been supposed to be due in the case of benzene to its ring formation, because the rotation of that substance is much higher than that of its isomeride, dipropargyl. This, however, became doubtful when it was found that d-$\Delta^{3:8(9)}$-p-menthadiene, which contains two unsaturated groupings in conjunction, gave abnormally high rotations, indicating the possibility that in benzene and other substances containing unsaturated groups in conjunction, the high rotations were also due to this circumstance. It was therefore desirable to examine some chain compound containing unsaturated groups in conjunction, in which there could be no influence due to ring formation. This was rendered possible by the examination of hexatriene, which contains three consecutive unsaturated groups. Hexatriene was found to have a remarkably high rotation of 12·196. The difference in the formation of hexatriene and benzene is simply the difference of ring formation, due to the loss of 2 atoms of hydrogen. This affects the magnetic rotation by 0·982, and if that amount is subtracted from the above a value is obtained for the magnetic rotation of benzene, based on the assumption that benzene contains three unsaturated groupings; this amounts to 11·214.

This number is practically that actually found for benzene, 11·284, and appears to point to two conclusions, namely, that benzene contains three contiguous unsaturated groupings (Kekulé's formula), and secondly that these have substantially the same values as in open chain compounds. It is also noticed that the values of these unsaturated groups when in conjunction, considerably increase with their number. The refractive and dispersive power of hexatriene is very high, but the numbers do not show such a close relationship to benzene as do the magnetic rotations. The difference of 0·07 between the rotation of benzene estimated from hexatriene and the found value was small and might partly be due to experimental error; it had therefore not been thought advisable to give any special significance to it in the meantime.

New Books.

Industrial Alcohol: Its Manufacture and Uses. A Practical Treatise based on Dr. Max Maercker's "Introduction to Distillation," as revised by Dr. Delbrück and Dr. Lange. By John K. Brachvogel, M.E. With Special Chapters by Charles J. Thatcher, Ph.D. Crosby Lockwood and Son, 7, Stationers' Hall Court, London. Munn and Company, 361, Broadway, New York. 1907. Price 16s. 6d. net.

8vo volume, containing 505 pages of subject matter, with 107 illustrations, and the alphabetical index. The subject matter is classified as follows: The Industrial Value of Tax-free Alcohol, and what it means for our Agricultural Interests. Summary of the Processes in Spirit Manufacture. I. Starch: How it is formed; its Characteristics, and the Changes it undergoes in Spirit Manufacture. II. The Enzymes or Ferments. III. The Products of Fermentation. IV. The Starchy Raw Materials in Spirit Manufacture; also Sacchariferous Raw Materials. V. Preparation of the Malt. VI. Steaming the Raw Material. VII. The Mashing Process and Apparatus. VIII. Fermenting the Mash. IX. Preparation of Artificial Yeast in the Distillery. X. Fermentation in Practice. XI. Distillation and Rectification. XII. Arrangement of the Distillery. XIII. The Spent Wash. XIV. The Denaturing of Alcohol. XV. Alcohol for the Production of Power. XVI. Heating with Alcohol. XVII. Illumination with Alcohol. XVIII. Statistics of Alcohol Production. Appendix.—Including Specifications for Methyl Alcohol and Benzine, submitted for Approval as Denaturing Materials. Also, Regulations and Instructions concerning Denatured Alcohol.

Synopsis of Mineral Characters, Alphabetically arranged for Laboratory and Field Use. By Ralph W. Richards, Assistant in Mineralogy, Harvard University. John Wiley and Sons, New York. U.S. America. 1907. Price 5s. 6d. net. Chapman and Hall, Limited, London.

12mo volume, containing 99 pages of subject matter, arranged as a dictionary, or in alphabetical order. It presents in systematic form the essential characters and the simplest determinative reactions of the common and important minerals, with definitions, also, of mineral terms and of those rocks associated with minerals.

The Textile Fibres: Their Physical, Microscopical, and Chemical Properties. By J. Merritt Matthews, Ph.D., Head of the Chemical and Dyeing Department, Philadelphia Textile School. 2nd Edit. John Wiley and Sons, New York, U.S. America. 1907. Price 17s. net. Chapman and Hall, Limited, London.

Contains 438 pages of subject matter, and an alphabetical index. In the text are 127 illustrations, and the book is of 8vo size. Its subject matter is classified all follows: I. Classification of the Textile Fibres. II. Wool and Hair Fibres. III. Chemical Nature and Properties of Wool and Hair Fibres. IV. Shoddy and Wool Substitutes. V. Minor Hair Fibres. VI. Silk: Its Origin and Cultivation. VII. Chemical Nature and Properties of Silk. VIII. Vegetable Fibres. IX. Cotton. X. Physical Structure and Properties of Cotton. XI. Chemical Properties of Cotton. Cellulose. XII. Mercerised Cotton. XIII. Seed-Hairs other than Cotton. XIV. Artificial Silks; Lustra Cellulose. XV. Linen. XVI. Jute, Ramie, Hemp, and Minor Vegetable Fibres. XVII. Qualitative Analysis of the Textile Fibres. XVIII. Quantitative Analysis of the Textile Fibres. Appendix.—I. Microscopic Analysis of Fibres. II. Machine for determining Strength of Fibres. III. Commercial Varieties of American Cotton. IV. Bibliography of the Textile Fibres.

Van Nostrand's Chemical Annual, 1907. A Handbook of Useful Data for Analytical, Manufacturing, and Investigating Chemists, and Chemical Students. First Year of Issue. Edited by John C. Olsen, A.M., Ph.D., Professor of Analytical Chemistry, Polytechnic Institute, Brooklyn, &c., with the Co-operation of Eminent Chemists. Archibald Constable and Co., Ltd., London. 1907. Price 12s. 6d. net.

8vo volume, containing frontispiece (portrait of Sir William Ramsay), 491 pages of subject matter, and an alphabetical index. The useful data, tabulated matter, &c., may be classed under the following heads: I. General. (i.) International Atomic Weights for 1906. (ii.) Mendeléef's Periodic System of the Elements. (iii.) Specific Gravity of Gases. (iv.) Physical Constants of the Elements. (v.) Gravimetric Factors and their Logarithms. (vi.) Factors for the Calculation of Indirect Gravimetric Analyses. (vii.) Molecular and Atomic Weights and their Logarithms. II. Calculation of Volumetric Analyses. III. Calculation of Gas Analyses. IV. Specific Gravity Tables. V. Equivalents of Weights and Measures. VI. Thermochemistry. VII. Review of Chemical Literature. VIII. New Books.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

16,910a (1906). Johnson (Verein. Chem. Fabr. in Mannheim). Removal of impurities from gases. May 10.

9935. Simon and Simon. Machine for drying by a current of heated air. April 29.

9941. Harrison, Bate, and Perks. Recovery of volatile liquids. April 29.

10,024. Meister, Lucius, und Brüning. Separating and simultaneously extracting water from mineral, vegetable, and animal substances. [Ger. Appl., May 30, 1906.]* April 30.

10,067. Fraser and Vaughan-Sherrin. Distillation of fractional liquids. April 30.

10,317. Smith. Rotary mixing machines. May 3.

10,447. Berkovits and Kridlo. Filter presses.* May 4.

10,664. Moffatt. Drying apparatus.* May 7.

10,744. Simon. Drying for vaporising machines. May 8.

10,777. Mackenzie (Caragol and Cole). Kilns.* May 8.

11,060. Seger. Centrifugal liquid separators.* May 11.

Complete Specifications Accepted.

8374 (1906). Harrison. Filter presses. May 15.

10,412 (1906). Koppers. Regenerative furnaces. May 15.

17,985 (1906). Boult (Goldman and Co.). Filters. May 8.

20,669 (1906). Price. Tunnel dryers for retorts, bricks, &c. May 15.

21,160 (1906). Skinner. *See under* IX.

24,310 (1906). Stroh. Impregnating liquids with gases. May 15.

25,472 (1906). Toyn. Non-conducting compositions for steam boilers. May 8.

28,225 (1906). Chmelewski. Kilns. May 15.

29,007 (1906). Jury. Apparatus for producing extracts by diffusion and concentration. May 8.

1290 (1907). Reckliess und Lehmann A.-G. Rotating drum filter. May 8.

2126 (1907). Conversy and Bouquet. Filters. May 8.

6635 (1907). Risberg. Centrifugal separators. May 15.

II.—FUEL, GAS, AND LIGHT.

Applications.

9966. Du Thil. Gas producer. April 29.

10,020. Wilkinson. *See under* VII.

10,201 and 10,202. Steel. Carburetting apparatus.* May 2.

10,226. Bormann. Gas generators.* May 2.

10,305. Dunnachie. *See under* VII.

10,346. Tully. Manufacture of gas for illuminating and heating purposes. May 3.

10,407. Lovibond. Obtaining light of predetermined colour-value and luminous intensity. May 4.

10,606. Simmance and Abady. Photometrical apparatus. May 7.

10,667. Wagner. Manufacture of briquettes. May 7.

10,804. Dixon. Treatment of bituminous coal to render it practically smokeless when burning, and for the recovery of by-products. May 9.

10,826. Fitzroy and Fraass. Artificial fuel. May 9.

Complete Specifications Accepted.

12,461 (1906). Thoms. Carburetting apparatus. May 15.

15,013 (1906). Tervet. Method and apparatus for testing gas. May 8.

16,471 (1906). Parker. Manufacture of coal gas. May 15.

17,069 (1906). Leadbeater. Artificial fuel. May 15.

19,624 (1906). Robertson, and Willans and Robinson, Ltd. Apparatus for filtering gas. May 15.

24,833 (1906). Charlouis. Gas-generating plant. May 8.

26,542 (1906). Barlen. Vertical coke oven. May 8.

26,698 (1906). Kurzer. Apparatus for gasifying oils and carburetting air. May 15.

805 (1907). Mieville. Apparatus for producing carburetted air. May 8.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

10,305. Dunnachie. *See under* VII.

10,775. Pagès, Camus et Cie. Direct extraction of pyroligneous substances. [Fr. Appl., May 10, 1906.]* May 8.

10,841. Calderwood. Manufacture of candles, night-lights, &c. May 9.

10,877. McMullen, Townsend, and Noad. Refining mineral oil. May 9.

Complete Specification Accepted.

28,014 (1906). Claussen. Mixing light and heavy mineral oils or hydrocarbons. May 8.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

9961. Johnson (Durand, Huguenin et Cie.). Manufacture of leuco-gallocyanine corresponding to pyrogallol.* April 29.

10,326. Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of indigo. May 3.

10,327. Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of β-naphthylindigo. May 3.

10,420. Newton (Bayer und Co.). Manufacture of azo dyestuffs. May 4.

10,476. Levinstein and Levinstein, Ltd. Dyestuffs and dyeing therewith. May 6.

10,527. Imray (Meister, Lucius, und Brüning). Manufacture of sulphurised dyestuffs for printing. May 6.

10,541. Johnson (Badische Anilin und Soda Fabrik). Manufacture of vat colouring matters. May 6.

10,770. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. May 8.

10,978. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-amino-*p*-oxydiphenylamine. May 10.

Complete Specifications Accepted.

11,196 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of nitroaminophenolsulphonic acids and dyestuffs therefrom. May 15.

16,085 (1906). Abel (Act.-Ges. f. Anilinfabr.) Manufacture of a new monoazo dyestuff. May 15.

6228 (1907). Badische Anilin und Soda Fabrik. Manufacture of azo colouring matters and pigments or lakes therefrom. May 15.

6336 (1907). Johnson (Badische Anilin und Soda Fabrik.) Manufacture of stable indigo white preparations. May 8.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

10,083. Goold (Jute and Hemp Manufacturing Co.). Procuring textile fibres from certain plants.* May 1.

10,108. Ashworth. Sizing textile fibres and fabrics, paper, &c. May 1.

10,164 & 10,165. Hanauer Kunstseidefabrik. *See under* XIX.

10,439. Scott. Dry-cleaning and degreasing fabrics. May 4.

10,476. Levinstein. *See under* IV.

10,542. Johnson (Badische Anilin und Soda Fabrik). Discharging dyed textile fibre and pastes therefor. May 6.

10,545. Berenguer. *See under* XIX.

10,557. Johnson (Durand, Huguenin et Cie.). Vat dyeing with colouring matters of the gallocyanine series. May 6.

10,578. Thies and Mathesius. Treatment of skeins.* May 7.

10,582. Rothwell - Jackson and Rothwell - Jackson. Kiers for treating fabrics, yarns, and fibres. May 7.

10,873 Kirchhoff. Treating mercerised tissues or fabrics.* May 9.

Complete Specifications Accepted.

11,154 (1906). Calico Printers' Assoc., Ltd., and Dydynski. Producing discharge effects in the printing of textiles. May 15.

13,334 (1906). Soc. Anon. de Blanchiment, Teinture, Impression et Apprêts de St. Julien. Fabric printing machines. May 8.

20,290 (1906). Mikulin. Compositions for coating and treating fibrous and textile material. May 8.

26,189 (1906). Howorth (Baumwollspinnerei Brodetz Kuffler und Reichel). Manufacture of cotton yarns. May 8.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

10,729. Newton (Bayer und Co.). Dyeing paper pulp. May 8.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

9924. Astruc. Manufacture of metallic compounds. [Fr. Appl., May 22, 1906.]* April 28.

9939. Neubürger and Westdeuts. Thomasphosphatwerke. Process of producing compounds of oxygen and nitrogen.* April 29.

10,020. Wilkinson. Apparatus for separating arsenic from burning coke and like fumes. April 30.

10,305. Dunnachie. Recovery of ammonia and improving the quality of tar in gases of blast and other furnaces, coke ovens, &c. May 3.

10,579. Beilby. *See under* XI.

10,771. Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable, anhydrous hydrosulphites. May 8.

10,825. Stead and Palmer. Carbonic acid gas producing apparatus. May 9.

Complete Specification Accepted.

3106 (1907). Steinem. Manufacture of carbonic acid gas. May 15.

VIII.—GLASS, POTTERY, AND ENAMELS.

Complete Specification Accepted.

2667 (1907). Jörgensen. Manufacture of imitation stained glass. May 17.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

10,064. Coward. Bituminous composition. April 30.

10,065. Coward. Manufacture of waterproof pavements, building blocks, and the like. April 30.

10,243. Schleuning. Artificial stone and like substance. May 2.

10,257. Cowper-Coles. Manufacture of cement.* May 2.

10,366. Cowper-Coles. Manufacture of cement. May 3.

10,524. Collier and Cooksey. Bricks, tiles, and terracotta. May 6.

10,673. Bowen. Plant for making cement and sand-lime products. May 8.

Complete Specifications Accepted.

10,091 (1906). Eldred. Manufacture of cement clinkers. May 8.

12,621 (1906). Schumacher. Increasing the binding power of basic silicates of lime. May 15.

16,641 (1906). Gibbons, Masters, and Baker. *See under* X.

19,723 (1906). Yates. Manufacture of cement. May 8.

20,669 (1906). Price. *See under* I.

20,723 (1906). Justice (Internat. Pavement Co.). Bituminous paving or pavement compositions. May 15.

21,160 (1906). Skinner. Mixing machinery especially for mixing slurry in cement manufacture. May 8.

28,199 (1906). Kilburn (Isolatoren-Fabrik "Pulvolit"). Manufacture of artificial stone. May 15.

1636 (1907). Ohlsson. Partially impregnating wood articles. May 8.

X.—METALLURGY.

Applications.

10,099. Jones. Converting iron into steel. May 1.

10,210. Cowper-Coles. Tinning plates and other articles. May 2.

10,225. Hall, and The Hull and Liverpool Red Oxide Co. Recovery of zinc from waste zinc liquid.* May 2.

10,230. Steiner. *See under* XI.

10,256. Carson. Reduction of zinc and other metals from their compounds. May 2.

10,525. Harbord. Drying air blast for metallurgical purposes. May 6.

10,734. Slater. Extracting gold, silver, and other metals from metal-bearing matter. May 8.

10,750. Reid. Treatment of ore.* May 8.

Complete Specifications Accepted.

8913a (1906). Monnot. Manufacture of compound metal ingots. May 15.

10,309 (1906). Rivière. Treatment of ores and detinning tinned iron sheets. May 15.

10,396 (1906). Gin. *See under* XI.

14,401 (1906). Fyfe. Apparatus for arresting and depositing fumes from ores. May 15.

16,641 (1906). Gibbons, Masters, and Baker. Ovens or kilns for annealing iron castings, burning bricks and pottery ware, &c. May 8.

18,803 (1906). Hyde and Swan. Coating metals with metals. May 8.

23,567 (1906). Dietzsch and Paull. Separation of ores. May 15.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

10,230. Steiner. Refining tin electrolytically and extraction of pure tin from alloys, waste, and the like. [Ger. Appl., Feb. 1, 1907.]* May 2.

10,336. Lake (Soc. Franç. de Caoutchouc Artific. "L'Elastes"). Insulating and elastic covering material.* May 3.

10,367. Cowper-Coles. Electrodeposition of iron. May 3.

10,514. Robertson and Klatzl. Electrodes.* May 6.

10,579. Beilby. Manufacture of sodium by electrolysis. May 7.

10,699. Marriott. Pitch product for insulating electric cable trenches. May 8.

Complete Specifications Accepted.

10,396 (1906). Gin. Production of steel and an electric furnace therefor. May 8.

16,870 (1906). Greenfield. Anodes for electrolytic purposes. May 15.

28,593 (1906). Bingham. Regulation of electric furnaces. May 8.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

10,359. Fichtenau. *See under* XVIIIC.

10,689. Irving. Soap or washing compound. May 8.

10,860. Austerlitz. Expressing oil from oil-seeds. May 9.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

10,363. Badische Anilin und Soda Fabrik. Manufacture of colouring matter lakes. [Ger. Appl., June 11, 1906.]* May 3.

Complete Specifications Accepted.

13,301 (1906). Adam. Carbon recovery plant for the manufacture of lamp black, &c. May 15.

20,702 (1906). Villard. Paint composition. May 15.

4719 (1907). Tidman and Pope. Apparatus for mixing and straining or sifting paints. May 15.

6228 (1907). Badische Anilin und Soda Fabrik. *See under* IV.

(*B.*)—Resins, Varnishes.

Complete Specification Accepted.

15,838 (1906). Guittet. Manufacture of driers for paints, varnishes, and oils. May 8.

(*C.*)—India-Rubber.

Applications.

10,008. Lugo. Manufacture of india-rubber products. April 30.

10,228. Tolkien. India-rubber substitute. May 2.

10,336. Lake (Soc. Franç. de Caoutchouc Artific. "L'Elastes"). *See under* XI.

10,848. Sandmann. Process for obtaining rubber, gutta-percha, and balata. [Ger. Appl., June 1, 1906.]* May 9.

Complete Specification Accepted.

12,527 (1906). Boult (Köneman). Treatment of rubber and rubber waste. May 15.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

10,751. Howroyd. Manufacture of tanning or sizing material. May 8.

Complete Specification Accepted.

17,129 (1906). Inrig. Treatment of waste leather, raw hides, skins, hoofs, horns, bones, &c. May 15.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

9931. Thörl. Production of starch from cereals.* April 29.

10,192. Willis (Irazoqui). Vacuum pans for boiling syrup. May 2.

10,196. Macfarlane. Apparatus for treating sugar in the centrifugal drying machine. May 2.

10,974. Boult (Philipp). Continuous juice extraction by diffusion. May 10.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

9995. Suzuki. Apparatus for brewing soy.* April 30.

Complete Specifications Accepted.

17,665 (1906). Hill and Hill. Brewing fermented liquors. May 8.

23,113 (1906). Davidson and Burra. Extraction of hops. May 15.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

10,362. Litoche, and Nutricia Centrale f. Backhausmilch. Preparing cows' milk for food.* May 3.

10,691. Stahel. Preserving vegetables and fruit.* May 8.

Complete Specification Accepted.

9889 (1906). Laves. Preparation of easily soluble iron albuminate and durable iron albuminate solutions. May 8.

(*B.*)—Sanitation; Water Purification.

Applications.

10,766. Hughes. Treatment of sewage. May 8.

10,984. Imhoff. Apparatus for purifying sewage and other waste water. [Ger. Appl., May 11, 1906.]* May 10.

Complete Specifications Accepted.

10,363 (1906). Applewhite. Machine for cleansing material used in bacteria filter beds. May 15.

15,388 (1906). Russell. Apparatus for washing and sterilising filter pulp. May 8.

17,267 (1906). Bridge. Purifying and sterilising water by ozonised air. May 8.

21,475 (1906). Hinkson. Water purifiers. May 8.

(*C.*)—Disinfectants.

Applications.

10,128. Gasparini. Disinfection of objects and spaces.* May 1.

10,359. Fichtenau. Production of a non-poisonous, vermin-destroying soap.* May 3.

Complete Specification Accepted.

3789 (1906). Schneider. Manufacture of disinfectants. May 8.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

10,108. Ashworth. *See under* V.

10,164. Hanauer Kunstseidefabrik. Manufacture of cellulose solutions. [Ger. Appl., May 2, 1906.]* May 1.

10,165. Hanauer Kunstseidefabrik. Manufacture of cellulose products. [Ger. Appl., May 2, 1906.]* May 1.

10,545. Berenguer. Preparation of concentrated solutions of cellulose and manufacture of threads from same. [Appl. in Portugal, July 9, 1906.]* May 6.

10,657. Luck. Treatment of flax, straw, and other fibrous material for use in the manufacture of paper pulp. May 7.

10,729. Newton (Bayer und Co.). *See under* VI.

Complete Specifications Accepted.

11,632A (1906). Coale. Purifying and bleaching cork. May 15.

17,671 (1906). Killeen. Wrapping and other paper. May 15.

17,777 (1906). Linfoot. Manifold paper. May 15.

26,502 (1906). Lederer. Preparation of acidylised cellulose solutions. May 8.

2511 (1907). Feeny (J. P. Bemberg A.-G.). Cellulose compound. May 8.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

10,025. Meister, Lucius, und Brüning. Manufacture of 4-antipyryldimethylamine. [Ger. Appl., May 30, 1906.]* April 30.

10,769. Wellcome, Bates, and Remfry. Therapeutic compound. May 8.

10,783. Ellis (Chem. Fabr. Sandoz). Manufacture of camphene. May 8.

10,784. Ellis (Chem. Fabr. Sandoz). Manufacture of camphene and by-products. May 8.

10,981. Imray (Meister, Lucius, und Brüning). Anti-streptococci serum. May 10.

Complete Specification Accepted.

6731 (1907). Kösters and Ottemann. Manufacture of amides of the higher fatty acids. May 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

10,258. Traube. Converting silver photographic prints into coloured prints. May 2.

10,400. Burnett. Photographic plates. May 4.

10,472. Thorton. Photographic films. May 6.

10,717. Palmer. Direct one-plate natural colour photography. May 8.

10,718. Palmer. Three-colour photography. May 8.

Complete Specification Accepted.

10,284 (1906). Buisson. Photographic developer. May 15.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

10,510. Kilburn (Rickmers). Explosives. May 6.

10,526. Ermel. Manufacture of nitrate explosives. May 6.

Complete Specification Accepted.

10,424 (1906). Volpert. Manufacture of safety explosives. May 15.

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Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. The programme was contained in the May 31st number.

In accordance with the provisions of Rule 18 of the By-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir Boverton Redwood has been nominated to the office of President, under Rule 8; Prof. Percy Frankland, Prof. R. Meldola, and Mr. Walter F. Reid have been nominated Vice-Presidents under Rule 8; and Mr. Eustace Carey has been nominated a Vice-President under Rule 11. Prof. W. R. Hodgkinson has been nominated an ordinary member of Council under Rule 17; and the Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Dr. Charles A. Keane, Mr. C. T. Kingzett, Mr. F. H. Tate, and Dr. L. T. Thorne have been nominated, under Rule 18, to fill four vacancies among the ordinary members of Council. No ballot will be required.

Canadian Section.

Meeting held at Montreal on Friday, March 15, 1907.

MR. MILTON L. HERSEY, VICE-CHAIRMAN, IN THE CHAIR.

THE FUNCTION OF THE CAUSTIC SODA PROCESS IN THE PRODUCTION OF CELLULOSE FROM WOODS.

BY J. A. DE CEW, B.A.SC.

In determining the most profitable utilisation of any raw material, the process employed in converting it into a marketable commodity must generally bear the economic responsibility. When, therefore, we consider raw products which have such a complex organic structure as is found in the various woods, the process problem becomes vastly more difficult, for many products may be made from the same source which differ widely in character and value. There are generally found certain combinations of conditions which adapt themselves to one particular process more than to another, and it is only when these conditions are realised that the process finds its real usefulness.

We have certain conditions in Canada in connection with our forest resources, to which the alkaline process of cellulose production is so well adapted, that we may safely say that in our economic development this process has a particular function to perform. This function is the production, from any woody material not sufficiently valuable to be classed as merchantable timber, of a cellulose fibre suitable for the manufacture of paper.

The discovery of methods of producing cellulose by the solvent action of certain chemicals on the vegetable fibres, produced a great advance in the paper making industry, and was really the beginning of cheap production. Cotton cellulose became very scarce owing to the increasing demand, and prices were correspondingly high, but the manufacture of wood cellulose opened up wide fields for exploitation and research, which resulted in the development of processes that can now produce this material at a minimum of cost.

Prior to the year 1860, the manufacture of cellulose fibre from straw and wood had been accomplished in a more or less experimental way in Germany, by boiling these materials under pressure in solutions of caustic alkali. At approximately the date mentioned the idea took root in the United States, patents were obtained, and works were established on such a large scale as to warrant the impression that it was purely an American process.

That Canada was not far behind, however, was shown by the fact that but a year or two after the first plant was built in America, soda cellulose was being produced in connection with the plant of the present Canada Paper Company of Windsor Mills, P.Q. There was at this time a very limited demand in Canada for this material, and the endeavour was made to place it in the British market, where it was then practically unknown. Shipments of both spruce and basswood fibre were sent over, but it was with extreme difficulty that this material was sold, as the British papermaker looked on wood fibre as a rank adulteration, totally unfit for admixture with rag stock.

Some trials of it were finally made, however, with marked success, and it is without doubt that, due to the progressive spirit of this pioneer among Canadian paper manufacturers, Canada may claim the distinction of being the first producer of wood cellulose for the British market.

In the early days of the process, straw cellulose was also made in various places in the United States, but a few years demonstrated that the woods were the cheaper raw material, and the cooking of the straw was abandoned. It is still, however, worked profitably in Germany, where a different relation of these values exists. In the period of 1865 to 1875 a large number of mills were erected throughout Canada and the United States, for the cooking of wood by the soda process. Then an acid process was introduced, first somewhat experimentally, and finally on a very large scale. This new process seemed to have many points of superiority over the older method, and has monopolised the attention of pulp chemists for many years; but although it has escaped some of the difficulties of the soda process, it has developed others of its own.

Both of the industries represented by these processes have since been growing side by side, until they have become highly developed and of enormous proportions, the rate of growth being largely in favour of the sulphite process. As we expect a large part of the future development to take place in Canada, and as our manufacturing conditions are considerably different from those of the other paper manufacturing States, it is more than likely that the soda process will be the most potent factor in our development.

The older or alkaline process consists in boiling wood, in the form of chips, in hot solutions of caustic soda at a high pressure. The soda contained in the waste liquors from this treatment is recovered by first concentrating the liquors by evaporation, burning off the organic matter, and causticising the remaining carbonate. In this way the process may be considered continuous, the recovery plant having already prepared the liquors for the next treatment.

In the sulphite process, however, the wood is generally boiled under pressure in a strongly acid solution consisting of acid sulphites and free sulphurous acid. At the completion of the cook, some of this free acid may be recovered, but practically all of the sulphur and the magnesium or lime from which the liquors are made, becomes a total loss. Although the cost of these liquors is less than that of the caustic soda, yet their total value is chargeable against the pulp produced, as against the cost of recovery, plus the percentage of loss in the case of the soda liquors. Again, the acidity of the liquors demands that special, acid-resisting linings must be used in the digesters, and that bronze pipings and fittings must be used for contact parts. On account of these conditions, the investment for this part of the process is much greater than is required for the alkaline liquors. The depreciation in a plant of this kind is also rapid, for the wear and tear and the cost of repairs is much higher than in the soda plant.

One distinct advantage of the sulphite liquors is due to their reducing action, by which the lignocellulose is dissolved in an almost unchanged condition, the fibres remaining quite free from colouring matter, although they are no nearer to being pure cellulose than the fibres by the other process. The use of this white unbleached fibre in the manufacture of newspapers and other grades where strength and colour are the only consideration, has thus created an enormous demand for sulphite. The sulphite process, however, has several limitations, and under many conditions can be well supplanted by the soda treatment. In the first place, sulphite pulp can only be made from clean wood, for the sulphite liquors have no dissolving action on knots, bark, resin, root, &c., and this means that only sound wood can be used, which must be very carefully prepared. On the other hand, very inferior material may be used for producing a good quality of soda fibre, as many of the impurities are dissolved in the process.

Owing to the acidity of the sulphite liquors, the small amount of combined silica present in all woods is totally unattacked, but this is completely dissolved and carried away by the soda in the alkaline treatment. This apparently insignificant fact is the cause of a distinct difference in the character of the fibre that these processes will produce, for the removal of the silica from the wood imparts to the soda fibre a soft, pliable, closely-felting nature for which it is especially valuable. Both the soda and sulphite fibre, however, must be bleached by an oxidising agent before it can be considered a pure cellulose suitable for use for fine papers, and under these conditions the two processes meet on a more even plane in regard to cost of production. We can fairly claim that the soda process, when properly established under favourable circumstances, can compete in cost of manufacture with the sulphite process in the production of bleached cellulose from the coniferous woods. This may be considered the only real point of contact of the two processes, although soda spruce fibre is still sometimes used for newspapers, for the increased value of the fibre is equalised by the small quantity required. The most important function of the soda process, however, consists in the manufacture of bleached fibre from the deciduous woods, for it is particularly adapted to these conditions, owing to the facility for production at low cost and the excellent quality of fibre obtained.

It is quite apparent that each process referred to has its own sphere of usefulness, and will consequently continue to develop in a different direction as heretofore, for the application of their products is supplementary rather than competitive. The fibres that we can obtain from the hard woods are quite different in character, being thinner and shorter, than those yielded by the conifers, and when isolated by means of soda, are so soft in texture, that they are especially valuable for the production of high grade papers of smooth surface and good finish.

Most of our Canadian or American book papers contain considerable quantities of soda poplar fibre, which serves the same purpose in American paper-making as the esparto fibre does in the English mills. It is on account of the large consumption of soda poplar for this purpose, that the soda industry in the United States is almost exclusively engaged in the treatment of poplar and other deciduous woods, for the production of this kind of fibre. This application of the process, however, has not yet been introduced into Canada, although we can offer some exceptional natural facilities; but these we will refer to again, after we have considered some of the general relationships and conditions of the caustic treatment.

The chemical reactions of the process consist, as we have already intimated, in a combination between the alkaline radicle and the more reactive portions of the wood, which, under the influence of temperature and pressure, breaks down with the formation of soluble products, and leaves the cellulose in the form of isolated fibres.

The results obtained with this process depend very largely upon the accuracy with which it is carried out. The action of the caustic soda is one of hydrolysis, in which the woody molecule is gradually broken down, with the formation of acid products, which combine with and neutralise the alkali. Now, if sufficient alkali were used, and the cooking action continued, the entire fibre would finally be dissolved, although the more resistant celluloses would be the last to disappear. It is therefore necessary, in order to bring into solution only the lignified portion of the wood, to add just sufficient alkali for this purpose. This is almost entirely neutralised by the acid products formed from the lignocellulose, and thus very little free alkali is left in the liquor to attack the rest of the fibre, which should be almost pure cellulose. At first the alkali is very active, and a rapid combination takes place, but the rate of reaction becomes continually slower, as the free alkali grows less and the resistance increases. As the actual amount of alkali required in this process varies with the kind of wood to be treated, the character of fibre to be produced, and the method of cooking, it necessarily follows that the data published by different observers is seldom in agreement, owing to differences in conditions. If the lignified portion of any wood shows unusual resistance to the alkali, or if for any other reason a more severe treatment is employed, the excess of alkali, while breaking up the lignic molecule, will also attack and dissolve the more soluble celluloses, and the result is a smaller yield of fibre. There are also such varying conditions as to causticity, pressure, circulation, and time of cooking, which are of considerable importance in the process, for some makers are obtaining from 1—200 lb. of fibre per cord more than others, in treating the same kind of wood.

In considering the relationship of the different woods to this process, we must divide them into two general classes, for the resistance offered by the lignification of the conifers is much greater than that of the broad-leafed woods. In each of these divisions some are relatively more resistant than others, depending, no doubt, on differences in chemical structure, concerning which very little is known. We can, however, formulate a general principle applying to the woods of any particular species, to the effect that resistance to hydrolysis increases with the lignification. The amount of lignification generally depends upon the age of the tree and the rate of growth, and in this way we explain the adaptability of the younger timber to the manufacture of pulp.

It is difficult to show, from actual practice, the relative resistance offered and yield obtained from old and young woods of the same species, for these are seldom treated separately, although there would be an advantage in doing so. This may be illustrated by taking an extreme case, such as the freshly-formed wood of twigs a few months old. In this case the cellulose is in such a hydrated and soluble condition that it is very often eaten and digested by browsing animals, and would probably be also entirely dissolved if subjected to such alkaline treatment as would be required to produce cellulose from very old wood.

In the cooking of woods of different species, quite different results are also obtained, and in this connection the writer submits the following data, based on actual mill experience, showing the amount of alkali required, and the yield of pulp obtained, in treating some of our Canadian woods :—

	Soda as carbonate.	Sp. gr.	Weight per cord.	Yield.	
				Per cent.	Air dry.
	lb.		lb.		lb.
Picea Nigra— Black Spruce	900	0·41	2250	40	1000
Tauga Canadensis— Hemlock	950	0·42	2300	38	970
Populus Grandidentata—Poplar .	800	0·43	2350	44	1150
Tilia Americana— Basswood	800	0·425	2325	44	1135
Betula Alba— White Birch	800	0·58	3190	42	1490
Acer Rubrum— Soft Maple ...	850	0·64	3520	40	1560
Betula Lutea— Yellow Birch .	850	0·66	3630	40	1610

The coniferous woods, such as spruce and hemlock, require a larger quantity of alkali per cord, and a longer time for cooking, while yielding a smaller quantity of pulp than is obtained from any of the broad-leaved woods. As the percentage yield does not vary greatly, the yield per cord bears a constant ratio to the specific gravity of the wood. However, the percentage yield is somewhat higher in those woods which are not too highly lignified, and which yield an easy bleaching pulp without too drastic a treatment. We see that the hard woods require even less alkali per cord than is required for spruce, and that with less fixed charges as represented by chemicals and time, 50 per cent. more of cellulose fibre can be obtained from such woods as maple and birch, than from the spruce. As long, therefore, as the price per cord of these various woods remains the same, as well as the value of the pulp produced from them, it is not a difficult calculation to estimate wherein lies the greatest profit. I have made no tabulation of the time required to cook these various woods, for here there is a wide difference in practice. However, the most improved plants are now able to effect the complete resolution of the wood in a very short time. In fact any of the deciduous woods can now be reduced in about four hours, while the spruce should not require more than six or seven. With the improvements in the methods of cooking that have been developed, which enable us to get about twice the work out of a digester that was formerly obtained, a number of special advantages have been found to be the result of these quick cooks. The shorter the time the alkali is in contact with the cellulose, the higher is the yield obtained, and the sounder and stronger is the fibre. If all of the cellulose is freed from the lignin at practically the same time, the free alkali will have very little time to react on the weaker celluloses, and the fibres will not be broken nor the points and serrations dissolved. Moreover, the fibres from the short cook are not hard to bleach, because the character of the cellulose is uniform. Under conditions of complete saturation with the right proportion of alkali, the lignocelluloses can be almost instantly dissolved by subjecting the material to the temperature and pressure that is ordinarily used for cooking the fibre. The writer has performed this experiment on a laboratory scale, and the fibre obtained so closely resembled the actual structure of the woody cell that hardly any cellulose could have been dissolved. In fact, the points of the fibres looked like needles under a hundred power magnification. This fact is merely mentioned in order to illustrate the trend of development in the cooking process, and the ideal conditions we wish to obtain; and we will now leave this part of the problem with a suggestion of the means with which we are striving towards this end. By removing the air from the woody cells a quick penetration can be obtained, and by the use of superheated steam the temperature and pressure are quickly applied. If now we discard the principle of diffusion and accelerate the final reactions by means of proper circulation, we may reduce to a minimum the time required in producing fibre by this process.

While we are considering the digesting conditions, we might refer to a special industrial development in connection with this process, which is now causing considerable interest in the paper trade. A fibre with peculiar properties is obtained, by treating the spruce, pine, or similar wood with an insufficient quantity of alkali to effect a complete solution of the ligneous component. A portion of the waste liquors is used in this treatment, along with the fresh caustic employed, and after this free alkali becomes wholly combined, the colouring matter present is partially absorbed by the wood, which thus becomes a brown colour. The fibres are still held together somewhat loosely by the lignocellulose that is undissolved, and are finally isolated by the mechanical action of revolving, edge-running stones. We thus obtain a mass of semi-lignified fibres in which the non-cellulose material is in a highly hydrated condition, and when these fibres become felted and fused together on the wire and dryers of the paper machine, they produce a paper of great strength, which is now widely known by the name of "Kraft."

Another phenomenon that illustrates the latent possibilities of the caustic soda treatment is the manufacture of a parchment-like paper from the pith of the cornstalk. Here we have a material with practically no fibrous structure, which after treatment with caustic soda has assumed a condition which enables the little cells to be melted together into a homogeneous mass. This condition must be somewhat similar to the mercerising action of caustic soda on cotton, and, when better understood, may have a similar revolutionary effect on the paper-making industry.

The most expensive part of the soda mill plant is the apparatus used in recovering the soda in the waste liquors, rendering it fit for subsequent operations. The efficiency and economy with which this is done has a most important bearing on the cost of production, as regarded from the standpoint of fuel, labour, and soda lost in recovery. But the amount of labour required and the soda lost are factors which depend upon a proper selection of apparatus and arrangement of plant. There is, therefore, a large opportunity for leakage in connection with these charges, for while the best practice demands 90 per cent. recovery, some plants are known to obtain only 80 per cent., their charge for fresh soda being double what it should be.

The charge for fuel required for heating and evaporation is one of considerable importance, owing to the large amount of water that must be removed from the waste liquors. This can be largely reduced by the use of quadruple effect vacuum evaporators, in which the best type of plant will evaporate about 3·5 lb. of water per lb. of steam used. The calorific value of the organic matter combined with the wood is also utilised in the production of steam, and various devices are employed for obtaining the maximum amount of evaporation from the heat available. Nevertheless, under the present conditions of this industry, we may safely estimate that over one-half the cost of production consists in the wood used for the fibre and the fuel used in the process.

As most of the mills now in operation are not very favourably situated in this respect, the possibilities of greatly reducing this item of expense exist in the ideal conditions that are offered by the utilisation of the vast amount of woody material now going to waste in connection with the lumbering industries. All the requirements and functions of this process seem to designate that it should really be a complement of a saw mill plant, for there we have many valuable products now going to waste which can all be utilised.

The ability of this process to produce good fibre from rough, knotty, and otherwise inferior timber, which is now left in the woods or consumed in a refuse burner, will suggest a method of greatly reducing one item of the expense. Certain grades of sawdust may also be very economically employed. This is now a very pressing point with the United States mills, for there the average cost for pulp wood alone must amount to more than 15 dollars per ton of pulp. Moreover, if a portion of the heat energy now dissipated in the refuse burners and the exhaust steam from the mill engines were used in the concentration of the soda liquors, the total cost of recovering the alkali would be reduced to the smaller items of expense, as labour, lime loss in recovery (not over 10 per cent.), and interest on investment, and depreciation. The cost of steam for digesting and drying the pulp would also be reduced to a minimum, and we have thus presented a combination of conditions which offers a very great economy in production.

Further than this, there are locations in Canada where an excellent quality of limestone lies contiguous to the saw mill, and where water power can be obtained, and under these conditions the producer would be able to obtain the lowest possible cost of manufacture by burning his own lime and making his own caustic and bleaching liquors by the electrolytic process. It is hard to conceive of a more ideal set of conditions on which to base an industry for world competition, for here we have all of the best facilities for economic production, in the immediate vicinity of the raw material.

Are we not, therefore, confronted by a strange paradox in the realisation of the fact that our poplar wood is being shipped out of the country, being manufactured under far less favourable conditions than we have at home, and is brought back to us in the form of pulp and paper, in spite of such apparent difficulties as freight and tariff? We have reason to hope, however, that some day these conditions will be changed, and that an industry with such possibilities for our country's development will receive the consideration that it deserves.

London Section.

Meeting held at Burlington House on Monday, May 6, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE WORKS CHEMIST AS ENGINEER.

BY OSCAR GUTTMANN, M.INST.C.E., F.I.C.

All chemical works have, in addition to purely chemical and exclusively manufacturing questions, a large number of engineering problems to solve. In fact, chemical manufacture requires quite as much attention from the engineering as from the chemical side. Very large chemical works can afford to have an engineering department, and even smaller works can, and very frequently do, employ with advantage a special engineer. Most works, however, under present conditions in this country, possess a more or less adequate staff of analysts and one or more well-trained foremen, but in order to grapple with the engineering problems, they rely either on the mechanical skill of the average Englishman or on some special talent in their works combined with what technical knowledge the average chemist can bring to bear on the matter.

I doubt whether many chemists ever pictured to themselves the surprisingly large amount of engineering work and control required in an average chemical factory.

When deciding on material for buildings and plant, the nature of the products to be manufactured and the products incidental to manufacture have to be carefully considered. The questions will arise: Are the raw material, or the finished product, or the effluents, acid or corrosive, or likely to form dangerous or noxious compounds under certain conditions? Are there any special fire or other risks, which ought to be known to the man responsible for the design of the plant or building? Obviously, not every kind of brickwork, concrete, or stone, nor any metal will do for every purpose, so that the apparatus, pipe lines, storage tanks, and many other parts of the plant, have to be considered individually. Thus, to take a well-known example, weak sulphuric acid is best contained in lead, but strong sulphuric acid in iron. Strong nitric acid can be handled in lead, but not so well in iron, whilst a mixture of strong sulphuric and nitric acids is safe in iron. Hydrochloric acid in time attacks almost any material, except silicious stone, earthenware, and ebonite; hence the latter substance is frequently used in pumps. Furthermore, hydrochloric acid scarcely attacks wood, especially if the latter is soaked in paraffin wax; hence on Continental railways it used to be carried in wooden tank trucks. Citric acid is one of the few substances which attacks silica, so that, for instance, kieselguhr cannot be used to filter it. Oxalic and tartaric acids cannot be evaporated in copper, but in lead only, while pure acetic acid is best worked in silver stills. In a similar way the material for the flooring has to be carefully selected.

The roofs require no small consideration. Not only is a roof probably that part of a building which costs most for upkeep, but the safety of the plant and operations frequently depends upon its good state, which should prevent rain, sand, or cold draughts to enter the building. It is frequently advisable to make the roof trusses of such strength as to allow shafting to be carried or pulley blocks fixed for hauling up materials and apparatus. In very many cases pipes and other ducts are best carried across the roof principals, provided these are not overloaded.

A very important part of the duties of a manager is the installation and supervision of the power house. Much depends, of course, upon the size of the factory and the quantity of steam or power required. Sometimes strict economy of fuel is not of paramount importance, though, in most cases, every penny is worth saving, because it is conducive to the better supervision of the plant. The choice and relative advantages of the various forms of prime movers, whether steam, water, gas, suction gas, or oil, need not be discussed here. Suffice it to say that any engineering knowledge he may possess will enable the manager to discriminate between the claims of rival makers and save him much ulterior disappointment. It is rather in the working and upkeep of such plant that his knowledge and skill will be of the greatest service. Naturally, in the case of a steam plant, fuel and water, and in the case of a gas plant the coal, should be analysed from time to time and their suitability and value thereby determined. It will be found useful to instal a water meter and keep daily records of the quantity of water evaporated and of the amount of coal consumed. An intelligent manager will be able to draw therefrom many conclusions with regard to the working of the factory generally. If he knows how to do it, he will even from time to time test the efficiency of his plant by making complete steam trials and thus trace any undue source of loss or waste. He must ascertain that his boilers are not given to "priming," *i.e.*, delivery of wet steam. He will test his flues from time to time, or, better still, instal an automatic carbon dioxide recorder. Everybody is aware that by the admission of more air a better combustion of the fuel results, but not everybody realises that by admitting too much air one cools the flues, and gets an irregular draught and imperfect combustion. A large economy of fuel can be obtained by simply tarring the brickwork from the outside, thus rendering it fairly impermeable.

In connection with boilers and engines, a large number of appliances are daily recommended, which are each supposed to effect such a saving that, were the totality of them taken, the consumption of coal should be practically *nil*. The fact is, however, that in large installations economies are easily effected, whereas in the case of single boilers and but little machinery, the attention of a small *personnel* has to be devoted to too many appliances at the same time, to enable them to effect a saving.

Automatic stoking and automatic feeding of boilers are very desirable additions to a boiler plant, the more so as one thereby generally obtains nearly smokeless combustion as well. Works that cannot afford such outlay, will do well to go carefully into the question of their grates. It is really surprising how rarely one meets in this country with special grate-bars, designed to give a maximum area for the admission of air, and yet permitting the use of small fuel; very large economies can result from a proper adaptation of grate-bars to the nature of the fuel.

To judge from the relative merits of the many smoke preventers on the market requires no mean engineering skill, because although the question is really a chemical one, the means to carry it out are for the most part mechanical. Some smoke preventers blow air through the fire-door over the coal, some under the grate, through the coal. Others blow steam and air over the incandescent coal from the front; again, others blow it in from the back of the grate, and induce air at the same time. Some have mechanical means to gradually close the fire door after coal has been charged, some have adjustable louvres, and so forth. It is indeed very difficult for the average chemist to arrive at a decision, even though many makers offer to put the plant up on trial, and remove it at their own expense.

Modern water softeners may be divided into three main classes. In the first, the softening medium is added alternately to the water contained in two tanks; the contents of one are allowed to settle, whilst the purified water is fed from the other. The second system is one in which hard water and softening medium are introduced in measured quantities, by a tipping arrangement, chain buckets, water wheel, or other similar device. In the third class, the mixing is effected by means of floats attached to levers, which open or close cocks for the admission of hard water and the softening medium in their correct proportions. They may, again, be subdivided into those in which the reaction between the softening medium and the hard water is promoted by heating with exhaust or live steam, and those where the work is done in the cold. These may be further subdivided into apparatus in which the sludge separates out by precipitation over baffle plates, and such in which this is effected by means of filters. One has to see that no excess of softening medium is carried into the boiler, and that the sludge is efficiently removed; further, that the apparatus is easily manipulated, and not liable to get out of order. All other things being equal, the choice between rival claims will rest with the apparatus which does the work more cheaply. The question of economy does not, however, depend upon the cost of the chemicals per 1000 gallons of water only, more frequently initial outlay and cost of labour being the deciding factor.

Feed water heaters and economisers are also frequent adjuncts to a boiler plant, and require attention. A careful engineer will not be satisfied with the mere cleaning of the boiler; he will pay proper attention to the kind of scale deposited, and learn something, either by personal inspection, or from the reports of the boiler inspector, about the nature of corrosions in boilers, and the dangers arising therefrom.

A further problem that frequently presents itself is the utilisation of the exhaust steam from the engine, or else its condensation and subsequent recovery as boiler feed. Exhaust steam can be very advantageously used to heat the water in water softeners, and thereby be recovered practically without cost. The cooling of water used for the condensation in the absence of an unlimited supply necessitates large towers and pumping plant, which demand further attention, space, and capital outlay.

The next important problem bears on the distribution of steam over the works. Although it is a very rare occurrence to find nowadays steam pipe lines in the open air which are not covered more or less with insulating composition, yet they are very frequently found bare inside workshops, it evidently not being realised by everybody how serious a loss in fuel is incurred thereby. The difference even between one insulating material and another is large enough to repay a proper study of the question.

Very frequently it is necessary to convey steam from the boiler-house to a number of separate buildings, and, possibly, very large distances have to be traversed. If the steam-pipe is a very large one, and a number of other pipes for compressed air, water, and perhaps also electric light leads, have to be carried to the same building, then it pays very well to have either a regular bricked trench accessible through manholes, floor plates, or otherwise, or even a passage sufficiently roomy for a man to walk through. In this case, it will be possible to rest the steam pipes on proper brackets or bases, provided with rollers and expansion joints. If, however, the steam has to be carried in one or several pipe lines of small diameter (say up to about 2 ins.), it will be simpler to carry them above ground on trestles. Whilst it is quite possible to carry such pipes on rollers, expansion joints are not suitable, because the pipe is apt to give way in many places, and then the whole arrangement for taking up the expansion of the metal may fail. A plan successfully adopted by myself some years ago obviates these difficulties and is shown in Fig. I. The pipes are simply hung up by chains which, in their turn, can be raised or lowered by means of a hook and nut. The pipe is thus free to expand in every direction. With small pipes there is really no expansion joint required, especially when there are bends or corners in the pipe line. The best plan, however, is to interpose from time to time a piece of flexible metallic tubing, which will take up any expansion. Such tubing is already used up to 12 in. in diameter, and will stand up to 200 lbs. pressure, whilst smaller tubing will even stand a ton and more per square inch. It might not be out of place to show here the way in which I have overcome the relative immobility of heavy steam valves to follow the expansion of the pipe to which they are connected. In the case of a single valve, a carriage on balls, as in Fig. 2, will be found very suitable. A more difficult problem was the one shown in Fig. 3, in which two branch lines were fed from a main line, and the two valves were on the branch lines. The expansion of the 4 in. main pipe on a distance of 150 yards, amounted to about 4 ins., which would have broken any joint, and, therefore, had to be carefully provided for. The drawing explains itself.

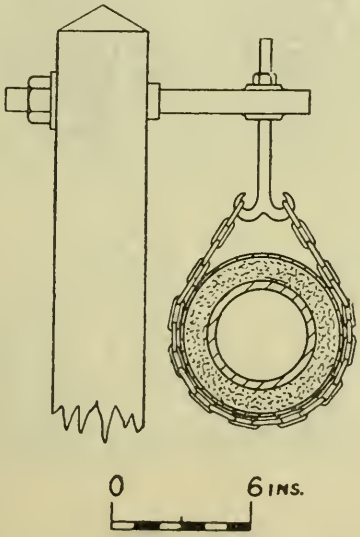


Fig. 1.

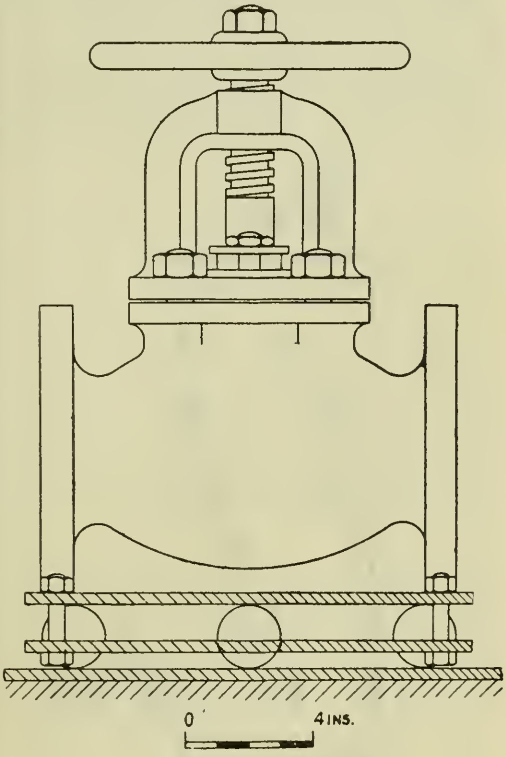


Fig. 2.

The distribution of steam from the boiler to the various workshops or apparatus requires a central distributor, sometimes even branch distributors. They should collect all the condensed water from the pipe-lines, separate the water carried over from the boiler, and at the same time have all valves easily accessible. Fig. 4 shows a distributor of my own construction, which occupies very little floor space, whilst 24 valves up to 2 ins. find room on it. The perforated baffle plates serve to separate the water from the steam.

The question of steam distribution brings us to the problem of collecting the condensed steam. As this represents a source of supply of the purest water, every drop of it ought to be collected for the boilers. Such

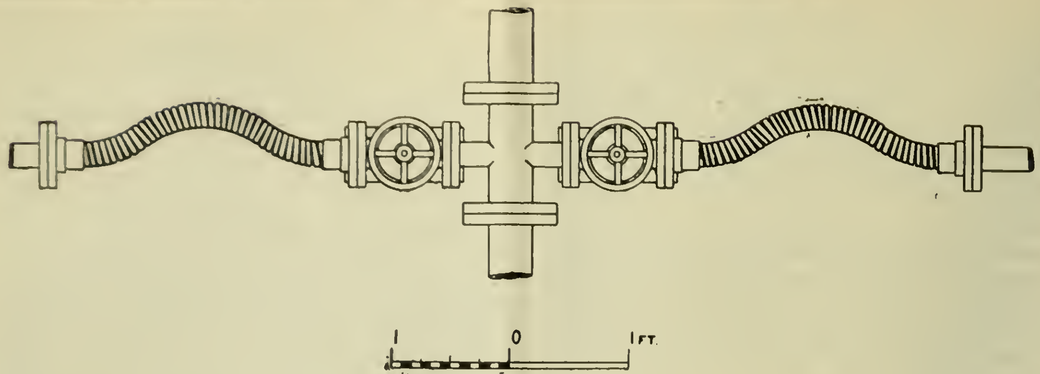


FIG. 3.

water does not condense in the steam pipes only, but to a much larger extent in apparatus for boiling and concentrating liquids. A judicious use of properly acting steam traps, and some expense on covering material, will save a great deal of money. When there are a series of boiling apparatus, such as steam pans, to be supplied with steam, the pressure of the steam must nearly always be reduced, so that its temperature may not exceed the boiling point of the liquid in the pan, or in order to conform to other conditions. A really good reducing valve is rare, and the best is useless if not properly attended to. Non-return valves must be attached to the steam traps, as otherwise a single leaky one may prevent the whole of the pans from working properly.

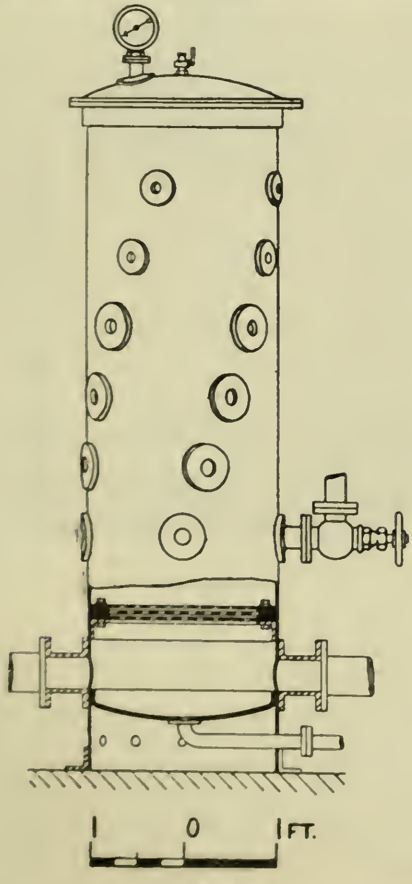
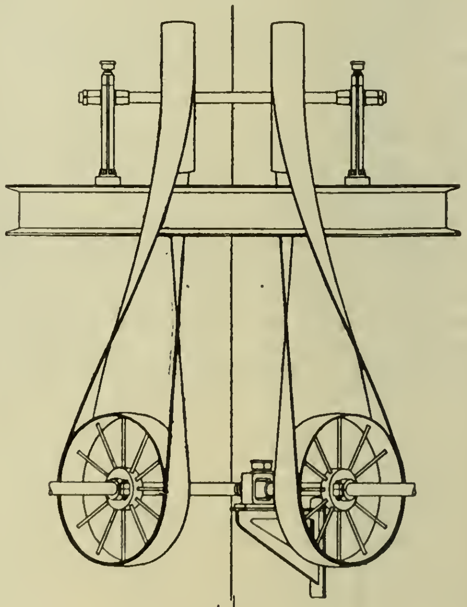


FIG. 4.

Of steam engines the varieties are legion. My advice is, take the best than money can buy, one that has every possible improvement for its size, and is made from the best material and in the best style possible. To have no trouble with repairs, not to have to stop just when everything works smoothly is alone worth a great deal, quite apart from the fact that the best steam engines repay the larger outlay simply by their constancy and economy in working. I do not intend to deal with the respective merits of gas engines, oil engines, steam engines, steam and water turbines, &c. I can only repeat—buy the best,

FIG. 5.



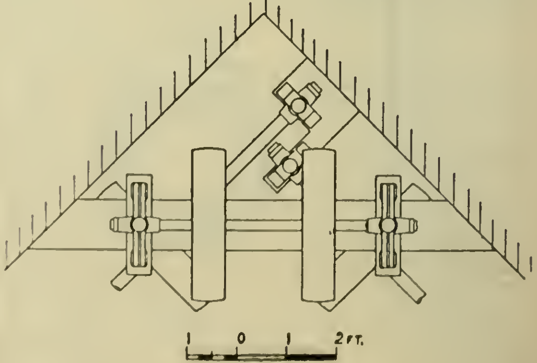


FIG. 6.

and to the chemist my advice is: Learn to understand your plant and to know all about it, so that you need not rely upon the sometimes fanciful reports of an engine driver.

The proper lubrication of engines, shafting, and bearings does not merely depend upon an ample supply of lubricant, but the chemist should also keep his eye on its chemical nature and on economy. It has happened in my own experience that cylinders and pistons of very fine steam engines were badly scored, and blame was put upon the chemicals used in softening water for the boilers. My suspicion that the lubricant was acid was promptly confirmed by chemical examination.

The transmission of power from one building to another is, again, a constantly occurring problem, and one that is not always judiciously solved. Few people are aware that as much as 40 per cent. of power can be wasted in defective shafting and gearing. A very efficient means of transmitting power at an angle was provided by me some time ago in a place where a pair of bevel wheels was so badly worn, and the lines of shafting so badly laid that the building was constantly shaken and a great deal of noise produced, not to speak of the enormous loss of power. This angle-drive is constructed for transmitting 40 h.p.; it is shown in plan and elevation, Figs. 5 and 6. One of the largest makers of shafting was asked to supply it, but he did not think it could work, and it was only after he had consulted a professor of engineering, who gave him some hope, that he carried out the order. This is now some years ago, and the transmission has never stood still since. In making such an angle-drive care has to be taken that the points at which the belts leave the pulleys are exactly above each other, as otherwise the belt will fall off. This arrangement will transmit power in one direction only for any given arrangement of the pulleys.

It is, of course, very rarely possible to transmit power from one house to another by means of belting. Sometimes very long ropes have to be used, and the amount of sag then necessitates very high and strong supports for the pulleys. Both in this case and when the power is transmitted to an adjacent building by means of a continuation of the shafting (either underground or above ground), a good deal of attention in laying out as well as in keeping up such an arrangement is required to prevent a serious loss in efficiency. Electrical transmission is very frequently the best and most economical solution. This at once brings before us the question of lighting a factory. Great care has to be bestowed on this point in some works, where serious responsibility is attached to any fault in this direction. If an electric installation is provided, advantage may be taken of it to transmit power to distant parts of the factory, to drive fans in otherwise inaccessible places, to supply delicate heating arrangements, or even for electrolytic work.

Many engineering details require to be attended to in connection with the handling of liquids. The pumping of liquids from one apparatus for use in another is almost a study in itself. Whether steam or belt-driven, plunger or centrifugal, pulsometer or membrane pumps, should be used, or whether delivery of a liquid should be effected by means of elevators (montejus), and of what material these pumps and the pipe lines should be made is rarely a matter of indifference. In this connection fans for carrying away fumes, for improving the draught (as in the manufacture of sulphuric and nitric acids), for supplying air to a drying room, and for many other purposes are worthy of mention. How difficult it sometimes is to do the right thing may be illustrated by a few examples from actual experience. A plunger pump refused to work with a hot volatile liquid until an air-vessel was interposed, wherein the vapour could condense. A pulsometer placed into a narrow unventilated hole could only be brought to work after the place had been rendered cool by proper ventilation. A number of acid elevators, made of cast iron, 1½ in. thick, burst at short intervals under 30 lb. pressure, although they had been tested up to 150 lb.; on investigation the cause was found in that long pipe-lines going to a higher level were fitted to these elevators, and that a bend at the end of the line favoured water-hammer action. Both in this country and in America, aluminium fans, pipes, &c., in connection with nitric acid, are coming more and more into use, whilst in Germany, and also in this country, earthenware fans and centrifugal pumps are preferred in acid works.

The supervision of effluents, both liquid and gaseous, requires considerable care. The choice of proper culverts, gutters, or pipes, depends frequently on the nature of the effluent, and when liquid effluents are sent into a sewer or a watercourse tests have to be made, sometimes for considerable distances, to avoid trouble with local authorities and interested parties; arrangements may also have to be provided for catching suspended matter, precipitating impurities, or for rendering the effluent clear or pure before admitting it into a watercourse.

Compressed air and vacuum pumps are important factors in chemical works. Both kinds are similar in construction, but the efficiency varies very much from maker to maker. Whilst in the case of an air compressor a proper volumetric efficiency must be demanded, and may be obtained if reasonable care is taken, the barometric effect is all-important in selecting a vacuum pump. Some processes are now so well regulated that a difference of a few millimetres in the vacuum entails considerable loss of time and cost. Some works are already demanding a guarantee for a vacuum of 2 mm. with very large pumps, and, what is more, they get even 1/8 mm. Reservoirs for storing compressed air and allowing it to cool are better not left alone, as usual, because, apart from condensed water, there have been explosions in such, and also in pipe lines, which were found to be due to hydrocarbons from the lubricant.

In addition to having so much detail work to attend to in the factory generally, the works chemist requires still further engineering knowledge of his plant. Mr. George Beilby, F.R.S., gave us, in 1899, a long list of apparatus required in chemical work (this J., 1899, 333, *seq.*). Of course, the chemist is rarely called upon to construct an apparatus or a machine, but he must have a working knowledge of those in regular use for all kinds of operation, and if he invents a new process, then he should be able to indicate his requirements for work on a large scale. Like Mr. Beilby, I, too, wish to emphasise most strongly that "works operations are not simply laboratory operations writ large." It is frequently easy to indicate a new process

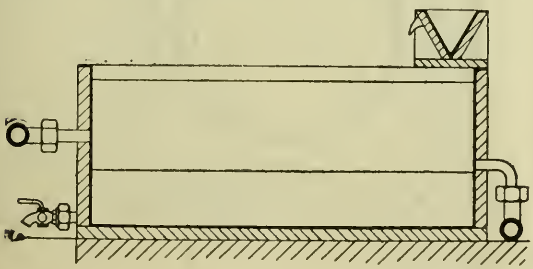


Fig. 7.

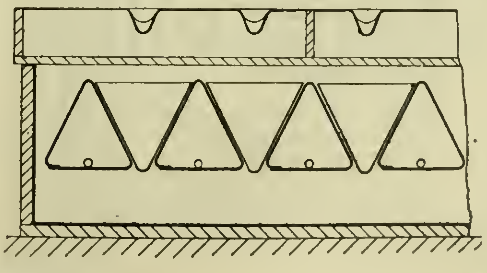
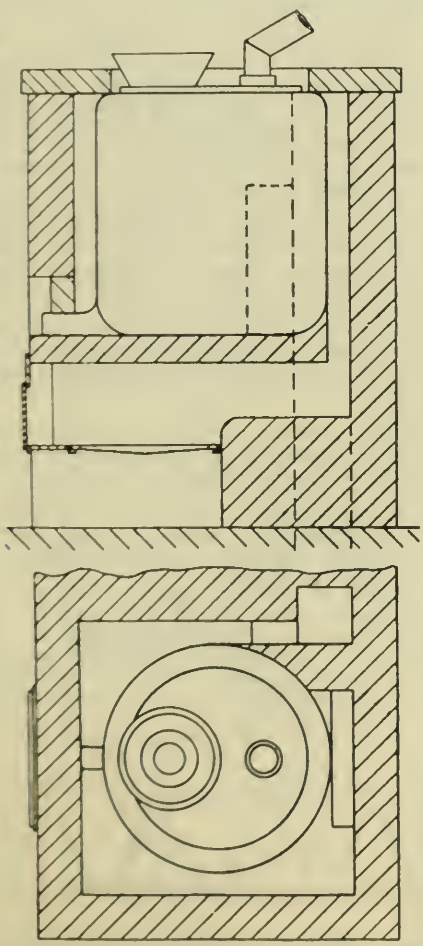


Fig. 8.

by small operations in the laboratory, but when the chemist is called upon to reproduce the process on a large scale, then far more real inventive genius is required to design the plant for its manufacture, and it may take months before all the difficulties are overcome and the process begins to pay, if indeed it does at all. It is therefore, useless to teach chemical technology with the help of beakers and test tubes. A striking example was shown recently, when candidates in an examination were asked to sketch out a filter for continuously filtering a hot liquid. Every one of the candidates showed a steam-heated funnel, and only one had the additional notion that for continuous work on a large scale a filter paper might prove impracticable, and therefore devised a sand filter. With better experience it would, however, have occurred to them that a filter is not necessarily round as it is in the laboratory, and that a number of rectangular filter papers placed over suitably shaped steam or hot-water compartments, as shown diagrammatically in Figs. 7 and 8, might allow of large quantities being dealt with quickly.

It is useless to ask the average engineering works to advise on all possible plant, since only very large works have a sufficient number of experienced engineers for every purpose. On the other hand, it is always possible to find such works that make a speciality of certain machines or apparatus, and their experience is, of course, valuable. It is in the construction of apparatus, and appliances for chemical processes, involving no mechanical arrangements, like plain stills, evaporating pans, lead cooling and heating tanks, even vitriol chambers and towers and the like, that the chemist will find his engineering knowledge useful. How simple does it seem to set a cast-iron pot into brickwork and fire it! Why, a beaker and a Bunsen burner offer such a close analogy! Yet the two small illustrations, Figs. 9 and 10, show two ways of bricking in such a pot, one of which will consume twice as much fuel and impart to the contents a much lower temperature than the other. There may be still further modifications in design, if the contents have to be heated very strongly or very gently.

Similarly intelligent attention must be given to the methods of heating. Regenerative firing or "*plus* pressure" in a salt cake furnace, overhead firing in sulphuric acid concentration or evaporation of liquors, firing with water gas or producer gas, heating by ordinary or superheated steam, under pressure or in vacuo, boiling in an oil or a lead bath, evaporation by waste gases, calcining, roasting, and many other processes of heating, all are beset with problems for the chemist and the engineer. An example may again be taken as an illustration. In a furnace a series of vessels for the concentra-



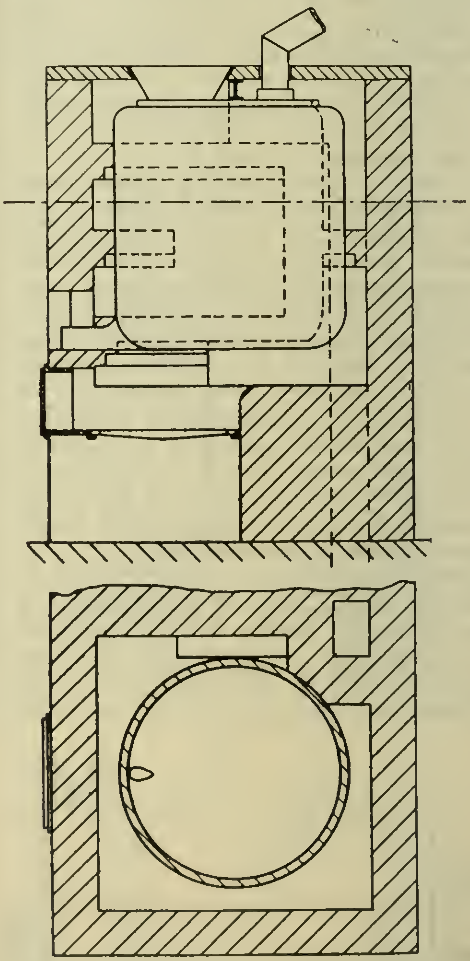


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FIG. 9.

FIG. 10.

tion of sulphuric acid were to be heated by producer gas, the flames playing all round them. Up to a certain degree of concentration all went well, but beyond that no amount of gas burned produced further concentration. Consideration showed that as producer gas contains about 20 per cent. of hydrogen, the products of combustion were quickly saturated with water vapour, and then their vapour tension was the same as that of the vapours escaping from the acid. When the gas producer was replaced by a simple regenerative coke furnace, the concentration proceeded smoothly.

The condensation of gases, or their absorption in liquids, the drying of pasty or dusty materials, or of such that must be dried at a certain low temperature, and the recovery or the rendering harmless of gases driven off, the filtering of cold and hot, acid and basic liquids, &c., are again processes applied in so many variations and from the largest to the smallest scale, that I need only point to them as constantly requiring engineering skill and attention.

It serves no further purpose to go on enumerating the many every-day operations in chemical manufacture, each one of which requires engineering as well as chemical knowledge. A most important duty must, however, not be overlooked—economy. To have wonderful and fanciful apparatus constructed, to use the most expensive materials, and to let them be made with the greatest care, is easy; to devise apparatus, that cost no more than the process can stand, and that will give no trouble in working, is more difficult; but to make them give the best results at the least cost requires that the chemist must be able, as Mr. David Howard expressed it so tersely, "to think in tons." But, even apart from construction and working, what a large field has a chemist in which to show his talent for economy! I have known a factory where three men were deputed to pick up every nail, every piece of wood or sacking or other waste material that had been thrown about by careless men under careless supervision in past years, and their two days' haul brought quite a large sum of money. I have known others where faulty air compressors required almost daily renewal of valves, where the number of leaky steam valves and water cocks found on the scrap heap was more than a hundred, where the steam wasted through leaky joints caused considerable nuisance at considerable expense, and yet all these could have been prevented or repaired at a small weekly cost, and the waste material made useful again. A chemist can in a hundred and one ways make himself highly valuable by looking after little engineering details, and he will become still more useful by being able to look after the building of small works railways, the provision of lifts, the erection of storage tanks for liquids of all kinds, the care of packing materials, like carboys and casks, the safety of the factory and workers against fire and accidents, and many other things.

After having, much to my gratification, patiently listened to this long syllabus of possibilities for a works chemist to act as engineer, you will, no doubt, be inclined to ask where the heaven-born genius should come from who can do all that work. To perform all these functions thoroughly requires a well-trained engineer with a large experience in chemical works, and, as Mr. Paton once explained, not merely a superior mechanic. It is useless, therefore, to expect a chemist to undertake all such work. On the other hand, a works chemist ought to possess an adequate knowledge of chemical technology* to enable him to understand all kinds of plant, to give proper instructions to the artisans in the works, to confer with specialists in case of improvements, and to settle details with them, as well as to work the plant afterwards.

In these days of great competition and scientific progress, a foreman, risen from the ranks, will only very rarely be able to act as a works manager. True, a number of men are still with us, who have worked hard to gain scientific knowledge, and to combine it with their practical experience. Such men have been amongst the founders of the enormous chemical industry of this country, and we are proud of those still working and those coming on. The future, however, belongs to the chemist who has gained practical experience as foreman of a department, and combines therewith a good engineering knowledge. Such a chemist ought to be properly trained, and that cannot be done with young men who come to college imperfectly prepared, and certainly not in three years, as prescribed at present; there ought to be another year added, so as to teach more mechanics and physics in the beginning and to give a proper course of chemical technology in the end.

Now there is only one thing more wanted, and that a most important one, namely, that manufacturers should realise that a works chemist is not solely an analyst, but a highly useful practical technologist, who, given a little confidence, will in a short time repay his salary many times over, and make them wonder that they could ever have done without him. And, after all, most chemical works are nothing but huge shops full of machines, which in monotonous sameness grind away at well-established processes, where there is little work for the pure chemist, but a great deal when he also has good engineering knowledge.

We have heard too much about the many chemists engaged on research in the large colour works of Germany. Highly valuable as they are, and important as their discoveries were, the German chemical industry is infinitely more indebted to that far greater number of works chemists who patiently and thoroughly investigated the manufacturing processes, who had the ability to devise improvements and economies, and who found generous manufacturers and their college-trained sons to give them their confidence. It is on these lines that we must progress.

Discussion.

Dr. **Wm. H. Nichols** (Past President) said Mr. Guttmann had laid much stress upon what he had found to be of great importance, *viz.*:—to obtain with the works chemist a sufficient amount of mechanical ability to produce results of a satisfactory character. It was not easy to find good chemists who were also good mechanical engineers. For this reason, the small works was at a disadvantage, as compared with works of sufficient magnitude to maintain mechanical and electrical engineering departments. He believed in allowing a young man to follow his own bent, and become a good chemist with as much engineering as possible, or a good engineer, with as much chemistry as possible. He ventured to assert that in the United States the good engineer with moderate chemical knowledge would do better than the good chemist with poor engineering equipment, though he feared that opinion would not meet with general approval. It was, however, the result of long experience. The importance of careful investigation leading up to improvement of processes could not be over-stated. More than 1000 separate investigations were made in the Investigation Laboratory of his own Company, before reaching the method and plant now employed in the manufacture of sulphuric acid by catalysis, each one supervised by the Chief Engineer and Chief Chemist. In general, realising the difference between a laboratory experiment and a manufacturing operation, they found it advantageous to begin with a small manufacturing plant, and make their inevitable mistakes on a small scale. The chemist must be prepared to build on the foundation of his failures, and the man who did not learn the lessons they taught would not succeed in the Chemical Industry. He must use each failure as a stepping stone to increase his perspective. And, after all, even in these days of magnificent discoveries, how little was known of what our science held in store. Like Sir Isaac Newton, they were like children walking on the beach, picking up here a pebble and there a shell, but knowing little of the vast ocean beyond. No science held out such alluring chances to the young student, whether his work led him into the realms of pure chemistry, or into its applications; for, whatever point he attained, there would always be higher goals brought to view. In his allusions to the importance of engineering in applied chemistry, he did not wish to be understood as detracting in any way from the importance of the investigator in pure chemistry. The two must go hand in hand, in order that the great discoveries should be utilised, and the race saved from the consequences of its own prodigal wastefulness of its raw materials.

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* I do not like the term "chemical engineering," because all branches of engineering come into use, and I do not mean "chemical technology" in the sense adopted in Germany, which is a knowledge of chemical processes, instead of the technical means to carry them out.

Mr. **Bryan Corcoran** said this paper seemed to be rather a case of chemist *versus* engineer, and the author had dealt politely with the engineer. Everybody would approve of what had been said about the first diagrams, but Fig. 4 might perhaps have something more said about it. An easy way to find how shafts in parallel planes running at an angle to each other might be driven was to experiment with two rollers and an elastic band; it would then be readily seen how the pulleys should be arranged to lead the band correctly from one to the other. The same face of the driving band should always be in contact with the pulleys; any arrangement in which the band was twisted was wrong. The band must lead straight on to the pulley, but might run off at an angle. The question of drying was often not very well understood. A chemist in his laboratory would dry substances by evaporation over his lamp, but when he came to a large installation that would not do. It was a common thing, however, to find a drying apparatus a more or less home-made affair, which had been enlarged from an experiment in the laboratory and not answering at all. To set out new works required more common sense than technical skill to avoid waste of space in roadways, staircases, and light where it was not necessary. He thought the engineer and chemist had each his own department; the chemist knew what end he wanted to gain, and he did not always know, without the assistance of the engineer, how to attain it. It was very easy to bridge a ditch with a plank, but one could not bridge a river in that way. A great many mechanical appliances did not carry out exactly what they were introduced to supersede. For instance the sewing machine did not sew; it did something which answered the purpose of sewing, but it was totally different from sewing.

Mr. **T. C. Cloud** thought this paper chiefly emphasised the fact that a chemical works manager must be neither a chemist nor an engineer—but must be both. He did not believe that a chemical works could be carried on satisfactorily where the management was in duplicate, partly by a chemist who was not an engineer, and partly by an engineer who was not a chemist. The training of chemical works managers was deficient in this: That to a large extent the managers were taken from the laboratory without engineering training. A successful chemical works manager should have much the same training as a successful metallurgical works manager, who generally had a thoroughly good engineering training in addition to his metallurgical and chemical training. He started at the lowest position in the office, perhaps in the assay office, and worked his way up, picking up his practical experience both in the metallurgical and in the engineering part and thus qualified himself for becoming a works manager. In a chemical works the same thing was necessary; if the manager was a chemist pure and simple, he was unable to thoroughly grasp the difficulties which cropped up when a process was transferred from the laboratory to the works; and unless he could do so, he was at a considerable disadvantage in giving instructions for those who were to make the necessary apparatus.

Mr. **W. F. Reid** said he should be the last to minimise the good qualities of the practical man; but what he had found about them was that they lacked initiative power; they were thoroughly familiar with the apparatus around them but, if a new process were introduced, they lacked the power of designing fresh apparatus. On the other hand, a student who came from a college was not familiar with apparatus on a commercial scale, nor of the materials of which such apparatus should be constructed. A similar state of affairs existed in Germany, due, doubtless, to the fact that the professors had no experience in factory work. It was no discredit to them, because if they had worked up their way from office boys in a factory to the position of professor, they could not possibly have gained the knowledge they had of pure science. Following the example set in Germany, an institution to train the professors in technology would have to be founded. The expense would be great, but the results must be considered. One point of detail he should like to mention. He had tried flexible pipes of all sorts but in his hands they invariably leaked. In small pipes he always found a bend or a nearly complete circle was as good as anything; it never leaked, since there was no joint, and it completely answered the purpose.

Dr. **L. T. Thorne** said to his mind the term "chemist" meant a man who had been educated on broad scientific lines, where the scientific foundations of the engineer and the chemist were combined, and in addition to that he required a large amount, the larger the better, of experience in research work. Speaking from practical experience, scientific research was almost the most valuable part of the technical chemist's education, for it gave him the capability of grasping or grappling with unexpected difficulties. The man who was trained as an engineer in a technical college was taught how to make and how to do various things; but, unless he had been well grounded in the scientific basis on which all those sciences were built up, when he was landed in a works and something turned up which had not been allowed for in his training in the technical college, he was too often thrown on his beam ends. He agreed that three years (which was considered sufficient in England) was not a sufficient time in which to turn out a man really capable of doing good technical work. That was so much recognised on the Continent that in a comparatively poor country like Switzerland, in the technical college at Zurich, the course extended practically through five years. Yet that college was full to overflowing.

Mr. **Thomas Tyrer** said Dr. Nichols had practically repeated one of the most important paragraphs of his presidential address in which was a phrase which he had not used to-night, but which Dr. Thorne's observation, namely, the "attitude of mind" of the person who was to take charge of operations—either chemical, engineering or mechanical—had recalled.

The law of supply and demand applied to the condition of teaching in this country. The first thing to do was to educate the British parent. It would be well if some one would take the trouble to elaborate these questions more clearly in the columns of the daily papers which were now more open than ever before to subjects of this kind. There were many who were quite competent to do this, and the result would be speedily shown in the new sense of responsibility on the part of parents, who would see that if they wanted to give their children a good start in the world the finest thing was a good and not a half education, either as to quality or time. Five years was needed to make a properly educated scientific technologist; certainly four.

If he had to select as head of a small works he should take the man who had had a pharmaceutical training. That might seem strange, but if they knew what a training in pharmacy meant, they would be inclined to agree with him. A pharmaceutical education included chemistry and physics and called out to a larger extent than was often the case the faculty of minute observation, probably one of the most useful qualities for managership.

Dr. **G. T. Morgan** said he believed the best arrangement in a works was to have a chemist knowing as much mechanics as he could learn, associated with an engineer of similar calibre, similar age, and as far as possible getting the same salary. In this connection, he referred rather to those more abstruse branches of chemistry, the manufacture of organic products, where the chemist must spend a great many years in getting at his fingers' ends the necessary knowledge of his subject.

A point rather insisted on was that three years' training was not sufficient, but in most cases where a young man was seriously minded, he contrived to get a fourth year's training before entering the works. Again the evolution of the chemist or engineer did not begin at the time when he went to the technical college. A youth who was intending to be an engineer began early to make locomotives, dynamos, &c., and a youth who decided to be a chemist pottered about with chemical experiments as much as he could and cared little or nothing for engineering. That was human nature, and therefore it was highly improbable that they would get many geniuses who could combine the two, but they might possibly get men of talent, good engineers with a certain knowledge of chemistry, and good chemists who had a certain knowledge of engineering. Those who thought otherwise would find themselves impaled on the horns of a dilemma. If it were possible by widening the basis of a scientific education to make a chemist also into an engineer it should be similarly possible by widening this scientific basis to make an engineer into a chemist, and thus cut out the technical chemist altogether. One practical difficulty to the speaker's suggestion was that the engineer was usually so much better paid than the chemist that it would be difficult to get a really capable engineer who would go for the same salary as the college-trained chemist.

Dr. M. O. Forster said that the point in the discussion which had interested him most, was the statement by Mr. Reid that the professors ought to be educated in technology. He only hoped the parentage of that statement was more substantial than a mere wish, because as the years went by, it became more and more clear to him that this was what he, as a teacher, most required from the view-point of chemical technology. The teachers of this country, however, owed their unfamiliarity with industrial problems largely to the apathy of manufacturers. Chemical students who became college teachers did so because they were fond of chemistry, and this career offered, at present, the best facilities for research. Consequently, they devoted their scanty leisure to an investigation which was often selected by fortuitous circumstances, and at this stage any problem was as interesting, within limits, as any other. Such young men should be caught early by the manufacturer, who, without divulging any trade secrets, might say, "Here is a certain difficulty, and if the problem seems interesting to you, I can give you plenty of raw material: if you arrive at a satisfactory conclusion it would be valuable to me, and you will receive a proportionate remuneration." Thus not only would the teachers themselves become interested in technical problems, and ultimately arrive at a stage when their advice on important difficulties might be really useful, but their teaching would subconsciously tend to develop the technological side of their subject, and their students would become more useful as works-chemists than they were at the present time. Thus much available talent could be diverted into manufacturing channels which was now employed unprofitably, according to the ideas of some people—though that is another question—in preparing new compounds.

Dr. W. H. Nichols said he would like to add a word to what had been said about the technical education of Professors. He did not approve of taking them from their work, and sending them out for a year or two in quest of practical knowledge, which in turn they should bring back to their students, and re-hash to them what was daily becoming obsolete. Let them keep at their usual work, which should require all their powers to keep up to date, or perchance a little in advance. Rather, as in the case in the Polytechnic Institute of Brooklyn, N.Y., give courses of lectures by practical scientific men on their own specialities, thus insuring to the students the theory from the Professor, and the latest practice from those who know.

The Chairman said what they wanted was a reconciler between the engineering side and the chemical side of scientific processes. Dr. Nichols had pointed out that a very admirable method, which he himself thought of and carried out 20 years ago, namely, the introduction of an intermediate plant between the laboratory and the manufactory. He built a room which consisted of simply four walls and necessary windows, a line of shafting, and a strong cement flooring. In that he was accustomed to erect apparatus which it was proposed to apply to an operation on a large scale. If it was not successful it was altered until at last something was arrived at which would satisfy the requirements; and from that they proceeded to design the larger plant. Another point which had come out, was the necessity for increased training in physics for the engineer. That was one of the most important things, as was also the need of increased training in physics for the chemist. There was no doubt great truth in what had been said by Dr. Thorne that the habit of investigation taught the chemist, in a way the engineer was not taught, to bring an unprejudiced and judicial mind to the consideration of the problems which lay before him. The engineer from his training was always prejudiced in favour of doing something in the way it had been done before, and what he had found most remarkably consistent with the engineer was the difficulty in getting him to do something which was new and outside his experience. He did not find that same difficulty with a man who had had a chemical training. But the chemical training a man got was too academic; he was not drawn sufficiently into contact with the hard facts of life; he did not recognise that in technology the aim was to make the thing at the least possible cost and with the largest possible yield. This brought him back to the necessity of having a man to occupy a judicial position who should be able to reconcile the views of the chemist and the engineer. Such a man was of the greatest value in works. But, as Dr. Forster had remarked, it was very difficult or impossible in many cases to get those who were the financial controllers of large works to see the necessity of having the powers of such a man at their disposal, having also at their disposal the chemist and the engineer.

Mr. Oscar Guttmann in reply said most of the speakers agreed with him that the works chemist must be a trained man, because the man from the ranks had either no initiative, or did not know how to use new plant or new processes. Unfortunately, in this country students were not encouraged to learn technology. They learnt chemistry, and nobody induced them to take up engineering except in a few instances. If they were made to take a fourth year, what excellent men would they make. They did not want engineers to be chemists, nor chemists to be engineers. Large chemical works had their special engineers, but they must think of the thousands of chemists who either alone or perhaps with a colleague had to look after everything that might happen in small works, and who were every day confronted by a new problem. Such a chemist could not be called upon to undertake practically everything in chemical engineering; he was not expected, nor did he wish him to know it; he could not know it properly, but he should have learnt enough to enable him to understand what was wanted. Then again, if he applied to engineering works for plant he should understand what was proposed. Dr. Nichols' later remarks had given the scientific chemist his due praise, and he mentioned one college in New York which gave extension lectures in engineering by practical men. To a certain extent we had that here in the Manchester School of Technology. It was an ordinary thing now in Germany that professors must have been at least two years in practice, and if they had not they were sent away for two years to gain the requisite experience. Dr. Forster had touched on an interesting question that the young teacher was rarely provided with an opportunity of occupying himself with problems that had a practical bearing. But the manufacturer, to give him his due, was placed in a difficulty here. He could not very well apply to an inexperienced young teacher, and on the other hand if he wanted a problem investigated, it was generally an important one which he did not want the whole world to know. As an alternative would it not be better if the young demonstrator went into practice for a year or two, or at least to visit a number of works and find out for himself what problems were awaiting solution? On the subject of the paper they would never agree entirely because there were so many controversial possibilities, but he thought he might claim to have shown comprehensively how much engineering knowledge was required for the average works chemist, and that they should endeavour to impart it to him.

Extra meeting held at Burlington House on Friday, May 10, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE PATENTS BILL, 1907.

BY R. J. FRISWELL, F.I.C.

(Chairman of the London Section.)

As a preface to the following paper, it may not be out of place to make known the history of our Society's connection with the recent Patent Bill.

It appears that as a result of the energetic work of the Manchester Chamber of Commerce, the Association of Chambers of Commerce appointed a deputation to call on the President of the Board of Trade. At a meeting of our Council in March, 1906, a letter from the Secretary of the Association was read, asking our Council to nominate representatives to join their deputation. Several letters and documents accompanied this request, and among them a forcible statement of the case on the part of the Manchester Chamber of Commerce was included. The deputation was to raise one point only, and our Council instructed its representatives to support that point, which was—To endeavour to secure legislation imposing the absolute forfeiture of such United Kingdom patents, owned out of the realm, as were not, within a period, worked in the Kingdom, unless good cause was shown for the delay. I gather that the actual object was invariably to impose compulsory working, even if for the time some delay was for good reason permitted, and with this object I am informed our Council was at the time in complete sympathy. It will be noted that I have only dealt with this particular matter by pointing out the difficulty arising from the retention of the phraseology of the Act of 1883, and the unsuccessful amending Act of 1902, in the Bill of 1907, now before us.

In considering, in a judicial manner, the Patents Bill, 1907, so far as it deals with chemical inventions, their separation into a separate class (the first departure from established usage) begins with Clause 2, which, read with the alteration to be made in the Act of 1883, will cause the following to become law, *viz.* :—

A *chemical* invention must, if required, be accompanied by such specimens or samples as may be prescribed. No similar demand is made on any other class of invention. This appears to be a very important change, for hitherto a patentee has only been required to describe his process of producing the chemical body he is concerned about. He will now, if the Bill becomes law without amendment, be under an obligation, "if required," to deposit at the least a specimen of the substance he proposes to make. It is to be observed that the proposed enactment is extremely wide, for no limit is laid down to govern the Comptroller in his demands as to either the quantity of the specimens or as to the number of them. For example, suppose a patent applied for for the production of a new azo dye from a new substance X combined with A, or B, or C, &c., the patentee would be bound, if required, to supply samples of all such bodies. Apparently no excuse would be permitted if the requirement is made, since the word "must" is employed, and it may be presumed that a refusal or inability to supply any one of these would lead to the exclusion of the substance not supplied from the scope of the patent. At any rate, no provision for relief from the obligation is made, except the words "if required," and it would seem that a Comptroller would feel obliged to take rigid measures to satisfy himself that an objection to produce samples was a reasonable one. This would certainly prove a source of trouble and expense to any patentee who should feel himself obliged to obtain a dispensation from the requirement, even if such a thing were possible.

In several criticisms already published it has been pointed out that no provision as to the custody or use or object of these specimens is made. It must at least be presumed that they are to be kept secret until the patent is either granted or refused, but after that, what is to be done with them? If they are exhibited in bottles in a museum, they can be of no use to anyone. Are they then to be held as a guarantee of good faith? If an action for infringement by a patentee or for revocation by another party is begun, are they to be at the disposal of the defendant in the one case or the plaintiff in the other, to enable him to convict the patentee of having departed from his specification? If this were the case, a very serious condition of affairs might arise, and a great obstacle be thrown in the way of industrial advance.

Take the case of a new substance such that claims for process and substance were both made. In the course of a short time, improvements in *working* might be made, and the substance originally impure might be greatly purified, so that while the sample deposited might have been of 20 per cent. purity the article on the market, after a few years, might be a 90 or 95 per cent. one. Who is to decide whether such improvement is such as to invalidate the patent? Or whether any, and if so how much, improvement may take place without the necessity of taking further patents. This opens a vast field for litigation.

This appearance in an impure form was the case with Mauve and with Magenta. The latter case was very remarkable, for while at first Magenta was very impure, within a very short time Nicholson had isolated the colouring matter itself and placed pure salts on the market, exhibiting at the exhibition of 1862 upwards of 80 lb. of the crystallised acetate. The existence of an original material such as the crude Magenta of Medlock's patent of January, 1860, as an exhibit, sample, or specimen, deposited with the Patent Office, might, it appears to me, be a very dangerous thing for the inventor in any trial for infringement brought before a Judge and jury, necessarily non-technical men.

The saccharin patent is again in point. The original substance introduced was deficient in sweetness owing to the presence of the tasteless para-toluene compound. The removal of this was possible in several ways, some being processes of purification of the finished product, some, methods of removal of one of the isomers at certain stages of the manufacture. Here it is again obvious that the deposit of samples would greatly embarrass the inventor, for if he had purified orthobenzoic sulphimide from para-sulphamine benzoic acid, he would be met with the statement that he had not disclosed the whole of his process, while if he had not, the argument would be that he was not entitled to purify, as the product marketed could not be procured by the patented process.

The only argument which can be adduced against these views is that the other side can make by the patent and exhibit the product in Court, or that the Judge can, as in the Rocceline case, order experts to work exactly as in the patent and report, or produce the product in Court. It need not be pointed out that this will produce very different effect on the mind of the Court, trained under English legal methods and traditions, and that the proposed new method seems repugnant to us, as it is a species of attempt to cause self incrimination by the patentee. It is strange to find the patentee treated as a suspicious character in this way.

No doubt this notion never existed in Mr. Lloyd George's mind. He undoubtedly hoped to protect British industry against the huge financial combinations he alluded to in his speech, and again, no doubt, the draftsmen of the Bill, being chiefly prompted by engineers, looked on chemical samples as equivalent to the drawings required in a mechanical invention. No chemist requires any information as to their fundamental difference.

It may also be argued that Mr. Lloyd George said in his speech on the second reading :—"It was never intended that every patentee of a chemical invention should be compelled to deposit samples. It was left entirely to the discretion of the Registrar." ("Times.")

But the difference in the Bill consists that in the principal Act (1883) the words are "such . . . as may be required," while in 1907 it will stand "such . . . as may be prescribed." What is the difference?

Now can anyone say that, under the principal Act, a mechanical invention has ever been admitted without a drawing? The word, whether "required" or "prescribed," is governed by "must" in the principal clause, and one need not be a seer to predict that the "Registrar" can only avoid a great responsibility, as he has hitherto done in the case of drawings with mechanical inventions, by invariably asking in chemical inventions ; he "must" ask for samples. While on this point I might call attention to the instability of many chemical substances. What will be the condition of them some months after preparation? It is well known that aldehydes are unstable, so are many cyanides and cyanogen compounds, many of the aniline dyes, some hydrocarbons such as Isoprene, nitrites, sulphites—in fact we know as yet very little as to the life of many compounds with which, when freshly made, we are familiar. If, therefore, samples are required for the purpose of the inquiry preceding grant, they should be destroyed as soon as done with, for obvious reasons.

Finally, attention may be given to Section 10, Subsection 2, which relates to compulsory working and compulsory licences. Precisely the same words in 1883 and in 1907 govern the whole clause, *viz.*, "adequate extent," but the legal process is much improved and simplified. It appears to me, however, that nothing short of a new Court could deal with this matter. How is manufacture to an *adequate* extent in the United Kingdom to be defined, or ascertained, or proved? The opportunities of litigation seem unlimited. This is essentially a case where half a loaf is worse than no bread. Let British patents be worked in Britain, or let them not be granted.

On the whole, I regret to find that after examination of the Act with the utmost desire to see good in it, and while admitting its good intention, I can only say that it will seriously increase the difficulties of the inventor with limited capital. It is, in fact, a case of aiming at the crow and hitting the pigeon. Intended to control the high-handed proceedings of two or three large German firms, it must inevitably unfavourably affect every inventor, poor or rich, native or alien, and, contrary to all the doctrines of democracy, add further strength to the power of the purse.

Lastly, it seems to me that patentees are incurring a great risk from any attempt to seriously alter the Act of 1883, by drawing distinctions between different classes of inventions or discoveries. The Act of 1902 is said to be a failure. But surely if that is so, Section 11 of the Act of 1907 is all that we require ; why should the whole Act go into the melting pot because the clauses imposing compulsory working, even as amended in 1892, have proved ineffective or costly?

Like the European nations, inventors must feel that their greatest interest is peace. The settlement of 1883 should not be disturbed, except where, as in Section 22, it has proved seriously defective, and where an attempt to mend it (the Act of 1902) has failed.

The Hon. Secretary (Mr. Julian L. Baker) points out that since the above remarks were written, Mr. W. Pearce, M.P., has informed us that Clause 2 has been amended, so that it now reads : "A provisional specification and a complete specification must, in the case of an application for a patent for a chemical invention, be accompanied by such specimens or samples as may be prescribed, and accordingly in Subsections (3) and (4) of Section 5 of the Patents, Designs, and Trade Marks Act, 1883 (which Act, as amended by any subsequent enactment, is hereinafter referred to as the principal Act), where the invention in respect of which an application is made is a chemical invention, such typical samples and specimens as may be prescribed shall, if required by the Comptroller, be furnished before the acceptance of the complete specification."

On careful consideration, we fail to see that the force of Clause 2 in its original form is in any way essentially modified—the wording is still emphatic and the intention of the framers of the Bill is clearly to demand samples. In such highly technical matters as chemical inventions the desire to use discretionary powers in demanding samples is not likely to be strong on the part of the Comptroller, the more so as there is no indication as to how he is to use his discretion. Neither is the Patent Office staff, as at present constituted, likely to be of much assistance to the Comptroller in deciding such a point. When Mr. Lloyd George introduced this measure, an apparently strong case was made in favour of the British inventor in demanding that samples should be deposited, as it was urged that foreign syndicates made claims to cover any possible invention that might afterwards be discovered. But the British inventor is in the same position as the foreign syndicate, and it will be apparent to all that many inventions would require careful working and expenditure of money before samples could be submitted to the Comptroller. It has been urged that such cases should be met by excusing or postponing the production of samples when there are reasons brought forward that their production entails a serious hardship on the inventor. It is true that the alteration of Clause 2 only takes effect in the complete specification, whereas in the original wording, it applied alike to provisional and complete specification of chemical patents. It may therefore be inferred, that the inventor of limited means has a few months' grace to prepare samples, and is accordingly in a somewhat stronger position in approaching persons to carry out experiments with a view of preparing the product or products claimed.

Clause 9 presents some novel and remarkable features, and paves the way for vexatious litigation and blackmail, for any person may, in the prescribed manner, apply to the Comptroller for an order revoking a patent on any one or more of the grounds on which the grant of a patent may be opposed. Thus, any person may harass a patentee, and although the intention of Mr. Lloyd George is to provide cheaper procedure for revocation for the poor inventor, the results of this clause, if it is passed in its present form, will render the obstructive action of powerful syndicates much easier. Thus, an inventor may have a patent granted to him and have started working it, and then finds that a syndicate applies for revocation. The chances are, that not having the means to face litigation, he would be forced to a compromise which would have no foundation in equity. As there is no proviso confining this to patents issued subsequent to the passing of the new Act, its effect will obviously be retrospective, as it will apply to all patents existing at the time the Bill becomes Law.

"PATENTS AND DESIGNS BILL," 1907.

BY OLIVER IMRAY AND A. G. BLOXAM.

There is very little doubt that some of the provisions of this Bill are the result of the action of the Manchester Chamber of Commerce, and the pressure brought upon the Board of Trade by that and kindred bodies, insisting upon the compulsory working of patents and the granting of compulsory licences. The Bill contains many provisions which, in our opinion, will be of considerable advantage to inventors and manufacturers generally. This Bill has been very carefully debated by the Chartered Institute of Patent Agents, and we have availed ourselves of the result of their deliberations, and the following observations are in many cases the expression of their views.

The fundamental principle upon which a wise Patent Law should be based is, that it is for the good of the State that inventors should receive every encouragement to publish their inventions. Every legal enactment that tends to encourage secrecy on the part of an inventor should be most carefully scrutinised before it is adopted.

Section 1 deals with the question of the legal position of *joint* patentees. The exact meaning of the section is by no means clear. According to the present interpretation by the High Court of the grant of a patent to joint patentees by the High Court (*In re* Gaulard and Gibbs' Patent), when one of the joint patentees dies the whole property in the patent vests in the survivor. Furthermore, as the law at present stands, each joint patentee is at liberty to work the invention, or to dispose of his interest in the patent, quite independently of the other or others, and without having to account to the other or others for any profit made. The present position may entail a great hardship on an inventor. What is, therefore, apparently required is simply a clause by which the representatives of a deceased patentee should stand in exactly the same position as the patentee stood prior to his decease.

Section 2 now requires that in the case of chemical inventions a complete specification must be accompanied by such specimens or samples as may be prescribed.

It is much easier for the large chemical companies and firms, who employ large staffs of chemists, to prepare and lodge samples, than for an inventor—for example, an employee—who has no means or works at his disposal, but who may nevertheless have conceived a valuable chemical invention. This section will therefore, both for the above reason and also because of the large expense involved, press more hardly on the poor inventor than on the great firms against whom it is evidently directed. The large foreign firms, moreover, having had for many years past to file samples in the German Patent Office, are better able to meet the requirements of this section than an English inventor; moreover, they can afford to make many more samples and thus obtain much wider protection, and the samples which they make will be much purer than the small inventor is likely to make, so that, if it is possible subsequently to appeal to the sample, the large manufacturer will have a great advantage. It appears to us, however, that any subsequent appeal to the sample will be highly unsatisfactory. Who is to vouch for the conditions under which the sample has been kept? How many experts can say what are the components of an azo-dyestuff? In the case of high explosives it would be extremely dangerous to handle or store samples. Many chemical inventions deal, at the present time, with the rarer metals, and it would be a serious expense to an inventor to lodge samples, while where the metal is extremely rare, almost impossible. If an inventor files samples it must have the effect of limiting his invention and of leaving the field open to others to make obvious analogues and to claim them as separate inventions. As the chance of others doing this is much less if he works in secret, the inventor will prefer such working.

The criticisms of examiners who are mere bookmen are already sufficiently irritating; when opportunity is given them to pretend to analyse samples to see if they are what they claim to be, matters will be much worse. At the present time competition is so keen that every day's delay in filing the patent application is of importance. The preparation of the necessary sample will frequently mean weeks. Dr. Otto Witt pointed out, in 1893, that the German requirements as to lodging samples and specimens gave a great advantage to large manufacturers over the inventor working for himself or over the small manufacturer. The filing of samples has been abandoned in the United States and Canada, and has become a mere farce in Germany. In the interests of the independent inventor and the small manufacturer this clause should be strongly opposed. It is doubtless more particularly aimed at the wealthy German dye-manufacturers who protect so many inventions in this country but do not work them here, and has for its object to make the obtaining of omnibus patents more difficult.

There are, however, many hundreds of patents taken out for other chemical inventions, and in aiming to strike at one particular industry the whole chemical industry is involved.

It is believed that Section 6, which appears to have been borrowed from Germany, will lead to a great increase in the number of oppositions, and will entail great hardship to many inventors, and especially to poor inventors. In effect it enacts that all objections which are usually raised as a defence to an action for infringement (except want of utility, prior use, and disconformity) may be utilised as grounds of opposition, coupled with an additional ground which opens the door to blackmail and fraud. As an example: A lodges an application on the first of January, accompanied by a provisional specification, for a patent for an improved steam-engine, and B on the first of February for a patent for a new lubricating compound. If B publishes his invention in the meantime, then all A has to do to enable him to stop B's patent is to insert in his complete specification a statement that he finds B's lubricant suitable for his engine. A need not make any claim to the lubricant, but simply describe it, so that no objection can be raised on the ground of disconformity. Then since B's invention "has been described" . . . in a "complete specification for a British patent which . . . will be of prior date to the patent the grant of which is opposed," . . A can successfully oppose the grant of B's patent. In addition to this it is believed that it will be a great hardship, particularly to a poor inventor, to be compelled to fight what is practically a patent action before he can obtain a patent. Such an action would generally be decided before the invention had been brought into use, so that the action would have to be decided upon mere paper-publications, without any experience of the utility of the alleged invention. In our opinion the grant of a patent should never be refused merely on the ground of prior printed description. This is the principle upon which the Act of 1902 established the system of searching which now prevails, and this principle ought to be maintained.

The action would also be fought at a time when the inventor would be least able to bear the expense, and it would become practically impossible for any inventor to secure patents without obtaining professional assistance.

If such wide grounds of opposition are given, then there should be an unrestricted appeal to the Courts, as in infringement cases, as an appeal to the Law-officer would be eminently unsatisfactory and inadequate.

Section 7 is a good section, permitting extension of period for sealing patents in certain cases.

Section 8 is also a good section, doing away with the necessity of giving reasons for obtaining extensions of time for payment of taxes, &c.

Section 9 is a very important one, giving power to the Comptroller to revoke a patent on the same grounds as those on which a patent can be opposed. We think this section should be strongly opposed for the following reasons: Taken with Section 6, this section gives the Comptroller the power of a High Court Judge, and from him there is to be but one appeal—*viz.*, to a Judge of First Instance. It also appears to be eminently inequitable that the infringer of a patent should have two chances in his favour and the patentee only one. If the infringer is successful in an action for revocation the decision is final, whereas if he is unsuccessful the decision counts for nothing, for he can again attack the patent on precisely the same grounds before an entirely different and higher tribunal as a defence to an action for infringement. An action for revocation and an action for infringement ought to be tried before the same tribunal.

Again, it appears to be absurd that when the comparatively minor point of infringement is in question there should be an appeal to the highest tribunal in the land, whereas when the very existence of the patent is at stake the final decision is to rest with a Judge of First Instance, who would probably not be able to take further evidence on appeal.

In addition to this the office of the Comptroller is, while partially legal, largely administrative; and the present work of the Patent Office is such that it is believed to be a physical impossibility to satisfactorily undertake the judicial duties which are entailed by what is practically patent litigation.

A further point is that this section would open up a third procedure for revocation, which would then stand:

1. Application to the Comptroller with appeal to a Judge of First Instance.
2. As a counter-move to an action for infringement with appeal to the House of Lords.
3. Application to the Board of Trade with reference to the Court.

And finally, it would appear extraordinary that, if it is sought to revoke a patent on the grounds both of want of novelty and want of utility, it will be necessary to lodge two petitions, one to the Comptroller and the other to the Court; and it is equally extraordinary to give the Comptroller the great power of revoking a grant from the Crown while denying him the lesser power of granting compulsory licences.

Probably this section had its origin in the belief that it would greatly simplify and cheapen procedure to go before the Comptroller; but, as Mr. Gordon recently pointed out in a paper he read before the Society of Arts, it is not so much the Court that causes the expense as the evidence of the experts and the many other witnesses that are brought forward; and therefore the expense is likely to be just as serious before the Comptroller as before the Court.

Section 10 is another very important one, giving power to the Comptroller to revoke a patent worked exclusively or mainly outside the United Kingdom. In our opinion this section would have exactly the contrary effect to that desired, for, so far from protecting British industries, it would enable large foreign manufacturers to crush British industries.

At present the owner of a British patent can prevent the importation into this country of the patented goods made abroad by others. Under the section, however, if the foreign manufacturer was working on a larger scale than the patentee, he, or someone on his behalf, could have the British patent revoked, and then the goods could be freely imported. Or, while the patentee is still struggling to get his patent worked in this country, the manufacture may become well-established abroad, either by his licence under his foreign patent, or because he has no foreign patent. Thereupon his patent can be revoked.

Take another class of case: Brown has a patent for an improved manufacture of rubber from latex. He holds his patent to prevent importation of the rubber, but, naturally, makes the rubber in Ceylon. When, in defence of Smith's action for revocation, Brown pleads that it is impossible to import the latex in order to work here, because the freight would swallow up the profit, Smith proves that he can import and work at a profit, Brown's patent will have to be revoked.

As is possibly well known, the very large majority of patent agents have for years been opposed to compulsory working, and have striven, with some success, to secure modifications of the Continental and other laws in which such requirements prevail. To compel a patentee to establish works in a series of countries, or else to forfeit his rights, is a great hardship. Many inventions can be satisfactorily and profitably worked from a single factory, while such manufacture could not be continued except at a loss if factories had to be started in each country. In all the leading patent-granting countries the consensus of opinion appears to be in favour of compulsory licences in lieu of compulsory working; and a further and not unimportant point is that the majority of the British Colonies pass what are practically *replicas* of any British Patent Act; and, while it might benefit our Colonies to compel British, as well as foreign patentees, to establish factories in each Colony, or forfeit their rights, still it would entail great hardship on the home patentee.

On the other hand, it is the almost universal opinion of patent agents that home industries should not be unfairly prejudiced by "dog-in-the-manger" grants, and that if any home manufacturer is unduly handicapped, redress should be obtainable; and, in our opinion, this protection to home industries can be satisfactorily secured by a suitable compulsory licence clause.

Section 10, as framed, affords many encouragements to litigation, and, moreover, seriously encroaches upon the "consideration" (*viz.*, fourteen years' enjoyment) given by the State in return for the disclosure by the patentee of his invention to the public.

When a patent is exploited either privately or through a public company, there is generally a thorough investigation as to its validity. Every source of invalidity—that is, each additional possible cause of invalidity—increases the difficulty of getting capitalists to take up an invention and embark capital in its manufacture. If there is a clause in the law by which the non-working of the patent within a given time or its non-working in this country, if it is worked abroad, renders the grant liable to cancellation, that introduces a fresh source of invalidity, or possible invalidity, and renders it to that extent more difficult to get an invention taken up. It may be taken that patents are presumably intended to grant some right, and that the annulling of that right on the ground that the patentee has failed to comply with some almost impossible requirement of the law is a condition that will not commend itself.

Spasmodic and more or less fictitious manufacture for the mere purpose of complying with the requirements of a working clause has no practical effect in promoting native industry, but it has a great effect in discouraging inventors from taking patents and subsequently in destroying their patent rights if acquired. It is common for an intending patentee to inquire what are the conditions for maintenance in different countries, and to avoid those countries which impose onerous conditions in regard to working. Many inventions are of such a character that the inventor cannot get them worked except with the consent of powerful bodies, such as great companies.

It is pertinent to ask, What is working the invention? In many cases the invention is a small step the carrying out of which would entail but little "working"; for instance, the coupling operation, which is the sole step constituting the so-called invention in an azo dyestuff patent.

The evil aimed at by this section should not be treated as a ground of revocation, but should be included as one of the grounds upon which a compulsory licence may be granted under Section 11.

Section 11 relates to the granting of compulsory licences, and endeavours to make clearer the provisions of the 1902 Act in this particular. The section, however, is somewhat vague in its terms.

In the first place, no indication is given as to what "adequate extent" or "reasonable terms" imply. We are of opinion that a further proviso should be added to this section, somewhat to the following effect:—"That no application for compulsory licence shall be entertained until after the applicant has made the patentee a *bona-fide* offer of terms for such grant, and has produced evidence of his ability to comply with the terms so offered."

With regard to Sections 9, 10, and 11, it should be made clear (should these sections, either as now drawn or as hereafter modified, become law) what is the exact meaning of the words "any person interested"; it would, for instance, be altogether against the object of the Act if a dealer in dyes could get a patent revoked in order that he might buy Swiss products rather than dyes from a German owner of a British patent, and this would certainly be of no advantage to British industry. It is suggested that the person applying for revocation ought to be compelled to undertake the manufacture himself if the patent is revoked.

The following resolution was passed at the meeting of the International Association for the Protection of Industrial Property, in Vienna (1897):—"The Congress is of opinion that it will in the future be necessary to give up the principle of compulsory working." At that Congress representatives of Austria, England, France, Germany, Hungary, Italy, Russia, and Switzerland were present. The same Association, at the Congress held in Berlin in 1904, proposed the following resolution:—"Neglect to work a patented invention should entail, not the voidance of the patent, but a compulsory licence drawn up in accordance with the internal law of each country."

This resolution was passed by a large majority, and confirmed at the Congresses held by the same Association at Liège in 1905, and Milan in 1906. All new Continental laws on the subject in consequence are more lenient than those they replace.

If a provision in accord with the foregoing resolution comes to be embodied in the International Convention at an early date, as may fairly be anticipated, revocation under Section 10 will become a dead-letter, because it is provided in the section that there shall be no revocation in contravention with any such convention.

Sections 12, 13, 14, and 15 are purely official sections which must necessarily meet with approval.

Section 16 deals with the avoidance of certain conditions attached to the sale, &c., of patented articles. This section unnecessarily interferes with the freedom of contract. In any case where there is a refusal to grant licences without such objected-to conditions, or without unreasonable terms, this could be sufficiently met by Section 11, relating to the grant of compulsory licences.

Section 17 limits the rights of appeal in certain cases. For the reasons given previously the appeals referred to in this section should not be limited to a Judge of the High Court appointed by the Lord Chancellor, and the parties should have the right of appeal to the Appeal Court and the House of Lords, as in action for infringement.

In conclusion, we submit that the most important provisions of this Bill are directed against certain foreign manufacturers, who take advantage of the Free Trade of this country, and that if this is a real injury to the country special legislative enactments should be passed to prevent it, not an Act of so wide a character as to include all patentees, greatly to their inconvenience, and, in our opinion, to the detriment of the general trade of the country.

Mr. **Levinstein** wrote a reply to Messrs. Imray and Bloxam's criticism, of which the following is an abstract :—The Manchester Chamber of Commerce took a leading part in the agitation for a summary and cheap procedure for "compulsory working" of patents. Its efforts were, however, strongly supported not only by the trading and industrial community, but also by our own society. The deputation which waited on Mr. Lloyd George on April 9, 1906, and which urged him to enforce compulsory working of British patents in this country if worked abroad, represented more than 100 Chambers of Commerce and a large number of Members of Parliament ; it was further supported by six members, specially appointed by this Society of Chemical Industry, and also by the Manchester Association of Engineers, the Silk Association, the Pharmaceutical Society, the United Turkey Red Association, the British Cotton and Wool Dyers, the Calico Printers' Association, the Bradford Dyers, the Science Guild, and a number of the largest employers of the country, and by leaders of our operative classes, representing more than a quarter of a million of our workpeople. I will not follow Messrs. Imray and Bloxam into all details to which they take exception, but will only deal with the more important points of the new Bill.

Section 2.—This section has been inserted into the new Bill for no other reason than to stop as far as possible abuse frequently committed by some patentees under cover of Section 18 (the amendment of patents) of the old Act. It is well known that some patentees throw out their nets as far as possible. They include in their British patents a large number of alleged inventions, which in reality they have never made. For example : A patentee may have discovered one combination, but, not satisfied with his ingenuity, he includes in his claims all theoretically possible combinations, which sometimes run into thousands. This accounts for the fact that some British specifications cover from 20—30 pages of printed matter, whilst the corresponding German and American patents may only cover from 3—4 pages. To make the points still clearer : An inventor has discovered, for example, a new organic acid ; he applies in Germany or America for protection of his acid ; this acid may be suitable for the production of colouring matters, but when the same patentee applies for his British patent, his mind has meantime expanded, and he includes in his claim not only the acid which he discovered, but also an endless number of colouring matters, which he may have arrived at by theoretical deductions, but which colouring matters, in fact he has never made or seen. He thus not only deceives the public, but blocks the way to British or other inventors. If by luck the speculative combinations turn out useful, so much the better for him ; but if not, and he finds that many of his speculative inventions will not work, he applies to the Patent Office, under Section 18, under the pretext that he wants to narrow down his claims. He applies to strike out all combinations, and claims which do not hold water, and would, in case of an action for infringement, invalidate his patent. It happens sometimes that, say, out of 20 claims, 15 or more are disclaimed, and as long as he does not enlarge his invention, or make it substantially different from the original, the Patent Office will accommodate him.

There is, however, one point which requires amendment. I am of the opinion that it would be preferable to file samples or specimens only with the final specification, and not with the provisional.

I will now generally deal with Sections 9, 10, and 11, of which Section 10 is the most important, of the new Bill, and its consequences, if the Bill becomes law, may be far reaching. There is little doubt that it will confer a great boon on inventors, manufacturers, and our working-classes, and generally increase the stability of our industries.

Messrs. Imray and Bloxam object to the authority of the Comptroller being in the first instance applied to under the Sections 9 and 10. It is, however, in my opinion, of the utmost importance that the authority of the Comptroller should be upheld as the authority or Tribunal of First Instance ; this is one of the most valuable provisions of the Bill, as it affords some hopes that these hearings may be expeditiously and cheaply carried out. The authors of the paper appear to suggest that the first hearing should be before a Judge of the High Court, with appeal to the Court of Appeal. Such a procedure could not recommend itself to poor inventors and manufacturers. A great action-at-law, heard with the aid of counsels and experts—first before one Judge and then, on appeal, before three Judges—implies an expenditure and law costs of thousands of pounds, and would consequently make the most important parts of the new Bill almost inoperative or ineffective. The questions which the Comptroller will have to decide are purely questions of fact, and not of law. The Comptroller already decides most important matters, namely, the grant of patents, disclaimers, or amendments, and he is assisted by a large staff of scientifically trained experts, chemists, engineers, &c. But if he should even at any time commit an error of judgment of facts, the new Bill provides for final appeal to a Judge of the High Court. There is no authority, be he a patent lawyer, a patent agent, or a Judge of the High Court of Justice, who possesses such a profound knowledge and experience of patents as the Comptroller and his staff, through whose hands about 15,000 patents annually are passing. His competency has never been challenged. With suitably drawn rules as to the procedure, the total cost for an application under Sections 9 or 10 need not exceed a few hundred pounds, including an appeal to the Judge, whilst, if two Courts were substituted, the cost may be, if a number of counsels and experts are admitted, anything from £3000 to £6000.

With regard to Section 11, it would certainly be preferable to substitute the Comptroller for the Board of Trade, and I am inclined to believe that the Parliamentary Committee will consider this point.

Finally, I appeal to our Society to support a summary and cheap procedure, otherwise this very excellent Bill, to the main feature of which we have already pledged ourselves, may become ineffective.

Discussion.

Mr. J. **Wetter** drew attention to the fact that there were many cases in which a manufacturer had to consider whether it was better to obtain a patent for his invention or to use it secretly at his own works. The first course was more advantageous to the public, because it forced the inventor to publish his invention, thereby enabling others to use it after the expiration of his patent. If he chose the second course, the secret might be kept for an indefinite time and might die with the inventor. The question then arose, what would happen if a subsequent inventor of the same process took out a patent?

According to the present law the patent was either rendered invalid, not only against the first inventor who had used the process secretly, but also against everybody else, or it was not affected at all, that is to say, either the patentee lost all rights granted by the patent, or the first inventor lost the right of using his process, neither of which alternatives agreed with our notions of justice. That defect might be removed by a special article or clause in the new Patent Act, stating that a patent should be without effect against any person who before the date of the patent had used the invention secretly, but on a commercial scale.

Under the present law, the best course which the secret user and the patentee could adopt was to make a compromise, under which the patentee agreed not to interfere with the first user, while the latter agreed not to publish any facts which might throw doubt on the validity of the patent. But supposing that one of the two parties refused a compromise, the other had to face litigation or blackmail. It was not satisfactory that the secret user should be at the mercy of the subsequent patentee, or that the latter should be at the mercy of the secret user.

In the German Patent Law these facts had received due consideration long ago, and as the promoters of the new Patent Bill intended to imitate foreign patent laws as regards compulsory working of inventions, he wished to direct their attention to the above-mentioned feature and to the desirability of removing causes of litigation.

Mr. A. G. **Bloxam** said that the Society was the representative of the chemical industry of English-speaking people, and they must admit, though with regret, that the manufacture of dyestuffs was a negligible part of that industry. He thought the question before the meeting was, whether the chemical industry which did exist was to be handicapped for the sake of the very small amount which was concerned with the manufacture of dyestuffs. It might be said that the provisions of this new Bill would resuscitate the dyestuff industry; but he did not think that was likely to be the case. He could not conceive what advantage would be gained by the filing of samples illustrative of types of chemical compounds claimed in a specification. If it was thought that these samples would be an aid subsequently to litigation, it was entirely illusory. One could imagine what a very large number of samples would be deposited, and the kind of manner in which they would be preserved. But who would guarantee that they had been kept under proper conditions? Mr. Levinstein had laid great stress on the fact, which he, Mr. Levinstein, assumed to exist to a considerable extent, that these powerful foreign companies filed specifications claiming inventions very broadly and that subsequently, when they found they could not make all the dyestuffs which they had included, amended the Specification in order to make valid the patent, which would otherwise be invalid. But he submitted that that was very rarely done. The number of chemical specifications amended was very small in comparison with the number of patents granted; and if a specification were amended so as to make it valid, who was hurt? All the combinations which the patentee no longer wished to cover were disclaimed, and it was open to anybody who could make them in a successful manner to apply for a patent subsequently; and such patent would be perfectly valid. He thought that Section 2, even as amended in the latest version, would be disastrous to chemical invention generally. Even if it did any good to the dyestuff industry, he did not see why they should sacrifice general interests in order to protect that industry only.

Mr. O. **Imray** said he did not think that one-half per cent. of the patent specifications relating to dyestuffs which were amended in any way whatever. With regard to Mr. Levinstein's remark as to the expense, if they were going to have the Comptroller put into the position that he could actually revoke a patent, they might rest assured that they would have to have the same counsel, the same expert witnesses, and everything else before the Comptroller as were now before the Court; and the expense would not be reduced one iota. Then there would be an appeal to the Judge, and the same thing gone over again; and all that simply to protect the few chemical inventions relating to dyestuffs. He had had a good many years' experience with compulsory working in foreign countries; it was a humbug, nothing more nor less. The whole tendency of legislation in all foreign countries for the last ten years had been to do away with compulsory working, as it was found to be of no use. They were trying to handicap foreign inventors, and especially German inventors; but this Bill, if passed, would apply to every British inventor. All the British Colonies, directly the Act was passed in this country, would pass similar laws; and the effect would be that every British manufacturer would have to establish a manufactory in the Colonies.

Mr. Oscar **Guttmann** read a statement, of which the following is an abstract:—

Reasons are shown for objecting to the proposal to allow the revocation of patents; he develops this argument at considerable length, and shows reasons for believing that the effect would be oppressive and unduly favourable to wealthy companies and to infringers.

He then deals with compulsory licences, to which he objects on principle; he gives attention to details of methods in which they will work, and considers them generally likely to increase litigation.

He next deals with the deposit of specimens in case of chemical patents, which he considers likely to cause inconvenience and delay.

The next point concerns the limit of 50 years prior publication, which may be used as an objection by the Patent Office, and he points out that this does not prevent the public from opposing on publication antecedent to the 50 years.

Having pointed out the new regulation not requiring interest in an opposer, which he considers existing decisions will render inoperative, he concludes by stating that Clause 3, allowing patents of addition, is in his opinion the only valuable part of the Bill.

Mr. A. Gordon **Salamon** said that so far he could not see that any speaker had made out a case against the deposition of samples when required. It had been suggested that the clause was only intended to apply to dyestuffs, but to that he could not assent, and he could speak quite impartially. It would apply in many other cases—for instance, in a recent patent litigation, it was denied on the one side that the product mentioned in a vital specification could be made at all, whilst the assertion that it could be manufactured constituted the case on the other side. Assuming that the Comptroller was equal to his work (which assuredly would be so), then the section, as altered, left it entirely within his discretion whether or no he should demand the deposition of a sample; and, exercising that discretion in an impartial manner, he took it that he would only ask for one if he had occasion to think that the patent was doubtful or fictitious. If the sample then deposited was unsatisfactory, it would save subsequent expensive litigation, and would prove that the patent sought was not to be regarded as a legitimate attempt to improve that which had previously existed. But even then there were one or two points which he thought had escaped consideration. He suggested it was highly advisable that a sworn affidavit should accompany the deposit of the sample, stating that it was made according to the description submitted in the specification. Otherwise it might be a fraudulent or deceptive sample. If such a requirement were not made, the door would be opened to fraud and subsequent complications. Again, in the case of samples which were subject to decomposition, he thought it should be within the discretion of the Comptroller to have an analysis made of the product or sample at the time of deposition, and record made of it by a competent authority. They ought to endeavour to do away with paper patents as much as possible in every industry; and that, he believed, was the dominant intention of this clause of the Bill.

He would draw attention to one other striking defect of the Patent Law, which possibly it might be too late now to rectify in this Bill. He had always felt that the greater the invention, in other words, the greater good an inventor did for the public, the longer time did he take to work it out and perfect it. A toy might be patented which could be sold in Cornhill the next day for 2d., and the protection would continue for 14 years. On the other hand, a patent for a world-benefiting process like the Gilchrist-Thomas, in its necessary development took several years off its life, and not only several years of time, but a large expenditure of capital. It seemed to him very unjust and against the principle of the grant that the amount of profit made within the last few years of the life of a patent should be taken as a criterion of whether or not an extension should be granted. The more money the patentee made out of a great invention the greater benefit it necessarily was to the public; and he did not think that in any event the amount made within the last few years of its life should be taken as in any way influencing the judgment against an extension of time; on the contrary, it ought to be distinctly in the opposite direction. Again, a poor man having to work out a big process, and having arrived at the stage when he had it practically perfect, ought not to be put to the existing great expense of going to the Privy Council in order to get an extension. Although the power must be vested in the Privy Council, he thought the mode of procedure ought to be vastly cheapened.

Mr. **Bernard Dukes** said the first point to which he should like to call attention was Clause 2, and it seemed to him an extraordinary thing that it had not struck any of them that the title "Chemical Invention" was exceedingly vague; it would include anything from a sulphuric acid tower to a new mixture of chicory. Mr. Salamon had suggested that these samples, when deposited, should be accompanied by an affidavit. Mr. Lloyd-George in introducing the Bill heralded it as the "Poor Man's Patent Bill," but the drawing up of an affidavit, the stamp, and the production of a sample, all cost money. He had never yet found anybody who would be unscrupulous enough to supply a false sample, who would stop short at swearing a false affidavit. He had never yet known any English inventor who had taken out a foreign patent and introduced his invention into a foreign country because of the compulsory working clauses. He had introduced it there if he had found it pay; but if he did not find it pay, nobody in the country would find it pay either, until such time as the public had been educated into using it; and by that time, the time for compulsory working would have long ceased. Mr. Salamon had mentioned that a great invention should be privileged with regard to an extension of time. But that gentleman knew better almost than anyone else that great inventions did not spring out of the head of the inventor complete and perfect, but by the time the patent expired the original inventor had already taken out so many subsequent patents that he always kept in advance of any one of his competitors. He considered the present rule was quite good enough.

Mr. **Bower** said there were two objections to the proposed Bill; one was that it possibly invited additional expense and litigation. The members of the Chartered Institute of Patent Agents had been looking into this Bill, and it had been discussed with the sole object of improving the Bill from the general point of view, and without reference to particular interests. Anybody who had anything to do with Patent Law, whether as solicitor, counsel, or expert, could not serve his interest better than by leaving the Bill severely alone, and letting it pass with all its defects. Mr. Salamon had suggested what he thought was another opening for litigation; it was bad enough to have to submit samples, but if an analysis had to be made of them, he saw a vista of subsidiary litigation, almost as great as that which might accompany any infringement of a patent, and this might happen at several stages in the life of the patent. He thought the promoters had entirely lost sight of the basis of English Patent Law, which was, broadly, that in exchange for a complete disclosure of the invention, the State granted a limited monopoly. The framers of this Bill seemed to think that a patent was a free gift to the inventor, who gave nothing in return, and they apparently assumed that inventors were going to apply for the protection of the English Patent Law on the old footing, although by this Bill, at almost every turn, they ran the risk of having their patent taken away from them. It seemed to him that that was rather too much to expect; and one result he thought would be—the secret working of processes abroad and the products introduced into this country, so that the English public would never get what they did now, the disclosure for all times of a valuable invention, but would be flooded with foreign importations more than ever. Before such a radical change in the basis of legislation were undertaken, there ought to be a proper inquiry into it. With regard to the remuneration of the inventor, he thought that part of his remuneration in exchange for his disclosures ought to be that, within certain wide limits, he could make his profit as he chose. It was dangerous to put all these restrictions upon him as to what clauses he might or might not insert in his licence. He knew there had been some cases of abuse, but it was dangerous to legislate for hard cases; for it was a well-known saying that hard cases made bad law. He did not like even the principle of a compulsory licence, though he recognised that it had to come; but it came about simply because the inventor was not playing the game. The original idea upon which the English Patent Law was based was that the inventor should obtain his remuneration by working the invention. It was no part of the implied contract between the State and the inventor that he should keep his invention bottled up for 14 years, as had been done in some cases.

Mr. H. **Sefton-Jones** said that the more the matter was looked into, the more it would be seen to bristle with difficulties. If Mr. Lloyd-George had inquired a little more carefully into the result of some of these provisions, which had appeared more or less in foreign legislation, he would have realised how dangerous some of them were. He did not want to reiterate what had been forcibly put already, but they all knew what took place in the United States with regard to samples. He believed the provision still remained in force that samples might be called for, but they were refused if offered. It would be much better to follow the wise and large provisions of the American law than to adopt the lawyer-made restrictions which encumbered European legislation. Compulsory working was a nuisance to everybody concerned, except, perhaps, to those who were interested in the working. To the patentee it was an extra source of trouble and risk of loss. There were many inventions which could not be worked by an ordinary inventor. He quite agreed with Mr. Levinstein that what was wanted was a more rational procedure with regard to compulsory licences. Such licences, according to his experience, were necessary, but if they were to be granted with the procedure which now obtained, and with restrictions which were read into the law, they were practically illusory. He remembered a case in which there was really no defence to the application; it would not have hurt the company of whom it was required, a German company, to grant the licence, and it was pure obstruction which made them refuse. The case went before the Board of Trade, and the result was a refusal, not on the ground of the application itself, but because the officials of the Board of Trade considered the business record of one of the gentlemen associated with the application was not sufficiently satisfactory. On that account, the perfectly innocent inventors were refused a licence.

Mr. **Hugh Fletcher Moulton** said it struck him that an idea which appeared in one of the memoranda which had been read was that this Bill would be the infringers' palladium; that it was to be for the protection of the gentleman who saw that something was a good idea, a good invention, and one which told him what was necessary to enable him to complete an invention of his own—a way which was really better than his original, but at the time the inventor, being in a hurry, was not able to make a sample of the particular product, and, therefore, this gentleman could infringe the patent. Few wished to proceed on that line, but at any rate there was nothing in this Bill which would prevent the same justice being meted out to the man who tried to do that as in the past. Anyone thinking that the absence of a sample was a defence to an action for infringement would be very seriously mistaken. In patent legislation there were two things to be aimed at—facility in obtaining protection, and full security of property when a patent had been obtained. It was very important that the simplicity of procedure for getting protection should be preserved. The old system had been well described as registration of a claim to title for an invention—nothing more; and he was not certain that that was not the best of all. In England, before an invention was disclosed, whatever claim there might be had to be registered. There was not the chance, as there might be in America, where two years were allowed in which to register the claim, of taking it round and seeing what could be done with it; the claim had to be registered at once, and it seemed to him everything should be done to facilitate that registration. There was supposed to be a danger of bad patents being granted; that, unluckily, could not be helped, but that danger was very small compared to that of saying to a man, before he had proved his invention to be useful, that he had to spend a large sum of money in fighting his way through the Patent Office, through opposition on every ground practically (as this Bill provided), and at the end getting a patent which was no better than the old one. The decision of the Patent Office was of no value to the inventor, and would put him to great expense before he had come before the court of final appeal, that of public utility. It seemed to him that was the most dangerous part of the whole Bill.

Mr. Astbury, K.C., M.P., said it was a great pleasure to him to be present and hear the various views on a subject in which he took a great interest. In the first place, he was given to understand, though one would hardly have thought so, that the Society of Chemical Industry was one of the moving spirits in pressing the Government to introduce a Bill to remedy a disadvantage from which many believed they now suffered, namely, that rich corporations abroad obtained patents in this country and never attempted to work them, obtaining by this means a closed market here for their products. However they might vary in their views as to the proposed measure, at any rate Mr. Lloyd-George, with whom he had come largely into contact over this Bill, had received every deputation which had gone to him, and had listened to all opinions. Even at the present time, while the Bill was going through Committee, Mr. Lloyd-George's attitude inspired confidence that representations on any particular matter would still have full consideration, while a very large number of amendments on the first nine clauses had been accepted, many of which he himself had had the honour of moving. With regard to the specimen clause, he agreed with what the Chairman said about it in its original form, but the present amendment, for which he himself was responsible, seemed one which would not cause any of the difficulties suggested, and would serve many purposes if it were worked as he believed it would be. It had been asked what would be done with the samples, and whether the patent would not be limited by reason of the necessity of samples being required, and also what was to be done in cases of unstable chemical compounds, which if lodged in the Patent Office would deteriorate and become useless. All these were very important points, but the clause as it was drawn, and as those who framed it intended, meant this: First of all, there was absolute discretion given to the Comptroller whether and to what extent he should require any samples at all. In the second place, the clause as now altered provided that the sample was only to be required before the complete specification. Many chemical inventors were undoubtedly dissatisfied with the real invention they had made, so they piled on additional subsidiary matters which they hoped would work out all right, and they spread their net as wide as possible. One speaker said, what did that matter, it only affected himself, because he could come afterwards and amend, by striking them out; but that was the very thing they wanted to prevent. A disclaimer might very well interfere with subsequent inventions. A large number of these chemical patents did make disclosure of a number of subsidiary combinations which had never been made, and some of which could not be made, which disclosure did in certain events interfere with subsequent developments. He did not think it was the slightest answer to say that a man, having done that, could afterwards come, when he wanted to sue on the patent, and say he would amend the specification, and only keep in that which was good. The real protection was this: the Comptroller, especially the present Comptroller, and no doubt his successors, would be men appointed with reference to their knowledge of these matters, was perfectly competent to say when and under what circumstances it would be fair and just to ask for a sample. It was very advisable, and it had always been the practice in the administration of such matters, to keep the law elastic. Hard and fast rules were not wanted, but what was wanted was to have good men to administer the laws and give them a certain amount of elasticity, under which they could prevent abuse and not work injustice. The evil feared from this clause would not arise, and much good would come from it. As to the unstable goods, he did not think that mattered; Mr. Salamon threw out a very good idea, notwithstanding what had been said about the increasing expense. The notion was to try and limit the granting of patents as much as possible to really valid inventions, and here he could not quite agree with Mr. Moulton. There was nothing more injurious to commerce than a number of invalid patents, upon which the large firms who owned them were able to work, and do an enormous amount of injury to trade. He knew two particular cases where one foreign corporation stood on 17 patents and another on 13, very few of which had the slightest chance of holding water if they had been fought. But how many were there in this country who were making a small profit who were willing to fight an action in order to get 16 out of 18 patents declared invalid? There were very few small traders who could afford to run the risk of an action which might cost £8,000 or £10,000 for the privilege of getting somebody else's patent declared invalid, in cases where they could only make a few hundreds a year out of the particular subject-matter of the patent if let alone. It was the view of those who framed this Bill that it was far better that a number of these bad and hopeless patents, which still dealt with difficult subject-matter, should not be in the hands of those large capitalists for the purpose of terrorising small manufacturers and users. He entirely agreed with what the Chairman had said about compulsory working. Some subsequent speakers, however, could not say anything too hard about this compulsory working clause. He thought there had been a great deal of misapprehension throughout the country about what Clause 10 was. It had been talked about as if it would interfere with English patents and English industries, and that a man who took out a patent in this country might take two or three years and have to spend money before he got his patent to work, and that there would be all kinds of doubt thrown on his title. There was nothing of that kind in Clause 10. The period had been altered, and all it said was that if it was proved that at the end of four years from the date of the patent the invention was substantially worked abroad and not in this country, then, unless the patentee could prove certain matters, his patent might be revoked. How was that going to injuriously affect anybody in this country? Anybody who took out a patent in this country would presumably work it here if he worked it at all; if he did not, he probably would not work it at all, and his patent would not be interfered with. He did not think that English inventors would go to Germany and the United States when they wanted to work their inventions. The view of the Government was that if English people chose to work their patents in Germany, there was not the slightest reason why they should have a closed market in this country for their products. That was a matter of policy. One gentleman said with considerable force that the framers of this Bill had acted on the assumption that a patent was a mere present which the country was making to the inventors. That was not quite fair to them, but before discussing that from the opposite point of view, it must be remembered that the whole consideration for the grant of the patent was under the Statute of Monopolies. The theory was that it would pay the country to give the patentee a close time of 14 years, in consideration of an inventor inventing, disclosing, and introducing a new article of manufacture, or a new process into this country. The disclosure was only one part of the consideration. He was quite sure the majority of people in this country did not want a monopoly to be given to foreigners for 14 years for a process which might be extremely valuable, but which should not be worked in this country, so that nobody here was trained in the industry, and nobody taught how to put the invention into practical operation. The result of this state of things is that not only did they give for nothing but the disclosure an absolutely closed market for 14 years, but what happened at the end? Did they then get the benefit of it? Nothing of the kind. Long before the 14 years elapsed, a number of subsidiary patents were taken out on the same lines, which went on perhaps for another period of 10 or 14 years, and at the end, when the time did arrive that the patents had all run out, we had no workpeople trained to work the process and no one skilled in the industry, and we had then to start an absolutely brand-new process, and the attempt might take, according to the difficulty and expense of the machinery and cost of working, another term of many years before we could get our people up to the state of efficiency to make the article at anything like a price which would compete with those who had all this long time enjoyed the monopoly which we had given them. He did not believe that the people of this country desired that the policy of this Clause 10, which was demanded by most of the Chambers of Commerce, should be abandoned; it did not compel a single Englishman or a foreigner to work his process here; it simply said if four years after the granting of the patent in this country it turns out that the invention is being worked entirely abroad, and if a satisfactory reason is not given why it is not worked here, then go on working as much as you like, where you like, but we will not give you a monopoly here for any further period. Amendments would no doubt be made in the clause as it was passing through Committee, but he did not think they would go at all in the direction of annulling the effect of the clause, but rather of strengthening it in the direction he had indicated. He agreed largely with many of the remarks which had been made upon Clause 9. The Chairman referred to the Comptroller having the power to revoke patents which might cause litigation and blackmail, but it might please them to know that Clause 9 had been very largely amended; the Government had brought in two considerable amendments, and had accepted three of his own, and the effect as now drawn was that the Comptroller was only to have the power within four years from the grant of a patent, at the suit of any person who was at present able or entitled to bring a petition for revocation, to revoke a patent on any ground on which a patent might be opposed, providing there were no proceedings for infringement or revocation pending. That brought in Clause 6, which largely extended the powers of the Comptroller in oppositions, but he believed and hoped the Government was going, on report—(by some mistake it was found to be too late in Committee)—to propose that the last five lines of Clause 6 should be deleted, and that the Comptroller should not have power on opposition to refuse the grant on the ground of prior publication or insufficiency of specification. That was a very important matter, because those were extremely difficult things to deal with, and he agreed that if the Comptroller were entitled to consider oppositions on those grounds, it would turn him into a judicial officer for trying extremely difficult questions of law and fact, on which Counsel and experts would be taken in, and he did not see why the trial should not be quite as long before him, if not longer, than before a Judge, but if that was altered in the way he suggested, he did not think there would be much to complain of. With regard to Clause 10, on Compulsory working, he should like to refer to one matter which he regretted to say the Government had not accepted. He pressed strongly in Committee that the tribunal who should try that matter should be the Court and not the Comptroller. It had been represented that it was a mere question of fact, and that the Comptroller was a perfectly proper tribunal on the ground of cheapness. He believed it was to the interest of everybody concerned in the administration of law to make litigation less expensive and more expeditious. The only question however, was whether if they allowed the Comptroller to take a new and extremely responsible jurisdiction, that result would be attained. His own view was that the expense would be doubled. He did not think the Comptroller had either the means or the power of restraining either Counsel or experts that a Judge of the High Court would have, and in keeping the litigation within bounds. The jurisdiction under Clause 10 was not merely to prove whether a patent was substantially or only worked abroad—that might be very simple, but when you came to the limitation of revocations, where the patentee was allowed to excuse himself if he proved many things which were referred to in the Clause, and gave reasons why he had not worked his invention which might or might not prevail, that seemed to him a very delicate and difficult jurisdiction to exercise. The amendment he proposed was that the Court should try this question and not the Comptroller, and that there should be no appeal from the decision of the Judge, except by leave. He believed that leave would not be given in simple cases but in the more difficult cases it would be to the advantage of subsequent litigants that one or two cases should be taken to the Court of Appeal and have the line laid down, and the law and practice would then be rendered more certain and efficient. At present this suggestion was not accepted, and the Clause as it stood was that the Comptroller was the first tribunal, with an appeal to the Judge, whose decision was to be final. With regard to compulsory licences, one gentleman gave some very interesting statistics of cases he had known. He said that compulsory licences were entirely useless, that you could do no good with them unless you stopped importing. He did not take that view at all. What was the object of the Clause? Again it was a question of policy. Looked at from the mere interest of the inventor, especially if he happened to be a large Corporation, it might be better for him to make the article somewhere where he could get cheap labour, or keep it all in his own hands, but that was not the idea of the framers of the Clause. There were a vast number of inventions, which would increase as science progressed, the use of which became vital in many industries. He quite agreed that nothing ought to remain in the Bill which discouraged inventors; men versed in chemistry, electricity, and other sciences should be encouraged to come and work in this country, and they could not be encouraged unless they were given a free hand and reasonable profits from the invention when they had made it. But there was another side to the picture, and consistently with giving them a sufficient reward the rest of the country must be considered. Take the case of a large Corporation that got hold of a patent that happened to be for some important alteration in some great industry; assume it was vital, and that those who used it could absolutely crush out people who used the old methods, and that all the other industries in this country, unless they used the patented method must go to the wall. It was absurd to say that this one Corporation should be allowed for 14 years not merely to get a very large benefit from the invention, but to kill other industries in this country in a way which was not necessary for the purpose of giving him full and proper consideration for his disclosure. In cases of that kind the man should be compelled to grant compulsory licences on such terms as would give him sufficient remuneration. That was the policy of the framers of the Bill. The principle had been in both the two previous Acts, but it had been hedged round with so many conditions that it had been proved unworkable.

Mr. GUTTMANN asked if Mr. Astbury could point to a single industry in this country which had been hampered in that way.

Mr. ASTBURY said he could not specify them at the moment, but his own view was that there were many. There was not the slightest doubt that the inventions in the boot industry, for instance, had made it practically impossible for anybody to make cheap boots commercially unless they used those inventions. He had been in the litigation on both sides, and he knew there were machines in existence without the use of which the smaller bootmakers would absolutely go to the wall. It was the use of that particular form of boot machinery which had stayed the invasion of American boots into this country. There were many other cases, such as the Bessemer steel process, with which there was great difficulty in competing.

Mr. W. F. REID said he did not wonder at Mr. Astbury expressing his surprise that the opinions he had heard differed very much from the policy which he understood the Society represented. The only person who had really represented the views and policy of the Society was Mr. Salamon, but it must be remembered that this was not a meeting of the Society, but an extra meeting to consider this Bill, and the bulk of the speakers had been patent agents, who had been good enough to come and enlighten them on the other side of the question. But when some of these gentlemen acted as wet nurses to the inventor, he thought they were in a very false position. As an inventor himself, and speaking for himself, he did not think that patent agents were either qualified or justified in putting themselves in *loco parentis* to the British inventor. It was only right to say that the Bill, so far as it had been brought through the House, represented very fairly indeed what the Society on two different occasions had asked the Government to do. He was a member representing the Council on two deputations to the Board of Trade; on one occasion they were received by Mr. Balfour, but they did not get practically anything they wanted. They were, on a later occasion, received by Mr. Lloyd George, who listened to them very carefully, and although one speaker had said there ought to be an inquiry, in his opinion, there had been the fullest and most complete inquiry into this subject, and the result was a Bill, which, although it might have weak points, was a patriotic and earnest endeavour to meet a great want, not only of the chemical, but of the other industries of the country. Apart from the commercial point of view, there were others which were of great importance, if foreigners were to be allowed to have a monopoly. There was the great question of fixation of nitrogen from the atmosphere, which might seriously affect our national defence if the industry became established in foreign countries, and was excluded from this by patent monopolies granted to foreigners. With regard to the question of samples, he did not see the slightest objection to giving the Comptroller a sample if he wished. According to the present wording, he was to use his discretion.

Mr. J. Tcherniac said he feared there would be some danger from the clause with regard to compulsory working in the case of a poor inventor. An invention might require expensive machinery in order to work it out, which he might not have the means of obtaining. In foreign countries it was possible that syndicates might produce the same substance which he had invented and bring it here to sell, and if, after three or four years, he had not advanced his invention far enough to produce it, he ran the risk of losing it.

Mr. J. Y. Johnson said there was one point which he considered of great importance, to which he should like to call attention, particularly as Mr. Astbury said that Mr. Lloyd George was still open to any reasonable suggestions. This was with regard to Clause 35, which was retrospective, and this, he thought, was not only unreasonable, but unfair. A man applied for a patent, and disclosed his invention on certain conditions, one of those conditions certainly not being that after three years he might have it revoked, on the grounds stated in the new Act. In many cases he would keep the invention secret, if he knew that in three years' time it might be revoked on those grounds. It was, therefore, unfair that the clause with regard to revocation should be retrospective and apply to patents applied for before the Act was passed and before any indication had been given as to the conditions of the new Act.

The Chairman said that the meeting was called at the express suggestion of Mr. Pearce, because he thought it was necessary to have some idea of the opinion of the members of the London section. The deputations under the auspices of the Association of Chambers of Commerce, in which members of the Council took part, really confined their representations to practically one point, namely, that it was advisable there should be an absolute forfeiture of all British patents which were worked without, but not within, the United Kingdom. They had had a discussion which had ranged over a large number of other points. There was this question of the deposit of samples. Mr. Pearce had handed him a list of the amendments, and had suggested one which he intended to bring forward, and which he hoped Mr. Astbury would take note of, as he understood it was still possible that certain things could be done. It was that where the invention in respect of which the application was made was a chemical invention, such typical examples and specimens as might be prescribed were to be required by the Comptroller, and there it was proposed to put in "for the purpose of his inquiry" before the words "the acceptance of the complete specification." If such words were inserted, he thought it would remove many objections which had been made to the introduction of these samples. He was pleased to find that Mr. Astbury took note as to the remarks he had felt called upon to make as to the instability of many chemical compounds, the fact was all chemists, scientific or practical, were singularly ignorant of the stability of many chemical substances. Take the case of Nicholson's Blue. That substance, and it was one of the most unchangeable substances when used as a dye, as it would stand exposure to light, heat, and all sorts of actions for years, but the sodium salt itself, when kept, if it was not absolutely dry, was affected by something which he believed to be some low form of life, decomposed and smelt abominably, and after a short time its colour disappeared. Nobody would suspect that such a thing was possible. Another case occurred to Prof. Tilden, who kept a bottle containing isoprene, which one would imagine to be very unchangeable. This he had found changed into india-rubber. He endeavoured for months, and he believed for years, to try and find out the way to produce this change voluntarily, but did not succeed. This went to support Mr. Salamon's suggestion, that if samples were to be deposited, they should not be kept, but should be destroyed or got rid of, but, before that was done, there should be a registered analysis for identification. As to the possibility of patents being used in such a way as to act as deterrents to manufacturers in this country through the non-granting of licences, he must agree with those who considered that that was a blot on our present system, which required alteration, and he was pleased to hear that Mr. Astbury approved of what he had said on that point. He knew there were numbers of cases in which serious injury might accrue to this country. There was one which at present was not occurring, but was on the point of it, and that related to all the industries making use of indigo. Artificial indigo, produced not by the plant, but by chemical means, was rapidly displacing natural indigo, but it was entirely made outside the realm, and in a very short time we should be placed in a position of being absolutely at the mercy of manufacturers of indigo, who would not be British subjects, and who would not be amenable to the laws of this country. There was, therefore, a very sound reason indeed for introducing the clause as to compulsory working. They all felt that Mr. Lloyd George had been working hard for what he believed to be the true interests of the country, and after what they had heard from Mr. Astbury they must feel that he was surrounded by men who were equally concerned for the good of the country, and men whose knowledge and experience of law and other matters were such as to make it quite clear they were perfectly safe in their hands. They only asked that attention should be paid to certain points on which they considered the Bill was weak. They knew that the legislators would receive with pleasure any information they could give, and they would be all happy to place at the service of the Committee any technical information on matters on which legislators were naturally not such good judges as those engaged in industry.

Newcastle Section.

Meeting held at Armstrong College on Thursday, March 21, 1907.

PROFESSOR HENRY LOUIS IN THE CHAIR.

THE CARBONISATION OF DURHAM COKING COAL AND THE DISTRIBUTION OF NITROGEN AND SULPHUR.

BY ANDREW SHORT, B.SC.

The carbonisation of coal by destructive distillation has been the subject of many investigations, both in the laboratory and on a large scale. The following notes refer particularly to the carbonisation of Durham coal coked in patent coke-ovens.

In coke works the methods are somewhat similar to those adopted in gas-works, the chief difference being a question of the ultimate product. In a patent coke-oven the quantity of coal dealt with in a charge is much greater, and the time required for carbonisation is much longer, than in gas works practice. Hence the conditions required and the products of distillation differ somewhat in the two cases. The temperature of carbonisation is probably higher in coke-ovens than in most gas works, also it is not so easy to prevent the admission of air into a coke-oven as with a gas retort.

The investigations here described were carried out on a battery of patent coke-ovens of the Otto-Hilgenstock type, the plant belonging to the Priestman Collieries, Ltd., at Blaydon-on-Tyne. The ovens are rectangular chambers some 33 ft. long, 6 ft. 6 ins. high, and 20 to 22 ins. wide. They are fired by gas, which is burnt in large Bunsen burners, arranged underneath vertical flues. The charge of coal is about 6 tons 15 cwt. The gases are led off by an ascension pipe into a gas-main, and, by means of exhausters, are drawn through air- and water-coolers, and then forced through scrubbers as is usual in gas-works. The gas is then returned to the ovens, where it is burnt in the flues for the purpose of carrying on the distillation of the coal.

Table I.

Analysis of gas at various periods of carbonisation.

	After 1 hour.	6 hours.	11 hours.	16 hours.	21 hours.	26 hours.	Later test. Oven off main.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Carbon dioxide	1·4	2·2	1·4	1·0	1·0	1·4	0·8
Unsaturated hydrocarbons	5·6	5·0	3·4	1·4	0·2	0·0	0·0
Oxygen	0·8	0·8	0·7	0·2	0·2	0·4	0·0
Carbon monoxide ...	5·4	4·9	4·3	4·4	4·6	9·2	5·4
Hydrogen	39·2	44·8	47·9	54·5	62·6	59·2	76·8
Methane	41·1	36·1	34·1	29·8	23·0	4·0	4·5
Nitrogen	6·5	6·2	8·2	8·7	8·4	25·8	12·5

Average Analysis of Gas.

		Per cent.
Carbon dioxide	=	1·8
Unsaturated hydrocarbons	=	3·8
Oxygen	=	0·6
Carbon monoxide	=	5·0
Hydrogen	=	51·5
Methane	=	28·4
Nitrogen	=	8·9
		100·0

Calorific value (net) = 500 B.T.U. per cb. ft.

Chart A

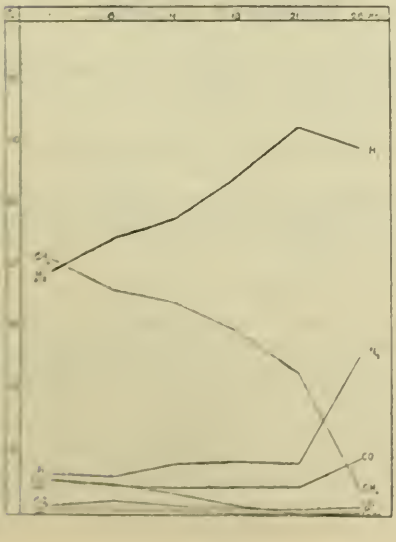
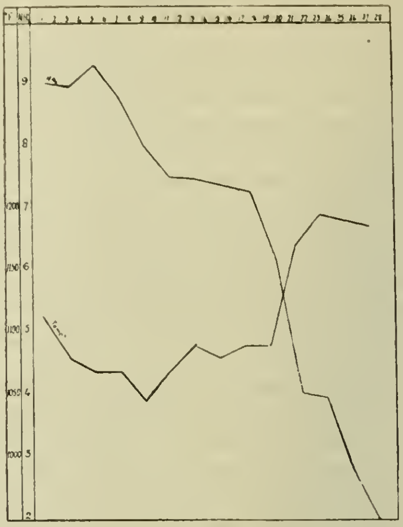


Chart B



The figures illustrated by Table I. and Charts A and B are the results of experiments made with a view to showing some changes taking place during the distillation of coal in such ovens. Taking Table I., which gives the analyses of gas, it will be seen that at the commencement of distillation, when the temperature of the charge is low, the gas given off is rich in illuminants, and relatively poor in hydrogen. As coking proceeds the oven becomes hotter, and the gases suffer by reason of the increase in temperature, and alter gradually in composition. The percentage of hydrogen increases steadily, and methane and olefines decrease in proportion. The tests were taken at intervals of five hours, the gas being drawn off from the ascension pipe, at a point some 2 ft. 6 ins. from the base. The analysis of gas at the 26th hour is somewhat interesting, as it shows a decrease in the percentage of hydrogen, and a corresponding increase in carbon monoxide and nitrogen. This is explained by the fact that the ovens are never absolutely air-tight, so that when the volume of gas given off decreases, as it does towards the end of the coking period, there is a slight suction exerted on the oven by the exhausters which draw off the gas. The result is that a little air has been drawn in and has evidently burnt up part of the hydrogen and the carbon. Thus there is an increase in the proportion of carbon monoxide and a considerable percentage of nitrogen has been introduced. In order to find the effect of relieving this suction, the same oven was afterwards shut off from the gas main, and the ascension pipe cap removed, so that the gas found its way naturally into the air, without any suction being exerted on the oven. A sample of the gas was drawn off, and the analysis is shown in the table. The hydrogen shows a great increase and the proportions of carbon monoxide and nitrogen are considerably diminished.

The evolution of ammonia is shown on Chart B, and also the temperature of the gases leaving the oven. The changes shown on this chart are such as might be expected after studying the changes recorded in Table I. A certain volume of gas was aspirated through sulphuric acid, to absorb the ammonia, and measured. The solution, after being made alkaline with sodium hydroxide, was distilled off into standard sulphuric acid and the amount of ammonia determined by titration with sodium hydroxide. By correcting the volume of gas for temperature and pressure the ammonia content was determined in grms. per cubic metre. The tests were taken every two hours over the whole coking period.

It will be seen that, as coking proceeds, the ammonia gradually falls until towards the end of the period it is practically *nil*. The temperature, on the other hand, rises considerably towards the end.

It is a well-known fact that ammonia decomposes on heating, and this has been illustrated by Lunge, who shows that when ammonia is passed through a tube heated to 600° C. filled with broken porcelain, 34·14 per cent. is decomposed with a slow current of ammonia, and 21·36 per cent. with a rapid current, while at 780° C. the decomposition is complete. Thus it is important that the temperature in the top of the oven should be kept down as far as practicable, and that the gases should be led off as quickly as possible.

In order to see whether a mixture of a large excess of coal gas together with a relatively small quantity of ammonia exercised any protecting influence on the ammonia, I tried the following experiment:—A sample of gas, taken from the main, immediately before entering the scrubbers, was drawn through a tube of Jena glass 2 ft. long, filled with broken pieces of firebrick. The tube was heated to a full red heat in an ordinary Erlenmeyer furnace, and the gas was drawn, in a moderate stream, through the red-hot tube, with the following result:—

		grms. per cb. m.
Ammonia in gas before entering tube ..	=	5·26
Ammonia in gas after leaving tube	=	3·77
Ammonia decomposed	=	1·49

Thus the ammonia suffered decomposition to the extent of 28·3 per cent.

The decomposition of ammonia in the oven probably takes place in two ways, *viz.*, dissociation into nitrogen and hydrogen, and, by contact with the red-hot coke, cyanide of ammonia is produced, and free hydrogen evolved, $2NH_3 + C = NH_4CN + H_2$. Thus we might expect with a higher temperature of carbonisation an increase in cyanogen.

Table II.

Variation of cyanogen in liquor with increased temperature.

Date.	Gas pressure.	Ascension pipe temp.	Ammonia in liquor.	Hydrocyanic acid in liquor.	Hydrocyanic acid per 100 parts of ammonia.
	in.	°F.	grms. per 100 c.c.	grms. per 100 c.c.	
1906.					
Sept. 21 ..	1·20	1069	1·26	0·025	1·98
„ 26 ..	1·20	1086	1·41	0·028	1·99
Oct. 3 ..	1·23	1086	1·26	0·029	2·30
„ 16 ..	1·27	1121	1·34	0·035	2·61
„ 23 ..	1·28	1170	1·48	0·032	2·17
Nov. 15 ..	1·27	1165	1·60	0·038	2·37
Dec. 6 ..	1·27	1150	1·59	0·043	2·70
„ 20 ..	1·27	1150	1·50	0·041	2·70
1907.					
Jan. 18 ..	1·26	1200	1·46	0·036	2·46
„ 22 ..	1·27	1210	1·63	0·043	2·64
Feb. 6 ..	1·27	1200	1·56	0·038	2·43
„ 19 ..	1·25	1130	1·51	0·032	2·12
„ 26 ..	1·27	1176	1·69	0·041	2·43
			1·48	0·035	

Table II. shows the variation in cyanides contained in the ammoniacal liquor with increasing gas pressure on the burners and therefore increased temperature in the oven flues. The table gives the gas pressure, the temperature of gas in the ascension pipes, the percentages of ammonia and cyanogen as cyanides in the liquor. As the strength of the liquor varies from day to day, the relative proportion of cyanide to ammonia has been calculated. It will be seen that as the pressure of gas is increased the temperature of the gases leaving the oven also rises, and an increase in the amount of cyanogen follows. The discrepancies in the table can be explained by the fact that the tests were taken only at intervals. The general trend is, however, shown fairly clearly to be an increase of cyanogen with increased temperature, the cyanide resulting from the decomposition of ammonia.

A comparison of the conditions existing in the various forms of retort used for the distillation of coal affords an interesting study. In the horizontal gas retort we have a comparatively small ▭ shaped retort heated all round by the flue-gases. The coal is charged into this red-hot retort, and lies in a more or less thin layer on the bottom, leaving a considerable space above it. The retort is cooled somewhat by the coal. As distillation proceeds, the temperature of the retort increases, and the gases coming off come in contact with the hot sides and top of the retort. That decomposition takes place is seen from the thick deposits of carbon on the roof of the retort, this carbon being to a large extent the product of decomposition of hydrocarbons in the gas. Towards the end of the distillation the charge becomes very hot and more decomposition takes place, resulting in the production, during the later stages, of a gas low in hydrocarbons and rich in hydrogen, the hydrogen being a result of the decomposition of the hydrocarbons. The ammonia yield also suffers, especially when the temperature of distillation is high, as is the case in most modern gas-works, and the quality of the tar also deteriorates. On the other hand the charge is worked off more quickly than in a coke-oven. This decomposition has been fully realised and attempts have been made to overcome the difficulty by adopting different methods of carbonisation. One, and perhaps the most successful from a chemical point of view, is the vertical gas retort, forms of which are being worked both in this country and on the Continent. This type of retort consists of an upright cylinder into which the coal is charged from the top. The charge practically fills the retort, which is heated from the outside, the heat gradually penetrating to the centre. The gas evidently takes its course up through the comparatively cool core to the top of the retort, where it immediately enters the ascension pipe at a low temperature, and is drawn off without further contact with the highly-heated sides of the retort, and so is not liable to undergo further decomposition. Bueb, in a description of the vertical gas retorts of the Dessau type, gives the average yield of ammonia from vertical retorts as 3·11 kilos. per ton of coal and from ordinary retorts, 2·32 kilos., an increase of 34 per cent. in ammonia yield. He also states that the quality of the tar is greatly improved, as it contains a much larger proportion of benzene and its homologues, is thinner, and practically free from suspended carbon. Besides, the coke produced in the vertical retort is harder than that from horizontal retorts.

In the horizontal coke-oven there is a large rectangular chamber some 33 ft. long by 6 ft. 6 ins. high and 2 ft. wide which is almost completely filled with coal, leaving only a relatively small space at the top for the exit of the gases. Coking proceeds from the sides inwards, and the heat gradually penetrates to the core. This oven would seem to combine some of the features of both the vertical and horizontal gas retorts. For instance, the centre of the charge remains at a comparatively low temperature for the greater part of the coking period, rising at the centre only towards the end of the distillation. The temperature of the flues is at least 2000° F., whilst that of the gases leaving the oven is only 1000°—1200° F. It is thus reasonable to suppose that a proportion of the gas rises through the cooler centre core, as is contended to be the case in the vertical retort, especially as the coke in the centre, near the top of the charge, is frequently a little honeycombed, whilst that on the outside is always hard and dense. The gas must, however, as in the horizontal retort, pass under the hot top of the oven on its way to the ascension pipe, and if this surface is highly heated, decomposition will take place. The volume of the space above the coal is, however, much smaller compared with the bulk of the charge than in the horizontal retort. In any case the yield of ammonia is very similar to that from a horizontal gas retort, and the tar is moderately low in free carbon, when compared to that from gas works, working at high temperatures. A vertical coke oven, with recovery of bye-products, has recently been patented by A. O. Jones, and it will be interesting to see, when this oven is in use, whether the improvements obtained by Bueb and others with the vertical gas-retort, are repeated with a vertical coke-oven, which is similar in principle.

Distribution of nitrogen.—Figures showing the distribution of nitrogen have been published by various authors, among whom are Foster, Knublauch, and, recently, McLeod.* Foster's figures relate to English coal, Knublauch's to German, and McLeod's to Scottish coals.

Some of the data are tabulated below :—

Nitrogen.	Foster.	Knublauch.	McLeod.
	per cent.	per cent.	per cent.
As ammonia	14·50	12 to 14	17·1
As cyanogen	1·56	2·0	1·2
In the coke	48·68	50·0	58·3
In the tar	35·26	30·0	3·9
In the gas			19·5

The figures given below were obtained from the results of actual working on the large scale in coke oven practice, and most of them over a considerable period, the object being to obtain results over an extended period rather than from isolated tests or laboratory distillations. The following method was adopted :—The average percentages of nitrogen were determined in the coal, coke, and tar, in the ammoniacal liquor, and in the end gas after leaving the scrubbers, together with the yields of these various products. The total quantity of coal carbonised during six months was calculated back to dry coal, the average moisture in it being known. The quantity of coke made was similarly calculated to dry coke. The moisture was determined in each by daily tests. To the coke figure was added the coke breeze and ballast, also calculated to the dry material. This figure for "total coke" worked out at 76·44 per cent. on the dry coal. The yield of tar on dry coal was 4·00 per cent. The total quantity of ammonium sulphate made, each lot of which was analysed, was calculated back to ammonia. To this figure was added the ammonia in the spent liquor from the stills, and thus a figure was found for total ammonia in the gas-liquor, and calculated back to percentage yield of ammonia on the dry coal. This figure worked out to 0·288 per cent. From the analysis of the ammoniacal liquor (see Tables III. and IV.) we get the distribution of nitrogen in it as ammonia, cyanide, and sulphocyanide (any nitrogenous organic bodies contained in the liquor were neglected). Having these proportions, and knowing the percentage of the nitrogen in the coal which is actually obtained from the liquor as ammonia, we can get the relative proportions of the nitrogen yielded as cyanide and sulphocyanide in the liquor. The analysis of the liquor must be performed on the fresh sample, since, on keeping the liquor for a time, the cyanide disappears, probably reacting with ammonium polysulphide produced, on standing, from the ammonium sulphide, to form ammonium sulphocyanide. For example, a fresh sample of liquor gave 0·042 per cent. of hydrocyanic acid. After seven days the percentage had dropped to 0·027, and after 21 days to 0·009 per cent.

TABLE III.

Analysis of ammoniacal liquor.

grms. per 100 c.c.
Ammonia—Free .... = 1·41
„ Fixed.................. = 0·11
Total .... = 1·52

Sulphur. Total .... = 0·262
„ as sulphuretted hydrogen = 0·237
„ as sulphocyanides ..... = 0·013
„ as thiosulphate and sulphite .... = 0·008
„ as sulphate .... = 0·004
Carbon dioxide .... = 1·49
Cyanides—
Ferrocyanides .... = *nil.*
Cyanides as HCN .... = 0·036
Sulphocyanides (as HCN) .... = 0·0119
Chlorides (calculated as HCl)...... = 0·153

TABLE IV.

Distribution of nitrogen in liquor.

per cent.
Nitrogen as ammonia .... = 98·31
„ „ cyanides .... = 1·47
Sulphocyanides .... = 0·22

Distribution of sulphur in liquor.

Sulphur as sulphuretted hydrogen = 90·46
„ „ sulphocyanides .... = 4·96
„ „ sulphite and thiosulphate = 3·05
„ „ sulphate .... = 1·53

There now remains the nitrogen in the gas. The cyanogen is only partially extracted by the scrubbers; that portion remaining in the gas was estimated by the Prussian blue method, the small quantity of residual ammonia in the gas being estimated in the usual way. Assuming that a ton of coals yields 10,000 cb. ft. of gas, the percentage of the nitrogen of the coal which remains in the end gas as cyanogen and ammonia can be calculated. The figure, 10,000 cb. ft., for the yield of gas is assumed since in coke works the gas is not measured as it is in gas works. Table V. gives the various figures for the nitrogen distribution. The difference figure is taken as free nitrogen in the gas. This it is impossible to verify as under the best working conditions some air is liable to be drawn into the oven.

TABLE V.

Nitrogen distribution.

The dry coal contains 1·57 per cent. nitrogen.

		Calc. to dry coal, per cent. nitrogen.	Total nitrogen.	Total nitrogen.
Nitrogen—	per cent.		per cent.	per cent.
In coke	0 89	0·680	—	43·31
In tar	1·17	0·047	—	2·98
Nitrogen as ammonia—				
(*a*) In liquor	1·52 ammonia	0·237	15·10	15·16
(*b*) In end gas	—	0·001	0·06	
Nitrogen as cyanogen—				
Cyanides in liquor .	0·036 HCN	0 0035	0·226	1·43
Cyanides in end gas.	55·54 grs. 100 cb. ft.	0·0183	1·170	
Sulphocyanides in liquor	0·013 sulphur as ¹SCN	0·0005	0·033	
Nitrogen in gas and loss (difference) .	—	0·5827	—	37·12
	—	1·57	—	100·00

That the length of time of distillation influences the percentage of nitrogen left in the coke, has been shown by Anderson and Roberts, who find that if coal is quickly carbonised, a much larger proportion of nitrogen is retained in the coke than is the case with slow carbonisation. In a laboratory distillation with the coal used in the above investigations, I found that 64·91 per cent. of the nitrogen of the coal remained in the coke, a result considerably higher than that obtained on the working scale. The length of time of distillation was, in the laboratory experiment, about three hours, as against 28—29 hours on the large scale. The average percentage of nitrogen yielded as ammonia in the laboratory distillations was 16·05 per cent.

Distribution of sulphur.—The figures for the distribution of sulphur were obtained in a manner similar to those for the nitrogen distribution. The average sulphur contents of coal, coke, and tar were determined, the percentages of sulphur reappearing in the coke and tar were obtained from these figures. The analysis of the ammoniacal liquor gives the ratio of ammonia to sulphur in it. The ammonia obtained from the liquor corresponds to a certain percentage on the coal. From the ratio of ammonia to sulphur we can calculate back the sulphur contained in the liquor to percentage on the coal. Now knowing the sulphur content of the coal we can easily calculate the percentage of the sulphur which appears in the liquor. The distribution of the sulphur in the liquor is shown in Table IV.

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* This Journal, 1907, p. 137.

The sulphur in the gas, existing as sulphuretted hydrogen was determined, and also the sulphur compounds other than sulphuretted hydrogen, which are contained in the gas. Assuming as before that a ton of coal yields 10,000 cb. ft. of gas, the figures can be calculated back to percentage on the sulphur contained in the coal. The distribution of sulphur is shown in Table VI.

Table VI.

Sulphur distribution.

The dry coal contains 0·824 per cent. sulphur.

		Calc. on dry coal.	Total sulphur.	Total sulphur.
Sulphur—	per cent.	per cent.	per cent.	per cent.
In coke	0·782	0·598	—	72·53
In tar	0·30	0·012	—	1·45
Sulphur as sulphuretted hydrogen—				
(*a*) In gas	240·6 grs. per 100 cb.ft.	0·153	18·56	24·00
(*b*) In liquor	0·237	0·045	5·44	
Sulphur as compounds other than sulphuretted hydrogen—				
(*a*) In gas	14·92 grs. per 100 cb. ft.	0·009	1·149	1·72
(*b*) In liquor	0·025	0·004	0·574	
Difference, loss, &c. .	—	0·003	—	0·30
	—	0·824	—	100·0

It was necessary to make the tests on the gas when the sulphate plant was shut down, since the waste gases from the saturators are passed back into the gas-main and mix with the gas from the ovens, being ultimately burnt in the flues. Since these gases consist mainly of sulphuretted hydrogen and carbon dioxide, together with a small quantity of hydrocyanic acid, these compounds would come out abnormally high under ordinary working conditions.

In conclusion, I have to thank Messrs. The Priestman Collieries, Ltd., for their kind permission to publish these figures, and for affording me facilities for carrying out the experiments, and also Mr. E. A. F. Knott for his kind assistance in a great deal of the analytical work.

New England Section.

Meeting held at Boston on Friday, March 1, 1907.

MR. HENRY HOWARD IN THE CHAIR.

THE DETERMINATION OF SMALL AMOUNTS OF ANTIMONY BY THE BERZELIUS-MARSH METHOD.

BY CHARLES ROBERT SANGER AND JAMES ANDREW GIBSON.

The Berzelius-Marsh method has been successfully applied to the quantitative determination of arsenic. On the one hand, the process which depends upon the weighing of the "mirror," first suggested by Berzelius himself(1), has been carefully worked out by Gautier(2), Chittenden and Donaldson(3), and several others, and is applicable to cases in which the amount of arsenic is too small for precipitation as sulphide or in which the separation of the latter would be inconvenient. On the other hand, for cases in which the mirror of arsenic is too small for weighing, or in the rapid estimation of very small amounts, methods similar to that which was first described by one of us(4) have found wide application.

The extension of the gravimetric Berzelius-Marsh method to the determination of antimony is impossible for the reason that, under ordinary circumstances, a large part of the antimony is deposited on the zinc in the reduction flask and does not leave the solution as the hydride. In attempting to apply the method of Sanger(4) to the determination of small amounts of antimony, we were met not only by this difficulty, but also by the well-known irregularity in the deposition of the antimony in the heated tube, the temperature at which the antimony hydride is decomposed being so low that much of the deposit is formed in the wide part of the tube; hence a series of standard mirrors under these conditions is impossible. We have found, however, that both of these obstacles are surmountable, and that small amounts of antimony in solution can be reduced with practical completeness to the hydride, which, when suitably heated, deposits the antimony in such a form as to admit of estimation with reasonable accuracy by comparison with standard mirrors. In arriving at this result two studies were made; first, as to the influence of the concentration of the antimony ions on the deposition of the antimony upon the zinc; second, as to the influence of the temperature and cross-section of the heated tube on the formation of the mirror.

I. *The evolution of antimony hydride in the reduction flask.*—A solution of pure recrystallised tartar emetic was prepared of such a strength that 10 grms. contained 0·0996 grm. of antimony (average of five determinations of the antimony as pentasulphide, also confirmed by the volumetric method given below). A definite amount of this solution was introduced in small portions into the reduction flask (see Fig. 2), which contained 0·5 grm. of zinc and 20 c.c. of dilute sulphuric acid (1 to 12). The evolved hydride was carried through a hot tube by a current of hydrogen according to the method described below, except that the tube was heated, as in the determination of arsenic, at its wide portion. After the deposition of the antimony in the heated tube had evidently reached its maximum, we determined the amount of the deposit, as well as the amount precipitated on the zinc and the residue still in solution. The volume of liquid in the reduction flask was approximately the same in all cases. To find the amount of antimony deposited in the heated tube, the portion of the tube containing the deposit was weighed, the mirror dissolved in hydrochloric acid and potassium chlorate, and the tube, after washing with alcohol and ether, reweighed. The metallic antimony and zinc left in the reduction flask were filtered, washed, and dissolved in hydrochloric acid with the aid of a small amount of potassium chlorate. The antimony in this solution was determined by the iodometric method of Gooch and Gruener(5). The solution, free from chlorine, was reduced by boiling with potassium iodide in excess of sulphuric and tartaric acids. Any residual iodine was bleached by careful addition of approximately hundredth-normal sulphurous acid, and the solution, neutralised with sodium hydroxide, was titrated with iodine after addition of sodium bicarbonate. In the filtrate from the metallic antimony and zinc, the unreduced antimony in solution was determined also by titration with iodine. Four series of determinations were made, using weighed amounts of the tartar emetic solution, equivalent respectively to about 150, 100, 50, and 10 mgrms. of antimony. The results are given in the following table. The analyses under columns C and D were made, in series A and B, with an approximately decinormal solution of iodine, standardised, through sodium thiosulphate and potassium bichromate, against pure iron. In series C and D an approximately centinormal solution of iodine was used, standardised against a determinate solution of thiosulphate made from the decinormal.

TABLE I.

No.	A. Antimony taken.	B. Antimony dep. in tube.	C. Antimony ppd. on zinc.	D. Antimony not reduced.	E. Ratio c/b.
	mgrms.	mgrms.	mgrms.	mgrms.	
			SERIES A.		
1	147·8	9·6	106·8	14·3	11·1
2	156·1	13·8	117·7	7·6	8·5
3	149·2	19·2	105·0	9·6	5·5
4	152·0	19·6	90·0	26·9	4·6
5	151·0	12·9	136·7	12·3	10·6
6	152·9	16·9	100·1	19·7	5·9
	Average of Series A				7·7
			SERIES B.		
1	101·5	17·3	71·9	7·1	4·2
2	100·9	21·6	lost	lost	—
3	100·9	20·0	65·3	5·5	3·3
4	100·7	12·8	73·5	11·2	5·7
5	100·3	13·5	lost	4·7	—
6	100·5	15·7	64·4	7·4	4·1
	Average of Series B				4·3
			SERIES C.		
1	49·7	13·3	28·3	3·6	2·1
2	,,	14·9	22·7	3·6	1·5
3	,,	11·7	27·4	6·3	2·3
4	,,	lost	24·9	2·9	—
5	,,	16·9	21·8	3·9	1·3
	Average of Series C				1·8
			SERIES D.		
1	9·4	7·8	1·8	1·4	0·2
2	10·4	8·7	1·0	1·9	0·1
3	9·5	4·9	2·2	4·7	0·4
4	9·5	5·7	2·0	2·7	0·3
5	9·6	8·7	1·4	3·2	0·2
6	9·6	7·8	2·0	3·3	0·3
	Average of Series D........................				0·3

A study of the above table will show that there is apparently a considerable amount of unreduced antimony in solution and that all the antimony taken is not accounted for, except in series D, in which it is less than the amount apparently found. Though the impurities in the zinc were probably too slight to influence the reaction in any way, yet the amount of zinc, which was purposely small in order to avoid the introduction of large quantities into the solutions to be titrated, was perhaps insufficient for reduction. It is not unfair to suppose that a more complete reduction would have given the same ratios between the precipitated antimony and that evolved as hydride. As to the inequality between the amounts of antimony taken and found, we think that this may be explained by the errors in the titration of such small amounts.

In spite of these criticisms of the above results, it seems to us that the study points to the conclusion that practically all of a small amount of antimony, when introduced into the Marsh apparatus, can be converted to the hydride and collected as a metallic mirror. This conclusion is reached by a consideration of the averages, for each series, of the ratios of antimony precipitated on the zinc to that deposited in the heated tube. These ratios vary from 7·7 in series A to 0·3 in series D, and the rate of progression is not the result of chance. Plotting these results, we have the following curve, in which the ordinates are the amount of antimony taken and the abscissæ the ratios of antimony precipitated on the zinc to that deposited in the heated tube.

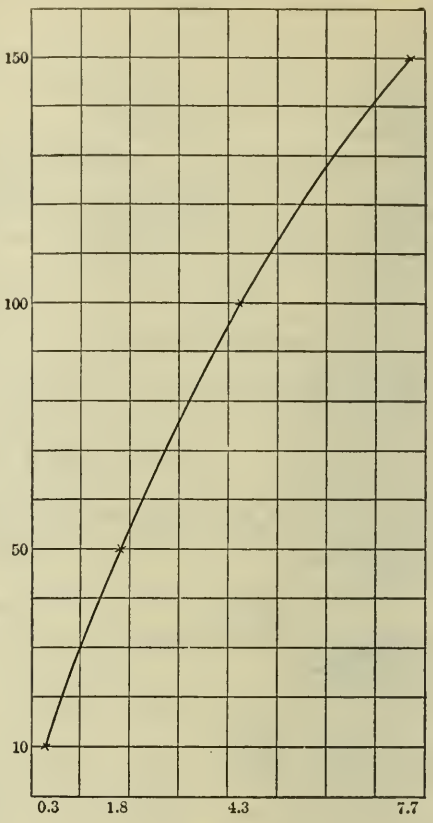

FIG. 1.

From inspection of this curve, it seems reasonable to suppose that amounts of antimony under a milligram when introduced into the reduction flask would be practically converted to hydride, and we have proceeded on this assumption in the development of the method which follows, since in that method the amount of antimony usually taken for a determination in no case exceeds one-tenth of a milligram and is usually considerably under that amount.

With the exception of an abstract of a paper by Rieckher(6), we have found no previous study of the ratio of antimony deposited on the zinc to that evolved as hydride. In this abstract the ratio is said to be between 92 to 8 and 96 to 4, *i.e.*, from 11·5 to 24, but the data for this conclusion are not given. As the original paper of Rieckher is not accessible to us, we can only assume that the concentration of the antimony ions must have been much greater than in our experiments.

II. *The temperature and cross-section of the deposition tube.*—

The preparation of pure, gaseous antimony hydride has been accomplished in recent years by Stock and Doht(7) and by Stock and Guttmann(8). The pure gas has been shown by these authors to have in many respects quite different properties from those of the various mixtures of hydrogen and hydride of antimony which have been in the hands of so many investigators. As to the property which concerns us in this investigation, the decomposition of the hydride by heat, Stock and Guttmann have shown that the pure gas decomposes slowly at ordinary temperature, but very readily in the presence of catalytic agents, notably antimony itself. In the case, however, of the mixture of hydrogen and antimony hydride which comes from a Marsh apparatus containing minimal amounts of antimony, the concentration of the hydrogen is very great compared with that of the hydride, and the decomposition would not take place except at a relatively high temperature. We have, therefore, no data as to the decomposition point of antimony hydride in such dilution, since investigators of this point, for example Brunn(9), have dealt with mixtures containing much greater amounts of antimony. Brunn gives the decomposition point of antimony hydride as 150° C; of arsenic hydride as 230°; but the amount of each in the mixture is not stated. Furthermore, in our work, the differences in the amounts of antimony are relatively so slight in comparison with the large amount of diluting hydrogen, that the temperature required for decomposition should not vary within wide limits. As the amount of antimony to be estimated in mirror form should not exceed 0·1 mg. of antimonious oxide, the question to be considered is the lowest temperature at which the hydride for this amount, mixed with a relatively very large volume of hydrogen, would be decomposed when passed through the heated tube. At the same time, with a view to the possibility of separating small amounts of arsenic and antimony by the difference in decomposition points of the diluted hydrides, we included in our investigation the decomposition point of diluted arsenic hydride. While it is well known that antimony hydride, in any dilution, decomposes at a lower temperature than arsenic hydride at equal dilution, there were no exact data to guide us. At the beginning of the study, the tube was heated just behind the drawn out portion, or as we shall call it, the capillary. It was very soon found that even with small portions of antimony there was a tendency to deposition in the wide part of the tube back of the heated portion, since the larger surfaces offer greater chance for deposition of the rapidly condensing antimony. It was then found necessary to heat the capillary itself, which had the effect of concentrating the deposit at the desired place, just in front of the heated space. For determining the decomposition temperature, we used the thermo-electric method of Le Chatelier, employing for the purpose a couple of which the wires were platinum and an alloy of platinum with ten per cent. of rhodium. The couple was standardised by determining the electromotive force (in micro-volts) produced by heating the junction in the vapour of boiling naphthalene (218°) diphenylamine (302°) and sulphur (445°). With these three boiling points as ordinates and the corresponding electromotive forces as abscissæ, a perfectly straight line was obtained. As the temperature to be measured did not exceed 700° or fall below 200°, it was justifiable to extend this line and use it as a means of determining the temperatures by observation of the electromotive forces produced. The study, as far as it concerned the separation of arsenic and antimony, is not completed, hence the results are reserved for another publication. Sufficient data were obtained to show that there was a possibility of separating arsenic and antimony by the difference in decomposition points of their diluted hydrides, and the investigation will be continued in this laboratory. Concerning the arsenic hydride, it will be sufficient to say that an amount of diluted hydride corresponding to 0·04 mg. of arsenious oxide is completely decomposed at 340° if the length of capillary heated is 3·5 cm.; at 410° if the length is 2 cm.; and at about 450° if the length is 1 cm. Conversely, no arsenic is deposited from this amount at 330° with a heating length of 1 cm.; none at about 300° if the length is 2 cm.; and none at about 250° if the length is 3·5 cm. We are unable to get as definite results on the decomposition of antimony hydride, since the difficulty in deposition of the antimony mirror on the glass tubing used, which was afterwards solved, as explained later, prevented the results from being uniform. We think, however, that we are safe in saying that amounts of hydride from 0·1 mg. antimonious oxide and under are entirely decomposed at a temperature of 300° and a heating length of 2 cm.

Having shown that practically all the antimony may be evolved as hydride from the small amounts to be used in our work, and that the hydride, diluted with hydrogen, can be entirely decomposed by heating the capillary through which the gases pass at a temperature which is easily controlled, we then proceeded to develop a method for estimating minimal amounts of antimony.

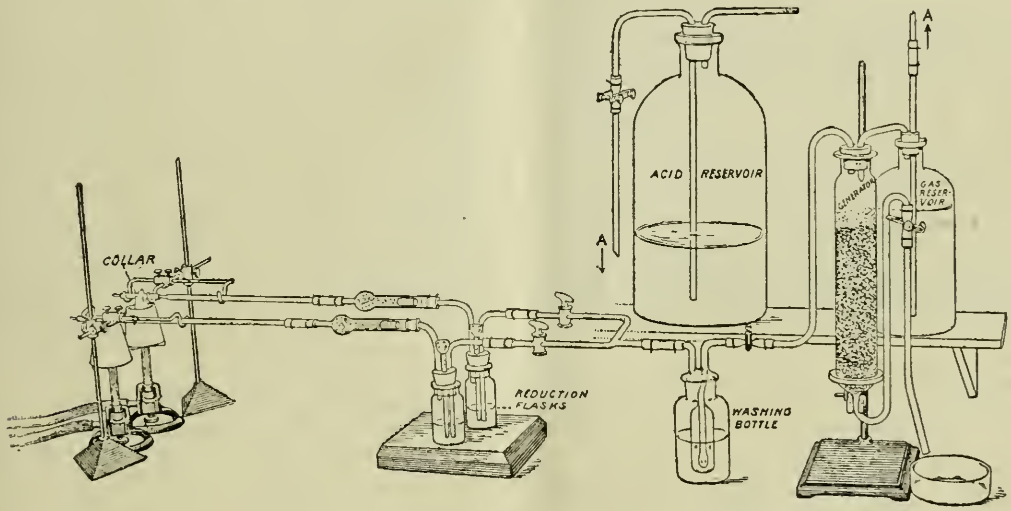

FIGURE 2

Apparatus for the Determination of Small Amounts of Antimony.

The apparatus(10) consists of a constant hydrogen generator, two reduction flasks, and two heating tubes, so that duplicate determinations may be carried out at the same time. The generator which we have found most convenient is one proposed by Richards, and is similar to the forms described by him some years ago(11). Any form of constant generator will answer which provides for withdrawal of the spent acid without disconnection. The zinc in the generator is conveniently sensitised, according to the suggestion of Gooch(12), by brief treatment with a solution of cupric sulphate and subsequent washing. The acid is sulphuric, at a dilution of one to eight. The hydrogen from our generator shows no arsenic or antimony when run for hours at a time. As the hydrogen, with which the antimony hydride is heated, must contain no hydrogen sulphide, as hereafter shown, the hydrogen from the generator is passed through a ten per cent. solution of cupric sulphate contained in an Allihn or other suitable washing bottle. From this, the hydrogen, which needs no further purification, passes to a Y-tube with two glass stop-cocks. To these stop-cocks are attached the reduction flasks, which are wide-mouthed bottles of 60 to 75 c.c. capacity. These are fitted with a pure rubber stopper with three holes. Through one hole passes. to the bottom of the bottle, a right angle tube connected with the stop-cocks: through the second a tube passing nearly to the bottom of the bottle and extending three to five cm. above the stopper. The upper end of this tube is open, the lower somewhat constricted. In the tube is placed a small funnel, blown from narrow tubing, through which the solution to be reduced is added. The third hole in the stopper carries the right angle delivery tube for the hydrogen, which passes just below the stopper. On its upper end is a rubber stopper over which is placed a 15 cm. (total length) tube filled with calcium chloride in fused sticks. We have found it convenient to half fill the tube with calcium chloride, and then to introduce a second, smaller tube filled with the chloride. By this arrangement the rear portion of the chloride, which soon becomes moist, may be frequently and conveniently renewed without disturbing the rest.

To the calcium chloride tube is connected the hard glass reduction tube drawn out to a straight capillary and ending in a capillary point. This tube is supported throughout its length by three adjustable brass hooks (No. 6 gauge, 4·1 mm.). The middle hook, which has a shank 10 cm. long, is fastened to a stand by the ordinary double clamp. On the top of the shank and about two-thirds the distance from the clamped end are soldered two ordinary screw connectors at right angles to the shank. The other hooks, which are somewhat longer than the first, are bent at right angles in the plane of the table, and their shanks pass in opposite directions through the connectors, in which they can be clamped by the screws. The end hooks are thus capable of being raised or lowered, or of being moved laterally, so that the combination of the three hooks will support any tube and capillary. We found it best to protect the capillary from direct contact with the flame, and at the same time to secure a more uniform heating by enclosing it in a brass tube or collar, which is slipped over the capillary and rests on the two anterior hooks of the support. This collar is 5 cm. long, with an outer diameter of 6 mm., and an inner of 4 mm. It is heated towards the anterior end by the tip of a flame 5 to 6 mm. high from a burner with a good air supply and protected by a conical chimney. We assume that under these conditions the capillary is heated, through a space of 3 cm., at about 500°.

The preparation of standard mirrors.—A standard solution of antimony was made by dissolving 2·3068 grms. of recrystallised tartar emetic in water, and making up to 1 liter. This solution (I.) contains 1 mg. of antimonious oxide in each cubic centimeter. Of solution I., 10 c.c. were diluted to a liter, giving a solution (II.) containing 0·01 mg. per c.c. The tartrate offers the most convenient and accurate solution, and we satisfied ourselves that the presence of the tartrate ions had no effect whatever on the deposition of the mirror. The strength of solution I. was also checked by analysis.

The zinc used in the reduction flask was the same as that used in the generator, but in smaller pieces, averaging perhaps 1 cm. in their longest dimension. The weight used was from 3 to 5 grms. This zinc, which is obtained of the New Jersey Zinc Company of New York, contains not over 0·019 per cent. of lead, and not more than 0·013 per cent. of iron; hence, the evolution of hydrogen by its contact with dilute sulphuric acid is slow. Platinum or other sensitising agents, either in form of foil, or as a deposit on the zinc, cannot be used, as we have proved by trial, since they show a tendency to hold back antimony, even greater than in the case of arsenic(13). We had resource, therefore, to hydrochloric acid, in a dilution of 1 to 10, of which we use exactly 20 c.c. for each run. The hydrochloric acid, which is obtained of Messrs. Baker and Adamson, of Easton, Pa., contains no antimony, and only about 0·02 mg. of arsenious oxide per liter, an amount which is inappreciable in our work on antimony(14). By use of hydrochloric acid, and purification of the hydrogen from the generator, there is no necessity for purification of the hydrogen from the reduction flask, provided sulphur compounds reducible to hydrogen sulphide are absent. Whenever the hydrogen contains hydrogen sulphide, the deposit in the heated tube is more or less reddish-yellow in colour, due, presumably, to the presence of antimonious sulphide. The fused sticks of calcium chloride used for drying (Merck) dissolved clear in water, and the solution showed an alkalinity of not over 0·3 per cent. We have seen no reason to believe that hydride of antimony is held back by this preparation, nor has there been any loss of antimony observed from an unduly moist condition of the chloride. We have, however, kept the chloride as active as possible by refilling the rear half of the tube with fresh chloride after every half-dozen runs, as explained, or when the accumulation of moisture becomes noticeable. When not in use, the tubes are kept stoppered.

The selection of hard glass tubing is a matter of the highest importance for the success of the method. We used at first a German glass, source not known to us, which had been used in arsenic work without apparent disadvantage. This glass had a slight brown colour after long ignition. Antimony mirrors deposited on this under the conditions about to be described, were often white and not clearly defined. We next tried a sample of American glass, but this gave the brown colour on ignition still more, and the deposits of antimony were entirely white. Next a Jena glass, which on ignition, gave the well-known opaque appearance, and on which the mirrors were also entirely white. Finally, we resorted to a glass of Kavalier, which did not give any colour or opacity on long heating. The deposits of antimony on the capillaries drawn from this glass were satisfactory, and it was used in the preparation of the standard mirrors(15). The glass tubing varies from 5 or 6 mm. inside diameter, to 7 or 8 mm. outside. The inside of the tube should be thoroughly cleaned before use. For this purpose a bundle of tubes is entirely immersed for some time in concentrated sulphuric acid, to which sodic chromate has been added. The tubes are then washed, dried, and stored away from dust. In drawing out the capillary, care should be taken to draw to the same outside diameter, and as nearly as possible to the same length. If one starts with tubes of as nearly equal size as possible, and observes these conditions, a capillary of nearly constant bore is obtained. It is on this uniformity of bore that the gradation of the standards depends. One should, therefore, at least draw the tubes to the same diameter, since this condition is easily governed, and is the chief factor in determining the bore. We have used for this purpose a Brown and Sharpe wire gauge, and have drawn the tubing to gauge No. 13, which corresponds to 1·8 mm., or 0·072 in.

In beginning the run, 3 to 5 grms. of zinc are placed in the reduction flask, which is then attached at one end to the stop-cock of the constant generator, at the other to the drying tube. To the latter is then attached the ignition tube, with the collar over the capillary. Twenty c.c. dilute hydrochloric acid are added through the funnel tube, and the apparatus may be tested for tightness by closing the end of the capillary with the finger while adding the acid. The hydrogen is then turned on from the generator, and, when the air is expelled, is lighted at the end of the capillary and turned down to a height of about 1 mm. It is important that this height be maintained as nearly as possible throughout the run, and that the flame should burn steadily, since an irregular flow of hydrogen results in an uneven deposit of antimony. After the apparatus has been in action for 5 or 10 minutes, the measured amount of antimony is added to the reduction flask through the funnel, which is then rinsed into the flask with a little water. No air is introduced into the apparatus if the funnel is sufficiently small compared to the tube in which it is set, and if the lower end of the tube is constricted. The deposit of antimony makes its appearance in five to ten minutes, and is completely deposited in thirty, though we have usually waited forty to fifty minutes, to avoid the possibility of loss. We have satisfied ourselves that all the antimony is deposited from the hydride at this point, since a further heating along the tube gives no mirror. The tubes containing the mirrors are sealed at each end and mounted in a frame, made of blackened wood. The tubes are fastened in holes passing through the upper and lower sides of the frame. As the antimony mirrors are affected by moist air, and, in the course of time, by light, we take the precaution to seal the tubes and to keep the set of standards in the dark. The deterioration of the standards with time is not a serious objection to the method, since a fresh set can readily be made when desired(16).

The amounts of antimony used by us are, in mgrms. of antimonious oxide (Sb_2O_3), as follows:—0·005; 0·01; 0·015; 0·02; 0·025; 0·03; 0·035; 0·04; 0·045; 0·05; 0·06; 0·07. Above 0·07 mgrm. it is of no advantage to make a mirror, as the recognition of the differences in the higher mirrors is difficult. These mirrors may be used as standards when viewed by reflected light, but it is much better to use transmitted light. This is best arranged by mounting the frame in a box, similar in form to the fluoroscope, which may be of wood or metal. This box, about 25 cm. long and open at each end, is larger at the bottom than at the top, and carries a rabbet at the bottom through which the frame can be slipped. It is provided at the top with means of shading the eyes against all light except that which comes through the set of mirrors. If the box is held against a white surface, the mirrors gain greatly in sharpness, and smaller differences may be in this way detected when comparing mirrors obtained in an analysis.

Analysis of solutions containing antimony.—To test the availability of the standard mirrors, a series of seven analyses were made of solutions in which the amounts of antimony were unknown to the analyst. The solutions were weighed to the second decimal place in a side-neck test tube of about 30 c.c. capacity. After the apparatus had been running for about ten minutes, a few drops of the solution were added to the reduction flask. If no mirror appeared within ten minutes, a larger portion of the solution was added, and if this again gave no mirror the addition was continued. After the appearance of the mirror, the run was continued for 30 or 40 minutes, until there was no probability of further deposit. By reweighing the test tube after the addition of the portion or portions which produced the mirror, the amount of solution taken was determined. The mirror obtained from this amount was then compared with the standards and the amount of antimony read off. From the amount in the aliquot portion, the amount in solution was calculated. Very often the mirror obtained from a given portion of the solution will be found too small or too large for estimation. In this case one can readily determine the proper amount of solution to be used. The following table shows the results of these analyses:—

No. of analyses.	Standard solution used.	c.c. of solution taken.	Sb_2O_3 taken.	Total weight diluted solution	Weight diluted solution taken for analysis.	Mirror reading.	Sb_2O_3 found.	Sb_2O_3 found mean.	Per cent. Sb_2O_3 found
			mgrms.	grms.	grms.	mgrms.	mgrms.	mgrms.	
2	II.	5	0·05	24·49	(*a*) 5·56 (*b*) 13·93	0·014 0·027	0·06 0·05	0·055	110
1	II.	10	0·10	25·36	(*a*) 11·64 (*b*) 13·72	0·038 0·042	0·08 0·08	0·080	80
6	II.	30	0·30	29·95	(*a*) 3·14 (*b*) 2·40	0·035 0·025	0·33 0·31	0·320	107
7	I.	0·5	0·50	24·48	(*a*) 1·91 (*b*) 1·62	0·043 0·038	0·55 0·57	0·560	112
3	I.	1·0	1·00	23·94	(*a*) 0·83 (*b*) 1·58	0·038 0·048	1·10 0·73	0·915	92
4	I.	1·5	1·50	26·22	(*a*) 0·72 (*b*) 0·79	0·040 0·045	1·46 1·49	1·475	98
5	I.	2·0	2·00	23·21	(*a*) 0·45 (*b*) 0·68	0·038 0·048	1·96 1·64	1·800	90
								Average percentage	98

The results are as good as can be expected, considering the small amounts of antimony under estimation and the difficulty of reading the mirrors more accurately than within 0·002 or 0·003 mgrm. The demand on the method made by these analyses is much more severe than would occur in actual practice. It is safe to say that the method will give a close approximation to the amount of antimony present in a given product, within the limits for which it is intended. It will serve also as a means of quickly, though roughly, estimating amounts which would require the ordinary analytical methods for an exact determination.

As to the delicacy of the process in the detection of minimal amounts of antimony, a mirror corresponding to 0·005 mgrm. can be detected and identified with certainty. With 0·001 mgrm. a faint deposit is seen. Yet the differentiation of amounts under 0·01 mgrm. presents some difficulty; Possibly the solution of the problem of how to sensitise the zinc properly in the Marsh process as applied to arsenic, will enable one to detect smaller amounts of antimony with certainty. The question of the delicacy of the process has not so much concerned us, however, as its practicability. Its application to the determination of small amounts must, of course, be worked out for each particular problem. This does not come, however, within the scope of the present investigation, but certain applications of the method are under consideration in this laboratory.

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(1) Berzelius, Jahresb., 1837, 191. The decomposition of the arsenic hydride by heating the tube was also suggested by Liebig (Ann., 1837, 217), but the idea of weighing the arsenic seems to have originated with Berzelius.

(2) Bull. Soc. Chim., 1876, 250.

(3) Am. Chem. J., 1881, 235. Chem. News, 1881, 21.

(4) Proc. Am. Acad., xxvi., 1891, 24. Amer. Chem. J., 1891, 431.

(5) Amer. J. Sci., 1891, 213.

(6) Neues Jahrbuch Pharm., xxviii., 10, 1867?; ref., Jahresb., 255.

(7) Ber., 1901, 2339; 1902, 2270.

(8) Ibid., 1904, 885 and 901.

(9) Ibid., 1889, 3202.

(10) This apparatus, which is shown in Figure 2, is essentially the same as that described, but not illustrated, in the paper of Sanger (1891) above referred to. An apparatus of practically the same principle is shown on page 226 of Vol. II. of the Final Report of the Royal Commission on Arsenical Poisoning (Appendix 22, Report to the Commission by McGowan and Finlow on the methods employed in testing for arsenic); London, Eyre and Spottiswoode, 1903.

(11) Amer. Chem. J., 1898, 189.

(12) Amer. J. Sci., 1894, 292.

(13) The discussion as to the effect of other metals on the evolution of arsenic hydride has been revived in recent years through the endeavours to increase the delicacy of the Marsh test for arsenic. This question, as applied to arsenic and antimony, will be taken up by one of us in a future paper.

(14) This would mean not over 0·00004 mgrm. of arsenic in the amount of hydrochloric acid used, which is beyond the limit of the delicacy of the process as applied to arsenic.

(15) A cursory qualitative examination of the different samples of tubing showed no marked points of difference except that the fourth tubing contained no barium, while the others did. The amount of barium in the others was proportional to the degree of change in appearance of the mirror produced on the samples. Lack of time prevents an investigation on this point, and an opinion as to the influence of the barium, if any, would be mere conjecture; as, for example, whether the barium oxide could act catalytically in causing an oxidation of the antimony, since it seems probable that the white deposit is due to an oxide of antimony. In the absence of any definite knowledge on the matter one can only determine the availability of a sample of glass by actual trial.

(16) The suggestion of Panzer (Chem. Centralbl., lxxiv. (1), 1903, 821) to seal standard arsenic mirrors with phosphorus pentoxide could probably be applied with advantage to the set of antimony mirrors.

New York Section.

Meeting held at Chemists' Club on Friday, April 19, 1907.

MR. MAXIMILIAN TOCH IN THE CHAIR.

MODERN VIEWS ON THE CONSTITUTION OF SOAP.

BY DR. J. LEWKOWITSCH.

Soap was known and has been used long before its true nature had been recognised. It was prepared, as Plinius records, by boiling fat with wood ashes (causticised with lime), and was henceforth looked upon as a compound consisting of fat and alkali. It is true, in 1741 Claude Joseph Geoffroy (Geoffroy the younger) observed that the fatty material obtained on decomposing soap with a mineral acid differed from all known oils and fats in that it dissolved readily in alcohol, in which oils and fats were known to be practically insoluble. He was thus the first to prepare the higher fatty acids, and to lead the way to the recognition of the true nature of soap. But his observation passed unnoticed, and does not even appear to have been known to Chevreul, who must be looked upon as the true and first discoverer of those fatty acids which occur in our commercial soaps. Not until Chevreul, in 1811, made his famous analysis of soap, which formed the starting point of his memorable researches on the constitution of fats and oils, was it known that soap consisted of the alkali salts of fatty acids obtained by the saponification of fats and oils.

Whereas Chevreul's discovery laid the true foundation of the candle industry, and of its by-products, his researches had little influence on the industry of soap-making proper, notwithstanding his own opinion :—" J'ai vu que l'art du savonnier recevait de ces connaissances une précision qu'il n'avait pu avoir tant que la nature des savons n'avait pas eté parfaitement connue." At his time soapmaking had reached already a comparatively high development as an art, which was jealously guarded as a secret, to be handed down as a kind of heirloom from father to son. In the soap works the process of saponification played a most important part. Since the alkaline lyes which were then at the disposal of the soapmaker contained as impurities, not only carbonate, which was frequently useless, but, in addition to it, sodium chloride, sodium sulphate, and other impurities, it so happened that when part of the caustic alkali present had done its work, the foreign salts prevented the remainder of the caustic alkali from acting on neutral fat. Hence, when a certain stage in the course of boiling had been reached, the soap which had been formed already was thrown up together with unsaponified fat. The "spent lyes" had then to be withdrawn, to be replaced by fresh lyes, and the boiling was continued until all the neutral fat was saponified. Consequently, the saponification of a batch of oil or fat took at that time as many days as nowadays it takes hours. The daily work at the soap pan sharpened the perception of the operator, and it must be freely acknowledged that the product obtained was a very creditable performance, under the circumstances. Looked at from a modern point of view, the soapmaker unconsciously handled, with no inconsiderable skill, the laws of mass action and of the phase rule, which we can nowadays apply to the problem as an *a priori* proposition. The soapmaking industry thus represents, like so many of the older chemical industries, a fine illustration of how crude empiricism helped to seize upon facts which science deduces many years later as theoretical postulates.

Although Chevreul clearly showed that soap consisted of the alkali salts of fatty acids, his observations had, as stated already, no direct influence on the art of soapmaking. Nor were his important observations on the comparatively ready hydrolytic dissociation of the alkali salts of stearic acid into an acid-salt (potassium bistearate), free alkali, and an infinitesimal quantity of free stearic acid on the one hand, and on the less ready hydrolytic dissociation of the oleates[*] on the other hand, of immediate use to the soapmaker. For the obvious rule to be drawn therefrom, *viz.*, to "finish" the soaps in the pan in the presence of free alkali (to prevent hydrolysis) had long been learnt and practised on the large scale. Even the scientific chemist overlooked and forgot Chevreul's observations, which very soon fell into oblivion.

This is not the occasion to show how it came about that erroneous theories, such as Rotondi's, were propounded to explain the behaviour of soap, and how, after a long interval, Chevreul's original notions were re-established as true by the researches of Krafft and his collaborators.[†] Krafft and Wiglow went even further than Chevreul, and from some of their experiments derived the conclusion that the hydrolytic dissociation of soap can reach completion, if one of the two components of the normal salt is removed—for instance, if the free fatty acid be removed by shaking out the soap solution repeatedly with toluene. However, this statement appeared to me to be inconsistent with the well-known fact that free alkali prevents the hydrolytic dissociation of soap. On theoretical grounds it was, therefore, to be expected that in a soap solution an equilibrium must be reached between the hydrolysing tendency of water and the opposite tendency of free alkali to prevent hydrolysis. Hence it would follow that if a certain amount of water be added to a soap solution, a definite quantity only, but not the whole quantity of fatty acids can be extracted, and that a certain amount of soap must remain undissociated, such soap being protected, as it were, from further hydrolysis by the amount of alkali set free in consequence of the hydrolytic dissociation that had been accomplished so far. In order to prove that this theoretical postulate must be borne out by facts, I have instituted a series of experiments which are detailed in the following table :—

Hydrolysis, by means of water, of 1 *grm. of pure anhydrous soap.*

Na_2O.	From					
	Oleic acid (commercial).		Stearic acid.		Palmitic acid.	
	400 c.c. water.	900 c.c. water.	400 c.c. water.	900 c.c. water.	400 c.c. water.	900 c.c. water.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
By phenolphthalein, in the cold	3·93	2·87	7·83	4·32	5·96	4·13
„ „ after boiling	3 25	5·0	0·23	3·76	5·19	7·03
„ methyl orange	3·18	1·38	2·2	2·93	0·60	0·61
Total Na_2O found	10·36	10·15	10·26	11·01	11·75	11·77
Theory	10·197		10·03		11·15	
Fatty anhydrides—						
Hydrolysed	77·369	75·59	85·47	85·014	81·29	82·97
Not hydrolysed	9·37	5·25	2·71	3·3	1·94	1·96
Insoluble in water and ether	0·17	0·84	1·43	0·18	1·5	0·29
Total found	86·709	81·68	89·61	88·494	84·73	85·22
Theory	89·803		89·87		88·85	

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[*] Chevreul proposed to base on this different behaviour of the stearates from the oleates a means of separating stearic acid from oleic acid.

[†] Chem. Technology and Analysis of Oils, Fats and Waxes, pp. 75—85.

These experiments prove that the quantity of soda found is slightly greater than theory requires; this can easily be explained by the action of the water on the glass vessels. The amount of fatty anhydrides found is, in the case of oleic acid, much below theory; this must be due to oxidation that had taken place on drying the oleic acid. Although also in the other two cases the agreement between experiment and theory is not as good as might be expected (owing to the large quantity of solvent used, and the number of operations through which the small quantity of fatty acids had to be put), still, the experiments bear out fully the theoretical postulate that complete hydrolysis cannot possibly occur. In the case of palmitic acid, the hydrolysis had reached a remarkably high degree, so that the statements of Krafft and Wiglow, who worked especially with palmitic acid, can be readily explained.

Some years before Krafft and his collaborators took up the work of Chevreul, Alder Wright and Thompson had published a series of observations on the behaviour of the alkali salts of fatty acids, from which most of those rules can be derived which the "rule-of-thumb" soapmakers had unwittingly practised during centuries. As I have given elsewhere a systematic survey of all those researches which underlie the theory of soapmaking, I need only briefly state the conclusions to be derived therefrom. I propose to enumerate them in the same order in which the soapmaker conducts his operations.

It was always well known to him that in order to complete the saponification of neutral fats, an excess of caustic alkalis is required. In order to show how far saponification will proceed, if only the theoretically-required quantity of caustic alkali be used, I have carried out the following two experiments on tallow (conjointly with Mr. H. E. Clapham), and on safflower oil (conjointly with Mr. de Greiff):—

(1) 2000 grms. of tallow were boiled by means of open steam, as in the method employed on a large scale, with 282 grms. of pure caustic soda—the theoretical quantity required to neutralise the fatty acids obtainable. The boiling was continued beyond the time required on a manufacturing scale. The pasty soap was then found to consist of: Total fatty matter, 33 per cent.; total alkali, 3·708 per cent.; fatty acids as soap, 31·01 per cent.; combined alkali as soap, 3·496 per cent.; unsaponified fat, 2 per cent.; free alkali, 0·212 per cent. This experiment shows that only 94 per cent. of tallow had been saponified. On adding an excess of alkali, the equilibrium between the reacting masses is changed in the direction of a greater amount of soap being formed, so that by employing a suitable excess—as is done on a large scale—complete hydrolysis of the fat, followed immediately by complete neutralisation of the fatty acids, is obtained.

(2) 3000 grms. of safflower oil (of the saponification value 192·37) were similarly boiled with a solution containing 412·2 grms. of sodium hydroxide. After the whole amount of caustic soda had been added, a sample of the mass was taken out of the soap kettle; its composition was as follows: Fatty matter, 29·23 per cent. (consisting of fatty acids, 25·18 per cent.; unsaponified oil, 4·05 per cent.); total alkali, 3·09 per cent. (consisting of combined alkali, 2·86 per cent.; free alkali, 0·23 per cent.); or, calculated to 100 parts: Fat saponified, 86·14 per cent.; fat unsaponified, 13·86 per cent.; alkali combined, 92·56 per cent.; alkali free, 7·44 per cent.

The remainder of the fatty mass was boiled for a somewhat longer period, then thrown up by salt and the curd analysed. The curd contained: Fatty matter, 60·10 per cent. (consisting of combined fatty acids, 54·92 per cent.; unsaponified fat, 5·18 per cent.); total alkali, 6·59 per cent. (consisting of combined alkali, 6·26 per cent.; free alkali, 0·33 per cent.); or, calculated to 100 parts: Fat saponified, 91·36 per cent.; fat unsaponified, 8·64 per cent.; alkali combined, 95 per cent.; alkali free, 5 per cent.

As stated already, the practical soapmaker was well aware of these fundamental facts, and had, therefore, always worked with an excess of caustic alkali; indeed, not infrequently with an enormous excess. At the time when neither caustic alkali nor even the crude soda ashes from sea-coast plants (Alicante, Barilla soda) were known, the soapmaker had already mastered the fact that potash soap can be converted by means of sodium chloride into soda soap and potassium chloride. Having at his disposal no other alkali than the one he obtained by causticising wood ashes, he first prepared soft soaps, which were converted into soda soaps by being repeatedly boiled up with common salt. When "soda ashes" were at his disposal, the soapmaker soon found, by practical experience, that the sodium carbonate acted differently from common salt in that it proved incapable of converting potash soap into soda soap in a satisfactory manner. For the behaviour of the carbonates is the reverse of that of the chlorides, the prevailing tendency being towards the formation of potash soap and sodium carbonate, whether potassium carbonate be intermixed with soda soap in proportions equivalent to the basis, or sodium carbonate be intermixed with potash soap. If the old-fashioned soapmaker had had the caustic alkalis at his disposal. as his *confrère* has them nowadays, he would no doubt also have found by experience what has been confirmed by somewhat recent experiments, namely, that the affinities of the caustic alkalis to those fatty acids with which he had to deal would be sensibly the same; and if he had taken equivalent amounts of caustic soda and caustic potash to saponify a given amount of oil or fat, however large the excess of caustic alkalis, he would no doubt have found that the soap formed consisted of approximately equal quantities of soda and potash soaps.

Whilst working with the lyes obtained by causticising Barilla soda, or even the Le Blanc soda of the early decades of the last century, the soapmaker had ample occasion to study the influence of the impurities, such as sodium sulphate, sulphite, &c., and must thus soon have recognised that soap possessed the property of being thrown out of its pasty emulsion by an excess of those salts. No doubt he readily observed that salt lyes containing considerable quantities of sodium sulphate were required in a much larger quantity to "open" the soap than solutions of sodium chloride. Hence we may safely assume that the experience the old-fashioned soapmaker possessed would have enabled him to condemn as unpractical a patented process (published about 25 years ago) aiming at the "salting out" of soaps with sodium sulphate instead of common salt.

The most difficult problem in the chain of operations—the "finishing" of the soap—had also been solved successfully in the course of years. Innumerable trials and failures were doubtless necessary before the soapmaker discovered how the soap which had been thrown up by salt as an insoluble curdy mass had to be "fined down" to the pasty mass, which was to yield, after settling and cooling, the commercial article. Without being acquainted with the laws of chemical equilibrium, he found that in order to obtain a commercial soap he must ultimately (*i.e.*, at the temperature at which the boiling is finished) have in his soap-pan a mechanical mixture of soap-paste practically free from mineral salts and caustic alkali, on the one hand, and an aqueous solution rich in mineral salts, &c., yet poor in dissolved soap, on the other hand. When the whole mass was allowed to cool down, separation into two layers, the "neat soap" and the "nigre," took place. After chemical analysis had enabled us to determine the amount of fatty acids in a soap, it was found that it was not possible to obtain in the pan a soap with a higher proportion of fatty acids than 63 to 64 per cent. The commercial soaps were, therefore, looked upon as a kind of crystalline compound, containing a definite amount of water—"water of crystallisation." Some slender support to this view was lent by the fact that in soaps containing the above-named proportion of fatty acids, a kind of crystallisation ("feather") was noticeable; this crystallisation was considered to be due to the harder stearates and palmitates separating out in a semi-crystalline form from the magma of oleate.

In the course of a long series of experiments which I had carried out on a large scale on many tons of varied fatty materials, with the object of producing a commercial soap having a higher proportion of fatty acids than 63—64 per cent., I had never been able to obtain a soap of the desired higher percentage. Hence I derived as the average composition of soaps made from glycerides of the mean molecular weight 860, the following*:—Anhydrous soap, 69 per cent. (fatty anhydrides, 61·80 per cent.; sodium oxide, Na_2O, 7·21 per cent.); water, by difference, 30·99 per cent. All the different commercial soaps I made, must, therefore have contained practically the same amount of water. Hence I adopted the view that this proportion of water might be termed "water of constitution," inasmuch as a (commercial) soap having less water cannot be made in the soap kettle.

This view has recently been attacked as erroneous by Merklen in a very remarkable work, "Études sur la Constitution des Savons du Commerce dans ses Rapports avec la Fabrication" (Marseille). The views which Merklen sets forth in this pamphlet deserve careful and repeated study. It is impossible to describe here at length the experiments which the author instituted, but I will briefly indicate the most salient points of his work. His fundamental view, based on the application of the laws of chemical equilibrium and of the phase rule to the present problem, is the following: Commercial soap is not a product which has a definite composition, but has, on the contrary, an essentially variable composition. The actual composition of a given commercial soap depends (1) on the nature of the fatty acids, (2) on the composition of the "nigre" (in the case of "settled" soaps) and (3) on the temperature at which the boiling is conducted. Another important factor conditioning the ultimate composition would be the pressure, but since soap is always being made at the ordinary pressure, this factor, representing, as it were, a constant, may be left out of consideration.† The finished soap behaves like a colloid. (The view that soap behaves like a colloid has been adopted first by Krafft and Wiglow, Berichte, 1895, 2573. With regard to the objections of Kahlenberg and Schreiner to Krafft's theory and the rejoinder of the latter, see Lewkowitsch, Jahrbuch der Chem., 1899, 352). Commercial soap should, therefore, be looked upon as an "absorption-product," of which the most characteristic property is its continuous variation. The absorption of water by the colloid soap being a function of (1) the nature and structure of the colloid; (2) of the nature of the solvent; (3) of the nature of the salts and the alkali ("electrolytes"); and (4) of the temperature, the variations in the composition of the commercial soap would be explained by variations in the composition of the factors set out above. Briefly stated, soap should not be looked upon as a compound of sodium salts of fatty acids with which a definite amount of water is combined chemically, but rather as an "absorption-product," the composition of which is a function of the environment in which the sodium salts of the fatty acids happen to be found at the moment of the finishing operation.

Let us briefly consider, in the light of these views, the practical operations involved in the production of a "settled" soap in the soap pan. It should be premised that the process of saponification itself has nothing to do with these views, it being immaterial for our purpose whether the soap paste, obtained in the first operation, be produced from neutral fats and caustic soda or from fatty acids and sodium carbonate. Such difference as does exist does not affect the principle of the present question, but only such minor points as absence or presence of glycerin, difference in the composition of the solvent, &c. (Chevreul foreshadowed the process of manufacturing soap by the union of free fatty acids with alkali—a process which was realised in the early years of the stearine candle manufacture by the production of oleic acid soap.) The soap paste, which may or may not contain an excess of alkali, is treated with common salt. The latter absorbs and withdraws water from the pasty mass, and when a certain concentration of the salt solution is reached, the soap is thrown up in a curdy form, poor in water and rich in salt. These curdy soap granules occlude some of the saline solution. The more concentrated the salt solution is, the less water is retained by the soap granules, or "curd," as it is termed in technical parlance. The composition of the "curd" is at this stage a function of the composition of the salt solution, which may contain free caustic alkali, sodium carbonate, and also glycerin, &c., as the case may be. After withdrawing the lye, and preparatory to boiling with the "strengthening" change, water (and a small quantity of caustic alkali) is added to "close" the soap. The grains of soap absorb water, parting with salt until the salt solution has become so dilute that it dissolves soap, and that finally a homogeneous mass is obtained. The next operation is merely a repetition of the process of graining, with that difference, however, that the salt solution is now made less concentrated than before, with a view to producing a less coarse grain, so as to facilitate the operation of "finishing." (See above.) The mass in the soap pan represents at this stage a biphasic system, the two component phases of which have been characterised already. The composition of the two phases differs, whilst their constitution is the same; both contain the same substances, only in different proportions; both are colloidal solutions of sodium salts of fatty acids in an alkaline salt solution, the proportions of salts and soap only varying to a considerable extent. (See below.)

On cooling we should, therefore, obtain two layers only, *viz.*, "neat" soap and "nigre." As is well known, very frequently three layers are found, the third layer being a strong salt solution below the nigre. The occurrence of this third layer is readily explained. At the temperature of the finishing operation the nigre is essentially an alkaline salt solution, holding so much soap in solution as corresponds to the then prevailing temperature. If the "nigre" cools, the equilibrium can no longer remain undisturbed, and a portion of the saline solution separates out, leaving the nigre richer in soap than it was at the highest temperature reached during the boiling operation. (If the soap-pan is well protected against loss of heat by radiation it may happen that no salt solution separates.) From the large numbers of experiments published by Merklen in support of his views, one example may be given as typifying the boiling of a tallow soap.

The "neat" soap gave the following numbers:—Water, 36·10 per cent.; fatty anhydrides, 56·77 per cent.; combined alkali as Na_2O, 6·59 per cent.; anhydrous soap, 63·36 per cent.; free alkali, 0·25 per cent.; sodium chloride, 0·29 per cent. For a genuine commercial tallow soap the amount of "anhydrous soap" is rather low. The "nigre" consisted of three layers:—(1) The uppermost layer, yielding the following numbers—water, 36·40 per cent.; free alkali, 0·28 per cent.; sodium chloride, 0·29 per cent.; anhydrous soap (by difference), 63·03 per cent., has approximately the same composition as the "neat" soap. (2) The next layer forming the middle portion of the "nigre" gave the following numbers:—Water, 53·40 per cent.; free alkali, 0·73 per cent.; sodium chloride, 0·90 per cent.; anhydrous soap (by difference), 44·97 per cent. (3) The lowest layer, forming the well known greyish spongy mass, furnished the following numbers on analysis:—Water, 68·30 per cent.; free alkali, 1·31 per cent.; sodium chloride, 1·85 per cent.; anhydrous soap (by difference), 28·54 per cent.

The "lye" below the "nigre" contained:—Sodium carbonate, 0·86 per cent.; sodium hydroxide, 1·87 per cent.; sodium chloride, 3·40 per cent. The composition of the nigre is thus obviously a function of the temperature; the composition changes continually with the fall of the temperature, and the changes are only arrested when the mass solidifies.

Views similar to those developed by Merklen have been published, curiously enough, at the same time and independently of Merklen, by Leimdörfer (Augsburger Seifensiederzeitung, 1906, Nos. 24 to 29). His deductions are, however, not expressed with that clearness which is found in Merklen's book. They are clothed in a more popular form; in fact, too popular a form. Moreover, no experimental data are supplied, and the exposition frequently appears rather diffuse. Still, the fundamental ideas are the same, and it should be emphasised that Leimdörfer has especially succeeded in giving a good explanation of the theory of that kind of blue-mottled soap, which is known on the Continent under the name "Eschweger Seife" and "Savon marbré de Nantes." This soap represents at the boiling temperature a mixture of two soap solutions[*], so carefully balanced by the art of the soapmaker that they have approximately the same specific gravity at a temperature slightly below the boiling temperature. Hence, on solidification of the mass, no separation of the components into two distinct layers takes place. What separation does take place occurs so slowly that the solution which is richer in soap solidifies and imprisons the solution which is poor in soap, before the latter has had time to segregate in the shape of a lower layer. Hence the desired "marble" in the soap is obtained. (No doubt chemical analysis will enable the scientific soapmaker to determine *a priori* what the practised soap-boiler at the soap-pan is able to hit off, as it were, instinctively. I am all the more confident in putting forward this assertion as I have carried out, about fifteen years ago, on a large scale a very considerable number of experiments, following up each "change" in the process of boiling soap in the pan, and analysing both the lyes and the soap of each "change." Thus I was able to fix beforehand for each "change" the composition which the half-finished soap and the lyes should have, being solely guided by the chemical analysis got from preceding successful "boilings." These experiments have not been published hitherto for obvious reasons.) Stress should also be laid upon the fact that Leimdörfer considers the settled soap as a product of crystallisation.

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* Chem. Technology and Analysis of Oils, Fats, and Waxes, p. 1067.

† Patents have been taken out for the production of soap under pressure as also in a vacuum.

The fact that commercial soaps boiled on a "nigre" contain approximately the same percentage of fatty acids, the variations amounting to no more than 1 per cent. if proper care is exercised, may be explained in the light of Merklen's views by the fact that in the process of manufacturing "settled" soaps, we choose as constants not only the temperature and the pressure, but also the proportion of free alkali in the "nigre" and the amount of soap held in solution by the nigre. The two last conditions implicitly postulate that the amount of salt must also be approximately constant. Such slight variations as actually do occur may then be ascribed to slight variations in the composition of the nigre, the amount of salt left in the neat soap, &c. It may, indeed, be granted that these factors are fairly constant in practice, as in the large modern soap works all working details are so carefully observed, that soaps having practically identical composition are being manufactured from week to week without any difficulty whatever. Those oils and fats which do not yield a "settled" soap of 63 per cent. fatty acids if used alone, are mixed in practice with other oils and fats, so that the mixture yields a "settled" soap of 63 to 64 per cent. of fatty acids.

Now, if we accept the fact that the percentage of 63 to 64 per cent. of fatty acids is the maximum obtainable in a "settled" soap, it would appear immaterial whether we consider the water (or to speak more correctly, the dilute salt solution) which a "settled" soap retains, as the maximum amount of water (or solution) which the colloid—sodium salts of mixed fatty acids—can absorb, or whether we look upon it as "water of constitution." If, however, it were possible to prepare a commercial "settled" soap containing more than 63 per cent. of fatty acids, *i.e.*, more than 69 per cent. of anhydrous soap, then the theory which assumes "water of constitution" must fall to the ground, and the explanation that soap is a colloid would certainly deserve to be preferred.

Amongst the soap analyses Merklen has published in detail there are many which contain less than 69 per cent. of anhydrous soap, but I also find six which contain from 71 to 74 per cent. of anhydrous soap. This would appear to me to be inconsistent with the general experience on which I have laid stress so frequently throughout this paper.

My difficulty might be met by the contention that the "settled" soaps found in commerce contain too much water in their freshly prepared state, and that they would part with more water (or rather dilute salt solution) on settling in the soap pan, if they did not solidify too soon. And it might further be said in view of my difficulty, that the colloid which absorbs the maximum of water and the minimum of salt is that one which is obtained in the process of "graining" with the most concentrated salt solution. Of course, such grained soap mechanically occludes portions of that concentrated salt solution, and would therefore show a much lower percentage of fatty acids than 63—64 per cent. It appeared to me that some light might be thrown on this question if such a grained soap were pressed so as to remove the occluded salt solution. Therefore the following experiments were undertaken, the amount of salt used in the three succeeding experiments being gradually reduced to the smallest amount possible.

Pure tallow was converted on a practical scale into a genuine commercial soap. This finished soap contained anhydrous soap, 67·00 per cent.; sodium chloride, 0·934 per cent. A bar of this soap was boiled up with water to a homogeneous paste and treated with solid salt, until an excess of salt was found at the bottom of the salt solution. The curdy mass was expressed, first by hand in a cloth, then in a spindle press up to a pressure of 20 lb., then at 40 lb., and finally in a hydraulic press at 75 atmospheres. The percentages of fatty acids in the successively prepared "soaps" were the following:—38·0 per cent., 58·6 per cent., 62·8 per cent., and 65·4 per cent. The edges of the press cake were then cut off, the mass roughly broken, and pressed again at 100 atmospheres. The resulting soap contained:—anhydrous soap, 73·10 per cent.; sodium chloride, 22·18 per cent. The mass was, of course, not a commercial soap, being a mechanical mixture of 22·18 per cent. sodium chloride, 73·10 per cent. anhydrous soap, and 4·72 per cent. of water.

Evidently in this experiment too much salt had been used in the "graining." Hence in the following experiment the "graining" was performed by careful addition of a saturated brine solution to the soap jelly (prepared as above) until a clear separation of the "curd" had taken place. The curd so obtained was pressed as before. The mass pressed at 75 atmospheres contained 68·4 per cent. fatty acids. Pressed at 100 atmospheres it yielded 69·6 per cent. fatty acids. Finally, after pressing at 150 atmospheres, the mass contained:—Anhydrous soap, 85·24 per cent.; sodium chloride, 1·74 per cent.; water (by difference), 13·02 per cent. This mass differs, of course, very much from a commercial soap.

As the proportion of salt must be considered to be still too high, the commercial genuine soap which formed the starting point was shredded and pressed up to 150 atmospheres. The expressed mass contained:—Anhydrous soap, 73·88 per cent.; sodium chloride, 0·87 per cent.; water (by difference), 25·25 per cent. This mass was, however, not a commercial soap but rather that form of soap which is ready for the plodding machine in the manufacture of a toilet soap.

The foregoing experiments have not removed the difficulty which I find in accepting fully Merklen's views. At present I am unable to reconcile his statement as to having obtained those six commercial soaps with higher percentage than 69 per cent. of anhydrous soap, with my own experience.

Obviously only further experiments can remove this difficulty, as also some minor difficulties, such as the influence of the metallic soaps, which settle out from the genuine soap into the "nigre," &c. But whatever may be the outcome of renewed experiments, Merklen's views cannot fail to stimulate further research into the composition of soap, and thus help to raise the industry of soapmaking, which has only too long been looked upon as a mere art, to the rank of a scientifically well-founded industry, the operations of which are governed by the laws of mass action, the phase rule, and the modern chemistry of colloids.

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[*] Cpr. also A. A. Shukoff, Augsburger Seifensiederzeitung, 1901, No. 22.

Meeting held at the Chemists' Club, on Friday, April 19. 1907.

MR. MAXIMILIAN TOCH IN THE CHAIR.

HISTORY AND USES OF SOAP IN PHARMACY AND MEDICINE.

BY DR. WM. C. ALPERS.

History does not record the name of the inventor of soap, and it is likely that none ever existed. The accidental combination of the potash in wood ashes with an animal fat, probably happened wherever Nomads roamed through the countries; but the resulting product was valued little and played no part in their primitive households. In the old sacred records the word "soap" is mentioned twice, once in the book of Jeremiah, and once in Malachai. But it refers probably to the juice of a plant, that was then, as well as centuries later, used by the dyers of woollens. Nor did the old Greeks know soap. Homer, who gives us minute accounts of domestic life and customs, does not mention the word, nor has any mention been made of it in the discovered records of the Assyrians and Egyptians. Soap was also an unknown thing to Chinese civilisation, which has flourished to a high degree for thousands of years in spite of Liebig's dictum that the state of a nation's civilisation is indicated by its consumption of soap. What substitutes did the old Chinese use for soap? There was, in the first instance, the native soda from the north of China and Tibet, called kien in Chinese; hence, European soap is now called fan-kien, *i.e.*, "foreign soap." The old Chinese further used a preparation called fei-tsau-to, made from the pods of the *Acacia concinna*. Finally, rice water was used in cleaning clothes.

The first authentic mention of soap is made by Pliny the Elder, who speaks in a scientific way of a remedy for tumors made from ashes and oil. At another place he describes a process for the preparation of soap, differing but little from that pursued at the present day, and ascribes its invention to the Gauls, who made it from tallow and beech-wood ashes, and used it to make their hair blond. He also makes mention of a hard and a soft soap. The remnants of a fairly well-equipped soap factory have been unearthed in Pompeii, containing pieces of soap in perfect condition, although more than 1700 years old. As Pliny died in 97 A.D., we may infer that soap was used by the Romans in the last two or three centuries before Christ.

Pharmacy and medicine paid but little attention to these alkaline soaps, although in all pharmacopœias of the last century hard and soft soaps are mentioned, and methods for their preparations given. The Materia Medica of the Massachusetts Medical College in 1808 speaks of sapo, soap, prepared with oil of olive and soda, called Castile soap. The first American Pharmacopœia mentions simply: Sapo, Castile soap, or *Sapo hispanicus*. A later edition, in 1831, speaks of sapo, soap, prepared from soda and olive oil, and of *Sapo vulgaris*, common soap, prepared from soda and animal oil.

Not until 1880 is soft soap official in our Pharmacopœia, which, besides olive oil soap, speaks of *Sapo viridis*, green soap, soap prepared from potash and fixed oils, and describes it as a "soft greenish yellow unctuous jelly." In the British Pharmacopœia hard and soft soaps are both official as early as 1818, where we read of :—*Sapo durus*—soap from soda and olive oil, and *Sapo mollis*—soap from potash and various oils. The French codex, as far back as 1748, mentions a number of soaps, *viz.*: *Sapo albus*, ordinary soap; *Sapo variegatus*, and *Sapo hispanicus*. Later on a *Sapo albus*, made of almond oil, is mentioned. In various pharmaceutical works a turpentine soap is mentioned (about 1818) made of potassium carbonate, oil of turpentine, and rosin, and Henry and Guibert in their "Traité de Pharmacie" in 1818 mention a soap, made of beef marrow and soda. The German Pharmacopœia, more than a century ago, speaks of: *Sapo domesticus*, *Sapo medicatus*, a white powder, *Sapo oleaceous* (Castile soap), *Sapo terebinthinatus*, and *Sapo viridis*, or *Kalinus*. The principal use of all these soaps, however, as far as medicine is concerned, was the administration of various medicaments in pill form, and soap was probably the most favoured excipient for making pills. Opium, squills, sodium bicarbonate, aloes, myrrh, iron, various mercury compounds, and others, were made into pills by the aid of soap, and in the Pharmacopœia of 1830, we also find a pill called officially, Compound pill of soap, and containing half a grain of opium and two grains of soap in each pill. This is a harmless name for so powerful a pill, which, however, was dropped in 1880. Up to this time medicine had no other use for soap except as a general hygienic agent.

We also have insoluble soap, that is, salts of fatty acids with other metals, and these salts, or at least one of them, has been used in medicine for many centuries. This is the lead salt of oleic and palmitic acids, generally called lead plaster. As far back as 1653, in a book on Materia Medica, by Nicholas Culpepper, in London, the author describes a lead plaster under the name of *Diachylon simple*. This description begins as follows :—"Let the Letharge boil with the Oyl of Olive and Hogs grease a long time, continually stirring it with the branch of a Palm or other tree of a binding nature, as Oak, Box, or Medlar, which is new cut, that the vertue of the Spatula may be mixed with the Plaister, etc." Those who have access to medicinal books of still older dates will probably find in them similar descriptions. This lead soap entered into all pharmacopœias. The method of making it does not differ materially in the various countries; litharge, olive oil and water are boiled till saponification takes place. Lead plaster forms the base of a number of other plasters and is often mixed with a soluble soap. Thus in a London Pharmacopœia of 1720, a soap plaster is described, consisting of hard soap and lead plaster.

When the manufacture of soap became a prominent industry, additions of various kinds were made, first to impart an agreeable odour and make the soap more attractive and desirable as a toilet article, but soon other ingredients were added with a view of giving it medicinal properties. These so-called medicinal soaps, containing various medicaments that were otherwise applied in the form of ointments or plasters, as sulphur, tar, carbolic acid, &c., were in the beginning a strictly commercial enterprise, until two German dermatologists, Dr. Unna of Hamburg, and Dr. Eickhoff of Elberfeld, took this matter up in 1885 and created medicinal soaps on strictly scientific principles. Both wrote a series of articles recommending soaps in place of plasters and setting forth their advantages very eloquently. These advantages were stated to rest on the fact that soaps, as compared with plasters, are less troublesome, more effective, cleaner, and less disagreeable, absolutely harmless and less expensive. Four different methods of application are recommended by these dermatologists, *viz.*, simple washing; rubbing dry the applied foam with woollen cloths; allowing the foam to dry on the skin; and finally, retaining the applied foam by means of watertight dressings. The third method, the drying of the foam on the skin, is the most usual. While, therefore, the soaps thus applied will also exercise their cleansing properties they are principally used as plasters; and we may term these medicated soaps soluble plasters. Both Unna and Eickhoff lay great stress on the necessity of preparing a good soap-stock to which the medication is added. They reject the cocoanut-oil soap, which is largely used as a fine toilet soap on account of its foaming properties, and state that nine-tenths of the skin diseases, as chapped hands, roughness, sensitiveness, &c., are caused by the use of such soaps. In connection with this statement, the question might arise in this country if the composition of domestic and toilet soaps might not be made subject to the present Food and Drug Law, and a definition of "soap" as a hygienic agent expected from the chemical authorities in Washington. The soap that Eickhoff recommended as the best stock for medicinal soap consists of three parts of beef tallow, and one part of olive oil, saponified with soda lye to a neutral soap. To this stock soap a mixture, consisting of 2 per cent. of lanolin and 3 per cent. olive oil, is added, in order to produce a superfatted soap, which is claimed to be far superior to neutral soap for medicinal purposes. A long list of medicinal soaps are prepared by various additions according to the kind of skin disease for which they are used, as resorcinol, salicylic acid, quinine, hydroxylamine, iodoform, creolin, ergotin, iodine, menthol, salol, aristol, mercury compounds, &c. The claim that superfatted soaps are more beneficial to the skin than neutral soaps, must be left to the dermatologist; opposing views have been taken by many physicians who do not endorse this claim, on account of the want of stability of such soap, and because of the free fatty acids that they contain, which are said to be deleterious to the skin.

Soon after the investigations of Chevreul, efforts were also made to form soaps of other metals, and mercury, zinc and calcium soaps were prepared with more or less success. A drawback in their manufacture was the somewhat uncertain and varying composition of the various fats, and it was natural that the idea was conceived to first separate the fatty acids, and then use the pure acid—oleic, palmitic, or stearic acid—to form soap. Prof. John Marshall, as early as 1872, proposed a combination of oleic acid with freshly precipitated oxides or alkaloids. However, he did not produce definite chemical compounds, but made solutions of such oleates in a large excess of oleic acid. Preparations of this kind were received with much favour by the medical profession, and in 1890 three of them found their way into the pharmacopœia, *viz.*, the oleates of mercury, zinc and veratrina. In the last edition, the zinc compound is again dropped, but atropine, cocaine, and quinine added. The percentages of oxides and alkaloids vary from 2 to 25 per cent., and the name oleate is adopted for the preparation.

This is greatly to be regretted, for as stated before, these preparations are not definite chemical oleates, but mixtures or solutions of oleates in oleic acid and olive oil. On the other hand, a stearic acid soap, *viz.*, zinc stearate, is described as a definite chemical compound, forming a fine white powder, but no method for its manufacture given.

It is not unlikely that soaps of definite composition as regards the various fatty acids, will receive more attention in the future; for the use of soap as base in place of ointment seems to gain favour from day to day; so that in the next edition of our pharmacopœia we may expect to see real oleates, and possibly solutions of oleates in various fatty acids or oils.

Meeting held at Chemists' Club, on Friday, April 19, 1907.

MR. MAXIMILIAN TOCH IN THE CHAIR.

COTTON SEED SOAP STOCK.

BY DR. DAVID WESSON.

The average annual production of crude cotton seed oil in the United States is about three million barrels of 50 galls. or 375 lb. Cotton seed oil is sold by weight and settled for on the basis of 7½ lb. to the gallon, a trade custom of more antiquity than usefulness. The crude oil as it is pressed from the seed varies in colour from light sherry to almost black. Light claret would represent the average. The colouring matter consists of a dark resinous substance soluble in alcohol and ether, but sparingly soluble in hot petroleum spirit. It combines with caustic soda, forming a water soluble alkali salt, which has apparently considerable colouring powers, but is of no value as a dye when compared with cutch and catechu. Besides colouring matter, the crude oil contains varying amounts of albumin, suspended particles of cotton seed meats, a peculiar pectin-like body, 0·25 to 0·5 per cent. of moisture, and varying amounts of free fatty acids.

Up to the present time no better method of refining has been discovered than that of treating the oil with caustic soda, which neutralises the free acids, coagulates the albumin, and dissolves the colouring matter. The treatment is conducted in large tanks working from 50 to 300 barrels. There are nearly as many styles of tanks as there are refineries. The essential features consist of some method of agitating the oil. The oil is heated and agitated with lye of the proper strength till the soap stock separates in flakes of higher specific gravity than the oil. Steam and agitation are shut off, and the flakes drop to the bottom of the tank in a slimy mass, commonly known as cotton seed soap stock, or foots.

According to the very interesting book of cotton seed statistics published by Messrs. Aspegren and Co., of the New York Produce Exchange, the refining losses in this country for the past five years ran as follows: 1902, 15 per cent.; 1903, 9 per cent.; 1904, 9 per cent.; 1905, 9 per cent.; 1906, 8 per cent. Assuming 9 per cent. to be the average loss, and that all the soap stock made contained 50 per cent. fatty acids, the annual production from three million barrels of crude oil would be 432,000 barrels, having a value of about 1½ million dollars.

Fresh soap stock before exposure to the air varies in colour according to the oil from which it is made. The locality, age of crush, and strength of lye, all cause variation from light dirty yellow, through dark green, to deep red. On exposure to the air the colour becomes black.

The consistency of the material varies with the amount of alkali and strength of lye used, and the skill of the refiner. The soap stock may appear soft and fluid or as hard as putty. It may appear a homogeneous mass or like a mixture of soap and free oil. The specific gravity varies from 0·970 to 1·04, 1·00 being the general average.

The odour of soap stock is very similar to decomposed fish, doubtless due to methylamine. The amount of water present has a great influence, not only on consistency, but on keeping qualities. Soap stock containing much over 40 per cent. water will ferment readily in hot weather. This fermentation breaks up most of the neutral glycerides with the separation of a very unpleasant smelling aqueous liquid, having an acid reaction. If confined in barrels, the gas produced by the fermentation will burn the packages. Fermented soap stock does not produce as good coloured soap as can be made from the fresh material.

Commercially, soap stock is sold on a 50 per cent. fatty acid basis. Soap stock containing less than 40 per cent. cannot be delivered on contracts. As drawn from the refining kettle, soap stock varies greatly in composition. The total fatty acids run from 35 to 65 per cent; 45 per cent. is a fair average. A typical analysis is as follows:—

Water	36·00
*Fatty anhydrides	48·50
Glycerine	3·98
Caustic soda (Na_2O)	3·20
Colouring matter	2·42
Organic matter	5·80
	100·00

* Fatty acids 50 per cent.

To convert this material into soap, it must be boiled up with a small excess of caustic soda, and then salted out. The lye from the saponification change carries the bulk of the organic and colouring matters, and as a rule solidifies on cooling. The resultant soap, commonly called "killed foots," is washed several times with very small excess of caustic in each change; then a strengthening change is given, and after one or two washes, settled. The colouring matter which is soluble in caustic soda is also soluble in dilute salt solutions. Strong brine, however, renders it insoluble. Proper washing of cotton seed foots soaps requires considerable experience and care. To obtain the best economy, the washing should be conducted in such a manner that the lighter-coloured lyes should be used over again on the darker-coloured soaps.

The "settled foots soap" is used as a basis for various textile soaps. It is commonly boiled down on salt brine till it contains 66 per cent. fatty acids. Mixed with soap from harder fats and rosin, it forms the basis for many cheap laundry soaps. A number of very popular washing powders consist of nothing but settled foots soap and soda ash. The pure soap from cotton seed soap stock is too soft to be used by itself, except in a mill soap, but the various combinations in which it can be worked to advantage make it a very important commercial product. It is by far the cheapest soap-making material in the market to-day.

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MR. MAXIMILIAN TOCH IN THE CHAIR.

RECOVERY OF GLYCERIN FROM SOAP LYES.

BY J. F. HINCKLEY.

The soap lyes as they come to the glycerin plant from the soap factory contain from 3 to 6 per cent. of glycerin, and from 8 to 14 per cent. of salt, the remainder being water with a varying small amount of impurities. The lyes are first allowed to cool, and a part of the soapy matter present rises to the surface and is skimmed off. If an iron salt is to be used to purify the lyes, the caustic and carbonate amounting to from 0·30 per cent. to 0·40 per cent. is neutralised with sulphuric acid, and about ¼ of 1 per cent. of sulphate of iron is added. The lyes are agitated with air during the addition of the chemicals, and the iron salt reacts on the soapy matter present, and iron soaps of the fatty acids are formed, and are removed by filter pressing. The lye, which is now clear, is drawn into the evaporator, where crude of 34° Beaumé is made, containing from 6 to 8 per cent. of salt, 80 to 85 per cent. of glycerin, the balance being water with a small amount of organic matter. The chief aim in using a metallic salt in the purification of soap lyes, is the removal of the soaps of lower fatty acids, formic, acetic, butyric, caprylic, &c. This is well accomplished by the following method: There is first added to the lyes ¼ of 1 per cent. of slaked lime as milk of lime, the lyes being agitated with air for 30 minutes and then allowed to settle. The lime soaps which are formed readily sink to the bottom. The tanks in which lye is treated or stored, are fitted with a draw-off pipe with a swing joint, in order to avoid drawing off any but clear lye. The lye is filtered into a lead lined tank and neutralised with hydrochloric acid, whilst being agitated with air, and from 0·04 to 0·05 per cent. of free acid being left. The thick scum of fatty and resinous compounds which forms on the surface, is removed by skimming. A small amount of aluminium chloride or sulphate can advantageously be used at this point to combine with and help remove a part of the soluble fatty acids which may be present. The lye, after it has become clear by subsidence, is allowed to run without filtering into a second lead lined tank, where its acidity is neutralised with caustic soda, preparatory to taking into the evaporator. By leaving the lye 0·01 per cent. alkaline at this point the albuminous matter still remaining in the lye is coagulated. The salt which is precipitated in the process of boiling down the lye in the evaporator can be removed in two ways. First, by emptying the evaporator and pouring the salt out into a large pan where it can be dried by the use of vacuum and steam, or the same result can be obtained by the use of a large cylinder placed below the evaporator and into which the salt can fall as it is precipitated from the solution in the process of boiling. This does not necessitate the shutting down of the evaporator, for by the closing of a valve the cylinder can be emptied and the salt removed to a tank from which it can be drawn to a centrifugal, and thus made dry. In the evaporators, a vacuum of from 25 ins. to 27 ins. should be maintained. The evaporation can be carried on with exhaust steam until the lye has become saturated with salt, which it does at 25° Beaumé; beyond this, it is more economical to use live steam of 60 or 70 lb. pressure. A tube evaporator is only efficient when the tubes are kept clean. This is accomplished by boiling out the evaporator often with fresh lye, and if the tubes are of iron, by scraping them at least once a month to remove any adhering scale. Dash plates suspended in the top of the evaporator prevent much throwing over of the boiling liquor, and what does pass into the vapour pipe is caught in cylindrical drums called catchalls, and runs back to the evaporator. A wet vacuum pump is used. There are two main types of tube evaporators used. In the one made entirely of iron the tubes are vertical; the liquor circulates in the tubes and the steam on the outside. In the other type, the evaporator is made of iron, and is fitted with horizontal brass tubes, the liquor circulating outside the tubes and the steam inside. The latter evaporator is the more durable, as the brass tubes do not have to be replaced often as is the case with the iron tubes.

As to another type of evaporator in which no salt adheres to the heating surface, see Lewkowitsch, Chem. Technolog., p. 1090.

The crude glycerin, after standing to allow the excess of salt to settle, is taken into the still of the refining plant and distilled. The crude is heated in the still with a closed steam coil, and distilled with steam at a temperature of about 320° F., passing out through a small open coil.

To obtain economic results, and to prevent the throwing over of the salt in the distillate, the steam may be expanded and retreated or superheated. When superheated steam is used, a coal fire is maintained directly under the still, and the steam used for distilling passes through a coil placed in the fire space. Distillation is carried on with the crude at a temperature of 350° F., and a loss of 5 per cent. is usually sustained in plants of this construction, caused probably by decomposition of glycerin, due to local overheating. In this style of a still it is always necessary to agitate the crude with a mechanical rotating stirrer. When using reheated steam, the steam at a pressure of from 120 to 150 lb. is expanded into a closed coil, placed inside a cylindrical heater. The coil is surrounded by steam taken directly from the boiler.

Nearly all of the glycerin passing off from the still is condensed in the catchalls, from two to four being attached to each still. From here the vapours pass down through the tubes of a water-cooled condenser, dropping as sweet-water into a drum below. This sweet-water may be used either to thin down the foots preliminary to their treatment, or it can be used in boiling out, and thus removing the salt scale on the inside of the tubes in the evaporators of the crude plant. The vacuum which should be maintained in the refinery is indicated by the temperature of the vapours passing from the sweet-water down to the vacuum pump. The distillate from the catchalls is concentrated in an evaporator, a closed coil of course being used. To prevent loss of glycerin, one or two catchalls and a drum are placed between the evaporator and the vacuum pump. As the evaporation proceeds, temperature gradually rises until it has reached 290° F. If it is desired to clarify the glycerin, it is accomplished by filter pressing while still hot, and using about 1 per cent. of bone black.

A special treatment for waste lyes has been patented by W. E. Garrigues. (See this J., 1904, 1153.)

The foots which are dropped from the still contain from 40 to 50 per cent. of glycerin, 10 to 20 per cent. sodium acetate, 5 to 10 per cent. of sodium salts of non-volatile organic acids, the remainder being water, and sodium chloride and sulphate. The foots are transferred to a lead lined or wooden tank, and boiled with the amount of sulphuric acid required to neutralise all of the alkaline salts present. After cooling, the thick tarry mass which has collected on the surface is skimmed off and the liquor filtered through canvas bags and afterwards concentrated in a cast iron evaporator. During the concentration all of the volatile organic acids, chiefly acetic, are expelled. The concentrate can be returned to the tank in the crude glycerin plant, or if the concentration has been carried far enough, it can be distilled alone or mixed with other crude.

Trimethylene glycol has given a great deal of trouble in some plants. It is without doubt a product of decomposition or fermentation of the fats, as it is only found where large amounts of low grade fats or kitchen greases are saponified. It is free in the stock, and can readily be removed by giving the stock a wash preliminary to its saponification.

Meeting held at Chemists' Club on Friday, April 19, 1907.

MR. MAXIMILIAN TOCH IN THE CHAIR.

DETERMINATION OF CASTOR OIL IN MIXTURES, SOAPS, AND ALIZARINE ASSISTANTS.

BY NATHANIEL J. LANE, B.SC.

Some years ago, while investigating the methods for determining castor oil, the writer found that the lead soaps of that oil (lead ricinoleate) were wholly insoluble in petroleum ether. Upon that fact, the following method is based.

From 3 to 3·5 grms. of the oil or fatty acids are used for the analysis. If the sample is sulphonated, a quantity sufficient to yield the above weight of fatty acid must be boiled for about two hours with dilute hydrochloric acid (1—5) with frequent shaking (Lewkowitsch, vol. 2, p. 1002). It is absolutely essential that the desulphonation should be complete. The acid solution is poured into a separating funnel, shaken with ether, and the ethereal solution washed with water until free from acid. The ether is then distilled, the fatty matter weighed and saponified by boiling with alcohol and about 1 grm. of potassium hydroxide. When the saponification is complete, a drop of phenolphthalein is added, the solution rendered slightly acid with acetic acid, and normal sodium hydroxide is added until the solution is slightly pink. The liquid is then poured slowly into 200 c.c. of boiling water and 30 c.c. of a ten per cent. solution of lead acetate contained in a 500 c.c. Erlenmeyer flask. The boiling is kept up for about 5—6 minutes, and the flask is then cooled by rotating the flask under a stream of running water. (See this J., 1905, 715). The shaking is continued until the lead soap adheres to the sides of the flask and the aqueous solution is clear, except for solid particles floating in it. If it remains milky, it is an indication that the desulphonation was not complete, and the test must be repeated. The aqueous solution is poured off or filtered if necessary. The flask is heated on the steam bath until the contents are melted; they are then cooled, and any remaining water is shaken out. The flask is again heated, and about 10 c.c. of petroleum ether are added. This usually combines with the soap, rendering it more fluid. From 75 to 80 c.c. of petroleum ether are added, and the solution boiled under a reflux condenser. The solution is poured into a stoppered glass cylinder, graduated in 5 c.c. to 500 c.c., with a stopcock just below the 250 c.c. mark. The cylinder should be made of glass, thin enough to allow the solution to be boiled. A 500 c.c. graduated flask may be used, but the cylinder is more convenient. The Erlenmeyer flask is repeatedly rinsed with petroleum ether, boiling each time and transferring as much as possible of the lead soaps to the cylinder, using about 200 to 225 c.c. altogether. When much castor oil is present, it is impracticable to rinse the flask completely; but this does not affect the result, as the repeated washings extract the oleate of lead. The ethereal solution is diluted to nearly the 500 c.c. mark with petroleum ether of b. pt. 28—30°. Then the whole is boiled for a minute. This completes the extraction. Neglect of this last detail will produce an inaccurate result.

If the sample contains 80 per cent. or more of castor oil, petroleum ether of 38°—40° b. pt. is used for rinsing and washing the flask; if under 80 per cent., that of 28°—30° b. pt. The per cent. of castor oil can be judged by the fact that when it is under 80 per cent., the lead soap dissolves in hot petroleum ether of 30° b. pt.; while if over 80 per cent., it remains a semi-fluid mass, and is more perfectly extracted by the solvent of higher boiling point.

The solution is allowed to stand at least three hours, or preferably over night, in a cool place, so that the lead ricinoleate is completely precipitated, diluted to 500 c.c., shaken and allowed to settle. 250 c.c. are drawn off or filtered if necessary, and distilled down to 75—80 c.c., The residue is decomposed in a separatory funnel with 10 c.c. of 10 per cent. acetic acid, washed with water until the washings are perfectly neutral to phenolphthalein, and made alkaline by one drop of $N/10$ sodium hydrate. The liquid is distilled in a 200 c.c. Erlenmeyer flask, until most of the petroleum ether has been expelled; 50 c.c. of neutral alcohol are added, and the solution titrated with $N/10$ sodium hydrate.

The volume, multiplied by 0·0282, gives the oleic acid. This weight, multiplied by 100, and divided by 80, represents oil other than castor oil. On multiplying this weight by two, and subtracting it from the original weight taken (or the weight of the fatty acids divided by 95 to give the equivalent of oil), the result is the quantity of castor oil in the sample. The factor 80 is taken, since most of the oils used in these materials are vegetable oils, principally olive, corn, &c., which contain approximately that percentage of liquid acids. If the admixed oil can be identified, its percentage of liquid acids should be substituted for 80.

It is essential that the greater part of the petroleum ether used for the dilution should be of the lower boiling point. The lead ricinoleate is precipitated from this on cooling, as a flocculent mass resembling aluminium hydroxide, a very characteristic reaction of castor oil mixtures; lead stearate and palmitate being white, slowly subsiding powders. It is impossible to determine the liquid acids in these mixtures by the lead soap and ethylic ether method, because lead stearate and palmitate are soluble in a solution of lead ricinoleate in ethylic ether.

The following results were obtained by the method described in this paper:—

Used.		Castor oil found.
		per cent.
Castor oil 50	Olive oil 50	47·83
,, ,, 70	,, ,, 30	69·96
,, ,, 85	,, ,, 15	84·57
,, ,, 85	,, ,, 15	84·45

A commercial sample consisting of castor and olive oils and oleic acid was found to contain castor oil 76 per cent.; the manufacturers stated it contained 75 per cent.

Meeting held at the Chemists' Club, on Friday, April 19, 1907.

MAXIMILIAN TOCH IN THE CHAIR.

LIQUID SOAP FROM A SANITARY STANDPOINT.

BY DR. WILHELM DREYFUS.

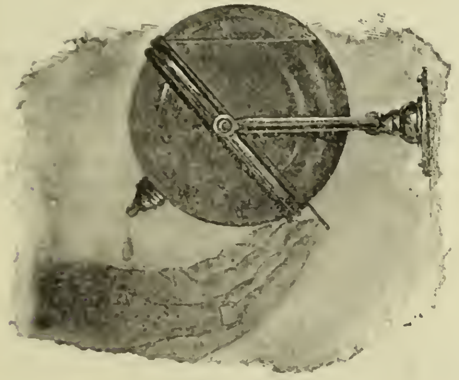
Various kinds of liquid soaps have long been in vogue in medicine and surgery for the treatment of specific skin diseases, or for the sterilisation of the skin in surgical operations. The expensive process of manufacture, and of incorporating expensive curative chemical agents, and the difficulty of properly dispensing liquid soap, has made it impossible for such soaps to compete with cake soap for toilet uses.

The various soap machines, discharging powdered or granulated soap, that have in recent times been offered to the public, while dispensing with the possibility of direct infection, have not found the favour anticipated by their originators. Owing to the complicated mechanical construction, they are clumsy and unreliable in operation, and at best they are wasteful of time and material, the soap granules, when wetted, cake together, and prevent a speedy and proper cleansing of the hands.

All disadvantages are overcome by the use of a soap in the liquid state, discharged from a proper dispenser in a measured quantity. The vital characteristics of a proper dispenser are reliable, easy, and sanitary operation, by omitting any kind of pump or valve for the discharge of the soap, and by constructing it of such material that will not be chemically acted upon by the soap it contains, and, further, by eliminating as much as possible metallic contact with the soap, to prevent the formation of metallic salts which will turn the soap turbid, and cause, in time, considerable decomposition.

I think the dispenser shown in the illustration will be found satisfactory from every standpoint. It is made of glass, firmly supported round the centre by metallic brackets, and can be placed on the washstand, or attached to the wall in any position desired. The soap is discharged in a measured quantity by the steel plunger, encased in a steel tube, nickel and silver plated. In operating it, all that is necessary is to tilt the globe with the tips of the fingers of one hand, when sufficient liquid soap will drop into the palm to thoroughly cleanse the hands.

The soap is so manufactured from pure vegetable oils as to yield a concentrated liquid, colourless, odourless, and practically neutral to phenolphthalein. It will not congeal at extremely low temperatures in the winter, nor turn rancid in the summer. Being automatically discharged from the dispenser, every user is thus supplied individually, as it were, with his own soap, and all danger of contamination and infection thereby eliminated.



ANALYSIS OF CAMPHOR.

BY J. E. CRANE AND C. M. JOYCE.

(This J., April 30, 1907, pp. 386—388.)

ERRATA.

P 386, col. 2, line 31, for "commercial," read, "chemically."

P. 387, col. 1, lines 1 and 2, the formula should read,

$$c=115\cdot205\left(\sqrt{1+0\cdot04367\frac{a}{l}}-1\right).$$

Obituary.

GEORGE EDWARD DAVIS,

Formerly Hon. Gen. Secretary of the Society, and a Vice-President.

George E. Davis was born at Eton in 1850. After studying at the Slough Mechanics' Institute and the Royal School of Mines, he devoted his attention to the technology of the alkali and cognate industries, finally entering the employment of Messrs. R. Bealey and Co., of Radcliffe, alkali manufacturers, as chemist. He afterwards held an appointment with Messrs. J. C. Gamble and Sons, pioneers in the Weldon chlorine process, at Gerard's Bridge, St. Helens, and later entered into consulting and professional practice in Manchester, during which his ability and experience attracted the attention of the late Dr. R. Angus Smith, Chief Inspector under the Alkali Acts, who appointed him an inspector under those Acts, and he went to reside in St. Helens, where he was the leading spirit among a group of chemists and chemical engineers engaged in various works in the district. This group formed itself into the "Faraday" Club, which resulted in the formation of a larger association, which again developed, under Davis's energising influence and the co-operation of influential men, into the Society of Chemical Industry, of which Prof. H. E. Roscoe was first president. Davis was the first Honorary General Secretary (1881 to July, 1883), and subsequently became Chairman of the Manchester Section (1895—1898), and a Vice-President of the Council (1898—1901). Pressure of other interests gradually relaxed Davis's official connection with the Society, though he ever regarded it with paternal concern, and in later years partially resumed active relations with the Manchester and London Sections.

His keen interest in technological questions led to his relinquishing his official inspectorship and developing a project for the recovery of benzol from crude gas at Messrs. Newton, Chambers, and Co.'s works and collieries at Rockingham, but the unexpected fall in benzol values made the process unremunerative, and Davis resumed consulting and professional practice. Later he conceived the idea of a trade paper, dealing with the trade aspects of industrial chemistry, and his characteristic energy and untiring industry made the "Chemical Trade Journal" a distinct success. Davis contributed to chemical, technological, and microscopical literature. He published works on the microscope, "Sizing and Mildew in Cotton Goods" (in conjunction with Dr. C. Dreyfus and Mr. P. Holland), "The River Irwell and its Tributaries," and a "Handbook of Chemical Engineering," besides editing the monthly "Northern Microscopist."

He was an original Fellow of the Institute of Chemistry, and served on its Council during the years 1877—1880 and 1883—1885.

He died, after a short illness, on April 20th.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
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United States.—1s. each, to the Secretary of the Society.
French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page 516.*)

English Patents.

Filtering gases or liquids; Apparatus for ——. S. Bornett, London. Eng. Pat. 8323, April 6, 1906.

A closed receptacle of sufficient strength is fitted with one or more dishes or tanks, each provided with a false bottom covered with filtering material, and also provided with outlet pipes below that material, which pipes pass through the shell of the receptacle into the air or into some apparatus wherein a lower pressure is maintained than is applied in the receptacle. The residue on the filtering material is removed through openings in the shell, which are tightly closed during the filtering process. In the case of gases, these are forced through the apparatus under pressure; and in the case of liquids, the latter are run into the dishes and subjected to the action of compressed air, steam, or gases.—C. S.

Filters. A. J. Boult, London. From E. Goldman and Co., Chicago. Eng. Pat. 17,985, Aug. 10, 1906.

See U.S. Pat. 834,637 of 1906; this J., 1906, 1136.—T.F.B.

Filters [for precious metal ore slimes]. E. Burt, El Oro, Mexico. Eng. Pat. 22,187, Oct. 8, 1906.

The invention relates especially to high-pressure filters for ore slimes. A number of cylindrical "filter mats," formed of filter-cloth stretched over a wire trellis, are suspended within a cylinder so that they can swing freely. The cylinder is mounted on trunnions and can be tilted at any angle. The space enclosed by each "mat" is connected by a pipe which passes through the cylinder to a common main without. The sludge or other material to be filtered is forced by air pressure into the cylinder through a perforated pipe which passes through one end. The latter, during this part of the operation, is maintained in a horizontal position. The liquid passes through the "mats" to the outlet pipe, and the solid matters collect in cakes on the outsides of the "mats." When enough solid matter has collected, the supply of sludge is shut off, and the solids are washed by a suitable liquid, or dried by compressed air, admitted through the perforated pipe. The cylinder is then tilted, a door at the lower end is opened, and the cakes of solid matter washed or blown off the mats (which swing sideways when the cylinder is tilted) and out of the cylinder by water, or compressed air is forced into the interior of the "mats" through the exit pipe.—W. H. C.

Drum filter; Rotating —— with apparatus for blowing or spraying in compressed air, steam, or water, and with a transporting apparatus for the removal of impurities. J. Reckliess and A. and A. Lehmann Akt.-Ges., Berlin. Eng. Pat. 1290, Jan. 17, 1907.

A horizontal drum of metallic gauze, closed at one end and lined with a suitable filtering medium, is rotated by a shaft within an outer casing. The open end of the drum abuts against the edge of the supply tank, and the joint between them is made tight by an elastic packing ring. The liquid to be filtered flows from the supply tank into the interior of the drum through the open end. The clear liquid passes through the filtering material and the gauze, and escapes, leaving the solids upon the interior surface. The solids are continuously removed by causing a stream of compressed air, water, or steam to impinge upon the exterior of each portion of the gauze as it reaches the highest position. The compressed air, &c., is supplied from a perforated pipe, placed above and parallel to the upper side of the drum, and the solids are projected on to a continuous travelling belt, which conveys them away over the edge of the supply tank. "Tension bars" are provided to take up the slack of the belt, and a number of tipping scoops, rotated within the drum, lift up any loose solid matter from the bottom of the drum and deposit it on the travelling belt.—W. H. C.

Extracts; Apparatus for the production of —— by diffusion and concentration. L. F. Jury, Vernaicon, France. Eng. Pat. 29,007, Dec. 19, 1906. Under Int. Conv., Dec. 19, 1905.

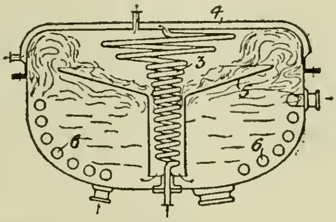
See Addition to Fr. Pat. 358,783 of 1905; this J., 1906, 598.—T. F. B.

United States Patents.

Extraction of liquids from solid materials; Apparatus for the ——. W. M. Barnes, Philadelphia. U.S. Pat. 846,447, March 12, 1907.

The apparatus consists of a round-bottomed vessel, which runs on a track, and of a cover, supported independently, which will fit air-tight over the vessel, the portion of the track immediately below the cover being supported on springs. The vessel consists of an outer wall and a perforated inner wall; the space between the walls is divided up by ribs which converge towards the centre of the base of the vessel, where they lead into an orifice which, when the vessel and cover are in alignment, communicates with a fixed outlet in the centre of the track. A source of air pressure and a pipe, leading from it to the vessel through the cover, are also provided.—T. F. B.

Foaming liquids; Apparatus for treating ——. F. H. Lehnert, Assignor to E. Fischer, Dresden, Germany. U.S. Pat. 847,085, March 12, 1907.



The apparatus consists, as shown in the accompanying figure, of a receptacle provided with a heating coil, 6, and a funnel, 5, into which the froth from the liquid passes. Here it is cooled by means of the coil, 3, and passes again into the lower part of the receptacle. The receptacle is closed by a hollow cooling-cover, 4, in which the water coming from the cooling coil circulates.—T. F. B.

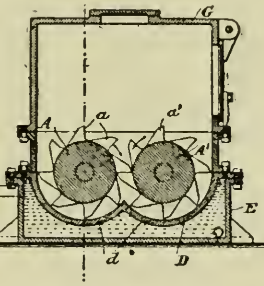
Still. J. H. Ullrick. Nashville, Tenn. U.S. Pat. 851,045, April 23, 1907.

The condenser is formed of a coil of pipe of rectangular cross-section, and each "whirl" of the coil is separately connected to an air-inlet and gas-outlet pipe which passes vertically through the condenser tank and is open above and below. The still is fed with heated water from the condenser tank, this water being first passed through an intermediate filter tank to purify it.—W. H. C.

Mixing or combining liquids, &c.; Apparatus for mechanically ——. F. J. H. M. Berberich, Kiel, Germany. U.S. Pat. 851,153, April 23, 1907.

See Eng. Pat. 8895 of 1905; this J., 1906, 167.—T. F. B.

Mixing and treating plastic substances; Machine for ——. F. I. du Pont, Wilmington, Del. U.S. Pat. 851,607, April 23, 1907.



The material is treated in an air-tight casing, G, having a doubly curved bottom, *d*, in which the rolls, A, A^1, provided with teeth, *a*, a^1, are rotated. The lower part of the casing is surrounded by a water-jacket, E, to keep the materials under treatment at a low temperature. —W. H. C.

Retort. C. H. Duisdieker. Pekin, Ill. U.S. Pat. 851,409, April 23, 1907.

Lugs or projections are formed on the exterior of the retorts so that when the latter are placed vertically in the heating chamber, the lugs engage one another and keep the retorts spaced apart to allow the heating gases to circulate between them.—W. H. C.

French Patent.

Filter with filtering medium of progressively decreasing porosity. C. Cuau. Fr. Pat. 372,281, Dec. 5, 1906.

The filtering medium is so arranged that its porosity diminishes from the centre towards the periphery of the filter, so that the drops of water encounter a progressively increasing resistance in traversing the various zones of the filter, whilst none of the water can pass directly between the exterior of the filtering medium and the inner surface of the walls of the surrounding vessel. This effect can be produced by the use of sand, the innermost layers of which are loose, whilst the grains in the outer strata are held together by some binding medium (cement, &c.): or an earthenware vessel may be made in such a manner that the inner portion is porous and the outer part vitreous; or, again, a number of discs or blocks of progressively decreasing porosity may be superimposed in a surrounding vessel.—C. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 521.)

Slate and coke breeze; Burning of washer ——. C. G. Atwater. Eng. Rec., 54, 577; Chemical Abstracts (Amer. Chem. Soc.), 1907, 1, 633—634.

Experiments on the burning of washer slate and coke breeze under boilers carried out at Sydney, Cape Breton, by the author, indicated that the slate and breeze or a mixture of the two could be profitably used as a fuel for steam plants when used with forced draught in properly constructed furnaces. The trouble in cleaning fires arising from slagging of the ash and consequent sticking of the clinker to the grate, of certain coals, was obviated by the use of these fuels. With the cost of these fuels at approximately 40 per cent. that of steam coal, and allowing an extra man for ash handling and extra cleaning of fires, the author finds a considerable economy in the use of these fuels, the mixed washer slate and coke breeze giving the best results. Analyses of coal and ash were as follows:—

	H_2O.	Combustible.	Ash.	Total combustible lost in ash.
				per cent.
Coal	3·45	91·74	4·81	—
Ash	—	16·22	83·78	1·03
Slate	7·91	62·25	29·84	—
Ash	—	25·10	74·84	7·23
Coke	4·75	75·65	19·60	—
Ash	—	39·40	60·60	6·96
Mixture....	3·27	65·33	31·40	—
Ash	—	23·32	76·68	7·64

Blast-furnace gases; Regeneration of ——. W. Schmidhammer. X., page 616.

English Patents.

Briquettes; Manufacture of ——. L. A. Jouques, London. Eng. Pat. 8758, April 11, 1906.

Size made from skin, hoofs, horn, or sinews, but not from bone, is placed in a water-jacketed pan, with about eleven times its own weight of water, and kept liquid at a temperature of about 60° C., in which condition it is mixed with formaldehyde, in the proportion of about 4 fluid oz. of aldehyde (diluted with about 20 times its own weight of water) to every 100 lb. of the liquid size. The product is discharged continuously into a mixer fed with a measured quantity of coal, the two feeds being adjusted to the proportions of 15—20 galls. of size per ton of coal. On entering the mixer, the size strikes against a rotating boss, which distributes it through the coal, the action being facilitated by centrifugal force. From the mixer, the mixture is discharged on to a conveyor, which feeds it to a rotary press.—C. S.

Fuel; Manufacture of agglomerate ——. L. Bouland, Chaton, France. Eng. Pat. 6820, March 21, 1907. Under Int. Conv., March 22, 1906.

About 33 parts of "carbon," obtained by burning old paper, are mixed with from 7 to 10 parts of heavy shale or other oil, and the paste so formed is mixed with about 40 parts of fish waste which has been previously treated with from 7 to 10 parts of sodium nitrate. To 100 parts of the above mass about 1000 parts of previously ground solid sewage matter and 2 parts of petroleum coke are added, and after a thorough mixing, the mass is formed into briquettes.—W. H. C.

Smoke; Apparatus for cleansing ——. J. L. Matthews, Baltimore, U.S.A. Eng. Pat. 13,669, June 14, 1906.

The smoke is conducted from a hood placed over the top of the stack, through a straight or coiled conduit, to the bottom of a collecting tank placed some distance below. A jet of steam sprayed into the hood cleanses the smoke, and the soot and other solid impurities are deposited in a shallow layer of water which is maintained on the bottom of the tank. A second steam jet may be placed in the tank to further cleanse the smoke and to assist the draught. —W. H. C.

Coke oven; Vertical ——. R. Barlen, Duisburg-Wanheimerort, Germany. Eng. Pat. 26,542, Nov. 22, 1906. Under Int. Conv., Feb. 9, 1906.

See Fr. Pat. 371,538 of 1906; this J., 1907, 400.—T. F. B.

Gas from coal and carbonaceous materials; Manufacture of ——, *also relating to water-gas.* A. F. Browne, London. Eng. Pat. 11,099, May 11, 1906.

The materials are carbonised in a vertical retort provided with a central trunk, into which the gases liberated from the surface of the charge are conducted through openings in the walls. The trunk extends far enough down into the mass of the charge for the contained gases to be subjected to a temperature sufficient for their conversion into permanent gas, which latter is drawn off through an eduction pipe within the trunk. Means are provided for securing a regular supply of material to the retort, and for the withdrawal of the coke-like residue, so as to maintain the charge at a fairly constant level; and also for the introduction of steam into the retort, for the purpose of making water-gas.—C. S.

Mixing, measuring, and carburetting gaseous bodies; Apparatus for ——. A. Bouvier and E. Collon, Paris. Eng. Pat. 21,022, Sept. 21, 1906. Under Int. Conv., Sept. 30, 1905.

The apparatus, which is designed for producing a mixture of air and gas of constant composition and at constant pressure, consists of a gas pump and an air pump, suitably proportioned and both driven by the same crank shaft, gasholders for the gas and air respectively, and a mixing chamber through which the streams of gas and air flow before entering the service-pipes. The gasholders may consist either of float bells, weighted so as to keep their contents under equal pressure, or of closed air-tight reservoirs of constant volume, the two vessels having suitably proportioned capacities and being fitted with devices for maintaining a constant internal pressure. If float bells are used, they are fitted on the outside with projecting lugs, which, when the bells reach the highest or lowest positions, operate tipping levers which control the inlet valves for the gas and air; if receivers of constant volume are employed, they are connected to a wedge device which is operated by the pressure within the receivers so as to control the inlet valves.—H. B.

Gas generating plant. M. D. Charlouis, s'Gravenhage, Holland. Eng. Pat. 24,833, Nov. 5, 1906.

See Fr. Pat. 371,917 of 1906; this J., 1907, 400.—T. F. B.

Carburetted air: Apparatus for the production of ——. M. F. Mieville, Chichester. Eng. Pat. 805, Jan. 11, 1907.

Air is delivered by a blower into a gasholder, the bell of which automatically regulates the air inlet valve. The air issuing from the gasholder is divided into two streams, which pass through two separate chambers in a carburetter, only one chamber in which contains the carburetting liquid. Both the carburetted and uncarburetted air streams, on issuing from their respective chambers, pass through a bed of calcium chloride, and the dried gases then flow through a mixing chamber into a gasholder connected to the service pipe. The movements of the bell control the valve between the carburetter and the mixing chamber. The inlet pipes of both gasholders are fitted with non-return valves, to prevent back-firing. —H. B.

Gas washer-scrubbers. S. Hersey, London. Eng. Pat. 11,004, May 10, 1906.

In a gas washer-scrubber, of the kind in which each rotary member is constructed of a number of segmental "bundles" built up of parallel segmental plates, spaced apart and clamped between end boards, each bundle being held in position between circular iron plates, the horizontal bolts clamping together the plates of each bundle are, according to this invention, arranged with their heads countersunk in the end boards, so as to permit of close contact between the end boards and the circular iron plates. Or, instead of sinking the heads of the bolts in the end boards, the outer surfaces of the latter may be provided with battens, on to which the circular iron plates are clamped, the battens leaving a space for the heads of the bolts between the end boards and the circular plates.—H. B.

Gases; Apparatus for the purification of ——. W. Hess, Koenigshof, Bohemia. Eng. Pat. 27,247, Nov. 30, 1906.

The cylindrical purifier is divided into two chambers of unequal size, connected by a pipe containing a fan, and also by an opening or direct short pipe in the vertical wall between the chambers. The ends of the said pipes project into the chambers and are provided with vertically arranged valve-seatings (to prevent the lodgment of dust or the like), and cut-off valves that can be operated from the outside. A liquid seal is provided at the bottom of the purifier, together with means for washing the gas. —C. S.

Testing gas; Method of and apparatus for ——. W. P. Tervet. Eng. Pat. 15,013, July 2, 1906. XXIII., page 641.

Incandescent mantles; Manufacture of ——. T. Terrell. Eng. Pat. 6814, March 21, 1906.

The patentee seeks leave to amend his specification by striking out the words "Starch or any other suitable substance may be used instead of collodion," the invention being thus confined to the coating of the unburnt mantles with collodion (this J., 1907, 398).—T. F. B.

Incandescent electric lamp filaments; Manufacture of cement joints for ——. A. Just and F. Hanaman, Budapest; H. Landesberger and I. Salzmann, Vienna; and Vereinigte Electricitäts A.-G., Budapest. Eng. Pat. 9349, April 20, 1906.

Filaments of tungsten or tungsten alloys are connected to the leading-in wires of incandescent lamps, by applying to the joints a carbon cement (prepared, for example, from soot and coal tar, with or without the addition of finely-divided tungsten or tungsten carbide), and then heating the whole to a high temperature in a neutral or reducing gas, so as to expel all gaseous or volatile matters from the joint. The filament is then mounted in a bulb as usual. —H. B.

Photometers. H. T. Harrison. Eng. Pat. 11,052, May 11, 1906. XXIII., page 642.

United States Patents.

Fuel; Composition of matter to be used as —— and process of making same. E. L. Culver, South Omaha, Nebr. U.S. Pat. 851,407, April 23, 1907.

The fuel claimed consists of 85 parts of "manure," previously dried and disintegrated, 5 parts of coal tar, and 10 parts of pulverised coal. To every ton of this mixture, 4 lb. of potassium chlorate, 2 lb. of saltpetre, and the necessary quantity of some suitable binding agent are added, and the mass formed into briquettes. —W. H. C.

Pulverulent materials for moulding or briquetting; Apparatus for preparing ——. G. J. Mashek, Newark, N.J. U.S. Pat. 852,024, April 30, 1907.

The apparatus consists of horizontal chambers provided with rotating shafts passing longitudinally through these chambers and provided with blades. The material passes into and through the first, or drying chamber, in the form of a shower, and is here met by heated gases from a furnace. It then passes into the second, or mixing, chamber, in which it is mixed with pitch and water; this chamber is steam-jacketed, and is provided with means for delivering melted pitch and water into it at the bottom, and withdrawing the pitch-foam at the top. The mixture then passes into the last, or cooling, chamber, to which a cooling medium is also supplied.—A. G. L.

Pulverulent materials for moulding or briquetting; Process of preparing ——. G. J. Mashek, Newark, N.J. U.S. Pat. 852,025, April 30, 1907.

The process consists in drying powdered material by means of hot gases, whilst in the form of a shower, then mixing the dried material with pitch-foam, produced by the action of water on melted pitch, and finally cooling the whole by a current of air to a point at which the binder is in a plastic condition.—A. G. L.

Coke-oven. A. Kerschgens, Administrator of J. Kerschgens, Charleroi, Pa. U.S. Pat. 850,939, April 23, 1907.

The claim is for a series of coke ovens with bottom and side flues and with a track situated in front of the ovens on which the apparatus for operating the valves travels. —W. H. C.

Gas; Apparatus for producing ——. G. Marconnet, Paris. U.S. Pat. 851,954, April 30, 1907.

See Fr. Pat. 340,075 of 1904; this J., 1904, 745.—T. F. B.

Gas-producer. C. L. Huston, Coatesville, Pa. U.S. Pat. 852,228, April 30, 1907.

The body portion of the producer is supported on a frame above a water-sealed ash-pit, and the lower portion is formed by inner and outer, parallel, conical bosh-plates. The outer bosh-plate is secured above to an annular flange depending from the frame supporting the body portion, and extends downwards to below the water level in the ash-pit. The inner bosh-plate is constructed in segmental sections with projecting pieces secured to the outer bosh-plate; its lower edge is above the water-level in the ash-pit, and its upper edge is some distance from the underside of the body portion. The various parts are so arranged that a solid bed of ashes rests on the bottom of the ash-pit, and extends up to a point above the lower end of the inner bosh-plate, so that the ashes rest upon both the inner bosh-plate and the lower portion of the outer bosh-plate. Air is supplied to the annular space between the bosh-plates and passes into the producer both through the passage above the inner bosh-plate, and down through the mass of ashes supported by the lower portion of the outer bosh-plate and up through the space enclosed by the inner bosh-plate.—A. S.

Coal; Method of distilling ——. O. A. Gobbe, Jumet, Belgium. U.S. Pat. 852,268, April 30, 1907.

See Fr. Pat. 366,002 of 1906; this J., 1906, 975.—T. F. B.

French Patents.

Fuel with a mineral oil basis. F. Dobler. Fr. Pat. 372,173, Feb. 13, 1906.

The mineral oil is incorporated with a solution of casein in caustic soda or sodium carbonate, with or without an addition of other combustible or inert materials.—C. S.

Filaments for electric incandescence lamps; Process for making extremely fine ——. J. Lux. Fr. Pat. 373,671, March 24, 1906.

See Eng. Pat. 7189 of 1906; this J., 1907, 144.—T. F. B.

Incandescence bodies for electric lamps; Process for making —— by means of difficultly fusible metals. J. Lux. Fr. Pat. 373,672, March 24, 1906.

See Eng. Pat. 7188 of 1906; this J., 1907, 462.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 522).

Fir wood; By-products from ——. Bd. of Trade J., May 30, 1907. [T.R.]

According to the "Pacific Lumber Trade Journal" (Seattle), a Puget Sound Company is successfully extracting valuable by-products from Douglas fir. From a cord of stumps or of wind shake wood the company has obtained turpentine, wood spirits, tar, pyroligneous acid, and pure charcoal, having an aggregate commercial value of 28.60 dols., while the outside cost of production is 12 dols. per cord. The test was made with a cord of ordinary fir wood. The first treatment consisted of passing superheated steam through the chipped wood; the chips were then placed in a fire retort and reduced to charcoal, the volatile products being condensed. The two liquids thus obtained were distilled, and the following final products obtained as a result of the test with one cord of wood:—7·85 galls. of pure turpentine; 17·14 galls. of second-grade turpentine, or wood spirits; 88 galls. of high-grade tar; 138·86 galls. of pyroligneous acid; 880 lb., 55 bushels, of chemically pure charcoal.

Phenols; Diphenylcarbamide chloride as a reagent for ——. J. Herzog. XXIII., page 645.

Fuller's earth and its application to the bleaching of oils. C. L. Parsons. XII., page 623.

English Patent.

Mineral oils or hydrocarbons; Process for mixing light and heavy ——. F. G. Claussen, Rome. Eng. Pat. 28,014, Dec. 8, 1906. Under Int. Conv., Dec. 13, 1905.

The hydrocarbons are mixed together, and a small quantity of sulphuric or other suitable acid is added to the mixture, which is then thoroughly agitated, allowed to settle, and the oil decanted from the residual acid. Zinc oxide, or some other suitable substance, capable of decolorising the liquid and precipitating the remaining traces of acid, is then added, and after agitation and settling, the oil is separated from the precipitate. As an example it is stated that 50 litres of "benzine," sp. gr. 0·680, mixed with 50 litres of heavy mineral oil, sp. gr. 1·000, and treated as above described with 3 per cent. of sulphuric acid of 66° B. and 3 per cent. of zinc oxide, gave, after treatment, 100 litres of an oil having a specific gravity of from 0·715 to 0·720.—W. H. C.

United States Patents.

[*Destructive distillation*] *Vegetable matter; Apparatus for recovering products from* ——. R. H. Partridge, Broadrun, Va. U.S. Pat. 840,362, Jan. 1, 1907.

The material under treatment is pressed into briquettes and loaded into a closed sheet-iron car containing a perforated coil. The car is placed in an oven, and a cap in the car top is opened, so as to enable the distillation products to escape into an overhanging dome, which in turn communicates with an outlet pipe leading to a condenser.—C. S.

Volatilisable contents of sedimentary mineral strata; Process of extracting and recovering the ——. D. R. Baker, Delaware, Ohio. U.S. Pat. 849,524, April 9, 1907

Two closed wells are sunk some distance apart down to the sedimentary stratum. By means of conductors in these wells and in the stratum between them, a current of electricity is sent through the stratum, any evolved gases being collected and withdrawn at the mouths of the two wells.—A. G. L.

Ammonia from gases; Extraction of ——. W. Feld, Hönningen-on-the-Rhine, Germany. U.S. Pat. 851,349, April 23, 1907.

This invention relates to a process for extracting ammonia from gases containing less than one molecular proportion of carbon dioxide to two molecular proportions of ammonia. The process consists in introducing air into the retorts in which the material is distilled, treating the gases so as to remove tar and water from them, and then extracting the ammonia by treatment with a liquor containing a calcium salt, such as calcium sulphate, held partly in solution, and partly in suspension. Gases containing carbon dioxide may also be used together with the liquor containing the calcium salt.—W. C. H.

Hydrocarbon derivatives; Process for the preparation of water-soluble ——. F. Boleg, Canstatt, Assignor to Ges. z. Verwerthung der Boleg'schen Wasserlöslichen Mineralöle und Kohlenwasserstoffe, Berlin. U.S. Pat. 850,898, April 23, 1907.

See Fr. Pat. 338,738 of 1903; this J., 1904, 655.—T. F. B.

French Patents.

Fuel with a mineral oil basis. F. Dobler. Fr. Pat. 372,173, Feb. 13, 1906. II., page 601.

Mineral oils or other light hydrocarbons; Enriching —— *with heavy mineral oils or hydrocarbons.* C. Humbert. Fr. Pat. 372,366, Dec. 10, 1906. Under Int. Conv., Dec. 13, 1905.

See Eng. Pat. 28,014 of 1906; preceding these.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 523.)

Aniline; Nitration of ——. J. B. Tingle and F. C. Blanck. Science, **24**. 821. Am. Ch. Soc., Abstr., 1907, 564.

After a review of previous work and a general outline of the objects of the investigation, the results so far obtained are provisionally formulated as follows: In the formation of mononitro derivatives of N-substituted anilines, the position taken by the nitro group appears to depend on two factors: (*a*) the nature (positive or negative) of this substituting group; (*b*) the strength of the acid which was mixed with the nitric acid. As both of these factors may be varied between very wide limits in the same or in opposite directions, the possibility is afforded of so arranging them as to produce any desired isomeride. The same principles may reasonably be expected to hold for substances other than aniline derivatives, and their application should not prove to be confined to nitration.

Sulphides of ammonium and sodium as partial reducing agents for polynitro-compounds. K. Brand. J. prakt. Chem., 1906, **74**, 449—472. Am. Ch. Soc., Abstr., 1907, 722.

Whereas ammonium sulphide is generally used in the laboratory, and the sulphides of sodium are most largely used in technical processes for the reduction of polynitro compounds, little general information concerning the latter is available (1) because knowledge of their use is largely controlled by patents, and (2) because, where investigated hitherto, these reagents have apparently given contradictory results. Some of these results as given in the literature are quoted by the author, then a systematic experimental survey is given. With *m*-dinitrobenzene the following results were obtained :—

Reagent.	Per cent. hydrolysis.	Chief product.	Per cent. yield.	By-product.	Per cent. yield
$(NH_4)_2S$ ..	Less than 1	*m*-nitraniline	70–80	*m*-dinitroazoxybenzene	
NH_4SH ..	Less than 1	*m*-nitraniline	—	*m*-nitrophenylhydroxylamine	
Na_2S ..	86·40	*m*-dinitroazoxybenzene	—	*m*-nitraniline	
Na_2S (acetic ester)	—	*m*-nitraniline	50·0	*m*-dinitroazoxybenzene	7·0
NaSH ..	0·15	,,	94·0	,,	trace
Na_2S_2 .. (1 mol.)	64·60	,,	87·0	,,	5·5
Na_2S_2 .. (½ mol.)	—	,,	43·5	,,	5·5
Na_2S_5 ..	5·70	,,	100·0	,,	

The percentages of hydrolysis were calculated from the concentration of hydroxyl ions in *N*/10 solutions of tho reagents (Küster, Z. anorg. Chem., **43**, 53).—From a consideration of the percentages of hydrolysis and the percentages of yield, the conclusion is drawn that the presence of hydroxyl ions favours the formation of azoxy compounds, while their absence (neutral solution) favours the formation of amino compounds. All of the evidence submitted supports this conclusion. From the facts (1) that sodium hydrosulphide is practically non-ionised and (2) by reaction with nitro groups is smoothly converted into thiosulphate, a valuable by-product, it is recommended as the most efficient and economical technical reducing agent of polynitro compounds. By its use the following comparative yields were obtained :—

Substance.	Chief product.	Yield.	Substance.	Chief product.	Yield.
m-dinitrobenzene	*m*-nitraniline	94	2.4-dinitraniline	4-nitro-1 2-phenylenediamine	good
2.6-dinitrotoluene	2-amino-6-nitro-1-toluene	good	sodium picrate	picramic acid	84
2.4-dinitrotoluene	4-amino-2-nitro-1-toluene	80			

Oxalic esters and aromatic amines ; Condensation of ——. [*Triphenylmethane dyestuffs.*] A. Guyot. Compt. rend., 1907, **144**, 1051—1052.

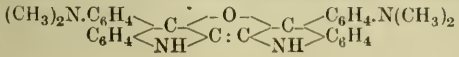
OXALIC esters condense with 1, 2, or 3 mols. of an aromatic tertiary amine in presence of aluminium chloride according to the conditions employed. At a high temperature using a large excess of the latter reagent, the following reaction takes place :

$$CO_2R.CO_2R + 3C_6H_5.NR'_2 = R.OH + H_2O + (R'_2N.C_6H_4)_3C.CO_2R$$

When the compounds obtained in this way are heated with concentrated sulphuric acid at 100°—150° C., they lose carbon monoxide and yield the corresponding hexaalkyltriaminotriphenylcarbinols $(R_2N.C_6H_4)_3C.OH$. In this way is furnished a new method of obtaining the dyestuffs of the triphenylmethane series, which has the advantage of dispensing with the use of carbonyl chloride.—J. C. C.

Friedel and Craft's reaction ; An extension of ——. A. Haller and A. Guyot. Compt. rend., 1907, **144**, 947—951.

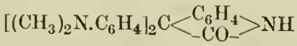
TERTIARY amines, and certain secondary amines such as diphenylamine, can be condensed with a large number of organic compounds in presence of aluminium chloride using a suitable solvent. The following condensations were effected :—(1) *Indigotin and dimethylaniline :* orange leaflets, m. pt. 272° C., probably possessing the constitution



(2) *Benzil and dimethylaniline :* pale-yellow needles, m. pt., 214° C. ; the compound has the formula $C_{30}H_{30}ON_2$, but the constitution is not known with certainty. (3) *o-Dibenzoylbenzene and dimethylaniline :* as in the above cases, 2 mols. of the latter condense with one of the former with loss of 1 mol. of water ; but in this reaction two compounds are formed in colourless crystals, m. pts. 186° C. and 226° C. respectively. These are probably stereoisomerides. (4) *Ethyl phenylglyoxylate and dimethyaniline :* colourless leaflets m. pt. 98° C. of formula $C_{26}H_{30}O_2N_2$. When heated with concentrated sulphuric acid, this substance loses 1 mol. of carbon dioxide at 110° C., and is transformed into Malachite Green. The constitution of the compound is therefore :

$$[(CH_3)_2N.C_6H_4]_2 : C(C_6H_5).CO_2.C_2H_5.$$

(5) *Benzophenone and dimethylaniline :* the expected *p*-dimethylaminotriphenylcarbinol could not be isolated in the crystalline condition, but the deep brown viscous mass yielded, on standing, crystals of dimethylaminotriphenylmethane, the quantity of which was increased by treating the whole with zinc and acetic acid. The crude substance gave a red solution with acids, like the carbinol (Baeyer and Villiger). (6) *Isatin and dimethylaniline :* colourless prisms, m. pt. 234° C. of the constitution

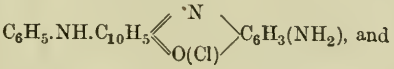


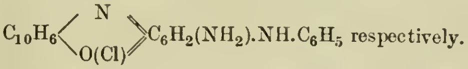
$$[(CH_3)_2N.C_6H_4]_2C\genfrac{<}{>}{0pt}{}{C_6H_4}{-CO-}NH$$

already described by Baeyer. Similar condensation products were obtained from anthraquinone, β-methylanthraquinone, β-dimethylaminoanthraquinone and dimethyl- or diethyl-aniline, the nature of which, however, is not yet determined.—J. C. C.

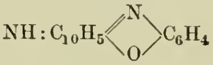
Azoxonium compounds. V. F. Kehrmann. Ber., 1907, **40**, 2071—2089.

WHEN the dyestuff obtained by Nietzki and Otto by the condensation of quinonedichloroimide with β-naphthol is mixed with aniline and exposed to the air, two dyestuffs are produced, the one insoluble and the other soluble in alcohol. The former, which is the principal product, is soluble in water with a green-blue colour and dyes tannin-mordanted cotton like Capri Blue, but gives rather a less green shade. The second dyestuff is violet. These have probably the constitutions :

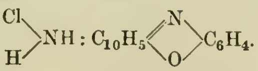




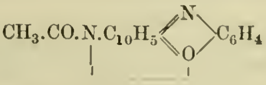
The author has prepared a dyestuff isomeric with Nietzki and Otto's by condensing 4-amino-1 : 2-naphthoquinone with o-aminophenol hydrochloride. This is a yellow substance, m. pt. 215° C., and has tho constitution,



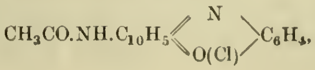
its salts, which are also yellow, being formulated as (for the hydrochloride)



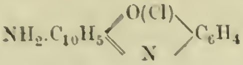
It dyes tannin-mordanted cotton rusty brown. The analogous dyestuff prepared from *o*-amino-*m*-cresol dyes tannin-mordanted cotton brick-red. The acetyl derivatives of these dyestuffs are deeper in colour than the parent substances, and yield magenta-red salts ; thoy are therefore considered to have the constitution



for tho free acetyl compound, and

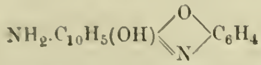


for its salts. When the acetyl derivative of 4-amino-*p*-naphthoquinone is condensed with *o*-aminophenol, and the acetyl group eliminated, the fourth isomeride of Nietzki and Otto's dyestuff is produced, having the constitution,



$$NH_2.C_{10}H_5\left<\begin{matrix} O(Cl) \\ N \end{matrix}\right>C_6H_4$$

This forms black-violet crystals, giving a blood-red solution in hot, and a brown-yellow solution in cold water. The corresponding (pseudo) base is yellow, and has the formula,



$$NH_2.C_{10}H_5(OH)\left<\begin{matrix} O \\ N \end{matrix}\right>C_6H_4$$

Similar compounds are produced from *o*-amino-*m*-cresol.
—J. C. C.

Quinoneimide dyestuffs; Explanation of the formation of —— from amines by oxidation and halogen melts. A. Ostrogovich and T. Silbermann. Bul. Soc. de Sciinte din Bucuresci, 1906, **15**, 281—302. Chem. Zentr., 1907, **1**, 1194—1197.

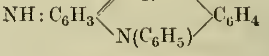
The authors have experimented as to the conditions under which rosaniline derivatives, Chrysanilines, and Indulines, respectively, are formed by heating aromatic amines with oxidising agents or with free halogens. They conclude that in all such reactions, quinone-imides are the primary products—in general, *p*-quinone compounds, but if the para position be occupied, *o*-quinone compounds. These quinone-imides are neither phenylated nor anilidised, but, wherever possible, condense with compounds having two atoms of hydrogen connected to a carbon atom either directly, or through the medium of a nitrogen atom. Thus, condensation of the *p*-quinone-imide with the methyl group of *p*-toluidine leads to the formation of rosaniline derivatives (*p*-rosaniline), whilst *o*-quinone-imide similarly forms Chrysanilines; if no methyl groups be present, then the condensation takes place through the medium of amino groups, and Indulines are formed. The following process for the preparation of Induline dyestuffs is described. Equal parts by weight of aniline and iodine are heated together to about 70° C. until the brown mixture becomes ruby-red. The temperature is then immediately raised; the mass becomes thicker at 100° C., and at 140° C. begins to crystallise; at 180° C. the reaction is complete. The mass is kept at this temperature for a short time, and after cooling, is purified by washing with dilute hydrochloric acid, or by adding the requisite quantity of sodium carbonate and heating in a current of steam. The yield is almost quantitative. The iodine can be easily recovered from the mother liquors. If chlorine be used, the aniline is heated with a quarter of its weight of the halogen under pressure to 160° C., or chlorine is led into hot aniline, and reaction brought about by heating to 180° C. Induline can also be prepared by heating to 180° C. a mixture of equal parts of aniline and aniline hydrochloride with air, lead peroxide, persulphate, &c. Or, a mixture of equal weights of aniline hydrochloride and lead peroxide is powdered, sprinkled with water or hydrochloric acid, and heated to 100° C.; the mass is then extracted with hot water, and the residue converted into Induline by heating with aniline hydrochloride to 180° C.—A. S.

Rosaniline compounds, o-and m-halogen-rosaniline derivatives; Production of —— by the iodine melt. T. Silbermann and A. Ostrogovich. Bul. Soc. de Sciinte din Bucuresci, 1906, **15**, 303—307. Chem. Zentr., 1907, **1**, 1197. (See preceding abstract.)

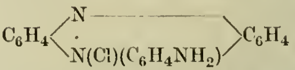
Twenty-two grms. of *p*-toluidine are dissolved in 38 grms. of aniline, and 60 grms. of iodine are added, and dissolved by agitation, the temperature rising to about 60° C. The mixture is then heated gradually to 180° C., at which temperature the whole solidifies. The product is powdered, and washed with cold water. The residue contains more than 80 per cent. of the theoretical quantity of *p*-Rosaniline. Magenta is prepared in an analogous manner from 19 grms. of aniline, 22 grms. each of *o*- and *p*-toluidine, and 60 grms. of iodine. By heating *p*-bromo-aniline with *p*-toluidine, Induline, Chrysaniline, and Chrysotoluidine are produced, but if a small quantity of iodine be added, practically only *p*-Rosaniline is formed. By starting with substituted anilines, the *ortho-* and the hitherto unknown *meta*-halogen rosaniline derivatives can be obtained. Di-*o*-chloropararosaniline is only very slightly soluble in water, but has a greater affinity for the fibre than the unsubstituted compound; the corresponding bromo-derivative has similar properties. In the preparation of *m*-dichloro- and *m*-dibromo-pararosaniline, a considerable quantity of Chrysaniline is formed as a by-product.—A. S.

Aposafranine and its homologues. P. Barbier and P. Sisley. Bull. Soc. Chim., 1907, [4], 1, 468—474.

Since aposafranine can be obtained by the diazotisation of phenosafranine, there should be two aposafranines corresponding to the *symm-* and *unsymm*-phenosafranines (this J., 1906, 1037). The formulæ suggested for the two aposafranines are:—



$$NH:C_6H_3\left<\begin{matrix} =N- \\ N(C_6H_5) \end{matrix}\right>C_6H_4$$



$$C_6H_4\left<\begin{matrix} N- \\ \cdot \\ N(Cl)(C_6H_4NH_2) \end{matrix}\right>C_6H_4$$

Aposafranine can be prepared by heating for 6—7 hours at 160°—170° C. a mixture of the hydrochlorides of amino-azobenzene and aniline dissolved in water saturated with aniline. After removing a small amount of induline, the aposafranine can be precipitated by means of salt. The aqueous solution of the hydrochloride has a magenta red colour. A dyestuff, $C_{30}H_{22}N_4$, 2HCl, less soluble in the salt solution is also formed, and appears to be identical with Caro's water-soluble induline. Homoaposafranine is obtained by the reaction of diazoaminobenzene on the hydrochloride of *o*-toluidine in alcohol. The hydrochloride is a bronzy micro-crystalline powder, dissolving easily in water with a reddish-violet colour, and forming a dichroïc solution in alcohol. Closely resembling it in its properties is isohomoaposafranine, which is formed by the interaction of *o*-toluidine hydrochloride and *p*-amino-azobenzene. Toluaposafranine is obtained by the interaction of the hydrochloride of *o*-toluidine and *p*-amino-azotoluene in alcohol. The hydrochloride is a reddish-brown powder, very soluble in water. From its formation by the method described by the authors, Caro's induline is a phenylated anilidoaposafranine.—F. Shdn.

Basic dyestuffs; Action of iodine and potassium iodide on some ——. L. Pelet and E. Gillièron. Schweiz. Woch. Chem. Pharm., 1907, **45**, 88—90. Chem. Zentr., 1907, **1**, 1259.

If solutions of the hydrochlorides of Safranine, Magenta, Chrysoïdine, Methylene Blue, Auramine, Crystal Violet, Phosphine, or Muscarine be treated with a solution of iodine in potassium iodide, dark-coloured, heavy precipitates are produced, which can be dried at 50° C. without decomposition, giving dark masses, some of which exhibit metallic lustre. The reaction proceeds according to the equation: $M.HCl+KI.I_2=M.HI.I_2+KCl$, the products being di-iodo-hydriodides. The products are slightly soluble in water, almost insoluble in benzene, toluene, and xylene, slightly soluble in carbon bisulphide, somewhat more soluble in acetone, alcohol, chloroform, nitrobenzene, and aniline, fairly easily soluble in mineral acids and alkalis. It is stated that the dyestuffs mentioned may be determined volumetrically in accordance with the equation given above, with the exception of Crystal Violet and Auramine O, which form tri-iodo-hydriodides. Some of the products if left in contact with excess of the potassium iodide-iodine solution, take up more iodine. Tolusafranine and Chrysoïdine, for example, form tri-iodo-hydriodides, and Methylene Blue, a tetra-iodo-hydriodide. On the other hand, certain of the compounds lose a portion of their iodine on prolonged contact with reagents or solvents. Thus, the di-iodohydriodide of Tolusafranine lost one atomic proportion of iodine when left for five days in a concentrated solution of sodium bicarbonate, and the tetra-iodo-hydriodide of Methylene Blue similarly lost one atomic proportion of iodine when extracted 60 times in succession with chloroform.—A. S.

English Patents.

Azo dyestuffs; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 14,921, June 30, 1906.

See Fr. Pat. 367,504 of 1906; this J., 1906, 1143.—T. F. B.

Dyestuff; Yellow sulphine [sulphide] —— of the quinophthalone series. Ges. für Chem. Ind. in Basel, Switzerland. Eng. Pat. 4159, Feb. 19, 1907. Under Int. Conv., Dec. 24, 1906.

Yellow to orange-yellow dyestuffs are produced by introducing a sulphydrate group into quinophthalone derivatives. Example: A salt of β-sulphophthalic acid (COOH : COOH : $SO_3H = 2 : 3 : 6$) is treated with "phosphoric chloride" and, on decomposing the product of the reaction with ice-cold water, the sulphochloride of phthalic acid is obtained. On reducing the latter, for instance, with zinc dust, β-thiophthalic acid (COOH : COOH : $SH = 2 : 3 : 6$) is produced as a yellow crystalline mass. This dissolves in hot water and easily gives soluble salts with alkalis. On melting it forms an anhydride between 160° and 170° C. Twenty parts by weight of the thiophthalic acid and 20 parts of β-naphthoquinaldine are heated together at 150° C. in an oil-bath; the temperature is raised to 200° C. during four hours, and is maintained at this point till the condensation is complete. The cooled mass may be used at once as a sulphide dyestuff, or may be purified by solution in sodium sulphide, filtration, and precipitation by means of hydrochloric acid. It dyes cotton an orange-yellow, which becomes on oxidation a pure yellow of excellent fastness. Ordinary quinaldine or its substitution products may be employed instead of the naphtho compound, and dithiophthalic acid instead of thiophthalic acid.—A. B. S.

Indigo White preparations; Manufacture of stable ——. J. Y. Johnson, London. From Badische Anilin- und Soda-Fabrik, Ludwigshafen, Germany. Eng. Pat. 6336, March 15, 1907.

In the production of solid stable salts of indigo white by evaporating a solution of these salts in a vacuum, there is a tendency towards the formation of hard lumps, which may enclose some of the solution and prevent complete dehydration. This may be avoided by mixing the solution with sulphite cellulose waste liquor, which, on evaporation, froths and forms bubbles, whereby the removal of the last traces of water from the indigo white is facilitated and a friable porous mass is finally obtained. It is also claimed that by this process the product is more stable in air and more soluble in water than is the case when the sulphite liquor is not used.—J. C. C.

United States Patents.

Phenylnaphthimidazole; Amido-oxysulphonic acid of —— and process of making same. O. Schulthess and L. Kerkovius, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 851,444, April 23, 1907.

See Eng. Pat. 11,759 of 1905; this J., 1906, 215.—T. F. B.

Sulfin [Sulphide] dyestuff; Yellow —— of the quinophthalone series, and process of making same. A. Bertschmann, Assignor to Soc. Chem. Ind. in Basle. U.S. Pat. 852,158, April 30, 1907.

See Eng. Pat. 4159 of 1907; preceding these.—T. F. B.

French Patent.

Sulphide dyestuffs; Process for producing easily soluble preparations of ——. L. Cassella und Co. Fr. Pat. 373,033, March 7, 1906.

See Eng. Pat. 7273 of 1906; this J., 1906, 1214.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page 523.*)

Fibres separated from cotton seeds; Properties of ——. E. Drabble. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 32—34.

The author states that the water-retaining capacity of carefully teased fibres is only slightly inferior to that of degreased "best" cotton-wool. The absorptive value (which was determined by measuring the height to which water rises in a tube packed with the material) was found to be greater than that of "super" cotton-wool, but inferior to that given by commercial cellulose. The material shows a comparatively slight contraction on saturation, especially when compared with most other dressings. On account of the shortness of the fibres, the material packs more densely than any other cotton or wood wools. It is stated that the fibres have been successfully used for papermaking, yielding blotting paper having a higher absorbency value than that of paper from any other form of cotton.—P. F. C.

Silk, half-silk, woollen, and half-woollen fabrics and yarns; Old and new bleaching methods for ——. J. Haas. Osterr. Wollen- u. Leinen-Ind., 1907, 27, 444; Chem.-Zeit., 1907, 31, Rep., 245.

The author is of opinion that hydrogen peroxide is the most satisfactory bleaching material for animal fibres. —A. B. S.

Weighting in dyed silks; Determination of ——. P. Sisley. Rev. Gén. Mat. Col., 1907, 11, 97—105.

The author has examined the various methods which have been proposed for the determination of the weighting in dyed silks, and finds that most satisfactory results are obtained by the indirect process of determining the nitrogen of the silk fibroïn by a modification of Kjeldahl's method. Comparative experiments on different kinds of silk showed that the mean amount of nitrogen in dry, boiled-off silk is 18·38 per cent., or 16·56 per cent. in silk containing a normal proportion (10 per cent.) of moisture. The details of the method of determining the weighting are as follows:—One to 2 grms. of the material are treated for ten minutes in a boiling bath of 25 per cent. acetic acid, rinsed in distilled water, immersed for ten minutes in a 3 per cent. solution of crystallised trisodium phosphate at 50° C., again rinsed with distilled water, and then ungummed by two treatments of twenty minutes each in a boiling bath containing 3 per cent. of soap and 0·2 per cent. of sodium carbonate. The purified silk is now washed with distilled water, dried, wrapped in cotton muslin, and heated gently with 20 c.c. of concentrated sulphuric acid, 10 grms of potassium sulphate, and 0·5 grm. of anhydrous copper sulphate. When effervescence ceases, the mixture is heated to boiling; the reaction is complete in twenty to thirty minutes. The ammonia is finally distilled off in the usual manner, and the percentage of silk fibroïn calculated.—A. S.

English Patents.

Cotton yarns; Manufacture of ——. F. W. Howorth, London. From Baumwollspinnerei Brodetz, Kuffler und Reichel, Brodetz, Austria. Eng. Pat. 26,189, Nov. 19, 1906.

See Fr. Pat. 371,625 of 1906; this J., 1907, 468.—T. F. B.

Cellulose compound [formate]; Production of a new ——. V. F. Feeny. From J. P. Bemberg, Akt.-Ges. Eng. Pat. 2511, Jan. 31, 1907. XIX., page 634.

Conditioning yarn; Apparatus for ——. J. Briggs, Blackburn. Eng. Pat. 19,276, Aug. 29, 1906.

This apparatus consists of a tank to contain the conditioning liquid, into which can be lowered an openwork receiver or frame. This frame contains one or more perforated drawer-like receptacles, each of which is provided with a sliding false bottom. When the frame is raised above the tank, these drawers can be slid out on to supports fixed at the side of the tank. The method of use is as follows:—The outer frame having been raised from the tank, the drawer-like receivers are run out on to the side supports and filled with the goods to be treated: they are then replaced in the frame and the whole is lowered into the tank. When the treatment is finished, the frame is raised and the drawers are run out on to a support on the opposite side of the tank. A catch prevents the sliding false bottoms of the drawers from going with the drawers, so that the contents drop out into trucks placed below to receive them. The drawers are pushed across to the other side, taking their bottoms with them, and are then ready for recharging.—A. B. S.

Cotton fabrics and yarns; Treatment of —— for improving their texture and rendering their dye more permanent. P. Beresin, St. Petersburg. Eng. Pat. 6992, March 23, 1906.

See Fr. Pat. 364,577 of 1906; this J., 1906, 1042.—T. F. B.

Printing yarns; Apparatus for ——. F. A. Gontor, London. Eng. Pat. 9881, April 27, 1906.

The patent relates to improvements in the printing machine described in Eng. Pat. 17,169 of 1902 (this J., 1903, 1127). The alteration consists in the fact that, when the colour tables rise, they lift the printing rollers so that the spindle ends of the latter come into engagement with the forked ends of a reciprocating bar, which causes the roller to pass to and fro over the yarn on the table. —A. B. S.

Fabric printing machines. Soc. Anon. de Blanchiment, Teinture, Impression, et Apprets de St. Julien, St. Julien, France. Eng. Pat. 13,334, June 9, 1906. Under Int. Conv., March 31, 1906.

See Fr. Pat. 364,806 of 1906; this J., 1906, 982.—T. F. B.

Thread, artificial; Manufacture of —— from solutions of cellulose. R. Linkmeyer, Herford, Germany. U.S. Pat. 852,126, April 30, 1907.

See Eng. Pat. 4755 of 1905; this J., 1906, 371.—T. F. B.

Hemp fibre; Manufacture of artificial ——. F. Lehner, Zurich, Switzerland. U.S. Pat. 853,093, May 7, 1907.

See Fr. Pat. 363,782 of 1906; this J., 1906, 881.—T. F. B.

Printing blocks and plates; Process of manufacturing ——. L. Collardon, Leipzig, Germany. U.S. Pat. 851,918, April 30, 1907.

See Eng. Pat. 27,090 of 1904; this J., 1905, 842.—T. F. B.

French Patents.

Silk, artificial; Manufacture of —— or other similar filaments. W. P. Dreaper. Fr. Pat. 373,088, Dec. 29, 1906. Under Int. Conv., Dec. 30, 1905.

See Eng. Pat. 27,222 of 1905; this J., 1907, 196.—T. F. B.

Drying warps or skeins of thread or other woven or felted products or fibrous materials; Machines for ——. A. N. Marr. Fr. Pat. 373,183, Sept. 25, 1906. Under Int. Conv., Sept. 27, 1905.

See Eng. Pat. 19,508 of 1905; this J., 1906, 924.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 526.)

United States Patent.

Leather; Process of colouring ——. W. M. Norris, Princeton, N.J. U.S. Pat. 851,995, April 30, 1907.

The claims relate to the steps in the process of dyeing leather, consisting in treating the latter in succession with an acidulated solution of potassium permanganate, a solution of a ferrous salt, and a solution of a suitable vegetable extract and sal-soda (sodium carbonate), and afterwards washing it thoroughly with warm water.—A. S.

French Patent.

Paper pulp; Process for improving the coloration of ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 373,182, March 12, 1906.

See Eng. Pat. 5342 of 1906; this J., 1907, 317.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 528.)

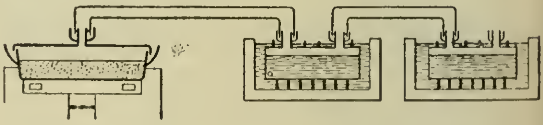
Potash Syndicate; Sales of —— in 1906. Brit. Cons. Rep. [T.R.]

The following table shows the sales realised by the Potash Syndicate in the year 1906 compared with the preceding year:—

	1905.	1906.
	metric tons.	metric tons.
Chlorate of potash and potash fertilisers	136,734	140,946
Sulphate of potassium	20,646	24,910
"Sulphate of potash magnesia,"	8,096	9,811
Potash fertilising salts	60,882	77,146
Kainite	249,829	263,937
Carnallite and Kieserite	7,082	6,734
Total	483,269	523,484

Two years ago the price of potassium salts was reduced, but at the close of 1906 it was raised to the standard obtaining in 1904. This advance, which applies to all European countries except Germany, is equivalent to an increase per 10 metric tons of £2 for France, the Netherlands, Belgium, Scotland, and Ireland, and of £1 10s. for England. The future development of the German potassium industry will depend mainly upon the ability of the Syndicate to prevent over-production, in spite of the strenuous activity displayed in establishing new concerns; of the total of 36 mines belonging to the Syndicate, no less than 31 companies are at present occupied in sinking new shafts.

Hydrofluoric acid; Manufacture of ——. A. G. Betts. Eng. and Min. J., 1907, 83, 753.



A plant for the manufacture of hydrofluoric acid on the large scale is shown in the figure. The still is of cast iron, about 8 ft. in diameter, 3 ft. deep at the centre, and 1 in. thick, the bottom being slightly curved. It has a cast-iron cover resting in strong sulphuric acid contained in the annular trough around the still. All other joints are sealed in a similar manner, but for those on the condensers, water may be used as sealing liquid. The condensers consist of a series of two or three lead boxes of about 1 cb. m. capacity, submerged in water, and partly filled with water or dilute hydrofluoric acid. The lead delivery pipes may be about 5 in. in diameter. The condensers are provided with overflows. The charge for the still consists of 1000 lb. of ground fluorspar and 1000—1200 lb. of sulphuric acid of 66° B., and the yield of hydrofluoric acid is 80—90 per cent. of the theoretical. Hydrofluoric acid may be prepared in a similar manner in the laboratory, using a cast-iron still, 1 ft. in diameter and 6 in. deep, closed by a lead plate, ¼ in. thick, with a lead pipe leading from the still to a lead bottle containing water, the joints being luted with dry cement. Beer barrels lined with rosin have proved very satisfactory for the shipment of the acid.

For the determination of hydrofluoric acid, a known quantity is mixed with neutral, nearly saturated potassium nitrate solution, a precipitate of potassium fluosilicate being produced. The cold solution with precipitate is now titrated with sodium hydroxide solution and phenolphthalein, to obtain the total hydrofluoric and hydrofluosilicic acids. The whole is then heated to boiling, and again titrated with sodium hydroxide solution. From the result of the second titration, the quantity of hydrofluosilicic acid is calculated according to the equation: $K_2SiF_6 + 4NaOH = 2KF + 4NaF + SiO_2 + 2H_2O$.—A. S.

Hydrofluoric acid; Preparation of anhydrous ——. G. Goldschmiedt. Monatsh. f. Chem., 1907, **28**, 297—298.

In Fremy's method of preparing anhydrous hydrofluoric acid by heating dry potassium hydrofluoride gradually to redness in a retort, platinum vessels have hitherto been exclusively employed. The author finds, however, that a pear-shaped copper vessel answers equally well as the retort. He has thus obtained a colourless anhydrous distillate, suitable in every respect for the preparation of free fluorine. The copper vessel was not appreciably attacked during the distillation.—C. A. M.

Thiocyanic acid; Anhydrous —— [*Preliminary communication*]. A. Rosenheim and R. Levy. Ber., 1907, **40**, 2166—2169.

Anhydrous potassium thiocyanate was mixed with phosphorus pentoxide in a distillation flask, the neck of which was fitted with a cork carrying a dropping funnel and a tube leading to a hydrogen apparatus. The distillation tube was directly connected to a small gas wash-bottle surrounded by ice and salt. The flask was cooled by means of ice, and sulphuric acid slowly dropped in. Colourless vapours were evolved, condensing in the receiver to a white crystalline mass of pure thiocyanic acid. The crystalline acid can be kept at 0° C. for several hours without change. It melts and turns yellow at about 5° C. At the ordinary temperature it turns red in a few minutes, then suddenly setting, with evolution of heat, to a mass of fine, yellow crystals. The acid is soluble in water, at 0° C., without decomposition, but polymerisation products soon separate out at the ordinary temperature. It has a pungent odour, and after exposure to the air for some time, the smell of hydrocyanic acid becomes perceptible.—F. Shdn.

Per-salts; Contribution to the study of ——. E. P. Alvarez. Chem. News, 1906, **94**, 269—271.

Pernitrates, perphosphates, perarsenates, pertungstates, and perphosphotungstates were easily obtained by the action of sodium dioxide on the alkali salts of nitric, phosphoric, arsenic, tungstic and phosphotungstic acids. *Potassium pernitrate*—100 grms. of potassium nitrate were dissolved in a mixture of 2000 grms. of water and 1800 grms. of alcohol at 98°, then cooled in a bath of ice and salt, and 160 grms. of sodium dioxide gradually added. Part of the pernitrate was precipitated by 1800 grms. of absolute alcohol, separated rapidly by means of the filter pump, washed with anhydrous alcohol, and dried *in vacuo* over phosphorus pentoxide. The filtrate on spontaneous evaporation yielded the greater part of the crystallised salt. The other per-salts were obtained in the same manner except that the quantities used were as follows: *Sodium perphosphate*—Disodium phosphate, 50 grms.; alcohol, 3000 grms.; water, 3000 grms.; sodium dioxide, 70 grms. *Sodium perarsenate*—Disodium arsenate, 50 grms.; alcohol, 2000 grms.; water, 2000 grms.; sodium dioxide, 100 grms. *Sodium pertungstate*—Sodium tungstate, 50 grms.; alcohol, 1000 grms.; water, 1000 grms.; sodium oxide, 90 grms. *Sodium phosphopertungstate*—Phosphotungstic acid, 20 grms.; alcohol 750 grms.; water, 750 grms.; sodium dioxide, 80 grms. The reactions of formation are:—$KNO_3 + Na_2O_2 + H_2O = KNO_4 + 2NaOH$; $Na_2HPO_4 + Na_2O_2 + H_2O = NaPO_4 + 3NaOH$; $Na_2HAsO_4 + Na_2O_2 + H_2O = NaAsO_4 + 3NaOH$; $2Na_2WO_4 + Na_2O_2 + 2H_2O = 2NaWO_4 + 4NaOH$. The per-salts are decomposed by water as follows:—$KNO_4 + H_2O = KNO_3 + H_2O + O$; $NaPO_4 + 2H_2O = NaH_2PO_4 + H_2O + O$; $NaAsO_4 + 2H_2O = NaH_2AsO_4 + H_2O + O$; $2NaWO_4 + H_2O = Na_2W_2O_7 + H_2O + O$. All these alkali per-salts are white solids, and occur both in amorphous and crystalline varieties. The amorphous varieties, obtained by precipitation by alcohol, contained varying quantities of the hydrate of sodium dioxide, which almost completely veiled the reactions of the per-salts. Many specimens of commercial amorphous perborates were also observed to have a strong alkaline reaction, due chiefly to the hydrate of sodium dioxide, which makes them caustic and unfit for use in medicine. The crystallised salts on the other hand when carefully washed and dried *in vacuo* are neutral and their behaviour toward reagents is very different from that of the amorphous products. The pernitrates on the addition of ferrous sulphate and sulphuric acid evolve oxygen with brisk effervescence and assume the colour of the nitrates. The perphosphates and perarsenates give precipitates with the magnesium and the molybdate mixtures. If 10 c.c. of distilled water and 5 c.c. of hydrochloric acid are added to 0·5 grm. of sodium pertungstate or phosphopertungstate, there is an immediate and abundant evolution of oxygen. When the mixture is boiled, an abundant yellow precipitate of metatungstic acid appears after some time: if stannous chloride be then added, the liquid becomes blue and the blue oxide of tungsten is precipitated. These per-salts might play an important part in medicine, in the arts and industries, and in chemical analysis, &c. The pernitrates, for example, from which heat liberates 15 to 16 per cent. of oxygen, in addition to what they yield as nitrates, are very readily ignited and, therefore, of service in the manufacture of explosives. The perphosphates, from which water liberates 13 to 14 per cent. of oxygen, are available in medicine.

2 : 1-*Ferroferric oxide.* O. Hauser. Ber., 1907, **40**, 1958—1960.

Ferroferric ammonium carbonate was prepared by the method described in a former communication (this J., 1905, 1130). It was washed with alcohol and ether, and shaken with hot, strong potassium hydroxide solution, whilst a current of coal-gas was simultaneously transmitted through it. The alkali causes the precipitation of a black oxide, which must be washed out of contact with the air. This substance differs from other ferroferric oxides in being non-magnetic and in becoming rapidly oxidised in the air, with evolution of heat, to ferric oxide. Analyses give the ratio of total iron to ferric iron as 2·97 : 1. When dried in an indifferent gas at 100° C., 2 : 1-ferroferric oxide has the composition, $4FeO,Fe_2O_3,5H_2O$. The sesquioxide obtained by the action of air has a darker colour than the ordinary sesquioxide, is strongly magnetic, contains no ferrous oxide, and has the composition, Fe_2O_3,H_2O. Ferroferric oxide from *licorite*, $Fe'''OH,Fe''_2Ca(SiO_4)_2$, free from manganese, is identical with that prepared artificially; indeed, this oxide appears to form the base of the mineral.—F. Shdn.

Iron sulphide; Modification of ——. F. Rinne and H. E. Boeke. Z. anorg. Chem., 1907, **53**, 338—343.

Le Chatelier and Ziegler (Bull. Soc. d'Encour., 1902, 368), and Treitschke and Tammann (Z. anorg. Chem., 1906, **49**, 320) have found that commercial iron sulphide undergoes a transformation at 130° C., the change being accompanied by evolution of heat and by a change of volume sufficient to burst porcelain tubes in which the sulphide is fused and then cooled. The authors find that this transformation is due to the presence of metallic iron in the commercial sulphide. It does not occur with iron sulphide prepared artificially nor with magnetic pyrites from Bodenmais, Bavaria. From a study of the heating and cooling curves of artificially prepared mixtures of iron sulphide and iron, it was found that mixed crystals are formed. The saturated crystals contain 7 per cent. of metallic iron, and undergo transformation at 138° C. without alteration of the concentrations of the two components. In the case of the unsaturated crystals with less than 7 per cent. of metallic iron, the transformation temperature is lower, and is not constant, but extends over several degrees. A similar transformation was observed with a specimen of troilite from meteoric iron, and this was proved to be due to the presence of a small proportion of carbon.—A. S.

Cobaltous hydroxide; Spontaneous oxidation of —— in alkaline solution. A. Job. Compt. rend., 1907, **144**, 1044—1047.

Equal volumes of solutions of cobaltous sulphate (30 per cent.), sodium tartrate (50 per cent.), and sodium hydroxide (30 per cent.), when mixed, yield a violet solution, which when agitated with air or oxygen, gradually turns green. The green liquid contains a cobalt compound corresponding to the oxide, Co_2O_3; but the amount of oxygen which the solution will absorb is far in excess of that needed to convert the oxide, CoO, present into the trioxide, Co_2O_3, and it is evident that the latter acts as a carrier, inducing the oxidation of the tartrate. This latter action is limited by the addition of glycerol; but even here some oxidation takes place, corresponding to a quantity of oxygen exactly equal to that absorbed in the oxidation of the cobaltous oxide. The author concludes that the compound, CoO_2, is in the first instance formed, and then oxidises the tartrate, becoming itself reduced to the trioxide, Co_2O_3. This conclusion is supported by the fact that a manganous compound, similarly treated, is converted into the dioxide, MnO_2, ultimately leaving a manganic compound (derived from Mn_2O_3) in solution. These alkaline solutions of cobalt and of manganese fix not only oxygen, but also nitrosyl; but whereas the manganese solution reacts much the more rapidly of the two with oxygen, the cobalt solution reacts more rapidly with nitrosyl.—J. T. D.

Carbonate in caustic alkali solutions; Determination of —— by Winkler's method. M. Le Blanc. XXIII., page 642.

Chlorides; A necessary modification of Volhard's method for the determination of ——. M. A. Rosanoff and A. E. Hill. XXIII., page 642.

Metallic salts; Action of phenylhydrazine on some ——. I. Reaction of molybdates. II. Detection and colorimetric determination of gold. E. Pozzi-Escot. XXIII., page 645.

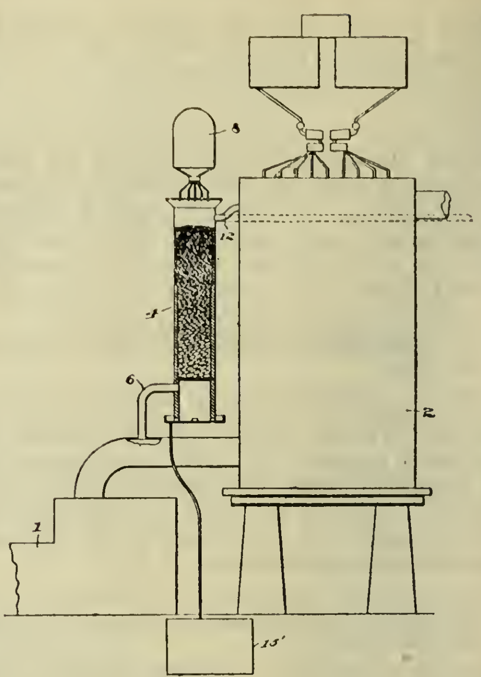
English Patent.

Ozonising oxygen or mixtures of gases containing oxygen; Process of ——. F. Fischer, Berlin. Eng. Pat. 3692, Feb. 14, 1907. Under Int. Conv., Feb. 16, 1906.

This process of ozonising oxygen or mixtures of gases containing oxygen, consists in moving oxygen or the gases containing it over red hot non-metallic bodies, such as a Nernst electrode, at a speed of over 1 m. per second, or in moving the red-hot non-metallic body through the gas at that speed.—W. C. H.

United States Patents.

Nitrating sulphur dioxide; Apparatus for ——. P. J. Berrig, North Weymouth, Mass., Assignor to The American Agricultural Chemical Co., New York. U.S. Pat. 850,820, April 16, 1907.



Sulphur dioxide, to be used for the manufacture of sulphuric acid, is supplied from a furnace, 1, to the bottom of a Glover tower, 2, the top of the latter being in connection with a lead chamber. The furnace is also connected with a nitrating chamber, 4, which contains a mass of finely-divided distributing material, over which a regulated quantity of nitrating liquid, such as sodium nitrate solution, is discharged by gravity in the form of spray from a receptacle 8, the latter being out of free communication with the Glover tower. The surplus acid from the nitrating chamber is conveyed to a storage receptacle, 15′, in order to prevent it passing into the acid produced in the apparatus. The inlet, 6, and outlet, 12, of the nitrating chamber are of relatively small size, so that a portion only of the sulphur dioxide passes through the chamber, and from the upper part of the latter direct to the lead chamber.—B. N.

Alkali hydrates and zinc sulphide; Apparatus for producing ——. C. Ranson, Brussels, and H. W. de Stucklé, Dieuze, Germany. U.S. Pat. 850,965, April 23, 1907.

See Fr. Pat. 353,496 of 1905; this J., 1905, 1013.—T. F. B.

Zinc and lead ores; Process of treating ——. J. Thelberg. U.S. Pat. 851,187, April 23, 1907. XIIIA., page 624.

Zinc sulphate; Process of producing —— directly from the ore. G. O. Angell, Philadelphia, Pa. U.S. Pat. 851,639, April 30, 1907.

Zinc and copper sulphates are obtained directly from ores containing sulphides of those metals, by roasting the crushed ore, which may be mixed with iron pyrites in a furnace provided with several chambers. The oxides of sulphur are collected in a closed chamber and, the source of heat being shut off, are allowed to act, in the presence of steam and atmospheric oxygen, on the oxides present in the roasted ore. The soluble sulphates are then leached out with water.—A. G. L.

Potash from feldspathic or other potash-bearing rock; Method of extracting ——. A. S. Cushman, Connecticut. U.S. Pat. 851,922, April 30, 1907.

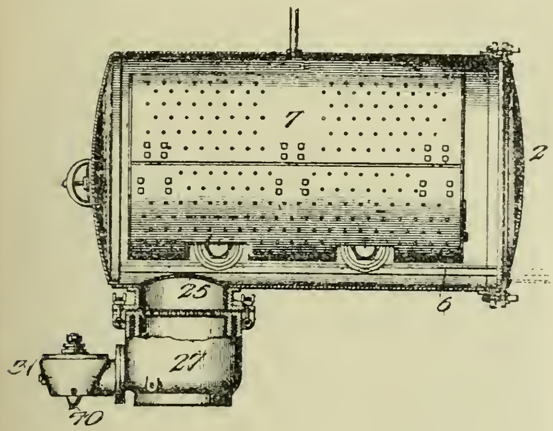
For the extraction of potash, soda, and other alkaline bases from rocks or minerals containing alkali metals, the latter, in a finely-ground condition, are subjected to electrolysis in an electrolyte containing hydrofluoric acid in the anode compartment of an electrolytic diaphragm cell. The alkali formed in the cathode compartment of the cell is neutralised by an acid.—A. S.

Dicalcium phosphate; Method of producing ——. E. Bergmann, Ohlau, Germany. U.S. Pats. 852,371 and 852,372, April 30, 1907.

See Fr. Pat. 335,790 of 1903; this J., 1904, 253.—T. F. B.

Sulphur-smelting apparatus. E. F. White, Easton, Pa. U.S. Pat. 847,869, March 19, 1907.

The apparatus consists of a smelting-cylinder, 2, approximately circular in cross-section, and having tracks, 6, secured in its lower portion. On this track travels an ore-charging car, 7, which is constructed of perforated metallic sections, as shown, a number of which are mounted so as to admit of independent movement and to provide dumping sections. The wheels of the car are partially enclosed in housings. A sump, 25 and 27, communicates with the cylinder; means for heating the sump, and a tap-valve, 31, are provided. This tap-valve communicates with the sump, and consists of a valve-body formed with a transversely-disposed port; a cone-shaped plug-seat opening through the body; a heating-jacket surrounding the seat; a valve-plug, 40, fitting the seat, this plug being formed with openings corresponding with the port in the body; a cover secured to the body and overlying the plug; and a gland-nut having threaded connection with the cover and bearing upon the plug.—A. G. L.



Minerals [*Graphite*]; *Apparatus for separating* ——. J. F. Latimer, Toronto, Canada. U.S. Pat. 851,599, April 23, 1907.

The apparatus consists of a vessel with a funnel-shaped bottom having a discharge opening at the apex. A screen of suitable mesh is placed inside the vessel at the top of the funnel-shaped portion, water being supplied by a vertical, rotating supply pipe, the outlet of which is below the screen. Attached to the supply pipe above the screen are horizontal paddles which by their rotation assist in detaching the graphite from the gangue, and accelerate the upward current of water above the screen. The graphite, which has been previously treated with oil, rises through the water and is directed by a deflecting plate to the discharge opening at the top of the vessel. —O. F. H.

Minerals [*Graphite*]; *Process for separating* ——. J. F. Latimer, Toronto, Canada. U.S. Pat. 851,600, April 23, 1907.

The crushed mineral is mixed with oil and treated in the apparatus described in the preceding abstract. The separated graphite is carried upward to the top discharge opening by the accelerated upflowing current of water above the screen, and the gangue settles to the bottom discharge opening through the slower upflowing current of water below the screen.—O. F. H.

French Patents.

Sulphuric acid; Apparatus for concentrating ——. L. Stange. Fr. Pat. 373,326, Jan. 4, 1907.

See U.S. Pat. 837,592 of 1906; this J., 1907, 151.—T. F. B.

Gas [*Ammonium chloride vapours*]; *Apparatus for generating* —— *by the combination of chemicals contained in different receptacles.* H. Ferré. Fourth Addition, dated Nov. 19, 1906, to Fr. Pat. 305,802, Nov. 28, 1900.

The present special form of the apparatus is intended for the production of ammonium chloride fumes for scenic effects, and consists of two receptacles mounted in juxtaposition, and charged with inert granular material, impregnated in the one case with ammonium carbonate and ammonia, and in the other with hydrochloric acid. Air is forced through these receptacles, and expels their contents into a third receptacle, from which the resulting ammonium chloride fumes escape through a suitable orifice.—C. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 528.)

English Patents.

Glass tank and pot furnace; Combined ——. J. A. Chambers, Allegheny, Pa. Eng. Pat. 15,292, July 5, 1906.

The furnace described comprises a tank melting chamber, the end of which, opposite to the end where the materials are fed in, is provided with an overflow trough, arranged to discharge glass from the tank into a series of pots, placed in the form of an annular ring upon a rotatable table, contained in a pot heating chamber. As each pot is filled from the overflow, and is carried round by the rotation of the table, the contained glass is fined and settles. At a point directly opposite the overflow, the pot chamber is provided with a door, through which full pots can be removed, and empty pots introduced; these latter undergo a preliminary heating during their passage round to the overflow, which softens any adhering chilled glass in them. The pot chamber is in direct open communication with the tank chamber, and is heated wholly by radiation and conduction from it. An auxiliary heating furnace may be arranged at a convenient distance from the door of the pot chamber, for the reception of the pots withdrawn from the chamber. In this furnace, provided with doors, the pots may be carried on a rotating table, and the glass can thus undergo further fining and heating before it is worked. One or more pot chambers may be connected with the tank portion. (See also Eng. Pat. 2879 of 1906; this J., 1906, 427.)—W. C. H.

Glass, porcelain, majolica, stoneware, and like articles; Furnaces for burning ——. C. Mayer, Oeslau, Germany. Eng. Pat. 29,427, Dec. 24, 1906. Under Int. Conv., Dec. 29, 1905.

A continuous muffle furnace, comprising heating, burning, and cooling portions, is provided with two transporting carriages, which can be raised and moved laterally on both sides of the burning chamber. The articles to be burnt are contained in vessels or baskets, which are put into the preliminary heating, burning, and cooling chambers, and rest on ribs or rails on the bottom of the heating and cooling chambers. The transporting carriages are mounted on a rail that can be raised or lowered, and operate through slits in the floors of the chambers. As the rail is raised, the transporting carriages lift the vessels or baskets vertically, and carry them the required distance forward by the forward movement of the carriages; on then lowering the rail, the carriages again deposit the vessels on the ribs in the next position further forward, and at the same time the supporting arms of the carriages are removed downwards out of the range of the injurious heating effects of the heating chamber.—W. C. H.

United States Patents.

Glass-furnace. S. O. Richardson, Jun., Toledo, Ohio. U.S. Pat. 849,021, April 2, 1907.

The furnace consists of a heating chamber, in which a closed melting-pot is mounted. This pot is provided with a feed-port, opening outside of the heating chamber, and with an outlet-port discharging into the furnace. The furnace is also provided with a plaining chamber, which receives "metal" from the pot through a conduit. Below the conduit an air-port is interposed between the heating chamber and the plaining chamber.—A. G. L.

Sheet glass ; Drawing ——. I. W. Colburn, Franklin, Pa., and J. Player, River Forest, Ill., Assignors to Colburn Machine Glass Co., Franklin, Pa. U.S. Pat. 849,531, April 9, 1907.

A mass of molten glass is caused to overflow its container at two opposite points, whilst a sheet of glass is drawn from the mass with its plane in a line between these two points. At the same time, the level of the molten glass is kept approximately constant, and films of heated gases are directed over the surface of the molten mass on opposite sides of the sheet. The temperature of these gases is kept higher than that at which striæ or wave-lines can form. The apparatus for carrying out the above process is also claimed.—A. G. L.

Glass ; Opaque ——. A. L. Reinmann, Hanover, N.J. U.S. Pat. 851,317, April 23, 1907.

This invention relates to the production of artificial alabaster, an opaque glass, obtained from about 100 lb. of pure white sand, 42 lb. of "soda," preferably of 90 per cent. strength, 20 lb. of finely-powdered and sifted asbestos, and 4 lb. of nitre, or 20 lb of finely-powdered talcum. About 1 lb. of arsenic may also be used, and the mass may be coloured with metallic oxides. This composition of matter for artificial alabaster is also claimed.—W. C. H.

French Patents.

Ceramic pastes (slips) ; Preparation of ——. L. Auclair. Fr. Pat. 372,858, Dec. 22, 1906.

"Colloidal" bodies, such as silica and alumina, which obstinately retain water during drying, and lead to fracture of the finished product, are removed from clays by treatment with a solution of sodium, ammonium, or potassium carbonate (0·2 to 0·5 per cent. of sodium carbonate being used). The clay is separated by means of a filter-press, the cakes obtained being dried at 100° C. On treating them with a small quantity of water, they give a very liquid slip after this treatment.—A. G. L.

Furnaces ; Regenerative crucible ——, *applicable for enamelling and other purposes.* Incandescent Heat Co., Ltd., and A. Smallwood. Fr. Pat 373,218, Sept. 17, 1906.

See Eng. Pat. 18,877 of 1905 ; this J., 1906, 1049.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(Continued from page 529.)

Lime mortars ; Strength of ——. W. J. Dibdin, Royal Inst. Brit. Archit. Eng. Rec., 55, 161—162. Chem. Abs. (Amer. Chem. Soc. 1907, 1, 8991).

An extended series of tests, undertaken to determine the factors which affect the strength of lime mortar and the importance of each, has been made by the author. These tests include an investigation into the strength of various mixtures of sand and lime, the effect of fineness of the sand, the effect of clay in the sand, and the effect of delay in using the mortar. Both tension and compression tests were made on briquettes having a breaking area of 1 sq. in. In the compression tests the briquettes were cylindrical in form, 1 in. high, and 1·12 in. in diameter, giving a sectional area of 1 sq. in. In determining the strength of various mixtures, a mortar was made of sand grading 1/20 to 1/30 in., and mixed with lime in the proportion 1 : 1, the lime used being the "best gray lime," and unslaked. Briquettes of this mortar showed an average compression strength of 150 lb. per sq. in. at the end of three months. With mixtures of 1 : 2, 1 : 3, and 1 : 4, the compression strengths became 62 lb., 54lb., and 53 lb., respectively. In subsequent tests it was found that in all cases where the sand was coarser than 1/50 in., the mortar was stronger when only 1 and 2 volumes were used, these two mixtures being about equal in strength, but when the sand was finer than 1/50 in., the compression strengths of the various proportions were about equal at the end of three months, ranging from 58 to 66lb. per sq. in. The tests for tensile strength were in the same ratio. This indicates that with a coarse sand an increase in the lime content is a distinct advantage. Briquettes were then made of a mortar, 1 : 1 mixture, using sand of various grades of fineness. With sand grading 1/20 to 1/30 in., the average compression strength at the end of three months was 150 lb. This decreased to 58 lb. for sand of 1/50 to 1/75 in. fineness. There seemed to be a decided decrease in the compression strength as the size of the grains decreased. To determine the effect of clay, about 600 tension and compression tests were made with various percentages of clay mixed with mortar. The clay was ground to pass 1/75 in. and was added in proportions of 2½, 5, 7½, and 10 per cent. The variation in strength developed by the different mixtures was not nearly so pronounced as before, and when 7½ or 10 per cent. of clay was added, the 5 : 1 briquettes were about as strong in both compression and tension tests as the richer mixtures. The compression strength, moreover, showed a marked increase with the addition of clay. With additions of 7½ or 10 per cent., the briquettes of all mixtures exceeded 200 lb., and averaged 225 lb. By tests made with sand which naturally contained clay, it was found that the compression strength was decreased one-half by washing out the clay. To determine the effect of delay in using mortar after it is mixed, briquettes were tested which were made of new mortar and mortar, 1, 2, 3, 7, and 11 days old, respectively, the proportion of sand and lime in all cases being 3 : 1. From these tests it appears that up to seven days there is an increase in strength, but after that time, that is, after the mortar has once set, the effect of a second breaking up is distinctly detrimental, although better results were obtained than at any time before the first setting. The compression strength at one month gradually rose to 116 lb. per sq. in. with 7-day old mortar, and fell to 83 lb. when the mortar had been allowed to stand 11 days before being used. In making the various compression tests, it was noticed that "spalling" occurred when clean sand was used in over-limed mortar. When clay was used with the sand, "spalling" occurred frequently.

English Patents.

Wood ; Apparatus for the treatment of —— with preservative compositions. H. Altena, Oberhausen, Germany. Eng. Pat. 15,631, July 10, 1906.

See Fr. Pat. 363,811 of 1906 ; this J., 1906, 848.—T. F. B.

Wood or other materials ; A method of partially impregnating ——. J. O. Ohlsson, Stockholm. Eng. Pat. 1636, Jan. 22, 1907.

When articles of wood or other material are impregnated by being immersed completely, or nearly completely, in the impregnating material, the method described provides a means of preventing or diminishing the amount of the impregnation at any portions of the articles. It consists in surrounding or coating such portions of the surface of the articles with one or more substances of such a nature that the penetration of the impregnating material is either prevented or diminished, for instance by means of sleeves of sheet metal, or by a coating of a gummy or resinous or fatty substance, according to the nature of the impregnating material, or by filling the pores of the surfaces with precipitated silica, gypsum, aluminium hydroxide, &c. When the articles are provided naturally with a cover, such as the bark upon trees, it is only necessary to remove this cover from those portions of the surface where impregnation is required.—W. C. H.

Corundum ; Treatment of —— for the manufacture of ceramic and other compositions. F. Engelhorn (C. F. Boehringer und Soehne), Mannheim-Waldhof, Germany, Eng. Pat. 15,539, July 9, 1906.

See Fr. Pat. 372,845 of 1906 ; following these.—T. F. B.

Cement clinkers; Process of and apparatus for making ——. B. E. Eldred, Bronxville, U.S.A. Eng. Pat. 10,091, April 30, 1906.

SEE Fr. Pat. 365,579 of 1906; this J., 1906, 987.—T. F. B.

Cement; Mixing machinery applicable especially for mixing slurry in the manufacture of ——. H. Skinner, Rosherville, Kent. Eng. Pat. 21,160, Sept. 24, 1906.

ACCORDING to this invention, slurry or other material contained in a tank is mixed by causing a vertical cylinder open at both ends to revolve in it; the larger part of the cylinder is immersed in the slurry, and is provided on the outside with screw threads to drive the slurry downwards, and on the inside with screw threads to force it upwards through the cylinder, and discharge it from the bell-mouthed upper end, and throw it back into the bulk of the slurry, at a distance from the cylinder. Radial baffle-plates may be arranged vertically on the bottom of the tank, just clear of the outside screw. For larger plant, the tank, instead of being circular with a concave bottom, may be annular with a similar concave bottom, and a number of revolving cylinders may be attached to arms, radiating from a central column, and caused by suitable gearing to revolve on their axes, and also to travel round in the annular tank. The lower end of each vertical axis may carry a loose baffle-plate, which will trail behind the cylinder, as the latter travels round the annular tank.—W. C. H.

UNITED STATES PATENTS.

Lime; Method of treating [hydraulic] ——. M. R. Isaacs, Philadelphia, Pa. U.S. Pat. 843,277, Feb. 5, 1907.

FROM 2 to 30 per cent. of sodium fluoride, or other soluble fluoride, are added to the lime, in order to retard the setting of the latter.—A. G. L.

Stone, artificial; Process for manufacturing ——. J. Standt, Bonn, Germany. U.S. Pat. 850,689, April 16, 1907.

A RESINOUS substance, "having catalytic properties," is dissolved in linseed-oil or other oily or fatty binding agent, and the solution is mixed with ground quartz sand and powdered clay, or other filling substance, in quantity sufficient to produce a moist and porous mixture. This is exposed in a thin layer to the action of the air at a temperature of 100° to 130° C. for 15 or 20 minutes. The solidified mixture is then moulded into objects of the required shape, and hardened at a temperature not exceeding 200° C.—A. G. L.

Sand-lime, or composite brick or stone; Manufacture of ——. A. S. Crocker, Rochester, N.Y. Assignor to L. Elkus, Indianapolis, Ind. U.S. Pat. 851,406, April 23, 1907.

PANS to contain calcium carbonate and vessels to hold hydrochloric acid are supported, the latter above the former, within a "hardening cylinder" from a shaft. The latter extends along the upper part of the cylinder, and can be rotated.—W. H. C.

Cement; Impermeable —— for resisting water. G. Frollo, Milan, Italy. U.S. Pat. 849,778, April 9, 1907.

THE cement is composed of linseed oil, water, "quick-sand," colophony, "tailors' chalk," marble, and zinc sulphate.—A. G. L.

Cement-kiln. J. S. Wentz, Philadelphia, Pa. U.S. Pat. 849,873, April 9, 1907.

THE kiln is provided with an elongated body portion, a flat hearth, and an arched roof enclosing the hearth. To the body of the kiln are coupled, by means of lateral projections and eyebolts, a series of suspension rods which can be vertically adjusted. A reciprocating motion can be imparted to the entire body of the kiln, including the hearth and roof. Means are provided for feeding the raw material on to the hearth and discharging the burnt material from it, as well as means for feeding fuel into the discharge end of the kiln between the hearth and the roof. A stack communicates with the inlet end of the kiln, so that the products of combustion pass through the kiln in contact with, and against the stream of material. —A. G. L.

Cement-kiln. W. H. Harding, Philadelphia, Pa. U.S. Pat. 850,750, April 16, 1907.

AT the upper end of a rotary kiln, a combustion chamber is formed, having a storage space below the mouth of the kiln, and out of the path of the products of combustion. Into this storage space raw material is discharged from a bin over the combustion chamber by a number of tubes leading through the chamber, and terminating below the opening of the kiln, the raw material being heated in its passage through these tubes by the products of combustion. A conveyor removes the raw material from the storage-space and delivers it to the kiln.—A. G. L.

Cement; Process of making hydraulic ——. E. Mueller, Alsen, N.Y. U.S. Pat. 850,778, April 16, 1907.

A CARBONACEOUS fuel, *e.g.*, powdered coal, and a powdered flux, *e.g.*, calcium fluoride (fluorspar), are intimately mixed together, and simultaneously introduced into the kiln.—A. G. L.

Portland cement; Waterproof ——, and process of making same. S. B. Newberry, Sandusky, Ohio. U.S. Pat. 851,247, April 23, 1907.

THE process described of rendering cement waterproof consists in mixing with it a small percentage of the insoluble calcium salt of a fatty acid, such as calcium stearate, substantially free from glycerin or other soluble substance. The claims also include the composition of matter produced by the process.—W. C. H.

Cement kiln. T. M. Morgan, Longue Pointe, Canada. U.S. Pat. 851,765, April 30, 1907.

SEE Eng. Pat. 6946 of 1906; this J., 1906, 848.—T. F. B.

FRENCH PATENTS.

Corundum; Process for the treatment of ——. C. F. Boehringer und Söhne. Fr. Pat. 372,845, March 1, 1906.

NATURAL or artificial corundum, or fused aluminium oxide, is mixed with binding agents hardening in water, such as cement, hydraulic lime, or plaster. The mixture is moulded and burnt, the product obtained being claimed to resist the action of acids and alkalis, as well as that of heat.—A. G. L.

Wood; Process for preserving ——, and apparatus therefor. Soc. Anon. per la Conservazione del Legno. Fr. Pat. 372,192, Oct. 22, 1906.

THE process consists in heating the wood for 1½—2½ hours at a temperature of 130°—150° C. in a bath of substances which fuse or soften at high, and solidify at low temperatures, such as anthracene or pitch; at the end of this treatment, the wood is removed with the least possible delay to one or more cold baths, in which it is subjected to the action of other preserving agents. Preferably, one cold bath is used, in which a solution of zinc chloride (or other salts) of 2° to 4° B. rests on a heavier immiscible liquid, *e.g.*, creosote of 10° to 14° B. The wood is first placed so as to be immersed in the creosote only. The sudden chilling draws the creosote, which dissolves the anthracene or pitch easily, into the wood; when sufficient creosote has entered, the wood is raised so as to be surrounded by the salt solution, which penetrates it and mixes with the creosote. The apparatus in which the process is carried out is also claimed.—A. G. L.

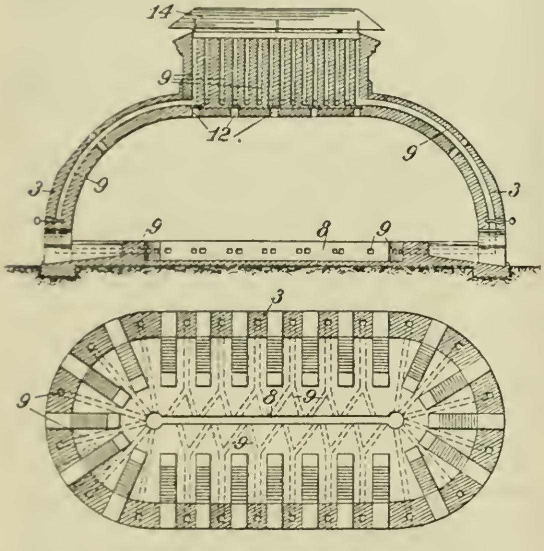
Bricks; Manufacture of light —— composed of clay or marl and vegetable materials. B. Giscard. First Addition, dated Oct. 24, 1906, to Fr. Pat. 366,291, Feb. 17, 1906. (This J., 1906, 986.)

FUSIBLE mineral substances may be added to the materials of which the bricks are composed, in order to increase their resistance to moisture. The bricks may also be enamelled.—A. G. L.

Building stones, bricks, and pipes made of slag; Method of making ——. Cöln-Müsener Bergwerks Akt.-Ver. First Addition, dated Nov. 19, 1906, to Fr. Pat. 362,808, of Jan. 29, 1906.

Objects made of slag are rapidly hardened by subjecting them to the action of carbonic acid in a partial vacuum. For this purpose, the hardening chamber containing the objects is partly evacuated; carbonic acid or a mixture of gases containing carbonic acid is then introduced, the absorption of the carbonic acid itself aiding in the creation of a vacuum. Fresh carbonic acid is introduced from time to time; if a mixture of gases is used, the residual gases are pumped out at intervals. The vacuum is preferably maintained to a determined extent by automatic means. —A. G. L.

Bricks, lime, and the like; Kiln for burning ——. P. Czigler and J. Eotvös. Fr. Pat. 373,000, Dec. 14, 1906.



The kiln is designed to economise heat. For this purpose, the products of combustion are made to pass through a number of channels (9) arranged in the crown of the furnace, whence they pass to other passages between the inner and outer walls of the furnace (3), on their way to a central channel (8) placed below the bed of the furnace, from which they go to the chimney. In starting the furnace, the passages in the walls of the furnace are closed by dampers, the burnt gases escaping into the open air through the channels in the crown of the furnace, the ports (12) which are afterwards closed, being then open, and the top (14) being raised.—A. G. L.

Stone artificial; Process for making ——. J. Staudt. First Addition, dated Dec. 26, 1906, to Fr. Pat. 348,601, Dec. 6, 1904.

See U.S. Pat. 850,682 of 1907; preceding these.—T. F. B.

Cement; Burning of —— *in vertical kilns.* Maschinenbau-Anstalt Humboldt. Fr. Pat. 372,219, Nov. 19, 1906.

The cement materials are mixed with a finely divided combustible, and with sufficient water to hold the mass together, and the mixture is introduced in the wet state into the fixed kiln in which the cement is burnt. A feeble binding agent such as underburnt cement, finely ground, may be added, and the mixture may be suitably moulded. The presence of the water vapour is claimed to facilitate the burning.—A. G. L.

X.—METALLURGY.

(*Continued from page* 533.)

Iron and steel; Report of Committee on the uniform nomenclature of ——. Iron and Steel Inst., May, 1907.

In 1901 the International Association for Testing Materials appointed an influential committee to establish uniform nomenclature for iron and steel. The committee comprised Prof. H. M. Howe (New York), chairman; Mr. L. Lévy (Paris) and Prof. D. Tschernoff (St. Petersburg), vice-chairmen; Prof. A. Sauveur (Harvard), secretary, and seventeen members, including Messrs. E. P. Martin, A. Pourcel, H. Wedding, and H. H. Campbell. The report was presented by Profs. H. M. Howe and A. Sauveur at the Brussels Congress of the International Association. The report was received and adopted by the Congress.

The following definitions were given:—

Alloy cast irons.—Those which owe their properties chiefly to the presence of an element (or elements) other than carbon.

Alloy steels.—Those which owe their properties chiefly to the presence of an element (or elements) other than carbon.

Basic pig iron.—In America, pig iron containing so little silicon and sulphur that it is suited for easy conversion into steel by the basic open-hearth process. It is restricted to pig iron containing not more than 1·00 per cent. of silicon.

Bessemer pig iron.—That which contains so little phosphorus and sulphur that it can be used by itself for conversion into steel by the original or acid Bessemer process. In America, this term is restricted to pig iron containing not more than 0·10 per cent. of phosphorus.

Bessemer steel.—Steel made by the Bessemer process, whether its carbon content is high, low, or intermediate.

Blister steel.—Steel made by carburising wrought iron by heating it in contact with carbonaceous matter. It might also be made by so carburising a low-carbon steel.

Cast iron.—Generically, iron containing so much carbon, or its equivalent, that it is not malleable at any temperature. Specifically, cast iron in the form of castings, other than pigs, or remelted cast iron suitable for casting into such castings, as distinguished from pig iron, *i.e.*, cast iron in pigs, &c. (See Pig iron.) The committee recommends drawing the line between cast iron and steel at 2·20 per cent. of carbon, for the reason that this appears from the results of Carpenter and Keeling to be the critical percentage of carbon corresponding to the point "a" in the diagrams of Roberts-Austen and Roozeboom. As to the signification of this critical point, the committee is not prepared to express an opinion.

Cast steel.—The same as crucible steel; obsolescent, and to be avoided because confusing, and because it offers a temptation to fraud.

Cemented steel.—The same as blister steel.

Charcoal hearth cast iron.—Cast iron which has had its silicon and usually its phosphorus removed in the charcoal hearth, but still contains so much carbon as to be distinctly cast iron.

Converted steel.—The same as blister steel.

Crucible steel.—Steel made by the crucible process, whether its carbon content is high, low, or intermediate.

Grey pig iron and grey cast iron.—Pig iron and cast iron in the fracture of which the iron itself is nearly, or quite, concealed by graphite, so that the fracture has the grey colour of graphite.

Hæmatite pig iron.—Originally pig iron made from the hæmatite ores of England, which happen to be so free from phosphorus and sulphur that the pig iron made from them can be used by itself for the acid-Bessemer process. By association, it has come to mean any pig iron thus relatively free from phosphorus and sulphur. The term is not used in America, and is undesirable.

Hot metal or direct metal.—The molten cast iron from the blast-furnace before it has been allowed to solidify.

Ingot iron.—Steel cast into an initially malleable mass and containing so little carbon or its equivalent that it does not harden greatly on sudden cooling. The word is rarely used in England, "mild steel" or "low-carbon steel" or "soft steel" being generally used in its place. In America, the line between soft steel and half-hard steel is usually drawn at a carbon content of about 0·20 per cent.

Ingot steel.—Steel cast into an initially malleable mass and containing so much carbon or its equivalent that it hardens greatly on sudden cooling. The word is rarely used in England, but "hard steel," "high-carbon steel," or "half-hard steel" are used in its place.

Malleable castings.—Castings of malleable iron, which see.

Malleable cast iron.—Iron which, when first made, is cast in the condition of cast iron, and is made malleable by subsequent treatment without fusion. Although the English name of this variety suggests that it is cast iron, it is not truly a variety of cast iron, but rather forms an independent species of iron, because it lacks the essential property of cast iron, *viz.*, its extreme brittleness. Though the term "malleable castings" is very common, the term "malleable cast iron" is very rarely used. The common but inexcusable term, we regret to say, is "malleable," pronounced "mallable," used as a substantive.

Malleable iron.—The same as wrought iron. Used in Great Britain, but not in the United States, except carelessly, as meaning "malleable cast iron."

Malleable pig iron.—An American trade name for the pig iron suitable for converting into malleable castings through the process of melting, treating when molten, casting in a brittle state, and then making malleable without remelting. The term should be used with care to avoid confusion. This material is also called in trade in America "malleable iron"; but this use should be avoided, because "malleable iron" has the older and (in Great Britain) firmly established meaning of "wrought iron."

Mottled pig iron and mottled cast iron.—Pig iron and cast iron, the structure of which is mottled, with white parts in which no graphite is seen, and grey parts in which graphite is seen.

Open-hearth steel.—Steel made by the open-hearth process, whether its carbon content is high, low, or intermediate.

Pig iron.—Cast iron which has been cast into pigs direct from the blast-furnace. This name is also applied to molten cast iron which is about to be so cast into pigs, or is in a condition in which it could readily be cast into pigs.

Plate iron.—A name applied in Great Britain to refined cast iron.

Puddled iron.—Wrought iron made by the puddling process.

Puddled steel.—Steel made by the puddling process, and necessarily slag-bearing. (See Weld steel.)

Refined cast iron.—Cast iron which has had most of its silicon removed in the refinery furnace, but still contains so much carbon as to be distinctly cast iron.

Shear steel.—Steel, usually in the form of bars, made from blister steel by shearing it into short lengths, piling, and welding these by rolling or hammering them at a welding heat. If this process of shearing, piling, &c., is repeated, the product is called "double shear steel."

Steel.—Iron which is malleable at least in some one range of temperature, and in addition is either (*a*) cast into an initially malleable mass; or (*b*) is capable of hardening greatly by sudden cooling; or (*c*) is both so cast and so capable of hardening. Variety *a* includes also molten iron, which, if cast, would be malleable, as do its two sub-varieties, "ingot-iron" and "ingot-steel." (Tungsten steel is malleable only when red-hot.)

Steel-cast (adjective).—Consisting of solid Bessemer, open-hearth, crucible, or other slagless steel, and neither forged nor rolled; applied to steel castings. For instance, a "steel-cast" gun is a gun which is a steel casting, *i.e.*, which has been neither forged nor rolled. To call it a "cast steel" gun would imply that it was made of crucible steel, to which the term "cast steel" is restricted.

Steel castings.—Unforged and unrolled castings made of Bessemer, open-hearth, crucible, or any other steel. Ingots and pigs are, in a sense, castings; the term "steel castings" is used in a more restricted sense, excluding ingots and pigs, and including only specially shaped castings, such as are generally used without forging or rolling. They may, however, later be forged, *e.g.*, under the drop press, when they cease to be "castings" and become "drop forgings," or, if only part is forged, then they are partly forgings and partly castings.

Washed metal.—Cast iron from which most of the silicon and phosphorus have been removed by the Bell-Krupp process without removing much of the carbon, so that it still contains enough carbon to be classed as cast iron. The name "washed metal" is extended to cover this product even if its carbon is somewhat below the proper limit for cast iron.

Weld iron.—The same as wrought iron. Obsolescent and needless.

Weld steel.—Iron containing sufficient carbon to be capable of hardening greatly by sudden cooling, and in addition slag-bearing, because made by welding together pasty particles of metal in a bath of slag, as in puddling, and not later freed from that slag by melting. The term is rarely used.

White pig iron and white cast iron.—Pig iron and cast iron in the fracture of which little or no graphite is visible, so that their fracture is silvery and white.

Wrought iron.—Slag-bearing, malleable iron, which does not harden materially when suddenly cooled.

Wrought steel.—The same as weld steel. Rarely used.

The following are definitions of names designating special sizes or shapes of iron and steel:—

Bar iron.—Wrought iron in the form of bars, rods, &c.

Muck bar.—The rough bars, usually 1 inch thick and about 4 inches wide, made by the first rolling of a ball of puddled iron.

Merchant bar.—Wrought iron in the form of merchantable bars or rods made by shearing muck bar into short lengths, piling it and rolling or forging it at a welding heat.

Bloom.—1. A large bar, drawn from an ingot or similar mass, for further manufacture. 2. A rough bar of wrought iron drawn from a Catalan or bloomery ball for further manufacture.

Billet.—A small bar drawn from a pile, bloom, or ingot for further manufacture. The committee recommends that the line between blooms and billets be drawn at the size of 5 inches square, as representing common custom.

Slab.—A flat piece or plate, with its largest surfaces plane, drawn or sheared from an ingot or like mass for further treatment.

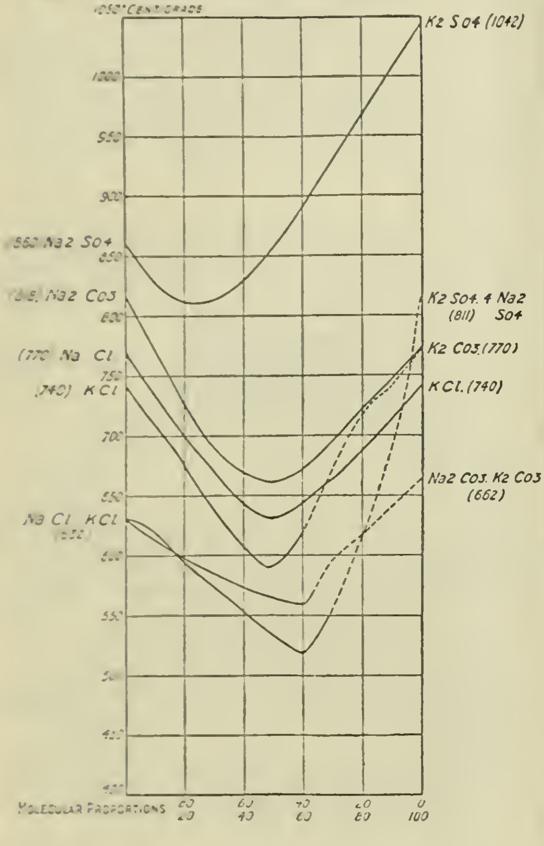
In conclusion, the view is expressed that it would be well to decide on a definite carbon content to serve as a boundary line between ingot iron and ingot steel, between puddled iron and puddled steel, and between any other varieties of wrought iron and weld steel. Two plans have been considered. One is to draw this line at 0·32 per cent. of carbon or its equivalent in other elements, for the reason that this carbon content appears to correspond to the critical point O in the diagrams of Roberts-Austen and Roozeboom. This has the merit of corresponding to a definite physical boundary. The other plan is to draw the boundary at 0·20 per cent. of carbon, because this is a convenient place to separate the important classes "soft steel" and "half-hard steel," so that if this point were adopted, "ingot iron" would be synonymous with "soft steel," and "ingot steel" would be the equivalent of the two classes "half-hard steel" and "hard steel."

Wrought iron; The structure of ——. A. Sauveur. Electrochem. and Metall. Ind., 1907, 5, 119—120.

THE author ignores the usual impurities of wrought iron which is considered simply as containing iron free from carbon (ferrite) and slag. By means of microphotographs he shows that wrought iron does not, as is generally assumed, possess a fibrous structure. The slag only is drawn into fibres, whilst the ferrite is present, as in steel, in the form of polygonal, often hexagonal, grains, each of which is made up of a number of cubical crystals, whose axes lie in the same directions.—A. G. L.

Pyrometers; Sentinel ——, *and their application to the annealing, hardening, and general heat treatment of tool steel.* H. Brearley and F. C. Moorwood. Iron and Steel Inst., May, 1907. [Advance proof.]

MELTING-POINT CURVES OF METALLIC SALTS



THE use of small cylinders of metallic salts which fuse at definite temperatures is advocated in order to determine accurately the temperatures within an annealing furnace. Almost any required temperature may be obtained by using cylinders made by mixing the potassium and sodium salts in suitable proportions, the melting points of a number of such mixtures being indicated by the diagram. In general, these melting points are perfectly definite, but in some cases, indicated by the dotted lines, the melting point of the mixture is not so clearly seen. In cases where the "sentinel" cylinder cannot be kept under direct observation, as in the interiors of annealing boxes, it may be enclosed in a wrought-iron tube placed in the furnace; a spring presses the sentinel against the end of the tube, and makes electrical contact, ringing a bell, as soon as the latter has melted and the spring touches the tube.—A. G. L.

Sulphur; Distribution of —— *in metal ingot moulds.* J. Henderson. Iron and Steel Inst., May, 1907. [Advance proof.]

THE sulphur in steel castings does not decrease proportionally all the way down. The author finds that the excessive sulphur does not go deeper than the second inch, beyond this the distribution being even. It would be more satisfactory, then, in estimating the sulphur contents, to take a sample from the bottom alone. The lowest percentage of carbon in these moulds is generally associated with the highest sulphur, showing, probably, that the latter exists as a segregate of manganese sulphide.
—C. A. W.

Steel and iron; Influence of vanadium on ——. P. Pütz. Metallurgie, 3, 714—721. Chem. Abs. (Amer. Chem. Soc.) 1907, **1**, 546.

THIS work on the metallography of steel containing vanadium up to about 1·5 per cent. is supplementary to a study of the mechanical properties of such steels, previously published. Samples with about 0·2 per cent. of carbon and similar ones containing varying amounts of vanadium up to 0·68 per cent. were cooled in the air after forging, and examined. The predominant effect of vanadium was to decrease the size of the ferrite grains and to make the material harder. Steels richer in carbon, with up to 0·55 per cent. of carbon, cooled in six hours from 900°—500° were perlitic. The addition of vanadium has a marked influence on the structure of these steels, rendering the ordinary lamellar structure due to perlite fine grained and homogeneous, the carbide distributing itself uniformly in the whole mass. Vanadium favours the formation and increases the stability of sorbite. Carbon steels approximating 0·6—0·8 per cent. of carbon were heated for 20 minutes at 950° and then cooled in about 4 minutes to 400°. These showed sorbite in a marked stage of transition into perlite. The same steels with 0·8—1·0 per cent. addition of vanadium were much more characteristically sorbitic. A very varied series of heat treatments was undertaken to determine the stability of sorbite in these steels; vanadium steel was found to possess the best properties when cooled in 3—3½ hours from 850° or 900° to 500°, while the ordinary carbon steel required but 2½ hours. Both steels if improperly cooled, with resulting carbide separation, may be regenerated by heating at 1000° for 40 minutes and subsequently cooling as directed. No definite results relative to the influence of vanadium on the stability of martensite in hardened steels were attained. The well-known action of atmospheric oxygen in separating carbon from steel is found to be much diminished by the addition of vanadium. The amounts of vanadium necessary to produce desirable results in the treatment of steel are much less than are required in other cases such as chromium, tungsten, and nickel.

Boron steels; Properties of ——. L. Guillet. Compt. rend., 1907, **144**, 1049—1050.

THE author finds that in boron steels, containing from 0·28 to 0·60 per cent. of carbon and from 0·21 to 0·85 per cent. of boron, the effect of the boron is to raise the breaking stress, especially after tempering. Many of the steels are very fragile, but this is lessened after tempering. Micrographic examination shows that they are composed of a solid solution containing very little boron, perlite, and a granular substance which seems to be a borocarbide of iron; this substance probably causes the fragility of the steels, for it disappears after tempering, having apparently passed into solution.—J. T. D.

Iron; Alloys of —— *with tin and gold.* E. Isaac and G. Tammann. Z. anorg. Chem., 1907, **53**, 281—297.

IRON and tin in the molten state are not miscible in all proportions. Mixtures containing from 50 to 89 per cent. of tin separate into two layers, a heavier one containing 50 per cent., and a lighter one containing 89 per cent. of tin. At 1140° C. the heavier layer decomposes into the melt containing 89 per cent. of tin and mixed crystals of iron and tin containing 19 per cent. of tin. The tin held in solid solution by the iron has no appreciable influence on the temperature at which that metal loses its magnetic properties. Tin and iron form at least one compound (at 893° C.), probably Fe_3Sn, which at 780° C. undergoes transformation. A break in the curve was also observed at 496° C., but it was not found possible to establish whether this was due to a second transformation of the compound mentioned, or to the formation of another compound. The compound of iron and tin which forms at 893° C. is more resistant to acids than tin or iron, but not sufficiently so to allow of its separation from the latter in this way. Iron and gold form no compounds. The molten metals are miscible in all proportions. Two series of mixed crystals are formed on solidification, containing respectively up to 28 per cent. of gold and up to 37 per cent. of iron. The alloys containing between 28 and 63 per cent. of gold, when quenched from 1050° C., consist of mixtures of the two kinds of mixed crystals. If the alloys be cooled slowly, however, the only homogeneous ones (*i.e.*, alloys consisting of one kind of mixed crystals) are those containing up to 18 per cent. of gold on the one hand, and up to 15 per cent. of iron on the other. This difference between the quenched and the slowly cooled alloys is due to the fact that whereas γ-iron dissolves about 28 per cent. of gold, α-iron dissolves less than 20 per cent. Gold has no appreciable influence on the transformation temperatures of iron.—A. S.

[Ore] Tailings ; Storage of —— for future handling. H. T. Durant. Eng. and Mining J., 1907, **83**, 727.

THE author points out that in various parts of America and also in South Africa large dumps of ore tailings have been rendered, by the method of storage, valueless, or much less valuable than should have been the case. Thus, in a wet-crushing mill treating a free-milling gold ore, the average value of the mill tailings was 1¾ dwts. The tailings were too poor to be worked at a profit under existing local conditions, and were stored without any attempt at classification, whereas they might easily have been separated into 40 per cent. of slimes containing 1 dwt. per ton, and 60 per cent. of sands with 2¼ dwts. of gold per ton. In another case a mechanical analysis of tailings containing rather more than 1 dwt. of gold per ton, showed that about 50 per cent. of the total gold was contained in the coarser portion constituting about 10 per cent. by weight of the whole tailings.—A. S.

Silver ; Alloys of ——, with lead and tin. G. J. Petrenko. Z. anorg. Chem., 1907, **53**, 200—211.

No combination of silver and lead, and no mixed crystals of these metals, appear to be formed. Alloys of silver and tin, containing up to 20 atoms per cent. of tin, deposit, on cooling, homogeneous mixed crystals of the two metals. With between 20 and 27 per cent., a compound, Ag_3Sn, separates alongside of these mixed crystals, increasing in proportion as the percentage of tin increases. Beyond 27 atoms per cent. of tin, the compound, Ag_3Sn, alone separates, the remainder solidifying on cooling sufficiently, as a eutectic containing about 96 atoms per cent. of tin. From alloys containing more tin than this, metallic tin separates till the eutectic composition is reached. The compound, Ag_3Sn, appears to be dimorphous, since it separates at about 480° C., and undergoes change, with evolution of heat, at about 220° C.—J. T. D.

Silver ; Alloys of ——, with the metals of the iron group. G. J. Petrenko. Z. anorg. Chem., 1907, **53**, 212—215.

SILVER forms no compound with iron, nickel, or cobalt. Iron and cobalt are insoluble in silver up to 1600° C., but nickel forms with silver a series of mixed crystals, in which the proportion of silver never exceeds 4 per cent. These separate at a temperature of about 1465° C., and no other halt in the cooling occurs till the melting point of silver is reached. The fluid, when completely melted, always consists of two layers, if more than 4 per cent. of silver be present.—J. T. D.

Arsenic and antimony in refined copper ; The Knorr method of determining ——. P. Butler. Chem. Eng., **5**, 66—67. Chem. Abs. (Am. Chem. Soc.), 1907, **1**, 538.

ONE HUNDRED grms. of the copper turnings are dissolved by the gradual addition of 400 grms. of concentrated nitric acid. The solution is evaporated until basic copper nitrate separates on the sides of the beaker. Distilled water is added until a volume of about 600 c.c. is obtained, and a pinch of potassium chlorate added to the boiling solution. Six hundred mgrms. of arsenic- and antimony-free ferrous sulphate are now gradually added, the solution boiled for two minutes, and removed from the heat. The iron will be precipitated as ferric hydroxide, carrying down with it all the arsenic, antimony, and tin present. The precipitate is filtered off, dissolved through the filter by hydrochloric acid (sp. gr. 1·17) into a distilling flask of special design, provided with a ground thistle tube with a glass stopcock and bulb condenser with ground joint. Ten c.c. of sulphuric acid are added, 10—15 drops of 10 per cent. hypophosphorous acid, and sufficient hydrochloric acid to make up the volume to about two-thirds the capacity of the flask. Distillation under constant volume, maintained by the funnel tube, is conducted at a moderate heat, the distillate being fractioned into beakers containing cold water. The arsenic is precipitated in the distillates by hydrogen sulphide. The antimony is distilled by raising the temperature until fumes of sulphur trioxide pass over, and maintaining at this temperature so long as the distillates give any precipitate with hydrogen sulphide. The distillate is collected in water acidulated with tartaric acid, and the antimony precipitated by hydrogen sulphide in oxalic acid solution.

Copper ; Silicides of ——. E. Rudolfi. Z. anorg. Chem., 1907, **53**, 216—227.

FUSED mixtures of copper and silicon containing from 0 to 4·5 per cent. of silicon, deposit on cooling, mixed crystals containing as a limit 4·5 per cent. of silicon. Those containing 4·5 to 7·83, deposit crystals containing 4·5 per cent., till the remaining liquid reaches 7·83 per cent. of silicon, when crystals containing 7·34 per cent. also form. At 9·79 per cent. of silicon, the cooling curve has a minimum point, and eutectic solidification occurs. Between 7·83 and 9·79 per cent., the solid is a mixture of the crystals of 7·34 per cent. and the eutectic, and from 9·79 to 17·6 per cent., the eutectic is mixed with crystals of the compound, Cu_3Si ; the latter being in maximum amount at 12·8 per cent. At higher silicon-concentrations than 17·6 per cent., silicon crystallises out till the concentration is reduced sufficiently for the separation of crystals of the compound, Cu_3Si. With mixtures containing a little over 8 per cent. of silicon, mixed crystals containing 8·3 per cent. separate ; but when these are kept for some hours at 710° C., they decompose, forming the crystals with 4·5 per cent. and a compound, $Cu_{19}Si_4$. These two compounds, Cu_3Si and $Cu_{19}Si_4$, are the only copper silicides ; the so-called silicides of Vigouroux (Cu_2Si) and Lebeau (Cu_4Si) are really eutectics, and consist of the compound, Cu_3Si, mixed respectively with silicon and with the mixed crystals containing 8·3 per cent. of silicon. The alloys containing 1—5 per cent. of silicon can be drawn into wire. As the silicon-content rises, the alloy must be frequently reheated to prevent it from becoming brittle during the process. The alloys with more than 8 per cent. of silicon are easily pulverised. Their colour changes from brass-yellow (1 per cent.) through pale-yellow to white (6·5—10 per cent.) and steel-grey (above 10 per cent.). Those with 6·25—25 per cent. of silicon, oxidise rapidly even in dry air.—J. T. D.

Roasting pyrites and blende ; Theory of ——, and the new mechanical roasting furnaces. M. P. Truchot. Rev. Gén. Chim., 10, 1—6. Chem. Abs. (Am. Ch. Soc.) 1, 896.

IT is not probable that ferrous sulphide exists in appreciable quantity during the roasting of pyrites, as the atoms of sulphur in the iron disulphide molecule are symmetrical with reference to the iron atom, and must be equally mobile. That the ferrous sulphide does exist transitorily, however, may be assumed from the presence of ferrous sulphate in notable quantities during the early stages of the process, the latter being formed from ferrous oxide and catalytic sulphur trioxide. The course of the oxidation of pyrites can then be expressed as follows :— $FeS_2 + O_2 = FeS + SO_2$; $FeS + 3O = FeO + SO_2$; $2FeO + O = Fe_2O_3$. If the furnace receive insufficient draught, magnetic oxide may be formed as a coating on the ore particles, thus preventing further oxidation of the enclosed sulphur. Other sulphides occurring in varying quantities in pyrites, become more or less completely oxidised during the roasting process. Ordinary iron pyrites (FeS_2)

becomes completely oxidised at 440°—450°, while the other oxidation temperatures are as follows: magnetic pyrites (Fe_2S_3), chalcopyrite (CuS.FeS), chalcocite (CuS), and galena (PbS) 525°—535°; zinc blende, 750°—760°; nickel and cobalt speisses, 800°—850°. To determine the course of the oxidation of these impurities, a pyrites ore yielding a cinder containing 1·40 per cent. of copper and 0·704 per cent. of zinc was roasted, sampled at six-hour intervals, and analysed. From the results obtained, the following conclusions are drawn:—(1) Ferrous sulphate appears chiefly during the early hours of the roast, then diminishes, and finally increases again a little at the end, probably owing to the increased formation of sulphur trioxide. (2) Copper sulphate is practically absent during the first 12 hours of the roast, and is formed abundantly only in the last six hours, the sulphur trioxide here playing the same rôle as above. The final temperature should therefore be sufficient to decompose the ferrous sulphate, but not the copper sulphate. (3) Copper oxide increases slowly towards the end of the roast, owing to slight decomposition of the copper sulphate. A part of this oxide is finally reconverted into copper sulphate. (4) The copper sulphide diminishes continually, leaving 1·57 per cent. of the copper as cupric sulphide at the end. (5) Zinc sulphate increases continually to the end, when it reaches 31 per cent. of the whole zinc. (6) Zinc oxide increases to the 18th hour, then diminishes. (7) Lead sulphide is transformed into lead sulphate, some of which in presence of silica may give lead silicate and sulphur trioxide. (8) Sulphates and carbonates of barium and calcium are left as sulphates. (9) Moisture may favour the formation of sulphuric acid. Roasting zinc blende below 5—8 per cent. of sulphur is difficult, without auxiliary heat and furnace linings of very efficient insulating materials.

Sulphur in roasted zinc blende; Determination of ——, and also capacity for desulphurisation of zinc blende. V. Hassreidter. Z. angew. Chem., 1906, **19**, 137.

The author recommends the following method for the determination of the "objectionable sulphur" (sulphur present as zinc sulphate and as sulphide) in roasted zinc blende:—(1) Twenty-five grms. of the ore are extracted with warm water, the solution is made up to a measured volume, filtered, and in 200 c.c. of the filtrate the zinc (together with any cadmium) determined by Schaffner's method, the quantity being calculated as zinc sulphate. (2) From 2 to 3 grms. of the ore are dissolved by boiling with hydrochloric acid and stannous chloride (30 grms. of pure tin dissolved in 1 litre of hydrochloric acid of sp. gr. 1·19) under a reflux condenser. The hydrogen sulphide evolved is passed through a 10-bulb absorption tube containing 30—40 c.c. of a mixture of bromine and hydrochloric acid. When all the hydrogen sulphide is expelled, the contents of the absorption-tube are heated to expel excess of bromine, and after almost neutralising the hydrochloric acid with sodium carbonate, the sulphuric acid (from oxidation of hydrogen sulphide) is precipitated with barium chloride.

The results of the determination of "objectionable sulphur" in this manner, may be used to control, in some measure, the roasting process. A high percentage of zinc sulphate indicates that the temperature was not high enough at the last shelf, or that too much air entered the furnace. A high proportion of sulphide, on the other hand, points to a local fusion of sulphide which afterwards resisted desulphurisation, or that the material was insufficiently stirred, or that there was a deficiency of air in the furnace.—A. S.

Oxides; Reduction of —— by aluminium and the preparation of chromium. E. Vigouroux. Bull Soc. Chim., [4], 1, 10. Chem. Abs. (Am. Chem. Soc.) 1907, 1, 824.

The author observes that an oxide is the more readily reduced, the higher its degree of oxidation. Thus, ferric oxide is more readily reduced than is ferrous oxide. This conclusion is applied to the preparation of chromium by the action of aluminium on a mixture of its oxides. 600 grms. of chromic oxide and 120 grms. of chromic anhydride are mixed together, and then 270 grms. of powdered aluminium added, a magnesia-lined crucible being used. A vivid reaction takes place, lasting about a minute, and an ingot of chromium is obtained, containing 98·5 per cent. of the pure metal, the impurities being silicon, aluminium, and iron.

Metallic substitution; Investigations on ——. A. J. J. Vandevelde. Bull. Acad. roy. Belg., Classe des Sciences, 1906, 35—75; Chem. Zentr., 1907, 1, 1392—1393.

The author has examined the replacement of copper by zinc in hydrochloric acid solutions of cupric chloride and in nitric acid solutions of copper nitrate. The acidities of the test solutions were 0·1-, 0·2-, 0·3-, and 0·4-*N* respectively. In the cupric chloride solutions the replacement of the copper is effected with a velocity proportional to the concentration of the acid. In the copper nitrate solutions, on the other hand, just as in sulphuric acid solutions of copper sulphate, the reaction-velocity is only accelerated for a short time by the acid, after which no further effect is observed. The solution of zinc in acids was also studied, 12·5 grms. of the metal being subjected to the action of 250 c.c. each of water and of 0·1-, 0·2-, 0·3-, and 0·4-*N* solutions of hydrochloric and nitric acids. It was found that for all concentrations, the induction period is longer with hydrochloric than with sulphuric acid, and indeed to such an extent, that even after 16 hours, the rate of solution of the metal is still lower than with sulphuric acid. With nitric acid, the induction period is shorter than with sulphuric acid, but the reaction itself is less vigorous. A comparison of the action of the acids alone and in conjunction with their copper salts, on zinc, showed that the induction period is shorter when the copper salt is present, and that the intensity of the action corresponds to the concentration of hydrogen ions in the solution. The author also compared the action of a solution of copper sulphate and sodium chloride ($CuSO_4+2NaCl$) on the one hand, and one of cupric chloride and sodium sulphate ($CuCl_2+Na_2SO_4$) on the other. He found that the two solutions acted alike in metal-substitution experiments, but differently with respect to diffusion.—A. S.

Blast-furnace gases; Regeneration of ——. W. Schmidhammer. Stahl. u. Eisen, 1907, **27**, 558—559.

The chief difficulty encountered in the direct utilisation of blast-furnace gases as fuel lies in their variable calorific value. The author gives the results of experiments on the regeneration of two different blast-furnace gases by passing them, together with oxygen, through a shaft filled with charcoal or coke heated to incandescence, whereby the carbon dioxide contained in the gas is reduced to carbon monoxide, whilst simultaneously a portion of the charcoal or coke is burnt to carbon monoxide. It is shown that the process tends to lessen any differences in the calorific value of different gases, and this tendency can be strengthened by increasing the quantity of oxygen added, in proportion as the quality of the gas falls. An example is given relating to the gas from a furnace yielding 10 tons of pig iron per hour. The quantity of gas per hour was 34,000 cb. m., capable of yielding 9000 h.p. For the regeneration of this gas in the manner described above, there were required 6048 kilos. of carbon and 3706 cb. m. of oxygen, and the regenerated gas amounted to 45,254 cb. m., with a calorific power of 1797 Cals. per cb. m., and capable of yielding 22,627 h.p. The cost of the process was as follows:—

	Pfennige.
6048 kilos. of carbon = 7800 kilos. of coal at 1·2 Pf.	9364
3706 cb. m. of oxygen at 4 Pf.	14,820
300 h.p. hours for compressor at 3 Pf.	900
Amortisation, per hour	1141
Working expenses, &c.	685
	26,910

or 0·59 Pf. per cb. m. of regenerated gas, which could be used in heating and smelting furnaces of all kinds.—A. S.

Lead discovery in Derbyshire. Oil and Col. Tr. J., June 1, 1907. [T.R.]

AN exceptionally rich vein of lead ore has been reached in the Golconda Mine, which is situated on the limestone uplands between the Via Gellia and the High Peak Railway. The ore is in the form known as a "pipe," *i.e.*, it lies in a horizontal bed, as distinct from the "rake" type of vein, which is deep, narrow, and inclines a little from the vertical. The vein is 2 ft. thick, and most of the space is filled by large lumps of excellent lead ore. As usual, the ore is embedded in barytes, but in the Golconda vein the proportion of galena is very much above the average. This abnormal bed of ore occurs 50 fathoms below the surface, at the junction of the ordinary carboniferous mountain limestone with the magnesian limestone, the latter being on the top. Although the "pipe" is being vigorously worked it shows no signs of getting poorer.

Mineral deposits in Greece. For. Office Ann. Series, No. 3785. [T.R.]

DURING 1906 chrome ore has been exported from the Lamia district: it is reported that further developments of these mines are in progress, and a considerable output is expected in 1907. Throughout the Piræus district and the adjacent islands there exist important deposits of chrome, few of which are worked at present. The ores from these deposits show 30 to 50 per cent. oxide of chrome, and average about 4 per cent. silica.

Large deposits of magnesite exist in Eubœa and on the mainland, but notwithstanding the high percentage shown, only one company is now working.

Large deposits of various iron ores of different grades are to be met with in many parts of the district, which, in the near future, will undoubtedly be of value.

Copper exists in Greece, and, although only appearing in small veins, might, in view of the present value of that mineral, prove worth exploiting. One copper deposit is already being worked.

ENGLISH PATENTS.

Ores or metallurgical products; Apparatus or plant for the leaching of —— and the subsequent separation of the liquids from the solids. J. H. Gillies, Melbourne, Victoria. Eng. Pat. 994, Jan. 13, 1906.

THE ore is systematically extracted with a liquid in the apparatus shown in Fig. 1. The ore descends from the hopper, G, downwards through the stepped annular space between the two walls, A, B, meeting in so doing liquid flowing upwards, and entering through the pipe, E. The whole is enclosed in the steam-jacket, F, surrounded by an outer wall, *a*. The leached ore passes out through the opening, A^2, whilst the solution overflows into the central space, D, whence it is removed by the pipe, B^2, to the first of a series of settling tanks, mounted in groups of three or four, above one another, one group being shown in Fig. 2. Solution and slime enter these settling tanks through the central cylinders, K. The sludge is discharged from the vessels through the openings, L, into launders, P, whilst the liquid overflows into the sump, R. The sludge in each launder, P, is washed with liquid obtained from the next group of settling tanks, whilst the liquid in the highest sump, R, is used for the leaching of the next lot of ore.—A. G. L.

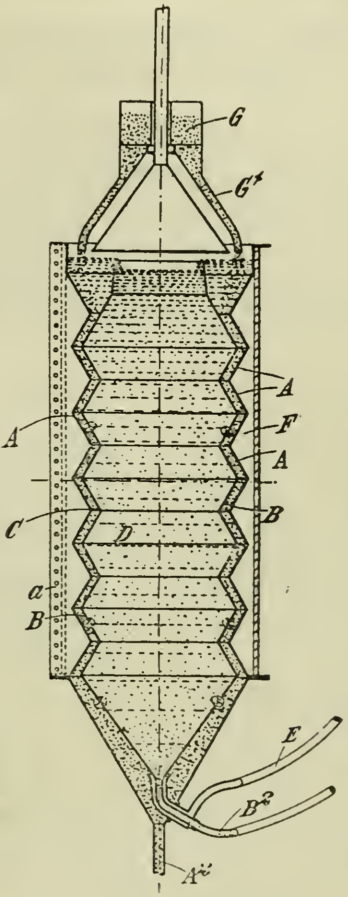


FIG 1.

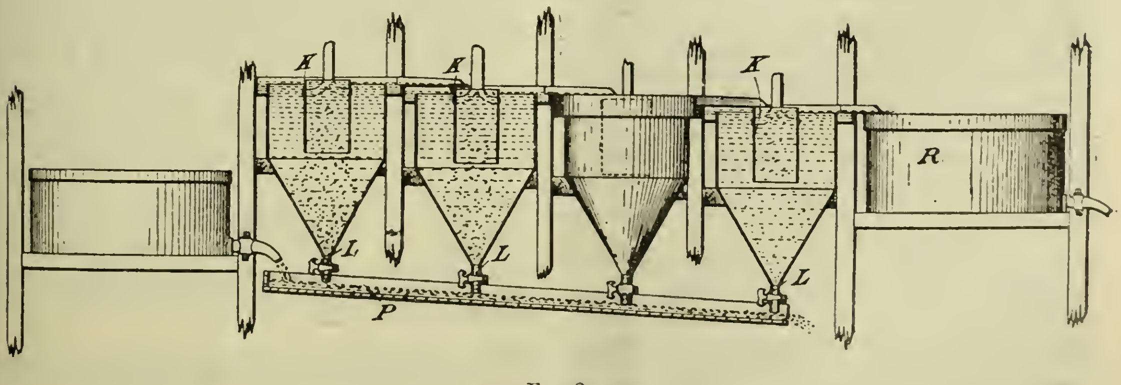


FIG. 2.

Zinciferous ores and metallurgical products; Process for the treatment of ——. J. H. Gillies, Melbourne, Victoria. Eng. Pat. 1004, Jan. 13, 1906.

The zinc ore is first roasted so as to form as much zinc sulphate as possible, and is then systematically treated with dilute sulphuric acid in the apparatus described in Eng. Pat. 994 of 1906 (see preceding abstract). In order to hasten the action, strong acid may be fed in with the ore. If iron or copper are present, they may be removed by running the liquid from the extractor into a vat, where it is treated with zinc oxide, before passing it through the settling tanks, in which slimes and oxides are then removed.—A. G. L.

Sulphide ores; Treatment of metallic —— *preparatory to obtaining the metals therefrom.* N. Lébédeff and B. Poméranzoff, St. Petersburg. Eng. Pat. 5479, March 6, 1906.

Approximately equal parts by volume of clay and sulphide ore are mixed, and the mixture is either formed into briquettes, which are heated at 300° to 400° C. in a chamber through which heated air is led; or else, the mixture is placed directly on the hearth of the reverberatory furnace in which the subsequent fusion is to take place, and treated there with an oxidising flame. In either case, the heat should be gradually increased. The clay used should contain a considerable amount of iron oxide, which acts as the oxygen carrier for the oxidation of the sulphides.—A. G. L.

Sulphide ores; Treatment of complex ——. G. de Bechi and R. W. Rücker, London. Eng. Pat. 9339, April 20, 1906.

Complex sulphide ores, *e.g.*, Broken Hill ores, are finely ground and treated with a boiling acid solution of ferric sulphate. Zinc sulphate and ferrous sulphate are thus obtained in solution, whilst gangue, lead sulphate, and sulphur, together with gold and silver, remain undissolved, and are treated in any usual manner. The iron in the hot solution is re-oxidised to ferric sulphate by adding nitric acid and sulphuric acid, the latter derived from the calcination of zinc sulphate, as described below; the evolved nitrous fumes are collected and reconverted into nitric acid, any loss being made good by the addition of a small quantity of sodium nitrate. The oxidised solution is then allowed to cool, when zinc sulphate crystallises out; this is calcined, the fumes being caught in water, giving zinc oxide and dilute sulphuric acid. To eliminate the iron dissolved from the ore, the liquid is boiled occasionally with zinc oxide derived from a previous operation, zinc sulphate passing into solution, whilst ferric hydroxide is precipitated. Manganese sulphate is more soluble in a hot than in a cold solution; consequently, it does not crystallise out with the zinc sulphate, but accumulates until the solution is saturated with it whilst hot, after which it remains behind with the gangue and lead sulphate.—A. G. L.

Sulphide ores; Process for the treatment of complex ——. H. Baker, Weston Point, Cheshire. Eng. Pat. 26,934, Nov. 27, 1906.

The ore is treated with chlorine in the presence of water or aqueous solutions. If basic substances, *e.g.*, oxides or carbonates, are present in the ore, sufficient sulphuric or sulphurous acid is added to keep the solution always slightly acid, in order to prevent the precipitation of ferric oxide or copper oxide. Sulphuric acid is used instead of hydrochloric acid, as in Eng. Pat. 26,790 of 1905 (this J., 1907, 52), in order to convert any calcium compound present into the insoluble calcium sulphate, and so to prevent contamination of the resulting copper-zinc solution by calcium salts.—A. G. L.

Ore materials; Process of consolidating finely divided ——. A. Malden, St. Margarets, Middlesex, and W. J. Malden, Surbiton, Surrey. Eng. Pat. 9210, April 18, 1906.

Finely divided ore material is moulded into briquettes with the addition of lime (or other alkaline-earth oxide) and a solution of boric acid, or of a borate, preferably the mineral known as "boric calcite."—A. G. L.

Ores; Treatment of —— *preliminary to smelting.* J. Savelsberg, Papenburg-on-Ems, Germany. Eng. Pat. 9426, April 21, 1906.

See Addition of April 21, 1906, to Fr. Pat. 351,535 of 1905; this J., 1906, 991.—T. F. B.

Ornamentation of metallic surfaces; Process for the ——. S. O. Cowper-Coles, London. Eng. Pat. 17,554, Aug. 3, 1906.

The desired pattern is painted on the metallic surface with a gum solution or a grease preparation, then the whole surface is covered with a heat-resisting material, such as enamel, and afterwards the material covering the pattern is removed, *e.g.*, by rubbing, and the plate heated in an atmosphere of zinc vapour, as described in Eng. Pat. 12,452 of 1906.—A. G. L.

Aluminium; Process for uniting ——. S. O. Cowper-Coles, London. Eng. Pat. 28,354, Dec. 12, 1906.

The parts to be united are strongly heated, so as to produce on them a thick coat of oxide, which forms a pocket or jacket within which the molten aluminium is retained. When sufficient metal has been melted, the two parts are pressed together so as to burst the skins of oxide and to allow the molten aluminium to flow together. As a further support for the oxide skin, a thin piece of iron may be wrapped around the joint, or plates of iron may be placed at either side.—A. G. L.

United States Patents.

Blocks of ores; Method of forming —— *for metallurgical purposes.* A. Rónay, Budapest, Austria-Hungary. Reissue, No. 12,643, April 30, 1907, of U.S. Pat. 778,899, Jan. 3, 1905.

The powdered material, which may be slightly damped, is gradually subjected to an increasing pressure, ranging from 800 to 2000 atmospheres, after which the briquettes are subjected for a short time to the action of a gas containing carbon, such as carbon dioxide.—A. G. L.

Mercury retort and furnace. C. F. Brown, San Jose, Cal. U.S. Pat. 847,399, March 19, 1907.

The ore is fed in at the top of an inclined shoot, the bottom of which forms the top of a flue, up which pass gases from a combustion chamber placed below. Passages in the walls of the shoot and of the flue allow the gases to pass from the latter into the shoot, abutments being formed at intervals in the flue so as to deflect the gases into these passages. The mercury vapour escapes through an opening near the top of the shoot, whilst the roasted ore is removed through an opening at the lower end.
—A. G. L.

Furnace. H. B. Meech, New York. U.S. Pat. 847,962, March 19, 1907.

The furnace consists of a reverberatory furnace-bed separated by a bridge-wall from a combustion chamber, and a retort tapering in width and having its widest end opening through the front wall of the combustion chamber. A number of vertical and horizontal partitions are arranged below the furnace-bed and divide the space into escape-flues for the products of combustion from the furnace-bed and air-heating flues. A flue in communication with the escape-flues surrounds the retort, whilst passages lead from the air-heating flues and open through the front and rear walls of the combustion chamber.
—A. G. L.

Steel furnaces; Compound for facing the ports of open-hearth ——. A. H. Beale and E. F. McDowell, Pottsville, Pa. U.S. Pat. 850,723, April 16, 1907.

The compound consists of chrome ore, magnesite, and an anhydrous binding agent, *e.g.*, a hydrocarbon such as anhydrous pitch or tar.—A. G. L.

Furnace; Crucible ——. J. Borbeck, Altena, Germany. U.S. Pat. 852,867, May 7, 1907.

See Eng. Pat. 13,021 of 1906; this J., 1907, 154.—T. F. B.

Copper silicate ; Process for the treatment of ——. G. H. Waterbury, Denver, Colo., Assignor to Los Angeles Metals Extraction Co., Los Angeles, Cal. U.S. Pat. 847,448, March 19, 1907.

The ore containing copper silicate is first lightly roasted and then leached with dilute sulphuric acid or other reagent.—A. G. L.

Metals [Iron and steel]; Process of purifying ——. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metallurgique Française, Froges, Isère, France. U.S. Pat. 851,167, April 23, 1907.

The process consists in over-oxidising a bath of steel by the addition of ore and exposure to an oxidising flame, whereby the impurities are collected in the slag, then de-oxidising the steel (by the addition of pig iron) to raise its melting point above the temperature of the furnace, and thus to solidify the metal. The slag containing the impurities is then removed, and the melting point of the metal lowered to below the temperature of the furnace by the addition of pure carburising material, a neutral slag being also added to protect the surface of the metal from the oxidising action of the flame.—O. F. H.

Steel ; Manufacture of ——. R. A. Hadfield, Sheffield. U.S. Pat. 851,233, April 23, 1907.

The process consists in first making steel containing manganese, nickel, and chromium (the percentage of manganese being low), heating the steel to a temperature between 750° and 850° C., and quenching in oil, then reheating to a temperature between 620° and 630° C., and quenching in water. Increased tensile strength is claimed.—O. F. H.

Magnetic materials ; Manufacture of ——. R. A. Hadfield, Sheffield. U.S. Pat. 851,635, April 23, 1907.

See Eng. Pat. 22,130 of 1905 ; this J., 1906, 592.—T. F. B.

Ferro-molybdenum ; Manufacture of ——. H. W. C. Annable, Assignor to The Ferro-Alloys Synd., Ltd., London. U.S. Pat. 852,920, May 7, 1907.

See Fr. Pat. 370,645 of 1906 ; this J., 1907, 260.—T. F. B.

Condenser ; Metallurgical ——. W. M. Johnson, Iola, Kans. U.S. Pat. 851,520, April 23, 1907.

The condenser consists of a chamber with baffle-walls, having a non-metallic interior surface and a base plate of metal. Means are provided for cooling the base plate and some or all of the baffle-walls.—O. F. H.

Metal bodies ; Process of making compound ——. J. F. Monnot, New York. U.S. Pat. 851,684, April 30, 1907.

See Eng. Pat. 8913 of 1906 ; this J., 1907, 532.—T. F. B.

Converting metals [copper matte]; Art of ——. R. L. Lloyd, Cananea, Mexico. U.S. Pat. 851,816, April 30, 1907.

The process consists in blowing molten copper matte in presence of an acid slag, and removing the copper sulphide formed and adding fresh matte, until the slag becomes neutral and incapable of taking up any more foreign oxides, when it in its turn is removed and replaced by fresh acid slag.—A. G. L.

Detinning ; Process of ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. Assignors to Tin Products Co., New York. U.S. Pat. 851,946, April 30, 1907.

The tin scrap is treated in a closed vessel with dry chlorine, the latter being in such excess that only stannic chloride is formed, the temperature not being allowed to rise to the point at which the iron is attacked. The vessel may be water-cooled.—A G. L.

Flux. C. Ellis, White Plains, N.Y. Assignor to Ellis-Foster Co., New Jersey. U.S. Pat. 852,017, April 30, 1907.

The flux consists of 40 parts of pure iron powder, 12 parts of anhydrous borax, and 9 parts of potassium carbonate. —A. G. L.

Zinc ores ; Process of reducing ——. C. G. P. de Laval, Stockholm, Assignor to Soc. Anon. Métallurgique Proc. de Laval, Frankfort, Germany. U.S. Pat. 852,440, May 7, 1907.

See Fr. Pat. 356,097 of 1905 ; this J., 1905, 1311.—T. F. B.

Sulphides and other ores ; Apparatus for the treatment of ——. G. E. Kingsley, Toronto. U.S. Pat. 852,510, May 7, 1907.

See Eng. Pat. 23,909 of 1904 ; this J., 1905, 681.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*Continued from page* 536.)

(*A*.)—ELECTRO-CHEMISTRY.

Air ; Experimental investigation of the combustion of —— *in electric flame arcs.* A. Grau and F. Russ. Sitzungsber. K. Akad. Wiss. Wien. 1906, **115**, (II*a*), 1—86; Chem. Zentr., 1907, **1**, 1171—1173.

The first section of the paper deals with electrical measurements in long horizontal high-tension arcs, and also with the characteristics of the arcs obtained with electrodes of platinum, nickel, copper, silver, and zinc. With a given current strength, platinum electrodes show the highest and zinc the lowest potential. The ratio between the actual number of watts consumed (as measured directly) and the apparent number (watts : volt-ampères) is about 0.6 with arcs up to 5 cm. in length. In studying the oxide of nitrogen equilibrium in the high-tension electric flame, a vertical arc was used between platinum electrodes in a quartz tube or a water-cooled glass tube. By means of a water-cooled platinum capillary tube, the products could be withdrawn from any part of the tube for analysis. When the gases are withdrawn from the middle of an arc 5·4 cm. long (current strength, 0·1 ampère), the content of nitric oxide is 4·5 per cent. Gas withdrawn just beyond the arc contains 2·65 per cent. of nitric oxide, so that even at a few mm. distance from the arc, already 40 per cent. of the nitric oxide has been decomposed. Increase of the velocity of the current of air from 1·2 to 18 litres per hour had no effect on the composition of the final gas ; a further increase up to 32 litres per hour caused an increase of the content of nitric oxide in the final gas to 4·99 per cent., but a still further increase in the velocity led to a smaller content of nitric oxide. The content of nitric oxide in the final gas is affected by the current-strength employed. Up to 0·1 ampère (136 watts) it increases with the current-strength, but remains practically constant with stronger currents, the excess of watts above 136 not serving for producing a higher arc temperature, but being lost as radiant energy. The highest theoretical yield is 454 kilos. of nitric acid per kilo-watt-year with an arc 3 cm. long, and 539 kilos. with an arc 5 cm. long. According to Birkeland, the yield on the large scale is 500—600 kilos. of nitric acid, so that it would appear possible to obtain with fixed long arcs yields equal to those which, in the Birkeland-Eyde process, can only be obtained by "breaking" the arcs. For the analysis of the nitrous gases, these were first led into a mixing chamber, wherein most of the nitric oxide was oxidised to nitrogen peroxide. The gases were then either : (1) treated with excess of oxygen, the nitrogen peroxide absorbed in potassium hydroxide solution, and the oxygen in the residue determined ; (2) treated with sulphuric acid, and the nitrous vitriol decomposed in a Lunge nitrometer ; or (3) treated with alkali. The authors obtained good results by the first method, and state that the assumption that equal molecular proportions of nitrate and nitrite are formed is justified, since the oxidation of alkaline solutions of nitrite mentioned by Lunge and Berl (this J., 1906, 533) proceeds very slowly. Good results can also be obtained by method (2), if a sufficiently large number of absorption vessels is used to allow for the slowness of the absorption of dilute nitrous gases by sulphuric acid. The third method gives low results, about 1 per cent. of the total nitric oxide remaining unabsorbed. By using a final absorption vessel containing sulphuric acid, however, satisfactory results can be obtained.—A. S.

Electrolytic applications of alternating currents. A. Coppadoro. Gaz. chim. ital., 1907, **36.** II., 693—723.

The author describes some experiments on the conversion of alternating into continuous currents. An alternating current circuit, including a rheostat, an alternating current ampère-meter, an electrodynamometer, and an electrolytic cell (two nickel electrodes in sulphuric acid of sp. gr. 1·335), was divided into two similar branches, each including an ampère-meter, a copper voltameter, and a rectifier or valve-cell (Al—Pt in a 10 per cent. solution of alum), the valve cells being arranged in opposite directions. Both branches were disposed in thermostats. If the valve-cells acted in an ideal manner, the two copper precipitates should be of equal weight, and together should correspond to the intensity of the alternating current. It was found, however, that, whilst the first condition was fulfilled, the total copper amounted to only 50—84 per cent. of the theoretical amount. The intensity of the continuous current decreases continuously to a minimum whilst the circuit is closed as also does the E.M.F. at the rectifiers. The latter, therefore, are not able to completely convert the alternating current into two continuous currents of equal strength, but new alternating currents are produced with phases of widely-different strengths.

The formation of simple salts from electrodes by means of alternating currents has not been much studied. The author investigated the behaviour of nickel electrodes in sulphuric acid of different strengths and with different current-densities. In sulphuric acid of from 4 to 40 per cent. strength, nickel dissolves almost quantitatively (average current-yield, 95 per cent.) at the ordinary temperature, if the current-density exceed 50 ampères per sq. dcm. With smaller current-densities, the condition of the surface of the electrodes is of considerable influence. Nickel does not dissolve perceptibly in concentrated solutions of sulphuric acid when the current is not passed. In 50—60 per cent. sulphuric acid, the current-yield after attaining a maximum, falls again sharply, with increasing current-density. The nickel becomes passive; its surface becomes bright, and oxygen is evolved, in addition to the hydrogen and small quantities of hydrogen sulphide previously produced. If the concentration of the acid and the current density be so high that anhydrous nickel sulphate is formed, the proportion of oxygen formed increases considerably. Addition of oxidising agents, such as potassium permanganate or hydrogen peroxide, to the sulphuric acid markedly increases the solubility of the nickel, the current-efficiency rising to 100 per cent., whereas without the current such additions are without appreciable influence. Nickel also dissolves to a considerable extent in 15 per cent. hydrochloric acid, acetic acid, and nitric acid, under the influence of an alternating current; no chlorine is evolved when hydrochloric acid is used as electrolyte. The behaviour of nickel in electrolytes of alkali salt solutions was also studied.—A. S.

Electrolysis of mixtures of two molten salts; Transfer of ions in the ——. R. Lorenz and W. Ruckstuhl. Z. anorg. Chem., 1907, **52.** 41—47. Chem. Abs. (Amer. Chem. Soc.) 1907, **1**, 814.

Fused mixtures of lead chloride and potassium chloride were electrolysed with porous cells as diaphragms. The weight and composition of the electrolyte within the cell was determined before and after the electrolysis, and a correction applied for the evaporation during the run. From these data, together with the weight of the lead deposited in the cathode and of copper in a voltameter in series with the cell, the transport number was calculated. A table of the results is given. The transport number increases markedly as the percentage of lead chloride decreases, being 0·724 for 95·72 per cent. of lead chloride, and 1·600 for a 47·83 per cent. mixture. The change is fairly regular for the intermediate mixtures. These results were interpreted to mean that the lead existed partly as cation and partly as a complex anion, and that the latter increased in relative amount as the proportion of potassium chloride increased. This, it was pointed out, might be due to the chlorine ion from the potassium chloride retarding the dissociation of the lead chloride and favouring the formation of the complex anion.

Metals; Quantitative determination of —— by electrolysis. F. Foerster. XXIII., page 643.

Rotating anode; Determinations and separations with the ——. J. Langness. XXIII., page 644.

Copper; Electrolytic precipitation of —— from an alkaline cyanide electrolyte. A. L. Flanigen. XXIII., page 644.

Antimony; Electrolytic determination of ——. J. M. M. Dormaar. XXIV., page 644.

Antimony; Quantitative determination of —— by electrolysis of its sulpho-salt solutions. F. Foerster and J. Wolf. XXIII., page 644.

Anions; Determination of —— in the electrolytic way. J. H. Hildebrand. XXIII., page 644.

ENGLISH PATENTS.

Electrolytic cells; Batteries of ——. R. H. F. Finlay, Belfast, and A. H. Finlay, Holywood, Ireland. Eng. Pat. 1716, Jan. 23, 1906.

Each cell of the battery comprises three chambers, namely, anode, cathode, and electrolyte chambers, the latter being separated from the anode and cathode compartments by means of porous diaphragms. The anodes consist of carbon rods supported in a wood framework, *a* (Fig. 1) the cathodes, *b*, being made of cast iron (Fig. 2).

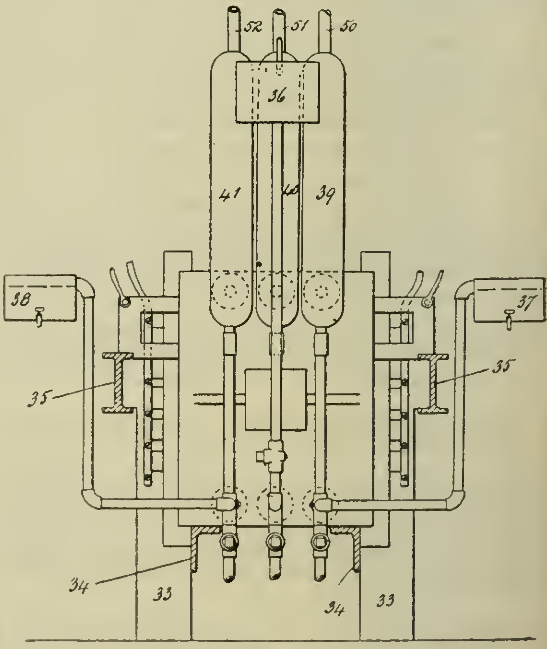


Fig. 1.

The electrolyte chambers comprise porous diaphragms, *d*, rendered non-porous on their outside edges, and spaced apart by non-porous distance-pieces, *p*, made in the shape of a frame. The electrodes, diaphragms, and distance pieces are bound together, between the end pieces, 30, in the form of a filter-press, the different portions being supported on a frame, 33, 34, 35 (Figs. 1 and 2). The electrodes, diaphragms, and distance pieces are each provided with three holes, above and below, so that when the parts are screwed together, continuous channels are formed through the battery. One channel communicates with the interior of each of the electrolyte chambers, with the feed cistern, 36, and with the central separator, 40, so that a circulation of the electrolyte is obtained from the cistern, 36, through the lower middle channel of the battery into the electrolyte chambers, returning by the upper middle channel to the separator, 40. The electrolyte also passes from the electrolyte chambers, through the porous diaphragms, *d*, into the cathode and anode chambers, and circulation of the liquids from these is similarly obtained by means of the separators, 39 and 41, through the two lower outer channels, returning by the upper outer channels in the battery. These circulatory systems are also in communication with the outflow cisterns, 37 and 38, respectively, for drawing off the products of the cathode and anode chambers. By means of the separators, the gases produced during the electrolysis may be removed from the liquids through the pipes, 50, 51, and 52 (Fig. 1).—B. N.

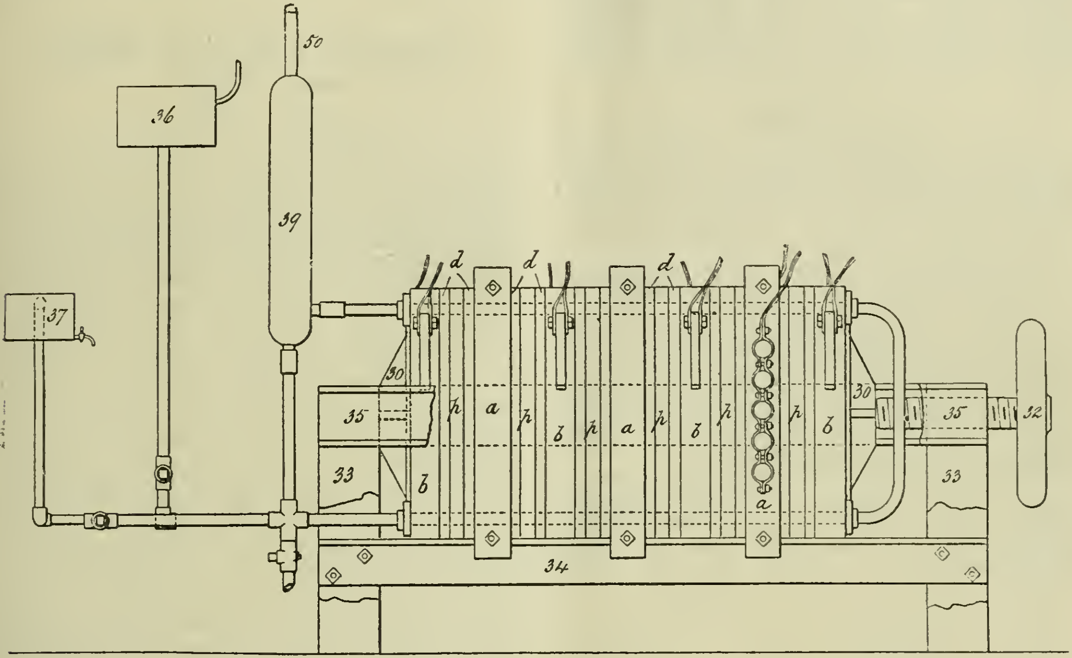


Fig. 2.

Accumulators; Charging ——. E. de Marcay, Paris. Eng. Pat. 8345a, April 6, 1906. Under Int. Conv., Jan. 24, 1906.

In accumulators of the type in which lead peroxide is used as the positive electrode, and an alloy of zinc, tin, mercury, antimony, lead, and cadmium as the negative electrode, zinc is deposited in such a quantity at the bottom of the plate, during the charging, as to ultimately form a short circuit. This may be avoided and a uniform deposition of zinc obtained, by injecting air into the cell, during the charging, in order to keep the liquid constantly moving.—B. N.

Incandescent electric lamp filaments; Manufacture of cement joints for ——. A. Just, F. Hanaman, H. Landesberger, and I. Salzmann and Ver. Electricitäts A.-G. Eng. Pat. 9349, April 20, 1906. II., page 601.

Furnaces; Lining for electric and other ——, *and method of preparing the same.* H. L. Hartenstein, Constantine, Mich., U.S.A. Eng. Pat. 10,161, May 1, 1906.

See U.S. Pat. 819,223 of 1906; this J., 1906, 544.—T. F. B.

Furnaces; Electric transformer ——. O. Frick, Saltsjöbaden, Sweden. Eng. Pat. 22,519, Oct. 11, 1906. Under Int. Conv., Dec. 18, 1905.

See Fr. Pat. 369,267 of 1906; this J., 1907, 157.—T. F. B.

Cement [for electrical purposes]; Manufacture of ——. J. A. Yates, Rosebank, U.S.A. Eng. Pat. 19,723, Sept. 4, 1906.

See Fr. Pat. 369,603 of 1906; this J., 1907, 100.—T. F. B.

Dynamo brushes, sliding contacts, or the like; Manufacture of —— *from carbon.* Gebr. Siemens und Co., Berlin. Eng. Pat. 27,499, Dec. 3, 1906. Under Int. Conv., Feb. 16, 1906.

From 2 to 5 per cent. of finely-ground silicon is mixed with carbon, and the whole baked at a temperature of about 1500° C. in a nitrogenous atmosphere or in pure nitrogen. The hardness of the finished body increases, whilst the electrical conductivity diminishes, with increasing content of silicon. The substance formed probably approximates to the compound, C_2Si_2N, if sufficient silicon be present.—A. G. L.

United States Patent.

Electric furnace. H. N. Potter, New Rochelle, N.Y., Assignor to G. Westinghouse, Pittsburg, Pa. U.S. Pat. 851,961, April 30, 1907.

The furnace consists of a resistance material in two parts, which can be brought together or separated. An electric current is caused to flow through the resistance material, thereby heating it, and across the gap, creating an arc, which serves as an auxiliary source of heat. A current of gas may be caused to flow across the gap at the same time, and the resistance material may be made in tubular form.—A. G. L.

French Patent.

Furnaces; Pyro-electric ——. F. E. Roach. Fr. Pat. 373,162, Nov. 30, 1906.

See U.S. Pat. 838,647 of 1906; this J., 1907, 208.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Copper and mercury; Anodic solution of ——. J. Shukow. J. Russ. Phys.-Chem., Ges., 1907, **38**, 253–1257. Chem. Zentr., 1907, 1, 1243.

In the anodic solution of metals having a variable valency, the metallic ions formed belong to that form of the metal which exhibits the greatest tendency to the formation of complex compounds with the electrolyte. Complex ions are formed more readily by cuprous ions in the case of copper and by mercuric ions in the case of mercury; consequently, in aqueous solutions of sodium chloride and hydrochloric acid, copper dissolves from an anode chiefly as cuprous ions, whilst mercury in solutions of potassium iodide, chloride, bromide, and thiocyanate dissolves mainly as mercuric ions. Small current densities and vigorous agitation favour the formation of cuprous and mercuric ions, whilst high current densities and cessation of agitation lead to formation of cupric and mercurous ions; if the anode metal is not capable of forming complex compounds with the electrolyte, the current density and agitation are without influence. For example, in solutions of potassium nitrate and sodium sulphate, copper invariably forms only cupric ions. With mercury in potassium, nitrate solutions, it was observed that the two kinds of ions go into solution in the ratio of their equilibrium concentrations, *i.e.*, mercurous : mercuric ions :: 120 : 1.—A. S.

ENGLISH PATENTS.

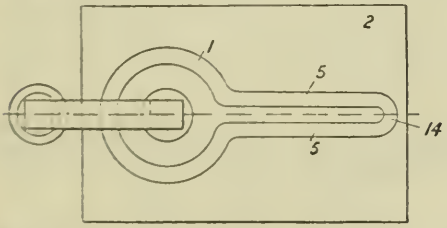
Steel; Process for the production of ——, and an electric furnace for carrying out the said process. G. Gin, Paris. Eng. Pat. 10,396, May 3, 1906. Under Int. Conv., May 3, 1905.

SEE Fr. Pat. 362,734 of 1906; this J., 1906, 767.—T. F. B.

Copper; Electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 13, 972, June 18, 1906.

THE copper is deposited electrically, on a cathode revolving at a peripheral speed of from 1500 to 2000 ft. per minute, using a current density of 200 ampères per sq. ft. of cathode surface, and an electrolyte containing 12·5 per cent. of copper sulphate and 13 per cent. of sulphuric acid, at a temperature of 40° C. The deposited copper is claimed to have the tensile strength of hard rolled copper and to be free from porosity.—A. G. L.

Furnaces; Electric smelting ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stalhane, Ludvika, Sweden. Eng. Pat. 1658, Jan. 22, 1907. Under Int. Conv., Jan. 26, 1906.



THE channel or groove, in which the material is to be treated, and which forms the secondary of the transformer, is made in the form of a nearly-closed circuit, 1, with projecting portions, 5, arranged near to each other and connected at the outer end, 14. The latter portion may extend into, and pass through, the hearth or smelting zone of a blast or similar furnace.—B. N.

UNITED STATES PATENTS.

Fluidity of molten or semi-molten materials; Method of maintaining or increasing —— by means of electricity. F. Wynne London. U.S. Pat. 848,422, March 26, 1907.

THE fluidity of a molten or semi-molten stream of silicate or other material is increased by passing a current of electricity lengthwise through the whole or a portion, of the stream of material, whilst the latter is falling through a gaseous medium.—A. G. L.

Electroplating solution. R. H. Marshall, Assignor to A. H. Kelley, Scottdale, Pa. U.S. Pat. 850,944, April 23, 1907.

THE solution contains, substantially equal quantities of a double cyanide of a metal of the nickel group, and a double cyanide of silver, the quantity of each of these metals (nickel and silver) present being greater than that of any metal other than nickel or silver.—B. N.

Ferro alloys; Process of producing low-carbon ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 852,347, April 30, 1907.

A CHARGE containing silica, carbon, and an iron compound, the two first being present in relatively large amount, is electrically smelted so as to produce a ferrosilicon high in silicon and low in carbon. This ferrosilicon is then removed from the smelting zone, and brought into contact with the oxide of a metal reducible by silicon, and which alloys with iron. A basic slag to flux the resulting silica, and means for supplying heat electrically, are also provided. —A. G. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 537.)

Oil-seeds of India; Composition of ——. J. W. Leather. Memoirs Depart. of Agricul. in India, 1907, 1, 13—38.

DETAILS are given of the chemical composition of the principal oil-seeds of India, the analyses being made by the usual methods, except in the determination of the oil, in which, after the bulk had been extracted with ether, the residue was dried in the air, crushed again, and once more extracted. It was found that the oil obtained in this second extraction varied from 0·02 to 0·15 grm. on about 3 grms. of material, and it was calculated that had it been omitted, the loss of oil would frequently have amounted to 3·33 per cent. The following amounts of oil were obtained:—Arachis seed (kernels), Mauritius variety, 44 to 49 per cent.; indigenous, 40 to 44 per cent.; *Bassia latifolia* (kernels), 36·01 to 49·04 per cent.; *Brassica*, yellow sarson, 44 to 49 per cent.; "Sarshaf" and "Toria," 37 to 45 per cent.; "Rai" and "Desirai," 27 to 37 per cent.; *Brassica juncea*, 32·51 to 40·84 per cent.; *B. napus*, 38·21 to 40·18 per cent.; *B. campestris*, 39·73 to 43·92 per cent.; *Carthamus tinctorius* (safflower seed), 22·47 to 33·55 per cent.; *Eruca sativa*, 25·40 to 36·71 per cent.; cotton seed, 17·41 to 19·89 per cent.; niger seed, 36·17 to 42·0 per cent.; linseed, 35·60 to 43·80 per cent.; poppy seed, 44·82 to 48·66 per cent.; castor beans (kernels), 55·24 to 71·95 per cent.; sesamé seed, 45·15 to 57·79 per cent.

Effect of transferring oil-seeds to another province.—Experiments were made upon oil-seeds shown to be richer in oil than those grown in another province. It was found that as a rule when the richer seeds from the one province were grown in the other province there was a decrease in the amount of oil yielded by the new crop. Thus linseed from different parts of India was grown at Lyallpur in the Punjab, and the seed obtained in two successive years examined with the following results:—

Seed.	Oil in original seed.	Oil in crop of 1905.	Oil in crop of 1906.
	per cent.	per cent.	per cent.
Linseed—			
White from Cawnpore....	44·62	41·28	39·90
,, ,, Khandwa ...	44·96	44·18	42·93
Brown from Partabgarh .	43·17	40·98	38·31
,, ,, Sholapur....	41·13	40·42	38·82

—C. A. M.

Chrysalis oil; Unsaponifiable matter of ——. J. Lewkowitsch. Z. Untersuch. Nahr. Genussm., 1907, 13, 552.

ON boiling the unsaponifiable matter in the oil extracted from chrysalides (this J., 1907, 24) with acetic anhydride, the author found that 84·67 per cent. (2·21 per cent. calculated on the oil) dissolved, whilst 15·33 per cent. (0·40 per cent. calculated on the oil) remained undissolved.

The insoluble portion was not acted upon even by sodium ethylate, and was found to be a hydrocarbon melting between 54° and 62° C. The soluble substance was recrystallised by Bömer's method and identified as cholesterol (m. pt. 114° C.).—C. A. M.

Oil from inoy kernels [*Poga oleosa*]; *Analysis of* ——. E. S. Edie. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 43—44.

The finely minced kernels were extracted with boiling ether, the extract was evaporated and dried on a water-bath till of constant weight. The yield of oil was 57·4 per cent. The oil, which was markedly acid in reaction, deposited about 25 per cent. of a white solid on standing. The iodine value of the liquid portion was 95·8, and that of the solid portion 78·2. The two portions gave the same saponification value, namely, 188. The oil as a whole gave results somewhat different from those obtained with a specimen examined at the Imperial Institute.—P.F.C.

Fuller's earth and its application to the bleaching of oils. C. L. Parsons. J. Amer. Chem. Soc., 1907, 29, 598—605.

The author gives an account of the occurrence, mining, preparation, and properties of American fuller's earth. For bleaching petroleum, Florida fuller's earth is much superior to English earth, but for bleaching edible fatty oils, the reverse is the case. The author, however, considers that the inferiority of the American product in this respect is not inherent in the earth itself, and expresses the opinion that imports of English fuller's earth into America will show a great falling off before many years are past.—A. S.

Saponification; Theory of —— [*III.*]. M. J. Stritar and R. Fanto. Monatsh. f. Chem., 1907, 28, 383—396.

Further experimental work is described with reference to the authors' conclusion that when alcoholic alkali hydroxide acts upon glycerides, direct saponification of these glycerides takes place to a considerable extent, in addition to formation of esters and saponification of those esters, whereas Kremann considers that a direct saponification of glycerides is out of the question. It is pointed out that ester formation is practically instantaneous when a large amount of alkali is used, but that the reactions proceed more slowly when smaller quantities are employed. In the case of triacetin, this point is reached when the amount of unused alkali has fallen to about 3 per cent. of the total quantity required for complete saponification but with rape oil the reactions become slow when the 16 per cent. of alkali hydroxyl originally used has fallen to about 7 per cent. Thus, in a typical experiment in which 10 grms. of rape oil were treated with 5 c.c. of $N/1$ alcoholic potassium hydroxide solution ($=16$ per cent. of hydroxyl), the liquid became clear in $1\frac{1}{2}$ minutes. After 2 minutes, the amount of unused hydroxyl was 6·8 per cent., and the amount of glycerol liberated was 48·1 per cent. of the total amount present. After 3 minutes, the unused hydroxyl was 6·5 and the free glycerol 60·2; after 10 minutes, hydroxyl 4·0 and glycerol 85·7; and after 1 hour, hydroxyl 1·1 and glycerol 95·7 per cent. Since, according to Kremann (this J., 1906, 856), the velocity of the saponification of esters of divalent acohols is more than twice, and that of the esters of trivalent alcohols more than three times that of the esters of monovalent alcohols, it seems a reasonable inference that saponification of glycerides without an intermediate formation of esters takes place to a considerable extent (in a homogeneous system) when the ratio of the concentration of the glycerides to the concentration of the esters does not fall below a certain value during a corresponding period of the reaction. Moreover, in the authors' opinion, the acceleration in the saponification of a triacin (triglyceride) by passing through the intermediate stage of another ester is to be attributed solely to the latter reaction rendering possible the formation of a homogeneous system. From the moment when the liquid becomes clear, the intermediate formation of esters will not accelerate the saponification, and the alkali must then be distributed between the ester and the glyceride fairly in accordance with the velocity of the respective reactions. The concentration of the ester and glyceride still present at definite periods of the process might be deduced from the results of the experiment given above, if both reactions (formation of ester and saponification of glyceride) proceeded practically directly. Apart from the formation of esters, however, which, as Lewkowitsch (Chem. Technol. Oils, Fats, and Waxes, p. 54) concludes, proceeds by stages, it is also *a priori* probable that the saponification of the glyceride also proceeds by stages in a homogeneous system; though in a non-homogeneous system one of the authors has found (this J., 1904, 988) that saponification takes place directly, and his conclusion is confirmed by Marcusson (this J., 1906, 1106). In order to obtain further experimental evidence as to the formation of intermediate products in saponification with alcoholic alkali, the authors employed the following method: The action of the potassium hydroxide was checked at the desired point by the addition of a known quantity of acetic acid, the excess of which was titrated, so as to obtain the amount of hydroxyl ion consumed. When now the soap in the reaction-products was decomposed with acetic acid, the bulk of the alcohol evaporated, the fatty layer separated (by means of petroleum spirit) and washed free from glycerol, salts, &c., and the amounts of alcohol and glycerol determined in the carefully dried residues, it was argued that in the case of both reactions proceeding directly, the sum of the hydroxyl ion consumed, S, *plus* the hydroxyl equivalents of the alcohol left in the residue, a, and of the glycerol, g, should have equalled the ester value, e, of the original oil (ester value being defined as the amount of hydroxyl in mgrms. required for complete saponification of the glyceride in 1 grm. of the fat). On the other hand, in the case of the formation of intermediate products, the sum of $S+a+g$ would have been greater than e. In two typical experiments on these lines, the sum exceeded e by 8·2 and 8·9 respectively, showing that in at least one of the reactions intermediate products had been formed. The amounts of glycerol in the glycerides in the residue were 14·3 and 13·3 per cent. respectively, which pointed to the presence of a diglyceride (13·4 per cent. of glycerol). If only the saponification of the glyceride proceeds by stages (assuming that it invariably does so in a homogeneous system), the excess over the ester value cannot exceed a certain amount, depending upon the quantity of hydroxyl consumed. This limit is fixed by the most favourable case—that in which all the hydroxyl has been used in the formation of intermediate products from the triacin (triglyceride) without separation of glycerol, corresponding to the first two stages of the saponification process. The excess would then be equal to S, and, in general, the sum of $g+a$ would be equal to e. But, in the authors' two experiments, the sum of $g+a$ was greater than e by 5·1 and 3·9 units respectively, and, hence, the esterification must have proceeded by stages. (See also this J., 1898, 1107; 1899, 1081; 1904, 905; 1907, 24, 263). —C. A. M.

Fats; A reagent in the chemistry of —— [*II.*]. E. Twitchell. J. Amer. Chem. Soc., 1907, 29, 566—571.

In a former communication (this J., 1906, 324) the author showed that stearosulphonic acids (this J., 1900, 254) had a catalytic action in hydrolysing the glycerides of higher fatty acids, and he now shows that the same agents can accelerate the esterification of higher fatty acids with alcohols when either of the respective constituents is in excess, and there is a deficiency of water. The reaction is most complete in the case of fatty acids and alcohols not volatile at 100° C., since the water formed can be removed by evaporation. In preparing a solution of pure naphthalenestearosulphonic acid for use as the reagent, the crude compound is dissolved in about five times its volume of ether, and the solution washed several times in a separating funnel with dilute hydrochloric acid, and then shaken with half its volume of water. This aqueous extract is washed several times with small quantities of ether, then heated to expel the last traces of ether, and finally diluted so as to contain about 10 per cent. of naphthalenestearosulphonic acid.

Quantitative esterification of glycerol.—In the author's experiments with glycerin (containing, according to the bichromate method. 95·36 per cent. of glycerol) 5 c.c. of a 1 per cent. solution were heated for 4½ hours in a flask, on the water-bath with 1 grm. of commercial "stearic" acid and 2 c.c. of the naphthalenestearosulphonic acid solution. The liquid was then heated with 50 c.c. of neutral alcohol and titrated with standard sodium hydroxide solution (with phenolphthalein as indicator) the result giving the amount of alkali consumed by the uncombined fatty acid. A blank experiment was also made with 1 grm. of the "stearic" acid and 2 c.c. of the reagent (but no glycerol), and the difference between the two results represented the glycerol that had combined with the fatty acid. The percentage of glycerol in the sample was thus found to be 95·09 per cent. Similarly, a sample of dynamite glycerin gave 97·30 per cent. of glycerol by the bichromate method, and 96·62 per cent. by the new method. When the mixture was heated in a basin instead of a flask, the results were 1 or 2 per cent. lower, this being attributed to evaporation of glycerol in the former case.

Quantitative esterification of other alcohols.—On heating 0·5 grm. of the alcohols from Chinese wax (mainly ceryl alcohol) with 1 grm. of "stearic" acid and 2 c.c. of the reagent, and making a blank determination as above described, the difference between the two titrations represented the amount of hydroxyl in the alcohol replaced by fatty acid. This expressed in mgrms. of potassium hydroxide for 1 grm. of the substance under examination is termed the *hydroxyl value* (in this case = 148·8). This value differs from the acetyl value in being calculated on the original substance, and not on the weight of that substance after the addition of the acetyl radical.

Esterification of hydroxy fatty acids or their glycerides.—When 0·235 grm. of castor oil, 1 grm. of "stearic" acid, and 2 c.c. of the reagent were heated together, the differences between the blank determination and the actual titration represented the alcoholic hydroxyl replaced by the fatty acid, and, an allowance being made for the alkali neutralised by the free acid in the oil, the hydroxyl value was found to be 153·2. In the case of the free fatty acids from the same castor oil, the hydroxyl value was found to be 158·8, whilst in a second experiment in which no "stearic" acid was employed, there was almost a sufficient excess of acidity in the castor oil fatty acids themselves, the hydroxyl value obtained being 154·6. It is pointed out that these hydroxyl values are somewhat lower than those calculated from the usually accepted acetyl values of castor oil and castor oil fatty acids.

Hydroxyl values of various fats and fatty acids.—The following results were obtained, only a small excess of "stearic" acid being used with the fats, and no "stearic" acid at all in the case of the fatty acids:—Lard, 1·8; lard fatty acids, 8·3; tallow, 2·3; olive oil, 6·4 and 5·0; cottonseed oil, 5·0 and 7·8; cottonseed oil fatty acids, 8·2; castor oil, 149·0; and castor oil fatty acids, 161·4. The results were practically the same when the heating was done in a current of dry hydrogen, showing that no hydroxyl compounds were formed in the process. Mono- and diglycerides heated in this way with an excess of fatty acid, yielded triglycerides.

Quantitative esterification of fatty acids.—Fatty acids heated with glycerol and the reagent were esterified to the extent of about 99 per cent. Allowance was made for the esterification of the carboxyl radical of the naphthalenestearosulphonic acid, and for the free acidity of the sulphonic radical, this acidity being determined by titration with standard alkali, with methyl orange as indicator.—C. A. M.

Margarine; Proportion of water in ——. P. Buttenberg. XVIII*A*., page 631.

United States Patents.

Separating liquids of different specific gravities; Apparatus for ——. [*Grease extractor*]. J. H. Cayford, Buenos Ayres, Argentina. U.S. Pat. 850,419, April 16, 1907.

The apparatus comprises a combined digester and grease extractor, and consists of a cylindrical vessel into which the liquid is introduced through a valved inlet on the side of the vessel near the top; a rotatable stirrer in the lower part of the vessel with arms mounted so as to rotate between blades projecting inwards from the walls of the vessel; a rotatable threaded shaft extending through the top to a point near the stirring mechanism; a non-rotatable inverted funnel threaded on the shaft and adapted to travel from the end of the shaft to a point above the inlet; means connected to this funnel for tapping off the grease; and means for creating in the vessel a greater pressure than in the discharge conduit. —A. G. L.

Fish oils; Process of eliminating the odours of ——. A. de Hemptinne, Ghent, Belgium. U.S. Pat. 852,662, May 7, 1907.

See Eng. Pat. 12,525 of 1905; this J., 1906, 80.—T. F. B.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page* 539.)

(*A*.)—PIGMENTS, PAINTS.

"*Grisol*": *a pigment free from lead; Report of the Comité des Arts chimiques on* ——. A. Livache. Bull. Soc. d'Encour., 1907, **109**, 369—372.

"Grisol" consists essentially of aluminium silicate and zinc oxide, tinted by carbon black, and with manganese resinate as a drier. It is absolutely free from lead. As a substitute for red-lead in the protection of iron against rusting, experiments extending over 10 months, up to the date of the report, have shown it to be completely satisfactory. Weight for weight it covers more than twice as great a surface as red-lead, and at a cost, per unit of surface, which is less than half that of red-lead.—M. J. S.

Zinc-lead pigment; Composition and analysis of ——. E. W. Buskett. Eng. and Mining J., 1907, **83**, 760.

The author states that zinc-lead pigment is not, as is usually accepted, a mixture of lead sulphate and zinc oxide, but a mixture of lead oxide and basic sulphate, zinc oxide and sulphate, and a compound of zinc oxide and lead oxide, probably zinc plumbate. "Sulphur dioxide is present in the pigment as a gas," and probably also in the form of sulphites of zinc and lead. The objectionable constituents are zinc sulphate and sulphur dioxide. The following methods have been found useful in practice for the analysis of the pigment. *Total zinc* is determined by titration with ferrocyanide in a hydrochloric acid solution. *Zinc sulphate.*—Ten grms. are extracted with 200 c.c. of water by boiling for 5 minutes, and after filtering, 10 c.c. of a standard solution of zinc and 15 c.c. of hydrochloric acid are added, and the whole titrated with ferrocyanide, the quantity of zinc added being subtracted from the result. *Lead sulphate and oxide.*—One grm. of substance is boiled for 5 minutes with 50 c.c. of a 30 per cent. solution of acetic acid, and filtered. The contents of the filter-paper, after draining, but without washing, are transferred to a beaker, and treated with 25 c.c. of ammonium acetate solution, heated to boiling, and titrated with ammonium molybdate. The filtrate from the original acetic acid solution is now added, and more ammonium molybdate solution run in. The first titration gives the lead sulphate, and the second the lead oxide. *Sulphur dioxide.*—One grm. of the pigment is treated with 100 c.c. of hot water and 5 c.c. of hydrochloric acid, and titrated with iodine solution and starch. *Moisture* is determined by drying 10 grms. at about 110° C. for one hour. The composition of a sample of zinc-lead pigment is given as follows:—Zinc oxide, 60·75; zinc sulphate, 0·61; lead oxide, 3·87; lead sulphate, 34·25; sulphur dioxide, 0·064; and water, 0·45 per cent.—A. S.

United States Patents.

Zinc and lead ores; Process of treating ——. J. Thelberg, New York, N.Y. U.S. Pat. 851,187, April 23, 1907.

Ores containing sulphides of zinc and lead are charged on to the bed of a furnace, and a superheated mixture of steam and air is forced from below through the bed of the furnace and the charge of ore. The sulphur, zinc, and lead are oxidised, and the volatilised oxide of zinc and sulphates of lead and zinc pass out with the furnace gases and are condensed for use as pigments, the sulphur dioxide being utilised for the manufacture of sulphuric acid. Claim is also made for the use of quicklime as part of the charge in the furnace.—O. F. H.

Lead oxide; Process of making ——. C. A. Hall, Philadelphia, Pa. U.S. Pat. 852,325, April 30, 1907.

LEAD oxide is prepared by causing comminuted lead moistened with water to pass in the form of a shower through a changing body of hot air under pressure, in order to induce oxidation, and then plunging the particles into water in order to detach the oxide, these operations being repeated until the whole of the lead is converted into oxide.—A. S.

(*B.*)—RESINS, VARNISHES.

Pine and its products; Industrial and scientific aspects of the ——. C. H. Hertz. Chem. Eng., 1907, 229—236.

THE author discusses the position of the industry of the manufacture of turpentine, &c., from the pine. The text of the paper is sub-divided as follows:—Effect of turpentine on timber; crude turpentine; distillation; spirits of turpentine; rosin.—A. S.

Colophony; Studies on American ——. C. Schwalbe. Wochenbl. Papierfab., 1907, **38**, 1303—1306.

ROSIN undergoes a change on prolonged exposure to light and air, as the result of which it becomes whitish in colour and opaque, and loses its conchoidal fracture. This "weathered" rosin is covered with a brittle crystalline crust, and is useless for paper-sizing. The change is accompanied by an increase in the portion of the rosin insoluble in light petroleum spirit, and by a rise in the melting point. The alteration proceeds from the outside of the lump of rosin inwards, the centre remaining sound. Normal rosin contains 4—6 per cent. of matter insoluble in light petroleum, whereas a badly weathered crust may contain over 70 per cent. Rosin kept for six months in a finely powdered condition, exposed to diffused daylight, contained 60 per cent. of matter insoluble in petroleum, whilst a portion of the same lump preserved in the dark contained only 4·5 per cent. Rosin, therefore, should be stored in the form of large lumps in closed casks. The melting point of normal rosin, determined by Kraemer and Sarnow's method (this J., 1903, 291), is 66°—69°, although some samples melt as high as 76° C.; but the melting point of the residue insoluble in petroleum is 107° C. The acid value of the altered rosin does not differ appreciably from that of the normal rosin, and is no guide as to quality. The dark colour of some samples of rosin is generally due to prolonged heating and has nothing to do with the above alteration, but the solutions of the altered rosin, whether in alcohol or alkali, have a dark reddish colour, and they degrade the colour of pulp if used for sizing. In American rosin, lumps of a whitish colour, like that of "weathered" rosin, sometimes occur; these, however, are plastic and consist of crude rosin from which the turpentine has not been expelled. Fahrion has recently shown (this J., 1907, 264) that the change which takes place on exposure to light is due to auto-oxidation; since turpentine is particularly prone to this kind of oxidation, with formation of ozone, these soft lumps of crude rosin increase the danger of destruction of the sizing, and this danger may even extend to the paper itself.—J. F. B.

Gum copal; Note on some chemical properties of Sierra Leone ——. D. Spence and E. S. Edie. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 47—48.

THE melting point of the specimen, which was of unknown origin, ranged from 80°—105° C. The most suitable solvent for this resin was aniline, which dissolved about 80 per cent. of it. The gum copal was acid to litmus. A filtered solution of the resin in aniline was, therefore, extracted with sodium carbonate solution, and the extract acidified. A white amorphous precipitate was thrown down, which accounted for quite 50 per cent. of the original copal.—P. F. C.

Oleoresin of Pinus halapensis. A. Tschirch and H. Schulz. Archiv der Pharm., 1907, **245**, 156—163.

THE oleoresin of the Aleppo pine, *Pinus halapensis*, is employed in the manufacture of Greek "resin-wine." It is a viscous semifluid product, of the consistence of thick honey, and much contaminated with accidental impurity. The mass contains light yellow lumps which show a crystalline structure under the microscope: acid value, direct, 125·9; indirect, 131·75; saponification value, cold, 145·31; hot, 154·14. The systematic examination of the resin by Tschirch's method shows that it consists of the following constituents. Five per cent. of halepopininic acid, $C_{21}H_{32}O_3$, removable by ammonium carbonate from the ether solution of the resin. About 59 per cent. of two acid resins, removable by sodium carbonate solution, consisting of halepopinolic acid, $C_{17}H_{26}O_2$, and halepopinitolic acid, $C_{16}H_{26}O_2$. The former is crystalline and is precipitated by lead acetate; the latter is amorphous and not thrown down by that reagent. Besides these acids there are present 21 to 26 per cent. of essential oil, 0·6 per cent. of resene, with traces of bitter principle.—J. O. B.

Turpentine and colophony industry of the United Provinces, India. Bd. of Trade J., May 16, 1907. [T.R.]

AN account of the turpentine and colophony industry of the United Provinces is given in the report of the Forest Department for the year ending June, 1906. The manufacture of turpentine and colophony is carried out in the Naini Tal and Jaunsar Divisions. In the former, 99,891 trees tapped yielded a total out-turn of 266,060 seers of crude resin, as compared with 170,364 seers in 1904–5; while in the latter, 6,000 trees tapped gave a yield of 21,384 seers, as against 6,816 seers in 1904–5. The following figures show the manufacture of turpentine and colophony during the year 1905–6:—

	Naini Tal Division.	Jaunsar Division.
Turpentine .... galls.	10,955	709
Colophony .... seers	175,120	17,883

ENGLISH PATENT.

Driers for paints, varnishes, and oils; Manufacture of ——. G. Guittet, Paris. Eng. Pat. 15,838, July 12, 1906.

SEE Fr. Pat. 367,989 of 1906; this J., 1906, 1226.—T. F. B.

UNITED STATES PATENTS.

Turpentine from wood; Apparatus for extracting ——. H. Rasche, Alki Point, Wash., Assignor to American Wood Extract Co. U.S. Pat. 850,098, April 9, 1907.

THE apparatus comprises a retort in which are cars loaded with the wood to be treated, a steam-raising apparatus, and a superheater. By means of a by-pass, part of the steam is led directly into the retort, whilst the remainder is first passed through the superheater, wherein it is heated to a temperature of 250° F. or above (at atmospheric pressure). The vapours evolved in the retort are continuously withdrawn, and delivered to a condenser, so that the pressure in the retort never becomes substantially greater than that of the atmosphere.—A. S.

Turpentine and other products from wood; Method of and apparatus for extracting ——. M. McKenzie, Plainfield, N.J. U.S. Pats. 851,687 and 852,236, April 30, 1907.

SEE Fr. Pat. 367,926 of 1906; this J., 1906, 1226.—T. F. B.

Wood; Process of extracting products [oil, turpentine, resin] from ——. F. Pope, New York, Assignor to W. C. Clark, Pittsburg, Pa. U.S. Pat. 852,078, April 30, 1907.

The claims relate to a process for the extraction of oil, turpentine, and resin from wood, in which the latter is treated in a closed vessel through which is circulated a hot solvent liquid maintained under sufficient pressure to prevent any substantial escape of vapour from the vessel. A suitable solvent liquid consists of a mixture of pine tar, "heavy residuum of wood extraction," and pine oil. The extracted products are recovered from the solvent by distillation.—A. S.

(*C.*)—INDIA-RUBBER, &c.

India-rubber plants from Southern Madagascar. J. Costantin and H. Poisson. Compt. rend., 1907, **144**, 1053—1057.

In the south-west (Province of Tuléar), the roots only of two plants are treated for rubber; the native names of these plants are *Kokomba* and *Kidroa*. Another plant, *Kompitsé*, is also used. The first two are species of *Mascarenhasia* (*M. Geayi* and *M. Kidroa*, the latter very similar to the already known *M. pallida*), the characters of which are detailed in the original. In the region of Fort Dauphin two new species of *Landolphia* have been discovered (*L. Mamolava* and *L. Manavo*); these are also described in full. Recent work has shown that *L. Madagascariensis* contains a latex difficult to coagulate, and furnishing a non-elastic product; the chief species really yielding rubber are *L. Mandrianambo, hispidula, Dubardi*, and *Richardiana*, which are found only towards the north, around the Bay of Antongil. The southern natives have devised a new method of treatment of the roots of *Kokomba* and *Kidroa*, which resembles in principle some recent patents. The roots are exposed to the sun to coagulate the latex, and are then decorticated by beating with a block of wood. A second exposure to sun follows, and the roots are then boiled with water, and the fibrous matter separated as far as possible. A second and a third drying and boiling follow, and after the third, the product is sufficiently free from fibre to be made up into the balls in which it comes into commerce.—J. T. D.

Latex from "Funtumia elastica"; Analysis [and coagulation] of ——. D. Spence. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 45—46.

The latex was treated with sodium hydroxide solution until the acid which it contains as a result of the partial decomposition of protein matter, was just neutralised, and the whole was then boiled till coagulation was complete. The presence of ammonia, sodium carbonate, or sodium hydroxide retarded the rate of coagulation, whilst ammonium chloride, calcium chloride, and barium chloride only hastened it on heating. Acids in small amount favoured the coagulation on boiling, but excess had a retarding effect, and also gave an inferior product. Alcohol showed a marked hastening effect, and a mixture of alcohol and phenol (10 : 1) caused almost instantaneous coagulation, even in the cold. The addition of a solution of ammonium molybdate in dilute nitric acid to the latex changed its colour to a greenish-brown, and a flocculent precipitate of caoutchouc separated and rose to the surface. On warming, the precipitate cohered to one mass, leaving the liquor almost transparent. Basic lead acetate gave a similar though less marked effect.—P. F. C.

English Patent.

Rubber; Manufacture of ——. M. Wilderman, London. Eng. Pat. 9290, April 19, 1906.

Raw rubber is treated with a solvent such as benzene or chloroform either alone or mixed with ethyl or methyl alcohol, capable of dissolving all the constituents. The excess of the solvent is evaporated until the minimum quantity required for the purification of the rubber remains. The solvent and dissolved resin are then removed by heating in water in a special vessel, kept at any desired temperature, the rubber collecting and floating on the water. The method may be applied with advantage to rubber from which a part of the inferior constituents have been removed by the process previously described (this J., 1906, 895).—S. R. T.

French Patent.

Rubber articles; Process of making and repairing ——. T. Gare. Fr. Pat. 373,354, Jan. 5, 1907. Under Int. Conv., May 29, 1906.

See Eng. Pat. 12,454 of 1906; this J., 1907, 539.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(*Continued from page* 540.)

Formaldehyde as a preservative for skins. W. Eitner. Der Gerber, 1907, 33, 121—123, 137—139.

The present high price of raw skins makes their proper preservation increasingly desirable, whilst the not infrequent transmission of infection through their agency has made sterilisation important from a sanitary point of view. Sterilisation of skins by means of formaldehyde vapour, as sometimes carried out, can only be regarded as of temporary value, although it assists the subsequent salting. In practice a considerable difference is observed between skins salted in a fresh and decomposed condition. The latter require more salt, and often, although showing no signs of visible decomposition, give trouble in the later stages of manufacture. Skins treated with formaldehyde before drying, dry well and are less subject to damage by insects during transit than those not so treated, and are also less liable to transmit disease. The author has experimented on calf skins with a mixture of equal parts of fusel oil and formaldehyde. A 5 per cent. solution, although inhibiting the ordinary putrefying organisms, still allowed the growth of depilatory bacteria, and when the skins were soaked in water they were easily dehaired and still fresh. They behaved quite normally in the subsequent processes, and produced good leather. Further experiments were made, in which dry hide was treated in a closed chamber, primarily on account of anthrax infection, for 24 hours with formalin vapour. These experiments proved that sound, well-dried hides suffered no damage. A chamber of 200 cubic metres capacity was used for 1000 kips, and 10 kilos. of formaldehyde were evaporated. If it is impossible to make use of the formaldehyde in the state of vapour, a 10 per cent. solution may be employed. In either case the cost works out at about 5 heller per skin. Formaldehyde is considerably cheaper than sulphur dioxide, and is more effective as a protection against insect ravages. The author has conducted extensive experiments to determine the most suitable concentration of the formaldehyde solution. Parallel experiments were made with solutions containing from 5 to 20 per cent of formaldehyde. The raw skins were treated with these solutions on the flesh side, folded, and kept at a temperature of 14° to 16° C. The skins treated with the 5 per cent. solution gave satisfactory results when tanned even after an interval of four weeks. Solutions of from 10 to 20 per cent. strength caused a certain amount of hardening, and consequent delay in the subsequent liming process. This can, however, be partly counteracted by the use of sodium sulphide. The prolonged action of formaldehyde causes, however, irreparable damage to skins intended for the manufacture of glue, the liquors from all the above experiments showing very little gelatinising power. The author concludes, for these reasons, that formaldehyde alone is unsuitable for the preservation of skin for long periods, although its use is desirable in cases of foul goods, and where the loss of the glue is already certain.—S. R. T.

Bastard logwood; [Tanning value of ——*] from Jamaica.* E. Drabble and M. Nierenstein. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 38—40.

The amount of tannin in the bastard logwood examined ranged from 6·34 to 6·69 per cent. The extract was found to be free from "phlobaphenes" and on that account it should be useful for the manufacture of book-binding leathers, where the "phlobaphenes" are the cause of the so-called "rot."—P. F. C.

Sprouted alumina, for the determination of the relative tanning value of vegetable tanning materials; Analysis with ——. H. Wislicenus and W. Muth. Collegium, 1907, 157—163, 169—175. (See this J., 1905, 294.)

The advantages the authors claim for sprouted alumina over hide-powder for tanning analysis are that its quality is much less variable, and it is not affected by temperature or the humidity of the atmosphere. It contains no soluble matter, far less is required for each determination, and after each experiment the alumina can be recovered by heating to a dull red heat, hence avoiding the waste that is attached to the use of hide-powder. In the analysis of a tanning material the authors first determine the moisture by drying about 2 grms. in a nickel or glass basin. In making up the solution such a quantity of material as will give 0·3 per cent. of tannin is taken, and is made up with boiling water in the usual way. For filtration, the authors use "S. and S. 602 extra-hart" filter papers, and wrap several of these (3 to 5) round a perforated glass tube similar in shape to a candle. These are fastened with an elastic band, and the liquor is sucked through by means of a water pump. After the filtration the papers are thrown away and fresh ones used for the next determination. 100 c.c. of the original liquor for "total solids" and 100 c.c. of the filtered liquor for "total solubles" are evaporated, and by deducting the latter from the former, the amount of "insolubles" is obtained. For the estimation of "non-tannins" the authors put about 2·5 grms. of sprouted alumina into a cylindrical glass tube, and pack the rest of the tube tightly with cotton wool. The tube is fitted with india-rubber bungs and glass tubes at either end, and is held in a perpendicular position by a clamp. The lower end is connected to a reservoir which can be raised or lowered by a clamp, while the upper end is connected by a siphon tube to a flask standing on the bench. The liquor is introduced into the reservoir, which is then raised above the height of the alumina tube. The process is now simply one of siphoning and should take from 5 to 6 hours, and when possible it is advisable to leave it overnight. The cotton-wool, being packed tightly in the tube, prevents the process going too rapidly. When about 110 c.c. have siphoned over, the apparatus is disconnected and 100 c.c. of the detannised liquor are evaporated to dryness. The residue gives the "non-tannins," and this figure when deducted from the "total solubles" gives the "tannin substance."—H. Br.

Tanning materials; Drying of residues in the analysis of ——. J. G. Parker and D. Stewart. Collegium, 1907, 140—143.

The authors have compared the use of the American combined evaporator and dryer with that of the ordinary water-bath and air-oven for the drying of residues in tanning analysis. The two methods agree very closely. In the combined evaporator and dryer the time required to obtain constant weights for non-tannin residues is 12 hours, for total solubles and for total solids 12—16 hours, the average internal temperature being 97° C. After evaporation on the water-bath the residues are dried for two hours at 105° C. in the air-oven, weighed and returned to the oven for half-an-hour or until the weight is constant. —H. Br.

Tannins; A colour reaction of ——. A. Brissemoret. XXIII., page 645.

English Patents.

Hides, skins, and the like; Machines for the treatment of ——. H. H. Lake, London. From R. Barron, Peabody, Mass., U.S.A. Eng. Pat. 9893, April 27, 1906.

Claim is made for improvements in a machine particularly adapted for shaving, but which may also be employed for fleshing and "putting out" the hides, and also expressing tan-liquor from them. The skin while being fed into the machine is worked by a revolving cylindrical tool in which a bed roll and pinch roll are arranged in such a manner that they cease their rotation when disengaged from each other, and commence rotation just before re-engagement. A special curved form of feeding board or spreader is employed, and an annular grinding mechanism keeps the tool in proper adjustment.—S. R. T.

Tanning, tawing, or curing hides or skins. W. P. Thompson, London. From A. E. Kelk, Louisville, Ky., U.S.A. Eng. Pat. 24,189, Oct. 30, 1906.

The time necessary for tanning may be shortened by soaking raw hides in a solution of commercial nicotine (90 per cent. purity) containing approximately 1 lb. of nicotine to 100 lb. of hide. The time required by the tanning liquor to penetrate the skin is reduced to from a quarter to a half of that now necessary. If the action of the nicotine be somewhat prolonged, it acts as a depilatory agent.—S. R. T.

Hides or skins; Process of treating ——. W. M. Norris, Princeton, U.S.A. Eng. Pat. 29,661, Dec. 29, 1906.

See U.S. Pat. 840,794 of 1907; this J., 1907, 332.—T. F. B.

XV.—MANURES, &c.

(*Continued from page* 540.)

Leguminosæ; The root bacteria of the ——. A. Rodella. J. Inst. Brewing, 1907, **13**, 320—327.

Many authors have observed in the cells of root-tubercles conglomerations of bacteria which degenerate, showing involution forms which have been termed "bacteroids," in the shape of large round or ramified bodies, rich in protein, which are subsequently utilised by the plant as reserve supplies of protein. Stutzer regards these bacteroids as superior forms as compared with the bacteria, but many contradictory theories have been advanced as to their nature and origin. The author has found that when the root-tubercles are sown in media under anaërobic conditions they always yield an anaërobic bacterium which closely resembles the *Clostridium Pasteurianum* of Winogradsky and which certainly belongs to the butyric acid group. The ramified bodies, improperly termed bacteroids, are exclusively due to the acid generated in the tubercles of the leguminosæ by the fermentation of the carbohydrates, and they can be obtained in artificial cultures either by similar fermentation or by the addition of organic acids, acetic, butyric, &c. The anaërobes of the root-tubercles live in contact with aërobic germs by symbiosis. They can be cultivated more easily in agar than in gelatin, because anaërobes develop more readily in liquid than in solid media, and the agar has the property of retaining the necessary moisture better than the gelatin. When cultivated at the bottom of a tube of dextrose-agar, the anaërobes develop so much gas, in 2—6 days at a temperature of 37° C., that the column of agar is driven up to the mouth of the tube. In practice, a long-necked flask, half filled with fresh milk-serum, is sterilised in an autoclave; when the temperature has fallen to 50°—60° C., the column of agar containing the pure culture is introduced into the liquid, and the flask is then nearly filled with a further quantity of sterilised milk-serum, also at 60° C., and a layer of 5 c.c. of sterilised oil is poured on the top of the liquid in the neck of the flask. Fermentation sets in after two or three days, and the culture is then ready for pouring on to the soil to be treated.—J. F. B.

English Patent.

Excreta, night-soil, &c.; Method of treating —— and of obtaining manure therefrom. J. H. W. Stringfellow. Eng. Pat. 8727, April 11, 1906. XVIII*B*., page 632.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 542.)

Dextrose; Influence of formaldehyde on the rotatory power of ——, and the theory of multirotation. G. Landini. Atti R. Accad. dei Lincei, Roma, 1907 [5], **16**, I., 52—58; Chem. Zentr., 1907, **1**, 1320.

If a solution of hydrochloric acid and formaldehyde be added to one of cane sugar, the diminution in the rotation does not correspond to the formation of invert sugar. With formaldehyde (formalin) alone, the rotation of cane sugar increases, although formalin usually contains a small quantity of acid. If a solution of dextrose which has attained its constant rotatory power be treated with formaldehyde, the rotation increases, the increase being approximately the same as that observed with a dextrose solution to which has been added a quantity of acid equal to that contained in the formaldehyde. Experiments with fresh solutions of dextrose and formaldehyde containing varying proportions of acid, gave results for which the most plausible explanation is offered by Jungius' hypothesis (Z. physik. Chem., **52**, 97), according to which the change is due to the reaction, α-dextrose$\rightleftarrows\gamma$-dextrose.
—A. S.

Starch; Xanthogenic esters of —— by interaction of alkali-starch and carbon disulphide. C. F. Cross, E. J. Bevan, and J. F. Briggs. Chem. Soc. Trans., 1907, **91**, 612—614.

The difficulty hitherto experienced in preparing xanthogenic esters of starch similar to those obtained from cellulose, was only mechanical, and was due to the imperfect contact of the reagents. This difficulty has been overcome by first saturating the dry powdered starch with carbon bisulphide and then stirring into the mixture the necessary quantity of 20 per cent. solution of sodium hydroxide, whereby a homogeneous emulsion of all the reagents is obtained. When the reaction is complete, the product is dissolved in water and forms a viscous solution of sodium starch xanthogenate. On acidification with acetic acid and treatment with iodine solution, the starch dixanthogenide is precipitated in a pulverulent condition. Analysis showed that the original reaction takes place approximately in the ratios, $C_6H_{10}O_5 : CS_2 : NaOH$, and that "reversion" takes place spontaneously with elimination of the xanthic residues. The course of this progressive decomposition has been followed over a period of 16 days and it is noted that at no stage could any free starch be detected amongst the products.—J. F. B.

Sucrose; Inversion of —— by acid mercuric nitrate. C. B. Cochran. XXIII., page 645.

Osmotic pressure of cane-sugar solutions in the vicinity of the freezing point of water. H. N. Morse, J. C. W. Frazer, and W. W. Holland. XXIV., page 647.

English Patent.

Extraction and desiccation of the solid parts contained in natural fluids or in solutions; Process and apparatus for the ——, particularly for the production of milk powder and the extraction of sugar from saccharine juices. P. Bévenot, Paris. Eng. Pat. 28,767, Dec. 17, 1906. Under Int. Conv., Dec. 16, 1905.

See Fr. Pat. 372,581 of 1906; following these.—T. F. B.

French Patents.

Saturating apparatus [for sugar solutions, &c.]; Rapid ——. E. J. B. Portemont. Fr. Pat. 372,956, March 5, 1906.

The apparatus consists of a series of communicating prismatic boxes, mounted end to end, and rotated by means of terminal hollow trunnions, through one of which the gas and liquid are introduced, whilst the saturated liquid is removed through the other.—C. S.

Desiccating apparatus for solid matters contained in natural liquids or in solutions, especially for making milk powder and extracting sugar from saccharine juices. P. Bévenot. Fr. Pat. 372,581, Dec. 15, 1906. XVIIIA., page 631.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 546.)

Brewing materials; Analytical control of ——. J. L. Baker and H. F. Hulton. J. Inst. Brewing, 1907, **13**, 328—342.

The routine examination of barley, for comparing samples with deliveries, comprises determinations of weight per 1000 corns, percentage of damaged corns and foreign matters, germination test, and moisture. When barley is kiln-dried, determinations of moisture should be made as it leaves the kilns. The examination of malt includes determinations of extract, diastatic power, colour, moisture, development of acrospire, and arsenic. Systematic records of the conditions of malting should be available. When the brewer buys malt in the open market, the cost per lb. of extract is generally the determining factor. An allowance as between sample and delivery of ±0·75 lb. per quarter is permissible; greater differences should be taken into account in the invoice. The cost per lb. of extract in ordinary malts in London varies from 3·9d. to 4·7d. The margin allowed on flaked maize and coloured malts, as regards extracts, is ±1 lb. per quarter. The cost per lb. of extract in coloured malts is higher than in ordinary malts. In determining the extract of coloured malts and of flaked maize, an equal weight of pale malt should be used, since the result varies according to the amount of diastase present. In all cases a proper system of sampling should be enforced. The analysis of cane sugar for brewing purposes comprises determinations of ash and extract. In the case of glucoses and invert sugars, the unfermentable residue is also of importance; the quality of the sugar may be controlled by an observation of its specific rotatory power. Caramel is valued according to its colour by Lovibond's tintometer; the cost of caramel colour is 1s. 2d. to 1s. 7d. per unit per 2 cwt. Other chemicals used in the brewery, *e.g.*, detergents, disinfectants, preservatives, and chemicals for water-hardening, should also be valued by analysis.
—J. F. B.

Oxalic acid; Formation of —— by fungi and yeasts. P. Lindner. Ber. deut. botan. Ges., 1907; Woch. f. Brau., 1907, **24**, 242—243.

Amongst the fungi cultivated from sewage fields, a colony was observed which was surrounded by a crystalline accumulation of calcium oxalate. The fungus was not fully identified, but somewhat resembled *Isaria*. Reinhardt has observed a similar production of oxalic acid by *Peziza*, living under parasitic conditions. In this case, the formation of oxalate was very easily induced by any slight infection of the cultures, the infecting spore being surrounded and killed by the oxalic acid excreted by the *Peziza* mycelium. This observation suggests an explanation of the frequent occurrence of calcium oxalate in tun yeast and cask sediments. The causal relationship between the stimulus of infection and the defensive excretion of oxalic acid by the yeast has not yet been definitely established, but it would appear that the proportion of calcium oxalate is greater the longer the stock of yeast has been in use, and presumably exposed to infection. In a certain brewery the proportion of oxalate was so great that it seemed to have an injurious influence on the yeast itself (compare Lebedeff, this J., 1907, 542). A considerable falling off in the fermentative power of the yeast was observed after it had been in use for five or six successive fermentations. Calcium oxalate is less injurious than free oxalic acid, and the effect would, therefore, be less marked with hard waters than with soft waters. The highest proportion of oxalate was observed in the deposits from Munich beers. The formation of oxalate has been observed in perfectly pure fermentations, whence it would seem that the stimulus is provided not only by foreign organisms, but also by solid and liquid bodies. In the brewery it happens that the places where the oxalate deposits are chiefly found, *viz.*, the walls of the tuns and pipes, are those which are the most frequent centres of infection, and wild yeasts are generally present underneath the deposits. The yeast *S. Hansenii*, which occurs in cotton-seed meal, shows a particularly strong tendency to produce oxalic acid. Certain observations of Emmerling on *Aspergillus niger* (Zent. Bakt., 1903, 273.) offer an alternative explanation of the production of the oxalic acid. He found that oxalic acid was formed when the fungus was provided with ammonium salts of α-amino-acids. Sugar and carbohydrates yielded no oxalic acid; Witte's peptone yielded the greatest quantity. Considerable quantities of oxalic acid were obtained from asparagine and aspartic acid, but none from arginine, histidine, and lysine.—J. F. B.

Claret; Notes on ——. P. Schidrowitz. J. Inst. Brewing, 1907, **13**, 302—312.

The clarets are classified according to district, growth, and vintage, each of which factors has an influence on the quality and composition of the wine. The Médoc wines are divided into four "growths," and the first of these, the "grands crus classés," is subdivided into five more. Analysis as a criterion of future quality is most useful when the wine is quite young, since that is the stage at which tasters are liable to pronounce erroneous opinions. The analytical results cannot be interpreted according to any hard and fast rule, but the author makes the following general remarks :—A wine may be regarded as sound if it possesses a sufficiency of alcohol and does not show an excess of acid (particularly volatile acid) and unfermented sugar. A wine with 10 per cent. of alcohol and no excess of acid or sugar would probably be sound, whereas if it contained 4 or 5 grms. per litre of unfermented sugar and an acidity greater than 3·5 grms. per litre, it would require very careful treatment; a wine containing less than 10 per cent. of alcohol would also be very liable to go wrong. The "size" of the wine is mainly gauged by its contents of alcohol, reduced extract (solids less fermentable sugar), and glycerol, but these are not sufficient to determine the quality, since their favourable effect may be nullified by excess of acid or tannin. The chief point is the "balance" of the quantities of the various constituents. If the alcohol : extract ratio be abnormally high or low, or if there be an obvious excess or deficiency of one or other constituent, the wine is rarely first class; in making standards, however, the district, growth, and vintage must be taken into account. During ageing, tartar is deposited and secondary bouquets, due to micro-organisms, are developed. The specific gravity of the wine generally increases owing to evaporation; the alcohol decreases; the acidity sometimes decreases owing to formation of tartar and esters, and sometimes increases owing to production of acetic and other free acids; the extract decreases owing to the deposition of tartar and the fermentation of sugar; the ash, total tartaric acid, and sugar decrease; the glycerol increases as a rule; the tannin decreases.—J. F. B.

Wines, coloured; Determination of total and volatile acids in ——. G. Guérin. J. Pharm. Chim., 1907, **25**, 491—492.

Total acids.—The wine is first boiled for a few moments under a vertical condenser to expel carbon dioxide, and is then cooled to the normal temperature. Ten c.c. are now treated with 5 c.c. of 10 per cent. mercuric acetate solution, and filtered into an Erlenmeyer flask, the precipitate and filter being washed with sufficient water to bring the volume of filtrate up to 300 c.c. The colourless liquid thus obtained is treated with 10 c.c. of a 20 per cent. solution of neutral sodium potassium tartrate and six drops of phenolphthalein solution, and titrated with $N/1$ potassium hydroxide solution. A blank experiment is then made with a mixture of the reagents in 295 c.c. of water, but without any of the wine, which is titrated as before.

Volatile acids.—Ten c.c. of the wine, freed from carbon dioxide, are evaporated on the water-bath; the soft residue is re-dissolved in boiling water, cooled, and treated with 5 c.c. of 10 per cent. mercuric acetate solution. The precipitate is removed by filtration, and washed with water to bring the volume of filtrate to 300 c.c. To this, 10 c.c. of neutral sodium potassium tartrate are added, and the titration performed with $N/1$ potassium hydroxide solution and phenolphthalein indicator. The result, deducted from the total acid value previously found, gives the equivalent of volatile acids.—J. O. B.

Wines; Proportion of sodium in ——. O. Krug. Z. Untersuch. Nahr. Genussm., 1907, **13**, 544—547.

The method described by Fresenius (*Quantitative Analysis*) was used in the determination of alkali metals in 46 samples of wine of different origin of 1905 vintage. The amount of potassium (as oxide) in the mineral matter ranged from 35·14 to 58·60 per cent., and the sodium (as oxide) from 0·03 to 2·45 per cent. Calculated upon the wine itself, the largest amount of sodium (as oxide) found was 4·5 mgrms. per 100 c.c., and the smallest 0·1 mgrm. per 100 c.c. Experiments were made upon three different vines to see whether manuring with Chili saltpetre would have any influence upon the proportion of sodium in the grape must, but no appreciable difference was produced by the treatment. The author concludes from these and previous results that a wine which, with a normal proportion of chlorine, contains more than 10 mgrms. of sodium (as oxide) in 100 c.c. must be regarded as adulterated. Natural wines containing an abnormal proportion of sodium appear to be of very rare occurrence.—C. A. M.

Apple musts and ciders; Sucrase [*invertase*] *in* ——. G. Warcollier. Compt. rend., 1907, **144**, 987—990.

In addition to a little starch, apple juice contains 8—30 per cent. of total sugars, consisting of sucrose, dextrose, and lævulose in very variable proportions. In spite of the fact that the sucrose is converted during the process of ripening into dextrose and lævulose by the action of the invertase in the fruit, this enzyme is entirely absent from the juice, being probably coagulated by the tannin of the must. It has been stated that ciders prepared from apples rich in sucrose remain sweet longer than those prepared from apples poor in sucrose. The author finds, however, that this is not the case, and that the sucrose is fermented by the natural yeasts of the musts quite as rapidly as the other sugars. The inversion of the sucrose, necessary for its fermentation, is effected by the invertase of the yeast. The invertase of the yeast diffuses into the must and is preserved for a considerable time in the cider. Cider one year old containing no sugar was freed from yeast by filtration through a clay filter and was found to possess the power of inverting added sucrose. The rate of inversion of the sucrose in a fermenting cider must is far greater than the rate at which the reducing sugars are fermented. Consequently in priming ciders with sucrose, it is quite unnecessary to invert the sucrose by boiling with tartaric acid, as is frequently recommended; in fact, when the priming is also required for sweetening purposes, the previous inversion of the sugar defeats the object desired.—J. F. B.

Vinegar; Manufacture of ——. J. Evans. Chem. and Drug., 1907, **70**, 809.

Wine vinegar, prepared from low-grade wines, has a sp. gr. 1·014—1·022; it contains 6—12 per cent. of acetic acid, and is distinguished from other vinegars by the presence of potassium hydrogen tartrate. Cider vinegar contains 3—6 per cent. of acetic acid and has a sp. gr. of 1·013—1·015; it has a distinct odour of apples and contains malic acid. Malt vinegar is prepared from a wort mashed from a mixture of malted and unmalted grain. Glucose or sugar vinegar is prepared from saccharine or starchy materials after conversion by acid. The trade descriptions of the strengths of vinegars are by numbers ranging from 24 to 16. The number indicates the number of grains of anhydrous sodium carbonate neutralised by one fluid ounce of vinegar. The number of the vinegar multiplied by the factor 0·259 gives the grms. of acetic acid per 100 c.c. There is no legal definition of vinegar, but it should be, the author thinks, wholly a fermentation product. The mash for malt vinegar is prepared from maize grist steamed and gelatinised in a converter under pressure and saccharified by malt. The clarified wort is cooled without boiling, and is fermented under conditions which produce the maximum amount of alcohol. The fermented wash is then acetified in tuns containing birch twigs on which the "mother of vinegar" is cultivated. The wash is pumped up and distributed over the twigs by a revolving sparger. The process takes 8—9 days, the temperature rising to 43° C. on the fourth day. The whole of the alcohol is not acetified, since a slight residue helps to preserve the vinegar and gradually produces acetic ester. The analysis of vinegar includes determinations of specific gravity, total solids, ash, alkalinity of ash, phosphoric acid, protein, total acidity, and calculation of original solids. Free mineral acids and poisonous metals should be looked for.—J. F. B.

English Patents.

Beer, stout, and other liquids; Chilling and carbonating ——, and apparatus therefor. E. G. Adlam, Bristol. Eng. Pat. 13,523, June 13, 1906.

According to this invention, the beer is first chilled and subsequently carbonated in a vertical cylindrical vessel of copper or other suitable material jacketed with insulating material. A stationary coil of copper piping extends from near the top to near the bottom of the vessel. The liquid to be treated is charged into the vessel under pressure, either by pumping or by "top-pressure" of air or gas, and is received therein in an open-ended distributing trough, from which it flows down over the coil in a fine, even film. The coil is charged with circulating brine or ammonia gas or other chilling agent, the whole of the chilling area of the coil being utilised while the vessel is being filled. A spindle carrying agitators passes up into the vessel from below and is rotated, when desired, for the purpose of rousing and assisting to carbonate the liquid. The vessel is fitted at the bottom with outlet nozzles, which are adjustable vertically so that the liquid can be drawn off from above any deposit formed during the chilling and carbonating. The liquid is carbonated by subsequently admitting carbon dioxide to the vessel. The vessel is provided with a hinged cover and is readily opened, the coil being removable for cleansing or other purposes. The process may be made practically continuous by using two vessels, one of which is being discharged while liquid is being chilled and carbonated in the other.—T. H. P.

Fermented liquors; Brewing of ——. H. J. Hill, Limehouse, and R. Hill, Isleworth. Eng. Pat. 17,665, Aug. 4, 1906.

After the wort leaves the boiling copper, the whole of the operations are performed in closed vessels to which only filtered sterilised air is allowed to have access. The wort from the copper flows into a closed hop-back fitted with non-return vent-valves and connected with the pure air main. From this it is pumped into an aërating vessel, in which it is agitated with pure air from the main introduced through the perforated arms of the stirrer. It is pumped thence through a tubular refrigerator into a closed fermentation tun, from which the carbon dioxide evolved during fermentation can be drawn off and stored under pressure. The fermented beer is run into a clarifying vessel below the fermentation tun, this vessel being in communication with both the pure air main and the carbon dioxide reservoir. Thence the beer is pumped through a chilling refrigerator to a filter, from which it passes to the delivery casks.—J. F. B.

Brewing beer and other liquors; Art of ——. Ozonair, Limited, London, and F. Rogerson, Streatham, Surrey. Eng. Pat. 17,969, Aug. 9, 1906.

The object of this invention is to prevent access of atmospheric impurities to wort at all stages of its preparation and fermentation, as well as to the yeast during storage, by using an atmosphere of purified ozonised air free from nitrogen compounds. Such air may be produced by the filtering and ozonising apparatus described in Eng. Pat. 4548 of 1903. The air may be forced either into the vessels themselves, when these are closed, or into a closed space containing the vessels, and may be drawn off in a continuous stream or may merely be allowed to remain in the closed space or vessels as long as necessary. Besides protecting the wort on the coolers and refrigerators and in the fermenting vessels, &c., this purified, ozonised air has a stimulating action on the yeast and is thus of especial value during hot seasons when the vitality or activity of the yeast becomes impaired.—T. H. P.

United States Patent.

Distillation [of fermented liquors]; Process of ——. J. N. Watt, Stockton, Cal. U.S. Pat. 851,718, April 30, 1907.

Fermented liquors are vaporised under reduced pressure, and the vapours, whilst under the reduced pressure, are subjected to fractional condensation at a temperature between the condensing points of alcohol and the head products at the reduced pressure. The temperature of the vapours is then reduced, whereby the alcohol is condensed and collected, and the head products are separated.—J. F. B.

French Patent.

Beer wort; Process for cooling ——. H. E. Deckebach. Fr. Pat. 373,594, Jan. 15, 1907.

See U.S. Pat. 841,126 of 1907; this J., 1907, 336.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 548.)

(*A.*)—FOODS.

Flour; A contribution to the chemistry of the bleaching of ——. S. Avery. J. Amer. Chem. Soc., 1907, 29, 571—572.

The general introduction of bleaching processes into American mills is stated to date from Alsop's electrical process (this J., 1903, 1062; 1904, 619). According to the author, the only methods in use are those in which nitrogen peroxide, produced either chemically or electrically, and mixed wtih a large excess of air, is used as the bleaching agent. Analyses of bleached and unbleached flour from the same wheat are given, showing that as regards moisture, ash, ether-extract, nitrogen, and crude fibre, the electrical process does not appreciably affect the chemical composition of the flour. Flour that had been treated was found to contain 0·78 part of nitrite (as sodium nitrite) per million. A bleached and unbleached sample of flour yielded loaves of the same size and quality. With regard to the effect of various substances that have been proposed as bleaching agents, the author finds that no bleaching is effected by oxygen (free from chlorine), ozone (free from nitrogen peroxide), or pure carbon dioxide. Bromine is a strong bleaching agent, 4 c.c. of the vapour at 25° C., mixed with 3 litres of air, being sufficient to bleach 1 kilo. of flour, whilst the maximum effect is obtained with 150 c.c. The use of more than 900 c.c. has a darkening effect. Chlorine behaves in an analogous manner to bromine (see also this J., 1906, 194).—C. A. M.

Colouring matters in pastry-ware; Use of carbon tetrachloride for the detection of —— which are forbidden by public health laws [in Italy]. V. Vetere. Giorn. Farm. Chim., 1907, 56, 97—106; Chem. Zentr., 1907, 1, 1359.

The author states that the methods proposed by Piutti and Bentivoglio (this J., 1906, 1168) are unsatisfactory. The coloration given as characteristic of "Martius yellow" is produced by all nitro-compounds, and consequently also by "Victoria yellow." Also, the shades of colour utilised by Piutti and Bentivoglio for the distinction of individual dyestuffs, depend upon the concentrations of the solutions. For example, "Martius yellow," "Victoria yellow," and "naphthol yellow S," when treated under similar conditions, all give a pink coloration. Many colouring matters which are not forbidden behave in the same way as "naphthol yellow S."—A. S.

Preservatives in milk. H. D. Richmond and E. H. Miller. Analyst, 1907, **32**, 144—153.

The authors have studied the effects of a number of substances on the souring of milk, these substances including aromatic acids, phenolic compounds, basic substances, and inorganic compounds, such, in fact, as are used generally as preservatives. The results obtained in the experiments are given in tabular form and also exhibited as curves. With benzoic, salicylic, and boric acids, the preservative effect is approximately proportional to the amount present; there is a general similarity between the benzoic and salicylic acid curves, and the first break in these takes place at a much lower acidity than in the case of the pure milk curve. The breaks in the boric acid curves are much nearer to that in the pure milk curve, a difference between the action of the aromatic acids and boric acid being thus indicated. Fluorides, sulphites, and phenols have a preservative action which increases with the quantity added, but in most cases, probably in all, small amounts cause the milk to go sour sooner than the control milk. Attention is drawn to the remarkably small increase which preservatives give to the "life" of milk. The addition of 0·1 per cent. of various preservatives increased the life as follows, at a temperature of 30° C.:—Boric acid, 10 hours; benzoic acid, 5·5 hours; salicylic acid, 7·5 hours; β-naphthol, 4·5 hours; potassium metabisulphite, 21 hours. As the same effect can be obtained by cooling the milk down a few degrees, there is evidently no justification for the use of preservatives. A few notes are also added on the detection and determination of preservatives in milk. Benzoates, or benzoic acid, are best separated by precipitating the curd of the milk with acetic acid and extracting the whey with chloroform; the extract is then washed with water, a little water is added together with a small quantity of phenolphthalein, and dilute alkali is run in drop by drop until the aqueous layer is pink. The benzoic acid is thus obtained in a few cubic centimetres of solution, to which can be applied any, or all, of the usual tests. In the determination of boric acid by titration in the presence of phenolphthalein, the quantity of the latter added has an enormous effect on the results obtained. The following modification of the method is, therefore, given as being trustworthy:—To a measured or weighed quantity of milk is added half of its volume of phenolphthalein solution (0·5 per cent.), and alkali is then run in until a pink colour appears; the solution is now boiled and titrated with acid, while hot, until it is perfectly white, $N/10$ alkali being then again added until the mixture is faintly pink. Thirty grms. of neutral glycerol are next introduced, and the mixture titrated with $N/10$ alkali; the quantity of alkali used for the final titration multiplied by 0·0062 will give the boric acid present.—W. P. S.

Caseïn fermentations and their uses. A. Rodella. Arch. Hyg., 1906, **59**, 337. Chem. Abs. (Amer. Ch. Soc.), 1907, **1**, 748.

In making a study of the chemical changes produced by bacteria in casein and in cheese, the author reaches the following results: (1) The fermentation of casein is caused by anaërobic bacilli, resulting in the formation of considerable amounts of volatile fatty acids along with many other products. (2) The aërobic bacilli (*Bac. subtilis, Megatherium mycoides*) are able also to convert casein into soluble products, but the process is quite different in that no volatile fatty acids are formed except, perhaps, in traces, and the end-product possesses a bitter taste. (3) The anaërobic fermentation of cheese is characterised by the appearance of a black colour. The colour may disappear if the medium reacts acid at the beginning; on the other hand, it appears much clearer if the ammonia cannot escape and the nutritive medium always reacts strongly alkaline. (4) This black colour is caused by formation of ferrous sulphide; it therefore depends on an inorganic, not an organic, compound. (5) The products of anaërobic casein fermentation are of great advantage to the cheese industry, so long as the process is kept under control with addition of acid or common salt. (6) On the basis of the study of anaërobic casein fermentations in cheese, a classification of the different varieties of cheese might be devised satisfactory both from the hygienic and the commercial standpoint. Thus, there is furnished a scientific basis for judging the ripening of cheese. (7) The fermentation of casein with the anaërobic bacilli described makes it possible to convert this product into an easily assimilable food which can be used advantageously for the nutrition of men and domestic animals.

Margarine; Proportion of water in ——. P. Buttenburg. Z. Untersuch. Nahr. Genussm., 1907, **13**, 542—544.

The proportion of water in 148 samples of margarine, examined by the author in 1906, ranged from 8·80 to 19·95 per cent., 43 samples containing more than 16 per cent. The average amounts in samples taken from special factories varied from 9·9 to 16·6 per cent., and the average of all the samples was 14·9 per cent. An excessively high proportion is usually due to insufficient blending of the materials in the factories, and there is no evidence of the addition of water by middlemen or small retailers.—C. A. M.

Sucrose; Inversion of —— by acid mercuric nitrate. C. B. Cochran. XXIII., page 645.

Tartaric acid; New method for the determination of ——. A. C. Chapman and P. Whitteridge. XXIII., page 645.

English Patents.

Aerating liquids [water]; Apparatus for ——, arranged for continuous working. A. Heinemann, Germany. Eng. Pat. 17,480, Aug. 3, 1906.

The object of the present invention is to avoid the overfilling of the apparatus such as is apt to occur in the case of the usual forms employed, when a less amount of aerated water is drawn off than that of fresh water added. Provision is now made for automatically disconnecting the pump, which supplies the water, and for relieving the air, whereby the difficulty already referred to is avoided, and the working of the apparatus is rendered more regular. —T. H. P.

French Patent.

Desiccating apparatus for solid matters contained in natural liquids or in solutions, especially for making milk powder and extracting sugar from saccharine juices. P. Bévenot. Fr. Pat. 372.581, Dec. 15, 1906.

The liquid is compressed by suitable means, and forced through atomising nozzles into a chamber where it spreads in the form of mist, and is dried by the action of hot air at a temperature of 60°—99° C. The mixture of air and powder ascends into an expansion chamber, where separation occurs, the powder being deposited on a sloping floor and falling down to a collector at the bottom of the apparatus, whilst the air escapes through the roof. The air is heated in chambers, adjoining the drying chamber, by means of steam radiators or the like.—C. S.

German Patent.

Milk-albumin; Process for obtaining dry, pure ——. G. E. Marsmann. Ger. Pat. 179,261, July 10, 1904.

The albumin separated in the usual manner from milk by ammonium sulphate or other precipitant is spread on a sheet of linen or the like stretched over a perforated hollow drum filled with quicklime, and mounted on a rotating horizontal axis. After drying, the albumin is washed by moistening with water, and the drying completed with the aid of the quicklime. By using whole milk in place of the milk-albumin, a dry milk powder is obtained.—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Industrial Diseases; Report of the Departmental Committee on Compensation for ——. [T.R.]

The Committee appointed to inquire and report as to what diseases and injuries other than injuries by accident are due to industrial occupations, are distinguishable as such, and can properly be added to the diseases enumerated in the third schedule of the Workmen's Compensation Bill, 1906, recommend that the following, among other diseases, be added to that schedule:—Poisoning by nitro- and amido- derivatives of benzene (dinitro-benzol, aniline, and others) or its sequelæ; any process involving the use of a nitro- or amido- derivative of benzene or its preparations or compounds.—Poisoning by carbon bisulphide or its sequelæ; any process involving the use of carbon bisulphide or its preparations or compounds.—Poisoning by nitrous fumes or its sequelæ; any process in which nitrous fumes are evolved.—Poisoning by nickel carbonyl or its sequelæ; any process in which nickel carbonyl gas is evolved.—Arsenic poisoning or its sequelæ; handling of arsenic or its preparations or compounds.—Lead poisoning or its sequelæ: handling of lead or its preparations or compounds.—Chrome ulceration or its sequelæ: any process involving the use of chromic acid or bichromate of ammonium, potassium, or sodium or their preparations. (See also this J., 1907, 511.)—Eczematous ulceration of the skin produced by dust or caustic or corrosive liquids or ulceration of the mucous membrane of the nose or mouth produced by dust. Epitheliomatous cancer or ulceration of the skin or of the corneal surface of the eye due to pitch, tar, or tarry compounds; handling or use of pitch, tar, or tarry compounds.

The other diseases scheduled relate to coal mining and to glanders in horses. The report continues:—

"The following were inquired into but not added to the schedule: *Naphtha.*—Cases are reported in which persons engaged in the cleaning out of naphtha storage tanks have been overcome and rendered unconscious from the fumes. Such cases are in the nature of accidents, but naphtha has also been alleged to be a cause of illness, gradually contracted, among workers in india-rubber factories. We have carefully investigated this question, have visited factories where naphtha is used, have examined and questioned the workers, and have asked the opinion of a number of witnesses qualified to speak with authority. The smell of naphtha vapour causes in some workers a headache, nausea, and vomiting, and if there is vaporisation from large surfaces spread over with the material in rooms with deficient ventilation, psychical disturbance may result, akin to that produced by alcoholic vapour. We have not been able to find evidence that workers are incapacitated for a period as long as a week, and are of opinion that naphtha poisoning should not be added to the list. *Sulphuretted hydrogen.*—Sulphuretted hydrogen gas, evolved in various processes in gas works and chemical works, has not unfrequently produced grave and even fatal illness; but its generally recognised effect is extreme suddenness of onset. The gassing takes place at a particular moment. We had evidence from the chief inspector under the Alkali Act, however, of special susceptibility of some persons to the effects of sulphuretted hydrogen gas, so much so as to necessitate their seeking some other employment. We are of opinion that such cases are exceedingly rare. Nor can idiosyncrasy of this kind be said to be equivalent to incapacity due to the nature of the employment. We consider that no sufficient argument has been adduced to enable us to regard the effect of the gas, for the purposes of the Workmen's Compensation Act, as other than due to accident. *Sodium cyanide and other cyanogen compounds.*—Hydrocyanic acid gas, similarly, generated in the manufacture of cyanide compounds, has caused fatal illness; but its effect is sudden also, and we have not received evidence that workmen suffer gradual poisoning as the result of exposure over a period of time. We communicated with the factory surgeon at a sodium cyanide plant in existence for some years, but no case of gradual poisoning among the workmen employed upon it had come under his notice, although any such case would have become known to him directly or indirectly. Cases of illness from these compounds are therefore 'accidents,' within the meaning of the Workmen's Compensation Act, and it is neither necessary nor possible to include this form of poisoning in the schedule."

Bacteria derived from sewage; Conditions under which ——, *may be present in the air of ventilating pipes, drains, inspection chambers, and sewers.* W. H. Horrocks. Roy. Soc. Proc., 1907, **79**, B, 255—266.

The experiments described show that specific bacteria may be ejected into the air of ventilating pipes, &c., by the bursting of bubbles at the surface of the sewage, by the separation of dried particles from the walls of the pipes, chambers, and sewers, and probably also by the ejection of minute droplets from flowing sewage. In carrying out the experiments, rich cultures of *B. prodigiosus* and *B. typhosus* were added to sewage, both in small and large quantities, and the mixture was passed through an experimental system of 6-in. pipes, provided with the traps, ventilating pipes, catch-pits, &c., required for the investigation. Open Petri dishes containing nutrient media were placed at various positions in the said ventilating pipes, &c., the medium facing upwards, and, after a certain period of exposure, were removed to the incubator. Further experiments proved that a disconnecting trap prevents microbes present in the sewer air from passing into a house drainage system, and that an air-inlet, even when provided with a mica valve, may be a source of danger if it be placed at or about the ground level. It might be mentioned that the plates were, in some cases, exposed at a height of 11 ft. 9 in. above the level of the sewage and still became infected by the specific bacteria present, although precautions were taken to prevent actual splashing of the sewage as it passed through the pipes.—W. P. S.

English Patents.

Excreta, night-soil, &c.; Method of treating —— *and of obtaining manure therefrom.* J. H. W. Stringfellow, Walthamstow. Eng. Pat. 8727, April 14, 1906.

Claim is made for a process which consists in mixing excreta with a suitable medium, consisting mainly of sulphates of aluminium, calcium, and magnesium, prepared from slag-wool (this J., 1905, 446) mixed with 50 per cent. of dry earth or peat. It is stated that the sulphates react with the nitrous and phosphoric acids and organic matter present, in such a way as to produce a mixture having the properties of natural Peruvian guano.—S. R. T.

Water; Purifying and sterilising —— *by ozonised air, and apparatus therefor.* J. H. Bridge, Philadelphia Eng. Pat. 17,267, July 31, 1906.

See Fr. Pat. 368,620 of 1906; this J., 1907, 30.—T. F. B

Water purifiers; [Electric ——]. F. B. Hinkson, Pittsburg. Eng. Pat. 21,475, Sept. 28, 1906. Under Int. Conv., Oct. 7, 1905.

See Fr. Pat. 370,281 of 1906; this J., 1907, 273.—T. F. B.

Purifying apparatus for liquids. C. Schmidt, Vienna. U.S. Pat. 851,778, April 30, 1907.

See Eng. Pat. 1158 of 1906; this J., 1906, 440.—T. F. B.

(*C.*)—DISINFECTANTS.

Phenol and cresol; Determination of —— *by a biological method.* M. W. Blyth and L. Goodban. Analyst, 1907, 32, 154—158.

It has been shown previously by one of the authors (this J., 1906, 1183) that the germicidal value of cresol is considerably greater than that of phenol, and they now record the results of experiments which prove that the mean dilution figure for pure, freshly-distilled, emulsified ortho-, meta-, and para-cresol is 270, and that of phenol under the same conditions is 130. Further, they find that when mixtures are made consisting of distilled cresols and phenol, the dilution figure obtained is strictly in accordance with the composition of the mixture. The "dilution figure" means that one part by weight of the germicide in D parts of water killed the organism under the conditions of the experiment in 12·5 minutes, but not in 10 minutes. Five grms. of the phenol or cresol were added to 25 c.c. of a solution containing 10 grms. of pure potassium soap (B.P.) and 10 grms. of pure resin soap; the mixture was then diluted to a volume of 100 c.c. This emulsion was added to 24-hour cultures of *B. coli communis* in broth (+15) at a temperature of 22° C. The percentage of phenol and cresol in a mixture is calculated from the formula:

$$(1)\ P=\frac{100\,(D_1-D_3)}{D_1-D_2},$$

where P is the percentage of phenol, D_1 the dilution figure for cresols, D_2 the dilution figure for phenol, and D_3 the dilution figure found for the mixture. The method described above is not applicable to mixtures containing water, and, in order to determine water at the same time as phenol, use is made of the fact that organic matter lowers the germicidal efficiency of coal-tar disinfectants. The organic matter most convenient to use is milk, 5 c.c. of this being introduced into each test. In the case of phenol, the dilution figure is lowered from 130 in water to 90 in milk, and in the case of cresols, from 270 in water to 170 in milk. Therefore, in a mixture of phenol, cresols, and water, the difference in the dilution figure obtained in water and milk will depend on the actual amount of phenol and cresol present, and, from the results obtained, it is possible to calculate the percentage of phenol, cresol, and water present. In the case of tar, let x be the percentage of phenol and cresol present, and D_3, the apparent dilution figure, then the real dilution is represented by $\frac{100\ D_3}{x}$. Let K_1 be the difference observed between the water figure, D_1, and the milk figure, M_1 for pure cresols, K_2 the difference between the water and milk figures for phenol, and K_3 the apparent difference between the water and milk figures of the sample under examination, then

$$(2)\ x=\frac{100\ D_3\,(K_1-K_2)-100\ K_3\,(D_1-D_2)}{K_1D_2-K_2D_1},$$

It is preferable to employ separated milk; the organism used, as well as the other details, may vary considerably, but for each set of experiments, all these details must be kept absolutely the same.—W. P. S.

Sulphuric acid as a fungicide; Dilute ——. H. Kraemer. Proc. Amer. Phil. Soc., **45**, 157.

The author observed that when sulphur was volatilised under certain conditions it was much more effective as a fungicide than when dusted upon plants. From his observations, he concluded that the effect might possibly be due to sulphuric acid formed. To test this, sulphur was burned under a bell jar connected with an aspirator, U-tubes being introduced with proper solutions for collecting volatile products. Under these conditions, when very slowly heated, 28·0 per cent. of the sulphur was converted into sulphuric acid, with the formation of only small amounts of sulphur dioxide, the remainder of the sulphur being sublimed. When rapidly heated, somewhat over 1¾ per cent. of sulphuric acid, and from ¼ to 1¼ per cent. of sulphurous acid were formed, the remainder being sublimed sulphur. Spraying experiments with solutions of sulphuric acid were made. It was found that a solution containing 1 part of sulphuric acid to 200 parts of water produced a marked burning effect upon some tender foliage, but that 1 to 1000 was perfectly safe and quite efficacious, especially so for treating the rose mildew.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 549.)

Barley straw for paper pulp. H. de Montessus. Monit. Papeterie franç; Papier-Zeit., 1907, **32**, 1534—1535.

Barley straw in Algeria costs only 5—6 francs per ton. The yield of bleached pulp amounts to about 40 per cent., although the cellulose-content may be as high as 56 per cent. Much of this cellulose consists of parenchymatous cells, most of which are eliminated during the washing process. The paper-making fibres have an average length of 1.5 mm., and an average diameter of 0·01 mm.; they closely resemble esparto fibres, are of uniform dimensions and silky to the touch. The author gives the following analysis of barley straw:—Cellulose, 52·00; fat and wax, 1·60; aqueous extract, 2·07; pectinous matter, 29·48; moisture, 8·20; ash, 6·65 per cent. Straw, being more highly lignified, requires a more severe treatment than esparto for the preparation of the pulp, higher pressures and more caustic soda being employed in the boiling.—J. F. B.

Paper; Free mineral acids in ——. L. Kollmann. Zentr. oest.-ung. Papierind, 1907, 261; Chem. Zeit., 1907, **31**, Rep. 210.

In continuation of a previous note (this J., 1907, 482), the author has examined 200 samples of paper without finding one which contained free mineral acid, although many of them had an acid reaction due to aluminium salts. Strips of paper were steeped in solutions of hydrochloric and sulphuric acids, ranging from 0·1 to 2 per cent., and were then dried without pressing. The acidity was determined immediately after drying, and after intervals of 3, 7, and 15 days respectively. Up to a concentration of about 1 per cent., it was found that the paper took up more hydrochloric acid than sulphuric acid; at higher concentrations the reverse was the case. The acid-contents of the papers diminished rapidly during the first three days, after which the decrease was slow, and finally the acidity became fairly constant when it fell to about 0.15 per cent.—J. F. B.

Roofing paper: Pulp for ——. G. Sellergen. Svensk Pappers Tidning; Paper Making, 1907, **26**, 231.

For the manufacture of good roofing felt, a content of 30—40 per cent. of wool is indispensable. If the wool be completely replaced by mechanical pulp, chemical pulp, jute, cotton, or linen, the resulting felt will not withstand the direct rays of the sun or atmospheric influences, especially rain and low temperatures. Felts containing wool also expand less in hot weather.—A. S.

Lignocelluloses; A new colour reaction of ——. A. S. Wheeler. Ber., 1907, **40**, 1888—1890.

The nitranilines give a blood-red colour reaction with lignocelluloses. The paranitraniline is the most convenient, and the reagent is composed of a 2 per cent. solution of this compound in hydrochloric acid, sp. gr. 1·06. At the ordinary temperature the coloration develops only slowly, but if the reagent be heated, the colour appears at once. The solution preserves its activity for an indefinite time.—J. F. B.

Cork formation; Role of phenols, and tannic and hydroxybenzoic acids in ——. E. Drabble and M. Nierenstein. Collegium, 1907, 179.

The authors have studied the condensation products of certain tannins, gallic acid, phenols, and hydroxybenzoic acids produced by the action of phosphoric, acetic, hydrochloric, and formic acids, and also by the action of carbon dioxide on a mixture of formaldehyde with a phenol, or tannic or hydroxybenzoic acid. They find that these condensation products give reactions similar to those of cork. Thus they are insoluble in Schweitzer's reagent and concentrated sulphuric acid, but are soluble in strong potassium hydroxide solution. It is suggested that such condensation products play an important part in cork formation, phenols, tannins, hydroxybenzoic acids and formaldehyde all being present in the plant tissues. In tracing the distribution of these bodies in the stem, the authors recommend potassium cyanide as a useful reagent for microscopical work. It gives a clear pink colour in the presence of gallic acid. Potassium bichromate gives an immediate brown colour with gallic acid, but with tannin acid no colour is obtained or a colour only very slowly developed. A chemical examination of cork showed the presence of gallic acid and derivatives of phenols, and of gallic, tannic, and hydroxybenzoic acids. Both the artificially prepared condensation product of gallic acid and that obtained from cork yielded diphenylmethane when distilled with zinc dust, whilst pyrogallol and protocatechuic acid were also obtained as degradation products from an alcoholic extract of cork. The authors consider that tannic and gallic acids and similar substances are precipitated in the walls of the cork cells by formaldehyde and acids present in the plants.—S. R. T.

Fibres separated from cotton seeds; Properties of ——. E. Drabble. V., page 605.

Colophony; Studies on American ——. C. Schwalbe. XIII*B*., page 625.

English Patents.

Cellulose solutions; Preparation of acidylised ——. L. Lederer, Sulzbach, Germany. Eng. Pat. 26,502, Nov. 22, 1906.

See Fr. Pat. 371,357 of 1906; this J., 1907, 340.—T. F. B.

Cellulose compound [formate]; Production of a new ——. V. F. Feeny, London. From J. P. Bernberg, Act-ges., Barmen-Rittershausen, Germany. Eng. Pat. 2511, Jan. 31, 1907.

Cellulose, 15—30 parts, is treated with 100 parts of 98 per cent. formic acid containing either 2—10 parts of sulphuric acid or else 2—4 parts of dry hydrochloric acid. At a temperature of 15°—18° C. with repeated stirring, the cellulose is completely dissolved in about 24 hours, and the cellulose formate is poured into water, and purified in the usual way. The product is soluble in formic acid, acetic acid, &c., and is to be used for producing films and threads, and for coating textiles. —J. F. B.

Cork; Manufacture of artificial ——. H. Coale, Baltimore, U.S.A. Eng. Pat. 11,632, May 18, 1906.

See Fr. Pat. 366,586 of 1906; this J., 1906, 1064.—T. F. B.

United States Patents.

Matter [adhesive material]; Composition of ——, *and process of making same [from waste sulphite lyes]*. J. S. Robeson, Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 851,378, April 23, 1907.

Farinaceous vegetable materials, such as boiled wheat flour rich in protein, are intimately mixed with unaltered or waste sulphite liquors and evaporated to a suitable consistency.—S. R. T.

Matter [adhesive material]; Composition of ——, *and process of making same [from waste sulphite lyes]*. J. S. Robeson, Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 851,379, April 23, 1907.

In the composition described in the preceding abstract, a soluble albuminoid or animal glue may be substituted for farinaceous materials.—S. R. T.

Matter [adhesive material]; Composition of ——, *and process of making same [from waste sulphite lyes]*. J. S. Robeson, Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 851,380, April 23, 1907.

Boiled starchy materials, molasses, or dextrin, are incorporated, either singly or together with concentrated sulphite liquor.—S R T

Matter [adhesive material]; Composition of ——, *and process of making same [from waste sulphite lyes]*. J. S. Robeson, Assignor to Robeson Process Co., Camden, N.J. U.S. Pat. 851,381, April 23, 1907.

A concentrated sulphite solution of non-woody tissue [waste sulphite lyes] is mixed with the condensed liquid obtained from the destructive distillation of wood, and heated till homogeneous.—S. R. T.

Cellulose derivative and process of making same. G. W. Miles, Belmont, Mass. Reissue No. 12,637, dated April 23, 1907, of U.S. Pat. 838,350, Dec. 11, 1906.

See Fr. Pat. 358,079 of 1905; this J., 1906, 195.—T. F. B.

French Patents.

Paper for dry copying; Preparation of ——. A. and M. Pidelaserra y Brias. Fr. Pat. 372,488, Dec. 8, 1906. Under Int. Conv., Dec. 20, 1905.

Copying paper is steeped in a solution of glycerin, and the water is evaporated off. The proportion of glycerin may be varied according to the effect desired; the smaller the percentage of glycerin the drier is the paper, but the pressure required to obtain the copy is greater; a solution containing 5 per cent. of glycerin gives satisfactory results.—J. F. B.

Celluloid; Manufacture of a substitute for ——. L. Arbezcarme. Fr. Pat. 372,512, Dec. 13, 1906.

A substance resembling celluloid is prepared by replacing the camphor usually employed by a mixture of rosin and naphthalene. These substances may be mixed either by fusion or in alcoholic solutions; the physical properties of the products differ according to the proportions of the ingredients, the mass being more plastic the greater the percentage of naphthalene.—J. F. B.

Plastic material containing celluloid, gelatin, and glucose. L. Bondet. Fr. Pat. 372,599, Dec. 15, 1906.

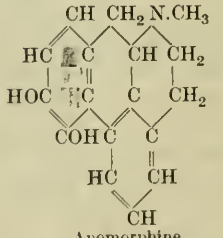
A solution is prepared of resinous material, six parts, in alcohol, eight parts, and another solution of the same resinous material, two parts, in five parts of a vegetable oil; these two solutions are mixed. A mixture is then made of 80 parts of gelatin and 20 parts of glucose and dissolved in half its weight of 45 per cent. alcohol. 13—15 parts of the first mixture are then mechanically incorporated with 85—87 parts of the second, the milling operation being continued for an hour at a temperature of 70° C. This mixture is finally milled with about an equal weight of the ordinary celluloid paste, and rolled into sheets.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

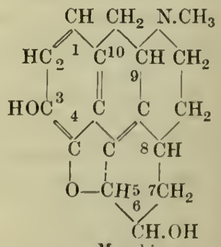
(*Continued from page* 552.)

Apomorphine; Constitution of ——. *A contribution to the question of the constitution of morphine.* R. Pschorr. Ber., 1907, **40**, 1984—1995.

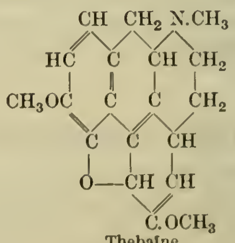
The author brings forward further evidence in favour of the view that the constitutions of apomorphine, morphine, and thebaïne are best represented by the following formulæ:—



Apomorphine.



Morphine.



Thebaïne.

—A. S.

Morphine; Knowledge of ——. *XI. Hydroxymethylmorphimethine (ketodihydromethylmorphimethine).* L. Knorr and H. Hörlein. Ber., 1907, **40**, 2042—2048.

The authors find that the compound previously named hydroxymethylmorphimethine (this J., 1906, 494) is really ketodihydromorphimethine, and that it is formed from hydroxycodeine in a manner quite analogous to the formation of narceine from narcotine (methylhydrasteine from hydrastine). It yields a mono-acetyl derivative, and not a di-acetyl compound as previously reported. It is pointed out that the formation of ketodihydromethylmorphimethine in this manner proves that the nitrogen of the side ring of morphine alkaloids is united at the hydrogenised bridge of the phenanthrene nucleus (position 9 or 10). The authors consider also that Pschorr's pyridine formula (see preceding abstract) needs modification in the light of these facts. The formula they suggest differs from that of Pschorr in that the hydrogen atom at position, 5, is transferred to the carbon atom between positions, 8 and 9.—A. S.

Anisotheobromine. Sztankay. Pharm. Post., 1907, 154. J. Pharm. Chim., 1907, **25**, 494—495.

This is a molecular combination of sodium-theobromine with sodium anisate, $C_7H_7N_4O_2Na.C_6H_4.OCH_3.CO_2Na$. Forty-five grms. of theobromine are dissolved in a solution of 10 grms. of sodium hydroxide in a mixture of water and alcohol; this liquid is mixed with a solution of 21 grms. of sodium carbonate and 38 grms. of anisic acid in water; the mixture is evaporated to dryness on the water-bath. Anisotheobromine is employed as a substitute for diuretine, being claimed to be more stable, and less easily acted on by atmospheric carbon dioxide than the latter.—J. O. B.

Euscopol [Scopolamine hydrobromide]. Riedel. Pharm. Zeit., 1907, **52**, 158. J. Pharm. Chim., 1907, **25**, 492—493.

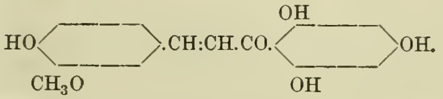
Euscopol is the name given to chemically pure, optically inactive scopolamine hydrobromide, m. pt. 180°—181° C. It differs from the salt official in the Ph. G. IV., which is a mixture of the hydrobromides of optically active and inactive scopolamine. The melting point of euscopol is not very sharp; it softens at 165°—170° C., melts at 180°—181° C., and gives a clear liquid at 185° C. Euscopol picrate crystallises in long denticulated foliaceous crystals; m. pt. 192°—194°; the picrate of the optically active base forms fine needles, m. pt. 190°—191°. The medicinal dose of euscopol is about $\frac{1}{10}$ higher than that of ordinary scopolamine hydrobromide.—J. O. B.

Coumarin in Achlys triphylla; Occurrence of ——. C. E. Bradley. J. Amer. Chem. Soc., 1907, **29** [4], 606.

Achlys triphylla is found abundantly in the fir forests west of the Cascade Mountains, from British Columbia to California. The plant is sometimes called "elk weed," but more commonly "wild vanilla," on account of its fragrant odour. A small quantity of the fresh leaves was shaken with ether, and the latter allowed to evaporate slowly. Minute needle-like crystals were obtained from the residue. They had the odour of coumarin, were insoluble in cold water, but soluble in warm water, alcohol, and chloroform. On extracting the air-dried plant with chloroform instead of with ether, colourless crystals were obtained, possessing a very strong odour of coumarin and honey, and melting at 65° C. Ferric chloride gave no colour to their aqueous solution, showing the absence of vanillin. On fusion with caustic potash, the crystals yielded acetic and salicylic acids. By shaking out the water extract of the plant with ether, a yield of 0·20 per cent. of coumarin was obtained on the air-dried plant. A large proportion of the coumarin exists in the leaf stalks. Among the several plants containing coumarin, *Hierochloa borealis* is the only western species noted.
—O. R.

Homo-eriodictyol; Constitution of ——. *A crystalline substance from eriodictyon leaves.* By F. B. Power and Frank Tutin. Chem. Soc. Proc., 1907, **23**, 133.

The substance termed *homo-eriodictyol*, $C_{16}H_{14}O_6$ (m. pt 223°), previously isolated and described by the authors (this J., 1906, 1065), has been further investigated. It is isomeric with hesperitin (Ber., 1881, **14**, 970), and similar to the latter in many of its properties, but its sodium compound has the normal formula $C_{16}H_{13}O_6Na$ (see Perkin, Chem. Soc. Trans., 1898, **73**, 1037). Homo-eriodictyol contains one methoxyl group and yields a *tetra-acetyl* derivative, $C_{16}H_{10}O_6(C_2H_3O)_4$ (m. pt. 154°). On fusion with potash it gives protocatechuic acid. When homo-eriodictyol is hydrolysed with a concentrated aqueous solution of potassium hydroxide, it yields phloroglucinol and ferulic acid (4-hydroxy-3-methoxycinnamic acid). From these results it is concluded that homo-eriodictyol must possess the following constitution:



The "eriodyctionon," recently described by Mossler (this J., 1907, 275), is evidently identical with homo-eriodictyol.

Eriodictyol, $C_{15}H_{12}O_6$ (m. pt. 267°), a crystalline substance which was also isolated by the authors from eriodictyon leaves (*loc. cit.*), contains no methoxyl group. When heated with acetic anhydride it yielded two compounds, melting at 137° and 195°—196° respectively. It is considered probable that homo-eriodictyol is a monomethyl ether of eriodictyol.

Oil of the Pacific arbor vitæ; Essential ——. W. C. Blasdale. J. Amer. Chem. Soc., 1907, **29**, 539—541.

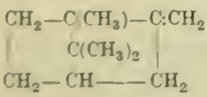
The air-dry foliage of Pacific arbor vitæ (*Thuja plicata*) was steam distilled, the oil thus obtained being fractionated. The largest fraction boiled at 198°—200° C.; it was found to have a sp. gr. (at 15° C.) of 0·9142, a refractive index of 1·4532, and an angular rotation, in a 100-mm. tube, of —0°·52′. It formed a crystalline addition product with sodium bisulphite, and a white, crystalline product (m. pt. 121°) on treatment with bromine in ligroin solution. In all these respects the compound agrees with thujone, the *d*-isomeride of which occurs in the essential oil of the white or swamp cedar (*Thuja occidentalis*). The above described oil is probably a mixture of the two optically active modifications. By subjecting shavings of the wood of Pacific arbor vitæ to steam distillation, and extracting the distillate with petroleum ether, a white crystalline substance was obtained which possessed the odour of the wood in a marked degree. The recrystallised substance melted at 80°. Its empirical formula appears to be $C_{10}H_{12}O_2$.—L. E.

Juniperus phœnicea; Essential oil of ——. J. Rodié. Bull. Soc. Chim., 1907, [4], **1**, 492—497.

In examining the essential oil of *Juniperus phœnicea*, the author has shown that 92·3 per cent. of the oil consists of terpenes boiling below 180° C. (this J., 1906, 1065). 6·51 per cent. of the oil boils above 180° C. This fraction is a thick reddish-brown liquid, with an odour closely resembling that of juniper wood. It has sp. gr. 0·946 at 15° C., and optical rotation in a 100 mm. tube, —1° 10′. It has a saponification value of 18·2, and after acetylation this value rises to 85·4. On treatment with sodium bisulphite, an aldehyde with a powerful odour was obtained. This yielded, on heating with pyruvic acid and β-naphthylamine in alcoholic solution, a naphthocinchoninic acid decomposing at 275°—276° C. After saponification, the following acids were isolated:—Acetic; caproic, boiling between 190° C. and 210° C., and with sp. gr. 0·930 at 16° C.; and an acid boiling between 255° C. and 265° C., with sp. gr. 0·970 at 15° C. After purification, the specific gravity of this latter acid rose to 0·975. Besides the aldehyde and acids, terpenes are present in the fraction of the oil boiling above 180° C.—F. Shdn.

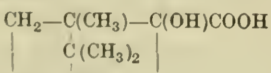
Terpenes and essential oils (83*rd communication*). *Observations in the fenchone series. Homocamphene and homocamphenylic acid.* O. Wallach. Annalen, 1907, **353**, 209—227.

THE author has resumed his examination of fenchone to obtain a better understanding of its constitution, and to correct the formula recently put forward by Semmler (this J., 1906, 826, and Ber., 1906, **39**, 3960). The semicarbazone of fenchone can be made by allowing a solution of semicarbazide hydrochloride and sodium acetate to react with an alcoholic solution of fenchone for two weeks, and distilling with steam. The fenchone semicarbazone which remains behind crystallises from dilute alcohol in large, well defined rhombic prisms, melting at 182°—183° C. The dextro and lævo modifications of fenchone both yield semicarbazones. A racemic mixture of the *d*- and *l*-fenchone-semicarbazones melts at 172°—173° C.; *d*-fenchone semicarbazone has $[\alpha]_D = +47{\cdot}04°$, and *l*-fenchone-semicarbazone has $[\alpha]_D = -46{\cdot}82°$ to $-46{\cdot}88°$. The fraction of *Thuja* oil boiling between 190° and 200° C. was oxidised with permanganate to remove thujone and then treated with semicarbazide. On crystallising the product from methyl alcohol, the difficultly soluble semicarbazone of *l*-camphor, melting at 238° C., was obtained first then the more easily soluble semicarbazone of *l*-fenchone, melting at 182°—183° C. As camphor forms a semicarbazone more readily than fenchone, the two substances can be separated by this method. As *Thuja* oil, after fractionation, only gives the semicarbazone of *a*-thujone, and not that of camphor, it follows that the presence of camphor after oxidation is due to an ester of *l*-borneol in the original oil. By a similar method it was shown that commercial *d*-fenchone contained *d*-camphor. Homofenchyl alcohol, (*a*-methylfenchol), $C_{11}H_{19}OH$, was obtained by the action of methylmagnesium iodide on *d*-fenchone; this substance boils at 215°—216° C., melts at 61° C., and has $[\alpha]_D = 1{\cdot}12°$—$2{\cdot}2°$. Homofenchene, $C_{11}H_{18}$, was prepared from this by fusion with potassium bisulphate at 160° C. It boils at 170°—172° C., and melts at 32°—37° C. Homofenchene resembles camphene in appearance and odour, it has sp. gr. 0·8520, and $n_D = 1{\cdot}4557$ at 46°—47° C. and $[\alpha]_D = 23{\cdot}06°$. On oxidation with permanganate at 40°—60° C., an acid melting at 179° C. was produced in small quantities owing to the presence of camphor in the fenchone used. The principal product was a lactone-like substance, $C_{11}H_{16}O_3$, melting at 157° C. Homocamphene was obtained from camphor by a similar process, and boiled at 166°—168° C., and melted at 28° C. On oxidation with permanganate, this yielded homocamphenylic or *a*-borneolcarboxylic acid, $C_{10}H_{16}(OH)COOH$, which was isolated by means of its difficultly soluble sodium salt. This acid crystallises from alcohol and melts at 179° C., and is identical with the acid obtained by the oxidation of homofenchene. The acid has $[\alpha]_D = -34{\cdot}8°$ in methyl alcohol, and $= -30{\cdot}72°$ in ether. On oxidation with lead peroxide, *d*-camphor melting at 175° C. is produced. The following formulæ are given:—



$$\begin{array}{l} CH_2\text{—}C(CH_3)\text{—}C{:}CH_2 \\ \big|\quad\quad C(CH_3)_2 \quad\big| \\ CH_2\text{—}CH\text{———}CH_2 \end{array}$$

Homocamphene.



$$\begin{array}{l} CH_2\text{—}C(CH_3)\text{—}C(OH)COOH \\ \big|\quad\quad C(CH_3)_2 \quad\big| \\ CH_2\text{—}CH\text{———}CH_2 \end{array}$$

Homocamphenylic acid.

—F. SHDN.

Sulphonal; Detection of —— in trional and tetronal. E. Gabutti. J. Pharm. Chim., 1907, **25**, 183—186.

ADULTERATION of trional (diethylsulphone-methylethylmethane) and tetronal (diethylsulphone-diethylmethane), with sulphonal, may be readily detected by treating the suspected sample with ether, in which sulphonal is markedly less soluble than the other two compounds. Ten c.c. of ether completely dissolves 0·5 grm. of trional, and 1 grm. of tetronal, at 15° C.; but it only dissolves about 0·07 grm. of sulphonal. The residue left undissolved by ether could be identified as sulphonal by its known reactions and its m. pt. 125·5° C. The evaporation residue of the ethereal extract should be examined microscopically. Sulphonal occurs in elegant foliated crystals, resembling those of ammonium-magnesium phosphate; trional forms square tablets; and tetronal, radiating, almost round, fibrous groups, similar to urea oxalate. —J. O. B.

Monotal [*Guaiacyl ethyl glycollate*]. — Impens. Apoth. Zeit., 1907, **22**, 147. J. Pharm. Chim., 1907, **25**, 493—494.

THE ethyl-glycollic acid ester of guaiacol,

$$C_2H_5OCH_2.CO.OC_6H_4.OCH_3,$$

has been introduced into medicine under the above name. It is an oily, colourless liquid, with a faintly aromatic odour; b. pt. 170° C. at 25 mm. Solubility in water, 0·32 : 100; readily soluble in oils, 29·6 parts dissolving in 100 parts of olive oil at 19° C. It is less caustic than guaiacol.—J. O. B.

Ethyleneglycol and some other alcohols; Preparation of ——. L. Henry. Bull. Acad. roy. Belg., Classe des Sciences, 1906, 732—740. Chem. Zentr., 1907, **1**, 1314.

THE author has applied the observations of Haller on the alcoholysis of fats (this J., 1906, 1158; 1907, 328) to the preparation of some alcohols not easily obtained by other means. Ethyleneglycol was obtained with a yield of 90 per cent. of the theoretical, by gently boiling for a quarter of an hour a mixture of 146 grms. of ethylenediacetin, $C_2H_4(C_2H_3O_2)_2$, with 28 grms. of methyl alcohol, containing 1·5 per cent. of hydrochloric acid, and then distilling. Trimethyleneglycol, $C_3H_6(OH)_2$, trimethylenemonochlorhydrin, $C_3H_6Cl(OH)$, and acetol, $CH_3.CO.CH_2OH$, were obtained, in good yields, in an analogous manner by boiling methyl alcohol, containing 1—2 per cent. of hydrochloric acid, with trimethylenediacetate, trimethylenechloroacetate, and the acetyl ester of acetol, respectively.—A. S.

Mercuric chloride; Solubility of —— in mixed solvents. M. Dukelski. Z. anorg. Chem., 1907, **53**, 327—337.

THE author determined the solubility of mercuric chloride in various organic solvents, and in mixtures of two solvents. The solubility in carbon tetrachloride is *nil*, and it is also very slight in chloroform, the saturated solution at −20·5° C. containing 0·01 per cent., and at +44·2° C., 0·12 per cent. of mercuric chloride. The chief results obtained are shown in the following tables, the figures representing the percentage by weight of mercuric chloride in the solution:—

Benzene.		Ethylene Chloride.		Ethyl acetate.		$C_6H_6 + C_2H_5OH$.		$C_6H_6 + 2C_2H_5OH$.	
°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.
	per cent.		per cent.		per cent.		per cent.		per cent.
+6·5	0·26	0·0	1·33	0·0	22·8	−2·5	15·20	−5·2	19·45
18·0	0·53	+12·5	1·55	+6·5	22·7	0·0	15·40	0·0	20·13
34·1	0·64	20·8	1·68	26·1	22·8	+6·0	16·38	+9·1	21·65
54·1	1·02	25·3	1·73	38·5	23·5	20·5	18.40	20.9	23.57
69·0	1·39	30·2	1·92	45·3	26·4	20·65	18·50	24·4	24·19
		33·0	2·05			24·5	19·33	36·5	26·53
		45·9	2·42			34·5	21·34	53·7	31·27
						54·4	24·84	74·0	38·74

$CHCl_3 + C_2H_5OH$.		$CHCl_3 + 2C_2H_5OH$.		$CHCl_3 + CH_3OH$.		$CHCl_3 + 2CH_3OH$.		$CCl_4 + 2CH_3OH$.	
°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.
	per cent.		per cent.		per cent.		per cent.		per cent.
−20·5	3·82	−20·5	6·60	−12·0	1·73	−12·0	3·33	0·0	5·20
−12·0	4·43	0·0	7·69	0·0	3·51	0·0	6·73	+7·7	6·69
0·0	4·89	+8·0	8·96	+8·0	5·63	+8·0	8·21	24·9	14·06
+8·0	5·37	23·0	10·66	23·0	10·15	23·0	16·56	30·6	19·40
23·0	7·12	38·5	12·50	24·9	10·71	24·9	18·45	35·5	20·50
38·5	8·51	44·2	14·40	30·6	11·40	30·6	19·70	36·1	21·80
44·2	9·51			38·5	12·02	38·5	20·83	48·5	21·90
45·6	9·98								

$C_2H_4Cl_2 + 2CH_3OH$.		$CH_3CO_2C_2H_5 + C_6H_6$.		$CH_3CO_2C_2H_5 + CHCl_3$.		$2CH_3CO_2C_2H_5 + CCl_4$		Mercuric cyanide in methyl alcohol.	
°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$HgCl_2$.	°C.	$Hg(CN)_2$
	per cent.		per cent.		per cent.		per cent.		per cent.
0·0	13·33	0·0	9·62	0·0	3·34	0·0	9·24	0·0	26·10
+12·5	21·30	+6·5	9·62	26·1	4·07	+10·3	9·05	+14·7	29·17
20·8	29·33	25·7	9·78	36·1	4·78	25·7	9·32	23·4	32·01
25·3	34·78	27·6	9·98	46·0	5·38	27·6	9·50	27·4	31·77
30·2	36·87	35·5	10·81	48·5	5·10	38·5	9·89	31·7	32·53
33·0	37·01	45·3	13·69			45·3	11·70	38·1	33·29
37·4	37·95							44·5	34·05
45·9	39·36								

Curve-diagrams plotted from the above results are given, as also are curves showing the solubility of mercuric bromide in a mixture of benzene and ethyl alcohol, and of mercuric cyanide in a mixture of benzene and methyl alcohol.—A. S.

Tannins ; A colour reaction of ——. A. Brissemoret. XXIII., page 645.

Tartaric acid ; New method for the determination of ——. A. C. Chapman and P. Whitteridge. XXIII., page 645.

English Patents.

Iron albumenate ; Process for preparing easily soluble —— and durable iron albumenate solutions. E. Laves, Hannover, Germany. Eng. Pat. 9889, April 27, 1906.

See Ger. Pat. 173,013 of 1904 ; this J., 1907, 33.—T. F. B.

Chloracetic ether [ester] and chloracetic acid ; Process for producing ——. G. Imbert, Nuremberg. Eng. Pat 5013, March 1, 1907.

This process consists in treating dichlorethoxyethylene (141 kilos.) with the theoretical quantity of water (18 kilos.), when hydrogen chloride escapes, and pure ethyl chloracetate remains in almost quantitative yield: $C_2HCl_2.OC_2H_5 + H_2O = HCl + CH_2Cl.CO_2C_2H_5$ (compare Eng. Pat. 678 of 1906; this J., 1907, 167). If the dichloroethoxyethylene is boiled with excess of water, chloracetic acid is formed.—T. H. P.

Fatty acids ; Manufacture of amides of the higher ——. O. A. H. H. Kösters, Hemelingen, and L. Ottemann, Bremen, Germany. Eng. Pat. 6731, March 20, 1907.

A higher fatty acid, such as stearic acid, is heated to a suitable temperature in a closed vessel, whilst a current of dry ammonia gas is pumped through the melted acid from a receptacle, in which it is stored under pressure. The ammonia escaping from the fatty acid carries with it the water produced by the reaction, and passes through a chamber containing quicklime, in which the moisture is absorbed, whilst the dry ammonia is returned to the pump-circuit. The pressure in the whole apparatus is equal to the pressure in the ammonia reservoir, which is connected with the circuit by a three-way pipe.—J. F. B.

United States Patents.

Organic peroxides ; Preparation of monobasic ——. A. C. Houghton, Syracuse, N.Y. U.S. Pat. 851,752, April 30, 1907.

Monobasic organic peroxides are formed by treating a monobasic aromatic peracid with the anhydride of a dibasic fatty acid. For instance, an aqueous solution of benzoic peracid is agitated with succinic anhydride until the reaction is complete, and the precipitate is then removed.—J. F. B.

Nucleinic acids ; Compound of silver and ——. O. Degner, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 852,544, May 7, 1907.

See Eng. Pat. 8407 of 1906 ; this J., 1907, 551.—T. F. B.

Formonucleinic acid ; Compound of silver and ——. O. Degner, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 852,545, May 7, 1907.

See Eng Pat. 8407 of 1906 ; this J., 1907 551.—T. F. B.

Hexamethylenetetramine-sodium acetate double salt. P. Bergell, Assignor to J. A. Wülfing, Berlin. U.S. Pat. 852,993, May 7, 1907.

See Eng. Pat. 29,093 of 1906 ; this J., 1907, 343.—T. F. B.

French Patents.

Amino-alcohols with secondary alcoholic function and their acidyl derivatives ; Preparation of ——. E. Fourneau. Fr. Pat. 372,212, Nov. 15, 1906.

Amino-alcohols having the general formula :

$$R.R'.N.CH_2.CH_2.CHOH.R'',$$

where R and R′ = H or an alkyl radical, and where R″ = alkyl or aryl or aralkyl, are prepared by treating with ammonia or amines the chlorhydrins of the formula, $CH_2Cl.CH_2.CHOH.R''$. These chlorhydrins are obtained by the action of organo-magnesium compounds on acroleïn hydrochloride (β-chloropropionic aldehyde). The chlorhydrins are heated in sealed vessels with the amines at a temperature of about 125° C. for six hours in benzene solution. Dimethylamino-dimethylcarbinol, dimethylamino-ethylphenylcarbinol and methylamino-ethylphenylcarbinol are specifically described.—J. F. B.

Butyl-xylene or butyl-toluene; Manufacture of tertiary ——. Act. Ges. f. Anilin-Fab. Fr. Pat. 372,603 Dec. 15. 1906.

A CURRENT of isobutylene gas is passed through a mixture of 5 kilos. of *m*-xylene, 200 grms. of anhydrous aluminium chloride, and 50 grms. of isobutyl chloride, the temperature being maintained at 10° C. The product is washed with water, the oil is seperated and submitted to fractional distillation, the product boiling at 200°—203° C. being collected. Gaseous hydrochloric or hydrobromic acid may be employed instead of isobutyl chloride for the purpose of starting the reaction.—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(*Continued from page* 552.)

Triaminobenzene and triaminotoluene as developers. E. König and O. Staehlin. Phot. Korr., 1907, **44**, 162: Chem. Zeit., 1907, **31**, Rep. 212.

TRIAMINOBENZENE and triaminotoluene can be employed as photographic developers in presence of sulphite only, without the use of alkalis. The developing power of the latter amine is far greater than that of the former, and almost attains to that of amidol. Whilst amidol and diaminoresorcinol cannot be employed with alkali without fogging, the above triamines develop both clearly and strongly in alkaline solution. The neutral solutions of these new developers are very permanent, but their alkaline solutions rapidly become yellow. *p*-Toluylenediamine is a more powerful developer than *p*-phenylenediamine: the two *p*-aminocresols also develop more powerfully than *p*-aminophenol, so that the general rule holds good, *viz.*:—The developing power of a benzene derivative, which contains the necessary minimum of two developing groups, increases with the entrance of methyl groups into the aromatic ring. The influence of a methyl group is especially strong when it occupies an ortho position to a hydroxyl group.—J. F. B.

Potassium permanganate; Use of —— to remove excess of sodium thiosulphate from photographic plates. A. Granger. Compt. rend., 1907, **144**, 1017—1018.

THE plate on being taken out of the fixing bath is rinsed two or three times in water for half a minute, and is then placed in a trough, and 250 c.c. of solution of permanganate (10 c.c. of solution containing 1 grm. per litre, made up to 250 c.c.) poured over it. This treatment is repeated as long as the permanganate turns brown. To remove manganese salts the plate is now immersed in a 1 per cent. solution of oxalic acid for a while, then rinsed till free from oxalic acid. The permanganate solution may be acidified by the addition of a little alkali bisulphate, and in this case becomes colourless on reduction and leaves no brown deposit on the plate; but the washing out of the acid salt is uncertain, and if any should remain it is more likely to damage the plate than oxalic acid would be.—J. T. D.

Three-colour process; A new ——. Traube. Phot. Rund., 21, 12. Chem. Abs. (Amer. Ch. Soc.) 1907, **1**, 822.

IT is found that the basic dyestuffs form intensely coloured bodies with silver iodide, and that the combination is so powerful that neither washing with the most varied reagents nor treatment with oxidising or reducing agents will break it up. The acid dyestuffs do not form such combinations, with the exception of the eosin group. To break up the combination, some solvent of silver iodide is necessary. To apply this principle to three-colour photography, the usual three diapositives are made in silver iodide, and the silver iodide of the three images is caused to combine with appropriate red, yellow, and blue dyestuffs. Then the pictures are fixed by treatment with a bath which dissolves the silver iodide, but fixes the dyestuff in the form of a lake. The three positives are then superposed as usual.

UNITED STATES PATENT.

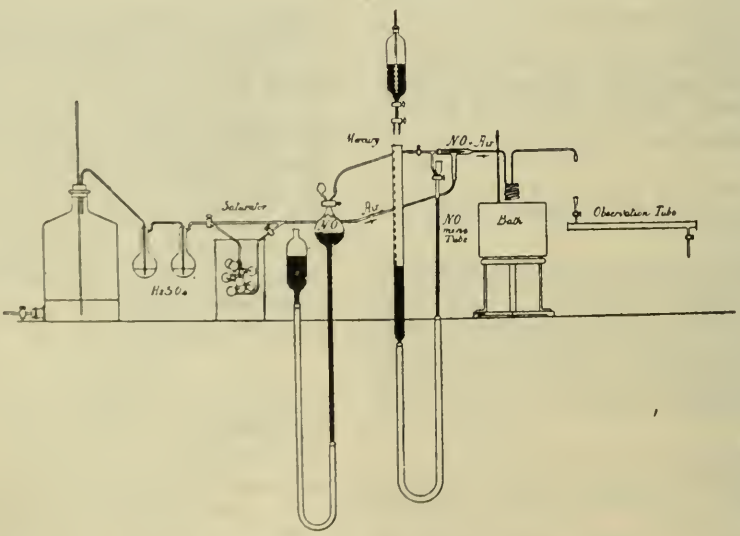
Photographic printing bath. T. Manly, London. U.S. Pat. 851,296, April 23, 1907.

SEE Eng. Pat. 17,007 of 1905; this J., 1906, 654.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 553.)

Nitrogen peroxide; Determination of small quantities of —— [e.g., from decomposition of guncotton]. R. Robertson and S. S. Napper. Chem. Soc. Trans., 1907, **91**, 761—764.



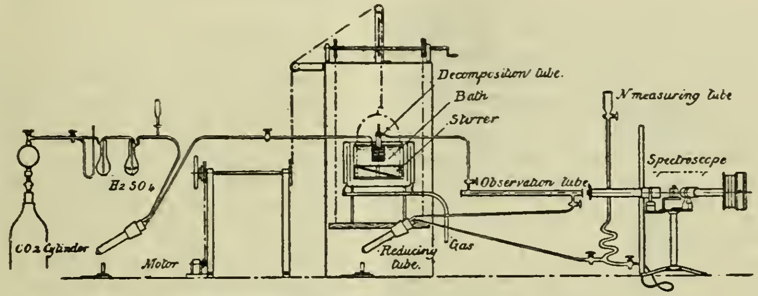
THE method is based upon the characteristic absorption spectrum of nitrogen peroxide. It was found that the lines could be distinguished even with very dilute mixtures of nitrogen peroxide and carbon dioxide or air, a few of the more prominent groups of lines being still visible at a concentration as low as 0·05 per cent. of nitrogen peroxide. As the proportion of nitrogen peroxide was raised, the lines increased in intensity and number and in mixtures containing nearly 1 per cent. of nitrogen peroxide, the violet end of the spectrum was completely absorbed. These differences were sufficiently well marked to allow of the estimation of the concentration, by comparison with standard mixtures, to within 0·02 per cent. in the case of the more dilute mixtures, and 0·05 per cent. in the case of the stronger ones. The vessel for containing the gas under observation was a straight glass tube 40 cm. long, with side tubes provided with stopcocks. The ends were closed by glass discs. Small glass bulbs, with two capillary ends, were filled with nitrogen peroxide, and dropped into a large cylinder which had been filled with dry carbon dioxide. The bulb was then broken, and when diffusion was complete, a portion of the gas was aspirated through the observation tube, and the absorption spectrum of the gas photographed. The composition of the gaseous mixtures used in the preparation of the standard photographs was calculated on the assumption that the nitrogen peroxide would be dissociated into NO_2 at the degree of dilution used in these experiments. The gas was measured at 27° C., and its composition was taken to be 80 per cent. of N_2O_4 and 20 per cent. of NO_2. In studying the effect of water vapour on nitrogen peroxide, in connection with the decomposition of explosives, an apparatus was used (see figure), in which a slow steady current of nitric oxide was obtained by dropping a very fine stream of mercury into the compensating tube of a gas burette connected to a capillary tube. This slow current of nitric oxide was blown through the capillary tube into a comparatively faster stream of air, the rate of which had been measured by passing it through two gas washing bulbs. The nitric oxide became oxidised to nitrogen peroxide on coming in contact with the air, and the absorption spectra of the mixtures were photographed, the proportion of nitric oxide present being estimated by comparison with the set of standard photographs of absorption spectra of nitrogen peroxide in carbon dioxide.—G. W. McD.

Guncotton; The evolution of nitrogen peroxide in the decomposition of ——. R. Robertson and S. S. Napper. Chem. Soc. Trans., 1907, **91**, 764—786.

The quantity of nitrogen peroxide set free when an explosive is heated has an important bearing on the stability of the material. The method employed was that described in the preceding abstract, by comparison of the photographic negative of the gaseous mixture in question with a negative of a standard mixture of nitrogen peroxide. As water is produced as a normal decomposition product of guncotton, it is important to note that liquid water causes the absorption spectrum of nitrogen peroxide to vanish when it exists in low concentration. On the other hand, experiments showed that at low concentrations, nitrogen peroxide is not acted on by water in the form of vapour, and consequently the figure obtained in the study of the decomposition of nitrocellulose may be taken as representing the amount of nitrogen peroxide which is actually produced under the various conditions of the experiment. The guncottons used in the experiments were in the pulped condition, and had a nitrogen content of 13 per cent., and a solubility in ether-alcohol of 10 per cent. The following results were obtained when submitted to the tests mentioned: Abel heat test at 76·6° C., 14—18 mins.; Will test at 135° C. (nitrogen per 2·5 grms. of guncotton in 4 hours), 6·7—6·8 mgrms.; Fume test at 135° C., 60 mins.; Bergmann and Junk test (c.c. of NO per 1 grm. of guncotton per 2 hours), 1·20—1·30 c.c.

Decomposition of guncotton in a vacuum.—2 grms. of guncotton were placed in a decomposition tube of 486 c.c. capacity, which was heated in an oil-bath at 135° C. The observation tube was connected directly to the decomposition tube, a manometer, and a source of supply of carbon dioxide. By the latter means the products of decomposition could be swept out of the apparatus, over a combustion tube containing heated copper and asbestos copper, and collected and measured as nitrogen over potassium hydroxide. The apparatus is evacuated, and the decomposition tube containing the guncotton, placed in the bath. At intervals the spectrum of nitrogen peroxide is photographed, and the fall in the manometer noted every quarter of an hour, during the course of the experiment. Finally, the products of decomposition are led through the combustion tube and estimated as nitrogen. Under the condition of this experiment, guncotton disengages about 25 per cent. of the total nitrogen evolved, in the form of nitrogen peroxide. The rest of the nitrogen is for the most part present as nitric oxide.

Decomposition of guncotton in a stream of carbon dioxide (Will test). (This J., 1902, 21, 819.)—For the purpose of studying the amount of nitrogen peroxide given off by the guncotton, the gas, after leaving the decomposition tube, was passed through a tube which permitted its absorption spectrum to be photographed at intervals without interfering with the progress of the test. The arrangement of the apparatus is shown in Fig. 1. The results obtained by this method in the case of the samples of stable guncotton previously mentioned, showed that the ratio of nitrogen as nitrogen peroxide to total nitrogen was in one case 39 per cent., in another 42 per cent. An analytical confirmation of these figures was obtained by leading the gases from the decomposition tube through two absorption tubes containing sulphuric acid, and then into the potassium hydroxide absorption burette without the interposition of a heated combustion tube. The results obtained were entirely confirmatory of the spectroscopic method.



Apparatus for observing gases from Will test.

Fig. 1.

Influence of rate of carbon dioxide.—When guncotton is allowed to decompose in a steady atmosphere of carbon dioxide, it is found that much less nitrogen peroxide is obtained among the decomposition products than when these are continually removed, as in the Will test. The following figures show the effect of reducing the rate of the current of carbon dioxide from the normal rate of 1,000 c.c. per hour to the fractional rates given in the table:—

Rate of carbon dioxide.	Per cent. of N_2 existing as NO_2.
Normal	40
1/3 Normal	36
1/4 ,,	35
1/8 ,,	18
1/10 ,,	20

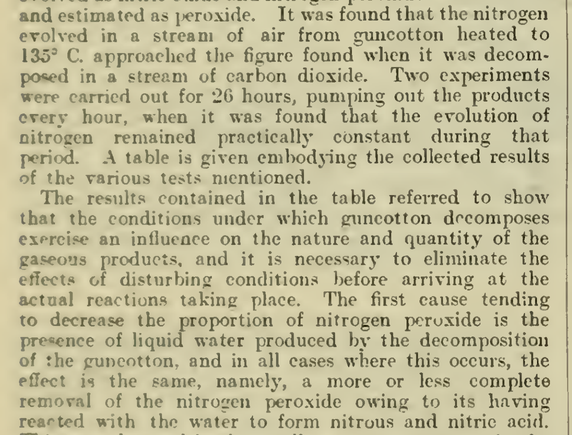
An experiment made to determine the course of the decomposition when the guncotton was heated for a period five times longer than the usual four hour Will test, showed that the proportion of nitrogen existing as peroxide to total nitrogen in the gases evolved is more than 40 per cent.

Decomposition of guncotton in an unchanged atmosphere of carbon dioxide.—Both the nitrogen existing as peroxide and the total nitrogen evolved during the experiment were estimated. Results showed that from 13 to 15 per cent. of the total nitrogen existed as nitrogen peroxide. This is less than in the case of the vacuum experiments, and much less than in the case of the ordinary Will test. The decreased ratio is doubtless due to the reduction of the nitrogen peroxide by the heated guncotton, since the gases are not removed from the decomposition vessel until after the expiration of an hour.

Decomposition of guncotton in presence of nitric oxide.—The effect of nitric oxide on the decomposition was studied in a stream of the gas under the condition of the Will test at 135° C., and also in an unchanged atmosphere of nitric oxide at 130° C. The quantity of nitrogen peroxide evolved under these conditions is considerably greater than that obtained when an atmosphere of carbon dioxide is used, which suggests that the oxides of nitrogen cause an acceleration in the rate of decomposition, which was expected.

Decomposition of guncotton in air.—The guncotton was decomposed in air under such conditions that the nitrogen evolved as nitric oxide and nitrogen peroxide was observed and estimated as peroxide. It was found that the nitrogen evolved in a stream of air from guncotton heated to 135° C. approached the figure found when it was decomposed in a stream of carbon dioxide. Two experiments were carried out for 26 hours, pumping out the products every hour, when it was found that the evolution of nitrogen remained practically constant during that period. A table is given embodying the collected results of the various tests mentioned.

The results contained in the table referred to show that the conditions under which guncotton decomposes exercise an influence on the nature and quantity of the gaseous products, and it is necessary to eliminate the effects of disturbing conditions before arriving at the actual reactions taking place. The first cause tending to decrease the proportion of nitrogen peroxide is the presence of liquid water produced by the decomposition of the guncotton, and in all cases where this occurs, the effect is the same, namely, a more or less complete removal of the nitrogen peroxide owing to its having reacted with the water to form nitrous and nitric acid. This was observed in the small vacuum apparatus, in the decomposition in an unchanged atmosphere of carbon dioxide, and in the Will test if the current of carbon dioxide was very slow. The second cause, affecting the composition of the gases, is action between the nitrogen peroxide originally evolved and the heated guncotton or its decomposition products. This appears to have a considerable effect, since under the conditions of the Will test, when the gases are continuously removed, the proportion of nitrogen peroxide to total nitrogen is greater than in any other method, and when the rate of removal is reduced, it falls from 40 to 20 per cent. In a vacuum, although the gases are removed with perhaps greater ease than in the Will test, they are free to diffuse back and react with the heated guncotton during the whole period of the experiment. The effect is also shown in the experiments on decomposing guncotton in an unchanged atmosphere of carbon dioxide, where the proportion of nitrogen peroxide fell to 13—15 per cent., which is one-third of that obtained when the gases were continuously removed. There is also a slight but decided increase in the total nitrogen when the proportion of nitrogen peroxide is low, as will be seen from the following figures:—



Apparatus for estimation of NO_2 evolved in vacuo.

Fig. 2.

Decomposition.	Percentage ratio. N_2 as NO_2 : Total N_2.	Total N_2 in mgrms.
Will test	42·0	0·67
In vacuum	21·5	0·75
In atmosphere of CO_2 ..	13·0	0·88

The Will test is the method of decomposition which seems to be most free from complications caused by the by-products, and consequently the results given by it represent as nearly as can be obtained at present, the course of the inherent decomposition of guncotton. By its means the actual or intrinsic stability of two samples may be compared, although it is not necessarily the best adapted for a practical stability test, since under ordinary conditions of storage the by-products are retained in close contact with the explosive. The presence of 40 per cent. of the total nitrogen in the form of peroxide is opposed to the results of previous workers on this subject, but this disagreement is most probably due to their use of unsuitable apparatus and less perfect methods of estimating this gas.—G. W. McD.

Nitrocellulose; Decomposition of —— at temperatures below its ignition point. A. Saposhnikow. J. Russ. Phys.-Chem. Ges., 1907, **38**, 1186—1192. Chem. Zentr., 1907, **1**, 1185—1186.

The experiments were carried out with a pyroxylin of approximately the composition, $C_{24}H_{31}(O.NO_2)_9O_{11}$, at temperatures of from 120°—165° C. On heating at 165° C., decomposition proceeded rapidly, culminating after about half an hour in an explosion. Between 120° and 160° C., decomposition proceeded calmly with evolution of gaseous products consisting of steam, nitric oxide, carbon dioxide, carbon monoxide, and nitrogen in proportions varying with the temperature employed. Between 150° and 160° C., there is not much variation in the composition of the gaseous decomposition products, but as the temperature of decomposition falls below 145°, the proportion of nitric oxide diminishes, and that of carbon dioxide increases. A further change in the relative proportions of all the constituent gases occurs between 120° and 125° C. The rate of decomposition decreases rapidly as the temperature falls from 160° to 155° C., at which point there is a break, the retardation of the rate of decomposition becoming less pronounced. Between 145° and 125° C., the retardation of the rate of decomposition becomes still less marked.
—A. S.

English Patent.

Explosives; Method for making plastic, horny ——. V. Vender, Milan, Italy. Eng. Pat. 9791, April 26, 1906.

See Fr. Pat. 372,267 of 1906; this J., 1907, 553.—T. F. B.

United States Patents.

Explosive. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 852,142, April 30, 1907.

The explosive is composed of:—Tetranitrodiglycerol

(5—30 parts), trinitroglycerol (10—45 parts), sodium nitrate (15—75 parts), and wood meal (5—25 parts).
—G. W. McD.

Explosive. F. Sparre, Assignor to the E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 852,143, April 30, 1907.

The explosive consists of nitrocellulose, nitroglycerol, trinitrotoluene, tetranitrodiglycerol, and vaseline.
—G. W. McD.

Explosives; Manufacture of ——. H. C. L. Bloxam. Assignor to South African Maganite Explosives Synd., Ltd., Cape Town. U.S. Pat. 853,056, May 7, 1907.

See Eng. Pat. 3005 of 1906; this J., 1906, 868.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 556.)

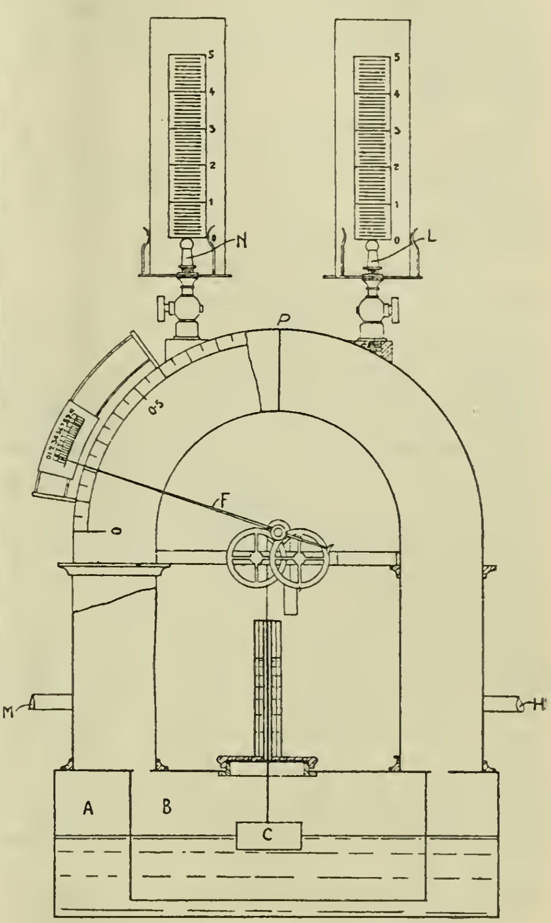
APPARATUS.

Thermoelements; Constancy of ——. W. P. White. Phys. Rev., 1906, 23, 449—475. Chem. Abs. (Amer. Chem. Soc.) 1907, 1, 692.

The author recommends the use of the thermoelectric thermometer, not only for high, but for intermediate and even for ordinary temperature work, and points out some of the precautions to be observed in order to obtain constant and accurate measurements. The first portion of the paper is a theoretical consideration of the thermoelement with special reference to the cause of non-homogeneity, and a graphical method is given whereby the error due to this cause can be determined. Then follows a description of work on various elements. Chemical non-homogeneity can usually be neglected in new elements, but with use the couples are subject to contamination unless precautions are taken. Physical defects, like uneven annealing, must be corrected. For accurate work, the temperature distribution along the element should be, as nearly as possible, always the same. This is especially true of a non-homogeneous element. The condition of the wires can readily be determined by one of several tests described in detail. The contamination of the platinum wire in several thermo-elements was found to be either rhodium or iridium, which must have vaporised from the other member of the element. Chemical analysis showed the platinum wire to have taken up in one case 1·5 per cent. of rhodium; in the other 1·5 per cent. of iridium. It is also shown, contrary to previous statements, that a reducing atmosphere containing carbon, illuminating gas, &c., has no harmful effects, unless compounds such as silicates or iron oxides are present, from which the wire can be contaminated by vapours of the reduced metals. In an oxidising atmosphere these elements are harmless, but above 900° C., rhodium and iridium volatilise and contaminate the wire. This, however, can be prevented by surrounding the platinum wire by a tube of glazed Marquardt porcelain, which is fairly durable even at 1500° C. It is desirable, however, to expose good thermo-elements to high temperatures for as short periods as possible. For ordinary temperatures, copper-constantan was used with five junctions in series. This series arrangement has the advantage of giving greater E.M.F. with consequent greater precision in its measurement, and also tends to neutralise the accidental irregularities in the wires. These metals are liable to become coated with a film of oxide which may introduce an error of as much as 0·5 per cent. By removing this film the original value is nearly if not quite restored. Thermo-elements of platinum-rhodium and of constantan copper, when used with proper precautions, have been found free from any error as great as 0·005 per cent. With platinum this amounts to less than 0·05 per cent. at 1000° C., and with constantan, to less than 0·002 at 40° C.

English Patents.

Testing gas; Method of and apparatus for ——. W. P. Tervet, Plymouth. Eng. Pat. 15,013, July 2, 1906.



The method, which is designed for use in determining the percentage of carbon dioxide in coal gas, is based upon the fact that when gas containing carbon dioxide is burned under stated conditions, a shorter flame is produced than is given by the same gas from which the carbon dioxide has been removed. To obtain a flame of equal length from the former gas (the conditions remaining otherwise the same) it is necessary to increase the pressure, and the increment of pressure required is a measure of the percentage of carbon dioxide present. The apparatus used is a modified form of jet photometer; the arch is divided at P and is fitted with two jet burners, in one of which, L, the gas admitted at H burns, the gas admitted at M burning at N. The two tanks, A and B (the latter being open at the bottom), are of such dimensions that the surface of the liquid is of exactly the same area in both. In making a test, the gas under examination is passed through a small lime purifier or the like, to free it from carbon dioxide, and is then admitted at both M and H; it is lit at N and L, and the supply is regulated until both flames are of equal length. The pressure being equal throughout the apparatus, the pointer, F, does not move. The supply of purified gas at, say, H, is now cut off, and the gas containing the carbon dioxide is admitted instead. It will be necessary to use a higher pressure than before, to maintain in L a flame of the same length as in N; the water-level in B will therefore be forced up, raising the float, C, and causing the pointer to travel over the scale more or less, according to the degree of pressure required.—H. B.

Photometers. H. T. Harrison, London. Eng. Pat. 11,052, May 11, 1906.

In a flicker photometer, the surfaces to be illuminated intermittently by the sources of light under comparison are caused to rotate by means, such as vanes or blades, connected with said surfaces and actuated by the pressure of air from a nozzle provided with a valve that can be adjusted to vary the speed of rotation. The air pressure may be generated by a pneumatic bulb or other suitable device.—C. S.

United States Patent.

Fire-damp and other light gas in mines, &c.; Apparatus for detecting the presence and volume of ——. J. McCutcheon, Edinburgh. U.S. Pat. 852,895, May 7, 1907.

See Eng. Pat. 24,900 of 1905; this J., 1906, 954.—T. F. B.

INORGANIC—QUANTITATIVE.

Carbonate in caustic alkali solutions; Determination of —— *by Winkler's method.* M. Le Blanc. Z. anorg. Chem., 1907, **53**, 344—348.

Winkler's method for the determination of alkali carbonate in presence of alkali hydroxide is satisfactory in the case of *N*/1 or *N*/2 solutions (compare Küster, this J., 1897, 163; and Novotny, this J., 1905, 860), but is not reliable in the case of *N*/10 solutions, owing to the fact that when barium carbonate is precipitated from neutral solutions of barium chloride by alkali carbonate, the liquid becomes appreciably acid. In two series of experiments a 2-*N* neutral solution of barium chloride was treated with varying quantities of distilled water and of *N*/10 potassium or sodium carbonate solution, the quantity of barium solution being such that, after the addition of alkali carbonate, 10 c.c. of 2-*N* barium solution remained in excess. In every case the liquid was faintly acid after the precipitation of barium carbonate, the acidity increasing with the quantity of alkali carbonate added, but not in regular proportion therewith. With 100 c.c. of *N*/10 potassium carbonate and sodium carbonate solutions respectively, there were required 0·5 and 0·3 c.c. of *N*/10 barium hydroxide solution to neutralise the resulting acidity. The author points out the analogy between these observations and those of Linder and Picton, Whitney, and Ober, who found that colloidal arsenious sulphide precipitated barium hydroxide from solutions of barium chloride.—A. S.

Chlorides; A necessary modification of Volhard's method for the determination of ——. M. A. Rosanoff and A. E. Hill. J. Amer. Chem. Soc., 1907, **29**. 269—275.

In order to ascertain whether it is necessary or not to filter off the separated silver chloride in the determination of chlorides by Volhard's thiocyanate method, the authors determined the velocity of the reaction between silver chloride and ammonium thiocyanate. It was found that with molecular proportions of silver chloride (0·286 grm.) and ammonium thiocyanate (0·152 grm.), the volume of liquid being 200 c.c., and the temperature 28·2°—28·4° C., about 43 per cent. of the ammonium thiocyanate is converted into chloride in 2 minutes. With a large excess of silver chloride (as is present in Volhard's method), the reaction proceeds much more quickly, and it is evident, therefore, that in using Volhard's thiocyanate method, the precipitated silver chloride must be filtered off before titrating the excess of silver nitrate. In the determination of bromides and iodides by this method, filtration is unnecessary, the reaction between silver bromide or iodide and dissolved thiocyanate proceeding much more slowly than in the case of silver chloride.—A. S.

Indicators; A study of ——. E. Salm. Z. physik. Chem. 1906, **57**, 471—501.

A set of seventeen solutions whose hydrogen ion concentration varied progressively from 2-*N* (strong acid) to 10^{-15}*N* (strong base) was prepared. For the concentration range, 2-*N* to 10^{-4}*N* inclusive, hydrochloric acid solutions were used. The solutions of concentrations between 10^{-5} and 10^{-11}*N* inclusive were prepared by mixing solutions of the three sodium orthophosphates in the proper proportions. Solutions of potassium hydroxide were used for the rest of the series. The hydrogen ion concentration in each solution was determined by the measurement of the E. M. F. of the H+-concentration cell. The colour reaction of each solution with each of a large number of indicators was determined, and the results tabulated. A portion of the results is given in the accompanying table. The indicator solutions were prepared according to Glaser (Indicatoren der Acidimetrie und Alkalimetrie, Wiesbaden, 1901), the concentration being 0·1 – 0·15 grm. per 100 c.c. of solvent. 0·1 c.c. of the indicator solution was added to 10 c.c. of the solution to be tested. The colours were observed by transmitted light. For each adjacent pair of solutions, some indicator (frequently several) was found which gave a pronounced difference in colour for the difference in H+-concentration existing between the two solutions. By use of this table the H+-concentration of any solution can be readily estimated. By the use of a colorimeter the author was able to determine this concentration accurately enough to calculate the dissociation constants of several weak acids. His results agree very well with Ostwald's values by the conductivity method. The dissociation constants of the following indicators were determined:—

Acids.		Alkalis.	
Methyl orange ..	$4.6 \cdot 10^{-4}$	Cyanine	$4.2 \cdot 10^{-6}$
Paranitrophenol .	$2.3 \cdot 10^{-7}$	Dimethylamino-azobenzene ...	$1.4 \cdot 10^{-11}$
Rosolic acid	$1.1 \cdot 10^{-8}$		
Alizarin	$8.8 \cdot 10^{-9}$		
Phenolphthalein..	$8.0 \cdot 10^{-10}$		

See Table on page 643.

In choosing an indicator for a titration, one should be taken which gives the colour change not at the neutral point but at the "equivalent" point, that is, when an equal number of equivalents of acid and base have been used. The H+ concentrations in 0·1-*N* solutions of the following salts are, NaH_2PO_4, $9.3 \cdot 10^{-5}$, Na_2HPO_4, $1.3 \cdot 10^{-9}$, and Na_3PO_4, $4.3 \cdot 10^{-13}$. Reference to the table shows that the first hydrogen of phosphoric acid can be titrated with sodium hydroxide, using methyl orange as indicator, the second using phenolphthalein, and the third using trinitrobenzene. The proper indicator to use in any titration is easily determined from the dissociation constants of the acid and base.

Iron; Colorimetric determination of ——. H. N. Stokes and J. R. Cain. J. Amer. Chem. Soc., 1907, **29**, 409—443.

The intensity of the colour of a solution of ferric thiocyanate is dependent on the composition of the solution, and does not depend on the concentration; moreover, fluorides, phosphates, oxalates, and other salts interfere. The authors find that, for extracting the ferric thiocyanate from aqueous solution, a mixture of two volumes of ether with five volumes of amyl alcohol makes a better solvent than undiluted ether. In order to keep the iron in the peroxidised condition, and so prevent the colour fading, they add a few mgrms. of potassium persulphate. In place of ammonium thiocyanate they use free thiocyanic acid, or rather, since the latter is oxidised by the persulphate, giving a yellow colour to the solution, the double salt, $Hg(SCN)_2.2HSCN$. Before the actual estimation, the iron must be concentrated into a small bulk of solution, free from interfering substances. This may be done either by evaporation or by precipitation, in the latter case a suitable substance is used to "collect" the precipitate; if the iron be precipitated as hydroxide, hydrated manganese peroxide is used. If it be separated as sulphide (which is the case when interfering bodies, such as tartrates or citrates, are present), then the "collector" is cadmium sulphide; this precipitate is dissolved and reprecipitated as hydroxide. A simple form of colorimeter is described, consisting essentially of two similar tubes with a burette attached to each. Each tube contains 5 c.c. of the amyl alcohol-ether mixture, 5 c.c. of the thiocyanate reagent, 5 c.c. of water, and a few mgrms. of potassium persulphate; one of the tubes (the "test" cylinder) contains the iron. The cylinders are matched by adding to the "standard" cylinder sufficient of a standard solution of iron from its burette. The difference in reading of the two burettes is noticed, and the process repeated three to four times, the mean of the differences being taken. Methods and analytical data for the estimation of iron in solutions of most metallic salts are given.—C. A. W.

Conc. of H + ions.	Methyl orange.	Mauve.	Congo red.	Sodium alizarin-sulphonate.	Rosolic acid.	Phenolphthalein.	α-Naphthol benzein.	Tropaeolin O.	Trinitrobenzene.	Benzopurpurin.	Safranine.
2·0 *N*	Rose-red	Yellow	Blue	Yellowish-green	Yellow	Colourless	Brownish-yellow	Yellow	Colourless	Blue	Blue
1·0 *N*	..	Green	..	..	..	..	..	..	..	Blue-violet	Lilac
10^{-1} *N*	..	Blue-green	..	..	..	..	..	..	..	Violet	Rose-red
10^{-2} *N*	..	Blue	..	..	..	..	..	..	..	..	..
10^{-3} *N*	Orange-red	Violet	Blue	..	Light brown	..	..	..	..	Red-violet	..
10^{-4} *N*	Orange	..	Violet	..	..	..	..	..		Rose	..
10^{-5} *N*	Yellow	..	Scarlet	Brown	..	..	..	Greenish-Yellow	..	Yellow with Red tint	..
10^{-6} *N*	..	..	..	Red	Light Brown	..	..	..	..	..	..
10^{-7} *N*	..	..	..	..	Rose	..	..	..	..	..	..
10^{-8} *N*	..	..	..	..	Red	Colourless	..	..	..	..	..
10^{-9} *N*	..	..	..	..	..	Rose	..	..	..	..	..
10^{-10} *N*	..	..	..	..	..	Red	Green	..	..	..	..
10^{-11} *N*	..	..	..	Lilac	..	..	Greenish blue	Greenish-Yellow	..	..	..
10^{-12} *N*	..	..	..	Violet	..	..	..	Orange	Colourless	..	..
10^{-13} *N*	..	..	..	..	..	..	..	Orange-red	Orange	Yellow with Red tint	
10^{-14} *N*	..	..	..	..	Red slowly brighter	Red quickly colourless	..	..	Orange-red	Rose	Rose-red
10^{-15} *N*	Colourless	..	..	..	Red, quickly colourless	Red, quickly colourless	..		Almost colourless	..	Violet

Iron ; Determination of —— in presence of titanium. F. A. Gooch and H. D. Newton. Amer. J. Science, 1907, **23**, 365—367.

The ordinary process of reducing ferric salts by means of zinc, either in a flask or in a reductor, may be made applicable in the presence of titanium compounds by adding copper oxide, or preferably bismuth oxide, to the reduced cold solution, and filtering, before titrating with potassium permanganate.—F. Sodn.

Nickel ; New method for the determination of ——. O. Brunck. Z. angew. Chem., 1907, **20**, 834.

The author finds that dimethylglyoxime, which has been proposed by Tschugaeff (this J., 1905, 941) as a reagent for the detection of nickel, can also be used for the quantitative determination of that metal. If a neutral solution of a nickel salt be treated with an alcoholic solution of dimethylglyoxime, a red crystalline precipitate is produced. The acid set free in the reaction, however, causes the precipitation to be incomplete, and it is necessary to add ammonia in order to get accurate results. The precipitate can be dried at temperatures above 100° C. without decomposition (it sublimes at 250° C.); it has the composition, $C_8H_{14}N_4O_4Ni$. Cobalt does not interfere, provided that not more than 0·1 grm. per 100 c.c. is present. In working the process, the neutral or faintly acid solution containing nickel is heated, and treated with rather more than the theoretical quantity of dimethylglyoxime. Ammonia is then added gradually until a slight excess is present, the precipitate is collected in a Neubauer crucible, washed with hot water, and dried for three-quarters of an hour at 110°—120° C. If nickel and cobalt are both present, they are determined together by electrolysis, the deposit is dissolved in nitric acid, the solution evaporated with hydrochloric acid, and the nickel determined as described above. The method is also suitable for the separation of nickel and zinc.—A. S.

Metals ; Quantitative determination of —— by electrolysis. F. Foerster. Z. angew. Chem., 1906, **19**, 1842—49; 1889—1895.

A metal can be electrolytically deposited from the aqueous solution of its salt upon a cathode if the requisite cathode potential is equal to or less than that necessary to set free hydrogen at the same metal under these particular conditions. The Nernst potential formula can be used to express this with the addition of a new term, *n*, to the right hand member of the formula. If this new term be omitted from the right hand member, it lacks an expression for the equilibrium potential of hydrogen at atmospheric pressure toward a solution in which the osmotic pressure proportional to the concentration of the hydrogen ions prevails. If some metal other than platinised platinum be used as cathode, a higher cathode potential must be used than with platinum. This over-voltage is expressed in the new formula by *n*. It depends upon the nature and surface characteristics of the metal as well as upon the current density and temperature, and often undergoes temporary increases during the course of an electrolysis. If this new value is high for any metal, that metal may be deposited quantitatively from a comparatively strongly acid solution. The acidity of the solution must decrease with a decrease in the value of the new factor. The addition of nitric acid or its salts increases the concentration of the hydrogen ions by enabling the hydrogen to be more freely evolved. Chlorides have practically the same effect as nitrates, except that they may also form hypochlorites, &c. In any case they are undesirable in an electro-analysis, on account of their evil effects. Complex salt solutions have very much more unstable cathode potentials than have simple salts in solution.

These potentials depend upon the complexity of the anion which contains the metal, and this in turn depends greatly upon the nature of the metal. In the case of the complex cyanide anion, $M(CN)_x$, the tendency is for the anion to split up into M and $(CN)_x$. The smaller this tendency the more the metal ion concentration decreases, for any given excess of potassium cyanide, and the more the equilibrium potential of the metal against the solution increases. The separation potentials for some metals in cyanide solution lie very close together, and ruin any attempt to use these solutions for the separation of the metals. In the case of complex alkaline salts, however, no unstable condition exists in the separation potential. The oxalates undergo electrolytic reduction, the more easily, the greater the cathode potential or current density. Their reduction products are probably aldehydes, which polymerise, and have the effect of colloids on the deposit. The impoverishment of a solution toward the end of an analysis, in which sulphates are used, can be counterbalanced to some extent by using a large cathode, and warming the solution. The use of a wire gauze cathode is mentioned. Its advantages lie in the larger surface exposed for a given weight of platinum, and in its permeability to the electrolyte causing a decrease in impoverishment at the cathode. Practical examples are given of the determination of nickel, zinc, cadmium, and copper by the electrolytic method.

Rotating anode ; Determinations and separations with the ——. J. Langness. J. Amer. Chem. Soc., 1907, 29, 459—472.

The author points out the advantages of using a rotating anode, with which a much greater current strength and E.M.F. may be safely employed. He used a new form of anode, consisting of a platinum dish 7 cm. in diameter, and 3 cm. deep, and having in its sides ten slits, 1·8×0·5 cm., perpendicular to the edge. These slits, together with a circular opening 1·3 cm. in diameter at the bottom, insure free circulation of the liquid. The cathode is an ordinary platinum dish of the same shape, but slightly larger. It surrounds the anode and, during rotation of the latter, all the liquid is contained in the space between the two vessels, so that smaller volumes of the solvent may be used. Using a solution of copper sulphate containing 0·4876 grm. in 125 c.c., with an E.M.F. of 8 volts and a current of 8 ampères, 10 minutes are required for complete precipitation if a spiral anode be used, but only 6 minutes with the dish anode, the E.M.F. being 8 volts and current, 16 ampères. By agitating the liquid, 0·1 grm. of platinum may be precipitated in 2—5 minutes as compared with 4—5 hours using a stationary anode. Example: 25 c.c. of a solution of potassium chloroplatinate (containing about 0·1 grm. of platinum) were taken 5 c.c. of sulphuric acid (1 : 10) added, and the solution electrolysed at a pressure of 7 volts, and current of 14 ampères, the precipitation was complete in 4 minutes. Separation may also be effected, *e.g.*, silver may be separated from copper, nickel, or zinc, using a cyanide solution. Example: Silver from copper. The silver is first removed with a low current, 0·40—0·08 amp., and the decanted liquid electrolysed for copper with a current of 3 ampères. The solution contains about 2 grms. of potassium cyanide to 0·1 of copper and 0·1 grm. of silver.—C. A. W.

Copper ; Electrolytic precipitation of —— from an alkaline cyanide electrolyte. L. Flanigen. J. Amer. Chem. Soc., 1907, 29, 455—459.

The author points out the advantages of a cyanide electrolyte in the determination of copper electrolytically: (1) The deposit is adherent with no tendency to sponginess; (2) Since copper sulphide is soluble in potassium cyanide, several steps in the estimation of copper in minerals may be avoided. An investigation was made of the requisite conditions for obtaining a perfectly clean deposit free from platinum, which, under certain conditions, may be dissolved from the anode and precipitated with the copper. In the first experiment slightly more potassium cyanide was used than was necessary for the solution of the copper cyanide.

	1	2	3
Copper, in grms.	0·2031	0·2031	0·2031
Potassium cyanide, in grms. .	1·5	1·5	5·0
$N.D._{100}$ in ampères	0·21	0·23	0·76
Volts	4	4	4
Temperature	28° C.	28° C.	28° C.
Time, in hours	6	18½	18
Copper found	0·2031	0·2034*	0·2032*

In 2 and 3 the copper precipitated, contained platinum. Thus the precipitation of platinum may take place (1) if the time is prolonged, (2) if too great an excess of potassium cyanide is present. The presence of ammonium carbonate has no beneficial effect, but the addition of 10—15 c.c. of ammonia (sp. gr., 0·93), leads to highly successful results, especially on heating.—C. A. W.

Anions ; Determination of —— in the electrolytic way. J. H. Hildebrand. J. Amer. Chem. Soc., 1907, 29, 447—455.

The author shows that it is possible to determine electrolytically the negative radicals in such substances as carbonates, thiocyanates, and ferrocyanides of the alkali and alkaline-earth metals. He employs the mercury-cathode cell of Myers, using either a stationary or a revolving anode. The cathode is of mercury, and the anode consists of three platinum gauzes, either cylindrical in shape or, preferably, disc-shape, and heavily plated with silver. When the precipitation is complete, as shown by the current reaching zero or nearly so, the amalgam is washed into a beaker, decomposed with water, and the caustic alkali titrated with standard acid. The anode, which is covered with the silver salt of the anion, is washed, dried, and weighed. In this way silver ferrocyanide, silver ferricyanide, and even silver carbonate may be formed. Using a rotating anode a perfectly adherent deposit is obtained, moreover the decomposition around the cathode is rendered more complete.

The method is unsuitable for such salts as potassium chromate, sodium oxalate, &c., part of the salt being reduced by contact with the amalgam. The silver salts of other anions, *e.g.*, silver succinate, are not perfectly adherent.—C. A. W.

Antimony ; Quantitative determination of —— by electrolysis of its sulpho-salt solutions. F. Foerster and J. Wolf. Z. Elektrochem., 1907, 13, 205—210.

A source of error in the electrolytic determination of antimony, using solutions of the sulpho-salts in presence of potassium cyanide, has been detected. The authors confirm the observations of others that the deposited metal is always in excess of the theoretical amount by 1 to 1·5 per cent., and by careful examination of antimony deposited in some quantity have found the discrepancy to be due to the presence of antimony oxide, together with small quantities of sulphur.—R. S. H.

Antimony ; Electrolytic determination of ——. J. M. M. Dormaar. Z. anorg. Chem., 1907, 53, 349—360.

The author confirms Henz (Z. anorg. Chem., 1903, 37, 31), who found that whilst antimony is completely deposited electrolytically from a sulpho-salt solution to which potassium cyanide has been added (see this J., 1903, 512), the results are always too high. With 0·4228 grm. of antimony, using a current-density of 0·002 ampère, rising after a quarter of an hour to 0·006 ampère per sq. cm., the author found that the results were from 2·64 to 2·97 per cent. too high. The error increases with the quantity of antimony taken and the current-density employed. The author finds that the chief cause of the high results is the presence of antimony oxide in the deposited metal, due not to atmospheric oxidation, but apparently to a chemical reaction connected with the electrolytic process. A small portion of the error is due to the inclusion of the electrolyte (sodium sulphide) in the deposited antimony.

—A. S.

Metallic salts ; Action of phenylhydrazine on some ——. I. Reaction of molybdates. II. Detection and colorimetric determination of small quantities of gold. E. Pozzi-Escot. Ann. Chim. anal. appl., 1907, **12**, 90—92. Chem. Zentr., 1907, **1**, 1460—1461.

Reaction of molybdates.—If phenylhydrazine acetate be added to an alkaline molybdenum solution, a precipitate of the colour of lees of wine is produced at a dilution of 1 : 1000, or a coloration in more dilute solutions, up to 1 : 25,000, If a few drops of a solution of tannin be introduced, before adding the phenylhydrazine, an orange coloration is produced, and also a precipitate, yellow in dilute, mahogany-coloured in moderately concentrated solutions.

Detection and determination of gold.—If a solution of phenylhydrazine acetate be added to a very dilute gold solution, the liquid appears bluish by transmitted and brown by reflected light ; if excess of an organic acid (citric or formic acid) be added before the phenylhydrazine, the resulting coloration is violet, and remains for several hours without alteration. The intensity of the coloration is proportional to the quantity of gold, provided the latter does not rise above 2 parts per million.—A. S.

Sulphur in roasted zinc blende ; Determination of ——, and also capacity for desulphurisation of zinc blende. V. Hassreidter. X., page 616.

Arsenic and antimony in refined copper ; The Knorr method of determining ——. P. Butler. X., page 615.

Zinc-lead pigment ; Composition and analysis of ——. E. W. Buskett. XIII*A*., page 624.

ORGANIC—QUALITATIVE.

Phenols ; Diphenylcarbamide chloride as a reagent for ——. J. Herzog. Ber., 1907, **40**, 1831—1834.

Diphenylcarbamide chloride gives well-crystallised compounds with most phenols, and is, therefore, recommended as a test-reagent for these substances. The reaction is, however, not given with tertiary alcohols, and the free carboxyl group exerts a hindering effect, as salicylic acid does not respond to the test. The phenol-urethanes are obtained by heating the phenol with four times its quantity of pyridine and the equimolecular proportion of diphenylcarbamide chloride in a flask with a reflux tube for one hour on the boiling-water bath. The solution is poured into water and the reddish mass crystallised from light petroleum or alcohol. The test may be carried out with 0·1 grm. of the phenol.—J. C. C.

Tannins ; A colour reaction of ——. A. Brissemoret. Bull. Soc. Chim., 1907 [4], **1**, 474—483.

The author has noted the colours produced by Kiliani's reagent upon various tannins, and its use in the recognition of certain extracts. The substance to be examined is dissolved in just sufficient 60 per cent. alcohol or ethyl acetate, and the solution mixed with 3 c.c. of glacial acetic acid containing in each 100 c.c., 1 c.c. of a 5 per cent. solution of ferric sulphate. Sulphuric acid is mixed with 1 per cent. of its volume of ferric sulphate solution, and 3 c.c. of the mixture are cautiously poured down the side of the tube containing the acetic acid mixture. The characteristic colours are produced at the junction of the liquids. The bearing of the colours produced upon the constitution of the following classes of tannins is discussed : gallo-tannins ; caffeo-tannins ; phloroglucotannins. The reactions may be used for the identification of drugs. The presence of hamamelitannin in the tincture of *Hamamelis virginica* can be recognised as follows. Two c.c. of the liquid are evaporated, taken up with alcohol, filtered, mixed with ether, and allowed to stand for 24 hours ; the solution is then used for the test as described above, when a red colour is produced. For the dry extract of grey cinchona, 0·5 grm. is extracted with ethyl acetate containing hydrochloric acid, a wine-red coloration being produced. The dry extract of yellow cinchona is shaken with water containing hydrochloric acid, treated with potassium acetate, filtered, saturated with common salt, and shaken out with ethyl acetate. The ethyl acetate gives a ponceau red colour with the reagent. The fluid extract of grey cinchona is treated with a little hydrochloric acid and then absolute alcohol added, followed by excess of sodium sulphate. The clear liquid gives a carmine-red with the reagent. Catechol in its preparations can be recognised by triturating them with ethyl acetate ; the clear liquid gives a carmine-red coloration passing into purple. Preparations containing arecatannic acid give a garnet coloration.—F. Shdn.

Colouring matters in pastry-ware ; Use of carbon tetrachloride for the detection of —— which are forbidden by public health laws [*in Italy*]. V. Vetere. XVIII*A*., page 630.

Ligno-celluloses ; A new colour reaction of ——. A. S. Wheeler. XIX., page 633.

ORGANIC—QUANTITATIVE.

Sucrose ; Inversion of —— by acid mercuric nitrate. C. B. Cochran. J. Amer. Chem. Soc., 1907, **29**, 555—556.

The author has examined the action of Wiley's acid mercuric nitrate solution as an inverting agent for sucrose in the analysis of sweetened condensed milk. The chief conclusions are as follows :—Fifty c.c. of the solution to be inverted (containing 3 c.c. of acid mercuric nitrate solution per 100 c.c.) are transferred to a flask and heated in boiling water for seven, or at most, eight minutes. The sucrose-content, in the case of normal solutions, is given by the formula :—

$$\text{Sucrose} = \frac{100\text{D}}{132{\cdot}68 - 0{\cdot}5t}$$

in which D = difference in polarisation before and after inversion, and t = temperature above 20° C. Acid mercuric nitrate, as employed for the inversion of sucrose, has no influence on the polarisation of lactose, and at temperatures below 15° C., it inverts sucrose only very slowly ; thus, a half normal sucrose solution maintained at 15° C., showed a fall in polarisation of only 0·3 of a unit per hour, and, at lower temperatures, the rate of inversion was still slower. Hence, acid mercuric nitrate may be used in the analysis of sweetened condensed milk or of other solutions containing sucrose and lactose, provided the temperature of the solution is kept at, or below 15°, and the polarisation is made as soon as possible after the addition of the reagent. The author quotes experiments which show that sucrose, added to milk of known lactose-content, can be determined very accurately by the acid mercuric nitrate inversion method. —L. E.

Tartaric acid ; New method for the determination of ——. A. C. Chapman and P. Whitteridge. Analyst, 1907, **32**, 163—166.

In the method proposed, the tartaric acid is precipitated from its solution as barium tartrate, the latter being practically insoluble in dilute acetic acid, and the barium tartrate is titrated, subsequently, in sulphuric acid solution, with potassium permanganate. The process is carried out as follows :—A known weight of the substance to be analysed, containing about 0·1 grm. of tartaric acid, is dissolved in 40 c.c. of water ; the solution is neutralised with either sodium hydroxide or acetic acid, as the case may require, and is then heated nearly to boiling. Fifteen c.c. of bismuth reagent (prepared by dissolving 30 grms. of crystallised bismuth nitrate in 20 c.c. of glacial acetic acid, diluting the solution to a volume of 300 c.c. with water, and filtering, if necessary) are added, the mixture is stirred vigorously for a few minutes, and the precipitate is collected on a filter and washed well with boiling water. The precipitate is then dissolved off the paper with about 20 c.c. of hot 10 per cent. (by volume) sulphuric acid, a further 30 c.c. of the same acid being used to wash the paper. A 1 per cent. potassium permanganate solution is next run into the hot acid filtrate until a slight excess, not exceeding 0·5 c.c., is present, and this is titrated back with oxalic acid solution containing 19·9 grms. of the pure crystallised salt per litre. As the result of many determinations, it is found that 0·1 grm.

of tartaric acid corresponds with 14 c.c. of the permanganate solution. For complete precipitation, it is well to add one and a half times the quantity of bismuth reagent theoretically necessary. The method gives accurate results in the case of Rochelle salt, crude tartars, Seidlitz powders, and baking powders. Alum and succinic acid, if present, have no influence on the accuracy of the results, but the method cannot be applied to the determination of tartaric acid in the presence of citric, oxalic, and malic acids.—W. P. S.

Hydroxyl group; Quantitative determination of —— by the aid of organo-magnesium compounds. T. Zerewitinoff. Ber., 1907, **40**, 2023—2031.

The author has applied the method, suggested by Hibbert and Sudborough (Chem. Soc. Proc., 1903, **19**, 285), of estimating hydroxyl groups in organic compounds by measuring the quantity of methane evolved on treatment with magnesium-methyl iodide, to a large number of substances with satisfactory results. In those cases where the compound is insoluble in amyl ether, pyridine can be used as the solvent, and the experiment can be made in an atmosphere of air or nitrogen.—J. C. C.

Weighting in dyed silks; Determination of ——. P. Sisley. V., page 605.

Fats; A reagent in the chemistry of ——. II. E. Twitchell. XII., page 623.

Sprouted alumina for the determination of the relative tanning value of vegetable tanning materials; Analysis with ——. H. Wislicenus and W. Muth. XIV., page 627.

Tanning materials; Drying of residues in the analysis of ——. J. G. Parker and D. Stewart. XIV., page 627.

Brewing materials; Analytical control of ——. J. L. Baker and H. F. Hulton. XVII., page 628.

Wines, coloured; Determination of total and volatile acids in ——. G. Guérin. XVII., page 629.

Preservatives in milk. H. D. Richmond and E. H. Miller. XVIIIA., page 631.

Phenol and cresol; Determination of —— by a biological method. M. W. Blyth and L. Goodban. XVIIIC., page 632.

Sulphonal; Detection of —— in trional and tetronal. E. Gabutti. XX., page 636.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(Continued from page 557.)

Phosphorescence of calcium compounds containing manganese. Influence of molecular constitution and mass on the length of wave emitted. L. Bruninghaus. Compt. rend., 1907, **144**, 1040—1042.

The author had previously found that the addition of manganese to calcium salts increases the intensity of their phosphorescence under cathode rays, and that the maximum effect is produced in all cases when the ratio Mn : Ca was 1 : 254. He has now examined a larger number of compounds (preserving this ratio in all cases), and has examined the spectra, visible and photographic, of the light emitted. He concludes that two factors influence the result: (1) the constitution of the molecule, for two different molecules of approximately equal mass may give rise to phosphorescence of quite different colours. (2) The mass of the molecule; with similarly constituted molecules the emitted light is more refrangible, as the mass of the molecule is greater.—J. T. D.

Selenium; Action of fluorine on ——. P. Lebeau. Compt. rend., 1907, **144**, 1042—1044.

Selenium, in absence of glass, and in metal vessels, is attacked by fluorine with production of a tetrafluoride. This is a colourless liquid, boiling above 100° C., solidifying at — 80° C. It is decomposed by water, forming hydrofluoric and selenious acids. It is not affected by sulphur, arsenic, boron, silicon, nor carbon, but is attacked by yellow phosphorus, by the alkali metals, and mercury. Excess of fluorine has no effect on it. It attacks glass rapidly, and the authors consider that the "hexafluoride" of Brydges and Prideaux, which was produced in glass vessels, is in reality an oxyfluoride.—J. T. D.

Sulphur; Action of light on ——. G. A. Rankin. J. of Phys. Chem., 1907, **11**, 1—8. Chem. Zentr., 1907, **1**, 1171.

The author has studied the precipitation of insoluble amorphous sulphur from solutions of rhombic sulphur in carbon bisulphide, on exposure to light. It was found that only the violet and ultra-violet rays are concerned in causing the change. The nature of the solvent is without influence, the case being one of equilibrium between the two forms of sulphur, "of which the rhombic sulphur is the more stable form in the light, and the amorphous sulphur the more stable form in the dark." With increasing concentration of sulphur in the solution, the intensity of illumination required to produce a precipitate diminishes. With a given concentration of sulphur, the intensity of illumination required increases with the temperature. Ammonia and hydrogen sulphide hinder the precipitation of amorphous sulphur, even in bright sunlight.—A. S.

Colloid precipitation and adsorption. H. Freundlich. Z. angew. Chem., 1907, **20**, 749—750.

Colloidal "sols" are seen in the ultramicroscope to be not true solutions, but really suspensions of solid particles in liquids. The suspended colloid may either be hydrophil, *i.e.*, combined with the surrounding water, as in the case of most organic colloids, or hydrophobe, as in the case of the metals, sulphides, and some hydroxides. Colloids are positive or negative, according as they migrate to the cathode or the anode on passage of an electric current; the majority of colloids are positive, certain hydroxides are negative. The behaviour of the sols towards electrolytes depends on the sign of the colloid; in negative sols the active precipitating agent is the cathion of the electrolyte, and the concentration of salt required to effect precipitation depends on the valency of the cathion; equivalent quantities of cathions of equal valency possess about the same flocculating power. Exceptions to this rule are: the acids, the salts of heavy metals, and organic bases, which act in smaller concentrations than correspond to their valencies, whilst the bases and salts of organic acids require higher concentrations. In the case of positive colloids the valency of the anion is the determining factor of flocculation; bases and salts with organic anions are powerful flocculating agents, whilst acids and salts of organic bases are weaker. The flocculation of a sol by an electrolyte is always accompanied by adsorption, and the flocks of a negative colloid adsorb some of the base, whilst those of a positive colloid adsorb some of the acid, both in equivalent quantities. The addition of electrolytes causes a retardation of the migration of the colloid particles under the action of the electric current, the retardation increases with the concentration of the electrolyte until it reaches a point at which migration ceases, the colloid is "neutralised," and flocculation takes place. This neutralisation, like the flocculation, is associated with adsorption, and follows the same rule as regards the effects of cathions and anions and the sign of the colloid. Powerfully adsorbent anions hinder the flocculation of negative colloids, because they occupy space on the surface of the particles to the exclusion of the cathion necessary for neutralisation; the converse is also true for positive colloids. It would appear that in equimolecular concentrations of the inorganic ions, the quantities adsorbed are nearly equal. From the adsorption curve it is possible to calculate the concentrations at which the equivalent quantities of active ions necessary for neutralisation are adsorbed.—J. F. B.

Osmotic pressure of cane sugar solutions in the vicinity of the freezing point of water. H. N. Morse, J. C. W. Frazer, and W. W. Holland. Amer. Chem. J., 1907, 37, 425—467.

The authors have carried out a series of determinations of osmotic pressures of sucrose solutions. The concentration of the solutions ranged between 0·1—1·0 grm.-mol. weights per litre. The temperatures at which the determinations were made did not exceed the limits 0·12°—0·38° C. The results of the experiments showed that the osmotic pressure of sucrose solutions, in the vicinity of 0° C., considerably exceeds the calculated gas pressures for the same temperatures. The osmotic pressures of sucrose solutions in the vicinity of 0° C. are, on the whole, nearly equal to those observed in the vicinity of 20° C.; it may be that between these temperatures there is a point at which the osmotic pressure is a minimum; the authors have begun a series of determinations of osmotic pressures of sucrose solutions at temperatures between 0° and 20° C.—L. E.

New Books.

The Chemistry and Technology of Mixed Paints. By Maximilian Toch. D. van Nostrand Company, New York, U.S. America. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. 1907. Price 12s. 6d. net.

8vo volume, containing 161 pages of subject matter, with 62 illustrations (60 photomicrographic plates), and an alphabetical index. The subject matter is classified according to the following scheme: I. Manufacture of Mixed Paints. II. White Pigments. III. Lead Oxides. IV. Red Pigments. V. Burnt Ochre. American Sienna. Also Blue and Green Pigments. VI. Black Pigments. VII.-IX. Inert Fillers and Extenders. X.-XIV. Paint Vehicles. XV. Special Paints. (*a*) Floor paints. (*b*) Cement paint. (*c*) Damp-resisting paints. (*d*) Paints for Breweries: The Influence of Paint on Malted Liquors. XVI. Analytical.

Investigations on the Theory of the Photographic Process. By S. E. Sheppard, D.Sc., and C. E. Kenneth Mees, D.Sc. Longmans, Green, and Co., 39, Paternoster Row, London, E.C. New York, Bombay, and Calcutta. 1907. Price 6s. 6d. net.

Small 8vo volume, containing 335 pages of subject matter, with 65 illustrations and diagrams, and alphabetical indexes of subject matter and authors. The subject is subdivided and classified under the following heads: I. Introductory. (*a*) Bearing of Physical Chemistry on Development. (*b*) Instruments and Methods of Working. II. Physical Chemistry of Exposure, Development, and Fixation. III. The Sensitometry of Photographic Plates.

The Distillation of Resins. Resinate Lakes and Pigments. Carbon Pigments and Pigments for Typewriting Machines, Manifolders, &c. By Victor Schweizer. Maclaren and Sons, 37 and 38, Shoe Lane, London, E.C. D. van Nostrand and Company, 23, Murray, and 27, Warren Streets, New York. 1907. Price 10s. 6d.

8vo volume, containing 183 pages of subject matter with 68 illustrations, the table of contents being classified so as to serve also as an index. The subject is subdivided as follows: I. Resins and their employment for the production of Chemical Products. II. Rosin. III. Hard Resins. IV. Distillation of the Hard Resins. V. Manufacture of Illuminating Gas from Rosin. VI. The Dry Distillation of Rosin. VIa. Rosin Oils. VII. Nature of the Crude Products. VIII. Rectification of Rosin Oil. IX. Manufacture of Patent Lubricants. X. Rosin Soaps or Resinates. XI. Manufacture of Resinate Varnishes. XII. Carbon Pigments. XIIa. Manufacture of Lampblack and Lampblack Pigments. XIII. Lampblack Chambers. XIV. Making Lampblack Pigments. XV. Manufacture of Printing Inks. XVI. Other Lampblack Inks. XVII. Inks for Typewriting Machines.

Annual statement of the trade of the United Kingdom with Foreign Countries and British Possessions, 1906. [Cd. 3466.] Wyman and Sons, Fetter Lane, London, E.C. Price 6s. 8d.

This volume contains abstract tables showing the total imports and exports, for 1902 to 1906, of every article which is separately enumerated in the official classification, as well as detailed tables showing the quantity and value of the imports and exports of each article from and to each country. Several alterations have been made in the classification of imports and exports. In the import tables manufactured fuel is now shown separately, and the headings for electrical goods and apparatus, metals and ores, oil cloth, starch, &c., have been subdivided in greater detail than was formerly the case. The statements of the exports of the following classes of goods are also shown in greater detail, *viz.*, electrical goods and apparatus, oil, oil cloth, wool, &c.

Stereochemistry. By A. W. Stewart, D.Sc., Carnegie Research Fellow, and Lecturer on Stereochemistry in University College, London. Longmans, Green and Co., 39, Paternoster Row, London, E.C. 1907. Price 10s. 6d. New York, Bombay, and Calcutta.

Crown 8vo volume, containing 562 pages of subject matter, with 87 illustrations, and alphabetical indexes of subjects and names of authors. Commencing the work is a bibliographic list of standard works for reference. The treatment of the subject is planned as follows:—I.—Stereoisomerism. Part i.—Optical Activity.—i. The Assymetric Carbon Atom. ii. Inactive Compounds. iii. Active Compounds. iv. Determination of Configuration. v. The Assymetric Carbon Atom as a Ring-Member. vi. Two Exceptional Cases of Optical Activity. vii. Quantitative Relations between Activity and the Nature of the Assymetric Carbon Atom. viii. Other Active Elements. ix. Rotation. Part ii.—Stereoisomerism without Optical Activity.—i. Cis-Trans Isomerism in Cyclic Compounds. ii. Geometric Isomerism in the Ethylene Series. iii. Geometrical Isomerism in Carbon-Nitrogen Compounds. iv. Stereoisomerism in Nitrogen Compounds. v.—vii. Stereoisomerism in Cobalt, Platinum, and Chromium Compounds. Section II.—Stereochemical Problems into which Isomerism does not enter.—i. Phenomena of Steric Hindrance. ii. Relation between Space Formula and Chemical Properties. iii. Effects of Substitution upon the Formation and Stability of Cyclic Compounds. iv. Configuration of Optically Inactive Carbon Compounds. v. The Space Formula of Benzene. Appendix A.—Relations of Stereochemistry to Physiology. B.—Directions for the Construction of Stereochemical Models.

Mines and quarries; General report and statistics for 1906. *Part I. District statistics.* [Cd. 3478.] Wyman and Sons, Fetter Lane, London, E.C. Price 7d.

This return, which forms the first part of the General Report on Mines and Quarries for 1906, contains statistics of the number of persons employed, the output of minerals, and of accidents at mines and quarries in the United Kingdom arranged according to the inspection districts. The total output of the under-mentioned minerals in the United Kingdom in 1906, as compared with 1905, was as follows:—

—	1905.	1906.
	tons.	tons.
Coal	236,128,936	251,067,628
Iron ore	14,590,703	15,500,406
Clays and shale	15,134,754	15,291,352
Limestone (other than chalk)	12,501,780	12,758,588
Igneous rocks	5,956,900	6,165,750
Sandstone	5,640,684	5,261,150
Chalk	4,535,584	4,749,310

Forty-third Annual Report on Alkali, &c., Works, by the Chief Inspector. Wyman and Sons, Fetter Lane, London, E.C. Price 9d.

Mineral Resources of the United States. Department of the Interior, United States Geological Survey. Calendar Year, 1905. David T. Day, Chief of Division of Mining and Mineral Resources. Government Printing Office, Washington. 1906.

8vo volume, containing 1369 pages of subject matter, and the alphabetical index. The text deals with the following subjects: Metals.—I. Iron Ores. II. Manganese Ores. III. Gold and Silver. IV. Copper. V. Lead. VI. Zinc. VII. Zinc and Lead Ores. VIII. Mercury. IX. Steel-hardening Metals. X. Platinum. XI. Antimony. XII. Bismuth. XIII. Tin. Fuels.—XIV. Coal. XV. Coke. XVI. Gas, Coke, Tar, and Ammonia at Gas-works, and in Retort Coke Ovens. XVII. Natural Gas. XVIII. Petroleum. Structural Materials.—XIX. Cement. XX. Clayworking Industries. XXI. Lime and Sand-lime Brick. XXII. Sand and Gravel. XXIII. Slate. XXIV. Stone Industry, including Blast-furnace Flux. XXV. Abrasive Materials. Chemical Materials.—XXVI. Arsenious Oxide. XXVII. Borax. XXVIII. Bromine. XXIX. Fluorspar and Cryolite. XXX. Gypsum and Gypsum Products. XXXI. Phosphate Rock. XXXII. Salt. XXXIII. Sulphur and Pyrites. XXXIV. Barytes. XXXV. Mineral Paints. Miscellaneous.—XXXVI. Asbestos. XXXVII. Asphaltum and Bituminous Rock. XXXVIII. Bauxite and Aluminium. XXXIX. Black Sands. XL. Carbon Dioxide. XLI. Graphite. XLII. Lithium Minerals. XLIII. Magnesite. XLIV. Mica. XLV. Mineral Waters. XLVI. Monazite and Zircon. XLVII. Peat. XLVIII. Precious Stones. XLIX. Quartz. L. Talc and Soapstone. LI. Timber.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

11,154. Elmore. Separation of certain constituents of finely divided material by aid of oil or the like. May 13.

11,482. Rogers. Furnaces.

11,710. Soc. l'Air Liquide. *See under* XVIII*B*.

11,925. Lamort. Recuperating filter. [Fr. Appl., June 2, 1906.]* May 22.

12,087. Black and Lennox. Drying machines. May 24.

12,229. Davidson. Drying apparatus. May 27.

12,258. Neff and Brandes. Treatment of liquids.* May 27.

12,454. Ackermann. *See under* XVII.

Complete Specifications Accepted.

11,621 (1906). Stevens and Hughes. Filter presses. May 23.

15 947 (1906). Whiteley, Whiteley, and Peace. Drying machines. May 29.

20,813 (1906). Baron, and Fuel Saving and Water Treating Co. Regulating the respective quantities of two fluids to be mixed as they flow. June 5.

22,643 (1906). Bunschoten. Steam-heated cylinders for drying machines. May 29.

26,833 (1906). Frost. Centrifugal machines for separating liquids. June 5.

27,691 (1906) Hellström. Centrifugal liquid separators. May 29.

28,548 (1906). Dixon. Devices for separating light from heavy liquids. May 29.

29,554 (1906). Soc. Chim. des Usines du Rhone. Vessels charged with volatile liquids or liquids under pressure. May 23.

3705 (1907). Laisant. Filtering funnel. June 5.

6890 (1907). Féry. Pyrometers. May 23.

II.—FUEL, GAS, AND LIGHT.

Applications.

11,097. Pye. Distillation of gas coals. May 13.

11,206. Denham. Suction gas plants. May 14.

11,240. Glasscoe. Carburetted air gas apparatus. May 14.

11,716. Siemens und Halske A.-G. Manufacture of a plastic mass from tungsten compounds. [Ger. Appl., May 19, 1906.]* May 18.

11,717. Siemens und Halske A.-G. Manufacture of incandescence electric lamp filaments of tungsten or its alloys. [Ger. Appl., May 19, 1906.]* May 18.

12,040. Kermode. Burners for liquid fuel. May 24.

12,130. Catteau. Suction gas producers. May 25.

12,139. Planchon. Manufacture of filaments. May 25.

12,141. Ling. Preparation for consuming smoke and economising fuel.* May 25.

12,751. Doherty. Apparatus for washing and cooling gas.* June 1.

Complete Specifications Accepted.

9701 (1906). Cox. Carburetting apparatus. June 5.

9701a (1906). Cox. Gas-making plants. June 5.

11,925 and 11,926 (1906). Allison (American Chemical Eduction Co.). Distilling coal and other hydrocarbonaceous substances. May 29.

11,944 (1906). Just, Hanaman, and Verein. Elektricitäts A.-G. Manufacture of incandescing bodies for electric incandescent lamps. May 23.

13,480 (1906). Elworthy and Elworthy. Manufacture of gas for heating, illuminating, or power. June 5.

13,703 (1906). Bickerton, Robson, and National Gas Engine Co. Gas-producing plant of the suction type. May 29.

19,332 (1906). Moores and Petrides. Manufacture of air gas. May 23.

19,480 (1906). Coppée. Regenerative coke ovens. May 23.

20,042 (1906). Still and Adamson. Manufacture of incandescent gas mantles. June 5.

22,571 (1906). Atkinson. Incandescent gas mantles. June 5.

28,576 (1906). Buss and Fohr. Process of making briquettes of coal, turf, peat, and the like. June 5.

29,231 (1906). Hurlebusch. Portable gas plant. May 29.

29,599 (1906). Drinkwater and O'Connor. Reducing the arsenic in gas and other cokes. June 5.

1154 (1907). Wilkinson and Ellis. Preparation for perfecting combustion. May 29.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

11,185. Ryan and Burke. Process for obtaining lubricating oil from crude oil.* May 13.

11,498. Marriott. Composition for improving pitch and bitumen. May 16.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

11,609. Johnson (Kalle und Co.). Manufacture of new colouring matters of the thioindigo group.* May 17.

12,408. McQuinn. Dyes or stains. May 29.

12,461. Ransford (Cassella und Co.). Manufacture of a monoazo dyestuff from dioxynaphthalenesulpho acid. May 29.

12,695. Sharp. Dyes and tints combined with gum tragasol. June 1.

Complete Specifications Accepted.

20,837 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene compounds and colouring matters. June 5.

21,926 (1906). Junius. Manufacture of sulphur dyes. June 5.

24,518 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of 3-aminophenyl-5-oxy-1.2-naphthimidazoledisulphonic acid. May 23.

5640 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of triphenylmethane derivatives and of azo colouring matters therefrom. June 5.

6227 (1907). Badische Anilin und Soda Fabrik. Manufacture of azo colouring matter and pigments or lakes therefrom. May 29.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

11,575. Chedlow, Dreaper, and Hall. Treatment of textile fabrics. May 17.

11,715. Jukes, Wilson, and The Ballymenagh Woollen Factory. Manufacture of textile fabrics. May 18.

11,902. Ashton and Ashton. Machines for bleaching, scouring, or otherwise treating yarns or fabrics. May 22.

11,903. Schmitz. Manufacture of fatty compounds suitable for Turkey red dyeing. May 22.

11,928. Kraemer, and Kraemer und van Elsberg G.m.b.H. Improving textile fibres, threads, and fabrics.* May 22.

12,033. Schmitt. Production of artificial wool from jute, ramie, cotton, or other vegetable fibres. May 24.

12,215. Campbell. Apparatus for treating textile fibres.* May 27.

12,219. Johnson (Badische Anilin und Soda Fabrik). Dyeing with sulphur colouring matters and preparations for use therein.* May 27.

12,556. Dugour. Preparation for impregnating textile fabrics.* May 30.

Complete Specifications Accepted.

10,901 (1906). Brimkes. Apparatus for treating raw cotton, animal hair, and like material. May 23.

14,115 (1906). Lees and Eastwood. Shrinking piece goods. May 29.

15,629 (1906). Ellis (Merck). Impregnation of cotton fibres or cotton fabrics. May 29.

28,995 (1906). Venter. Devices for drying textile material. June 5.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

12,256. Reinhold and Palm. Composition for dyeing leather.* May 27.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

11,175. Engelhorn. Manufacturing composite aluminium oxides * May 13.

11 187. Boult (Günther and Franke). Extraction of sulphur from gangue or other material.* May 13.

11,338. Evans. Preparation of red oxide of iron and zinc sulphate. May 15.

11,494. Köhler. Manufacture of sulphur compounds. [Ger. Appl., May 28, 1906.]* May 16.

11,559. Petersen. Preventing the denitrating action in Gay-Lussac absorption apparatus.* May 17.

11,579. Mackey. Treatment of spent ammonia liquor. May 17.

12,110. New Salt Synd., Ltd., and Royston. Melting and purifying salt and other substances. May 25.

12,213. Eschelmann, and Ges. der Tentelewschen Chem. Fabr. Purification of gases from pyrites burners.* May 27.

12,237. Gaillot and Brisset. Converting the nitrogen of peat into ammonia and recovering the latter. May 27.

12,575. Kynaston, and United Alkali Co. Recovery of zinc or other metals from liquors. May 30.

12,577. Marcheville-Daguin et Cie. Extraction of sodium chloride from saline waters. [Fr. Appl., Dec. 22, 1906.]* May 30.

Complete Specifications Accepted.

11,902 (1906). Leslie. Manufacture and recovery of carbonic acid. May 23.

14,278 and 14,279 (1906). Dennis and Co., and Dennis. Sulphate of copper coolers. May 23.

15,591 (1906). Jaeger. Manufacture of metal oxides. May 23.

15,973 (1906). Bran and van Oordt. Separation of beryllia from alumina and iron. June 5.

16,340 (1906). Clayton. Regulating the supply of air to sulphur-burning furnaces. May 23.

16,910 (1906). Johnson (Verein Chem. Fabr.). Separation of arsenic from gases and liquids. June 5.

28,449 (1906). Wolffenstein and Boeters. Concentration of dilute nitric acid. June 5.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

12,583. Lake (Chem. Fabr. Gü trow). Manufacture of enamel. May 30.

Complete Specifications Accepted.

12,431 (1906). Fourcault. Apparatus for drawing glass. June 5.

16,714 (1906). Engelhorn. Manufacture of substances containing aluminium oxide, and their treatment to form ceramic masses. June 5.

18,769 (1906). Twyford and Moore. Gas-fired pottery and other kilns and ovens. May 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

11,514. Koepfer. Impregnating, colouring, or preserving wood.* May 16.

11,533. Macknight. Treatment of roads and substances therefor. May 17.

12,137. Lefranc. Artificial stone. [Fr. Appl., May 26, 1906.]* May 25.

Complete Specifications Accepted.

13,007 (1906). Bale. Compositions for absorbing dust. May 29.

14,992 (1906). Wilson and Wilson. Hydraulic cement. May 23.

18,964 (1906). Schwanenberg and Rinne. Hardening artificial stone compositions containing lime by carbonic acid. May 29.

29,408 (1906). Morgan. Cement kilns. May 23.

3404 (1907). Newberry. Manufacture of cement. May 29.

X.—METALLURGY.

Applications.

11,117. Angel. Concentration of ores containing metal sulphurets. May 13.

11,200. Thomas and Co., Ltd., and Thomas. Cleaning or pickling iron and steel. May 14.

11,297. Cowper-Coles. Recovery of gold from cyanide solutions. May 14.

11,431. MacArthur. Treatment of ores containing antimony. May 16.

11,454. Morehead. Crucible furnaces. May 16.

11,606. Kühne. Production of metals, metalloids, or alloys.* May 17.

11,679. De Back-Begavár. Treatment of tin articles to facilitate detinning. May 18.

11,865. Buendia. Concentration of minerals by means of an intermittent liquid current. [Span. Appl., May 23, 1906.]* May 22.

12,266. Maurice. Application of tantalum and its salts and alloys to preserving iron, &c. May 27.

12,267. Maurice. Extraction of tantalum from ores as an alloy. May 27.

12,467. Strab. Recovery of metal from blast-furnace dust. May 29.

12,505. Gutensohn. Treatment of silver, silver-lead, antimonial, and nickel sulphide ores. May 30.

12,563. Jullien et Dessollo. Rendering electrolytic copper homogeneous. [Belg. Appl., May 31, 1906.]* May 30.

12,575. Kynaston, and United Alkali Co. *See under* VII.

12,591. Imbert. Treatment of sulphurous ores by precipitation.* May 30.

12,592. Imbert. Treatment of oxidised zinc ores by precipitation.* May 30.

12,607. Moon and Moon. Manufacture of iron and steel. May 31.

12,726. Goschen (Solis). Apparatus for treating slimes, &c., with air and other fluids. June 1.

12,745. Cowper-Coles. Treatment of copper precipitate. June 1.

12,748. Cowper-Coles Rendering silver non-tarnishable. June 1.

Complete Specifications Accepted.

9959 (1906). Gauntlett, and Sherardizing Synd. Deposition of metals on metals or metallic articles. June 5.

11,191 (1906). Schmidt and Desgraz. Furnace for obtaining zinc from zinc ores. May 23.

11,974 (1906). Hadfield. Manufacture of magnetic material. May 29.

13,845 (1906). Newton and Newton. Magnetic separators. June 5.

16,440 (1906). Flohr. Manufacture of iron or steel by the basic Bessemer process. May 29.

28,587 (1906). Cowper-Coles. Production of alloys of silver. May 29.

387 (1907). Lash. Reduction of iron oxides. May 23.

407 (1907). Sauerbrey. Dressing ores, &c., on jigger sieves. May 23.

1085 (1907). Cowper-Coles. Magnetic separators. May 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

11,122. Szek. Accumulator plates. May 13.

11,353. Digby and Biggs. Devices for determining the resistances of liquids and electrolytes. May 15.

11,471. Cowper-Coles. Electro-deposition of metals. May 16.

11,478. Imray (Soc. Chem. Ind. in Basle). *See under* XX.

11,917. Röchling, Schoenawa, and Rodenhauser. Electrodes for resistance furnaces.* May 22.

12,220. Johnson (Badische Anilin und Soda Fabrik). Production and employment of electric currents of high periodicity. May 27.

12,581. Trillon, and Soc. Electro-Chimique du Giffre. Electric furnaces. [Fr. Appl., Sept. 26, 1906.]* May 30.

12,747. Cowper-Coles. Electro-deposition of iron. June 1.

Complete Specifications Accepted.

11,652 (1906). Buhot. Electric batteries. May 29.

17,768 (1906). Bridge. Electrically treating air and other gases. May 23.

21,349 (1906). Cowper-Coles. Electrolytic production of copper wire, strip, or the like. May 23.

22,752 (1906). Connor and Stubbs. Electrodes. May 29.

28,897 (1906). Cowper-Coles. Electro-deposition of iron. May 23.

596 (1907). Cowper-Coles. Electric furnaces. May 29.

3803 (1907). Féry and Langlet. Electric resistance furnaces. June 5.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

12,210. Barbé, Garelli, and De Paoli. Saponification of fatty matters by liquor ammonia under pressure.* May 27.

Complete Specification Accepted.

11,622 (1906). Iveson and Wilson. Apparatus for pressing soap, fat, or like substances. May 23.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

11,803. Steinau. Rendering lithopone proof against sunlight and atmospheric influences. [Ger. Appl., Sept. 17, 1906.]* May 21.

11,901. Hannay and Wilson. Manufacture of a white sulphate of lead pigment. May 22.

Complete Specification Accepted.

6227 (1907). Badische Anilin und Soda Fabrik. *See under* IV.

(*C.*)—India-Rubber.

Complete Specifications Accepted.

23,681 (1906). Ellis (Prod. Chim. de Croissy J. Basler et Cie.). Regeneration of rubber waste and improving the quality of caoutchouc. June 5.

24,970 (1906). Gentzsch. Utilisation of waste rubber. June 5.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

29,368A (1906). Roach and Roach. Composition for stuffing leather.* May 14.

11,279. Whybrow, Bendall, and Weygang. Leather substitute. May 14.

12,737. Dugour. Preparation used for producing artificial leather. June 1.

Complete Specifications Accepted.

13,621 (1906). Carter. Tan pits. May 23.
29,368 (1906). Roach and Roach. Process of tanning hides. May 23.

XV.—MANURES, &c.

Application.

12,741. Roth. Manufacture of a fertiliser from atmospheric nitrogen.* June 1.

Complete Specification Accepted.

28,108 (1906). Effront. Utilising the nitrogen contained in distillers' washes. June 5.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

11,159. Klopfer. Production of starch and gluten from wheat flour.* May 13.
11,491. Lichtenstein. Manufacture of caramel and of a material for use in making caramel. May 16.
11,799. Duryea. Manufacture of maltose.* May 21.
11,800. Duryea. Manufacture of glucose.* May 21.
11,801. Duryea. Highly modifying starch.* May 21.
11,802. Duryea. Process of refining syrup.* May 21.

Complete Specification Accepted.

12,291 (1906). Jewson. Manufacture of starch hydrolytic products. May 23.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

11,882. Bailey. Process for obtaining wort from unmalted grain. May 22.
12,102. Armstrong. Process of fermenting in brewing, distilling, and the like. May 23.
12,251. Heymann. Preparation of malt.* May 27.
12,454. Ackermann. Coating vessels, particularly fermenting vessels, with material capable of resisting the action of wort or other liquids.* May 29.
12,544. Boult (Heuser and Brain). Preparation of grains for malting. May 30.

Complete Specifications Accepted.

15,179 (1906). Foll. Apparatus for drying yeast. May 29.
15,254 (1906). Bailey. Production of sterilised non-deposit beer. May 29.
15,966 (1906). Kubessa. Brewing process. May 23.
27,343 (1906). Bailey. Obtaining wort from un-malted grain. May 23.
28,108 (1906). Effront. *See under* XV.
1101 (1907). Mackenzie (Deckebach). Process of cooling wort. June 5.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

11,159. Klopfer. *See under* XVI.
11,564. Winter. Substitutes for butter. May 17.
12,095. Riegel. Preparation of jelk-emulsion to be used in the production of edible fats, butter substitutes, &c. May 24.
12,164. Loring. Treatment of flour. May 27.
12,355. Sörensen. Artificial butter.* May 28.
12,561. Schou and Schou. Manufacture of margarine. [Ger. Appl., Dec. 14, 1906.]* May 30.

Complete Specifications Accepted.

12,398 (1906). Janitzky, Hamilton, and Cummings. Preservation of animal substances. May 29.
15,173 (1906). Wurm. Concentrating milk. June 5.
444 (1907). Twitchell and O'Connor. Apparatus for carbonating liquids. May 29.
8708 (1907). Aktiebolaget Baltic Separator. Manufacture of butter. May 29.

(*B.*)—Sanitation; Water Purification.

Applications.

11,282. Howard. Preparation of filter beds. May 14.
11,710. Soc. l'Air Liquide. Purification of air or other gases. [Fr. Appl., May 26, 1906.]* May 18.

Complete Specifications Accepted.

11,066 (1906). Fox. Apparatus for softening and purifying water. May 23.
20,440 (1906). Naylor and Naylor. Filter beds. May 23.
24,945 (1906). McLean and Paterson. Preparation of valuable products from sewage sludge. May 29.
29,378 (1906). Johnstone. Apparatus for treating offal. June 5.

(*C.*)—Disinfectants.

Applications.

11,132. Moore. Sheep-dip.* May 13.
12,171. Little and Morris. Cleansing fluids for dipping sheep. May 27.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

11,397. Béthisy and Fouchard. Manufacture of non-inflammable celluloid. [Fr. Appl., July 12, 1906.]* May 15.
12,629. Cremer. Manufacture or treatment of paper. May 31.
12,645. Newbery. Machines for marbling paper.* May 31.

Complete Specifications Accepted.

11,103 (1906). Fleury. Preparation of paper pulp. May 23.
12,920 (1906). Cochran. Production of cellulose. June 5.
15,068 (1906). Stock. Paper-making machines. June 5.
29,404 (1906). Lake (Pepperell Card and Paper Co.). Coating machine for paper. May 29.
1314 (1907). Langheck. Stahl, and Kahler. Covering paper or other surfaces with gelatine. May 29.
2770 (1907). Cantine. Machine for coating paper. May 23.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

11,478. Imray (Soc. Chem. Ind. in Basle). Electrolytic oxidation of isoborneol to camphor. May 16.
12,362. Moore. Preparation of compounds containing arsenic in organic combination. May 28.

Complete Specifications Accepted.

17,573 (1906). Goldsmith, and British Xylonite Co. Manufacture of camphor. May 29.

22,336 (1906). Johnson (Kalle und Co.). Manufacture of mercurial compounds of *o*-nitrotoluene and of *o*-nitrobenzaldehyde therefrom. May 29.

23,648 (1906). Newton (Bayer und Co.). Manufacture of halogen substitution derivatives of fatty acids. May 23.

23,780 (1906). Tompkins, and Clayton Aniline Co. Manufacture of trichlorethylene and hexachlorbenzene. June 5.

8375 (1907). Garin and David. Treating substances containing crude tartar. May 29.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

11,442. Braun. Colour photography. May 16.

12,304. Wellcome, Bates, and Starnes. Photographic processes.* May 28.

Complete Specifications Accepted

13,561 (1906). Burnett. Photographic plates. May 29.

1454 (1907). Smith. Manufacture of films for photographic and other purposes. May 29.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

12,378. New Explosives Co., Ltd., and Carter. Manufacture of compressed guncotton charges for projectiles, torpedoes, &c. May 28.

Complete Specifications Accepted.

13,983 (1906). White. Detonating compound for use in torpedoes, mining and blasting cartridges, &c. June 5.

16,676 (1906). Cocking, and Kynoch, Ltd. Manufacture of nitrocellulose. May 23.

21,866 (1906). Wheelwright. Igniting composition for the manufacture of matches. May 29.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Complete Specification Accepted.

24,405 (1906). South Staffordshire Mond Gas Co., and Pinnock. Portable gas analysis apparatus. June 5.

Journal of the Society of Chemical Industry.

No. 12, Vol. XXVI. JUNE 29, 1907. No. 12, Vol. XXVI.

CHARTER

OF THE

Society of Chemical Industry.

GRANTED JUNE 17th, 1907.

EDWARD THE SEVENTH, BY THE GRACE OF GOD, of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, King, Defender of the Faith:

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETING:

Whereas an humble petition has been presented to Us in Our Council by Eustace Carey Esquire, F.C.S., Edward Divers Esquire, M.D., F.I.C., D.Sc., F.R.S., Sir William Ramsay K.C.B., F.I.C., D.Sc., LL.D., F.R.S., Sir Henry Enfield Roscoe, Knight, Ph.D., LL.D., D.C.L., F.R.S., Sir James Dewar, Knight, F.I.C., M.A., LL.D., D.Sc., F.R.S., Ludwig Mond Esquire, F.I.C., Hon D.Sc. (Vict.), Ph.D., F.R.S., Ivan Levinstein Esquire, F.C.S., Sir Joseph Wilson Swan, Knight, D.Sc., M.A., F.R.S., Thomas Tyrer Esquire, F.I.C., F.C.S., George Beilby Esquire, F.R.S., David Howard Esquire, F.I.C., F.C.S., Sir Boverton Redwood, Knight, D.Sc., F.I.C., F.C.S., Samuel Hall Esquire, F.I.C., F.C.S., and Christopher C. Hutchinson Esquire, F.I.C., F.C.S., M.Inst.C.E., A.R.C.S.I., setting forth to the effect following:—

That the petitioner Eustace Carey is the President, the petitioners Sir James Dewar, Sir Henry Enfield Roscoe, Sir Joseph Wilson Swan, Ivan Levinstein and George Beilby are past Presidents, the petitioner Ludwig Mond is Honorary Foreign Secretary, the petitioners Edward Divers, David Howard, and Sir William Ramsay are Vice-Presidents, the petitioner Samuel Hall is the Honorary Treasurer, the petitioners Sir Boverton Redwood and Thomas Tyrer are members of the Council, and the said Christopher C. Hutchinson is a member of a Society named the "Society of Chemical Industry" (hereinafter called the "Society"):

That the Society was established in the year 1881, for the objects following (that is to say):—

A. To advance applied chemistry in all its branches;

B. To afford the members thereof opportunities for the interchange of ideas with respect to improvements in the various chemical industries and for the discussion of all matters bearing upon the practice of applied chemistry and the publication of information thereon;

C. To acquire and dispose of property for the purposes aforesaid ;

D. To do all other things incidental or conducive to the attainment of the above-named objects or any of them ;

That the Society comprises amongst its members chemical manufacturers and manufacturing chemists chemical engineers metallurgists and metallurgical chemists technological and consulting chemists and other persons employed in or connected with manufacturing operations cognate to or allied with industrial chemistry as well as professors and teachers of technology in the universities colleges technical institutes and schools of the United Kingdom of Great Britain and Ireland and many of the chemical and technological advisers of the various Departments of the Government are also members of the Society :

That the members of the Society exceed 4,000 in number of whom about 2,000 members reside abroad throughout Canada India New South Wales and other British Colonies and Dependencies as well as the United States of America Japan and the several countries of the Continent of Europe and that all such members take part subject to the management and direction of the Council in London in furthering and advancing the said objects for which the Society was established :

That the income of the Society is devoted solely towards the promotion and furtherance of the objects hereinbefore set forth and is derived from the entrance fees and annual contributions of members and the dividends accruing from the investments and other property of the Society :

That the wide distribution of the members and the desirability of furthering the advancement of the objects and purposes of the Society more effectively especially those connected with the interchange of ideas with respect to improvements in the various chemical industries the discussion of all matters bearing upon the practice of applied chemistry and the publication of information thereon rendered it necessary to hold meetings of as many members locally as is possible and with such object Local Sections have been formed at the centres following (that is to say) :—

Birmingham Canada Liverpool London Manchester Newcastle-upon-Tyne New England New York Nottingham Scotland Sydney (New South Wales) and Yorkshire :

That the Society has during the period 1881 to 1902 once and from the year 1902 twice in every month printed and published a journal intituled " the Journal of the Society of Chemical Industry " wherein are published *inter alia* the proceedings of the Society and of the Local Sections and such Journal has been issued free to all members and also presented for the use of the Public to various Learned and Technical Societies, Colleges and Educational Institutions, Public Libraries, and Public Departments :

That the Society has advanced all classes of arts and manufactures connected with or dependent upon the many ramifications of industrial chemistry :

That the Society has caused to be made known many valuable discoveries and has secured the application of improved modes and methods of manufacture in such manner that manufacturing industries carried on in Our Dominions of the United Kingdom Our Colonies and Dependencies as well as in other parts of the world have derived manifold and great advantages:

That the petitioners humbly urge upon Our gracious consideration as a matter of supreme and growing importance that the manufactures as well as the trade connected therewith of all portions of the Dominions under Our wise rule should by every means be encouraged by a bountiful dissemination of all useful knowledge so as to ensure the application to the arts and manufactures of all new discoveries to enable manufactured products to be the more economically obtained to utilise and better develop the abundant natural resources and produce of all parts of Our Empire and in such wise to enable Our Subjects of all classes and races to maintain successfully their position in the markets of the world:

That it has been represented to Us that it would greatly add to the Society's influence and tend to the better accomplishment of its objects and purposes and assure the better fulfilment of the aims aforesaid and especially promote the enlargement of the sphere of its labours in those of Our Dominions beyond the seas and by giving it a status and dignity not now possessed would be the means of securing adequate recognition amongst the communities of Foreign States with whom in pursuance of its objects and purposes it is desirable that it should cultivate relations of amity and free intercourse if the members of the Society were to be incorporated under and subject to the grant of Our Royal Charter:

That the petitioners propose if incorporated by the grant of Our Royal Charter as aforesaid that all persons who at the date of such incorporation are members of the Society shall be admitted as members of the Society incorporated by Royal Charter (hereinafter called "the Chartered Society") that all real and personal property choses in action liabilities duties and obligations of every kind and nature whatsoever vested in existing attached to or imposed upon the Society shall become vested in transferred attached to or imposed upon the Chartered Society as the case may be according to the several provisions of the existing law applicable thereto and that generally the constitution of the Society shall be and become the constitution of the Chartered Society:

And whereas the Petitioners by the said Petition on behalf of themselves and the other members of the Society most humbly pray that We would be graciously pleased to grant Our Royal Charter for incorporating the petitioners and others under the title of "Society of Chemical Industry" or such other title and with all such powers and privileges as are mentioned in the Petition or such other as to Us might seem fit:

NOW THEREFORE We having taken the said Petition into Our Royal consideration in Our Council and being satisfied that the intentions of the petitioners are laudable and deserving of encouragement have constituted erected and incorporated and We by Our prerogative Royal and of Our especial grace certain knowledge and mere motion by these presents for Us and Our Royal successors do constitute, erect and incorporate into one body politic and incorporate by the name of Society of Chemical Industry the said Eustace Carey Esquire, F.C.S., Edward Divers Esquire, M.D., F.I.C., D.Sc., F.R.S., Sir William Ramsay K.C.B., F.I.C., D.Sc., LL.D., F.R.S., Sir Henry Enfield Roscoe, Knight, Ph.D., LL.D., D.C.L., F.R.S., Sir James Dewar, Knight, F.I.C., M.A., LL.D., D.Sc., F.R.S., Ludwig Mond Esquire, F.I.C., Hon. D.Sc. (Vict.), Ph.D., F.R.S., Ivan Levinstein Esquire, F.C.S., Sir Joseph W. Swan, Knight, D.Sc., M.A., F.R.S., Thomas Tyrer Esquire, F.I.C., F.C.S., George Beilby Esquire, F.R.S., David Howard Esquire, F.I.C., F.C.S., Sir Boverton Redwood, Knight, D.Sc., F.I.C., F.C.S., Samuel Hall Esquire, F.I.C., F.C.S., and Christopher C. Hutchinson Esquire, F.I.C., F.C.S., M.Inst.C.E., A.R.C.S.I., and such other persons as are by this Our Charter made or declared to be members or shall hereafter be admitted as members of that body corporate with perpetual succession and a common seal and with power to alter and renew the same at their discretion and with capacity by that name to sue and be sued and to take and hold any personal property and notwithstanding the statutes of mortmain from time to time to purchase take and hold in perpetuity or for any term or estate any lands the yearly value of which including the site of a Hall shall not exceed in the whole the sum of two thousand pounds computing the same respectively at the Rack Rent which might have been had or obtained for the same respectively at the time of the purchase or acquisition thereof with power from time to time to sell grant lease exchange mortgage and dispose of the same but so that the body corporate aforesaid shall apply its profits (if any) or other income in promoting its objects and shall not at any time pay any dividend to its members or any of them.

And We do will ordain and declare as follows (that is to say) :—

PRELIMINARY.

1. In this Our Charter—

"The Society of 1881" means the said Society of Chemical Industry established in London in 1881.

"The Society" means the Society of Chemical Industry incorporated by this Our Charter.

"The Council" means the Council for the time being of the Society.

"General meeting" means a general meeting of the members of the Society.

"By-laws" means By-laws of the Society made under this Our Charter.

"Commencement of the By-laws" means the time when the first By-laws made under this Our Charter come into operation.

"The Journal" means the Journal of the Society published under the authority of the Council subject to the By-laws.

"Local Section" means members of the Society whose names are entered on the register of a district or locality and who subject to the By-laws are sanctioned by the Council to promote the objects of the Society in such district or locality.

"Month" means calendar month.

"The Interpretation Act" shall apply to this Our Charter.

TRANSFER OF PROPERTY.

2. The Society shall have power to receive from the Council of the Society of 1881 and other the trustees of the said Society and to hold all lands buildings property rights and easements which before the date of this Our Charter were vested in the Council as by law the governing body of the Society of 1881 or in any person in trust for the Society of 1881 or to which the Society of 1881 was in anywise entitled and all moneys securities credits choses in action books papers effects and other property whatsoever which before the date of this Our Charter belonged to the Council of the Society of 1881 as aforesaid or to any trustees on its behalf and the benefit of all contracts and engagements entered into by or on behalf of the Society of 1881 and in force before the date of this Our Charter to the same extent and for the same estate and interest as the same were previously to the date of this Our Charter vested in the Council of the Society of 1881 or any trustee on its behalf.

OBJECTS.

3. The objects of the Society shall be to carry on the work commenced and heretofore generally carried on by the Society of 1881 and to promote the application of chemical science to arts and manufactures and also the discussion and diffusion of all knowledge and information and to further by causing to be made or assisting in the making of investigations inquiries and reports upon novelties improvements inventions processes and the practical application of scientific discoveries bearing upon the practice of applied chemistry and of any of the industrial arts thereto allied and to carry on the publication of the Journal but such objects shall not comprise nor shall this Our Charter confer upon the Society any power or right to act as an examining Body for the purpose of prescribing or holding examinations whereby degrees qualifications or authority to practice or to use any distinctive title can or may be conferred upon practising consulting analytical or technical chemists or any other persons whatsoever whether or not members of the Society.

THE COUNCIL.

4. There shall be a Council of the Society consisting of subject to the provisions of any By-law—

(*a*) A President and 12 Vice-Presidents in addition to ordinary elected members not exceeding 12 in number chosen from members of the Society.

(*b*) *Ex officio* members as prescribed by the By-laws and the Chairman and Honorary Secretary respectively of the several Local Sections.

5. The first members of the Council shall be the following namely :—

Frederick E. Atteaux.
Leo Baekeland Ph.D.
Julian Levett Baker.
James Carter Bell.
Frederick Woodward Branson.
Alfred Burton.
Eustace Carey.
Alan Avery Claflin.
James Terence Conroy Ph.D.
Edward Divers M.D., D.Sc., F.R.S.
John Thomas Dunn D.Sc.
William Hodgson Ellis.
Thomas Fairley.
Charles Edward Fawsitt Ph.D.
Percy Faraday Frankland Ph.D., A.R.S.M., F.R.S.
Richard John Friswell.
Frederick Charles Garrett D.Sc.
Samuel Hall.
William Roscoe Hardwick B.Sc.
William Robert Eaton Hodgkinson Ph.D.
Egbert Grant Hooper.
Julius Hübner.
Charles Alexander Keane Ph.D., M.Sc.
Charles Thomas Kingzett.
Julius Lewkowitsch Ph.D.
Arthur Robert Ling.
Edward Gurley Love D.Sc.
John Stewart Macarthur.
Karl Emile Markel Ph.D.
Nicholas Henry Martin.
Raphael Meldola F.R.S.
Ludwig Mond Ph.D., F.R.S.
William Henry Nichols.
Francis Richard O'Shaughnessy.
Oliver Quibell.
Sir Boverton Redwood, Knight.
Walter Francis Reid.
Alfred Gordon Salamon.
Hugo Schweitzer Ph.D.
Harry Silvester.
Frederick John Smale M.A., Ph.D.
Robert Greig Smith D.Sc.
George Cameron Stone.
Francis Henry Tate.
Leonard Temple Thorne Ph.D.
Samuel Russell Trotman.
Thomas Tyrer.
Thomas Utrick Walton B.Sc.
Sir Thomas Wardle, Knight.
Charles Wightman.
Reginald Cowdell Woodcock.

6. The first meeting of the Council shall be held at Palace Chambers in the City of Westminster at five o'clock in the afternoon on the third Friday after the date of this Our Charter.

7. The first members of the Council shall hold office until members of the Council are elected as hereinafter provided.

8. By-laws shall prescribe the number of members of the Council and the mode of nomination of candidates for election to the Council and the mode and time of and any other matters relating to the elections including the first election and the mode of filling casual vacancies in the Council.

9. By-laws shall regulate the meetings of the Council and prescribe the number of members of the Council required to be present and act and regulate the proceedings thereat and the adjournment thereof and the appointment of Committees and any other matters connected with the exercise and discharge of the powers and duties of the Council.

10. No act or proceeding of the Council shall be invalidated by any vacancy in the Council provided the number of members of the Council be not reduced below one-half of the full number prescribed by By-laws.

11. The Council shall have the management and superintendence of the affairs of the Society and shall appoint and may remove and

shall determine the duties salaries and remuneration of the Secretary Editor Solicitors Bankers Clerks Agents and other officers and servants of the Society and shall determine the securities if any to be taken from any of them and may make such arrangements and enter into such agreements with them as the Council think fit.

12. The Council may apply the funds of the Society in purchasing and holding lands to the extent and in the manner hereinbefore recited and in acquiring extending and improving a library for the Society and in erecting and fitting up suitable buildings for the use of the members of the Society and for other purposes connected with the objects of the Society and in paying the salaries of librarians custodians and other officers and servants for any purposes of the Society and otherwise in promoting the objects of the Society.

13. The Council may apply the funds of the Society to preparing printing and publishing the Journal which shall contain information relating to applied chemistry and the practice thereof and other matter such as the Council shall subject to By-laws authorise and from time to time prescribe.

14. The Council may apply the funds of the Society for or towards making provision for pensioning officers and servants of the Society as to them may seem just.

15. The Council may at any meetings at which (subject to any provision in the By-laws) four members at least of the Council are present and acting exercise all powers of the Society except as regards such matters as are by this Our Charter or by By-laws required to be transacted by or at a general meeting of the Society.

16. The exercise of all powers exercisable by the Council shall be subject to the control of general meetings but so that any act done by the Council before any resolution of a general meeting shall not be invalidated by any such resolution.

Presidents and Vice-Presidents.

17. There shall be a President and Vice-Presidents of the Society and of the Council whose respective numbers powers duties and privileges (if any) shall be prescribed by By-laws.

18. The first President shall be Sir Boverton Redwood, Knight. The first Vice-Presidents shall be—

Leo Baekeland Ph.D.
James Carter Bell.
Eustace Carey.
Edward Divers M.D., D.Sc., F.R.S.
Percy Faraday Frankland Ph.D., A.R.S.M., F.R.S.
Julius Lewkowitsch Ph.D.
Edward Gurley Love D.Sc.
Raphael Meldola F.R.S.
William Henry Nichols D.Sc., LL.D.
Walter Francis Reid.
Alfred Gordon Salamon.
Charles Wightman.

19. A vacancy in the office of the first President or of any of the first Vice-Presidents shall be filled by the Council.

20. The first President and Vice-Presidents or their respective successors as aforesaid shall hold office until a President and Vice-Presidents respectively are elected or appointed as hereinafter provided.

21. The President and every Vice-President shall always be elected or appointed from among the members.

MEMBERS.

22. All persons who at the date of this Our Charter are attached to the Society of 1881 as members thereof shall under and by virtue of this Our Charter become and shall be members of the Society.

23. Notwithstanding anything in this Our Charter no person who has not attained the age of twenty-one years shall become by virtue of this Our Charter or be at any time eligible as a member.

24. The Council shall have power to decide conclusively respecting each person proposed for admission as a member whether he has or has not fulfilled such conditions as are required by this Our Charter or are prescribed by By-laws.

25. Notwithstanding anything in this Our Charter no person shall by virtue thereof become or be entitled to become or be a member of the Society before the commencement of the By-laws unless and until he pays the sum or sums payable by him under the By-laws of the Society of 1881 but members who have prior to the date of this Our Charter compounded for the sum or sums payable by them to the Society of 1881 are hereby excepted.

26. By-laws shall prescribe the amount of subscription fees or other charges payable from time to time by members other than those members who have prior to the date of this Our Charter compounded for the sum or sums payable by them to the Society of 1881.

RIGHTS OF MEMBERS.

27. All members of the Society shall subject to any restrictions in By-laws be entitled to be present and vote at general meetings and take part in the discussion of business thereat.

28. All members of the Society shall subject to any restrictions in By-laws be entitled to be present at and take part in the proceedings of any meeting of a Local Section except such meetings as shall be called by a local section for the purposes of management thereof at which meetings only those members of the Society shall be entitled to be present whose names appear on the register of such Local Section.

29. Every member of the Society shall be entitled to receive free of any payment therefor a copy of each number of the Journal as soon as practicable after the same shall be published but a member who at any time after the grant of this Our Charter shall be in default with his subscription shall not be entitled to receive such copy.

30. No member shall derive any pecuniary benefit from membership either directly or indirectly by way of dividend bonus or other-

wise nor shall any person claiming under or through any member save and except that nothing shall prevent the payment in good faith of remuneration to any member who shall be a duly appointed officer or servant of the Society or to any of the members thereof or other persons in return for services *bonâ fide* rendered or work done by them for or on behalf of the Society in furtherance of its objects under the authority or by the direction of the Council.

Cesser of Membership.

31. If any person ceases for any cause whatever to be a member of the Society he shall not nor shall his representatives have any interest in or claim against the funds or property of the Society.

Local Sections.

32. The Council shall be at liberty whenever thirty or more members of the Society from any district or locality by requisition in writing express their desire to the Council to hold meetings to further the objects of the Society in such district or locality and for such purpose to form a Local Section of the Society to cause to be prepared a register of the names of the said members and other members desirous of so doing and subject to any restrictions in By-laws the Council may consent to the formation of such Local Sections.

33. Subject to such rules and regulations as shall be submitted to and approved by the Council save that the same shall not be repugnant to or inconsistent with By-laws of the Society or be of any effect until so approved a Local Section shall be governed and managed by a Committee consisting of a Chairman an Honorary Secretary together with ordinary members of Committee not exceeding fifteen in number chosen from members of the Society whose names appear on the register of such Local Section.

34. The Chairman and Honorary Secretary of a Local Section shall be *ex officio* members of the Council.

Supplemental Charters.

35. Should We or Our successors think fit to grant any supplemental or additional Charter or Charters to the Society and the same be accepted by a majority of the Council consisting of two-thirds at least of the members thereof present at a meeting of the Council specially summoned for the purpose and should such acceptance be confirmed by a majority of the members present at a general meeting of the Society then and in that case such supplemental or additional Charter or Charters shall be deemed to constitute one Charter with these presents and may repeal amend alter or add to these presents or any such further Charter or Charters and shall be binding in all respects and for all purposes upon the Society and its members.

36. Subject to the express provisions of this Our Charter until the commencement of the By-laws the affairs of the Society and the meetings and proceedings of the Society and of the Council and the election of the Council shall be managed conducted and regulated according to and by the By-laws of the Society of 1881 as if that Society and the Council thereof were the Society and the Council thereof.

By-Laws.

37. The Council shall within six months from the date of this Our Charter prepare draft By-laws and shall send to each member of the Society a printed copy thereof inviting him to offer observations thereon within a time to be limited by the Council and the Council shall take into consideration all observations so offered and shall finally settle the draft By-laws and shall send to each member of the Society the draft By-laws as so finally settled and shall call a general meeting for the consideration and adoption of By-laws to be held on a day not less than one month and not more than three months after the expiration of six months from the date of this Our Charter and not less than 14 days' notice of the time and place of meeting shall be given to the members of the Society by the Council and the meeting so called shall be the first general meeting for the purposes of this Our Charter and all other purposes and the Chairman of that meeting shall be the President of the Society or in his absence one of the Vice-Presidents of the Society or in the absence of all the Vice-Presidents a member of the Council chosen by the meeting but any want of or irregularity in the sending of any such draft By-laws or in the giving of any such notice shall not affect the validity of the By-laws.

38. The Society from time to time may by resolution of a general meeting confirmed at a subsequent general meeting held not less than seven and not more than 28 days after the former meeting make such By-laws as to the Society seem fit and rescind any By-laws and make others in their stead but so that the By-laws for the time being be not in any respect repugnant to the law of England or inconsistent with any express provision of this Our Charter.

39. The purposes for which the Society may in manner aforesaid from time to time make By-laws in addition to any purpose in any other provision of this Our Charter indicated include the following (namely) :—

For regulating the election and admission of the members of the Society.

For regulating the amount and times of payment of entrance fees and other fees and subscriptions or other sums to be paid by members.

For regulating the mode time and place of summoning and holding annual and other general meetings and special meetings of the Society and the mode of voting thereat whether in person or by proxy or by ballot or by voting papers or otherwise and the conduct of proceedings thereat.

For defining and regulating the privileges and benefits of members of the Society.

For prescribing the cases circumstances conditions and manner in and on which a member of the Society may be excluded or suspended from membership.

For regulating the appointment of trustees and their powers and duties and the disposal of the moneys and property of the Society.

For regulating the appointment election rotation retirement and remuneration (if any) of a treasurer or treasurers secretary or secretaries editors and of an auditor or auditors.

For regulating the preparation and publication of the Journal the time or times of issue thereof and the information or other subject matter which shall appear and be published therein.

For prescribing the circumstances conditions and manner subject to which members of the Society may be registered as a Local Section and for regulating the management and proceedings of Local Sections and the rules and regulations thereof to be authorised by the Council.

And generally such By-laws as from time to time seem to the Society requisite for the better execution of this Our Charter and the furtherance of the objects of the Society.

40. By-laws made by the Society shall not commence or have effect until they have been submitted to and allowed by the Lords of Our Council of which allowance a certificate under the hand of the Clerk of our Privy Council shall be conclusive evidence.

41. The Council of the Society shall cause all By-laws when so allowed to be printed with the form of allowance and to be published with that form in the London Gazette.

In witness whereof We have caused these Our Letters to be made Patent.

Witness Ourself at Westminster the seventeenth day of June in the seventh year of Our reign.

BY WARRANT UNDER THE KING'S SIGN MANUAL.

MUIR MACKENZIE.

GREAT SEAL
OF THE
UNITED KINGDOM.

Official Notice.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held in Birmingham on Wednesday, July 10, and following days. The programme was contained in the May 31st number.

In accordance with the provisions of Rule 18 of the By-laws, notice is hereby given that those members whose names are printed in *italics* in the list of Council will retire from their respective offices at the forthcoming Annual Meeting.

Sir Boverton Redwood has been nominated to the office of President, under Rule 8; Prof. Percy Frankland, Prof. R. Meldola, and Mr. Walter F. Reid have been nominated Vice-Presidents under Rule 8; and Mr. Eustace Carey has been nominated a Vice-President under Rule 11. Prof. W. R. Hodgkinson has been nominated an ordinary member of Council under Rule 17; and the Hon. Treasurer and Hon. Foreign Secretary have been nominated for re-election to their respective offices.

Dr. Charles A. Keane, Mr. C. T. Kingzett, Mr. F. H. Tate, and Dr. L. T. Thorne have been nominated, under Rule 18, to fill four vacancies among the ordinary members of Council. No ballot will be required.

The London and North Western, Great Western, Midland, Great Northern, and Great Central Railway Companies have granted the following concessions with regard to fares:—

1. Return tickets at a single fare and a quarter for delegates and others travelling from their homes to Birmingham and back again, on giving up a certificate to be signed by Mr. O'Shaughnessy.

2. Tickets at a single fare and a quarter will be issued for the double journey (on production of card of membership or letter of invitation) *from* Birmingham to places where delegates reside during the Annual Meeting, provided that the distance is not more than 50 miles; the minimum in this case to be 1s. per passenger.

3. Season tickets at a charge of not less than the accumulated fare of a single fare and a quarter *per diem* (minimum 1s. *per diem*) can, if desired, be issued from Birmingham to places distant not more than 50 miles, and these tickets will be valid for more than one journey to enable the delegates sleeping out to return to their hosts for dinner. These tickets will be valid during the time of the Annual General Meeting, namely, from July 9th to July 13th inclusive.

The card of membership, issued in the June 15th number of the Journal, must not be given up to any Railway Company—but the Railway voucher, to be supplied by Mr. O'Shaughnessy with the Annual Meeting tickets, on application, must be given up in exchange for the tickets at a reduced fare.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR 1906.

(Made up to the 22nd May, 1907.)

REVENUE.

		£ *s.* *d.*	£ *s.* *d.*
Annual Subscriptions—			
202 Subscriptions for the year 1906 received in 1905 (*less* 4*s.* short paid)		252 6 0	
3876 Ditto ditto, in 1906		4845 0 0	
57 Ditto ditto, in 1907		71 5 0	
—— (Sundry excess payments and balances)		19 0 2	
4135			5187 11 2
Entrance Fees (353 at £1 1*s.* 0*d.*)		370 13 0	
Life Composition Fees (1 at £20 0*s.* 0*d.*)		20 0 0	
"Collective Index" Subscriptions		11 17 0	
"Decennial" Index ditto		16 11 0	
			28 8 0
	£ *s.* *d.*		
Interest from Investments—			
Gas Light & Coke Coy. 3% Consold. Stock	600 0 0	17 2 0	
Great Eastern Rly. 4% Irredeemable do.	1509 0 0	57 6 10	
Great Northern Ry. 3% Debenture do.	800 0 0	22 16 0	
Gt. Western Rly. 5% Guard. Prefce. do.	1250 0 0	59 7 6	
Metropolitan Rly. 5% Consolidated Stock	4476 9 2	127 11 8	
Midland Raily. 2½% Perpetual Prefce. do.	1696 0 0	40 5 8	
New South Wales 3% 1935 Stock	485 4 8	13 16 6	
New Zealand 3% 1945 do.	1000 0 0	28 10 0	
North British Ry. 3% Consd. Lien do.	1084 13 4	30 18 4	
Nottingham and Grantham Ry. 4½% do. do.	450 0 0	17 6 4	
Nottingham Joint Station 3% Debenture do.	200 0 0	5 14 0	
South Eastern Rly. 4½% Preferred Stock	673 0 0	28 15 4	
Southwark and Vauxhall Water Compy. 3% Debenture Stock	1000 0 0	28 10 0	
Deposit account at Bank	..	57 15 1	
			535 15 3
	£15,224 7 2		
Journal—			
Advertisements		231 1 3	
Sales		542 7 9	
			743 9 0
			£6495 3 5

EXPENDITURE.

	£ *s.* *d.*	£ *s.* *d.*	£. *s.* *d.*
Journal Expenses—			
Publishing		2566 1 11	
Editorial—			
Editor's Salary	600 0 0		
Do. Expenses	65 6 11		
Abstractors	567 16 5		
Indexing Journal	75 0 0		
Sub-Editor's Salary	150 0 0		
Foreign Journals	11 9 0		
Sundry do.	9 13 0		
		1479 5 4	
Insurance of Stock		7 17 6	
French Patents and Specifications		62 11 3	
			4115 16 0
Sectional Expenses		726 1 8	
Annual Meeting Expenses		167 19 6	
			894 1 2
Secretary's Salary		300 0 0	
Assistant		150 0 0	
			450 0 0
Printing Sundries		68 0 3	
Stationery		55 18 6	
Library (Binding Books)		10 13 2	
Clerical Assistance		20 17 6	
Hon. Treasurer's Assistant		52 10 0	
			207 19 5
Office Expenses (Including Rent, Lighting, &c.)		228 12 9	
Auditors Fee		10 10 0	
Sundry Charges		4 12 6	
Bank Charges		3 8 7	
Solicitors' Charges		4 3 0	
			251 8 10
Treasurer's Petty Cash and Postage		22 12 8	
Secretary's ditto ditto		63 7 8	
			86 0 4
"Decennial" Index (1896—1905) and Insurance of Manuscript			104 1 0
Investment—			
£450 Nottingham and Grantham Raily. Company 4½% Consolidated Stock		547 13 2	
Balance of Revenue over Expenditure			385 16 8
			£6495 3 5

THE TREASURER—IN ACCOUNT WITH THE SOCIETY OF CHEMICAL INDUSTRY FOR THE YEAR 1906.

Dr.

	£ s. d.	£ s. d.	£ s. d.
To Cash on Deposit (1 January, 1906)		750 0 0	
„ Balance at Bank (ditto)		361 1 6	
„ Cash in Secretary's hands (ditto)		8 9 9	
			1119 11 3
Annual Subscriptions—			
3 Subscriptions for the year 1904		3 15 0	
74 do. „ „ 1905		92 10 0	
3876 do. „ „ 1906		4843 15 0 1 5 0	
306 do. „ „ 1907		382 10 0	
3 do. „ „ 1908		2 10 0 1 5 0	
4262 Sundry excess payments, and payments "on a/c" of subscriptions for various years..		19 0 2	
			5346 10 2
Entrance Fees (353 at £1 1*s.* 0*d.*) ..			370 13 0
Life Composition Fees (1 at £20)....			20 0 0
"Collective" Index Subscriptions ..		11 17 0	
"Decennial" Index ditto		16 11 0	
			28 8 0
Interest from Investments—			
Gas Light and Coke Coy. 3% Consold. Stock..	600 0 0	17 2 0	
Great Eastern Rly. 4% Irredeemable do. ...	1509 0 0	57 6 10	
Great Northern Rly. 3% Debenture do.	800 0 0	22 16 0	
Great Western Rly. 5% Guard. Prefce. do. ..	1250 0 0	59 7 6	
Metropolitan 3% Consolidated Stock	4476 9 2	127 11 8	
Midland Rly. 2½% Perpetual Prefce. do. ..	1696 0 0	40 5 8	
New South Wales 3% 1935 Stock	485 4 8	13 16 6	
New Zealand 3% 1945 do.	1000 0 0	28 10 0	
North British Rly. 3% Consd. Lien Stock ..	1084 13 4	30 18 4	
Nottingham and Grantham Ry. 4½% Consold. do.	450 0 0	17 6 4	
Nottingham Joint Station 3% Debenture do.	200 0 0	5 14 0	
South Eastern Rly. 4½% Prefce. Stock	673 0 0	28 15 4	
Southwark and Vauxhall Water Compy. 3% Debenture Stock	1000 0 0	28 10 0	
Deposit account at Bank	..	57 15 1	
	£15,224 7 2		535 15 3
Journal—			
Advertisements		237 1 7	
Sales....................................		499 13 5	
			736 15 0
			£8157 12 8

Cr.

	£ s. d.	£ s. d.	£ s. d.
By Journal Expenses—			
Publishing		2581 17 2	
Editorial—			
Editor's Salary ...	600 0 0		
Editor's Expenses	63 16 9		
Abstractors	576 18 8		
Sub-Editor's Salary	150 0 0		
Indexing Journal .	150 19 6		
Foreign Journals .	11 9 0		
Sundry Journals ..	8 15 7		
		1561 19 6	
French Patents and Specifications		64 11 7	
Insurance of Stock		7 17 6	
			4216 5 9
Sectional Expenses—			
Birmingham and Midland Section		44 8 0	
Canadian Section		25 0 0	
Liverpool ditto.................		50 12 8	
London ditto.		139 17 11	
Manchester ditto.		55 17 0	
Newcastle-on-Tyne ditto.........		17 16 10	
New England, U.S.A. ditto.		82 15 2	
New York, U.S.A. ditto.		194 3 10	
Nottingham ditto.		42 1 9	
Scottish ditto.		33 17 11	
Sydney, New South Wales, ditto..		7 14 4	
Yorkshire ditto................		31 16 3	
			726 1 8
Expenses connected with Annual Meeting			167 19 6
Secretary's Salary (see also Sub-Editor)........................		300 0 0	
Assistant.........................		150 0 0	
			450 0 0
Printing Sundries		58 2 4	
Stationery		49 13 6	
Library (Binding Books)		16 10 11	
Clerical Assistance		20 17 6	
Honorarium to Treasurer's Assistant		52 10 0	
Sundries		4 12 6	
			202 6 9
Office Expenses, &c.—			
Rent..............................		153 15 0	
Gas and Electric Light		12 17 2	
Cleaning, Attendance, &c.		21 18 10	
Fittings, Telephones, Furniture, Repairs, Sundry Requisites, &c.		39 13 9	
Fire Insurance		0 8 0	
			228 12 9
Auditors' Fee		10 10 0	
Bank Charges		3 8 7	
Solicitors' Charges		4 5 0	
			18 3 7
Investment—			
£450 Nottingham and Grantham Rly. Co. 4½% Consolidated Stock			547 13 3
"Decennial" Index (1896—1905), paid on account		99 0 0	
Ditto, Insurance of Manuscript		5 1 0	
			104 1 0
Treasurer's Petty Cash and Postage		22 12 8	
Secretary's ditto ditto............		63 7 8	
			86 0 4
Cash on Deposit (31 December, 1906)		1000 0 0	
Balance at Bank (ditto)		393 11 4	
Cash in Secretary's hands (ditto)...		16 16 9	
			1410 8 1
			£8157 12 8

We have compared the above statement with the vouchers, counterfoils of the receipts issued and other records, and are of opinion it correctly exhibits the cash transactions of the Society for the year 1906. The amounts of the Metropolitan 3% Consolidated, 3% New Zealand and 3% New South Wales Stocks have been confirmed by the Chief Accountant to the Bank of England. Certificates for the remaining investments have been inspected and the Bank Balances have been certified to us by the Bankers.

23, St. Swithin's Lane. London, E.C.
16 April. 1907.

(Signed) MIALL. WILKINS, RANDALL & Co.,
Chartered Accountants.

London Section.

Meeting held at Burlington House on June 3, 1907

MR. R. J. FRISWELL IN THE CHAIR.

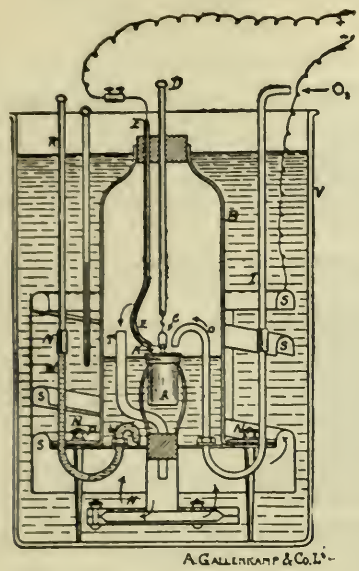
A CALORIMETER FOR VOLATILE LIQUID FUELS, SPECIALLY ADAPTED FOR PETROL.

BY W. HANSEN RAWLES.

The want of a simple and reliable calorimeter for volatile liquid fuels has long been felt, especially during the last few years, since "petrol" has come so much to the front as a source of energy. In "Engineering" (Sept. 21, 1906) a simple calorimeter for liquid fuels was described by Charles R. Darling.

The author, after extensive experiments with "petrol," has contrived to so modify and develop Darling's apparatus as to produce a calorimeter, which, although having a somewhat more complicated appearance, is really very simple to manipulate, and at the same time gives much more reliable results, as practically the whole of the serious sources of error have been removed.

The complete apparatus, as shown in the illustration, consists of a brass lamp, A, of 3-4 cc. capacity, having a jet of about 1/16 inch internal diameter, fitted with an asbestos wick, and a small cap, C. The lamp rests in a tripod



clip, which fits on to the main portion of the apparatus. The bell-jar, B (of glass or copper), the neck of which is fitted with a rubber stopper, carrying a glass rod, D, and an electrical conductor, E, for igniting the petrol, forms the combustion chamber, and is held in its place by means of the brass plate, P. The oxygen required for the combustion is conveyed through the glass tube, I. and introduced into the chamber through the copper tube, O, impinging on to the top of the lamp.

For very volatile liquids, such as "petrol," the lamp is surrounded by cold water during the combustion, to prevent over-heating and consequent boiling and explosion of the contained liquid. This water is introduced through the tube, W, by pouring it down a funnel attached to the rubber connection, N, and then replacing the funnel by a glass rod, R. The hot products of combustion pass down the tube, T, and bubble up through the perforated base-plate, H. A copper spiral of "arch" section fits accurately round the plate, P, and terminates at the top in a circular ring (also of arch section), perforated by small holes. This spiral, together with the plate, P, is held in position by the nuts, N, N, N. The whole apparatus fits loosely into an outer glass vessel, V.

An experiment is carried out as follows:—The "water equivalent" of the calorimeter is found by weighing the various materials composing the calorimeter, multiplying these weights by the specific heats of those materials, and adding the products together. The outer vessel, V, is filled up to the mark (2600 c.c.) with water at a temperature about 2·8 degrees below the temperature of the room. After adjusting the asbestos wick so as to give a steady flame of about ½ in. in height, about 1·5 c.c. of petrol is introduced into the lamp, A, by means of a pipette. The jet is covered with the cap, C, to prevent evaporation, and the lamp, cap, and petrol are accurately weighed. Let this weight equal w. The lamp (still closed by the cap) is quickly placed on its tripod, the tube O firmly adjusted over the lamp, and W screwed tightly into its bed. The bell-jar is now fixed in position on the thick rubber washer by means of the plate, P, the copper spiral rested on this plate with the projections fitting over the three threaded pins, and the nuts, N, N, N, screwed home so as to hold the whole firmly together, yet not tightly enough to produce unnecessary strain. A funnel is connected with the tube, W, by means of the rubber connection, N, and sufficient water (about 100 c.c.) introduced into the bell-jar at the same temperature as that of the water in V, to reach nearly to the top of the lamp, as shown in the figure. The funnel is now replaced by the rod, R. The stopper is inserted in the neck of the bell-jar, and the ignition tube, E, adjusted so that the platinum electrode, K, is slightly above, and about 1/6 inch from the lamp jet. With a little practice all this can be done in a very short time. A very slow stream of oxygen from a cylinder or other convenient reservoir is now passed into the apparatus, and the whole immersed in the water contained in V, which is well stirred, and its temperature (t_1), noted when uniform, by means of a thermometer reading to 0·05 degree. One terminal of an induction coil is connected with the conductor carried by E, and the other terminal is connected with the spiral S, or with the copper bell-jar, if this is used. The cap, C, is now raised from the lamp by means of the glass rod, D, and a momentary current passed through the coil. A spark passes between K and the lamp-jet, igniting the petrol. The electric wires are now removed, as they are good conductors of heat, and the oxygen supply adjusted so that the bubbles escape slowly from the holes in H. These gas bubbles collect round the ledge at the bottom of the spiral, then run up the spiral and finally escape through the small holes at the top into the air. The water is kept stirred during the combustion, which lasts about 12—15 minutes. When the petrol has completely burnt, and the flame is extinguished, the cap is once more lowered on to the lamp-jet, and the tube W opened by removing the rod R from N. The whole of the water in the bell-jar, which is slightly warmer than the outside water, is driven by the pressure of oxygen into the outer vessel. When bubbles begin to issue from W, the rod R is reinstated in its place. The water is still kept well stirred, and when no further rise in its temperature takes place, this maximum temperature (t_2), is noted. The temperature should have risen about 5° C. The apparatus is now removed from the outer vessel, the oxygen supply stopped, and the lamp with cap again weighed, after carefully drying. Let this weight be (w_2).

The calorific value of the petrol is calculated as follows: If M = total weight of water used (in grms.); W = water equivalent of apparatus; R = rise of temperature of the water; w = weight of petrol burnt in grms. = $(w_1 - w_2)$; then the calorific value = $(M+W)R/w$, and British thermal units per lb. = calorific value × 1·8.

The following points should be observed in working. The supply of oxygen should be only just sufficient to ensure smokeless burning of the petrol, as a large excess of oxygen is apt to cause the formation of a carbon deposit on the lamp jet, owing to the cooling of the flame. If this deposit forms it will, if not disturbed, burn off completely when the petrol is exhausted. (*Note*:—The author has found that a persistent formation of this deposit is an indication that the petrol is liable to give poor results in a motor.)

There is a slight evaporation of petrol between the initial weighing of the lamp and the ignition of the petrol in the calorimeter. This interval is usually about 4 to 5 minutes. The evaporation during this period may be determined by weighing the lamp and petrol as in the experiment, allowing to stand for the length of time taken to fit up and ignite, again weighing, and if any appreciable loss has taken place, subtracting this loss from the weight of petrol found $(w_1 - w_2)$, usually about 0·004 grm. It is advisable to replace the cap on the lamp jet after the petrol has ceased to burn as otherwise there will be subsequently a small decrease in weight, not due to combustible petrol. If it is preferred, the combustion may be stopped when any desired rise of temperature has been attained, by simply lowering the cap on the jet. The author prefers to allow the whole of the petrol to be burnt, as he finds that this gives rather more consistent results.

Special features of the calorimeter.—The copper spiral arch ensures very efficient cooling of the gas bubbles, and consequent absorption of the evolved heat by the water, as these bubbles have to travel a distance of nearly 36 inches in contact with both the water and the copper before they escape into the air. The whole apparatus is only 9 inches in height. Greater delicacy may, of course, be obtained by enclosing the whole calorimeter in a jacket and cover of non-conducting material, such as asbestos, felt, wool, &c. In this case, a stirrer of up and down movement is necessary. After different shapes of oxygen inlets had been tried, the one impinging on the lid of the lamp was found to be the best. One of the chief features of this calorimeter is the simple arrangement for transferring the water from the inside of the bell-jar to the outer vessel, without appreciably disturbing the apparatus. For heavier and less volatile liquids, a larger jet than that required for petrol is used. Although non-volatile liquids require an air-inlet to the lamp to ensure satisfactory combustion, in the case of volatile liquids, such as petrol, if this were present, an explosion would ensue. This calorimeter may readily be adapted for the valuation of solids, non-volatile liquids and gaseous fuels.

Discussion.

Mr. J. S. S. **Brame** said he had a bomb calorimeter, which gave reliable results, but he did not consider that was desirable for use with a volatile spirit. There had been one or two accidents with bombs using light spirit, owing to the fact that combustion was in that case practically an explosion. There was therefore a limit in the quantity of material that could be employed. In order to get the values of petrol, he had been working in conjunction with Prof. Lewes with calorimeters of the Junkers type, and great trouble had been experienced owing to the difficulty in getting a lamp which would give complete combustion. With all lamps dependent on vaporisation, there was a considerable residuum from most commercial petrols, which was not volatile even at 100° C., giving misleading results, for practically only the most volatile portion was burnt. For that reason he thought this new apparatus would prove valuable. The only point against it was that in the work which Mr. Cowan and himself had done with coal, with calorimeters of this type, they invariably found low results due to incomplete combustion. (This J., 1903, 1230.) Here, however, the combustion appeared very complete, and if a series of experiments showed complete combustion was obtained, the trouble with petrol had been got over. He was pleased to be able to confirm the authors results, for he had put down as an average of the values they had obtained in good petrols 11,150 calories (gross), which was in very perfect agreement with the results now shown.

Mr. **Rawles**, in reply, said he had had two explosions in using his calorimeter when trying a small vent-hole in the lid of the lamp, which was suggested to him as giving a better flame. He consequently discarded the suggestion. The quantity of petrol he used in this apparatus was 1·5 c.c. (about 1·2 grms.), and he obtained good results—within 100 calories of bomb determinations. Of course the apparatus could be used for solids by replacing the lamp by a crucible, and the spark ignition by the ordinary fuse ignition, or by the incandescence of a thin platinum wire, and for gases. He had tried to spark coal, and in some cases with success, but a curious effect was that if a small cone of the coal were sparked, the coal dust was deposited on the sides of the crucible.

Mr. **Brame** added that one disadvantage of this apparatus was that net values were not obtained. The gross calorific value would require re-calculation for the net value, based on the composition of the petrol.

MR. R. J. FRISWELL IN THE CHAIR.

INFLUENCE OF TEMPERATURE OF DYEING ON RESOLUTION.

BY W. P. DREAPER, F.I.C., AND A. WILSON, B.SC.

We have pointed out that Night Blue, $\left\{(CH_3)_2N.C_6H_4\right\}_2=C=C_{10}H_6:N.C_6H_4.CH_3,HCl$, may be absorbed by silk in two ways (J. Soc. Dyers and Col., 22, No. 9). When absorption takes place above 40° C., a second and more resistant dyeing effect is produced with part of the dye absorbed: this effect increases with the temperature up to 100° C., a greater proportion of the dye being fixed in this way. When dyed at 15° C., a subsequent soaping at the boil, or treatment with alcohol of ordinary strength will practically remove all the dye from the fibre, but as the temperature of the dye bath is increased, a certain proportion of the dye is fixed against the action of these solvents. In all cases the total amount of dye on the fibre was kept constant. This effect has been noticed with other basic dyes, but the dyes vary in their resistance against resolution in some way yet to be determined, especially with different solvents.

These experiments have been extended to the so-called acid class of dyes, with interesting results: similar differences have been observed when working with the same fibre, so that this action is not confined to basic dyes, the temperature effect being of a similar order when expressed in terms of the resistence of the dye to the action of solvents. It has not yet been proved, however, that the dye is fixed in two distinct ways, as in the case of Night Blue, when dyeing at a high temperature, which result may be due to the dissociation of the dye into more basic compounds, which are known to be more insoluble. This point is being investigated. The effect of drying the dyed fibre between the dyeing and resolution treatments has no appreciable effect on the proportion of colour removed. At any rate an increased temperature of the dye solution gives an increased resistence against the solvent action of soap solution or alcohol in the case of the acid dyes.

The following results are given to indicate the general reaction when silk is dyed with acid dyes.

Acid Anthracene Red 3B.—0·25% of dyestuff on the weight of silk was used in a 0·2% solution of acetic acid. The temperature of the soap (1% neutral oil soap solution) solution was 55° C., and the time of extraction 30 minutes.

Temp. of dyeing.	Dye remaining on fibre after soaping.
18°C.	0·002%
40°C.	0·01%
60°C.	0·11%
75°C.	0·13%
90°C.	0·18%

Similar results were observed with alcohol extraction at different temperatures, as indicated in the following table :—

Temp. of dyeing.	Alcohol at 18°. for 12 hours.	Alcohol at 55° for one hour.	Alcohol at 78° for one hour.
18°C.	0·18%	0·02%	0·007%
40°C.	0·23%	0·07%	0·015%
60°C.	0·24%	0·14%	0·08%
75°C.	0·245%	0·17%	0·13%
90°C.	0·25%	0·19%	0·17%

These collected figures do not indicate in themselves that there is any definite change in method of absorption, as in the case of Night Blue, where part of the dye may be held against the action of boiling soap for two hours or more. The following experiments do not indicate that there is a limit to this secondary fixing action. Silk absorbed the dye from a 5%, 10% 15% and 20% solution respectively, but without exhausting the dye bath. On extraction with soap solution at 55° C. the resulting range of shades was in practically the same ratio as that existing in the fibre after dyeing. Succeeding soap extractions removed dye from all the samples, and left a range of shades showing the same general effect. Within the range of these experiments there is no indication of a maximum fixing effect against the action of solvents. When alcohol (80 per cent.) partly takes the place of water, this fixing action is absent. A skein of silk, dyed with 0·25% Acid Anthracene Red 3B. at 78° C., absorbed about 0·05% of the dye, which was easily removed by soap at 55° C. A similar result was obtained with Night Blue (basic dye).

Silk boiled in water, or acid solution, before dyeing with acid colours at 18° C. gave practically the same effect. For instance, when dyeing with 0·25% of Acid Anthracene 3B and subsequently extracting with soap solution at 55° C. similar shades were produced to those obtained with the skeins dyed cold without this preliminary treatment. These results do not indicate that any change in the state of hydration, brought about by boiling the fibre in water or acid, is responsible for the added effect at higher temperatures. Similar results were obtained when Crocein M, $C_6H_5.N_2.C_6H_4.N_2.C_{10}H_4(OH)(SO_3Na)$, was substituted for Acid Anthracene Red 3B in the above experiments, although the greater solubility of the dye in soap solution made direct comparison with the above reactions more difficult. On the other hand, when using alcohol at the boil, very little Crocein M was extracted from any of the skeins.

When the possible effect of the presence of amino acids in the silk fibre at the time of dyeing is considered, and the claims which have been made as to the behaviour of acid and basic dyes towards them, the behaviour of dyes on such fibres as cotton, where these bodies are absent, towards subsequent resolution is of interest. Experiments with Benzopurpurene 4B. indicate that the same alteration in the subsequent resistance is noticed when dyeing at different temperatures. For instance, on boiling two skeins of cotton dyed to the same depth of shade at 100° C. and 18° C. respectively in the ordinary way, the piece dyed at 18° C. lost a large proportion of its colour, whilst the one dyed at 100° retained most of the dye. In alcohol at 18° C. similar extraction results were observed. Repeated extractions with fresh alcohol indicated that the whole of the colour might be removed in this way from both samples, but the relative resistance was quite marked between the one dyed cold and that dyed at the boil.

These experiments are still in progress. The effect of the addition of assistants to the dye solution and other details are being observed. Also, an attempt is being made to extend the experiments to other fibres, such as wool, mercerised cotton, and artificial silks of different makes. The results already obtained indicate a general temperature reaction which is independent of the nature of the dye or the fibre, and depending primarily on the actual conditions at the time of dyeing rather than on the fibre state. This seems to determine the subsequent resistance of the dye to the solvent action of such reagents as water, soap solution, or alcohol. In the case of Acid Anthracene Red 3B, the subsequent resistance to the action of light during fourteen days exposure seems to be a uniform one, irrespective of the temperature of dyeing, within the limits of 18° and 90° C.

These experiments will be extended to cover the "sulphur" and "developed" dyes. It is evident that these results are of importance to the practical dyer as well as from a theoretical point of view.

Discussion.

Dr. J. C. Cain said that the authors' results were extremely interesting, particularly in view of the paper read by Hübner recently, who pointed out there was practically no difference between the behaviour of various fibres, and that seemed to confirm the mechanical theory of dyeing. Had Mr. Dreaper tried any similar experiments with charcoal and such substances as Hübner used?

The Chairman said the authors' results agreed with the view he had always held, that dyeing was mainly a mechanical process, and that the chemical theories had been somewhat in advance of the amount of knowledge on which they were founded. With regard to the behaviour of silk, it seemed an assumption that a constituent which could only be determined by means practically amounting to the disintegration of the silk fibre, could be regarded as playing an important part in fixing the dye on the silk when it was a fibre. Thus, it might be proved that amino-acids could be obtained by treating silk in a particular way, but it by no means followed that they existed there so long as the silk was in the condition of fibre. That appeared to him one of the great objections to the attempt to distinguish between the behaviour of a particular chemical portion of the decomposition products of a fibre, and the fibre itself as a whole.

Mr. Dreaper, in reply, said he was not present at Hübner's paper, and had only seen a brief abstract of it. At present they had not extended the experiments in the direction of dyeing inorganic substances at different temperatures on the lines adopted by Linder and Picton, Hübner, Suido and others, but they intended to do so if possible. He quite agreed with the Chairman's remarks. In some one of their experiments they purposely boiled the silk fibre in water or acid before subjecting it to the dyeing operation, with the idea of trying to form amino-acid compounds, which might subsequently combine with the dye at a low temperature and produce positive results, but they were unable to observe any difference between the silks dyed, either cold, when previously boiled in acid or water, from those dipped directly into the dye solution, when tested in the way indicated.

THE LOSS OF NITRE IN THE CHAMBER PROCESS.*

Part III.

BY DR. J. K. H. INGLIS.

In papers already communicated to this Society,† an account has been given of some experiments which were undertaken with a view to deciding in what form the oxides of nitrogen are lost in the chamber process. The method employed was that of fractional distillation of the exit gases, and the results showed that a considerable quantity of nitrogen peroxide was present in the escape. The conclusion was therefore drawn that the nitre was lost simply through incomplete absorption in the Gay-Lussac tower. The method employed was, however, subject to considerable errors, and the evidence in favour of the presence of nitrogen peroxide rather than of nitric oxide was insufficient. It was therefore decided to carry on further investigations, with the special object of detecting any nitric oxide that might be present. Four experiments had already been carried out with this object (this Journal, 1906, 154); but the method used was indirect, and the plant tested was hardly in normal working order. The whole method was therefore elaborated, and the results of further experiment are given in this paper.

The improvements in the method of analysis consisted in carrying out the fractionation more thoroughly and at as low a temperature as possible, in taking every precaution to prevent secondary reactions taking place after the sample had been collected, and in avoiding the use of indirect analyses. The sample of gas, amounting to 15—26 litres, was condensed to a liquid in the form of bulb already described (*loc. cit.*, Fig. 2), the temperature being kept at 74·7° absolute. The volume of gas taken was determined by measuring the volume of liquid at that temperature, and using the results of Inglis and Coates (Chem. Soc. Trans., 1906, 886) for the relation between the volume of the liquid and that of the gas. This liquefied gas was then fractionated by pumping off the nitrogen and the oxygen through a Fleuss pump, the temperature being kept below 74·7° absolute. Now, at this temperature, the vapour pressure of nitric oxide could not be detected by means of an ordinary mercury manometer, and was therefore certainly very small. Consequently, since the vapour pressures of nitrogen and oxygen at that temperature are 530 mm. and 100 mm. respectively, nitric oxide ought to be almost completely separated by means of such fractionation from a mixture of nitrogen and oxygen. (This question will be discussed again later.) This fractionation, after the last traces of nitrogen and oxygen had been removed by means of a mercury pump, should, therefore, result in leaving behind in the bulb everything that was originally present in the flue gas except the nitrogen and the oxygen. Since, however, moisture was also condensed in the bulb, a number of secondary reactions might take place on warming. To avoid this possibility, the bulb, while still immersed in liquid air, was connected, through a drying tube containing phosphorus pentoxide, with another bulb (the "sample bulb") of about 30 c.c. capacity, which was also connected to the mercury pump. When the whole connection had been evacuated, the connection to the pump was closed; and, after placing the "sample bulb" in liquid air, the original "fractionation bulb"

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[*] Taken as read.

[†] This J., 1904, 643, and 1906, 149.

was removed from its liquid air bath. As the temperature rose the condensed gases distilled over in fractions, passing through the drying tube into the sample bulb, and condensing in that bulb almost completely dry. Since they came over in fractions (corresponding to their different volatilities), they could undergo no changes during these distillations, and therefore the sample condensed in the sample bulb contained the various substances in the same condition as that in which they were present in the original exit gas. This sample bulb was then sealed off and removed from the liquid air. As it warmed up, a certain amount of reaction took place, with the formation of apparently a small quantity of chamber crystals; but the amount of reaction was not enough to affect the analyses. There remained behind in the fractionation bulb a certain amount of substance which was not sufficiently volatile to distil over into the sample bulb. This was washed out with distilled water (after shaking with air and water), and titrated with standard barium hydroxide solution. The resulting value for the acidity, after allowing for the barium sulphate formed, corresponded to the amount of nitrogen oxides which had combined with water and oxides of sulphur during fractionation. This value (the only indirect determination) taken with the analysis of the sample bulb, gave, therefore, a complete analysis of the exit gases.

It remains to give an account of the method used for analysing the contents of the sample bulb. An interesting point in regard to this part of the sample was that, in the case of at least half the samples analysed, whereas the contents showed practically no colour at ordinary temperatures, a purple solid was formed at the temperature of liquid air (*cf.* this Journal, *loc. cit.*). Some considerable time was spent in attempting to determine the nature of this coloured substance: it was apparently more volatile than nitrogen peroxide, and it attacked mercury. In spite of the intensity of the colour, however, there seemed to be only a small quantity present; and under certain conditions the solid could be deposited in only a slightly coloured state. This seemed to indicate that the deeply coloured state was a more or less unstable one. Experiments were made in order to see if nitrosyl chloride could be made to solidify in a deeply coloured form—the usual colour of the solid being yellow—and it was found that a tube filled with nitrosyl chloride and sulphur dioxide could be made to undergo nearly the same changes. It was therefore considered probable that the coloured substance was simply nitrosyl chloride in some peculiar solid form; and the analysis of the samples was carried out on that assumption.

The nitric oxide was therefore separated from the other substances by fractionation at the temperature of liquid air. Since at any higher temperature gases came off which acted upon mercury, the remainder of the sample was shaken with mercury and sulphuric acid. According to the reactions that take place in the Lunge nitrometer, one would expect this treatment to change any nitrosyl chloride or nitrogen peroxide into nitric oxide. Miss Knight has kindly examined for me the action of mercury and sulphuric acid upon nitrates, under the conditions which were used in my experiments; and has found that the reduction of nitrates to nitric oxide is complete. It may, therefore, be safely assumed that the decomposition of the other bodies is also quantitative. After this treatment, the gases which were pumped out consisted only of nitric oxide, nitrous oxide, carbon dioxide, and sulphur dioxide: these were then separated as described in my earlier papers. It is to be noticed that only in one case (that of the non-volatile residue) is the analysis an indirect one. In all other cases the substances were separated in the pure state and measured. It is evident also that nitric oxide is obtained in three different fractions. There is first of all the amount determined indirectly by titration of the non-volatile residue. Secondly, there is the nitric oxide found as such in the sample bulb; and thirdly, there is the nitric oxide formed by the action of mercury and sulphuric acid upon other substances. These three amounts are put down separately in the table.

Seventeen analyses were carried out in this way in connection with a plant belonging to Messrs. Spencer Chapman and Messel of Silvertown. The plant consisted of the usual set of four chambers with two Gay-Lussac towers; it had been working extremely regularly for some time before the experiments were begun, and continued to do so during the experiments. The consumption of nitre was 2·58 parts of sodium nitrate for 100 parts of sulphur burnt, which was itself 47% of the ore. The oxygen in the escape was usually about 6·3%; and on this basis the loss of nitre would be represented by 0·86 c.c. of nitric oxide per litre of escape gases. The results of my experiments are contained in the table.

No.	Date, April.	Volume in litres.	Residual Acidity.	Barium sulphate in gr.	Nitre by titration calc. as nitric oxide.	Nitric oxide.	Nitrogen peroxide calc. as nitric oxide.	Nitrous oxide.	Total nitre calc. as nitric oxide.	Sulphur dioxide.	Carbon dioxide.	Works tests.	
												Sulphur dioxide.	Nitrogen peroxide as nitric oxide.
1	3	19·3	1·16	·0136	1·3	1·27	0	0·28	3·25	21·7	6·8	22·4	1·27
2		23·4	2·92	·0426	1·6	·0	1·07	0·13	2·93	12·0	6·4	13·6	0·84
3	5	25·7	2·28	·0274	2·3	1·84	0·27	0·11	4·63	10·9	6·1	11·2	1·6
4		19·6	3·30	·0477	1·9	3·00	0·25	0·20	5·55	11·5	—	11·2	0·84
5	10	23·9	2·7	·0379	1·8	2·71	2·24	0·16	7·07	4·65	5·82	2·2	1·6
6		26·8	3·2	·0431	2·3	2·41	1·86	0·14	6·85	7·3	5·93	3·2	1·8
7		15·3	3·2	·0475	1·6	2·15	0·52	0·13	4·53	12·8	5·95	13·6	2·3
8	19	26·0	2·9	·0400	1·9	2·45	1·30	0·50	6·65	5·2	5·7	3·7	0·74
10		16·5	2·4	·0365	1·1	2·39	0·23	0·32	4·36	14·6	5·8	12·0	0·84
11	21	22·6	3·8	·0526	2·6	2·71	0·56	0·12	6·11	5·6	5·7	2·9	1·9
12		16·1	2·9	·0453	1·1	1·11	1·52	0·14	4 01	10·0	6·4	8·0	1·06
13	24	25·0	1·86	·0277	0·9	1·26	0·61	0·26	3·29	13·1	6·5	14·4	1·8
14		23·3	3·3	·0460	2·2	1·87	0·46	0·29	5·11	4 2	6·4	3·0	1 37
15		18·3	2·7	·0500	1·3	2·64	1·16	0·20	5·50	4·9	6·1	4·0	1·94
16	26	25·0	3·3	·0485	1·9	2·58	0·40	0·09	5·06	11·3	6·7	11·7	1·9
17		20·7	4·1	·0526	3·7	6·6	trace	(0·10)	(10·5)	(44)	(6·5)	64	0·6
18		18·3	2·95	·0400	2 1	2·14	0·43	0·10	4·87	12·6	6·3	10·0	1·27

The "residual acidity" in this table denotes the number of c.c. of 0·1490 normal barium hydroxide solution required to neutralise the non-volatile residue obtained from ten litres of escape gases. In the next column is given the weight of the barium sulphate precipitated. From these two figures one can calculate as nitric oxide the amount of nitrogen oxides contained in this residue. The column headed "Nitre by titration calc. as nitric oxide" gives the results of this calculation. In all cases the figures represent c.c. of each substance per ten litres of exit gas. The last two columns give the results of the usual works tests.

As already stated, the actual loss of nitre would be represented by about 8·6 c.c. of nitric oxide per ten litres. But, taking the column of figures which represent the total amounts of oxides of nitrogen found in each sample, we see that the fluctuations are considerable, and that in no case can the whole loss be accounted for. In the mean, the amount found is about 5·2 c.c., or only 60% of the actual loss. As regards the other figures, we see that the nitrous oxide is variable, but is about the same as in my earlier experiments, and the carbon dioxide is pretty constant. The sulphur dioxide is very variable, and it is noticeable that the amount of nitrogen peroxide found varies inversely as the sulphur dioxide, being smallest when the latter is greatest. Now a high proportion of sulphur dioxide would naturally involve the presence of nitric oxide rather than of the peroxide. The variations of the nitric oxide do not, however, correspond to those of the sulphur dioxide, and it therefore seems probable either that there is a reduction to nitrogen, or that even under the conditions of these experiments the separation of the nitric oxide from the nitrogen and oxygen is not complete. Now the only way in which the completeness of this separation can be investigated is by consideration of the relative vapour pressures under the conditions of experiment. For, since nitric oxide interacts with oxygen, it is obviously impossible to make up a known mixture of nitric oxide, nitrogen, and oxygen, and then carry out an analysis. Unfortunately, our knowledge of nitric oxide is extremely scanty and unreliable, most experiments having been carried out with impure gases. I have not been able to make a series of determinations of the vapour pressures of solid nitric oxide, owing to the difficulty of measuring temperatures throughout the range required. Olszewski, however, gives the melting point of nitric oxide as —167° C., and the vapour pressure at that temperature as 138 mm. The vapour pressure at —189° C. is very nearly 0·75 mm. From these data, using Ramsay and Young's method, one can calculate approximately the vapour pressure of solid nitric oxide at any temperature. The value thus found for 74·7° Abs. is 0·03 mm., and the corresponding loss during fractionation should be only about 0·8 c.c. per ten litres; but "bumping" during fractionation might easily increase this loss to a considerable extent. The analysis of sample 17 does, however, throw some light on the possibility of obtaining all the nitric oxide. For the purpose of this experiment, the working of the chambers was deranged so that there was a large escape of nitric oxide. The amount of nitric oxide found in the analysis of this sample is certainly high, but it is still less than what would correspond to the actual loss of nitre at that moment. Unfortunately, owing to an accident, part of this sample was lost after the nitric oxide had been separated and measured; so that the remaining figures of this analysis are only approximate. The figure for nitric oxide is, however, accurate; and since the absorption in the Gay-Lussac tower indicated an additional loss of about 6 or 7 c.c .of nitric oxide per 10 litres—the total loss being therefore about 15 or 16 c.c. per 10 litres—we see that the amount found is about 5 c.c. less than the actual escape. This is not very different from the average deficiency, 3·3 c.c. of the other analyses; and it is probable, therefore, that the deficiency is due in all cases to the same cause. The two possible causes are (1) incompleteness of the separation during the fractionation, and (2) a possible reduction to nitrogen. The single result, however, with a deranged chamber, is not a sufficient basis for the drawing of a definite conclusion. A safe conclusion could only be drawn after a long series of experiments in which the escape of sulphur dioxide varied over a wide range.

The results of this paper and of my earlier papers may be summed up as follows. (1) The amount of nitre lost as nitrous oxide is very small, and is less than 10 per cent. of the whole loss. (2) A considerable proportion of nitre is lost as nitrogen peroxide and nitric oxide, the relative proportions of these two substances depending upon the escape of sulphur dioxide. (3) There is a possible reduction to nitrogen. Possibly the losses as nitric oxide and higher oxides might be lowered if the chambers could be so adjusted that the last traces of sulphur dioxide disappeared just before the gas left the Gay-Lussac tower.

These conclusions are directly opposed to some preliminary results published by Hempel and Heymann (Zeits. Electrochem., 1906, 600). These authors have also made use of liquid air in carrying out their separations; but whereas in my own experiments the separation was made as complete as possible, and each constituent measured in the pure state, Hempel and Heymann have used an indirect method. By measuring the changes in volume which were produced when the sample was exploded with a mixture of two volumes of hydrogen to one of oxygen, they claim to have proved the presence of nitrous oxide to the extent of about 0·1%. Such an amount would correspond to a loss of about 6 parts nitre to 100 of sulphur burnt. But such results are comparatively valueless; for the experimental error in such an indirect method is bound to be high. In addition the conditions under which they collected their sample were such that they were almost bound to lose any nitric oxide. Thus their reuslts correspond to the presence of far more nitre than is ever lost in well-managed works. Their conclusions are therefore inadmissible.

I should like to take this opportunity of again thanking Dr. Messel for giving me the opportunity of continuing my experiments, and for the kind interest he has taken in them. I should also like to thank Mr. E. C. Thompson for all the trouble he took and for the valuable help he gave me while I was collecting my samples. The analyses were carried out in University College London and I should like to thank Sir William Ramsay for his kind interest during the research.

University College, Reading.

New York Section

Meeting held at Chemists' Club on May 24, 1907.

MR. GEO. C. STONE IN THE CHAIR.

SOME ANALYTICAL DATA ON AMERICAN COALS.*

BY A. BEMENT.

In the following tabulation the author has made use of all of the ultimate analyses of American coals of which he has sufficient knowledge to offer without hesitation. These have been prepared principally from the report of the chemical division of the U.S. Geological Survey, published by the Survey as Professional Paper No. 48; in addition, some twelve analyses made on the different coal seams of Michigan, by Mr. Henry J. Williams of Boston, are given. In addition to this, the author has added one analysis of his own from a composite sample made up from borings in the principal coal seam of Christian County, Illinois. It will be observed that in the pure coal, the oxygen and a sufficient amount of hydrogen to form water has been listed in the column entitled water of combination, and only that portion of the hydrogen available for combustion is given. Likewise in the section devoted to combustible, only available hydrogen is given, for the reason that the remainder of the hydrogen, being considered in combination with oxygen, is not available for heat production, and therefore cannot be considered as combustible. The author, to give these compilations some signification, has been disposed to consider them as extended proximate analyses. The heating values, which are expressed in British thermal units, were determined with the Mahler calorimeter in all excepting the Michigan samples, and may be regarded as having a high degree of accuracy. For the Michigan samples, Mr. Williams employed his own calorimeter, which is a modification of the Mahler instrument. It would be desirable if moisture and ash values could have accompanied the compositions of the coal and of the combustible, but the data available is not sufficiently accurate for presentation in connection with the rest of the work. The greatest fault in coal analysis generally is failure, through improper sampling, to secure correct ash and moisture values, but as the composition of the coal itself is so much nearer a constant, analytical results on such samples can only have value as indicating the composition of the coal itself, or in other words, the pure coal and the combustible.

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* Taken as read.

Town.	Pure Coal.						Combustible.			
	Available Hydrogen.	Carbon.	Sulphur.	Water of Combination.	Nitrogen.	B.T.U.	Available Hydrogen.	Carbon.	Sulphur.	B.T.U.
Alabama—										
Carbon Hill	4·04	81·57	1·20	11·37	1·82	14,665	4·65	93·97	1·38	16,893
Horsecreek	4·64	84·09	·85	8·49	1·93	15,100	5·18	93·87	·95	16,856
Horsecreek	4·52	84·24	1·12	8·47	1·65	15,190	5·03	93·72	1·25	16,900
Arkansas—										
Bonanza	4·15	89·00	2·11	3·18	1·56	15,526	4·35	93·43	2·22	16,298
Bonanza	4·18	88·08	1·60	4·38	1·76	15,599	4·45	93·84	1·71	16,619
Coalhill	3·84	89·34	2·32	2·89	1·61	15,496	4·02	93·55	2·43	16,226
Huntington	3·97	88·05	1·48	4·79	1·71	15,602	4·25	94·17	1·58	16,686
Jenny Lind	3·96	87·38	1·49	5·40	1·77	15,623	4·27	94·13	1·60	16,829
Jenny Lind	3·82	88·90	1·77	3·78	1·73	15,566	4·04	94·09	1·87	16,473
(From several mines)	3·64	90·38	1·91	2·47	1·60	15,248	3·79	94·22	1·99	15,895
,, ,, ,,	4·20	89·60	2·01	2·68	1·51	15,907	4·39	93·52	2·09	16,602
Colorado—										
Lafayette	3·28	76·28	·73	18·19	1·52	13,465	4·08	95·01	·91	16,767
Illinois—										
Bush	4·37	80·20	4·41	9·54	1·48	14,611	4·91	90·13	4·96	16,420
Coffeen	3·88	75·51	5·56	13·52	1·53	13,923	4·57	88·89	6·54	16,389
Marion	4·00	81·63	2·15	10·49	1·73	14,679	4·56	92·99	2·45	16,722
O'Fallon	4·20	77·52	5·31	11·63	1·34	14,310	4·82	89·08	6·10	16,442
O'Fallon	4·32	76·65	6·10	11·82	1·11	13,963	4·96	88·03	7·01	16,036
Troy	3·92	80·51	1·75	12·30	1·52	14,320	4·55	93·42	2·03	16,616
Christian County .	3·92	74·86	4·86	15·13	1·23	13,918	4·69	89·50	5·81	16,640
Indiana—										
Boonville	4·41	78·47	5·73	9·83	1·56	14,377	4·98	88·55	6·47	16,225
Mildred	4·29	80·23	3·33	10·58	1·57	14,710	4·88	91·33	3·79	16,744
Mildred	4·13	81·54	2·46	10·28	1·59	14,672	4·69	92·52	2·79	16,648
Indian Territory—										
Edwards	4·15	79·96	4·30	9·83	1·76	14,623	4·70	90·44	4·86	16,540
Hartshorne	4·47	82·20	1·79	9·56	1·98	14,910	5·06	92·92	2·02	16,855
Henryette	4·34	81·43	2·32	10·41	1·50	14,712	4·93	92·94	2·63	16,701
Lehigh	3·90	77·38	4·92	12·11	1·69	13,942	4·52	89·77	5·71	16,174
Lehigh	3·85	76·48	5·98	11·91	1·78	13,665	4·46	88·61	6·93	15,832
Iowa—										
Altoona	4·43	75·82	8·54	10·04	1·17	14,203	4·99	85·39	9·62	15,996
Centerville	4·15	78·03	5·68	10·94	1·20	14,304	4·72	88·81	6·47	16,280
Centerville	4·69	80·82	5·23	8·25	1·01	14,640	5·17	89·07	5·76	16,134
Chariton	4·25	77·55	4·42	12·20	1·58	14,229	4·93	89·94	5·13	16,503
Hamilton	4·38	76·64	6·60	10·52	1·86	14,197	5·00	87·47	7·53	16,203
Laddsdale	4·15	78·96	6·65	9·00	1·24	14,555	4·62	87·97	7·41	16,215
Kansas—										
Atchison	4·83	77·60	9·94	6·36	1·27	14,722	5·23	84·01	10·76	15,938
Fleming	4·66	82·07	5·22	6·74	1·31	14,924	5·07	89·25	5·68	16,230
Scammon	4·79	81·21	6·68	5·91	1·41	15,167	5·17	87·62	7·21	16,365
West Mineral	4·62	82 30	4·42	7·41	1·25	15,107	5·06	90·10	4·84	16,539
Yale	4·68	79·42	8·05	6·67	1·18	14,943	5·08	86·19	8·73	16,216
Kentucky—										
Earlington	4·40	79·33	4·36	10·44	1·47	14,706	4·99	90·06	4·95	16,694
Earlington	4·02	79·89	4·56	10·07	1·46	14,595	4·54	90·30	5·16	16,497
Earlington	4·40	79·60	4·30	10·00	1·70	14,658	4·98	90·15	4·87	16,591
Straight Creek....	4·55	83·63	1·32	8·52	1·98	15,292	5·09	93·44	1·47	17,086
Wheatcroft	4·20	80·25	5·63	8·37	1·55	14,835	4·67	89·08	6·25	16,468
Seam.										
Michigan—										
Saginaw	4·17	81·65	1·15	11·42	1·61	14,612	4·80	93·88	1·32	16,801
Saginaw	4·40	82·01	1·06	10·93	1·60	14,725	5·03	93·76	1·21	16,834
Saginaw	3·95	81·73	·94	11·78	1·60	14,700	4·56	94·35	1·09	16,970
Upper Verne	4·30	82·20	1·67	10·20	1·63	14,681	4·88	93·23	1·89	16,650
Lower Verne	5·13	79·94	3·06	10·24	1·63	14,747	5·81	90·71	3·48	16,733
Lower Verne	5·11	79·38	3·34	10·52	1·65	14,800	5·82	90·38	3·80	16,850
Lower Verne	5·33	82·74	2·20	7·46	1·27	15,525	5·84	90·65	3 51	17,010
Lower Verne	4·91	80·44	4·40	8·77	1·48	15,141	5 47	89·63	4·90	16·870
Lower Verne	5·40	79·47	6·63	6·76	1·74	14,844	5·90	86·85	7·25	16,223
Lower Verne	4·64	76·63	7·83	9·42	1·48	14,777	5·21	86·00	8·79	16,584
Lower Verne	4·83	76·85	8·31	8·57	1·44	14,624	5·37	85·40	9·23	16,250
Upper Verne	4·31	80·74	2·24	11·26	1·45	14,902	4·94	92·50	2·56	17,072
Town.										
Missouri—										
Barnett	5·02	81·06	6·21	6·87	·84	15,136	5·44	87·83	6·73	16,400
Bevier	4·16	76·48	7·21	10·81	1·34	14,209	4·74	87·06	8·20	16,174
Mendota	4·19	76·96	5·80	11·75	1·30	13,922	4·82	88·51	6·67	16,011
Sprague..........	4·70	78·82	7·27	7·91	1·30	14,640	5·18	86·81	8·01	16,125
Sprague..........	4·62	80 75	5·73	7·53	1·37	14,935	5·07	88·64	6·29	16,394
Montana—										
Red Lodge	3·45	75·77	2·21	16·87	1 70	13,517	4·24	93·05	2·71	16,599
New Mexico—										
Gallup	3·75	78·43	·78	15·76	1·28	13,938	4·52	94·54	·94	16,801
Gallup	4·07	78·06	1·79	14·73	1·35	14,042	4·85	93·02	2·13	16,732
Gallup	4·77	81·20	2·10	10·90	1·03	14,891	5·42	92·20	2·38	16,908
North Dakota—										
Williston	2·26	72·02	·82	23·71	1·19	12,392	3·01	95·90	1·09	16,500
From L. S. Storrs .	2·53	72·80	2·79	20·90	·98	12,525	3·24	93·19	3·57	16,033
Pennsylvania—										
Scranton	2·82	92·18	·94	3·08	·98	15,286	2·94	96·08	·98	15,932
Scranton	4·53	86·97	1·37	5·86	1·27	15,604	4·88	93·65	1·47	16,802
Windber	4·11	89·60	1·63	3·17	1·49	15,847	4·31	93·98	1·71	16,621
Windber	4·10	89·90	·97	3·67	1·36	15,800	4·32	94·66	1·02	16,636
Texas—										
Crockett	3·32	72·56	1·45	21·35	1·32	13,042	4·29	93·83	1·88	16,865
Hoyt	2·59	72·07	·89	23·12	1·33	12,453	3·43	95·39	1·18	16,483

Town.	Pure Coal.						Combustible.			
	Available Hydrogen.	Carbon.	Sulphur.	Water of Combination.	Nitrogen.	B.T.U.	Available Hydrogen.	Carbon.	Sulphur.	B.T.U.
West Virginia—										
Ansted	4·78	86·50	1·01	6·20	1·51	15,546	5·18	93·73	1·09	16,845
Big Sandy	4·30	90·49	·74	3·02	1·45	15,939	4·50	94·72	·78	16,684
Big Sandy	5·06	90·56	·93	2·00	1·45	16,265	5·24	93·80	·96	16,846
Bretz	4·50	86·34	·99	6·51	1·66	15,607	4·90	94·02	1·08	16,995
Clarksburg	4·52	82·13	3·86	7·98	1·51	15,291	4·99	90·74	4·27	16,894
Coalton	4·50	85·53	1·11	7·10	1·66	15,507	4·93	92 85	1·22	16,995
Kingmont	4·67	84·86	·98	7·81	1·68	15,349	5·16	93·76	1·08	16,958
Kingmont	4·53	86·97	1·37	5·86	1·27	15,604	4·88	93·65	1·47	16,802
Mora	4·41	90·70	·60	3·16	1·13	16,037	4·61	94·76	·63	16,756
Powellton	4·60	86·06	·87	6·70	1·77	15,587	5·03	94·02	·95	17,029
Richard	4·68	85·89	1·21	6·60	1·62	15,498	5·10	93·58	1·32	16,886
Rush Run	4·42	88·70	·70	4·38	1·80	15,850	4·71	94·54	·75	16,894
Sun	3·88	87·53	1·27	6·20	1·12	15,780	4·19	94·44	1·37	17 026
Zenith	4·06	90·22	·60	3·94	1·18	15,929	4·28	95·09	·63	16,788
Wyoming—										
Cambria	3·90	73·71	5·56	15·76	1·07	13,817	4·69	88·63	6·68	16,613
Wyoming Coal and Mining Co.	3·18	75·35	·81	19·26	1·40	13,358	4·01	94·97	1·02	16,856

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

(*Continued from page* 600.)

English Patents.

Filter presses. A. C. Harrison, Hanley. Eng. Pat. 8374, April 7, 1906.

Two parallel rackwork tracks are supported longitudinally above an ordinary filter-press by metal girders and rails attached to the ends of the press-frame. A toothed wheel "traveller," arranged to work on the track, has a rod hanging down on each side. The ends of the two rods are provided with adjustable hooks which engage projections formed on the sides of the filter-plates. When it is desired to move the plates to open or close the press, the hooks are attached to each plate in succession, and the traveller worked by a hand-wheel.—W. H. C.

Filtering pulp and like materials; Apparatus for washing and sterilising ——. H. C. Russell, London. Eng. Pat. 15,388, July 6, 1906.

The apparatus consists of a tank having a concave bottom and straight sides and ends; the sides being turned inwards at the top, and having splash-plates attached to them so as to form a cover to the tank, but leaving sufficient space for the introduction of the pulpy mass to be washed and sterilised. Inside the tank are situated two horizontal stirrers, which revolve in opposite directions. At the top of the tank, and adjacent to the splash-plates, is a perforated metallic drum mounted on the rotating shaft of a conveyor. This drum is open at one end and discharges into a hopper situated outside the tank. The perforated drum may have an outer cover of finer perforated metal. As the drum rotates, the wash water and the scum passing through the perforations are conveyed by the screw to the hopper. Compressed air, and steam or water, are admitted through separate pipes at the lower part of the tank.—W. P. S.

Filter-press plates; Process to renovate ——. F. Hobbis, Widnes. Eng. Pat. 16,460, July 21, 1906.

Filter-press plates in which the ribs have been worn down, are renovated by covering the face of the plate with a layer of composition formed of cement, sand, salt, and fibrous material such as chopped hair. Before the composition has set, grooves are formed in the surface by means of a comb with suitable teeth. When the composition has set, the surface of each plate has the same grooved or ribbed form as a new plate. Unworn plates may be similarly coated to protect the metal from the corroding action of the liquids filtered.—W. H. C.

Furnaces; Regenerative ——. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 10,412, May 3, 1906.

The amount of heat in the waste gases entering the regenerators is greater than the quantity required to heat the incoming air, and consequently heat is lost in the gases going to the chimney. As the utilisation of the waste heat in large volumes of gases at a low temperature cannot be economically performed, it is proposed to withdraw a portion of the waste gases leaving the furnaces at a high temperature, before they enter the regenerator, and to use the heat thus withdrawn for heating boilers, or for any other purpose. (Reference is directed to Eng. Pat. 8355 of 1898).—W. H. C.

Kilns and the like; Method of heating ——. C. Dellwik, London. Eng. Pat. 5976, March 12, 1907. Under Int. Conv., March 22, 1906.

In rotary kilns for "nodulising" ores, &c., or for calcining cement, claim is made for the employment of a flame of intense calorific power at the discharge end, and for supplying the heat for the preliminary stages of the heating by a flame of lower intensity produced from a lower-grade fuel. The object is to prevent the formation of a ring of incrustation on the interior surface of the kiln.—W. H. C.

Separating and sorting apparatus; Pneumatic ——, *and the treatment of materials thereby.* T. Lord and J. Carey, Todmorden. Eng. Pat. 11,126, May 12, 1906.

The materials to be separated, dirty corn for example, are caused to pass across the face of a vertical, rapidly rotating, perforated disc. At the same time a rapid current of air is blown in a direction at right angles to the plane of the disc. The air blast passes through the falling corn and through the perforations in the disc, carrying the impurities with it to the other side, where they are collected separately. Several such discs with perforations of different dimensions may be arranged in series, and the air passed through them in succession. Claim is also made for a conical perforated disc the apex of which is not perforated.—W. H. C.

Separators; Centrifugal ——. J. V. M. Risberg, Sodertelje, Sweden. Eng. Pat. 6635, March 19, 1907.

THE claim is for the provision of means for preventing foreign matter from being carried away by the heavier liquid leaving the drum. An annular chamber is formed within the outer casing of the drum, through which the heavier liquid has to pass to the outlet. Owing to the size of this chamber, the rate of flow of the liquid through it is reduced, and time is allowed for the foreign matter to be deposited.—W. H. C.

Liquids; Method of and apparatus for impregnating —— *with gas and also for liberating the same.* H. Stroh, Heilbronn, Germany. Eng. Pat. 24,310, Oct. 31, 1906.

SEE Fr. Pat. 371,308 of 1906; this J., 1907, 308.—T. F. B.

Volatile liquids, or liquids under pressure [*ethyl chloride*]; *Tubes or vessels charged with* ——. Soc. Chim. des Usines du Rhone, Paris. Eng. Pat. 29,554, Dec. 28, 1906. Under Int. Conv., Jan. 5, 1906.

THE capillary discharge tube of the vessel is closed by a conical rubber pad held in position by a spring lever attached to a collar fitted to the container. The lever can be operated and the tube opened by one finger of the hand holding the vessel.—W. H. C.

Pyrometers. C. Féry, Paris. Eng. Pat. 6890, March 22, 1907. Under Int. Conv., April 3, 1906.

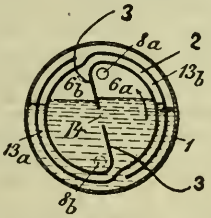
SEE Fr. Pat. 364,884 of 1906; this J., 1906, 916.—T. F. B.

UNITED STATES PATENTS.

Evaporator. F. S. Heath, Corry, Pa. U.S. Pat. 852,435, May 7, 1907.

AN evaporating-pan set over a furnace has two series of U-shaped circulating pipes fixed in the bottom and depending into the body of the furnace. The U-tubes have one leg longer than the other, so that the bottom connecting piece has a gentle rise from the bottom of the longer to the bottom of the shorter leg. The bends of each series have their longer legs on opposite sides of the pan, and the liquid flows down the longer leg, across the inclined part, and back to the pan through the shorter leg of each bend.—W. H. C.

High vacuums; Means for producing ——. W. Gaede, Freiburg, Germany. U.S. Pat. 852,947, May 7, 1907.



AN outer casing is connected to the vessel to be exhausted and to a cylindrical casing, 1, which is more than half filled with liquid, and in which a drum, 2, is mounted so that it can be rotated. The drum, 2, is divided into compartments, 6*a*, and 6*b*, by the radial partitions, 3, provided with an opening, 14, by which the compartments communicate below the surface of the liquid. The drum communicates with the vessel to be exhausted by the openings, 8*a*, 8*b*, and with the interior of the outer casing, 1, by the channels, 13*a*, 13*b*. The outer casing, 1, is connected to an ordinary air-pump.—W. H. C.

Drying apparatus; Vacuum ——. E. Passburg, Berlin. U.S. Pat. 853,260, May 14, 1907.

SEE Eng. Pat. 3432 of 1906; this J., 1906, 802.—T. F. B.

Air; Method of desiccating ——. P. A. Maignen and T. I. Crane, Philadelphia, Pa. U.S. Pat. 853,559, May 14, 1907.

FINELY-POWDERED lime is sifted into a current of air, and the latter is then circulated through suitable chambers until the lime has absorbed the bulk of the moisture. The air thus treated is afterwards passed through filters to remove the lime dust.—W. P. S.

Separating liquids; Method of ——. S. M. Kintner, Pittsburg, Pa. and W. W. Hanks, Durham, N.C., Assignors to Westinghouse Electric and Manufacturing Co., Pa. U.S. Pat. 854,295, May 21, 1907.

A MIXTURE of liquids of different specific gravities is allowed to settle, and the heavier liquid is then filtered through a porous material such as plaster of Paris, for which the liquids have different degrees of capillarity, and which is practically impervious to the liquid of lower specific gravity.—W. H. C.

Generating and storing products of combustion under pressure; Apparatus for ——. T. H. Cole, Southsea, England. U.S. Pat. 854,466, May 21, 1907.

THE gaseous products of combustion formed in an internal combustion motor, adapted to work on a four-phase cycle and arranged so that practically the whole of the exhaust gases are expelled at each exhaust stroke, are delivered under pressure into a reservoir. This reservoir is arranged to supply the compressed gases to work an engine, and is provided with relief valves. One valve is controlled from the internal combustion motor and relieves the back pressure on the working piston of the latter so long as the speed does not exceed a predetermined limit. The other valve opens when the pressure in the reservoir is greater than that against which the internal combustion motor can deliver the products of combustion into the reservoir.—W. H. C.

Filter. E. M. Wade, Los Angeles, Cal. U.S. Pat. 854,972, May 28, 1907.

A DRUM, the periphery of which is covered with filtering material, is mounted on a frame so that it can be rotated. The interior of the drum is divided into a number of compartments provided with ports. By a system of corresponding ports and a valve-cap, each compartment is successively (1), put in connection with a vacuum, (2), the vacuum broken, and (3), the compartment subjected to a plus pressure. Scrapers are provided to detach the solids from the filter cloth which can also be sprayed with liquid.—W. H. C.

FRENCH PATENTS.

Separation of vapours of volatile liquids contained in air by recuperation; Process for the ——. A. Barbezat. First Addition, dated March 3, 1906, to Fr. Pat. 372,524, Feb. 20, 1906.

A SLIGHTLY inclined heat interchanger, comprising two concentric tubes, is employed, and the air carrying the vapour which it is desired to separate, is caused to circulate first through the annular space and then to return through the inner tube. Pockets are provided at suitable distances in the outer tube, to collect liquids of different degrees of volatility separately, and to enable the cold of the condensed and separated liquids to be utilised.—W. H. C.

Sand filter. C. Cuau. Fr. Pat. 373,181, March 12, 1906.

IN order to prevent the contamination of the filtered liquid by contact with germ-laden air which might pass down between the wall of the vessel and the sand, or come into contact with the filtrate in the open draining channels, the sand is supported by discontinuous projections from the sides of the filter tank, and the draining channels are completely submerged. In this way it is sought to imitate the effectual purification obtained by natural filtration through the soil.—W. H. C.

Dryer; Rotary ——. R. G. Poncet. First Addition, dated Jan. 10, 1907, to Fr. Pat. 364,304, March 16, 1906.

AN agitator of rectangular cross-section, provided with projecting wings and fixed longitudinally in the drum.

is employed, in the place of the helical device described in the original patent. When the drum is rotated, the materials under treatment are stirred up and moved forward by the projecting wings of the agitator.—W. H. C.

Centrifugal machines for separating mud from liquids. J. T. Lindahl and C. A. Halling. Fr. Pat. 373,459, Jan. 10, 1907.

In centrifugal machines in which the solid particles are discharged by a rotating eccentric disc placed beneath the drum, the edges of the disc and of the outer casing are provided with serrations, so that a pressure is exerted on the mud which forces it to pass through the outlet openings rather than be carried forward by the disc. —W. H. C.

German Patent.

Heating device for evaporators, consisting of a vertical heating chamber with two groups of vertical heating tubes. K. Kubierschky. Ger. Pat. 175,792, Dec. 10, 1905.

The wide circulation tube in the usual form of heating chamber with vertical tubes, is replaced by a number of tubes of only slightly larger diameter than the heating tubes for the ascending liquid.—A. S.

II.—FUEL, GAS, AND LIGHT.

(*Continued from page* 601.)

Lignitic and sub-bituminous coals; Analysis of ——. A. J. Cox. J. Amer. Chem. Soc., 1907, 29, 775—783.

The author states that whilst the official method (American) for the determination of volatile matter (this J., 1906, 174) is satisfactory for coking coals, it gives inaccurate results with certain non-coking coals, owing to mechanical losses. For the examination of such coals, the author recommends the "smoking-off" method. The coal is subjected to a gentle heat just sufficient to cause smoke to rise from the crucible without burning at the edges. When the hydrocarbons have been expelled and only hydrogen is being liberated, the flame is regulated so that the gas is not ignited nor expelled fast enough to carry off solid particles as evidenced by the production of sparks. The determination is completed in the usual manner over the full Bunsen flame. This method is stated to be applicable to all kinds of coals, and to approach more nearly the conditions existing in coke ovens than the official method.—A. S.

Gas-producer practice; Investigation on the use of steam in ——. W. A. Bone and R. V. Wheeler. Iron and Steel Inst., May, 1907. [Advance proof].

The investigation comprised a series of five trials, each extending over a full working week, with a gas-producer plant of the Mond type, at an iron and steel works, the producers supplying washed gas both for gas-engines and for re-heating and puddling furnaces, all working under normal conditions, except that from week to week, the proportion of steam used was increased by raising the steam-saturation temperature of the blast, in five equal stages, from 60° to 80° C. The various chemical reactions occurring in the producer and the influence of different proportions of steam on them are discussed. The chief results of the trials are shown in the following table:—

Steam-saturation temperature.	60° C.	65° C.	70° C.	75° C.	80° C.
Coal consumption at producer, cwts. per hour	16·51	14·26	13·88	14·32	13·21
Coal consumption at boiler, cwts. per hour	2·0	1·8	2·38	2·87	3·35
Coal consumption for blast steam	nil.	nil.	0·66	1·17	1·65
Total carbon losses, per cent.	5·8	7·8	8·1	7·1	8·4
Mean percentage composition of gas obtained. Carbon dioxide	5·25	6·95	9·15	11·65	13·25
Carbon monoxide	27·30	25·40	21·70	18·35	16·05
Hydrogen	16·60	18·30	19·65	21·80	22·65
Methane	3·35	3·40	3·40	3·35	3·50
Nitrogen	47·50	45·90	46·10	44·83	44·55
Total combustibles	47·25	47·10	44·75	43·50	42·20
Calorific value of gas, gross	46·77	46·74	44·74	43·37	42·73
Calorific value of gas, nett	43·60	43·32	41·14	39·65	38·69
(Kilo.-cent. units per cubic foot at 0° C. and 760 mm.)					
Yield of gas, cubic feet per ton	138,250	134,400	141,450	145,800	147,500
Lb. of steam in blast per lb. of coal gasified	0·45	0·55	0·80	1·10	1·55
Percentage of steam decomposed	87·4	80·0	61·4	52·0	40·0
Cubic feet of air, at 0° C. and 760 mm., in blast per lb. of carbon gasified	36·95	34·9	36·8	36·9	37·1
Ratio of $\frac{\text{oxygen from steam}}{\text{oxygen from air}}$	0·50	0·62	0·65	0·75	0·80
Ammonia in gas, as lb. of ammonium sulphate per ton of coal	39·0	44·7	51·4	65·25	71·8
Efficiency ratios in actual trial— (1) Including steam for blower engine	0·778	0·750	0·727	0·701	0·665
(2) Including steam for blower engine and washers	0·715	0·687	0·660	0·640	0·604

It will be seen that as the steam-saturation temperature of the blast was raised beyond 65° C., the quality of the gas steadily deteriorated, as also did the general efficiency of the process. Owing to the effect of the steam in lowering the reaction temperature in the zone of combustion, the reaction, $C + 2H_2O = CO_2 + 2H_2$ proceeds at the expense of the reaction, $C + H_2O = CO + H_2$, and the equilibrium, $CO + H_2O \rightleftarrows CO_2 + H_2$, is displaced towards the right, so that the gas becomes richer in hydrogen and carbon dioxide, but much poorer in carbon monoxide. But the "furnace efficiency" of carbon monoxide is much higher than that of hydrogen, and the value of the gas obtained with steam-saturation temperatures of 60° and 65° C. was, as to its combustion in furnaces, superior to that of the gas obtained in any of the other trials to a much greater extent than would be expected from the relative calorific values. The yield of ammonia increases as the steam-saturation temperature is raised, but if it be necessary to consider also the fuel value of the gas, the best steam-saturation temperature appears to be about 65° C., when about 30 per cent. of the nitrogen of the coal is recovered as ammonia, together with a suitable gas for furnace operations. The total yield of tar was 24·1 tons from 419 tons of coal. The sulphur in the coal amounted to 19 lb. per ton, of which 16·5 lb. appeared in the gas, chiefly as hydrogen sulphide.—A. S.

Tar-fog; Determination of ——, and its removal from gases. R. H. Clayton and F. W. Skirrow. J. Gas Lighting, 1907, 98, 660—663.

For the correct estimation of suspended tar-fog in gases, it is essential that the filtering medium employed be placed within the gas main to ensure its temperature being the same as that of the gas, and that the sample be drawn from the point of average velocity, one-third of the diameter from the side of the main. The inlet to the filter-tube should also, if possible, face the gas stream, and the velocity of the gas through the inlet orifice must be higher than that of the gas in the main. In the authors' experiments, cotton-wool was employed as the filtering medium, the separated tar being extracted with carbon bisulphide, the latter evaporated, and the residual tar weighed. Any "free carbon" in the tar was therefore not included. The results obtained with coal-gas after condensation, but before any special treatment for removal of tar-fog, showed the presence of tar in quantities varying from about 3 to 25 grms. per 100 cb. ft. Tests of the efficiency of different tar separators showed that the Livesey washer removed from 85—88 per cent. of the tar from crude coal-gas and the Pelouze-Audouin separator, when the differential pressure between the inlet and outlet was above 2 inches, from 97—99 per cent., but that the efficiency rapidly diminished when the differential pressure fell below 2 inches. With carburetted water-gas, the Pelouze-Audouin separator as ordinarily constructed for coal-gas does not give good results. (See also Earnshaw, this J., 1906, 917.)

The removal of tar-fog by means of centrifugal separators is also considered, and experiments with a Crossley centrifugal fan on producer gas showed a removal efficiency varying from 89 to 97 per cent.—H. G. C.

Calorimetric bomb; Rate of combustion and pressure developed in a ——. F. G. Benedict and F. P. Fletcher, XXIII., page 717.

English Patents.

Filter-presses [for peat] or apparatus for separating fluid from solid substances. J. Stevens and A. H. Hughes, London. Eng. Pat. 11,621, May 18, 1906.

The peat is pressed in a chamber of frusto-conical, or other convenient shape by a ram of corresponding form which is forced into the chamber by hydraulic pressure, or other suitable means. The sides of the chamber and the head of the ram are provided with straining plates let into the interior surface of the chamber and the head of the ram, and provided with draining channels, so that the expressed liquid may flow away from contact with the peat to prevent its re-absorption when the pressure is removed. The special straining plates which form the subject of the claim are constructed of one, or more thicknesses of filter cloth, or other porous fabric, or sand supported between wire gauze plates. The draining plates so formed are supported between perforated or slotted metal sheets.—W. H. C.

Fuel; Artificial ——. J. W. Leadbeater, Doncaster. Eng. Pat. 17,069, July 28, 1906.

About 88 parts of coal, preferably anthracite, are ground, and well mixed, without warming, first, with 8 parts of sodium silicate and subsequently with 4 parts of dextrin (powder). The mass is then heated to about 75° F., and formed into briquettes in the usual way. In order to render the blocks waterproof, 10 lb. of lime-water and 1 lb. of rosin oil may be added to 1 ton of the fuel mixture. —W. H. C.

Coke ovens; Regenerative ——. E. Coppée, Brussels. Eng. Pat. 19,480, Aug. 31, 1906.

See Fr. Pat. 369,212 of 1906; this J., 1907, 84.—T. F. B.

Coke-oven doors. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 26,946, Nov. 27, 1906.

The joint between the oven and a hinged metal door, with a suitable locking arrangement, is made gas-tight by an endless rubber tube, let into a recess in the door, and expanded by compressed air after the latter is closed, against a casing fitted to the end of the oven. The metal of the door and frame is protected from the heat by a shield of refractory material which is lowered into a recessed chamber formed in the end of the oven. The space between the door and shield is filled with cooled gas under a slight pressure to prevent the hot gas leaking out of the oven and warping the metal.—W. H. C.

Distilling coals and other hydro-carbonaceous substances; Apparatus for ——. C. A. Allison, London. From American Chemical Eduction Co., New York. Eng. Pat. 11,926, May 22, 1906.

See U.S. Pat. 821,323 of 1906; this J., 1906, 584.—T. F. B.

Coal gas; Manufacture of —— for illuminating purposes. E. Parker, Levenshulme, Lancs. Eng. Pat. 16,471, July 21, 1906.

To prevent the decomposition of hydrocarbons and the formation of naphthalene in the manufacture of coal gas, the retorts, which may be horizontal or inclined, are constructed with an outlet pipe at one end only, from which the gas is drawn off by means of suction apparatus under reduced pressure. At the other end of the retort, steam is injected through a jet so as to pass along with the gases over the surface of the coal. The steam may be dried by a suitable superheating arrangement. A separate steam jet is provided to prevent dryness in the ascension pipe. The latter has a greater diameter to allow for the increase in volume of the gas.—R. L.

Air gas; Means of and apparatus for manufacturing ——. W. Moores and G. Petrides, London. Eng. Pat. 19,332, Aug. 29, 1906.

Sheets of wood-pulp are impregnated with a mixture of "chloride of lime, glycerin, ammonium chloride, and water"; they are then dried, dipped into "benzoline," and again dried. Two of these sheets, with a layer of "manganese dioxide" between, are fixed vertically along the middle of a carburetting tank, and other sheets are arranged parallel to these, spaced apart from them and from each other. The tank is then partly filled with petroleum spirit, and the air to be carburetted is passed through it as usual. —H. B.

Gasifying oils and carburetting air; Apparatus for ——. L. Kurzer, Dresden, Germany. Eng. Pat. 26,698, Nov. 24, 1906. Under Int. Conv., Nov. 30, 1905.

See Fr. Pat. 371,659 of 1906; this J., 1907, 400.—T. F. B.

Carburettors. L. Kurzer, Dresden. Eng. Pat. 28,660 Dec. 15, 1906. Under Int. Conv., Aug. 24, 1906.

The carburettor consists of a drum formed of a number of concentric cylinders, covered on their outer surfaces by an absorbent material, such as cloth. The drum is mounted in a receptacle containing heavy carburetting oil, which is absorbed by the cloth when the drum is rotated, and is taken up, in the form of vapour, by the air to be carburetted, passing through between the cylinders. (Reference is directed to Eng. Pat. 16,235 of 1884.)—R. L.

Gas producer, purifying apparatus, and gas engine; Portable gas plant comprising ——. H. Hurlebusch, Lehrte, Germany. Eng. Pat. 29,231, Dec. 22, 1906. Under Int. Conv., Jan. 15, 1906.

See Fr. Pat. 362,425 of 1906; this J., 1906, 748.—T. F. B.

Gas; Apparatus for filtering ——. J. Robertson, London, and Williams and Robinson, Ltd. Rugby. Eng. Pat. 19,624, Sept. 3, 1906.

This filter for gas and especially for producer gas consists of trays containing wood shavings, sawdust, or the like. The filtering material in one or more of these trays, preferably that in the last tray of the series, is covered with a screen of textile material, such as ordinary blanketing, which will prevent any particles of liquid or solid matter from passing, and will compel the gas to distribute itself evenly in the different portions of the apparatus.—R. L.

Incandescing bodies for electric incandescent lamps; Manufacture of ——. A. Just, F. Hanaman, and Vereinigte Electricitäts A.-G., Budapesth. Eng. Pat. 11,944, May 22, 1906.

For the manufacture of tungsten filaments in accordance with the process described in Eng. Pat. 20,175A of 1905 (this J., 1906, 974), the plastic mass is made with metatungstic acid or meta-tungstates, or mixtures of these with each other or with other tungsten compounds reducible to metal by hydrogen. Finely-divided metallic tungsten may with advantage be incorporated with the plastic mass.—H. B.

Filaments for electric incandescent lamps; Supports for metallic ——. A. Lederer, Vienna. Eng. Pat. 20,210, Sept. 11, 1906.

A METALLIC support for a metallic filament is provided with an extremely thin coating of a compound, preferably oxide, of the metal of which the support is composed. A suitable coating of oxide may be obtained by simply passing a clean, unoxidised wire (*e.g.* of nickel) through a flame.—H. B.

Incandescence filaments of electric incandescence lamps; Process for the soldering of —— to the conducting wires. H. Kuzel, Baden, Austria. Eng. Pat. 25,994, Nov. 16, 1906. Under Int. Conv., Jan. 20, 1906.

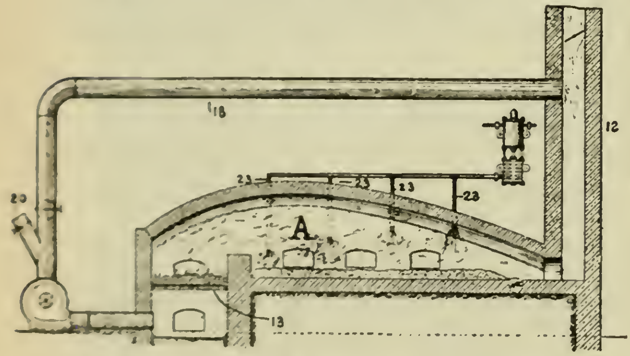
SEE Addition of Nov. 21, 1906, to Fr. Pat. 366,267 of 1906; this J., 1907, 520.—T. F. B.

UNITED STATES PATENTS.

Briquettes from coal, peat, and bog earth; Process for manufacturing ——. J. Buss, Munich, Assignor to C. Fohr, Schloss Wallenburg, Germany. U.S. Pat. 854,565, May 21, 1907.

SEE Fr. Pat. 372,744 of 1906; this J., 1907, 520.—T. F. B.

Combustion; Process of conducting ——. B. E. Eldred, Bronxville, N.Y., Assignor to Combustion Utilities Co., New York. U.S. Pat. 854,156, May 21, 1907.



A "TARDILY burning inflated flame" is produced in the reverberatory furnace, A, by drawing in a current of air through the pipe, 20, mixing it with products of combustion drawn from the chimney, 12, through the pipe, 18, and blowing it through a shallow bed of fuel on the grate, 13. The combustion is intensified in "successive upward strata" by blowing jets of air through the side of the furnace by the pipes, 23. The level of the jets above the hearth is successively increased as the position of the jets recedes from the grate, 13.—W. H. C.

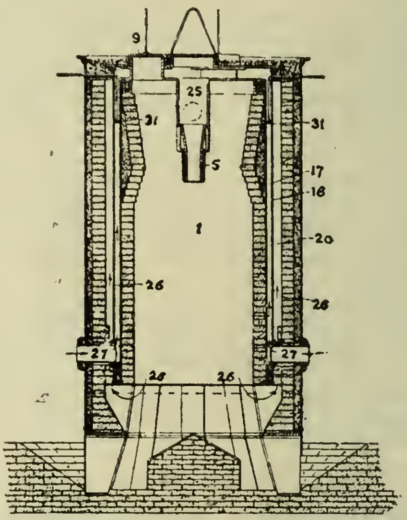
Coke oven. M. E. Rothberg and A. Ernst, Pittsburg, Pa. U.S. Pat. 841,052, Jan. 8, 1907.

THE heating flues are arranged in opposite pairs (extending half-way along the oven) in the side walls of the coking chambers, and communicate with flues under the chamber, these flues in turn discharging into central waste-gas mains arranged longitudinally of the battery of ovens. The mains lead to two regenerator chambers, beyond the battery, that can be placed in alternate connection with the chimney stack by a butterfly valve. Air is blown into the regenerators through a butterfly valve, and is conveyed through longitudinal mains and flues to branch-flues communicating with the heating flues, so as to produce a downward draught through all these latter flues toward the waste-gas main. The coke-oven gases after passing through a condensing plant, are returned through pipes, having burner connections, located in the heating flues.—C. S.

Coking coal; Process of ——. S. B. Sheldon, Buffalo, N.Y. U.S. Pat. 855,069, May 28, 1907.

THE claim is for the process of coking coal in the apparatus described in U.S. Pat. 847,614, of 1907 (this J. 1907, 519).—W. H. C.

Gas-producer. C. H. Morgan and A. J. Gifford, Worcester, Mass. U.S. Pat. 852,516, May 7, 1907.

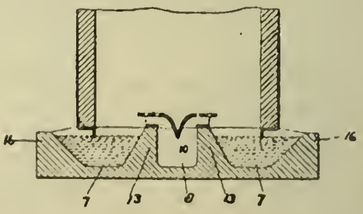


THE producer consists of a generator chamber, 1, of the shape shown, the fuel being charged through the opening, 9. Air enters through the openings, 27, and passes upwards through the annular space, 17, where it is saturated with water, sprayed against the walls of the annular space, 17, from the pipes, 31. The air then enters the hollow space in the double top of the generator and is delivered downwards into the generator by the vertical tuyère, 5. The gas leaves the generator near the bottom as indicated by the arrows, 26, passes up an outer annular gas space, 20, surrounding the air space, 17, and divided from it by a metal partition, 16, and is discharged near the top through the pipe, 25.—W. H. C.

Gas-producer. W. B. Hughes, Chestnut Hill, Pa. U.S. Pat. 852,957, May 7, 1907.

THE gas-producer has a stationary body and a revolving top and grate. The latter has a blast-pipe attached to it so that it revolves with the grate. Both the top and the grate are revolved together by suitable rack-work.—W. H. C.

Gas-producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 852,958, May 7, 1907.



THE gas-producer has an "artificial-stone" base, 16, with walls, 13, of the same material extending across the base. The space, 8, forms an air-channel, and the spaces, 7, 7, two water-channels one on either side of the air-channel. Over the air channel a deflector, 10, of the form shown, is arranged to prevent the ash from falling into and blocking the air-channel, 8, and to distribute the air.—W. H. C.

Hydrogen; Process of generating ——. C. Ellis, White Plains and B. E. Eldred, Bronxville, N.Y., Assignors to Combustion Utilities Co., New York. U.S. Pat. 854,157, May 21, 1907.

Producer gas, generated by blowing air through a producer charged with fuel, is led through a superheater chamber filled with chequerwork of refractory material in order to heat the latter. The gas is then passed under a boiler and burnt to generate steam. The producer is now worked with the steam instead of air to form water-gas, which is mixed with steam, and passed through the superheater to convert the carbon monoxide into dioxide. The mixture of carbon dioxide and hydrogen is then compressed, the former is separated in the liquid condition, and the latter is collected separately. The process is rendered continuous by repeating the above processes alternately.—W. H. C.

Producer-gas; Process of generating ——. M. F. Mangelsdorff, Assignor to Combustion Utilities Co., New York. U.S. Pat. 854,228, May 21, 1907.

Exhaust gas from a gas-engine is passed through a tube of porous material at a greater pressure than that of the air surrounding the tube. A portion of the nitrogen diffuses through the pores, and the residual gas, which is richer in carbon dioxide, is passed through a bed of ignited fuel in order to form producer-gas. The latter is then utilised again in the gas-engine. The generator is blown alternately with air and with the enriched gas. —W. H. C.

Gas-manufacturing process. J. J. Busenbenz, Assignor to Industrial Gas Construction Co., Chicago, Ill. U.S. Pat. 855,094, May 28, 1907.

In order to obtain a stable gas from a volatile liquid without the aid of heat, the oil, or other volatile liquid is forced out of a jet, in an atomised condition, by compressed air, into a mixing chamber which is not heated. A further quantity of air, sufficient to give the proper proportions to the mixture, is induced or drawn into the mixing chamber by the jet of atomised oil and air. —W. H. C.

Gases; Apparatus for analysing ——. W. Jones, Assignor to Jones-Julia Manufacturing Co. U.S. Pat. 854,696, May 21, 1907, XXIII., page 717.

French Patents.

Briquettes [of fuels and ores], and binding medium therefor. P. Léotard. Fr. Pat. 373,360, Jan. 7, 1907.

The binding medium (for 100 parts of combustible or ore) is composed of: non-crystalline calcium carbonate (preferably marl), 8—20 parts; sodium silicate, 2—6 parts; common salt, 0·5—2 parts, with sufficient water to make a liquid product. It is added to the basis, in the form of a fine jet, in a mixer, the resulting paste being pressed in moulds. The salt is said to stimulate combustion, and the marl and sodium silicate, to suppress smoke and clinker. In the case of briquetted ore, the binding medium forms a flux.—C. S.

Generator for gas, vapours, fluids or liquids. R. Desouches. First Addition, dated March 8, 1906, to Fr. Pat. 360,982, March 21, 1905.

The generator described in the principal patent (this J., 1906, 583) is here provided with a device, to be interposed between the generator and the motor, for filtering the gaseous or liquid combustible and carburetting a certain proportion of air therewith. The device consists of a tubular casing, containing discs of felt or other permeable material through which the combustible has to pass; the casing has numerous perforations, through which air is drawn into the combustible by the action of the motor, these perforations being regulated as desired by means of a perforated sleeve which surrounds the casing.—H. B.

Hydrogen; Manufacture of —— *for lighting, heating, and other applications.* L. Vignon. Fr. Pat. 373,271, Jan. 2, 1907.

Steam is passed over finely-divided iron at about 1200° C., the hydrogen produced being collected. The oxide of iron formed is then reduced to metallic iron again, by passing water-gas, producer-gas, or the like over it, and the metallic iron is again treated with steam.—H. B.

Electrodes for arc lamps. A. Blondel. Fr. Pat. 373,270, March 13, 1906.

Electrodes of carbon, especially those having a mineralised core, are constructed with metallic wires embedded longitudinally within them, so as to increase the conductivity of the electrodes and consequently to reduce the temperature at which they need be baked. The wire or wires (preferably of nickel or copper, and about 0·4 mm. thick) are fed continuously along with the electrode paste through the die from which the electrode is extruded, and the electrode is then baked; in this way the intimate contact of the wires with the mass of the electrode is ensured.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

(*Continued from page* 602.)

Wood-charcoal; Examination of gases evolved in the preparation of ——. E. Juon. Stahl u. Eisen, 1907, **27**, 733—739, 775—779.

The author has already described the varieties of charcoal obtained from different woods (this J., 1904, 1092). The charcoal was prepared by burning the wood in piles of 50—100 cb. m. capacity, in rectangular vaulted ovens, and the process of carbonisation was carried on by burning small coal in a chamber alongside the pile, and leading the hot gases into the pile. The woods used were fir, pine, and birch as grown in the Urals. The heating of the pile during the first two days produces large quantities of steam, and the temperature rises to about 200° C. At this stage heavy brown vapours begin to come off, but after two more days, the evolved gas is again colourless, and is dry. The heating of the pile from the outside is then discontinued by stopping the entrance of the gas from the coal, and all holes are closed with moist clay with the exception of the chimney. Large quantities of hydrocarbons and hydrogen are now evolved, and after 3—8 hours, the chimney is also plugged with moist clay. A considerable pressure of gas is thus produced in the pile, and the pressure is only very slowly relieved by the gas exuding through the porous walls. At this stage the temperature rises to the highest point (about 390° C.), and after that, gradually falls. At the end of a further period of 6—10 days, the temperature sinks to about 40° C., and the pile is then opened. In the experiments, gas was taken from an upper and a lower zone of the pile and analysed. During the period when the water and tarry matters are evolved, large quantities of carbon monoxide and dioxide are produced. The quantity of these increases gradually as the temperature rises, and reaches a maximum, after which the amount falls off, and at 300°—350°, when the holes admitting heating gases to the pile are closed, hydrogen and methane are beginning to increase. As soon as the evolution of hydrocarbons and hydrogen is very rapid, the exit is plugged, and the whole mass cools under pressure. In this process the charcoal absorbs some of the hydrocarbons: these are chiefly methane, but include propylene, butylene, and small quantities of benzene and toluene. The charcoal prepared in this way is heavier and about 6 per cent. higher in carbon than if the opening to the chimney were left open right to the end of the process. The total yield of charcoal is also larger. The author supposes that the increase of weight due to the cooling in the hydrocarbon atmosphere is the result of a condensation of some of these to complex and less volatile compounds. The percentage of carbon in the charcoal is of great importance when the charcoal is to be used for the blast furnace, and the enriching of the charcoal from the hydrocarbons, forms a much better method than the preparation of the charcoal in retorts at a higher temperature (700° C.), a smaller yield being obtained in the latter case, and the process

being expensive. A charcoal containing 78—80 per cent. of carbon is sufficient for blast furnace work, and a material of this kind can be prepared quite well in piles by the above method with a maximum temperature of 370°—400°.
—C. E. F.

Petroleum ; Optically inactive ——. M. A. Rakusin. Petroleum, 1907, 2, 599—602.

Surachany (Caucasus) crude oil is perfectly transparent in polarised light and gives the value K=100, as compared with $K=\frac{1}{3}\%$ for Balachany oil and K=1/24 for Grosny oil, this behaviour, in conjunction with the pink coloration it yields with trichloracetic acid, indicates the absence of any racemic products, and relegates the oil to the class of naturally filtered primary oils. The residue gives the value $K=3\frac{1}{3}\%$, shewing that the proportion of semi-carbonised products has increased about thirty-fold during distillation. An analogous optical behaviour was found in the case of two Italian crude oils: from Montechino and Velleia. The colorations with trichloracetic acid: *viz.*, faint trace in the former case and greyish-green in the latter, correspond with that furnished by decomposition products of cholesterol, and indicate a slight natural decomposition in the deeper oil deposits, some of the products of which have passed through with the oil in its filtration in the earth. The distillates from these oils at 150—200° C. gave a violet colour reaction with trichloracetic acid, and those at 200—250° C. a fine blue, the latter being unique, and the former only observed hitherto in the case of a petroleum from Irtysch. These Italian oils are therefore regarded as racemic mixtures of hydrocarbons, analogous to Pennsylvania oil; small quantities of decomposition products are probably present. The intensity of the colour reaction with trichloracetic acid is considered to afford a reliable criterion as to the relative degree of racemisation of petroleum, a point to be considered, in association with the degree of carbonisation and the length of the filtration process (in the sense adopted by Day), in judging the relative geological age of the oil.—C. S.

Petroleum ; A problem in the technical treatment of ——. K. Charitschkow. Techn. Westn. 1907, 1, 131 ; Chem. Zeit., 1907, 31, Rep., 266.

The principal constituents of alkali sludge in petroleum refining are monobasic naphthene-acids of cyclic constitution. The acids, which in a free state are liquid, do not solidify even at -70° C., and they furnish methyl- and ethyl esters of agreeable odour, glycerides, &c. Their copper salts have an intense green colour. None of these properties have yet found any technical application. It is not clear how monobasic naphthene-acids come to be formed in this alkali sludge ; for, according to Donath, the oxidation of petroleum hydrocarbons yields chiefly polybasic acids ; and it is known that ordinary burning oil from Baku and Grosny oil forms, on oxidation in the air, polybasic acids that spoil the oil under prolonged storage. The action of ozone on burning oil, in presence of alkali, also furnishes polybasic acids exclusively.—C. S.

Masut [Petroleum residuum] ; Distillation experiments with Boryslaw ——. M. Wielezynski. Chem.-Zeit., 1907, 31, 499.

Two methods were employed, *viz.*, " cracking distillation " in a vertical still ; and distillation in a horizontal still with steam at 250° C., the former being continued until nothing but coke was left, and the latter until the residue (tar) was 25 per cent. of the original charge. The cracking process furnished vaseline oil containing an average of 11·54 per cent. of paraffin wax with the setting point, 49·6° C., whilst the steam distillation yielded an oil containing an average of 23·95 per cent. of paraffin wax setting at 51·6° C. These figures agree with those obtained in practice, the amount of paraffin wax recovered in small refineries being hardly 3 per cent., as compared with 6 per cent. in large, well equipped works.—C. S.

English Patent.

Paving or pavement mixtures ; Bituminous ——. P. M. Justice. From International Pavement Co. Eng. Pat. 20,723, Sept. 18, 1906. IX., page 691.

United States Patents.

Distilling wood ; Apparatus for ——. A. J. McArthur, Collins, Ga. U.S. Pat. 855,330, May 28, 1907.

The retort in which the wood is distilled is connected by a valved pipe to a tar-receiver and to a turpentine condenser. The latter is also connected by a valved pipe to a turpentine-receiver, and both receivers are connected by valved pipes with a vacuum pump. The condenser coil is also connected to a relief valve.—W. H. C.

Lubricating oil ; Process for obtaining —— from crude oil [petroleum]. W. J. Ryan, Chester, and C. R. Burke, Overbrook, Pa. U.S. Pat. 854,057, May 21, 1907.

The crude petroleum is chilled to about —10° to —40° F. and filtered from objectionable ingredients at approximately the same temperature ; the flashing point of the oil is thus also raised. The colour of the final product may be varied by passing the oil for a longer or shorter distance through chilled filtering material. Prior to filtration the crude oil may be reduced to a specific gravity of 70° to 35° B., by the addition of naphtha or similar substance, which is subsequently removed from the filtrate.—C. A. M.

French Patent.

Petroleum ; Washing —— with alcohol. H. Guttmann. Fr. Pat. 373,072, Dec. 29, 1906.

To deprive petroleum of its disagreeable odour, smokiness, and tendency to " sweat " the lamp, the inventor proposes to wash it with half its volume of strong denatured alcohol in an agitator. The milky liquid is then allowed to settle for about 24 hours, and the washing is repeated until all the impurities have been extracted. The impure alcohol is used as fuel. The illuminating power of the oil is said to be increased by about 50 %.—C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

(*Continued from page* 605.)

Triphenylmethane dyestuffs ; Relation between constitution, colour, and absorption spectra of ——. F. Reitzenstein and W. Schwerdt. J. prakt. Chem. 1907, 75, 369—415.

The authors confirm the results of Reitzenstein and Runge (this J., 1905, 327 ; compare also 1906, 259) as to the influence of the nitro-group in presence of methyl- and amino-groups, on the shade of triphenylmethane dyestuffs, and have extended the work to the dyestuffs containing the chloro- and sulphonic acid groups. Their conclusions are as follows : In simple triphenylmethane dyestuffs in which one component is tetramethyldiaminophenylcarbinol, the nitro-group when in the ortho-position to the methane carbon atom, exerts a weakening influence on the colour, but when it is in the meta-position, the colour is augmented. When chlorine is in the ortho-position, the colour becomes purer and stronger, in the meta-position the colour is deeper, and in the para-position the shade becomes deeper and clearer. The presence of the sulphonic acid group in the ortho-position weakens the colour and gives it a greener shade ; in the meta-position the colour is weakened and is not so bright ; and in the para-position the shade is intensified. When one component of the dyestuff is tetramethyldiaminoditolylcarbinol, a distinct weakening in the shade is noticed, and the influence of the nitro-, chloro-, and sulphonic acid groups cannot be traced owing to the slight dyeing properties. If two molecules of these compounds are united by means of a five-carbon chain, a strengthening of the colour is produced. When, however, the two molecules are united by a chain of three carbon atoms, the blue shade disappears and a clear green colour takes its place. The absorption spectra of these dyestuffs are described.—J. C. C.

Ethyl-oxalate and dimethylaniline ; Products of condensation of ——, in presence of aluminium chloride. [*Triphenylmethane dyestuffs*]. A. Guyot. Compt. rend. 1907, **144**, 1120—1123.

Ethyl-p-dimethylaminophenylglyoxalate :—To 80 grms. of aluminium chloride in 150 c.c. of ether are added quickly, with stirring, 30 grms. of ethyl oxalate and 49 grms. of dimethylaniline in 150 c.c. of ether. After reaction, the liquid is poured on to ice. The brown ethereal solution is separated and dried, the ether evaporated, and the residue distilled with steam to remove excess of dimethylaniline. A yellow oil remains which solidifies at 90° C., and on recrystallising from alcohol yields fine yellow plates, m.p. 95° C., of practically pure ethyl-*p*-dimethylaminophenylglyoxalate,

$$(CH_3)_2N.C_6H_4.CO\ CO_2C_2H_5.$$

Ethyltetramethyldiaminodiphenylglycollate is contained in the blue-green aqueous solution from the preceding operation, and is separated by addition of zinc and sodium chlorides. A better yield is obtained by pouring suddenly a solution of 80 grms. of aluminium chloride in 200 c.c. of ether into 30 grms. of ethyl oxalate and 80 grms. of dimethylaniline dissolved in 100 c.c. of ether. Most of the ether distils off, and after cooling, 500 c.c of ether are added and the whole poured gradually on to ice, avoiding rise of temperature. From the aqueous solution the substance is precipitated as chlorozincate by addition of sodium and zinc chlorides. The chlorozincate is filtered off and washed with solution of sodium chloride, then dissolved in water. It slowly dissociates, and crystals of the pure ester $[(CH_3)_2N.C_6H_4]_2 COH.CO_2C_2H_5$, are deposited, as colourless transparent prisms. It dissolves in acetic acid with intense indigo colour, and condenses with tertiary aromatic amines in aqueous solution to form derivatives of triphenylmethane. It dissolves in concentrated sulphuric acid with intense yellow colour, and on heating to 140° C. the solution evolves carbon monoxide, and leaves tetramethyldiaminobenzophenone.

Ethylhexamethyltriaminotriphenyl acetate :—This product is obtained by pouring rapidly a solution of 30 grms. of aluminium chloride in 80 c.c. of ether upon a mixture of 6 grms. of ethyl oxalate and 70 grms. of dimethylaniline. Nearly all the ether distils, and after an hour the product is treated with ice, enough solution of sodium hydroxide added to retain all the alumina in solution, and the dimethylaniline expelled by distillation with steam. The new substance deposits during this process, and is obtained pure by one recrystallisation from boiling alcohol. It forms colourless crystals, m.p. 176° C., readily soluble in benzene and its homologues. It is dissolved without coloration by concentrated sulphuric acid, but the solution at 140° C. suddenly turns yellow and evolves abundance of carbon monoxide. On dilution and partial neutralisation by ammonia, the liquid becomes successively green, blue, and violet, and deposits the sulphate of Methyl Violet in crystals. Ethylhexamethyltriaminotriphenyl acetate has also been obtained by the author by condensing with dimethylaniline:—1. Ethyldimethylaminophenyl glyoxalate (with phosphoryl chloride or aluminium chloride). 2. Ethyltetramethyldiaminodiphenylglycollate (in acetic or hydrochloric solution at 100° C.). 3. Ethyltetramethyldiaminodiphenylaminoacetate (in acetic or hydrochloric acid solution at 100° C.). 4. Ethyloxalyl chloride at 100° C. without any condensing agent. The chief product in this case is however ethyldimethylaminophenylglyoxalate. Ethyl trichloracetate does not condense with dimethylaniline.—J. T. D.

Auramine ; Synthesis of —— by means of oxalic esters.
A. Guyot. Compt. rend. 1907, **144**, 1219-1220.

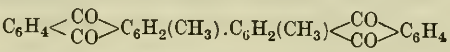
Tetraalkyldiaminodiphenylglycollic esters (this J. 1907, 603) form neutral salts with acids, the indigo-blue aqueous solutions of which react with ammonia, even when dilute, to furnish tetraalkyldiaminodiphenylaminoacetic esters according to the equation : $(R_2N.C_6H_4)_2 CCl.CO_2R' + 2\ NH_3 = NH_4Cl + (R_2N.C_6H_4)_2C(NH_2).CO_2R'$. These new compounds are *exo*-carboxylic derivatives of the leucauramines and possess all the properties of the latter. They dissolve in glacial acetic acid with an intense blue coloration, and condense with aromatic tertiary amines, either in neutral or acid solution, to form triphenylmethane derivatives. Thus, ethylhexamethyltriaminotriphenyl acetate (this J. *loc. cit.*) is produced by heating an equimolecular mixture of dimethylaniline and ethyltetramethyldiaminodiphenylaminoacetate in glacial acetic acid solution on the water-bath for some minutes.

$$[(CH_3)_2N.C_6H_4]_2C(CO_2.C_2H_5).NH_2 + C_6H_5\ N(CH_3)_2 =$$
$$[(CH_3)_2N.C_6H_4]_2C(CO_2.C_2H_5)\ C_6H_4\ N(CH_3)_2\ +\ NH_3$$

When a dilute alkaline solution of an aminoacetic ester is oxidised with dilute potassium ferricyanide solution in the cold, a quantitative yield of the corresponding auramine is produced. The author's experiments were made with the tetramethyl compound, from which he obtained ordinary Auramine.—J. C. C.

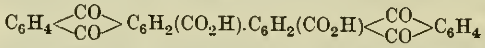
Flavanthrene ; Constitution and synthesis of ——. R. Scholl. Ber., 1907, **40**, 1691—1702.

The synthesis of flavanthrene has been effected by the following series of reactions. 1-Amino-2-methylanthraquinone is converted into 1-iodo-2-methylanthraquinone by the diazo reaction, and the latter compound is heated with copper powder to 290° C. In this way iodine is removed, and 2:2′-dimethyl-1:1′-dianthraquinonyl



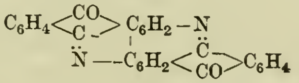
$$C_6H_4{<}{\begin{smallmatrix}CO\\CO\end{smallmatrix}}{>}C_6H_2(CH_3).C_6H_2(CH_3){<}{\begin{smallmatrix}CO\\CO\end{smallmatrix}}{>}C_6H_4$$

is produced. It can also be obtained from 1-amino-2-methylanthraquinone by treating the diazo-sulphate with copper powder and acetic anhydride. On oxidation with chromic acid in acetic acid solution, 1:1′-dianthraquinonyl-2:2′-dicarboxylic acid



$$C_6H_4{<}{\begin{smallmatrix}CO\\CO\end{smallmatrix}}{>}C_6H_2(CO_2H).C_6H_2(CO_2H){<}{\begin{smallmatrix}CO\\CO\end{smallmatrix}}{>}C_6H_4$$

results, which is converted into the carboxyamide by treating it with phosphorus pentachloride and subsequently with ammonia. When this compound is boiled for half an hour with aqueous caustic soda and bromine, Flavanthrene is obtained. This consequently has the constitution



—J. C. C.

English Patents.

Nitroaminophenolsulphonic acids and dyestuffs therefrom ; Manufacture of ——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 11,196, May 12, 1906.

Nitro-*o*-aminophenolsulphonic acids may be obtained by nitrating carbonylaminophenolsulphonic acids (prepared by treating *o*-aminophenolsulphonic acids containing a free para-position to the amino-group, with phosgene), and then eliminating the carbonyl group. The following new acids are described : nitro-*o*-aminophenolsulphonic acid, ($NH_2 : OH : NO_2 : SO_3H = 1 : 2 : 4 : 5$), nitro-*o*-amino-*p*-cresol-*o*-sulphonic acid ($CH_3 : OH : NH_2 : SO_3H : NO_2 = 1 : 4 : 3 : 5 : 6$), *p*-chloro-5-nitro-*o*-aminophenol-*o*-sulphonic acid ($Cl : OH : NH_2 : SO_3H : NO_2 = 4 : 1 : 2 : 6 : 5$), nitro-*o*-amino-*o*-cresol-*p*-sulphonic acid ($CH_3 : OH : NH_2 : SO_3H : NO_2 = 1 : 2 : 3 : 5 : 6$) and *o*-chloro-3-nitro-*o*-aminophenol-*p*-sulphonic acid ($OH : Cl : NH_2 : SO_3H : NO_2 = 1 : 2 : 6 : 4 : 3$). Example : Carbonylaminophenolsulphonic acid is obtained by passing phosgene into a cold solution of sodium *o*-aminophenol-*p*-sulphonate until the solution can no longer be diazotised ; the carbonyl derivative separates from strong solutions and may be crystallised from hot water. 10·75 kilos. of carbonylaminophenolsulphonic acid are dissolved in 45 kilos. of sulphuric acid (monohydrate) at 10—15° C., 12·5 kilos. of a mixture of nitric and sulphuric acids (26 per cent. of HNO_3) are then added at 5—10° C. After stirring for some time, the whole is poured on to ice, and the potassium salt of the nitro-carbonyl-*o*-aminophenol-*p*-sulphonic acid precipitated by adding potassium chloride. For hydrolysis, 14·9 kilos. of this potassium salt are dissolved in a little water, 10 kilos. of caustic soda solution (40° B.) added, and the whole heated for half an hour to about 90° C. On acidifying and cooling, the nitro-*o*-aminophenol-*p*-sulphonic acid separates in yellow crystals. The dyestuffs obtained by diazotising the foregoing acids and combining with the usual components, give red to black shades on chromed wool.—J. C. C.

Monoazo dyestuff ; Manufacture of a new ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 16,085, July 16, 1906.

See Fr. Pat. 368,259 of 1906 ; this J., 1906, 1215.—T. F. B.

3-*Aminophenyl*-5-*oxy* [*hydroxy*] - 1 : 2-*naphthimidazoledisulphonic acid ; Manufacture of* ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 24,518, Nov. 2, 1906.

When 3-aminophenyl-5-hydroxy-1 : 2-naphthimidazole-7-sulphonic acid is treated with 4 parts of fuming sulphuric acid (containing 25 per cent. of SO_3) at 80—100° C., a corresponding disulphonic acid is obtained which is sparingly soluble in water and is distinguished from the monosulphonic acid in being insoluble in mineral acids. The dyestuffs obtained from this new acid by treatment with diazo-compounds, such as diazobenzene, are easily soluble in water and dye cotton clear red shades which are very fast to acids.—J. C. C.

Azo colouring matter and pigments or lakes therefrom ; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6227, Mar. 14, 1907. Under Int. Conv., May 21, 1906.

See Fr. Pat. 373,475 of 1907 ; following these.—T. F. B.

Azo colouring matters and pigments or lakes therefrom ; Manufacture of ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 6228, March 14, 1907. Under Int. Conv., June 20, 1906.

See Fr. Pat. 373,475 of 1907 ; following these.—T. F. B.

United States Patents.

Anthraquinone derivative [*dyestuff*]. P. Thomaschewski, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 853,041, May 7, 1907.

Claim is made for compounds obtained by treating acetylated secondary alkylamino- or arylaminoanthraquinones with alkalis. The products are crystalline and practically insoluble in water. The product obtained by treating 1-acetylmethylamino-4-paratolylaminoanthraquinone with alkalis, forms bronze-like leaflets, and its sulphonic acid dissolves in alkali with a crimson-red colour and dyes unmordanted and chromed wool in bluish-red shades.
—A. B. S.

Anthracene dye ; Process of making ——. M. Isler, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 855,248, May 28, 1907.

See Fr. Pat. 372,261 of 1906 ; this J., 1907, 523.—T. F. B.

French Patents.

Dyestuffs ; Preparation of orthohydroxyazo ——. L. Cassella & Co. Fr. Pat. 373,109, Mar. 9th, 1906.

The diazo-compounds derived from arylsulphonic esters of *o*-amino-phenol or -naphthol, unlike those containing the hydroxyl group intact, react readily and quantitatively with the usual components. When the resulting dyestuffs are heated for a short time with dilute caustic soda, the aryl group is eliminated, and dyestuffs derived from *o*-amino-phenol or -naphthol are produced which are not obtainable by direct means. The arylsulphonic esters are obtained by condensing substitution products of *o*-nitrophenol with *p*-toluenesulphonic chloride in presence of an alkali, and reducing the nitro-compound, or by condensing the sulphochloride with *o*-amino-phenol or -naphthol or their derivatives in alkaline solution. In this way are obtained the dyestuffs :—*o*-diazophenol coupled with chromotropic acid, dyeing wool magenta-red which on chroming gives a fast bluish-red ; *o*-diazophenol-*p*-sulphonic acid coupled with salicylic acid, dyeing wool yellow which on chroming gives a yellowish brown fast to light and washing ; and 1-diazo-2-naphthol-4-sulphonic acid coupled with β-naphthol, dyeing wool red-brown which on chroming gives a splendid blue-black.—J. C. C.

p-Nitroso-p-acetaminodiphenylamine and its sulphonic acids ; Production of ——, *and of blue dyestuffs derived therefrom.* L. Cassella et Cie. First Addition dated March 12, 1906, to Fr. Pat. 350,334, Nov. 22, 1904.

The blue dyestuffs obtained as described in the chief patent (this J., 1905, 1297 ; 1906, 117) are also obtained by oxidising 1 : 3-diarylnaphthylenediamine-6 : 8-disulphonic acids with *p*-diaminodiphenylamine-*o*-sulphonic or *p*-diaminophenyltolylamine-*o*-sulphonic acid, or with their acetyl derivatives, the acetyl group being subsequently split off.—J. C. C.

Lakes [*from azo dyestuffs*] ; *Manufacture of* ——. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 373,115, March 10, 1906. XIII*A*., page 701.

Dyestuffs ; Production of sulphurised vat —— *and their sulphonic acids.* Badische Anilin- & Soda-Fabrik. Fr. Pat. 373,513, Dec. 31, 1906. Under Int. Conv., Jan. 22, and June 12, 1906.

Dyestuffs analogous to Thioindigo Red are obtained when arylthioglycollic acids or arylthioglycol-*o*-carboxylic acids of the type $R.S.CH_2.CO_2R'$ or $CO_2R^2.R.S.CH_2.CO_2R'$ (where R is a benzene or naphthalene radical, R' and R^2 atoms of hydrogen or metals or acyl or aryl radicals) are subjected to the action of acid condensing agents, and the resulting leuco-compounds oxidised in the usual manner. An alternative method is to act on the derivatives of arylthioglycol-*o*-carboxylic acid with alkaline condensing agents, or to subject them to the action of heat. The preparation of the arylthioglycol-*o*-carboxylic acids and their transformation into these leuco-compounds may be carried out in one operation. Thus, if thiocyanobenzoic acid or xanthobenzoic acid or their derivatives are heated with a halogen-substituted acetic acid in presence of alkali, the leuco-compounds are produced. The dyestuffs obtained show a great analogy with indigo and can be applied in the same way. They vary in shade from red or violet to blue, and on sulphonation furnish dyestuffs which dye wool.—J. C. C.

Dyestuffs [*Azo*] *insoluble in water ; Production of* ——. Badische Anilin- & Soda-Fabrik. Fr. Pat. 373,475, Jan. 11, 1907. Under Int. Conv., May 21, and July 20, 1906.

Azo dyestuffs suitable for making lakes are obtained by diazotising 4-chloro-2-nitro-, 4-chloro-3-nitro-, 2-chloro-5-nitro-, 3-chloro-6-nitro-, or 3-chloro-4-nitro-aniline and combining the diazo-compounds with β-naphthol. The combination may be effected in presence of aluminium hydroxide, heavy spar, etc., or these materials may be added afterwards. The lakes produced vary in shade from yellowish-orange to orange-red and are said to be very fast to light, oil or varnish, and lime.—J. C. C.

Sulphonic acids and their alkali salts ; Process for production of aromatic ——. W. Miersch. Fr. Pat. 373,338, Jan. 2, 1907. Under Int. Conv., Jan. 2, 1906.

If a sulphonation mixture be carefully heated with an alkali salt such as sodium chloride, two layers are formed, of which the upper contains the organic acid and the lower consists almost entirely of sodium bisulphate. This forms a convenient method of isolating organic sulphonic acids. Example : 58 kilos. of the sulphonation mixture from the preparation of benzenesulphonic acid, containing about 10 per cent. of water are added gradually to 12 kilos. of common salt, and the whole carefully heated. Hydrogen chloride is evolved, and separation into two layers takes place at about 130—140° C. These may be drawn off in the usual manner ; the lower layer consists of sodium bisulphate of 90—95 per cent. strength.—J. C. C.

GERMAN PATENTS.

Sulphide dyestuffs ; Process for preparing violet or violet-blue ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 178,982, June 29, 1904.

PHENOSAFRANOL is converted into sulphide dyestuffs by heating to high temperatures with sulphur, and amines of high boiling-point or phenols (or their acidyl or thio-derivatives) which are not by themselves capable of forming sulphide dyestuffs.—T. F. B.

Dyestuffs ; Process for preparing green acid mordant ——. [*Triphenylmethane-azo dyestuffs*]. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 175,825, March 18, 1905.

THE leuco-compounds of triphenylmethane dyestuffs of the general formula

$$(NH_2)(1)(SO_3H)(4)C_6H_3(3)CH(C_6H_4.NR_1R_2)(C_6H_4.NR_3CH_2C_6H_4SO_3H),$$

are diazotised, and combined with salicylic acid or cresotinic acid, and the azo compounds oxidised with lead peroxide or manganese peroxide. The leuco compound may be oxidised before diazotisation if desired. The dyestuffs are readily soluble in water, and the dyeings produced are fast to washing.—T. F. B.

Dyestuffs ; Process for preparing green acid mordant ——. [*Triphenylmethane-azo dyestuffs*]. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 175,826, June 22, 1905. Addition to Ger. Pat. 175,825 (see preceding abstract).

ON sulphonating compounds of the type

$$(NO_2)(SO_3H)C_6H_3.CH(C_6H_4.NR_1R_2)(C_6H_4.NR_3.CH_2C_6H_5),$$

internal salt formation occurs between the original sulphonic acid group and the $-NR_1R_2$ group. The resulting compounds can be used for the preparation of triphenylmethane-azo dyestuffs as described in the preceding abstract: the new dyestuffs give deeper shades after chroming on the fibre.—T. F. B.

Sulphide dyestuffs ; Process for preparing red or violet-red ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 179,021, Jan. 16, 1906. Addition to Ger. Pat. 171,177, March 15, 1905.

THE sulphide dyestuffs obtained by heating with alkali polysulphides, hydroxylated azines or oxyazines insoluble in alkali, of quinonoid constitution, are heated with a mixture of alkali polysulphide and copper or a copper compound ; the resulting dyestuffs tend to give bluer shades in dyeing than those obtained by the process described in the original patent (Eng. Pat. 4543 of 1905 ; this J., 1906, 260).—T. F. B.

o-Hydroxymonoazo dyestuffs ; Process for the manufacture of ——. Farbw. vorm. Meister, Lucius, und Brüning. Ger. Pat. 181,124, March 2, 1906. Addition to Ger. Pat. 174,905 of 1905 (this J., 1907, 313).

THE preparation of o-hydroxymonoazo dyestuffs by the combination of diazotised halogen-substituted o-aminophenols with 1.8-chloronaphtholsulphonic acids is effected in presence of organic acids or in neutral solution, instead of in presence of lime, as described in the original patent.
—A. S.

Benzanthrones ; Process for preparing ——. Badische Anilin und Soda Fabrik. Ger. Pat. 176,019, Aug. 21, 1904. Addition to Ger. Pat. 171,939, March 26, 1904.

BENZANTHRONES (see this J., 1905, 494 and 541.) can also be obtained by the condensation of anthracene with glycerol. The product consists partly of a compound insoluble in water, identical with the benzanthrone from anthranol (this J., 1905, 541); the part of the product which is soluble in water can be converted by melting with alkali hydroxides, into a violet " vat " dyestuff.—T. F. B.

Indigo ; Process for purifying synthetically prepared ——. Badische Anilin und Soda Fabrik. Ger. Pat. 179,351, Dec. 24, 1905. Addition to Ger. Pat. 148,114, March 12, 1903.

SYNTHETIC indigo may be purified by heating it when damp, to a temperature of, or above, 150° C., the time of heating depending on the temperature. The product is said to be especially suitable for vat-dyeing. (See this J., 1904, 248)—T. F. B.

Naphthalenesulphonic acids ; Process for preparing the diazo-oxides of ——. Kalle und Co. Ger. Pat. 175,593, Oct. 18, 1904.

THE diazo-oxides of naphthalenesulphonic acids are obtained by the action of zinc nitrite or its equivalent on aqueous solutions or suspensions of 1.2-aminonaphtholsulphonic acids.—T. F. B.

Dyestuffs of the Malachite Green series [*Triphenylmethane dyestuffs*] *; Process for preparing green basic* ——. Anilinfarben- und Extraktfabriken vorm. J. R. Geigy Ger. Pat. 178,769, Jan. 3, 1905.

GREEN dyestuffs of the triphenylmethane class are obtained by condensing a mixture of a tetra-alkyldiaminodiphenylcarbinol and *m*-xylene (or crude xylene) either with cold, concentrated sulphuric acid, or with 65—80% sulphuric acid at 100° C., and oxidising the leuco-compounds thus produced.—T. F. B.

Sulphide dyestuffs ; Process for preparing yellow to green substantive ——. D. Maron. Ger. Pat. 175,829, Feb. 2, 1905.

THE anhydro-compounds obtained by treating *o'-p'*-aminonitro-*p*-hydroxydiphenylamine with fatty or aromatic acids or their chlorides or anhydrides, are heated with sulphur and benzidine to 220°—240° C. The products are dyestuffs yielding on fabrics clear shades varying from olive-green to yellow.—T. F. B.

Dyestuffs of the gallocyanine series ; Process for preparing blue or greenish-blue ——. L. Durand, Huguenin, et Cie. Ger. Pats. 175,627, Feb. 12, 1905, and 175,628, Dec. 1, 1905.

GALLOCYANINE dyestuffs are condensed, in aqueous solution or suspension, with the salts of sulphonic acids of aromatic amines ; in this method, a portion of the dyestuff is reduced to the leuco-compound, which will not undergo the condensation : it is therefore advantageous to perform the process in presence of a suitable oxidising agent, or to oxidise the leuco-compound remaining in the product of condensation, and again condense it with the aminosulphonate.—T. F. B.

Dyestuffs ; Process for preparing blue to greenish-blue [*gallocyanine*] ——. L. Durand, Huguenin, et Cie. Ger. Pat. 178,841, Feb. 12, 1905.

GALLOCYANINE dyestuffs are condensed with salts of aromatic aminocarboxylic acids in aqueous solution or suspension.—T. F. B.

Dyestuff of the anthracene series ; Process for preparing a green acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 179,671, Feb. 16, 1905. Addition to Ger. Pat. 172,575, Feb. 12, 1905.

THE violet product obtained by the action of excess of hydrogen sulphide on a solution of dinitroanthrarufindisulphonic acid is converted into a green dyestuff by the action of alkali sulphides or sulphydrates ; the two operations may be combined, by treating an acid solution of dinitroanthrarufindisulphonic acid with excess of the alkali sulphide.—T. F. B.

Dyestuff of the anthracene series ; Process for preparing a green acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 180,016, Feb. 18, 1905. Addition to Ger. Pat. 179,671, (see preceding abstract).

THE intermediate product of the action of hydrogen sulphide on dinitroanthrarufindisulphonic acid can be converted into the green dyestuff by the action of hydrogen sulphide on its neutral or acid solutions : the process can be carried out in one operation if a neutral or acid solution of the anthrarufin derivative be treated with hydrogen sulphide until the formation of the green dyestuff is complete.—T. F. B.

Dyestuff of the anthracene series; Process for preparing a violet acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 176,641, Feb. 18, 1905.

The salts of dinitroanthrarufindisulphonic acids, or the green dyestuffs described in Ger. Pat. 172,575 (this J., 1907, 314), are converted into violet dyestuffs by treatment with excess of hydrogen sulphide in neutral or acid solution.—T. F. B.

Dyestuffs of the anthracene series; Process for preparing green acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 179,608, Feb. 18, 1905.

The addition product obtained by the action of hydrogen sulphide on the dyestuff of Ger. Pat. 172,575, (this J., 1907, 314), is decomposed by means of water, acids, or alkalis.—T. F. B.

Dyestuff of the anthracene series; Process for preparing a green acid ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 178,840, Feb. 25, 1905. Addition to Ger. Pat. 172,575, Feb. 12, 1905.

The green dyestuff of the original patent (this J., 1907, 314) can be obtained by the action of thiosulphuric acid or its salts, with or without sulphurous acid or a sulphite, on dinitroanthrarufindisulphonic acids in neutral or acid solution. The resulting dyestuffs contain sulphur. —T. F. B.

Condensation products of the naphthalene series; Process for preparing coloured ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 179,020, Oct. 21, 1905.

1.3-Naphthylaminesulphonic acid, in acid solution, or 1.3-naphtholsulphonic acid, in alkaline solution, or a derivative of one of these, is condensed with formaldehyde: the condensation takes place in two stages, 1 mol. of formaldehyde condensing with 2 mols. of the naphthalene compound, and the product reacting with a further molecule of formaldehyde to form a coloured compound: the colours of the new products are said to be yellow, brown, orange, red, or violet.—T. F. B.

ω-Chloroacetanilide and its homologues; Process for preparing ——. A. von Janson. Ger. Pat. 175,586, April 5, 1905.

ω-Chloroacetanilide and its homologues are said to be obtained in good yield (70—80 per cent. of theory) by the action of chloracetic acid on aniline and its homologues in presence of a phosphorus chloride or thionyl chloride.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

(*Continued from page* 606.)

Agave or sisal fibre. Bull. Imp. Inst., 1907, **5**, 28—31.

Favourable results have followed the cultivation of agave plants since 1893 in German East Africa, and it is estimated that soon the annual produce of sisal hemp will reach at least 10,000 tons, of a value of £350,000 to £400,000. Doubtless the cultivation could be carried out with equal success in British East Africa, the Coast lands being regarded as the most favourable spots for the purpose. An experimental plot has been planted at Nairobi. Certain parts of Uganda have also been found favourable for the cultivation of the sisal hemp plant. The native Sansevieria plant has the advantages over sisal hemp, of requiring little attention, growing well in the shade, of not requiring to be cut at a particular time, or to be treated immediately after cutting. On the other hand the agave plant yields 4 to 4½ per cent. of fibre as against about 3 per cent. from the leaves of *S. Ehrenbergii* or *S. cylindrica*; and sisal hemp of good quality fetches £35 to £40 per ton as compared with £28 to £30 per ton for Sansevieria fibre. It is pointed out that *S. guineensis*, yields a better fibre than the two species mentioned above. It is being cultivated in W. Africa, but has not yet been exploited in East Africa.—C. A. M.

Dyestuffs; Adsorption of —— by charcoal and fibres. A contribution to the theory of dyeing. H. Freundlich and G. Losev. Z. physik. Chem., 1907, **59**, 284—312.

The results of a large number of experiments show that the distribution of the dyestuffs, Crystal Violet, Crystal Ponceau, New Fuchsin (New Magenta), and Patent Blue, between wool, silk, cotton, and blood charcoal, on the one hand, and an aqueous solution on the other, is exactly similar in all cases, and corresponds essentially to the equation representing an adsorption process. The extent of the adsorption is independent of the nature of the adsorbent. Thus if a dyestuff, A, is adsorbed more strongly than a dyestuff, B, by charcoal, it will also be more strongly adsorbed by wool, silk, and cotton. Basic dyestuffs are decomposed quantitatively by the fibres and also by charcoal into base and acid; the acid remains in solution, whilst the base is adsorbed, probably in the form of an amorphous polymerisation product. In the case of Crystal Violet, the colour base adsorbed by the charcoal has a brownish-violet lustre; it is insoluble in water, but dissolves in acids, alcohols, and pyridine, with a bluish-violet colour, and thus has similar properties to the polymerised imino-base obtained by Baeyer by treating Pararosaniline with cold sodium hydroxide solution (see this J., 1904, 485). By treating Crystal Violet with sodium hydroxide solution under conditions similar to those prescribed by Baeyer, a powder is obtained closely resembling the colour base adsorbed by charcoal from solutions of that dyestuff. In the case of the acid dyestuffs, Patent Blue and Orange IV, no decomposition was caused by charcoal. The authors conclude, from the results of their investigation and the results obtained by other workers, that adsorption plays the chief part in all dyeing operations, whether with substantive or adjective, acid or basic dyestuffs. Different chemical actions may, however, also come into play. In dyeing with basic dyestuffs in the form of salts, these are decomposed, and the colour base is adsorbed by the fibre, probably in a colloidal form, insoluble in water. In the case of adjective dyestuffs, the dyeing consists in the formation on the fibre of an insoluble or colloidal, non-diffusible compound of the dyestuff with substances (mordants) which have previously been adsorbed. In many cases, also, the dyeing may be due to the formation of an insoluble or colloidal compound of the dyestuff with the fibre-substance.—A. S.

English Patents.

Cotton fibres or cotton fabrics; Method for the impregnation of ——. G. B. Ellis, London. From E. Merck, Darmstadt, Germany. Eng. Pat. 15,629, July 10, 1906.

See Fr. Pat. 367,725 of 1906; this J., 1906, 1144.—T. F. B.

Discharge effects in the printing of textiles; Process for producing ——. Calico Printers Assoc., Ltd., Manchester and H. Dydynski, Whaley Bridge. Eng. Pat. 11,154, May 12, 1906.

Discharge effects on textiles are produced by printing on the fabric a mixture of sodium bromide and bromate, and then immersing it in dilute sulphuric acid (12 per cent.) at 180—200° F. for from seven to twenty seconds. The bromide is recovered from the bath by boiling with a bichromate and distilling.—J. C. C.

Erratum. This J. 1907, 606, col. 1, l. 23 *for* "Gontor" *read* "Bontor."

United States Patents.

Cellulose ester [*acetate*]. H. S. Mork, Assignor to Chemical Products Co. U.S. Pat. 854,374, May 21, 1907. XIX., page 713.

Fixing or setting the colours of dyed fabrics and fibres; Process of ——. L. B. Fortner, Philadelphia, Pa. U.S. Pat. 852,943, May 7, 1907.

The dyed material is subjected while in a wet condition, to the action of a solution of formaldehyde "in combination with potash soap."—A. B. S.

French Patents.

Lubricating mixture for use in textile manufacture. G. Montoya. First Addition, dated Dec. 7, 1906, to Fr. Pat. 295,643 of Dec. 26, 1899.

Besides the fatty bodies mentioned in the chief patent, their decomposition products such as, oleine, stearine, glycerin, etc. may be employed. To obtain a more complete emulsion, 5% of soap should be added and 20% of water in which one kilo. of "Panama wood" has been macerated.—A. B. S.

Cellulose products ; Manufacture of brilliant ——. C. F. Müller. Fr. Pat. 373,429, Jan. 9, 1907. XIX., page 713.

Scouring of raw wool by means of defatted "suint" ; Process for ——. J. Dantzer. First Addition, dated Dec. 29, 1906, to Fr. Pat. 372,757, of Dec. 20, 1906 (this J. 1907, 525).

An apparatus for carrying out the process described in the main patent, is described. It is similar in construction to the McNaught apparatus. At the bottom of the vat is placed a perforated pipe through which compressed air is blown in order to emulsify the greasy liquor. The soluble suint collects as a liquid at the bottom of the vat, whilst the insoluble suint forms an emulsion which floats on the surface and is removed by skimming. The soluble suint is used again for scouring a fresh lot of wool.—A. B. S.

Skins, wool, &c. ; Degreasing of ——, and recovery of the solvent. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 373,681, Jan. 17, 1907. XIV., page 704.

Mordanting of fibrous materials by means of waste waters freed from tannin ; Process for the ——. F. Blumenthal and J. Wolff, jun. Fr. Pat. 373,706, Jan. 18, 1907.

The residual waters from the manufacture of gallic acid, &c. contain, besides a small amount of tannin, a number of other substances not yet strictly defined. These waters have the property of fixing chromium oxide on the fibre in a condition suitable for dyeing with mordant dyestuffs. These waters can replace tartar, lignorosin, etc. as assistants in chrome mordanting ; an addition of sulphuric acid is recommended. For example, with 1·5% of potassium bichromate, 1·5% of sulphuric acid, and 3% of "residual water" of 30° B., the same result is obtained as with 1·5% of bichromate, 1·5% of sulphuric acid, and 3% of lactic acid.—A. B. S.

Paper or textile fabrics ; Process for dyeing bands of —— in shaded or "mottled" designs by means of running water traversed by the band and serving to carry the colours. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat. 373,677, Mar. 24, 1906.

The band of paper or other material is passed through a vessel containing running water. Solutions of the desired colours are introduced into the water by drops or by fine jets, and are absorbed by the moving band of material before they can distribute themselves equally through the water. The effect of the movement of the band and the water is to give shaded or mottled effects. The direct dyeing colours may be fixed when necessary by means of steaming or drying, and the mordant dyestuffs by means of the respective mordants.—A. B. S.

Dyeing of hanks in a continuous band ; Apparatus for the ——. Destrée, Wiescher, & Co. Fr. Pat. 373,450, Jan. 10, 1907.

The machine consists of a vat in which are placed two perforated longitudinal partitions leaving between them and the walls of the vat a space for the steam pipes and for the introduction of dye liquor. The space between the two partitions is divided transversely into a number of compartments by means of perforated partitions, the bottom of each compartment being formed by a semicircular unperforated plate. Each compartment is divided into two by a vertical transverse partition which descends from the top of the vat and ends a little above the curved bottom. This partition can be fitted with a roller at the bottom to facilitate the movement of the material. Guiding and squeezing rollers are fixed above the vat. The band of hanks is passed through the machine in such a manner that it accumulates for a little in one side of each compartment before being carried on by the rollers to the next. By immersing all the rollers in the bath, the machine may be employed for indigo dyeing.—A. B. S.

German Patent.

Colour effects ; Process for obtaining peculiar —— on materials of different kinds. Farbw. vorm. Meister, Lucius, und Brüning. Ger. Pat. 180,680, Dec. 2, 1904.

Peculiar colour effects are produced by using azo dyestuffs which have a metallic lustre in the ordinary method of fixing bronzes and colour lakes.—A. S.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

(*Continued from page* 606.)

United States Patent.

Leather ; Process for dyeing granulated —— in different colours or shades. G. Feldmann, Berlin. U.S. Pat. 854,032, May 21, 1907.

See Eng. Pat. 6048 of 1907 ; this J., 1907, 540.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

(*Continued from page* 609.)

Alkali, &c., works ; Forty-third annual report on —— by the Chief Inspector. Proceedings during the year 1906, &c. February 27, 1907. Price 9d.

The present report is the last to be presented under the old Acts of 1881 and 1892 and the Provisional Order Confirmation (Salt Works) Act, 1884, now repealed. The Alkali, &c., Works Regulation Act, 1906, came into operation on Jan. 1, of the present year. It brings within its provisions several works which were not in the former Acts, and differs in various particulars from them. The following are the works newly included :

[*](1) and (2) *Sulphuric Acid Works.*—The former exemptions are removed, and the definition now clearly applies to works for the concentration and distillation of sulphuric acid.

(3) *Chemical Manure Works.*—The definition is extended to works in which any mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid.

(4) *Gas Liquor Works.*—The definition now clearly applies to works in which ammoniacal liquor is desulphurised by the application of heat in any process connected with the purification of gas.

(5) *Nitric Acid Works.*—The definition now clearly applies to works in which nitric acid is recovered from oxides of nitrogen.

(7) *Chlorine Works.*—The definition is extended to works in which chlorine is used in any manufacturing process.

(8) *Muriatic Acid Works* will now include any works (not being alkali works) where muriatic acid gas is evolved, either during the preparation of liquid muriatic acid or for use in any manufacturing process. "Fibre Separation Works," and "Tinplate Flux Works," and [†]"Salt Works" in which muriatic gas is evolved, will in future be included under this head.

(9) *Sulphide Works.*—The definition now includes all works in which sulphuretted hydrogen is evolved in the decomposition of sulphides, or is used in the production of such sulphides. It will thus include the works pre-

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[*] The numbers refer to those in the First Schedule to the Act.

[†] The definition of "salt works" excludes those in which salt is obtained without evolution of muriatic acid in the process for its extraction from brine.

viously registered as "Barium," "Strontium," and "Antimony Sulphide Works," but it is not restricted to these works.

(10) *Alkali Waste Works.*—The definition is extended. It will now include all works in which alkali waste or the drainage therefrom is subjected to any chemical process for the recovery of sulphur, or the utilisation of any constituent of such waste or drainage.

(12) *Lead Deposit Works.*—Works in which the sulphate of lead deposit from sulphuric acid chambers is dried are now added.

(16), (17), (18), (19) *Sulphocyanide, Picric Acid, Paraffin Oil,* and *Bisulphite Works* are all newly scheduled.

(20) *Tar Works* will include works where coal tar is distilled or is heated in any manufacturing process.

(21) *Zinc Works.*—The operation of the Act is extended to works for the extraction of zinc, not only from the ore as formerly, but also from any residue containing that metal. It is, however, limited as regards both kinds of work to cases where the metal is extracted by the application of heat.

Smelting Works are brought under the Act both as regards registration and inspection, several rules respecting which are modified.

The expression "best practicable means," in reference to prevention or escape of noxious or acid gases, receives in the new Act enlarged applications, and is made applicable to all Alkali and Alkali Waste works. In sulphuric acid works carried on by the lead chamber process, it is now required that the total acidity of the evolved gases should not exceed the equivalent of 4 grains of sulphuric anhydride per cb. ft. of residual gases before admixture of the same with smoke, &c. But in works for the concentration or distillation of sulphuric acid, the acidity of the gases discharged, including acid gases arising from the combustion of fuel, may not exceed 1½ grain of sulphuric anhydride in the cb. ft., an exception being however made in the case of the overheat pan process for a period of three years after the commencement of the Act, during which a limit of 2 grains in the cb. ft. of gases calculated as sulphuric anhydride is permitted.

The expression "noxious or offensive gas" under the new Act, includes the following gases and fumes:—muriatic, sulphuric and sulphurous acids, except the latter arising from the combustion of coal; nitric acid and acid-forming nitrogen oxides, sulphuretted hydrogen, chlorine and its acid compounds, chloride of sulphur, fluorine and cyanogen compounds, bisulphide of carbon, and fumes from cement or tar works, or such as contain copper, lead, antimony, arsenic, and zinc or their compounds.

In the year dealt with by the present report, 72 alkali works were registered as against 73 in the two preceding years, apart from which 1006 works were scheduled under the Acts against 995 in 1905, and 967 in 1904. The chief increase in scheduled works during 1906 has been in processes for the manufacture of sulphate or muriate (chloride) of ammonia.

There have been three prosecutions during the year, with recovery of penalties; one in the sulphuric acid manufacture, for excess acidity of escaping gases; and two in the manufacture of sulphate of ammonia, for escape of noxious and offensive gases.

Demand for the products of alkali and wet copper works has been active during the past year, and some works, or parts of works, that had lain idle, have been reinstated. 402,863 tons of burnt cupreous ore from the sulphuric acid manufacture were treated in the furnaces of the wet copper process, the produce being 14,502 tons of copper, 1850 oz. of gold, and 322,291 oz. of silver. The average escape of muriatic acid from the chimneys of alkali works remains substantially unchanged.

'Dolly' cream dye, known as "Metanil Yellow," the sodium salt of meta-aminobenzenesulphonic acid azo-diphenylamine, has been tested as a selective indicator, especially as between hydrochloric acid vapour and chlorine. Slips of filter paper stained with the dye are turned to a heliotrope colour by hydrochloric acid, (to which it is very sensitive) but are only slightly bleached by chlorine. Sulphuric acid gives on change of colour, unless sufficiently concentrated to char the paper.

In Chlorine works, no new developments have taken place. Alkali Waste works have been kept in full operation during the year. In sulphuric acid works, the use of brimstone is yearly decreasing, but sulphuretted hydrogen from waste gases of the sulphate of ammonia manufacture has become more and more important as a source of sulphur for the lead chamber process, a process which still holds its ground, although the few works in which the catalytic system is employed are of considerable importance. Pyrites of low arsenic content has of late become scarce, and in some works the ordinary processes of de-arsenication have been inadequate to deal with certain ores now imported. But recently, patented processes have been applied in the Widnes district whereby the arsenic is recovered as pure arsenious oxide, and not as a mud associated with sulphur and metallic sulphides. Several works in which this process will be used, will be started during the year. Catalytic or Contact processes for sulphuric acid manufacture "will be subject to no statutory limitations of escape of acid gases either from the exit of the process or from the final discharge into the atmosphere"; but they will be subject to the obligation of the "best practicable means" for reducing escape of noxious gases, being used.

The amounts of manure materials, in tons, imported in 1904, '5 and '6, are:

	1906.	1905.	1904.
Guano	24,906	29,223	24,276
Mineral phosphates	442,970	421,026	419,221
Nitrate of soda	108,486	104,436	120,526

The exports of sulphate of ammonia were in 1906, 201,500 tons, as compared with a home consumption of 82,000 tons against 189,350 tons and 68,000 tons respectively, for the preceding year.

Any work in which mineral phosphate is subjected to treatment involving chemical change through the application or use of any acid, comes within the definition of a "chemical manure work" in the new Act. Under the previous Acts, processes in which superphosphate was made in the usual way, not for sale as manure, but forming the first step of the operations for obtaining phosphoric acid, were exempt from registration.

Coke ovens, with recovery plant attached, have been erected in North Derbyshire, South Yorkshire, and North Staffordshire. The Claus process of sulphur recovery has extended in its application to coke-oven recovery plants, the continuous operations of which favour steadiness of reaction in the kiln. A successful attempt has been made to reduce the amount of volatile cyanides in coke-oven ammoniacal liquors, by addition of calcium polysulphide solution to the liquors entering the heater preceding the still; the percentage of hydrocyanic acid in the saturator gases entering the Claus kiln has been thus reduced below one per cent. A preliminary circular was issued in November directing attention to the necessity of steps being taken to diminish the amount of the volatile cyanides in ammoniacal liquors before distillation, and with the advent of the Act of 1906, a fresh circular on the same subject has been prepared.

As regards the "Conditions affecting Formation of Ferrocyanides (Blue Salt) in Sulphate of Ammonia Saturators" the work previously done as described in the preceding report (this J., 1906, 883) has been confirmed. Local alkalinity, occurring at some part of the saturator, and especially near the pipe distributing the vapours containing volatile ammonium salts (including ammonium cyanide) is the "determining cause" of the precipitation of the insoluble ammonium ferrous ferrocyanide among the separating crystals of ammonium sulphate, since hydrated sulphide or oxide of iron first separates from the liquor in the saturator if this be neutral or alkaline. Low temperature favours solubility of hydrocyanic acid, and when this is fixed as ferrocyanide, then, with access of ferrous salts in acid solution, the ammonium ferrous ferrocyanide forms, which on exposure to air becomes oxidised to ferric ferrocyanide, or Prussian blue. The acid saturator liquid may at any time be tested by hydrogen peroxide, which would immediately give a blue colour in presence of the ferrous ferrocyanide.

Amount of sulphate of ammonia produced in the United Kingdom—

	1906.	1905.	1904.
Gas works	157,160	155,957	150,208
Iron works	21,284	20,376	19,568
Shale works	48,534	46,344	42,486
Coke oven works	43,677	30,732	20,848
Producer gas and carbonising works (bone and coal)	18,736	15,705	12,880
	289,391	269,114	245,990

The production from shale distillation is confined to Scotland, which also has taken the greater share in the increase under the " Producer gas " head.

The " Constitution of Ammoniacal liquors " is dealt with extensively in the report, especially in connection with their cyanogen contents. Liquors derived from coke-oven processes differ materially in cyanogen contents from those of gas-works residual plant. It is stated that " in normal conditions cyanogen, combined as ammonium thiocyanate, is the product of *secondary* reactions proceeding in the liquors themselves:—" with access of air oxidation of ammonium sulphide results in the formation of some ammonium polysulphide," which immediately parts with its sulphur to the ammonium cyanide, which latter, as shown by the examination of virgin liquors, is one of the simple products of condensation." Owing to comparatively restricted storage room in coke-oven works, the liquors have less time for exposure to air, and thus for undergoing these secondary reactions. Hence, " though in such liquors the proportion of total cyanogen to ammonia may be less than in liquors from gas works sources, the mode of its combination is markedly different, cyanogen volatile as hydrocyanic acid far exceeding, as a rule, that fixed as thiocyanate or ferrocyanide, while the reverse obtains in samples of liquors examined from gas works sources." The liquors proceeding from condensation of steam and fuel gases from sulphate of ammonia saturators after extraction of the ammonia (known as " devil liquors ") when drawn from the *cold* end of the condensing apparatus, contain hydrocyanic acid in very marked amount, even sometimes up to one per cent.; hence great precautions are necessary in those who have the handling of such poisonous liquors, and it is stated that these should be taken off at the *hottest possible* point in the condensing system, where such liquors mix with the effluent from the ammoniacal stills leaving the works. A summary is given in tabular form of analyses of various liquors derived from coke-oven works in different districts, including analyses of " devil liquors," in which the effect of the temperature comes out strongly. When fuel gases, owing to defective flues, find access to the interior of the ovens, marked effects are produced on the constitution of the liquors; loss of ammonia results, there is an undue proportion of oxidised secondary products, phenoloid bodies become prominent, and the proportion of sulphur as thiosulphate increases. It is pointed out that, consequently. periodical analyses are a valuable guide to the conduct of the working.

S. E. Linder contributes a Memorandum, in which his previous work on the methods of analysis of ammoniacal liquors receives extension, especially in respect of the cyanogen contents. The method described in the preceding report for the estimation of thiocyanate has undergone complete revision, the method now adopted is based upon the formation of copper oxide and alkali thiocyanate when cuprous thiocyanate is digested with excess of alkali; on filtration, the thiocyanate is obtained in a condition suitable, after addition of nitric acid and iron alum, for exact titration with $N/10$ silver nitrate. When the proportion of thiocyanate is small, sodium carbonate may be used to decompose the cuprous salt, but otherwise caustic alkali must be used. Ferrocyanide may be absent, or present, in the liquors. In the former case (known qualitatively by testing the acidified boiled liquor with ferric chloride), to 50 c.c. of the boiled liquor, sodium bisulphite, followed by copper sulphate in distinct excess, is added. The liquid is then boiled for 1 or 2 minutes, filtered, and the dark brown precipitate is washed thrice with boiling water. The precipitate is washed back into the flask, and 25 c.c. of a 3 per cent. solution of sodium carbonate are added, and after 2 minutes' boiling, the solution is filtered through the same paper, (which is thrice washed with boiling water), then cooled, acidified with 5 c.c. of nitric acid, and titrated with silver nitrate, 1 c.c. of saturated solution of iron alum being added as indicator.

1 c.c. $N/10$ $AgNO_3 = \cdot 0076$ gram. $NH_4CyS = \cdot 0027$ gram. HCy. In the second case, with ferrocyanide present in the liquor, this is removed by addition of excess of iron alum to the hot solution, and after standing 2 minutes to allow the Prussian blue and hydrated oxide to settle, it is filtered, and treated as in the preceding case. Experiments made on liquors in the absence, and in the presence, respectively, of organic matter, showed the test to be reliable. Analytical comparison was then instituted between the described silver nitrate process, and the older method of oxidation of cuprous salt by nitric acid, the result of which was to show that the new was both more accurate and speedier than the old method. Two colorimetric methods for the estimation of thiocyanate are described; that by Pfeiffer, and that developed during the present year (1906) by J. W. Young, for direct application to the boiled liquor, after dilution to 100 times its original volume, when the colour struck by addition of nitric acid and iron alum is matched in Nessler test glasses against a weak standard solution of ammonium thiocyanate. This method, tested against the silver nitrate method, has given excellent results. S. E. Linder further summarises the work done in continuation of the researches described in the preceding report (this J., 1906, 882) on the composition of saturator gases. Although polysulphide and cyanide are known to be mutually exclusive in ammoniacal liquors $[(NH_4)_2S.S + NH_4Cy = (NH_4)_2S + NH_4CyS]$, yet ammonium sulphide and cyanide often coexist. On distilling together such a mixture, with exclusion of air, and collecting the evolved hydrocyanic acid in caustic soda, removing the sulphide by lead carbonate, and titrating with silver nitrate, it was shown that no appreciable formation of thiocyanate takes place, and that all the cyanide taken is recovered in the receiver. Further and varied experiments showed that when ammoniacal liquors are distilled, the saturator gases would be found to contain CO_2, H_2S, and HCy in the proportions in which they exist in the liquor, the whole of the cyanide being volatilised from the still. In the analysis of saturator gases, it may occur that small amounts of cyanide need to be determined in gas samples, too small for the use of the silver nitrate method. In this case, a modified polysulphide method is used. The following procedure is recommended :—" To 100 c.c. of solution add ammonium polysulphide in sufficient excess to colour it strongly yellow; raise to the boil, and nearly neutralise with dilute sulphuric acid—approach to the end point is indicated by the sulphur separating white. Boil for 15 minutes to expel sulphuretted hydrogen, cool to 90° or 95° C., add 5 c.c. of saturated iron alum, and filter, after allowing the solution to stand a few minutes to complete the oxidation. Cool the filtrate, acidify with 5 c.c. of nitric acid, shake to dissolve hydrated oxide and filter from residual sulphur. To the filtrate add 1 c.c. of iron alum and titrate with $N/10$ silver nitrate. 1 c.c. $= \cdot 0027$ gram HCyS, as HCy." It is preferred to add the silver salt in slight excess, and bring back with $N/10$ NH_4CyS.

From special experiments S. E. Linder determined that iron alum oxidises thiosulphate to tetrathionate (which has no injurious effect on silver titration), in a solution heated to 80°—90° C. Iron alum is without action on ferric thiocyanate, even in boiling solution. Direct titration of thiocyanate in presence of thiosulphate leads to high results; hence it is necessary to remove the latter by iron alum before titration. Examples are given of the determination of hydrocyanic acid in crude coal gas, and of ammonium thiocyanate in liquor from cyanide scrubbers, in which very similar results were obtained (*a*) by precipitation as cuprous thiocyanate, and (*b*) by oxidation with iron alum. For CO_2, H_2S and HCy gases which are associated with a large proportion of water as they issue from the saturator on cooling, form a liquor holding these gases in solution "in amounts determined by the partial pressure of the constituent gases, and their respective solubility factors at the temperature of the liquor with which they are in contact, that for hydrocyanic acid being by far the greatest." Thus, it is only at the saturator exit, before the gases could cool, that the full hydrocyanic acid content is found. If such "devil liquors" are returned to the still, directly, or with crude ammoniacal liquor, "the dissolved gases will be re-volatilised in the still and pass forward to the condensing system together with gases derived from the ammoniacal liquor itself. The actual composition of the gaseous mixture leaving the saturator is in such case determined by the CO_2, H_2S, and HCy in liquor contributed from two distinct sources of supply:—the first, that of ammoniacal liquor, fed into the system from without, from coke oven or gas retort scrubbers; the second, the body of liquor condensed in the system itself, and holding in solution gases which circulate, as it were, between condenser and still. Redistillation of this (devil) liquor profoundly affects the condition of the hot gases entering the condensing system, but has little or no effect upon that of the cold gases leaving it." Analytical results from devil liquors returned to crude liquor well, and re-pumped to the still respectively, are given in illustration. Details of processes of analysis and of calculation, and description of apparatus employed, are given in the Appendix.

The carbonisation temperatures in coke-ovens and gas retorts are shown graphically, and discussed. W. R. Herring is quoted as giving 2000° F. or higher "as the temperature of carbonisation in a well-worked gas retort," and Prof. Vivian B. Lewes is credited with the statement that 1700° F. is the upper limit for the economical production of ammonia. According to the same authority, of 100 parts of nitrogen in the coal retorted under ordinary gas works conditions, there are produced as ammonia, 15, as cyanogen 2, as nitrogen in gas and tar 35, and as nitrogen in coke, 48 parts. It is thence estimated that the amount of cyanide in the crude gas as made is about equivalent to 6 lb. of yellow prussiate per 1000 cb. ft. of gas. After washing processes, &c., where ammonia is removed, the equivalent of about 2 lb. of yellow prussiate accompanies the ammonia, leaving the equivalent of 4 lb. of the same in the gas, available for recovery.

Salt works will, under the new Act be known as "Muriatic Works," which are so defined as to exclude works in which salt is obtained from brine without evolution of muriatic acid. The total output of white salt produced from brine, and salt contained in brine used for making alkali by the ammonia-soda process, was in 1905, 1,658,364 tons as compared with 1,703,805 tons in 1904. The use of Mond producer gas as fuel at one works is referred to with approval. It is stated that "the even heating of the gas-fired pans contributes to maintain at a satisfactorily low figure the escape of muriatic acid at this work."

The number of works for the production of the acids of arsenic has increased to 35 from 27 of the previous year. This increase is partly due to the introduction of patented processes whereby arsenious oxide in "very pure" form is recovered from arsenical vitriol produced from highly arsenical pyrites. It is noteworthy, that while Great Britain until 1902 held first place for the production of metallic arsenic and arsenious oxide, she has latterly been far "out classed" by Germany, now the largest producer.

In Scotland, the number of works registered and of processes under inspection has increased as compared with the preceding year. There has been an extended adoption of recovery plant in coke and producer-gas works. The vacuum method as applied in the evaporation of the sulphate of ammonia liquors obtained when removing ammonia from "Mond" gas, is in use, preventing the escape of large volumes of steam, and, it is claimed, economising fuel. The total shale mined in the United Kingdom for 1906, was 2,546,522 tons, and the yield in lb. of sulphate of ammonia per ton of shale mined, 42·7, the corresponding numbers for the preceding year being 2,496,785 and 41·6 lb.

The Report consists of 166 pages, of which 20 pages are devoted to Scotland.—E. S.

Oxides of nitrogen; New ——. F. Raschig. Chem.-Zeit., 1907, **31**, 359.

THE red vapours produced from nitric oxide and air have a composition different from that generally accepted. The first stage in the reaction corresponds to the equation: $2NO + O_2 = N_2O_4$, but the product, which the author names iso-nitrogen tetroxide, is not identical with ordinary nitrogen peroxide, since it dissolves in acids and alkalis with formation of nitrous acid and separation of oxygen (*a*), whilst with the latter, under similar conditions, equivalent quantities of nitrite and nitrate are produced (*b*).

$$(a)\ N_2O_4 + 2NaOH = 2NaNO_2 + H_2O + O.$$
$$(b)\ N_2O_4 + 2NaOH = NaNO_2 + NaNO_3 + H_2O.$$

In presence of a further quantity of air, iso-nitrogen tetroxide is oxidised to isonitrogen pentoxide and behaves as such with stannous chloride whilst it dissolves in alkali with formation of nitrite, nitrate, and oxygen: $N_2O_5 + 2NaOH = NaNO_2 + NaNO_3 + H_2O + O$. If nitric oxide be treated with a large excess of oxygen, still higher oxides of nitrogen, N_2O_6(or NO_3) and N_2O_7, are formed, as shown by stannous chloride whilst they also liberate oxygen when they are absorbed in alkali.

$$N_2O_6 + 2NaOH = 2NaNO_2 + 3O + H_2O.$$
$$N_2O_7 + 2NaOH = NaNO_2 + NaNO_3 + 3O + H_2O$$

In presence of a small excess of oxygen, nitric oxide yields, first, a mixture of iso-nitrogen tetroxide and nitrogen hexoxide, and, subsequently, a mixture of iso-nitrogen pentoxide and nitrogen heptoxide.—A. S.

Acid sulphates; Study of ——. *II. An acid calcium-sodium sulphate.* J. D'Ans. Z. anorg. Chem., 1907, **53**, 419—422.

IF *glauberite* (Na_2Ca2SO_4) be introduced into a saturated solution of sodium sulphate in sulphuric acid, no change takes place. After diluting the solution with 10 per cent. sulphuric acid, however, tufts of needles are observed to form in the course of a few days, and eventually the whole of the *glauberite* is transformed into the new compound. The latter forms tufts of small, doubly-refracting needles, acid to litmus, and immediately decomposed by water with formation of gypsum. Specimens of the new substance, prepared under different conditions, showed that the content of sulphuric acid increased with the acidity of the mother liquor. Probably the substance is an isomorphous mixture of two compounds, in varying proportions, corresponding to the formula: $xCa_3Na_6(SO_4)_6,5H_2O + Na_3H(SO_4)_2,H_2O$. (See also this J., 1906, 534).—A. S.

Phosphates, double, of iron (ferric) and aluminium; New ——. L. J. Cohen. J. Amer. Chem. Soc., 1907, **29**, 714—721.

BY adding a large excess of diammonium phosphate to a solution of ferric chloride strongly acid with hydrochloric acid, J. L. Danziger obtained a white precipitate of the composition, $(NH_4)H_2PO_4,FePO_4$. The author repeated Danziger's work and confirms his results. The double phosphate is partially decomposed by water, ammonia and phosphoric acid going into solution, the latter in part owing to hydrolysis of the ferric phosphate. In order to obtain the salt pure, it is necessary to wash the precipitate first with an alcoholic solution (1 part of 95 per cent. alcohol to 2 parts of water) containing 0·1 per cent. of ammonium chloride, and then with alcohol (1 : 1) till free from chlorides. The new compound is readily soluble in mineral acids, including phosphoric acid, but practically insoluble in 50 per cent. acetic acid. It is completely hydrolysed by caustic alkalis. It is not re-precipitated by ammonia from its solution in phosphoric acid; in this respect it resembles ferric phosphate, which, also is not re-precipitated by ammonia from its solution in phosphoric acid. It is partially hydrolysed by cold ammonia, but when heated with a large excess of ammonia, it dissolves to a reddish-brown solution, from which excess of 95 per cent. alcohol separates a brown, voluminous, gelatinous precipitate of a composition corresponding to the formula, $2(NH_4)_2HPO_4,3FePO_4,3Fe(OH)_3$. A double phosphate of aluminium and ammonium, $(NH_4)H_2PO_4,AlPO_4$, was obtained by a similar manner to that used for preparing the iron compound. It has properties similar to those of the latter, except that it dissolves completely in alkalis just as aluminium phosphate does. On ignition, it loses ammonia and water.—A. S.

Copper peroxide. L. Moser. Z. anorg. Chem., 1907, **54**, 121—140.

COPPER peroxide, CuO_2,H_2O, can be obtained only by the oxidation of finely-divided cupric hydroxide by 15—30 per cent. neutral solution of hydrogen peroxide, the temperature being kept at about 0° C. When moist, the peroxide decomposes rapidly, oxygen and water being produced; in the dry condition, however, it is fairly stable. Copper peroxide is also formed by the action of sodium peroxide on cupric salts, but is rapidly decomposed by the alkali produced in the reaction.—A. S.

Aluminium sulphide; Compounds of ——, with chromium, nickel, cobalt, and magnesium sulphides. M. Houdard. Compt. rend. 1907, **144**, 1114—1116.

BY the process which yielded double sulphides of aluminium with manganese and iron, (this J. 1907, 469), or by heating the mixed metals in hydrogen sulphide, the author has obtained similar compounds with the four metals named above. Those of nickel, cobalt, and magnesium, however, are very unstable, and of uncertain composition. It is noteworthy that in presence of excess of chromium there is formed not chromic but chromous sulphide. All of these compounds appear to be analogous to *spinelle.*—J. T. D.

Ammonia; Reactions in liquid ——. (Potassium ammono-zincate, cuprous nitride, and an ammonobasic mercuric bromide). F. F. Fitzgerald. J. Amer. Chem. Soc., 1907, **29**, 656—665.

AN extension of Franklin's work (this J., 1905, 844). On treating a solution of copper nitrate in liquid ammonia with potassium amide, an olive-green precipitate is produced, which, on heating, yields cuprous nitride, Cu_3N, as a black amorphous mass. The latter is decomposed by water with evolution of considerable heat; with sulphuric acid it yields equivalent quantities of copper sulphate and metallic copper. It explodes readily when heated in air. By the action of potassium amide on an excess of mercuric bromide, ammonobasic mercuric bromide, $Hg:N.Hg.Br$, is formed. An ammono-zincate of potassium is obtained in well-defined, colourless crystals by the action of potassium amide dissolved in liquid ammonia on metallic zinc, or by the action of potassium amide on zinc amide. It is slightly soluble in ammonia, easily soluble in hydrochloric acid, and decomposed by water with formation of zinc hydroxide, ammonia, and potassium hydroxide. At 220° C., it loses about 8·5 per cent. of its weight of ammonia. The results of analyses agree best with the formula, $Zn(NHK)_2,2NH_3$.—A. S.

Selenion [selenium]; Purification and testing of ——. R. Threlfall. Roy. Soc. Proc., 1907, A, **79**, 167—174.

SELENIUM was found to be most satisfactorily purified by Ekman and Petterson's method, which consists of evaporation to dryness with nitric acid, sublimation of the selenious oxide, dissolving the sublimate in water, filtering, and precipitating the selenium by hydrochloric acid and sulphur dioxide: the precipitate was then thoroughly washed, reconverted into the oxide, and repeatedly sublimed in a current of air. The best method of detecting small quantities of tellurium in selenium appears to be Oppenheim's, by which it was found that less than 0·1 per cent. could be detected. Spectroscopic methods failed to detect as much as 1 per cent. of tellurium in selenium. The best method of separation was found to be the sublimation of the oxides, a sharp separation being possible in at most two sublimations at 360° C.; it was observed that selenious oxide sublimed at the lowest visible red heat, in a current of pure air, was completely re-sublimed below 320° C., leaving no visible residue. Arsenic was tested for in the selenium by distilling selenious acid with ferrous chloride and hydrochloric acid, diluting the distillates, and precipitating them with hydrogen sulphide; the precipitates were dissolved and reprecipitated, boiled with sodium metasulphite, and examined for arsenic in Thorpe's electrolytic apparatus (this J., 1903, 965): the amount of arsenic found in the purified selenium was 0·00038 per cent. Mercury could not be detected in the selenious oxide obtained by subliming sodium seleniate: its aqueous solution was saturated with calcium carbonate, dried at 100° C., and re-heated to a bright red heat; no mercury was detected by Marcel's method in the very slight sublimate; a delicate electrolytic method also failed to indicate the presence of mercury.—T. F. B.

Lead selenide. H. Pélabon. Compt. rend., 1907, **144**, 1159—1161.

THE fusibility curve of mixtures of lead and selenium has been studied, shewing the relation between the temperature of commencing solidification and the percentage of selenium. The addition of a small amount of selenium raises the temperature of solidification of lead, which reaches a maximum at 1065° C. with 27 per cent. of selenium. This temperature represents the melting point of lead selenide, PbSe. Up to this percentage of selenium, the liquid is a homogeneous mixture of lead selenide and metallic lead. With mixtures containing more selenium, the latter is given off on heating. The temperature of solidification now rapidly falls till a mixture containing 45 per cent. of selenium is obtained, which solidifies at 673° C. If more than 45 per cent. of selenium is present, the mixture separates into two layers. The lower layer solidifies at 673° C. and gives a greyish-black solid with a lamellar fracture. The upper layer is pure selenium. The lower layer is a saturated solution of selenium in lead selenide, PbSe, for the free selenium can be detected by means of a microscope, and can also be removed by means of potassium cyanide.—F. SHDN.

Titanium; Properties of hexavalent ——. P. Faber. Z. anal. Chem., 1907, **46**, 277—291.

THE author has studied the action of a number of reducing and oxidising agents on pertitanic acid solutions, and finds that this body resembles hydrogen peroxide very closely in its reactions, all substances which reduce the latter also reducing pertitanic acid, although sometimes more slowly; sodium hypophosphite, formic acid, and oxalic acid, which have no action on hydrogen peroxide, do not react with pertitanic acid. In the presence of formic acid or oxalic acid, hydrogen peroxide cannot be identified by the perchromic acid reaction, but gives the pertitanic acid reaction readily. Solutions of pertitanic acid are slowly decomposed on boiling. The author also prepared two new compounds of hexavalent titanium: An acetate, unstable at high temperatures (exploding easily on heating), but stable at low temperatures; and a phosphate, decomposing, but much less readily than the acetate, at high temperatures. It was found to possess the composition denoted by the formula, $Ti(OH)_3PO_4$, the phosphate of tetravalent titanium having the formula, $Ti(OH)PO_4$.
—A. G. L.

Deacon [chlorine] process; Equilibrium in the ——. K. Vogel v. Falckenstein. Z. physik. Chem., 1907, **59**, 313—335.

THE author has made a comprehensive study of the equilibrium in the Deacon chlorine process: $2Cl_2+2H_2O\rightleftarrows O_2+4HCl$, working in both directions, *viz.*, with mixtures of chlorine and steam, and of oxygen and hydrochloric acid. For temperatures between 430° and 500° C., cupric chloride was used as catalyst, whilst between 600° and 670° C., platinum chloride was employed. It is probable that at 900°—1000° C., equilibrium could be attained without the use of a catalyst. The detailed results of the experiments are set forth in tables. A complex formula is given by which the equilibrium at a given temperature can be calculated. (See also this J., 1906, 1095).—A. S.

Titanium; Volumetric determination of ——. G. Gallo. XXIII., page 719.

Heavy chemical industries; British ——. "Times" Commer. Suppl., June 3, 1907. [T.R.]

THE reports of the various companies carrying on the manufacture of alkalis and bleaching powder in the United

Kingdom show larger profits than have been earned for some years. Although the market prices of the staple products—caustic soda and bleaching powder—have not advanced, the prices of many of the subsidiary manufactured articles show considerable gains, and it is upon these rather than upon the alkali and bleach that some of the companies now depend for the larger share of their profits. The following table gives the average December prices of 58 per cent. alkali and 35 per cent. bleach for the last ten years, and it will be seen that since 1903 the market has been very steady :—

Year.	Bleaching Powder 35%.	Soda Ash 58%.
Dec. 1896...........	£6 12 6	£3 10 0
„ 1897...........	6 2 6	3 17 6
„ 1898...........	4 13 6	4 0 0
„ 1899...........	6 0 0	4 7 6
„ 1900...........	6 17 6	4 12 6
„ 1901...........	6 17 6	4 17 6
„ 1902...........	6 5 0	4 10 0
„ 1903...........	4 0 0	4 10 0
„ 1904...........	4 1 6	4 10 0
„ 1905	4 10 0	4 10 0
„ 1906...........	4 10 0	4 10 0

The declared profits made by the four principal alkali companies were £1,214,834, as compared with £1,052,394 and £774,093 in the two previous years. They would have been still larger, had not the accounts of one company covered six months only.

Magnesite industry of Austria. Ch. of Comm. J., June, 1907. [T.R.]

American Consul-General W. A. Rublee, of Vienna, states that the very considerable export of calcined magnesite from Austria to the United States, amounting during 1906 to nearly 53,000 tons net weight from the Vienna consular district alone, has attracted general attention to this industry, and new magnesite mines are being located in several parts of Austria. At present the Veitscher Magnesitwerke Actiengesellschaft is the principal company operating magnesite mines and is enjoying great prosperity, its shares, which have a par value of 400 crowns, now selling at 1140 crowns. This rise has taken place mainly in the last year owing to the continually increasing sales of magnesite to the United States. Magnesite was discovered in the province of Styria in the early eighties by Carl Spätėr, who had acquired some property near Veitsch, Styria, which was supposed to contain manganese ore. The first magnesite was produced in small quantities in 1882, but its production on a large scale began in 1890, when shipments were first made to the United States. In 1897 the Veitsch property was organised into a stock company. Magnesite mines were operated, in competition with the Veitsch mines, at Eichberg, Lower Austria, for a number of years, but were acquired by the Veitsch company in March, 1905. There are also magnesite mines in Hungary, which operate under a cartel agreement with the Veitsch company. At present, there are two or three independent concerns opening up magnesite properties in Austria and in Hungary, and there is some prospect of a lively competition after the furnaces are started within the next six months.

English Patents.

Sulphur-burning furnaces; Regulating the supply of air to ——. T. A. Clayton, London. Eng. Pat. 16,340, July 19, 1906.

This invention relates to the admission of air when it is required to diminish the intensity of the sulphur dioxide generated in a sulphur-burning furnace. A self-acting valve is operated by the difference in temperature between a tube exposed to the heat of the furnace, and a second tube cooled by a current of water. Both tubes are fixed at one end to the casing of the generator, and are free to expand at the other end. The end of the cool tube, which is kept as nearly as possible at a uniform temperature, forms the fulcrum of a lever, the extremity of which is in contact with the freely expanding hot tube. The lever engages with a sliding cap in the air valve, and when the heat of the furnace is so great that the admission of air is called for, the free end of the hot tube has moved the lever to a point at which it causes the sliding cap to let in air.—O. R.

Carbonic acid; Manufacture and recovery of ——. J. Leslie, Belfast. Eng. Pat. 11,902, May 22, 1906.

Furnace gases containing about 15 to 20 per cent. of carbon dioxide, 80 per cent. of nitrogen, and 0 to 5 per cent. of oxygen, pass from a purifier to a pump, in which they receive a preliminary compression. They are next cooled down to a low temperature in a heat interchanger, from which they are led through a drying vessel, containing calcium chloride or other dehydrating agent, into a refrigerator in which the carbon dioxide is condensed to snow. The remaining gases, which are still above their critical temperatures, are passed back through the pipes of the interchanger which effects the preliminary cooling. The carbon dioxide snow is liquefied by raising its temperature to —55° C., and is drawn off into tubes and cylinders in the usual way.—O. R.

Carbonic acid gas; Manufacture of ——. H. Steinem, London. Eng. Pat. 3106, Feb. 7, 1907.

This invention relates to an improvement on Eng. Pat. 13,825 of 1897 (this J., 1898, 667), whereby the two boilers, one containing carbonated lye and the other a steam boiler, are heated by a single furnace. In addition there is introduced a series of heat exchangers of which the first, heated by hot spent lye flowing through it, serves for preheating the charged lye ; the second, heated by steam, further raises the temperature of the charged lye ; and the third, heated by vapours issuing from the lye boiler (or with the addition of live steam), raises the charged lye to the temperature at which carbon dioxide is given off.—O. R.

Copper sulphate coolers. J. H. Dennis & Co. Ltd., and C. Dennis ; Liverpool. Eng. Pat. 14,278, June 22, 1906.

The crystallisation of copper sulphate is effected in a brickwork shell, preferably built on an impervious bed to minimise losses of liquor in cases of leakage or fracture. The brickwork is lined with special vitrified tiles made of blue ganister clay, which are smooth enough to be impervious, yet not so glazed as to hinder crystallisation. The tiles are set in Portland cement, which extends to within three-quarters of an inch of the inside face of the lining, but no nearer. When the cement has set, the spaces thus left are filled with a mixture of pure red and white lead, well kneaded.—O. R.

Copper sulphate coolers. J. H. Dennis & Co. Ltd., and C. Dennis; Liverpool. Eng. Pat. 14,279, June 22, 1906. (See preceding abstract).

In the case of coolers which are intended to hold large volumes of liquid or to be exposed to great ranges of temperature, the walls of the composite brickwork and steel shell are built with an inward camber, and the corners are stayed together by means of angle irons and tie bars.—O. R.

Oxides; Manufacture of metal ——. H. Jaeger, Kalk, Germany. Eng. Pat. 15,591, July 10, 1906.

See Fr. Pat. 370,640 of 1906 ; this J., 1907, 256.—T. F. B.

United States Patents.

Nitric acid; Method of concentrating ——. E. Collett, Christiania. U.S. Pat. 854,928, May 28, 1907.

See Fr. Pat. 357,221 of 1905 ; this J., 1906, 72.—T. F. B.

Still [for cuprammonium solution]; Continuous boiling-out ——. J. T. Ludlow and D. Mosher, San Francisco, Cal. U.S. Pat. 853,986, May 21, 1907.

This continuous still, for the treatment of ammonia metal oxide solution, is provided with a discharge for the metal oxide precipitate and an outlet for ammonia gas. The solution is run into the still by an inlet below, having been previously heated in a heat interchanger by the " boiled out " solution, which is discharged from the upper part of the still. The ammonia gas passes to a condenser and absorber, and there are means for conveying the cold "boiled out" solution, after leaving the interchanger to the condenser to act as a cooling medium, and to the absorber.—F. Sodn.

Salts of volatile bases [ammonium sulphite and carbamate]; Method of producing ——. T. Blass, West Seneca, N.Y., and J. L. Haehnlen and W. W. Cox, Lebanon, Pa. U.S. Pat. 854,453, May 21, 1907.

Acid gases, as those resulting from the roasting of pyritic ores, are allowed to react in a closed chamber with a volatile base, such as ammonia, and aqueous vapour in quantity sufficient for the separation of one salt only, in the form of powder—in this case, ammonium sulphite. The residual gas is then made to react in a second chamber with a further supply of ammonia, so as to produce another salt. In the present instance ammonium carbamate is thus formed from the carbon dioxide in the residue.—F. Sodn.

Beryllia; Process of separating —— from alumina and iron. F. Bran and G. van Oordt, Mannheim, Germany. U.S. Pat. 854,560, May 21, 1907.

See Fr. Pat. 367,861 of 1906; this J., 1906, 1147.—T. F. B.

French Patents.

Alumina; Manufacture of pure ——. A. Vergé. Fr. Pat. 373,070, March 8, 1906.

The product obtained by furnacing a mixture of bauxite and sodium carbonate at a high temperature, is lixiviated, and the solution is treated with sodium hydroxide in such proportion as to lower the (molecular) proportion of Al_2O_3 to Na_2O, from 1 : 1·10, to about 1 : 1·60. The solution is then heated under high pressure, until the greater part of the silico-aluminate of sodium present is precipitated in an insoluble form. After filtering, aluminium hydroxide may be precipitated from the liquid in the usual way, and is obtained in a condition suitable for the electrolytic production of aluminium. (Compare Eng. Pat. 19,924 of 1904; this J., 1904, 1088.)—E. S.

Nitrogen oxides; Process for the absorption and recovery of —— by fixed bases, dry and heated. A. T. Schloesing. Fr. Pat. 373,718, March 26, 1906.

Nitrogen oxides, such as the nitrous vapours produced from air, &c., by electrical means, are absorbed at a high temperature (200° to 350° C.) by a dry, fixed base, such as potash, soda, lime, baryta, or the corresponding carbonates, brought into contact with the vapours, either in vertical towers furnished with stages, or in a series of chambers, of which any one may be isolated from the others, and in which provision is made for maintaining approximately the required temperature throughout. Lime is preferably used as the absorbent, in the form of porous briquettes or thin plates or other shapes exposing much surface. The product obtained is a mixture of calcium nitrate and nitrite, the former predominating.—E. S.

Alkali cyanides; Manufacture of stable —— for transport and storage. Chem. Fabrik Schlempe G.m.b.H. Fr. Pat. 373,297, Jan. 3, 1907.

Alkali cyanides are rendered stable in the presence of air, atmospheric carbon dioxide, and moisture, without resort to fusion, by the addition of a very small proportion of an alkali hydroxide, preferably added to the liquor from which the cyanide is crystallised. The crystals are then moulded into briquettes under pressure.—E. S.

Potassium bisulphite; Manufacture of ——. D. V. van den Driessche. Fr. Pat. 373,457, Jan. 10, 1907.

An aqueous saturated solution of potassium bicarbonate, contained in a vessel having a smaller perforated vessel within it, is heated to the boiling point, whilst sulphur dioxide is passed, under pressure, into the immersed vessel, so that the gas escapes in all directions into the potassium bicarbonate solution, until the latter becomes fully charged. The solution is then left to cool, potassium bisulphite crystallising out.—E. S.

German Patents.

Caustic alkali; Process for obtaining —— from monocalcium phosphate and alkali sulphate. E. Crudo. Ger. Pat. 173,901, Dec. 18, 1904.

Dicalcium phosphate is treated with a concentrated solution of alkali bisulphate to which sulphuric acid has been added, the resulting solution, containing monoalkali phosphate and free phosphoric acid, is treated with precipitated tricalcium phosphate to neutralise the free phosphoric acid, and then sufficient quicklime is added to convert the monoalkali phosphate into dialkali phosphate with regeneration of dicalcium phosphate. The solution of dialkali phosphate is afterwards treated with a further quantity of lime to obtain tricalcium phosphate and caustic alkali.—A. S.

Potassium-magnesium carbonate formed as an intermediate product in the manufacture of potassium carbonate by the magnesia process; Method of decomposing the ——. Salzbergwerk Neu-Stassfurt. Ger. Pat. 172,313, June 13, 1902.

The decomposition of the potassium-magnesium carbonate by magnesia or magnesium hydroxide is effected at temperatures of from 20° to 50° C., instead of at 20° C. as heretofore. By working at the higher temperatures, use can be made of less active kinds of magnesia, for instance, the crystalline magnesia obtained on igniting magnesium chloride. It is stated that with a mixture of 69 parts of potassium-magnesium carbonate and 20 parts of magnesia at 40° C., 93·3 per cent. of the double salt are decomposed in half an hour.—A. S.

Magnesium and zinc peroxides; Process for the preparation of ——. E. Merck. Ger. Pat. 171,372, June 6, 1903.

Pure dry magnesia or zinc oxide is mixed with the calculated quantity of chemically pure hydrogen peroxide, and the mixture allowed to stand for some time.—A. S.

Barium peroxide hydrate; Process for the preparation of —— from barium peroxide. E. Merck. Ger. Pat. 170,351, March 9, 1905.

One kilo. of barium peroxide is treated at about 50° C. with 10 kilos. of a 5 per cent. solution of barium hydroxide, and filtered. The hydrated barium peroxide can be used directly for the preparation of hydrogen peroxide.—A. S.

Sodium persulphate; Process for the electrolytic preparation of —— from sodium sulphate. Konsortium für Elektrochem. Ind. G.m.b.H. and E. Müller. Ger. Pat. 172,508, Aug. 28, 1904. XI*A*., page 698.

Zinc chloride solutions; Process for obtaining colourless —— from waste liquors contaminated with organic matter. Th. Goldschmidt. Ger. Pat. 172,460, Oct. 11, 1904.

The waste liquors are evaporated, and the residual zinc chloride is heated considerably above its melting point, whereby the organic matter is converted into char, which can afterwards be easily removed from the zinc chloride solution by filtration.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

(*Continued from page* 610.)

Pottery; Lustre ——. W. Burton. J. Soc. Arts., 1907, **55**, 756—770.

Various kinds of lustre pottery produced from ancient times down to the present day are described, the author pointing out that true lustre ware exhibits not merely a metallic sheen, but also a play of iridescent colours. Thin films of gold or platinum on pottery produce a brilliant metallic surface, but the added quality of iridescence is most easily obtained by the use of bismuth, silver, or copper. The paper concludes with an account of the processes which the author has found best adapted to the purpose, Some compound of copper or silver, or a mixture of the two, is mixed with an inert substance such as china clay, or any ordinary red brick clay. The sulphides, oxides, or carbonates of the two metals are preferable to the chlorides or nitrates. The mixture of clay and metallic salt is carefully ground, and applied to the fired glaze with any ordinary potter's medium. The pieces are fired in a special muffle kiln, and the essential conditions of the firing are that the pieces be raised to the "lustreing" temperature, 650° C., and maintained at that, in the presence of a reducing atmosphere, for a sufficient time to develop the requisite stain in the glaze, and the iridescent colours. For the production of the reducing atmosphere, an iron muffle may be used, provided with tapped pipes, by means of which, when the correct temperature has been reached, the air left in the muffle can be swept out by a stream of carbon dioxide, and a reducing atmosphere produced by the admission of carbon monoxide or coal gas. After firing, the coating of lustre pigment is easily scrubbed away with soap and water. The author finds that the first effect of the lustre firing is apparently to volatilise some compound of silver, which penetrates the glaze, giving to it a yellowish stain, and that this is produced long before there is any stain from the copper compound, and whether the kiln atmosphere is reducing or not. No stain appears to be produced from copper until the atmosphere is powerfully reducing, and the red (copper) stain deepens during the whole time of reduction. If the firing is conducted for a long time, these volatile stains of silver and of copper spread slowly over the whole of the glaze surface. Silver gives lustre much more easily than copper. Excellent lustres can be produced on glazes of every type, except the felspathic glaze of hard paste porcelain, which seems to be impermeable to the stain of silver and of copper at the low temperature required for the effect.—W. C. H.

English Patent.

Ovens or kilns for annealing iron castings, for burning bricks or pottery-ware, and for other similar uses. W. P. Gibbons, R. Masters, and R. Baker. Eng. Pat. 16,641, July 24, 1906. X., page 696.

United States Patents.

Ceramic products; Manufacture of ——. M. Buchner, Mannheim, Germany. U.S. Pat. 853,341, May 14, 1907.

Alumina and a metallic oxide are fused together so as to form an aluminate. This is then mixed with clay, and the plastic mass produced is fired.—A. G. L.

Tiles, glass, &c.; Means or apparatus for burning or fixing the colours upon printed or decorated ——. L. W. Stanley, Bromley. U.S. Pat. 854,005, May 21, 1907.

See Eng. Pat. 23,078 of 1904; this J., 1906, 122.—T. F. B.

French Patents.

Glass threads; Process for making and spinning ——. E. Pick. Fr. Pat. 373,615, Jan. 16, 1907.

Threads that can be spun and woven are made by treating glass, as fast as it is drawn, with solutions of certain substances, such as rubber, collodion, shellac, &c. The application of the latter may take place, either by winding the glass on a bobbin covered with material saturated with the solution, or by drawing the glass thread over a similarly saturated, endless ribbon, interposed between the drawing arrangement and the bobbin. The material used for rendering the glass sufficiently supple and "elastic" for spinning, weaving, &c., may afterwards be entirely removed by a suitable solvent, such as ether, benzol, &c.
—O. R.

Ceramic products; Manufacture of light (weight) ——. M. J. Silvestre, sen. First addition, dated Nov. 30, 1906, to Fr. Pat. 369,417, Sept. 5, 1906 (this J., 1907, 96).

To increase the strength of light weight ceramic products, the plastic mixture specified in the original patent is reinforced by the inclusion of metallic stays, consisting of chains, wire network, or galvanised tiles. These remain *in situ* after burning, and increase the resistance of the ceramic product to breaking and crushing strain.—O. R.

Porcelain and other ceramic products; Kiln for burning ——. C. Rouveure. Fr. Pat. 373,430, Jan. 9, 1907.

A continuous, regenerative muffle furnace, heated by gaseous, liquid, or powdered fuel, is formed by a system of communicating chambers, each of which contains a muffle and stands over an independent pair of regenerators. The arrangement of gas inlets and flues is such as to provide for the equal distribution of heat throughout a chamber. A series of secondary burners serves to maintain the temperature of the chamber in places where the cooling down of the gases from the primary burners is inevitable. Air for the secondary burners is preheated by passing through flues surrounded by the channels through which the burnt gases circulate. To avoid possibility of explosion, the mains conveying gas to the primary and secondary burners are always surrounded by burnt or burning gases, and not by air, and a similar precaution is taken with regard to air pipes, which are nowhere surrounded by combustible gas. Equilibrium of gaseous pressure, between the interior of each chamber and the external ducts, is preferably maintained by means of a mercury manometer, acting electrically on a valve which regulates ingress and egress of air to and from the chamber.—O. R.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

(*Continued from page* 612.)

Tiles; Determination of the temperature at which —— *have been burnt.* H. Seger and E. Cramer. Tonind.-Zeit., 1907, 163; Chem. Zeit., 1907, **31**, [Rep.], 237.

The method proposed is based on the fact that in general the water absorption of tiles diminishes with increasing temperature of burning. The water absorption of the tiles in question having been determined, a piece is burnt at a dull red heat (using Seger cones as temperature indicators), and its water absorption determined; this will be greater than the original. The piece is then fired at successively higher temperatures until its water absorption is less than the original. The last temperature employed will be somewhat above the original burning temperature. The test is then repeated within narrower limits on a second piece, with as few burnings as possible.
—A. G. L.

Portland and slag cement; Action of sodium sulphide solution on ——. H. Renezeder. Oesterr. Wochenschr. öffentl. Baudienst, 1907, 45; Chem.-Zeit., 1907, **31**, [Rep.], 237.

Briquettes consisting of slag and of Portland cement mixed with 2 and with 4 parts of sand, were immersed in solutions containing 6·2, 31, and 124 grms. of sodium sulphide respectively per litre, and subjected to tensile and compression tests after 1, 3, 6, and 12 months. All the briquettes which had been immersed in the sulphide solutions for the longer periods of time were weaker than corresponding ones immersed in pure water, but it was found that briquettes which were allowed to harden in water for four weeks before being placed in the sulphide solution suffered practically no diminution in strength.
—A. G. L.

English Patents.

Silicates of lime; Method of increasing the binding power of basic ——. W. Schumacher, Osnabruck, Germany. Eng. Pat. 12,621, May 30, 1906.

See Fr. Pat. 366,755 of 1906; this J., 1906, 1098.—T. F. B.

Ovens or kilns for annealing iron castings, for burning bricks and pottery-ware, and for other similar uses. W. P. Gibbons, R. Masters, and R. Baker. Eng. Pat. 16,641, July 24, 1906. X., page 696.

Kilns [for bricks, &c.]. A. M. Chmelewski, Helsingfors, Finland. Eng. Pat. 28,225, Dec. 11, 1906.

See Fr. Pat. 371,831 of 1906; this J., 1907, 411.—T. F. B.

Kilns and the like; Method of heating ——. C. Dellwik. Eng. Pat. 5976, March 12, 1907. I., page 672.

Stone compositions containing lime; Process for hardening artificial —— by means of carbonic acid. E. Schwanenberg and A. Rinne, Hanover, Germany. Eng. Pat. 18,964, Aug. 24, 1906.

See Fr. Pat. 369,207 of 1906; this J., 1907, 96.—T. F. B.

Stone, artificial; Manufacture of ——. B. E. D. Kilburn, London. From Isolatoren-Fabrik "Pulvolit" Ges. m.b.H., Bockenheim-Frankfort on the Maine, Germany. Eng. Pat. 28,199, Dec. 11, 1906.

100 parts by weight of filling material are mixed with 15 to 20 parts by weight of flowers of sulphur and 75 parts by weight of an oily binding medium. The mixture is stiffened by heating it to 140°—160° C., and the articles moulded from the mass are hardened by heating to 160°—180° C. It is claimed that sulphur acts chemically on the oils (especially drying and fish oils) and greatly accelerates the resulting hardening and setting actions. (See Eng. Pat. 26,516 of 1904; this J., 1905, 1018.) —O. R.

Paving or pavement mixtures; Bituminous ——. P. M. Justice, London. From International Pavement Company, Hartford, Connecticut, U.S.A. Eng. Pat. 20,723, Sept. 18, 1906.

In order to overcome the detrimental action of the atmosphere on the petroleum residue, or other flux oil, which forms an essential ingredient of bituminous paving compositions, the flux oil is first completely oxidised by projecting air through it at 400° F. Refined asphaltum and oxidised flux are then thoroughly mixed at a suitably high temperature, and while still hot, finely comminuted limestone or other dust is added to the mixture in the proportion of 75 parts of dust to 100 parts of bituminous cement. The thoroughly incorporated mixture, called "fines-impregnated" cement, is then brought into contact with the remaining body material, such as crushed stone, sand, &c., in a suitable manner. Good results are obtained by heating and dry mixing in a pug mill, 850 to 950 parts of crushed stone, and gradually adding 140 to 150 parts of heated "fines-impregnated cement." The resulting mixture is then ready for compression. If intended for blocks, it is subjected to great pressure in moulds, and quickly cooled in flowing water. If intended for sheet pavements, the mixture is laid while heated and tamped or rolled upon the roadway.—O. R.

Cement; Hydraulic ——. J. Wilson, sen., and J. Wilson, jun., Runcorn. Eng. Pat. 14,992, July 2, 1906.

An acid-proof hydraulic cement is obtained by mixing 100 parts of "vat-waste" (calcium compounds remaining from the manufacture of black-ash) with 5 parts of salt, and calcining and grinding the mixture.—A. G. L.

Cement kilns. T. M. Morgan, Longue Pointe, Canada. Eng. Pat. 29,408, Dec. 24, 1906.

The usual stationary wall at the fuel-end of a rotatory cement kiln is replaced by a suspended cover automatically adjusting itself to variations in the length of the kiln, and which may be removed to allow of repairs to the kiln. This suspended wall is supported by rods or cables attached to a carriage which runs on a track parallel to the kiln, and which is supported by the roof truss of the whole structure. Normally the suspended wall is adjusted at a distance of one inch from the mouth of the kiln, but it may be in actual contact with it.—A. G. L.

Cement; Manufacture of ——. S. B. Newberry, Sandusky, U.S.A. Eng. Pat. 3404, Feb. 11, 1907.

See U.S. Pat. 851,247 of 1907; this J., 1907, 611.—T. F. B.

United States Patents.

Bricks [lime-sand]; Process of manufacturing ——. L. Elkus, Indianapolis, Ind. U.S. Pat. 852,500, May 7, 1907.

The sand is dried in a cylinder, the lime is pulverised and slaked, and the hydrated lime and dried sand are mixed with barium carbonate; this mixture is then discharged into a revolving pan in which it is thoroughly agitated and moistened, and the moistened material is pressed into the required forms, which are finally hardened under steam pressure in a hardening cylinder.—W. C. H.

Gypsum burning kiln. F. Raithel, Windsheim, Germany. U.S. Pat. 852,616, May 7, 1907.

See Fr. Pat. 371,989 of 1906; this J., 1907, 411.—T. F. B.

Fireproof material. K. Sakurai, San Francisco, Cal. U.S. Pat. 852,908, May 7, 1907.

A fireproof and refractory material is claimed as produced by this process, and as being a new article of manufacture. The material comprises "a refractory vehicle in two forms," one a coarse granular mass of burnt *magnesite*, and the other a fine powder of the same. Suitable proportions of this coarse and fine material are mixed together, and suitable amounts of an easily fusible binder, such as fusible clay and water, are added, and the mass is subjected to a high pressure, and then baked at a temperature sufficient only to fuse the clay and bind the particles together. The following approximate specification is given:—40 per cent. of coarse granular fire-proof vehicle, of 20 to 30 mesh; 40 per cent. of the same in powdered form, 150 to 200 mesh; 20 per cent. of the easily fusible binder, and sufficient water to make a paste, which is subjected to a pressure of 5,000 lb. to the square inch, and the pressed product baked at 1000° C. —W. C. H.

Paving-block; Bituminous ——. Clifford Richardson, New York, and C. N. Forrest, Brooklyn N.Y., Assignors to "The Barber Asphalt Paving Company," Philadelphia, Pa. U.S. Pat. 853,116, May 7, 1907.

This paving block is composed of a bituminous binding material and a mineral aggregate of crushed screenings, of which approximately 65 per cent. lies between $\frac{3}{4}$ inch and $\frac{1}{8}$ inch in size, and the balance of which passes a 20 mesh screen, and is graded substantially as follows:—Passing 100 mesh, 17%; 80 mesh, 17%; 50 mesh, 30%; 40 mesh, 13%; 30 mesh, 10%; 20 mesh, 8%; 10 mesh, 5%. The excess of particles that pass a $\frac{1}{8}$ mesh and are retained on a 20 mesh screen, are excluded.—W. C. H.

Bituminous composition. Clifford Richardson, New York, and C. N. Forrest, Brooklyn, N.Y., Assignors to the Barber Asphalt Paving Company, Philadelphia, Pa. U.S. Pat. 853,117, May 7, 1907.

A protective covering, which resists the injurious effects of the sun's rays, is produced by mixing from 25 to 50 per cent. of flaky graphitic carbon with a relatively pure native bitumen, the actinic rays being materially intercepted by the graphitic carbon.—W. C. H.

Impermeable, incombustible, insulating, and acid-proof material. U. A. Marga, Dieghem, Belgium. U.S. Pat. 854,367, May 21, 1907.

See Eng. Pat. 25,128 of 1904; this J., 1905, 136.—T. F. B.

Cement. T. Jones, Acme, Tex. U.S. Pat. 853,175, May 7, 1907.

Relatively pure broken gypsum is calcined in an oxidising atmosphere, and the residue reduced to powder, 2000 lb. of which are thoroughly mixed with 60 lb. of a mixture of alumina, potassium sulphate, and silica, which is prepared as follows: Silica is added to a boiling aqueous solution of caustic potash, and after expelling the water, the "potassium bi-silicate" formed is calcined, and then mixed with sulphuric acid "for the purpose of nullifying the effect of any undesirable reduction of said silica." Any potassium sulphate is dissolved out of the mass. To 160 lb. of potassium silicate, 87 lb. of "di-basic aluminium sulphate" are added, and the two compounds are ground together to promote chemical action, whereby anhydrous alumina, potassium sulphate, and silica, are produced. As an alternative, powdered calcined "di-basic aluminium sulphate" may be mixed with the powdered calcined gypsum. Or, a silicate containing free potassium sulphate may be reduced, the potassium sulphate removed, and 30 to 40 lb. of the residue admixed with 60 lb. of calcined "di-basic aluminium sulphate."—W. C. H.

Cement; Manufacture of hydraulic ——. B. Enright, South Bethlehem, Pa. U.S. Pat. 854,342, May 21, 1907.

Air and fuel are fed into a rotatory kiln in such proportions as to dry, calcine, and clinker the cement-materials within the kiln, and also to give flue-gases rich in carbon monoxide, which may be utilised to give heat elsewhere.
—A. G. L.

Erratum. This J., 1907, 611, col. 1., l. 36, *for* "Standt" *read* "Staudt."

French Patents.

Bricks; Manufacture of ——. A. A. Gery. Fr. Pat. 373,118, Dec. 31, 1906.

In burning bricks and like material in tunnel-shaped kilns, through which the bricks are slowly carried on a series of trucks, while exposed to the successive drying, burning, and cooling operations, the platforms of the trucks, which support the material to be burnt, are hollowed out and serve as pipes for the passage of hot gases. The pipes embodied in the exit truck, which forms the end of the train, communicate with the atmosphere, whilst the pipes in the entrance truck communicate with the drying chamber of the kiln. In this way the waste heat of the cooling bricks, &c. is utilised for drying the raw material.—O. R.

Bricks; Manufacture of ——. A. A. Gery. Fr. Pat. 373,119, Dec. 31, 1906.

The pipes from the exit truck (see preceding abstract), instead of communicating with the atmosphere, are connected with a reservoir in which air supplied to the kiln may be compressed. More regular effects are obtained in this way, by passing back the air carrying the waste heat from the cooling bricks, under slight pressure, to the drying and preheating portions of the kiln.—O. R.

Stone, artificial; Manufacture of ——. A. Charles. Fr. Pat. 373,419, Jan. 9, 1907. Under Int. Conv., March 1, 1906.

This invention differs from the ordinary sand-lime brick-making process in the following particulars: (1) The proportion of lime is increased (up to 50 per cent.); (2) the mixture of sand and lime is ground as fine as possible; (3) the mixture is moulded under greater pressure; (4) the steam pressure in the autoclave is increased; (5) when the product is to be used for paving, it may be strengthened by the introduction of uniformly distributed iron or steel rods into the mixture before compression. The ends of these metallic inclusions are flush with the surface of the finished product, and their object is to ensure that pavements constructed of such material shall not wear smooth, but always retain a corrugated surface.—O. R.

Cement [slag]; Manufacture of ——. H. Colloseus. Fr. Pat. 373,458, Jan. 10, 1907.

Milk of lime is injected into hot, molten, blast-furnace slag, with the result that the water contained in the former is completely vaporised, the lime contained in solution combines with the silica in the slag, and the lime in suspension is finely and uniformly disseminated throughout the product obtained. Classifying the slags that can be employed as containing: (*a*) 45 to 50 per cent., (*b*) 40 to 45 per cent., and (*c*) up to 40 per cent. of lime respectively, the lime contents of the "milks" that must be used are: 1 to 2 per cent. for (*a*), 2 to 5 per cent. for (*b*), and 10 per cent. for (*c*). The product is perfectly dry and may be pulverised at once like Portland cement clinker. Eng. Pat. 18,623 of 1903, this J., 1903, 1293, is referred to.—O. R.

X.—METALLURGY.

(*Continued from page* 619.)

Iron and manganese ores in Russia. Bd. of Trade J., June 6, 1907. [T.R.]

The quantity of iron ore produced in the districts of Ekaterinoslav, Upper Dnieper, Kherson, and Alexandrisk in 1906 was 3,454,911 tons, of which 482,239 tons were exported abroad, the latter figures showing an increase as compared with the year 1905. Two companies have approached the Ministry of Trade and Industry, urging the imposition of an export duty on Russian manganese ore exported abroad of 10 copecks per poud, or 7¾d. per cwt. The imposition of such a duty would, it is stated, considerably diminish the export of manganese ore abroad, and afford greater facilities to the native works of increasing their production of ferro-manganese for shipment to foreign markets, on which far better prices could be obtained than on the raw material. The price of manganese ore at Poti last year varied from 1*l.* 7*s.* 4*d.* to 1*l.* 8*s.* 11*d.* per ton, whereas ferro-manganese fetched as much as 10*l.* per ton on exportation. According to a report of the Mining and Metallurgical Union of the South of Russia, the world's total production of manganese, of a quality such as is obtainable in the Caucasus, during the last three years averaged about 870,969 tons per annum, while in the year 1903 about 435,484 tons were exported abroad from the Caucasus alone.

Tin production of Bolivia. For. Off. Ann. Ser. [T.R.]

The quantity of tin barrilla exported from Bolivia during 1906 was 63,848,626 pounds Spanish, or 29,370,368 kilos., with an average content of 60 per cent. or 17,622,221 kilos. of pure tin, as compared with 60,194,828 pounds Spanish, or 27,689,621 kilos. in 1905.

The Departments where tin is produced are Potosi, Oruro, La Paz and Cochabamba, the proportion being as follows:—

Department.	Quantity.	
	Pounds Spanish.	Equivalent in kilos.
Potosi with Uyuni, Tupiza, Colquechaca and part which is exported through the Custom-house at Oruro	34,075,669	15,674,808
Oruro	25,892,342	11,910,477
La Paz	3,800,415	1,748,191
Cochabamba	80,200	36,892
Total	63,848,626	29,370,368

Iron; Reduction of ——, *and formation of carbides.* R. Schenck, H. Semiller, and V. Falcke. Ber. 1907, **40**, 1704—1725.

The authors have extended their experiments on the equilibrium of the system: iron, ferrous oxide, carbon, carbon monoxide, carbon dioxide (this J., 1905, 803), with the object of discovering the cause of discrepancies between their figures and those of Baur and Glaessner (this J., 1903, 699). In all cases the system was heated to a determined temperature in a porcelain tube in an electric furnace, and kept at that temperature till equilibrium was established, in some cases many hours, sometimes days, being requisite. The pressure was then read, and the gases quickly extracted by means of a special pump, and analysed. Great care was taken to exclude air, and the gases were always found to consist of carbon oxides.

1. *System,* $Fe, FeO, C(amorphous), CO, CO_2$: The iron was obtained by reduction of the oxalate in hydrogen, and then partially converted into oxide with deposition of carbon, by being heated in a stream of carbon monoxide. The whole of the results obtained are tabulated, in two series conducted in different places by different observers. The equilibrium-pressure rises with the temperature, from 27 mm. at 455° C. to 858 mm. at 670° C., but the composition of the gases varies only slightly, the ratio of carbon monoxide to dioxide being at 552° C., 53·7 : 46·3, and at 662° C., 58·4 : 41·6.

2. *System,* $Fe, FeO, graphite, CO, CO_2$: The equili-

brium-constant, η (see this J. 1905, 803) is obviously independent of the variety of carbon used in the experiment, but ζ may (and does in fact) vary. The composition of the gases will therefore be the same for graphite as for amorphous carbon (for η represents the ratio of their pressures), but the total pressure will be different in the two cases. Heller's former figures for the equilibrium-pressure were 12 mm. at 500° C., 111 mm. at 640°, 574 mm. at 755°, and new determinations by Falcke give 129 mm. at 660°, rising to 304 mm. at 710° C. The pressures are thus notably lower than in the case of amorphous carbon.

3. *System, FeC,FeO,C(amorphous),CO,CO_2 :*—If in the first system the amount of iron taken be small, and the amount of carbon monoxide (and hence of gas-space) relatively great, the equilibrium-pressures are much smaller than in system 1. This is due to the conversion of the iron into *cementite* [Fe_3C].($3Fe + 2CO = Fe_3C + CO_2$) ; for a pig-iron free from manganese and rich in *cementite* gave under similar circumstances closely corresponding figures. Heller found pressures from 10 mm. at 468° C. to 780 mm. at 780° ; Semiller finds pressures from 83 mm. at 634° to 657 mm. at 779° C. ; and Falcke (whose figures agree closely with Heller's) finds the ratio, $CO : CO_2$ to be from 85·4 : 14·6 to 89·3 : 10·7. *Cementite* thus appears to be more readily oxidisable than iron.

4. *System, Fe_3O_4,FeO,C(amorphous),CO,CO_2 :* — The mixture of ferrous oxide and carbon obtained by heating reduced iron with carbon monoxide, was heated for some time in carbon dioxide, which produces a certain amount of magnetic oxide. The mixture so obtained gave equilibrium-pressures from 121 mm. at 528° C. to 699 mm. at 581°. The ratio, $CO : CO_2$, calculated from these pressures and the pressures and gas-ratio of system 1, is 42·6 : 57·4 at 581°. Baur and Glaessner found at the same temperature the ratio 41·9 : 58·1.

The results on the whole confirm those of Baur and Glaessner, especially between 550° and 700°, but the curve of results for system 1, shews no minimum. The minimum found by Baur and Glaessner is possibly due to equilibrium not having been attained, possibly to the formation of *cementite.* Above 700°, errors are likely to arise, through the formation of mixed crystals of iron and *cementite.*

Conditions of carbide-formation :—From the data obtained, the curves representing the conditions of equilibrium in the di-variant systems,

$$FeO + CO \leftrightarrows Fe + CO_2 ; \qquad \eta = \frac{x}{1-x} \qquad (c)$$

$$2CO \leftrightarrows CO_2 + C ; \qquad \zeta = \frac{x^2}{1-x}.P \qquad (e)$$

$$3FeO + 5CO \leftrightarrows Fe_3C + 4CO_2 ; \qquad \vartheta = \frac{x^5}{(1-x)^4}.P \qquad (b)$$

$$Fe_3O_4 + CO \leftrightarrows 3FeO + CO_2 ; \qquad \eta' = \frac{x}{1-x} \qquad (d)$$

can be traced ; and from the intersections of these, the conditions of the corresponding univariant systems can be calculated. The intersection of (*b*) and (*c*) is a point in the equilibrium curve of the system, Fe,FeO,Fe_3C,CO,CO_2 ; from it the equilibrium pressure of the system can be calculated. This at 650° C. is 51·92 atm., and at 700° 166·3 atm. These represent the pressures at which metallic iron is convertible into *cementite* by the action of carbon monoxide. Calculation also shews that at these same temperatures the gas ratio, $CO : CO_2$ in the equilibrium, $3Fe + 2CO \leftrightarrows Fe_3C + CO_2$ is 96 : 4 and 99 : 1 respectively ; that is, iron cannot be converted by mixtures containing less than these percentages of carbon monoxide.

Heat of formation of cementite :—From the data above obtained and van't Hoff's equation, the molecular heat of formation of *cementite* is calculated to be 8940 calories. This agrees very closely with Campbell's experimentally obtained result of 8494 calories.

Influence of manganese on the cementite equilibrium :—Results obtained with a number of pig-irons containing from 1 to 6 per cent. of manganese shewed that the equilibrium-pressures in system 3 are greatly reduced by the presence of manganese. With even 1 per cent., the pressure at 820° is only 180 mm., and with 6 per cent., it is 15 mm. at 943° and rises only to 96 mm. at 1110° C.

—J. T. D.

Cast iron as cast and heat-treated. W. H. Hatfield. Carnegie research. Iron and Steel Inst., May, 1907. [Advance proof.]

Decomposition of carbides :—A number of bars were heated, and at successive temperatures pairs were removed ; one of these was cooled in air, the other quenched in water, and both were micrographically examined. Similar tests were made with bars cooling from a high temperature. The author concludes that the carbide, Fe_3C, dissociates gradually between 800° and 900° C., but that the carbide, $Fe_{24}C$, decomposes between 740° and 650° C. in the vicinity of Ar_1.

Nature of annealing carbon :—The author confirms Bauerman's conclusion, that annealing carbon is amorphous, as it separates at too low a temperature for crystallisation.

Casting temperature :—The author confirms his former results, and concludes that 1. Cast irons of the same composition occasionally vary greatly in strength. 2. This variation is not influenced by the temperature of casting. 3. Differences in mechanical tests are usually accompanied by differences in micro-structure. 4. Inequalities in the metal can usually be rectified by judicious heat treatment.

—J. T. D.

Iron ; Absorption of nitrogen in the hardening of ——. H. Braune. Bihang till. Jernkontorets Annaler, 1907, **8**, 191. Chem.-Zeit., 1907, **31**, Rep., 284.

The author has studied the absorption of nitrogen in the cementation process. A specimen of iron containing 0·35 per cent. of carbon was hardened by heating in contact with bone charcoal and with birch-wood charcoal for 8 hours at 800° C., and subsequently, test pieces of the hardened metal were subjected to a white heat. The results were as follows :—

—	Percentage of nitrogen in :—			
	Original metal.	After cementation.	After 1st reheating.	After 2nd reheating.
(1) With bone charcoal.				
Outer portion of test-piece	0·010	0·070	0·040	0·030
Whole cross-section of test-piece	0·010	0·022	0·021	0·018
Inner portion of test piece	0·010	0·016	0·016	0·014
(2) With birch-wood charcoal.				
Outer portion of test-piece	0·010	0·024	0·018	0·017
Whole cross-section of test-piece	0·010	0·015	0·011	0·011
Inner portion of test-piece	0·010	0·012	0·010	0·010

Experiments were also made with iron containing 0·20 per cent. of carbon. The absorption of nitrogen by iron is greatest when cementation is effected with bone charcoal, the cyanogen compounds present in the latter acting as the medium by which carbon is transferred to the metal. If the cementing mixture be moist, more nitrogen is taken up by the iron, owing to the formation of ammonia from the cyanogen compounds ; this increased nitrogen content makes the metal brittle. To obtain a metal hardened only on the surface, cyanogen compounds are the best cementing agents, the absorption of the carbon taking place rapidly and at a relatively low temperature. If, however, it is desired to render the surface of the iron not only hard, but also tough, the cementation should be effected either electrically, or by means of heating gases which have been previously freed from ammonia. (See also this J., 1905, 621, 972 ; 1907, 50).—A. S.

Steel ; Relation between the process of manufacture and some of the physical properties of ——. F. W. Harbord. Iron and Steel Inst., May, 1907. [Advance proof.]

From the results of tests made on experimental bars of steels containing quantities of carbon varying from 0·1 to 0·75 per cent., the manganese being as far as possible

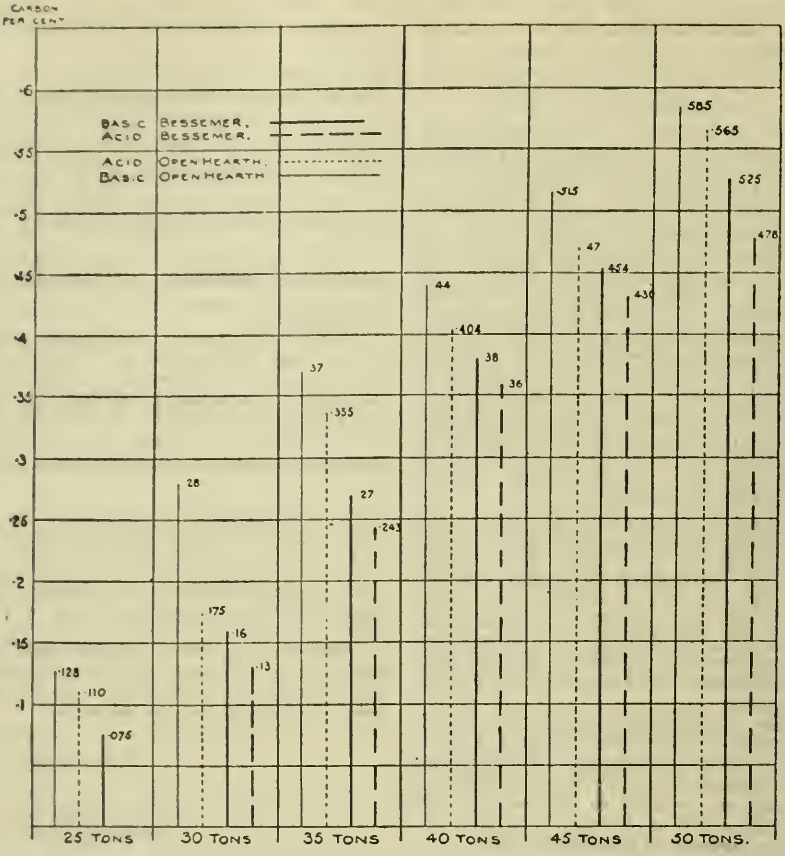


Diagram showing Percentages of Carbon in Different Varieties of Steel of same Tensile Strength deduced from Experimental Bars.

the same for the same content of carbon, it is shown that for steels of the same percentage of carbon, the tensile stresses are in the following order from highest to lowest: acid Bessemer steel, basic Bessemer, acid open-hearth, and basic open-hearth steel. Elastic limits, elongations, and reductions of area compare with the tensile tests, and these results are confirmed by a very large number of others collected from various sources. The following diagram shows percentage of carbon in different varieties of steel of the same tensile strength (deduced from experimental bars), from which it will be seen that for 30-ton steel and upwards, about 0·1 per cent. more carbon is required in basic open-hearth steel than in acid Bessemer steel to give the same result. The results of Brinell's ball test for hardness show that the order of hardness follows the tensile strength, and the author is of the opinion that it will be safe to allow an increase of from 0·10 per cent. to 0·12 per cent. of carbon for basic open-hearth steel rails as compared with acid Bessemer rails.

—O. F. H.

Steels; Carbon-tungsten ——. T. Swinden. Iron and Steel Inst., May, 1907. [Advance proof.]

A series of steels with a constant percentage (about 3 per cent.) of tungsten, and with carbon varying from 0·144 per cent. to 1·07 per cent. were examined mechanically, pyrometrically, and microscopically. The mechanical tests show that 3 per cent. of tungsten raises the tenacity without materially lessening the ductility, the maximum tenacity being at 0·9 per cent. of carbon. The elastic ratio is much higher than for carbon steels, but alternating stress tests show that the "shock" hardness or brittleness of high-carbon steels is not removed by tungsten. From the cooling curves it is found that below a certain initial temperature, the critical points occur as for carbon steels, but that on cooling from above this temperature, which varies from about 950° C. in the case of low-carbon steels to over 1100° C. for high-carbon steels, the cooling curves are much modified. Thus for steels containing less than 0·35 per cent. of carbon, heating beyond the initial temperature lowers Ar 1 to a definite "low point," Ar 2 is practically unaffected, Ar 3 is gradually suppressed in its normal position, but appears again below Ar 2, forming the upper maximum of the "low point"; for steels containing from 0·35 per cent. to 0·9 per cent. of carbon, Ar 1 is first lowered, and then increased heating displaces Ar 3·2 towards Ar 1; for steels containing more than 0·9 per cent. of carbon, the Ar 3.2.1 point is lowered as a whole, giving a single "low point." This "low point" is practically constant at 570° C. for 3 per cent. tungsten steels, and is not affected by the rate of cooling after lowering has once taken place. The micro-structures resemble those of carbon steels but are finer in pattern.—O. F. H.

Steel; Manufacture of ——, *from high-silicon phosphoric pig iron by the basic Bessemer process.* A. W. Richards. Iron and Steel Inst., May, 1907. [Advance proof].

Some iron oxide is put into the converter, with or without a small quantity of lime, and the molten Cleveland pig iron (low in sulphur; silicon, 1·5—3 per cent.; phosphorus, 1·45—1·55 per cent.) poured in. The metal is blown till all silicon is oxidised, and the converter then turned down, and as much of the slag as possible poured off. The slag contains: iron, 3 per cent.; silica, 35—45 per cent.; and no phosphorus; and owing to the low temperature during the first blowing, it affects the basic linings very slightly. The slag after the second blowing contains: iron, 8—11 per cent.; phosphoric acid, 14—20 per cent. (95—100 per cent. of it soluble in 1 per cent. solution of citric acid); silica, 11—12 per cent. The oxide added is completely reduced. The working is very clean, and the steel produced is of very regular quality, rolls excellently, and fulfils very rigid requirements. —J. T. D.

Steel; Production of ——, from pig-iron containing chromium, cobalt, and nickel. A. W. Richards. Iron & Steel Inst., May, 1907. [Advance proof.]

The pig-iron is produced from ore containing about 0·9 per cent. of nickel and cobalt and 2·4 per cent. of chromium. The ore requires a large amount of coke and of limestone for reduction, and produces pig-iron containing 1·75 per cent. of nickel and cobalt, 4 per cent. of chromium, and 4 per cent. of silicon. To make steel from this, there are charged into an open-hearth furnace, 3 tons each of lime and basic slag, followed by 3 tons of hæmatite iron ore. When the charge is pasty, two ladles containing 10—11 tons each of the melted chrome-nickel pig-iron are poured in. Thick foaming slag is formed, which after $\frac{3}{4}$—1 hour is run off at the slag notches. A second slag is then formed from the materials on the bottom and from additions of basic slag, fluorspar, and lime. This is also removed, with mechanical assistance as it is very viscous. With 4 per cent. of chromium in the pig-iron, 3 or 4 such slags have to be made and removed before the chromium is practically expelled. The metal is then worked as an ordinary open-hearth charge. The steel formed contains about 0·5 per cent. of chromium, some being reduced from the oxide in the slag during decarburisation. Steel higher in chromium is made by adding a sufficient quantity of the chromic pig-iron before tapping. The boil begins 9—10 hours after charging and lasts about an hour. The steel has very high tensile strength, is very tough, and resists reversal of strain very well. It is improved by heating to 650° C. after finishing, and cooling in air. Results of mechanical tests are given in the paper.—J. T. D.

Tungsten in steel; Alkalimetric method for the determination of ——. S. C. Lind and B. C. Trueblood. J. Amer. Chem. Soc., 1907, **29**, 477—481.

From 2 to 10 grms. of the steel are dissolved in about 30 c.c. of nitric acid of sp. gr. 1·2, 1—2 grms. of potassium chlorate being added if necessary. The solution is evaporated to dryness, the residue treated with 15—20 c.c. of concentrated hydrochloric acid, evaporated nearly to dryness, and a further small quantity of concentrated hydrochloric acid added. The whole is now diluted to 150—200 c.c., boiled for a few minutes and allowed to settle. After decanting off the clear liquid through a filter, the residue of silica and tungstic acid is washed repeatedly by decantation with hot 5—10 per cent. hydrochloric acid till free from iron (by thiocyanate test), and then washed free from acid with a 3—5 per cent. solution of sodium nitrate. The residue and filter are treated with excess of $N/5$ potassium hydroxide solution, and heated, if necessary, to complete the solution of the tungstic oxide; after cooling, the excess of alkali is titrated with $N/5$ hydrochloric acid and phenolphthaleïn. —A. S.

Electrolytic corrosion of iron and steel in concrete. A. A. Knudson. Electrician, 1907, **59**, 213—214.

Although steel structures are well preserved from ordinary corrosion in salt or fresh water, if surrounded by concrete, this no longer holds where the metal is subjected to even the most minute electrolytic action. Under these conditions the metal is corroded, and the concrete seriously disintegrated, the effect being more marked in salt than in fresh water by reason of the lower electrical resistance. The experiments on which these conclusions are based, emphasise the necessity for providing suitable waterproofing and electrical shielding of all structural steel work liable to be attacked by stray currents from tramways or power houses.—R. S. H.

Copper-tellurium. M. Chikashigé. Z. anorg. Chem., 1907, **54**, 50—57.

From the thermal and microscopical analysis the following conclusions are drawn. Two compounds exist having the composition corresponding to the formulæ, Cu_4Te_3 and Cu_2Te. The compound, Cu_2Te, is formed at 855° C. and is of a grey colour. It is only miscible with molten copper to a very small extent. With tellurium a series of mixed crystals are formed with a composition varying between 49·9 and 45 per cent. of copper. This compound and its mixed crystals with tellurium possesses two transition points at 387° and 351° respectively, and, consequently, there are three stable crystalline forms. The compound, Cu_4Te_3, occurs as a violet crystalline substance and is formed at 623° C.; at 365° C., these crystals are transformed into another crystalline variety with a considerable evolution of heat. A mixture of tellurium and the compound, Cu_4Te_3, with a content of about 17·3 per cent. of copper forms an eutectic. Down to 0·05 per cent., the presence of tellurium in copper can be detected with the microscope and evidently occurs as drops of the compound, Cu_2Te, surrounding the copper crystals; since tellurium occurs in some Japanese copper and has a considerable influence on the physical properties, the observation is of some practical importance.—R. S. H.

Zinc blende and calamine; Mixing of ——. F. Juretzka. Z. angew. Chem., 1907, **20**, 750—754.

The author gives a detailed example of the calculation of a suitable charge of zinc blende and calamine. The iron-content of the mixture must not exceed 10 to 12 per cent.; the coal added should be sufficient to leave 20 to 25 per cent. of carbon in the residue. The slag should be approximately a monosilicate, with metallic bases (FeO, MnO) and earth bases (Al_2O_3, CaO, BaO, MgO) in the ratio 1 : 1. The total sulphur should not exceed 4 to 6 per cent.; the more calcium sulphate is present, the higher will be the loss of metal. A little free lime should be added in order to decompose any metallic sulphides formed during the distillation. If much lead is present in the ore, it must be recovered; in this case, not less than 7 to 8 per cent. of lead should be present in the charge; on the other hand, if lead is not recovered, not more than 0·2 per cent. should be present.—A. G. L.

Willemite; Detection of —— by phosphorescence. E. K. Judd. Eng. and Mining J., 1907, **83**, 803.

At Franklin Furnace, N.J., U.S.A., a complex zinc ore composed of a granular mixture of franklinite, zinkite, and willemite, with calcite and garnet as the principal gangue minerals, is treated first in a magnetic separator. At the first pole most of the franklinite is removed, whilst the second attracts the garnet and the remainder of the franklinite. In the subsequent separation of the residual mixture of zinkite, willemite, and calcite, by a wet process, the willemite exhibits a tendency to pass with the calcite into the tailings, but, hitherto, no ready means of detecting its presence in the latter has been available. G. C. Stone has, however, utilised for this purpose, the marked luminescence exhibited by willemite when illuminated by ultra-violet light. Two heavy half-round copper bars, insulated from each other, are connected at one end by a porcelain tube which serves as a handle and as a receptacle for resistance coils. The free ends of the bars are 3 in. apart, and are provided with holes, through each of which a wrought-iron screw passes, the points of the two screws meeting in the middle of the space between the copper bars. The ends of the bars in the porcelain tube are connected with the two wires of a 110-volt electric lighting circuit, and, on passing the current, an arc is produced between the iron poles, emitting light rich in ultra-violet rays. If tailings containing willemite be exposed to this light, the fragments of that mineral exhibit a bright apple-green luminescence. By the aid of this test it was found that contrary to expectation, coarse jigs were more efficient than fine jigs for the separation of willemite.—A. S.

Wood charcoal; Examination of gases evolved in the preparation of ——. E. Juon. III., page 677.

Titanium; Volumetric determination of ——. G. Gallo. XXIII., page 719.

English Patents.

Ores; Process for the treatment of —— and for de-tinning tinned-iron sheets. L. Rivière, Paris. Eng. Pat. 10,309, May 2, 1906. Under Int. Conv., May 2, 1905.

See Fr. Pat. 360,602 of 1905; this J., 1906, 543.—T. F. B.

Zinc from zinc ores; Furnace for obtaining ——. P. Schmidt and A. Desgraz. Eng. Pat. 11,191, May 12, 1906.

SEE Fr. Pat. 367,368 of 1906; this J., 1906, 1155.—T. F. B.

Magnetic material; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 11,974, May 22, 1906.

SEE U.S. Pats. 836,756–8 and 842,403; this J., 1907, 155 and 415.—T. F. B.

Fumes from ores; Apparatus for the arresting and depositing of ——. W. W. Fyfe, London. Eng. Pat. 14,401, June 23, 1906.

THE fumes from roasting furnaces are condensed by passing them successively through dry screen and wet screen chambers. Each of the dry screen chambers is divided internally into three vertical compartments which are fitted at intervals with transverse frames, carrying screens of Hessian cloth, canvas, or similar material; gaps are left alternately in the frames at top and bottom to force the fumes to follow a zig-zag course over the surface of the screens. When charged with fumes, the frames are removed through the tops of the chambers, which are made of removable plates made gas-tight by means of asbestos packing interposed between them and the T-cross-bars on which they rest. The wet screen chambers consist of two compartments separated by a wall, and communicating with each other by ports situated below the level of the liquid which occupies the lower part of each chamber. The fumes, in passing from one compartment to the other, are forced to pass through these ports.—A. G. L.

Ovens or kilns for annealing iron castings, for burning bricks and pottery-ware, and for other similar uses. W. P. Gibbons, Lower Gornal, Staffs, R. Masters, Dudley, Worcester, and R. Baker, Smethwick, Staffs. Eng. Pat. 16,641, July 24, 1906.

A CIRCULAR kiln has, in the lower part of the wall, a main annular flue connected with a gas producer, and branch flues in the wall opening into the kiln some distance up. Secondary air passages leading from the outside, below the floor level, pass up at the sides of the branch gas flues, and the waste gases are withdrawn through a series of passages beneath the floor.—O. F. H.

Metals [Platinum, &c.]; Coating of metals with ——. A. C. Hyde, Ealing and K. R. Swan, London. Eng. Pat. 18,803, Aug. 22, 1906.

IRON, nickel, or their alloys are covered with a thin sheet of platinum or a metal of the platinum group, and heated in a muffle in an atmosphere of hydrogen to a temperature near the melting point of the more fusible metal. The metal or alloy may then be rolled, "spun," &c. without injury to the platinum coating.—O. F. H.

Metal ingots and other bodies; Manufacture and production of compound ——, *and apparatus to be used in such manufacture.* J. F. Monnot, New York. Eng. Pat. 8913A, Oct. 12, 1906 (under rule 5 of Pat. Rules, 1905).

THE metal ingot, which is to be coated with another metal, is thoroughly cleaned and heated in a non-oxidising atmosphere; it is then transferred to a movable casing, having a removable bottom plate, and filled with a reducing gas, as producer gas. The ingot and casing (with bottom plate removed), are then dipped into the molten coating metal. The bottom plate is replaced, so as to enclose a layer of the molten metal between the ingot and the walls of the casing, and the whole is removed from the bath, the coating being then allowed to solidify.—A. G. L.

Ores [Tin oxide and wolframite]; Separation of ——. F. Dietzsch, London, and J. Paull, Cannington, Cornwall. Eng. Pat. 23,567, Oct. 23, 1906.

IN order to separate wolframite from tin oxide, the ore, after roasting, is treated with sulphuric or other acid, and then passed through the magnetic separators. The treatment with acid dissolves or reduces the magnetic oxide of iron, which would otherwise coat the non-magnetic tin oxide, and so cause imperfect separation of the latter from the magnetic wolframite.—A. G. L.

Ores and the like; Process and device for dressing —— *on jigger sieves.* W. Sauerbrey, Cunnersdorf, Germany. Eng. Pat. 407, Jan. 7, 1907. Under Int. Conv., Jan. 8, 1906.

SEE Fr. Pat. 371,751 of 1906; this J., 1907, 416.—T. F. B.

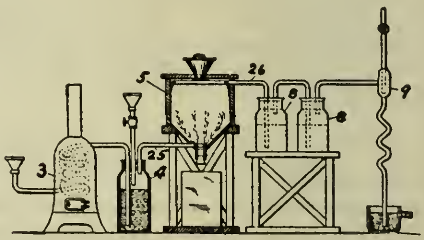
Kilns and the like; Method of heating ——. C. Dellwik. Eng. Pat. 5976, March 12, 1907. I., page 672.

Iron oxides; Process of and mixture for reducing ——. H. W. Lash, Cleveland, U.S.A. Eng. Pat. 387, Jan. 7, 1907.

THE finely-divided iron oxide (iron sands from New Zealand, or the St. Lawrence, &c.) is mixed with coke and not more than its own weight of "finely divided cast- or pig-iron," and smelted for steel in an open-hearth furnace. A readily combustible material, *e.g.*, sawdust or bituminous coal, may be added to the mixture so as to leave a porous mass after this material has been burnt. Fluxes, *e.g.*, lime and fluorspar, and binding agents may also be added.—A. G. L.

UNITED STATES PATENTS.

Ores; Apparatus for extracting metals [gold and silver] from their ——. C. R. Arnold, Philadelphia, Pa. U.S. Pat. 849,097, April 2, 1907. (See this J., 1906, 699.)



THE apparatus consists of a closed vat, 5, containing a pulp of finely crushed ore and cyanide solution, which is agitated by the passage through it of heated air mixed with a halogen gas. The air enters the vat at the bottom by the inlet, 25, after passing through the heater, 3, and the Woulffe bottle, 4, in which the halogen gas is generated. The air is withdrawn from the vat through the outlet, 26, and absorption tanks, 8, by means of a hydraulic pump, 9, which also serves to maintain the current of air through the whole apparatus.—O. F. H.

Metals [Copper]; Process for the extraction of —— *from their ores.* R. Lamb, New York. U.S. Pat. 852,438, May 7, 1907.

THE copper ore in the granular state is roasted at a low temperature in order to render the copper soluble and convert the iron into an insoluble oxide. The roasted ore is then placed in a closed vessel into which water and liquid sulphur dioxide are introduced. After the leaching of the ore by the sulphurous acid is finished, the solution and residue are separated pneumatically. The solution is then electrolysed between insoluble electrodes to deposit the copper. A low current density is used, and an excess of sulphurous acid is maintained in the solution, which is oxidised to sulphuric acid during the operation. This sulphuric acid, together with fresh liquid sulphur dioxide, serves for the leaching of the next lot of ore.—A. G. L.

[Copper] Ores; Method of treating ——. J. W. Boileau, Assignor to J. B. Knoblock, Denver, Colo. U.S. Pat. 853,575, May 14, 1907.

COPPER is extracted from ores by treating the latter, in a finely pulverised condition, with sulphuric acid, salt, and water, in the presence of hot air under pressure.—A. S.

Agglomerating minerals; Process of ——. W. G. Perkins and T. Cox, jun., San Francisco, Cal. U.S. Pat. 852,611, May 7, 1907.

MATERIALS containing oxides, sulphides, sulphates, carbonates, and silicates, and "possessing fuel properties," are agglomerated by placing them in a receptacle, applying heat, and introducing air, so as to cause combustion of a part of the materials.—A. G. L.

Ore; Apparatus for sintering fine ——. J. G. Bergquist, Assignor to American Sintering Co., Chicago. U.S. Pat. 853,433, May 14, 1907.

SEE Fr. Pat. 371,648 of 1906; this J., 1907, 416.—T. F. B.

Detinning. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va., Assignors to Tin Products Co., New York. U.S. Pat. 853,461, May 14, 1907.

THE tin scrap is detinned by subjecting it to the action of dry chlorine at a temperature below the volatilisation point of stannic chloride, then the stannic chloride is removed from the vessel by means of a current of dry chlorine, and, finally, the residual chlorine is displaced by air from which the oxygen has been removed.—A. S.

Tinning or coating metal sheets; Process of ——. L. C. Steele, Pittsburg, Pa. U.S. Pat. 854,006, May 21, 1907.

THE sheet of metal to be coated is passed upwards through a bath of the molten coating metal, such as tin, and through oil or similar substance resting thereon, and suction is applied across the width of the sheet, on both sides, just above the level of the coating metal. In this way the surplus tin is removed from the sheet of metal, and the oil is caused to pass continually over the surface of the latter as it emerges from the bath of coating metal. The oil withdrawn by the suction pump is filtered, and then returned to the bath.—A. S.

Mercury or quicksilver still. R. A. Lackmann, Portland, Oreg. U.S. Pat. 853,701, May 14, 1907.

THE impure mercury is introduced through a valved pipe into the still, which is closed gas-tight by a cover, suitably cooled. The surface of the portion of the cover within the still is silver-plated. Across the upper portion of the still is an inclined channel or gutter, provided in the middle with a spoon-shaped enlargement, directly below the apex of the conical bottom of the cover. The inclined gutter communicates with an outlet in the side of the still. On heating the still, the mercury is vaporised; it condenses on the conical bottom of the cover, drains back into the gutter, and passes thence, as explained, to the outlet and through a pipe into a receiver containing water.—A. S.

Cast metal; Manufacture of ——. R. C. Totten, Pittsburg, Pa. U.S. Pat. 854,126, May 21, 1907.

THE claims are for cast metal having a chilled surface and consisting of "coke or coal iron" and spiegeleisen. The metal contains at least 0·5 per cent. of combined carbon, together with manganese to the extent of at least 1 per cent. more than the proportion of combined carbon. —A. S.

Alloys; Manufacture of ——. G. E. Buttenshaw, Manchester. U.S. Pat. 854,462, May 21, 1907.

SEE Eng. Pat. 792 of 1905; this J., 1906, 184.—T. F. B.

Ores; Apparatus for treating ——. T. D. Pitts, Assignor to The New Cyanide Process Co., New York. U.S. Pat. 854,526, May 21, 1907.

THE apparatus consists of a rotatable casing or barrel, the inner walls of which are provided at intervals with annular plates or rings, to which radial baffle-plates are secured. Stationary inlet and outlet pipes are connected centrally with opposite ends of the casing, the inner end of the outlet pipe being provided with a part directed upward opening into the barrel.—A. G. L.

[Iron] Ores; Preparing and reducing ——. E. Pollacsek, New York. U.S. Pat. 854,527, May 21, 1907.

IRON ores are prepared for reduction by mixing them with a reducing agent, and a liquid containing a glue-like substance for the purpose of giving the mass a plastic consistency and binding together its components.—A.G.L.

FRENCH PATENTS.

Steel and alloy steels; Process for annealing and superficially carburising ——. J. Churchward. Fr. Pat. 372,503, Dec. 12, 1906.

THE steel is reheated to about 1100° C., and allowed to cool slowly to a temperature of 320° C. to 260° C. This treatment is repeated once or several times, and the steel finally allowed to cool slowly to the ordinary temperature. In the case of alloy steels, the first reheating is the same as for ordinary carbon steels, but subsequent reheatings are only carried to a point just below the critical temperatures for the alloy metals. Superficial carburisation may be effected by allowing the surface to be carburised to rest, during the annealing process, on a bed of carbonaceous material containing animal charcoal.—O. F. H.

Briquettes [of fuels and ores], and binding medium therefor. P. Léotard. Fr. Pat. 373,360, Jan. 7, 1907. II., page 677.

Furnace; Crucible ——. R. Lindemann. Fr. Pat. 373,433, Jan. 9, 1907.

THE furnace is of square cross-section and has double walls. The air supply after passing between the walls and beneath the grate, enters the furnace by four tangential openings at the corners, just above the grate.—O. F. H.

Ores; Jig or apparatus for concentrating or washing ——. A. Taylor. Fr. Pat. 373.497, Jan. 12, 1907.

A JIG or other similar concentrating machine is given a vibratory motion by being connected by two flexible steel bands to a shaft rotating excentrically. The vibratory motion may be transmitted to the jig as a whole, to the screen only, or to a piston in one compartment of the jig; and means are provided for altering the excentricity of the rotating shaft and so varying the rapidity of the vibrations.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(Continued from page 622.)

(*A.*)—ELECTRO-CHEMISTRY.

Nitrogen; Oxidation of —— *by the silent discharge through air.* E. Warburg and G. Leithäuser. Preuss. Akad. Wiss. Berlin, Sitz. Ber., 1907, **12**, 229—234.

HAUTEFEUILLE and Chappuis observed in 1881 that the silent discharge passing through mixtures of oxygen and nitrogen produced ozone and a nitrogen oxide, pernitric acid, N_2O_6, characterised by strong absorption in the visible spectrum. The authors find that a nitrogen oxide with this characteristic absorption, for which they propose the designation, Y, is formed whenever dry oxygen acts on nitric anhydride; the silent discharge is not essential. The resulting gas was examined for absorption in a tube of 30 cm. length, when 15 absorption bands were seen, as against the 8 described by Hautefeuille and Chappuis, who worked with evidently less concentrated Y-gas in a tube 2 m. in length. The absorption is at a maximum at 60° C., but the gas is soon decomposed by heat; it disappears at —79°, when a snow is condensed on the walls of the tube, the remaining gas not showing any absorption. The absorption also disappears when the Y-gas is passed through sulphuric acid or over phosphorus pentoxide, and further on addition of water vapour to the Y. The spectrum resembles that of ozone mapped by Ladenburg and Lehmann, whose oxygen, the author suggests, was probably not pure. The formula, N_2O_6, is not disproved. Together with the Y, ozone also disappears in the course of time. [cf. Raschig, page 686.]

Iron; Quantitative separation of —— *from titanium and aluminium. Use of a diaphragm in electrolytic analysis.* G. Magri and G. Ercolini. XXIII., page 719.

Tin; Electrolytic determination of —— *with the use of a rotating anode.* L. F. Witmer. XXIII., page 718.

Paper pulp: Bleaching —— with electrolytic hypochlorite solutions. W. P. Digby. XIX., page 712.

English Patents.

Electric batteries. E. Buhot, Paris. Eng. Pat. 11.652, May 18, 1906. Under Int. Conv., May 23, 1905.

See Fr. Pat. 354.551 of 1905; this J., 1905, 1115.—T. F. B.

Incandescing bodies for electric incandescent lamps; Manufacture of ——. A. Just, F. Hanaman, and Vereinigte Electricitäts A.-G. Eng. Pat. 11,944, May 22, 1906. II., page 675.

Filaments for electric incandescent lamps; Supports for metallic ——. A. Lederer. Eng. Pat. 20.210, Sept. 11, 1906. II., page 676.

Air and other gases: Mode of and means for electrically treating ——. J. H. Bridge, Philadelphia. Eng. Pat. 17.768, Aug. 7, 1906.

See U.S. Pats. 832,767 and 832.768 of 1906; this J., 1906, 1053.—T. F. B.

Furnaces, electric; Regulation of ——. C. Bingham, London. Eng. Pat. 28.593, Dec. 14, 1906.

In an electric furnace, such as is used for the manufacture of calcium carbide, the electrodes of one sign are placed at a higher level than those of opposite sign, and the voltage is varied by cutting out or inserting in circuit portions of the transformer, generator, or exciter of an alternating current generator, as the case may be. —O. F. H.

United States Patent.

Accumulators: Process for the production of active matter for —— with mixed oxides. H. Fredet, Brignoud, France. U.S. Pat. 854.940, May 28, 1907.

See Fr. Pat. 328,856 of 1903; this J., 1903, 1004.—T. F. B.

French Patents.

Electrodes for arc lamps. A. Blondel. Fr. Pat. 373,270, March 13, 1906. II., page 677.

Furnace; Electric resistance —— of carbon protected against oxidation. C. Féry and C. Langlet. First Addition, dated Dec. 26, 1906, to Fr. Pat. 363,437, Feb. 17, 1906 (this J. 1906, 854).

The addition relates to several different arrangements for preventing, in electric resistance furnaces, the dislocations, which arise from unequal dilatation of the various portions of the furnace. The exterior envelope of such a furnace as that described in the main patent, is heated to a lesser degree than the other parts of the furnace, and, in this addition, it is therefore so arranged as to permit of a free longitudinal displacement. Thus, the envelope may consist of two cylinders, fitted one within the other, or of one cylinder partially surrounding two others, with interior joints of asbestos. To enable the envelopes to glide, one over the other, more readily, the cylinders may be provided with radial wings, or with semicircular grooves in which balls engage. In alternative forms, which are described, the periphery of the outer cylinder is provided with undulations, or it may consist of rings stamped out and assembled one against the other, or the ends of the outer cylinder may be undulated or flexible. In the case of a muffle or crucible furnace, the independence of the heated parts may be secured by the employment of a rigid envelope, with a working chamber fixed only at one end of the envelope, and free to dilate in the interior of the furnace. An elastic conductor of carbon may be employed, fixed at the two extremities of the envelope, or a non-elastic conductor of carbon, fixed only to the envelope at the same extremity as the working chamber, and dilating freely with the latter in the interior of the furnace. The carbon conductor may also be made in the form of a U-shaped plate, or as a split cylindrical tube.—B. N.

Adhesive material, for rendering more solid the active material in electric accumulators. E. W. Barton-Wright and Q. Marino. Fr. Pat. 373,044, Dec. 28, 1906. Under Int. Conv. Nov. 29, 1906.

Castor oil is mixed with 5 to 6 per cent. of its weight of finely-powdered litharge, and 3 to 4 per cent. of manganese peroxide, and the mixture is boiled, allowed to clarify, and the oil decanted off from the powder, the latter being afterwards washed with benzene or alcohol to remove adhering oil. The powder is then mixed with 90 per cent. of its weight of litharge and with dilute sulphuric acid to form a paste.—B. N.

Accumulators. P. G. Triquet. Fr. Pat. 373,098, Dec. 29, 1906.

Each element of the accumulator consists of a porous plate of carbon, provided with cavities or conduits in which is disposed the active material. Metallic conductors are fixed to the plate itself, or in the active material. The plate of carbon may be prepared by the action of dilute acid on a plate of carburised cast iron, of convenient dimensions.—B. N.

Insulating product with cellulose basis; New ——. E. and M. Lamort. Fr. Pat. 373,407, Jan. 9, 1907.

A pulp, of mucilaginous and oily consistency, is prepared by "beating" suitable forms of cellulose (chemical or mechanical wood pulp, &c.) with water, gum, glue, resin, aluminium sulphate, aniline colours, &c. It is withdrawn from the "beater" at the moment that its properties are the same as those of hydrocellulose.—B. N.

Electrode of precious metal [platinum] for electrolysis. G. Thiele. Fr. Pat. 373,688, Jan. 18, 1907. Under Int. Conv., Jan. 19, 1906.

Fine platinum wires, acting as electrodes, are connected with a cheaper metal, such as copper. The platinum wire is gripped between two sheets of copper, and a bead of glass is slipped over the wire near to the point of junction. The latter is then covered, by electrolysis, with a metal, such as lead, not easily attacked by the electrolyte, the metal also enveloping the bead of glass. This metallic coating is finally covered with a plastic insulating material pressed between two plates of earthenware, porcelain, &c. A similar method of connecting one electrode with another of opposite polarity is also described.—B. N.

German Patent.

Sodium persulphate; Process for the electrolytic preparation of —— from sodium sulphate. Konsortium für Elektrochem. Ind. G.m.b.H. and E. Müller. Ger. Pat. 172,508, Aug. 28, 1904.

A saturated solution of sodium sulphate to which some concentrated sulphuric acid has been added, is used as electrolyte in the preparation of persulphate. The addition of sulphuric acid allows the use of a diaphragm to be dispensed with.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Gold; Electrolysis [Electrolytic precipitation] of —— from cyanide solutions. D. Lay. Eng. and Mining J., 1907, 83, 801—803.

Electrolytic precipitation gives better results than precipitation with zinc when the cyanide solution is very weak or is unduly contaminated with base metals. The author describes the plant employed in a works dealing with 150 tons of solution per 24 hours. Three precipitation tanks are used, each 35 ft. long, 5 ft. wide, and 3 ft. deep, placed side by side. The solution which contains, on the average, 0·01 per cent. of potassium cyanide, and should also contain 0·03 per cent. of free lime, flows through each tank at the rate of 50 tons per 24 hours. The anodes consist of plates of No. 10 sheet iron, 5 ft. 1 in. by 2 ft. 8 in., placed 3 in. apart and fitting in grooves in the walls of the tank; alternate plates are raised 1½ in. above the bottom of the tank in order to provide a zig-zag path for the solution. Sheet lead cathodes are suspended from cross-bars between the anodes; there are 3500 sq. ft.

of cathode surface in each tank. The current employed is 0·02—0·03 ampère at 4—5 volts; the E.M.F. must not be allowed to fall below 3 volts, otherwise oxides of precious metals may be deposited on the cathodes as a black non-adherent coating. The author has found that the percentage of precious metals precipitated depends upon the rate of flow of the solution and the cathode area, and not upon the amount of dissolved metals or the current. In his experience the equation: $K = 1750 \times R$, where K represents the number of square feet of cathode surface necessary for the complete precipitation of the precious metals, and R is the rate of flow (tons per hour) of solution, holds good, provided that the electrodes are connected in multiple, the anodes and cathodes are of equal area, and the distance between the anodes and cathodes is 1½ in.—A. S.

Alloys; Electrical conductivity of ——. *II, Relation between constitution and temperature coefficient.* W. Guertler. Z. anorg. Chem. 1907, **54**, 58—88.

Having in a previous investigation pointed out the relation between the volume-percentage of the constituents and the electrical conductivity of alloys (this J. 1907, 51), the author now derives similar relations between the constitution and the temperature coefficients of the electrical conductivity from numerous available data. Expressing the temperature coefficient as the percentage decrease of conductivity by raising the temperature from 0° C. to 100° C.; this value is about 27 or rather higher for all pure non-magnetic metals. A similar value holds for all alloys free from mixed crystals, and, conversely, if the temperature coefficient of an alloy is equal to or greater than 27, that alloy can contain no mixed crystals. Moreover the resistance of all such alloys, just as that of the pure metals, must disappear at the absolute zero. The close relationship found by Matthiessen between the electrical conductivity and its temperature coefficient is upheld and extended by the author. It is found that in all cases the shape of the curve giving the relation between the volume constitution of the alloys and their electrical conductivity is exactly similar to the shape of the curve representing the constitution and the temperature coefficient. The fall in conductivity occasioned by the presence of mixed crystals is equally apparent on the temperature-coefficient curves and is particularly remarkable in that the resistance occasioned in this way is independent of the ordinary resistance of the alloy, as calculated from the volume concentrations, and does not vary with the temperature, at any rate from the ordinary temperature down to the absolute zero. This "specific" property of mixed crystals is also characteristic of the compounds formed in some alloys, such alloys possessing an independent and invariable resistance superposed upon that determinable from the volume concentration of the constituents. In view of the fact that the temperature coefficient can be measured with irregularly shaped samples and with greater facility than the specific conductivity, the relationships which have been found to exist should be of great value in the study of the constitution of alloys.—R. S. H.

English Patents.

Anodes for electrical purposes. F. Greenfield, Birmingham. Eng. Pat. 16,870, July 26, 1906.

The anode (for electro-plating) consists of a series of bars or narrow plates, secured by means of a right-angled or hook-like extension and a screw passing through it to a wooden cross-bar, which forms the top member of a wooden frame immersed in the electrolyte. The bars are separated from each other so as to form a grating; their lower ends are kept in place by a rubber band. The individual bars, being light, can be readily removed from the electrolyte when not in use.—A. G. L.

Copper wire, strip, or the like; Electrolytic production of ——. S. O. Cowper-Coles, London. Eng. Pat. 21,349, Sept. 26, 1906.

In the electrolytic production of copper strip (this J., 1905, 976), V-shaped projections remain at the line of shearing. To avoid this, a number of spiral grooves are made on the mandrel on which the copper is deposited, every sixth groove being cut deeper, and the deposited metal may be afterwards unwound as a broad band of a width equal to the distance between the deeper grooves. The broad strip is passed between rollers to remove the projections, when the band splits into narrower strips, according to the number of fine grooves or scratches. —B. N.

Iron; Electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 28,897, Dec. 18, 1906.

Iron may be deposited from crude iron or iron ore, in a form suitable for the production of tubes, sheets, or wire, by charging the electrolyte liquid with iron oxide, and maintaining the latter in suspension by stirrers or similar means. A solution, containing 20 per cent. of cresol-sulphonic acids saturated with iron, and kept at a temperature of 70° C., is given as an electrolyte yielding excellent results.—B. N.

Magnetic [ore] separators. S. O. Cowper-Coles, London. Eng. Pat. 1085, Jan. 15, 1907.

The material to be treated is fed from a hopper through a number of shoots on to a conical revolving disc, from which it receives electrostatic charges of high potential, and from which it is thrown by centrifugal force, close to a series of powerful electro-magnets, which attract the magnetic portions, whilst the non-magnetic particles pass beyond the magnets and are collected separately. The rotating disc is charged from a conductor having a number of points located in proximity to the disc. —A. G. L.

United States Patent.

Metallic oxides; Process of reducing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 854,018, May 21, 1907.

Metallic oxides reducible by silicon are continuously reduced by passing an electric current through a molten mixture of the oxide, silicon, and a basic flux, the products being withdrawn, and fresh portions of the charge added, from time to time. The silicon is added in substantially the proportion needed to combine with the oxygen of the oxide, so as to give a product containing but little silicon.—A. G. L.

French Patent.

Iron ore; Process and apparatus for the magnetic separation of ——. G. Gröndal. First Addition, dated Dec. 28, 1906, to Fr. Pat. 340,858, March 1, 1904.

Claim is made for the use of fixed electro-magnets extending over a portion of the internal surface of a hollow revolving drum or of an endless band, the drum or band being made of non-magnetic material.—O. F. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

(*Continued from page* 624.)

Erratum. This J. 1907, 536, col. 1, l. 27 from top, *for* Schchta *read* Schacht.

Oil beans [Owala beans] from Southern Nigeria. Bull. Imp. Inst., 1907, **5**, 10—14.

The proportion of kernels in the sample examined, was 79·3 per cent., and the amount of oil in the whole beans, 31·2 per cent., whilst in the kernels, it was 39·0 per cent. Oil extracted from the undecomposed kernels gave the following results:—Sp. gr. at 100° C., 0·8637; solidifying point, 8° C.; acid value, 4·6; saponification value, 185; iodine value, 94·3; Hehner value, 94·2; and m.pt. of fatty acids, 52·4° C. Oil from an average sample of the beans, containing a large proportion of discoloured kernels, was yellowish-brown instead of pale yellow, and had a more pungent odour. Its acid value was 10, and it contained 0·27 per cent. of unsaponifiable matter. The oil did not dry on exposure to the air, and, on standing, slowly yielded a deposit of solid fat. None of the ordinary refining processes removed the unpleasant pungent odour, present even in the oil from the undecomposed kernels. Decortication of the beans was necessary to prevent the brown-colouring matter in the seed-husks getting into the oil before a technical trial for soap-making purposes could be made. The oil, notwithstanding the high melting point of its fatty acids, yielded a somewhat soft soap. Its value was about £3 per ton less than that of cotton-seed oil. The meal left after extraction of the oil from the selected beans, gave the following results :—Moisture, 12·9 ; ash, 3·5 ; proteids, 34·8 ; fibre, 6·6 ; sugar (dextrose), 8·2 ; and carbohydrates (other than sugar), 33·7 per cent. Its value as a feeding stuff was estimated to be about the same as that of cotton-seed cake (£4 to £5 per ton). It is stated that small quantities of the beans from the Congo Free State have been sold at £5 per ton in Antwerp, but that, owing to the slow demand, the trade has practically ceased. (See this J., 1906, 893).—C. A. M.

Stearine manufacture; Utilisation of inferior material, especially leather grease, for ——. L. Donelly. Chem.-Zeit., 1907, **31**, 499.

The 20—30% of dirt present in leather grease should, if possible, be removed by filtration, after which the fat is hydrolysed by the sulphuric acid process, owing to the difficulty of separating the emulsion formed by the glycerin-water and fatty acids when any other process is used. Leather grease containing 13 per cent. of unsaponifiable matter, 6·8 per cent. of water, and 5·25 per cent. of ash, will furnish only 60 per cent. of pure fatty acids, and these, being uncrystallisable, cannot be used alone for stearine, the percentage of hydrocarbons being also too high for distillation without considerable difficulty. They may, however, be successfully utilised, by mixing 300—400 parts with 1800 parts of fatty acids prepared from bone fat or pure tallow, and distilling the mixture. The resulting fatty acids crystallise well, behave satisfactorily in the press, and are equal in quality to the best material. In hydrolysing the leather grease it is necessary to use 5—7 per cent. of sulphuric acid of 66° B., on account of the large proportion of water and ash in the fat.—C. S.

Beeswax; Behaviour of —— towards ether at the ordinary temperature. G. Buchner. Chem.-Zeit., 1907, **31**, 570—571.

By leaving a specimen of beeswax (acid value, 19·5 ; ester value, 76·7) in contact with cold ether for some time, it was separated into two portions, (*a*), soluble in ether (30 per cent.) and (*b*), insoluble in ether, 70 per cent. These portions gave the following analytical values : acid value, (*a*), 40·0 ; (*b*), 11·6 ; ester value, (*a*), 43·8 ; (*b*), 87·5.—A. S.

Beeswax; Saponification of ——. R. Berg. Chem.-Zeit., 1907, **31**, 537—539.

The author maintains his view (which was opposed by Buchner (Chem.-Zeit. 1907, 270) that the time required for complete saponification differs not only in the case of different kinds of wax, but also often in the case of waxes of the same origin, the latter being influenced by various factors such as age of the lump, etc. He has found that German waxes were seldom completely saponified under 2 hours, the usual time being 3 to 3½ hours ; for Morocco waxes, about 5 hours were required ; for East African waxes, up to 6 hours ; and for Chinese and Tonking waxes, as much as 8 hours. In the author's opinion every beeswax contains more or less of lactonic anhydrides which are difficult to saponify, and in this respect, too, he differs from Buchner, who considers that these bodies are of only occasional occurrence.—C. A. M.

Cocoanut oil; Detection of —— in butter. W. Ludwig and H. Haupt. XXIII., page 720.

Lard; Detection of adulteration of —— with cocoanut oil. L. Robin. XXIII., page 720.

English Patent.

Soap, fat, or the like substances; Apparatus for pressing, and if desired, simultaneously varying the temperature of ——. W. E. Iveson and A. R. Wilson, Brighton. Eng. Pat. 11,622, May 18, 1906.

The soap is introduced into a conical hopper, whence it is conveyed by means of a conical Archimedean screw into a compressing chamber also provided with an Archimedean screw. Each of the screws may be driven at any speed desired, and means may be provided for heating or cooling the pressing chamber *e.g.* by a water jacket, or by a current of water passing through the interior of the screw. The material forced along the pressing chamber comes in contact with a revolving knife or knives acting against a perforated grid, and is finally expelled through a nozzle of rectangular or other suitable shape. —C. A. M.

United States Patents.

Cottonseed oil; Process of extracting ——. M. Bird, Sugar Land, Tex. U.S. Pat., 853,759, May 14, 1907.

The cottonseed meal or other product is extracted with kerosene, and the resulting solution treated with alkali so as to saponify the extracted cottonseed oil and to separate it in the form of soap from the hydrocarbon. —C. A. M.

Oils and fats; Process of combining —— with heavier fluids. T. E. Smith, Weehawken, N.J. U.S. Pat. 855,071, May 28, 1907.

A current of a heavier fluid, such as water, is projected upwards, through, and in continual contact with a lighter fluid, such as oil, whilst descending return currents may be induced until the liquids are homogeneously mixed. If necessary, oils or fats may be heated to render them sufficiently fluid, and the mass, after thorough admixture, cooled to a solid or semi-solid condition. The "vertical current" of the denser liquid may have practically a uniform diameter relatively small in comparison with the diameter of the entire fluid body through which it is projected ; or two initial currents from opposite sides of the vessel may be united into a single vertical current. —C. A. M.

French Patent.

Soap; Liquid ——. J. B. Doebele. Fr. Pat. 373,406, Jan. 9, 1907.

A mixture of approximately 60 parts of neutral soap, 35 of water, 3 of mineral oil, and 2 of common salt, is boiled until homogeneous, after which it is cooled and decanted. The finished neutral soap may be replaced by the ingredients for producing the same.—C. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*Continued from page 626.*)

(*A.*)—PIGMENTS, PAINTS.

Lithopone; Analysis of ——. F. Repiton. Ann. Chim. anal. appl., 1907, 12, 93—94. Chem. Zentr., 1907, 1, 1514—1515. (See this J. 1907, 476).

In the author's experience it is usually necessary to determine only zinc sulphide and oxide for the valuation of lithopone. Zinc sulphide is determined by treating a weighed quantity of the pigment with hydrochloric acid, absorbing the hydrogen sulphide in a standard solution of copper (ammoniacal, or containing tartaric acid), filtering off the copper sulphide, and titrating the excess of copper. For the determination of zinc oxide, the substance is treated with a solution of sodium acetate containing a large excess of acetic acid, and the zinc taken into solution determined.—A. S.

English Patent.

Lamp black; Carbon recovery plant for the manufacture of ——. J. M. Adam, Glasgow. Eng. Pat. 13,301, June 9, 1906.

Creosote or other suitable carbonaceous fuel is burnt in a furnace with an adjustable air supply, and the products of combustion are passed through a cooler, where by-products are condensed, into centrifugal separators, the carbon deposited being collected in underlying receivers. The furnace is surmounted by a boiler, in which steam is raised to drive a motor fan, which provides the suction necessary for the working of the apparatus. —O. R.

United States Patents.

Lithopones; Process for the preparation of ——. R. Alberti, Goslar, Germany. U.S. Pat. 854,011, May 21, 1907.

See Eng. Pat. 13,445 of 1905; this J., 1905, 978.—T. F. B.

Paint for ships' bottoms. G. G. Schobert, Birmingham. U.S. Pat. 854,241, May 21, 1907.

See Eng. Pat. 24,989 of 1904; this J., 1905, 142.—T. F. B.

Chrome pigments; Process of regenerating waste liquors from the manufacture of ——. A. S. Ramage, Detroit, Mich. U.S. Pat. 855,019, May 28, 1907.

The waste liquors are concentrated, and treated with sulphuric acid to liberate acetic acid, the sodium sulphate separated by refrigeration, and the residual acid solution (from which the remainder of the sulphuric acid may be precipitated) used in the preparation of lead acetate. Prior to the treatment with sulphuric acid, the liquors may be treated with acetic acid, a lead compound dissolved therein, and a chrome pigment precipitated, this operation being repeated to concentrate the alkali acetate. Or, the solution of lead acetate obtained in the final stage may be treated so as to yield a lead chromate, and the residual liquors utilised so that the process becomes continuous.—C. A. M.

French Patents.

Zinc compounds for use in paints. J. C. A. Meyer. Fr. Pat. 373,027, Mar. 6, 1906.

Scrap zinc or roasted zinc ore is treated with acetic acid, and the filtered solution is precipitated by sulphuretted hydrogen. The zinc sulphide is mixed with zinc hydroxide prepared by treating roasted zinc ore with just sufficient acid (preferably sulphuric acid if lead be present) to dissolve the zinc, precipitating the filtered solution by gaseous ammonia, and drying the precipitate at moderate heat. The zinc sulphide may be used alone in paints for outdoor use, being less susceptible than the hydroxide to chemical influences. —C. S.

Lakes [from azo dyestuffs]; Manufacture of ——. Farbw. vorm. Meister, Lucius, & Brüning. Fr. Pat. 373,115, Mar. 10, 1906.

The barium salt of the azo-dyestuff obtained by combining diazotised *o*-aminobenzoic acid with β-naphthol, is a red lake displaying strong dichroism, and lending itself therefore to the production of a good "bronze red." —J. C. C.

Dyestuffs [azo] insoluble in water; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 373,475, Jan. 11, 1907. IV., page 680.

(*B.*)—RESINS, VARNISHES.

Copal resin from the Gold Coast. Bull. Imp. Inst., 1907, 5, 16—19.

Three samples gave results coinciding with figures previously recorded for best African copal. They were partially soluble in alcohol, benzene, carbon bisulphide, chloroform, ether, and oil of turpentine; completely soluble in mixtures of benzene and alcohol, oil of turpentine and alcohol, or benzene and ether. They were valued commercially at 30s. to 60s. per cwt. The low estimation in which Accra copal is held, is attributed to the amount of dust and dirt it often contains, and to the fact that no attempt has been made to grade the different qualities. If "washed" by scraping off the outer layer of dirt, dipping the resin into a dilute alkaline solution and then into water, and drying before shipment, higher prices would be obtained. As regards the origin of Accra copal, it is stated that part is found in a fossilised or semi-fossilised condition, but that some is also obtained from living trees.—C. A. M.

United States Patent.

Manila copal, &c.; Process of rendering —— *insoluble in oil.* W. Baringer, Berlin. U.S. Pat. 854,071, May 21, 1907.

See Fr. Pat. 352,323 of 1905; this J., 1905, 934.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Latex and rubber of Parameria glandulifera from India. Bull. Imp. Inst., 1907, 5, 14—16.

The rubber from this climbing plant, which grows in S. Burma, Indo-China, and the Malay Peninsula, is of good quality and has long been collected by the natives. The sample of latex examined had a slightly sour odour. On coagulation it yielded about 19 per cent. of rubber. Boiling, or heating in boiling water caused partial coagulation, whilst complete coagulation could be produced by the addition of a small quantity of a mineral acid or of alcohol. Acetic acid had little effect in the cold, but coagulation resulted when heat was applied. An addition of sodium sulphate, magnesium sulphate, or sodium chloride caused the rubber to separate as a cream on the surface, aggregating into a clot on removal. The rubber was of a light brown colour and free from stickiness. Caoutchouc, 91·8; resin, 6·3; proteïds, 1·4; and ash, 0·5 per cent. A sample of dried rubber from the same plant, from the Andamans gave the following results:—Caoutchouc, 91·6; resin, 5·8; proteïds, 1·9; and ash, 0·7 per cent.—C. A. M.

English Patents.

Rubber and rubber waste; Treatment of ——. A. J. Boult, London. From W. A. Köneman, Chicago. Eng. Pat. 12,527, May 29, 1906.

See U.S. Pat. 834,623 of 1906; this J., 1906, 1161.—T. F. B.

Rubber, ebonite, leather and the like; Substitute for ——. A. Litzler, Mülhausen, Germany. Eng. Pat. 16,519, July 21, 1906.

Casein (30 parts) and gelatin (25), are mixed with magnesium sulphate (5), quicklime (5), tar (2), and glycerin (3 parts), and the whole is incorporated with pulverised, inert vegetable matter (30 parts) such as cork, sawdust, or paper cellulose. The mixture when dried forms a hard ebonite-like substance; by varying the proportions of the constituents, a flexible and elastic product may be obtained. —S. R. T.

Plastic compositions [rubber substitutes] from fibrous materials; Manufacture of ——. H. Gonnermann, Haarlem, Holland, and N. Reif, Hanover, Germany. Eng. Pat. 22,317, Oct. 9, 1906.

See Fr. Pat. 370,490 of 1906; this J., 1907, 265.—T. F. B.

United States Patent.

Caoutchouc, guttapercha, balata, and the like; Process for the treatment of the milks or lactiferous juices of ——. L. Morisse, Paris. U.S. Pat. 853,718, May 14, 1907.

See Eng. Pat. 7694 of 1905; this J., 1906, 82.—T. F. B.

French Patent.

Caoutchouc; Apparatus for extraction of —— *from plants, rhizomes, etc., containing the same.* D. Levat and L. Guiguet. Fr. Pat. 373,649, Jan. 17, 1907.

The apparatus is for the extraction of india-rubber from materials which contain it, and also for purifying crude caoutchouc. A number of millstones running in a trench round a vertical axis pound the rubber-bearing materials to a pulp. A spraying apparatus travelling with each millstone washes the pulp off it and out of the trench through gratings into a trough. Knives of ploughshare form arrest the coarser matter in front of the millstone and secure complete maceration.—S. R. T.

XIV.—TANNING, LEATHER, GLUE, SIZE.

(Continued from page 627.)

Tannin analysis; *Report of the Chairman* (*H. R. Procter*) *to the members of the International Commission on* ——. Collegium, 1907, 129—140, 164—168.

This Commission was appointed to consider the whole method of tannin analysis, with a view to its improvement, especially with regard to the determination of soluble non-tannin matters. Typical samples of tannin extracts and hide-powders for comparative analytical work were distributed among the members. The results confirmed what had previously been shewn by Continental, American, and English chemists, that the hide filter shewed a larger absorption of non-tannins than the shake methods, and that this was increased by the use of lightly chromed powder in the filter-bell, while the concordance of results was not better than that of shake methods. The figures tabulated below represent the mean results and the mean errors obtained with different extracts and powders. The number of experiments in each case is denoted by figures in brackets

Percentage of non-tannins. Filter method with Paessler's powder.

	Chestnut	Oak-wood	Hemlock	Mimosa D	Pine bark	Quebr. ord.	Quebr. decol.
Mean	(14) 8.3	(16) 13.2	(15) 16.4	(15) 9.6	(10) 16.8	(13) 5.1	(9) 12.4
Mean error	± 0.37	± 0.38	± 0.58	± 0.45	± 1.14	± 1.05	± 0.79

Percentage of non-tannins. All shake methods with all powders.

	Chestnut	Oak-wood	Hemlock	Mimosa D	Pine bark	Quebr. ord.	Quebr. decol.
Mean	(53) 9.7	(55) 14.2	(50) 18.2	(50) 11.7	(53) 19.7	(50) 7.6	(25) 14.4
Mean error	± 0.44	± 0.33	± 0.56	± 0.54	± 0.90	± 0.46	± 0.7

The Vienna maceration method with dry chromed powder showed good concordance of results, but lower non-tannins than the shake method.

Percentage of non-tannins. Vienna method.

	Chestnut	Oak-wood	Hemlock	Mimosa D	Pine bark	Quebracho.	Quebr. decol.
Mean	(11) 9.0	(10) 13·8	(11) 17.6	(11) 10.7	(7) 19·4	(8) 7.3	(7) 13.6
Mean error	0.35	0.37	0.35	0.57	1.39	0.80	0.39

It will be seen that in the shake method about 2 per cent. less non-tannins are absorbed than in the filter-bell method, the former giving results nearer the true tannin value. The Commission agreed that the filter-bell should not be further employed, and recommended by a large majority the method described by Procter and Bennett (this J., 1907, 79), though they considered that all shake methods conforming to the following conditions gave reliable results.

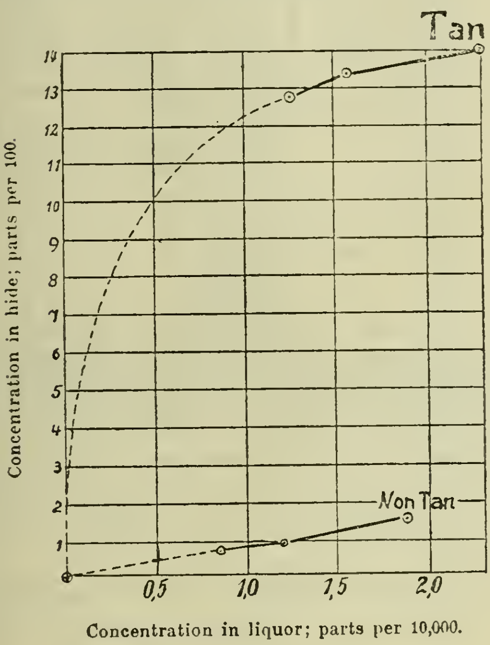
The solution, which must contain between 3·5 and 4·5 grms. of tanning matter per litre, must be detannised by shaking with chromed hide powder till no turbidity is produced in the clear filtered solution by salted gelatin or gelatin peptone. The powder must be added in one quantity equal to 6·0—6·5 grms. of dry hide per 100 c.c. of the tanning solution, and must contain not less than 0·5, and not more than 2 per cent. of chromium reckoned on the dry weight, and must be so washed that in a blank experiment with distilled water, not more than 5 mgrms. of solid residue per 100 c.c. shall be left on evaporation. All water contained in the powder must be determined and allowed for as water of dilution. For the filtration of tanning infusions, the Commission recommend that the filtrate should be optically clear both by reflected and transmitted light. Corrections for absorption should be determined and used for the particular method employed. The temperature of filtration should be between 15° C and 20° C.—H. Br.

Tannins; Action of formaldehyde on ——. F. Jean and C. Frabot. Collegium, 1907, 188—190. (See this Journal 1907, 213.)

The action of formaldehyde on the phenols in the presence of mineral acids gives condensation products of the type, $HO.R.CH_2.R.OH$. where ROH represents a phenolic radical. Applying this reaction to the tannins, the authors are able to make a precise classification, and to ascertain the purity of tanning materials. On heating a pyrogallol tannin on the water-bath with formaldehyde and hydrochloric acid, no precipitate is formed, whereas the catechol tannins are completely precipitated. With mixed tannins, the precipitation is only partial, the pyrogallol-tannin remaining in the filtrate. The insertion of the CH_2 group into a molecule so high in molecular weight as tannin, makes so little difference that the whole precipitate may be weighed and calculated as catechol-tannin present in the material. This method of determining tannin gives slightly higher results than the methods of the I.A.L.T.C., and America, these results however being constant even with varying quantities of formaldehyde and hydrochloric acid. A mixture of 1·86 grms. of quebracho-tannin and 1·276 grms. of chestnut-tannin (as determined by the I.A.L.T.C. method) gave with the formaldehyde method, 1·892 grms. of catechol-tannin. On adding a slight excess of ammonia to the filtrate, and boiling till neutral, a further precipitate was produced which weighed 0·87 grm. This latter result indicates that the pyrogallol-tannin of the chestnut is only imperfectly precipitated even in neutral solution, and as no tannin was detected in the filtrate from this precipitation, it is probable that the unestimated portion had combined with the formaldehyde.—H. Br.

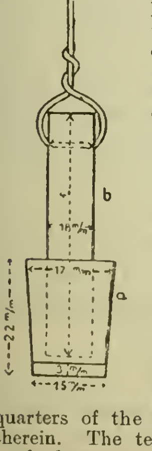
Tan and non-tan in liquor, and in hide-substance in equilibrium with it; The concentration of ——. Preliminary Note. R. E. Earp. Collegium, 1907, 175–176.

A solution of 10 grms. per litre was made from a chestnut extract which, on analysis showed 33·4 per cent. of tannin and 5·9 per cent. of non-tannins by the I. A. L. T. C. method, and 37·3 per cent. of tannin and 5·4 per cent. of non-tannins by Löwenthal's method. 200 c.c. of solution were agitated with 5 grms. of hide-powder. The powder was squeezed free from liquor and agitated with 200 c.c. of water, squeezed again, and the process repeated a third time. The three liquors were tested by the Löwenthal method and the concentration in the hide-powder calculated from these figures. The results are shown in the following curve diagram.



—H. Br.

Glue testing by means of Cambon's "fusiometer." S. Küttner and C. Ulrich. Z. öffentl. Chem., 1907, 13, 121—126. Chem. Zentr., 1907, 1, 1703—1704.



In practice, glues are generally tested by means of Cambon's "fusiometer." This consists of an ordinary stickferrule, *a* (see Fig.) of the dimensions shown, and weighing exactly 7 grms. *b* is a piece of cane or wood connected above to a wire. Two grms. of the glue are allowed to stand overnight in contact with 8 c.c. of water in a stoppered tube, the solution is then warmed, poured into the vessel, *a*, and allowed to set, *b* being inserted so that its lower end is just out of contact with the bottom of *a*. A beaker of water, 15 cm. high and 10 cm. in diameter, is disposed on a water-bath at 50° C., so that it projects into the bath to a distance of about 2 cm., but does not come into contact with the water. The "fusiometer" is suspended within the beaker so that about three-quarters of the height of *b* is immersed in the water therein. The temperature at which the vessel, *a*, falls to the bottom of the beaker is taken as the melting point of the glue. The results are only relative and are not, for instance, comparable with those obtained by Kissling's method (this J., 1900, 833; 1901, 509). Glues of first quality in 20 per cent. solution melt at 30° C. and upwards, those of second quality at 28°—29·1° C., and ordinary glues at 24·5°—25·5° C.—A. S.

Gelatin rendered insoluble by quinone. A. L. Lumière and A. Seyewetz. Bull. Soc. Chim., 1907, [4], 1, 428—431.

One hundred grms. of gelatin can be rendered insoluble by a solution of 1 grm. of quinone; the time required varies with the concentration of the solutions. The same result is obtained by the action of quinone solutions on dry gelatin, 20 grms. of the latter being rendered insoluble in boiling water by one litre of a 0·1 per cent. solution of quinone, after many hours: the same quantity of a 0·4 per cent. solution requires 1¾ hrs., and of a 0·6 per cent. solution, 1¼ hours. The gelatin product thus obtained has a pink colour, and swells in cold water, becoming elastic, but becomes brittle again on drying; it is unaltered by prolonged treatment with boiling water or with solutions of ammonia or alkali carbonates, but solutions of acids and alkali hydroxides gradually decompose it (compare this J., 1906, 1058). It appears to be a definite compound of gelatin and quinone, since it gives approximately the same figures on elementary analysis whether prepared with a large or small excess of quinone. No method of resolving it into its constituents was found, whereby any light could be thrown on its constitution.—T. F. B.

Stearine manufacture; Utilisation of inferior material, especially leather grease, for ——. L. Donelly. XII., page 700.

English Patents.

Tan pits or apparatus for tanning leather. J. Carter, Warrington. Eng. Pat. 13,621, June 14, 1906.

Reciprocating bars are placed at each side of the tan pits, below the surface, and are operated continuously in opposite directions by eccentrics, a zig-zag motion being imparted to the butts suspended from the bars.
—S. R. T.

Tanning hides; Process of ——. W. G. Roach, Cincinnati, and A. C. Roach, Newport, U.S.A. Eng. Pat. 29,368, Dec. 24, 1906.

See U.S. Pats. 839,204, 839,205, and 839,206 of 1907; this J., 1907, 265.—T. F. B.

Rubber, ebonite, leather and the like; Substitute for ——. A. Litzler. Eng. Pat. 16,519, July 21, 1906. XIIIC., page 701.

Waste leather, raw hides, skins, hoofs, horns, bones, etc.; Treatment of ——. [Plastic material]. A. G. Inrig, Tottenham. Eng. Pat. 17,129, July 30, 1906.

Leather, hides, and other animal refuse of a similar nature are boiled with a 3—10 per cent. solution of sodium hydroxide. When the action is sufficiently advanced, after about 1 hour, the liquid is cooled and neutralised with dilute sulphuric acid; heat is applied and a new material then rises to the top and is skimmed off. This material is mixed with an equal quantity of prepared bitumen and thoroughly incorporated by a steam-jacketed masticator. The bitumen contains in addition, petroleum residue or animal fat, sulphur, and horn, hoof or bone meal. The final product is plastic, and may, it is said, be rolled, or spread, moulded, &c., so as to form *e.g.* sheets, rods, tubes, or a material resembling ebony.—J. F. B.

United States Patents.

Hides or skins; Treating ——. S. K. Felton, jun., Philadelphia, Pa. U.S. Pat. 853,166, May 7, 1907.

The skins are limed on the flesh side, and the hair removed, after which, the unhaired skins are subjected alternately to the action of sodium sulphide and washing, and then to the action of a solution of a salt evolving sulphur dioxide in the presence of a mineral acid. Finally, the skins are steeped in a desulphurising bath containing lime and arsenic.—W. P. S.

Colouring and tanning apparatus. C. J. Glasel, Boston, Assignor to T. Latzlsperger, Sault aux Recollets, Canada. U.S. Pat. 854,415, May 21, 1907.

See Eng. Pat. 17,817 of 1903; this J., 1903, 1140.—T. F. B.

Casein; Process of treating ——, and compound [adhesive] obtained thereby. J. Taluau, Assignor to C. H. Royal, Philadelphia, Pa. U.S. Pat. 852,915, May 7, 1907.

Casein is dissolved in an alkaline solution, and incorporated with a solution of camphor ["gum camphor"] in methyl alcohol to which has been added a small quantity of formaldehyde.—W. P. S.

French Patents.

Tanning extracts; Decolorisation of ——. L. Dufour. First Addition, dated Dec. 17, 1906, to Fr. Pat. 367,917, July 9, 1906.

The tanning extracts are treated with a mixture of hypophosphorous acid or phosphorous acid or of their salts, and sulphurous acid, sulphites, bisulphites, or hyposulphites, when reduction and decolorisation takes place. The addition of formaldehyde to the above mixtures is also claimed.—S. R. T.

Skins, wool, etc.; Degreasing of ——, and recovery of the solvent. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 373,681, Jan. 17, 1907.

After the degreasing is finished, and the bulk of the solvent has been run off, the extractor, containing the degreased material, is connected with a cooler and receiver, and exhausted. Steam is then passed through a coil in the lower part of the extractor, and this, with the reduced pressure, causes part of the residual solvent to distil over. When no more distils, the remainder is expelled by admitting dry steam directly into the extractor, at such a rate that the temperature of the vessel will not exceed 60° C.—S. R. T.

XV.—MANURES, &c.

(*Continued from page* 627.)

United States Patent.

Fertiliser. F. G. Dokkenwadel, Coshocton, Ohio, Assignor to H. M. Grant, New York. U.S. Pat. 853,919, May 14, 1907.

Paper pulp, or a mixture of paper pulp and sawdust is intimately incorporated with sodium nitrate and marl. —C. A. M.

XVI.—SUGAR, STARCH, GUM, &c.

(*Continued from page* 628.)

Diffusion waste-waters [beetroots]; Return of the —— to the battery. H. Claassen. Z. Ver. Deut. Zuckerind., 1907, **57**, 525—530.

Further experience during the past season confirms the results already published (this J., 1906, 327). During the entire season the whole of the waste diffusion- and press-waters was returned to the battery, and during a portion of the time, the waste water from a diffusion battery of the old system was used to supply the extra water needed. The necessary conditions for safe "running" are that the waste water, properly freed from pulp, is maintained at a temperature of at least 50°—60° C. and kept as short a time as possible outside the battery. The process only pays if the pressings be dried; when this is done, however, not only is as much sugar of greater purity obtained in the juice, but a distinctly larger quantity of dry slices of higher sugar content and greater nutritive value is afforded. The pressings contain the non-sugar in a less soluble form than usual: hence, strong pressure may be employed, without causing loss of valuable non-sugars in the residue, or deterioration of the press-water which is to be returned to the battery.—L. J. de W.

Syrup; Determination of capillary —— in sugar products. A. Herzfeld. Z. Ver. deut. Zuckerind., 1907, 611—620.

According to Juckenack and Pasternack (Z. Unters. Nahr. u. Genussm., 1904, 17—19), the determination of starch syrup in fruit juices may be effected by means of the specific rotation (calculated on the apparent dry substance) after inversion; these chemists compiled a table by means of which the percentage of starch syrup corresponding to a given specific rotation, may be found. In the compilation of this table, $[\alpha]_D = 134{\cdot}1°$ was taken as the average value for the specific rotation of starch syrups. The method involves the assumptions, 1, that the content of dextrin and glucose in commercial starch syrups is fairly constant, 2, that the extract-content of pure fruit syrup consists entirely of invert sugar and sucrose. With a view to testing the accuracy of these assumptions, the author has investigated a number of American and German starch syrups and an invert sugar solution which had been heated for some time over a naked flame. His results showed that the specific rotations of most of the samples of German starch syrup approximate to the value (134·1°) on which the table of Juckenack and Pasternack is based; hence, the proportion of German starch syrup present in a sample of fruit juice may be determined fairly accurately by this method. The specific rotations of the American syrups however, were found to vary considerably from the rotation on which the table is based; hence, the method does not give accurate results in the case of samples containing American starch syrups. The experiments with the invert sugar solution showed that the superheating of this solution had caused a reduction in its specific rotation, with the result that it appeared to contain about 9 per cent. of starch sugar. Hence, the method cannot be used for the detection of small quantities of starch syrup in samples containing invert sugar prepared by the inversion of sugar syrup; in such cases, it can only serve as a qualitative indication of adulteration with large quantities of starch sugar. Similarly, the presence of raffinose vitiates the results obtained by this method.—L. E.

Sucrose in plant tissues; Detection of —— by means of invertase. E. Bourquelot. XXIII., page 720.

Glucosides in plants; Detection of —— by means of emulsin. E. Bourquelot. XXIII., page 721.

Potatoes; Relation between the specific gravity and starch contents of ——. G. Foth. XVII., page 705.

English Patent.

Starch hydrolytic products [dextrin]; Manufacture of ——. F. T. Jewson, Paisley. Eng. Pat. 12,291, May 26, 1906.

The starchy matter of maize or other grain, after separation from the husk, is boiled with about 10 parts of water until the starch is completely gelatinised. The mixture is then cooled to 60° C., and the husk stirred in, in the proportion "of about 5 parts of husk per 1 part of starch." The temperature is maintained at 60° or thereabouts until the starch has been hydrolysed to the desired extent to produce dextrin.—T. H. P.

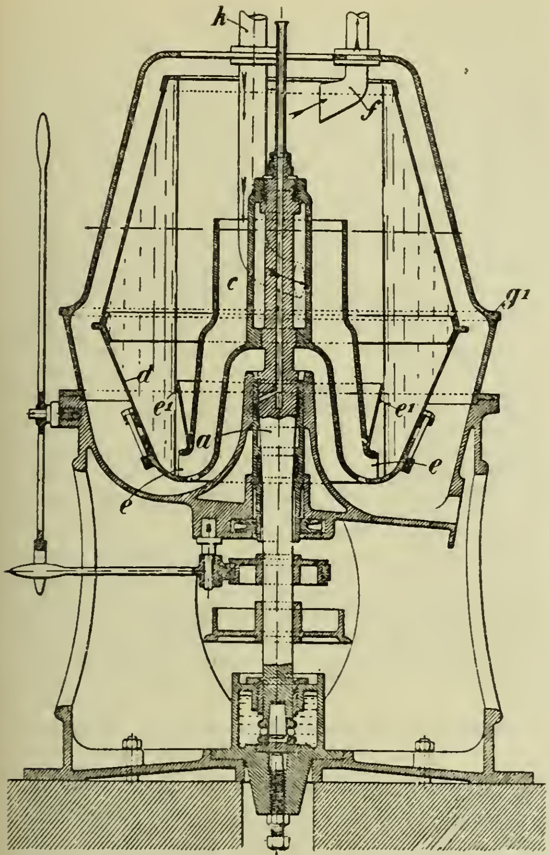
United States Patent.

Cornstalks, sugar-cane, &c.; Process of manufacturing products [for paper-making] from ——. V. Drewsen. U.S. Pat. 853,943, May 14, 1907. XIX., page 713.

French Patent.

Starch; Apparatus for the recovery of ——. H. Benoist and L. Graillot. Fr. Pat. 373,174, Dec. 21, 1906.

The essential features of the apparatus (see Fig.) consist of a pipe, *k*, through which the liquid containing suspended



starch flows into the distributing chamber, *c*, whence it passes through the annular space, *e*, into the centrifugal separator, *d*, mounted on the shaft, *a*. By means of a screen, *e*¹, the liquid, as it enters the separating chamber, becomes incorporated with that already present. A pipe, *f*, is arranged for the discharge of the exhausted liquid, which collects near the rotating shaft, whilst the solid particles of starch are projected on to the conical surface, *d*. Arrangements are provided for cleaning the separator and for quickly stopping it.—T. H. P.

German Patents.

Evaporator for sugar solutions and other liquids. O. Schelzig. Ger. Pat. 178,556, Nov. 15, 1903.

The evaporator is of the type with double bottom and interior heating. The liquid to be evaporated passes downwards through the evaporator along a helical trough or gutter.—A. S.

Juice or water from vegetable materials, especially beet slices ; Process for accelerating the separation of —— by pressing. P. Rassmus. Ger. Pat. 179,040, Dec. 16, 1905.

The material (beet slices) is brought into contact with carbon dioxide either before or during the pressing operation. It is stated that carbon dioxide prevents the bacterial formation of mucilage or gummy substances on the beet slices, and thus allows the juice to be readily separated without destroying the cells.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

(*Continued from page* 630.)

Protein-content of barley ; Colorimetric determination of the —— by means of Millon's reagent. C. J. Lintner. Z. ges. Brauw., 1907, 30, 293—294.

This method allows of the certain detection of a 2 per cent. difference in the protein-content of a barley, whilst, as a rule, one-half this difference is recognisable. The solutions employed are : (1) 10 per cent. mercuric nitrate solution containing 1·2 c.c. of concentrated nitric acid (sp. gr. 1·42) per 100 c.c. (2) 1 per cent. sodium nitrite solution, (3) dilute nitric acid (1 : 10). The reagent used in the test is prepared immediately before being required by mixing 10 parts of (1) with one part each of (2) and (3). The barleys to be tested are ground as finely as possible and quantities of 0·25 grm. of each are weighed out into small beakers of uniform dimensions (diameter 3 cm. and height 5 cm.), and mixed with 1·5 c.c. of the reagent to a homogeneous paste. The beakers are covered with crucible lids and kept at 50—55° C. for 20 minutes. After this treatment, the paste assumes a crimson colour which is more or less intense according to the protein-content of the barley. By comparing the intensity of the colour with that yielded by a barley containing a known proportion of protein—the best proportion being from 10 to 11 per cent. on the dry matter—the protein-content of the barley tested, can be estimated with fair accuracy.—T. H. P.

Malts ; Analytical report on this season's Bohemian ——. J. Satava. Böhm. Bierbrauer, 1907, 146 ; Woch. f. Brau., 1907, **24**, 296.

The author reports on the results obtained with the malts of the Pilsener type analysed during the present season. The development of the acrospire was shorter than in the previous year : 30 per cent. of the samples had acrospires up to half corn-length, 25 per cent. had acrospires over three-quarters corn-length. It would appear that in view of the ease with which modification was obtained in the present season, many maltsters had purposely grown a longer acrospire in order to obtain a darker malt. As regards friability, 59 per cent. of the samples were described as "very good" ; 32 per cent. were "satisfactory," containing 6—9 per cent. of vitreous and semi-vitreous corns ; 7 per cent. of the samples were "moderate," containing 10—15 per cent. of such corns, and only 2 per cent. were more or less "defective." The time of saccharification was within 20 minutes in 62 per cent. of the samples and 21—25 minutes in 37 per cent. The worts in the case of 85 per cent. of the samples were brilliant, in the case of 15 per cent. they were more or less opalescent, the latter being from short-grown malts. Opalescent worts occurred particularly in the case of pale malts with low moisture-content, *i.e.*, those cured with a powerful draught. This fault was more noticeable in barleys with low nitrogen-content grown in low-lying districts than in those from greater altitudes. As regards colour, 43 per cent. of the samples had a colour equivalent to 0·15—0·17 c.c. of N/10 iodine, and 38 per cent. between 0·175 and 0·20 c.c.—J. F. B.

Potatoes ; Relation between the specific gravity and starch contents of ——. G. Foth. Z. Spiritusind. 1907, **30**, 217—218.

In Germany it is customary to calculate the starch value of distillery potatoes from the sp. gr., by weighing 5 kilos. of potatoes first in air and then under water. When the potatoes are wet after washing and draining, a deduction of 1 per cent. from their weight in air, is made, to correct for the externally adherent moisture. Tables have been constructed from determinations made by Behrend, Maercker and Morgen, but the author finds that these tables are not sufficiently concordant, and that the variations give rise to disputes. The tables are based on the following observations : Potatoes containing 19·9 per cent. of dry substance have a sp. gr. of 1·081. An increase of 0·001 in the sp. gr. corresponds to an increase of 0·214 per cent. of dry substance. Between the percentage of dry substance and the percentage of starch there is an average difference of 5·752. The discrepancies in the older tables were due chiefly to the manner in which the numbers were reduced to one place of decimals. The author has re-calculated the tables, still adhering to the old data quoted above, but correcting the errors. The new tables have been adopted as a standard, and have been published by the German Association of Distillers.—J. F. B.

Yeast ; Behaviour of butyric acid and allied compounds towards ——. T. Bokorny. Zentralbl. Bakt., 1907, II. Abt., **18**, 171. Z. ges. Brauw., 1907, **30**, 262—263.

The growth of yeast in a nutritive and fermenting solution is not suppressed by the presence of 0·05 per cent. of butyric

acid, but is with a similar amount of hydrochloric acid. The toxic dose of butyric acid is 0·05—0·1 grm. for 10 grms. of pressed yeast. The limiting concentration at which isovaleric and caproic acids still poison yeast is between 0·05 and 0·1 per cent. Isocaproic acid is somewhat less injurious than normal caproic acid. The toxic dose for 10 grms. of pressed yeast is 0·25—0·5 grm. of isovaleric acid or 0·25 grm. of normal caproic acid. *o*-Nitrotoluene and *o*-nitrobenzaldehyde are more poisonous to yeast than the corresponding para compounds: o-toluidine, on the other hand, is less injurious than *p*-toluidine.
—A. S.

Wildier's "Bios." M. Ide. Zentr. Bakt., II. Abth., 1907, **18**, 194. Z. ges. Brauw., 1907, **30**, 278.

THE author's view, contrary to that of Pringsheim (see this J., 1906, 823), is, that the acclimatisation of yeast to ammoniacal nitrogen either is a delusion, or has no bearing on the "Bios" question. His investigations were made on (1) A cultures, consisting of yeast cells inoculated directly from a wort-culture into a solution containing mineral matter and sugar, that is, a nutrient medium poor in "Bios"; (2) B cultures, comprising yeast cells which, after being grown as an A culture, were sown in a fresh mineral solution, and (3) C cultures, prepared by re-inoculation with cells from a B culture. With the races of yeast employed, it was not found possible, by cultivating for weeks or even months on a medium containing but little "Bios," to produce such an alteration in the character of the cells that the yeast increased and fermented more rapidly in the absence of "Bios." On the contrary, the cells are apparently weakened pathologically and rendered incapable of causing normal fermentation when a fresh quantity of "Bios" is added. No sign of acclimatisation to a dearth of "Bios" is observable, although the author does not deny the possibility of the yeast thus adapting itself.—T. H. P.

Extractive-phosphorus; Relations of —— to protein-phosphorus in Aspergillus niger. W. Koch and H. S. Reed. J. Biol. Chem., 1907, **3**, 49—52. Chem. Zentr., 1907, **1**, 1699.

NUCLEIN-PHOSPHORUS appears to be the most important form so far as the requirements of the cell are concerned. It is produced at the cost of the remaining forms, with the exception of lecithin, and its quantity diminishes only under abnormal conditions of starvation of the mould. The next most important form is the lecithin-phosphorus. The water-soluble extractive-phosphorus is doubtless the raw material for the production of the other forms, and appears to represent an intermediate stage between phosphates and complex organic compounds of phosphoric acid.—A. S.

Enzymes; Modified method and new apparatus for the study of ——. S. L. Schouten. Zent. Bakt., 1907, [Abth. II.], **18**, 94; Woch. f. Brau., 1907, **24**, 299.

THE author has slightly modified Fermi's method for the study of proteolytic enzymes: A 7·5 per cent. solution of gelatin is prepared with water saturated with thymol and coloured red with vermilion. The solution is placed in test-tubes and is caused to solidify in such a way that it extends for some distance up the sides of the tube and its surface has the form of a semi-ellipse. The enzyme thus comes in contact with a large area of gelatin, and its presence can be recognised after only 12 hours' action. The author has also devised an apparatus for studying the enzymes of fungi, in which the liquid in the culture flask is filtered through a layer of cotton-wool into the experimental flask without coming in contact with the external air.—J. F. B.

Malt extracts; Fermentation experiments with [concentrated] ——. P. Mumme. Woch. f. Brau., 1907, **24**, 277—278.

IT has been supposed that only the Jopen beer yeast, *S. Bailii* (see this J. 1906, 131) is capable of fermenting highly concentrated malt extracts, but the author shows that almost any vigorous top or bottom fermentation yeast, including pressed yeast, is capable of carrying out the fermentation if the temperature be suitable. Fermented malt extracts when added to beer, produce no turbidity, whilst unfermented extracts frequently do so. The chief use for these extracts is for colouring beers when caramel is not permitted. The colouring matters used for beers are deficient in keeping properties because they are too dilute; after being in stock for some time they become strongly infected and transfer the infection to the beers to which they are added. The author therefore advocates the use of very highly concentrated extracts for this purpose. Extracts made from colour malt alone impart an objectionable burnt flavour to the beer. The author therefore prefers to prepare fermented colouring matters from highly concentrated worts brewed from a mixture of colour malt and ordinary pale malt, and he increases the colour of the wort by prolonged boiling; this produces a pleasant aromatic flavour. Not only in the case of Jopen beer but also in the case of these concentrated malt worts, an advantage is gained by avoiding accidental fermentation and starting the fermentation by pitching with yeast. A slightly higher temperature can then be allowed, and the time of maturing is considerably shortened. The yeast should not be roused with the wort after pitching, but works better when merely added and left to itself. In worts containing 50—60 per cent. of extract, fermentation sets in after 2—5 days at a temperature of 10°—15° C. In a series of experiments, apparent attenuations ranging from 4·8 to 24 per cent. were recorded, Jopen beer yeast giving 13·2 per cent. The highest attenuations and the most rapid clarification were obtained with ordinary lager beer pitching yeast in the fluid state without special treatment; five weeks were fully sufficient for clarification by secondary fermentation.—J. F. B.

Jopen beer; The fermentative organisms of ——. P. Lindner. Woch. f. Brau., 1907, **24**, 278—279.

MUMME (see preceding abstract and this J. 1906, 131) is inclined to regard *S. Bailii*, on the author's authority, as being the specific ferment of Danzig Jopen beer. The author points out that he has never taken up this position, but has merely stated that *S. Bailii* was isolated together with *S. farinosus* from a sample of that beer. Both these organisms are capable of living in concentrated solutions of maltose although they cannot ferment that sugar. In a different sample of Jopen beer, neither of the above yeasts could be detected, and this sample yielded yeasts capable of fermenting not only maltose but also sucrose and dextrin. Some of them decomposed melibiose and others did not, so that if Bau's test be accepted, Jopen beer would appear to contain both top- and bottom-fermentation varieties. No doubt in the fermentation of Jopen beer, accidental infection by different yeasts plays the chief part.—J. F. B.

Glycerol in alcoholic fermentation; Production of ——. R. Reisch. Zent. Bakt. 1907 [Abth. II.], **18**, 396; Woch. f. Brau., 1907, **24**, 299.

Two different wine-musts, containing different proportions of nitrogen, were filled into casks immediately after pressing; pure-cultivated yeast was added, and the casks were closed with fermentation-valves, the temperature being 12° C. Determinations of glycerol were made in the fresh must and subsequently at intervals, the proportion of alcohol being also determined. Glycerol was found to be present in the perfectly fresh musts before fermentation had started. The production of glycerol in the two casks during fermentation was 8·35 grms. and 7·61 grms. per litre respectively. The higher production of glycerol was found in the must richer in albumin, but the influence of the nitrogenous constituents did not appear to be very marked. The formation of glycerol proceeded at first in a similar ratio to that of the alcohol, but decreased after attaining a maximum when the proportion of alcohol was 2 per cent. by volume. No connection between the relative production of glycerol and alcohol was observed; hence the glycerol is not a direct product of the fermentation of the sugar, but is regarded as a product of the metabolism of the yeast.—J. F. B.

Cooler-deposits ; Influence of the malt on the quantity and nature of the ——. Behrend. Woch. f. Brau., 1907, **24**, 237—239.

THE amount of sediment deposited in the cooler varies with different malts. It has no connection with the percentage of nitrogen in the malt ; in fact, in the cases studied, the malt containing the least nitrogen gave the largest amount of moist deposit. It does, however, appear to depend on the composition of the nitrogenous matters so far as this influences the state of hydration of the precipitated colloids. It would seem from the table below, that the amount of moist deposit is greater, the higher the ratio of albuminoid nitrogen to amide nitrogen in the malt.

The cooler-deposits from the brewing of four different malts were collected and weighed and subsequently analysed.

	Wurtemberg country malt.	Tauber malt.	Dark Ulm malt.	Pale Kulmbach malt.
	per cent.	per cent.	per cent.	per cent.
Total nitrogen in dry malt	1·60	1·49	1·80	1·64
Albuminoid nitrogen, on total nitrogen	79·9	94·4	86·9	83·3
Amide nitrogen, on total nitrogen	20·1	5·6	13·1	16·7
Moist cooler deposit, on malt	1·98	3·95	3·31	2·29
Dry deposit, on malt ...	0·393	0·541	0·659	0·446
Water and water-soluble matter in moist deposit	91·6	96·6	90·6	92·1
Insoluble matter in dry deposit	8·4	3·4	9·4	7·9
Ditto, calculated on malt	0·166	0·134	0·311	0·181
Total nitrogen in dry deposit	4·49	2·36	4·24	3·75
Albuminoid nitrogen, on total nitrogen in dry deposit	91·9	84·7	89·0	90·6

The Tauber malt gave the greatest amount of deposit, and this sediment was of quite a fluid consistency, whilst the sediments from the other malt worts were in the form of thick mud. The Tauber malt was of a decidedly steely character, and some trouble was experienced in running off the wort.—J. F. B.

Beers sensitive to chill ; Action of tin on ——. A. Kreichgauer. Woch. f. Brau. 1907, **24**, 276—277.

WHEN small quantities of "tin salt" are added to beer, the haze does not appear immediately ; it is probable that the haze depends on the formation of basic salts. In testing the beers for their sensitiveness to tin, minute quantities of "tin salt" are added, and 24 hours later, the beer is placed in ice-water for one hour. Some beers develop a turbidity, the so-called glutin haze, under these conditions, without the presence of tin ; such of course cannot be tested. But non-sensitive beers will remain bright after 6 hours and even up to 15 hours at 0° C. Beers which are sensitive to chill only develop a haze when the temperature at which they are tested is lower than that of the cellar in which they had been clarified ; but with sensitive beers a difference of only 1° C. lower is quite sufficient to cause a haze. The lower the temperature of cellarage the less is the danger of hazes due to chill. In sensitive beers the addition of tin increases the sensitiveness to chill ; as the "tin salt" is increased the haze appears at higher temperatures, and in bad cases it can develop at the ordinary temperature. In a beer not extremely sensitive to chill, *e.g.*, one which develops a chill-haze after 3 hours at 0° C., the addition of 0·4 mgrm. of dissolved tin per hectolitre causes it to develop a tin-haze in 1 hour at 0° C. If the beer can withstand the test with the addition of 40 mgrms. of tin per hectolitre, it may be described as tin-resistant. Tin turbidities are most prevalent in severe winters. If a beer has been in contact with tin and if its sensitiveness to chill is thereby increased, hazes are to be feared. Most tin-hazes disappear on heating the beer to 40°—50° C. In very bad cases they only disappear after the addition of acid, *e.g.*, 1 per cent. of lactic acid. Beers returned suffering from tin-haze can be cured by the addition of "Kräusen" and cold cellarage. Tin vessels exposed for a long time to a low temperature are more likely to be attacked by beer than if kept at a moderate temperature, owing to a modification which takes place in the tin, whereby its density is lowered.—J. F. B.

Beer analysis ; Report on methods of ——. H. E. Barnard. U.S. Dept. Agric., Bureau of Chemistry, 1907, Circular No. 33.

THIS report contains details of methods which are to be adopted in official analyses of beers in the United States. The carbon dioxide is removed from the beer by shaking the sample in a large flask at a temperature not below 15° C. The use of the Zeiss immersion refractometer gives quite satisfactory results, and the method is now recognised as an alternative to the specific gravity method as the basis for calculating the percentage of alcohol and extract of the beer. In the direct determination of the extract, the beer solids are dried to constant weight at a temperature of 80° C. For the calculation of original wort extract, the formula : $O = 2A + E$, where A = alcohol percentage and E = extract of de-alcoholised beer, best represents what takes place in practical working. For the determination of total acidity, 20 c.c. of beer are heated to boiling and titrated with $N/10$ sodium hydroxide using neutral litmus as indicator, the result being expressed as lactic acid. The referee remarks that the end-point with neutral litmus paper is not sharp ; it is suggested that sharper limitation can be obtained with spots of phenolphthalein on a porcelain plate, but this indicator is not adopted. The volatile acid is determined in the alcoholic distillate ; the results however are not very concordant. The reducing sugars are determined gravimetrically (as maltose). The dextrin may be determined either gravimetrically as dextrose after hydrolysis by hydrochloric acid (Sachse-Allihn method) correcting for the maltose, or else by calculation from the specific rotatory power. The phosphoric acid is determined directly in the beer by titration with standard uranium solution. In the case of very dark samples it is determined in the ash.—J. F. B.

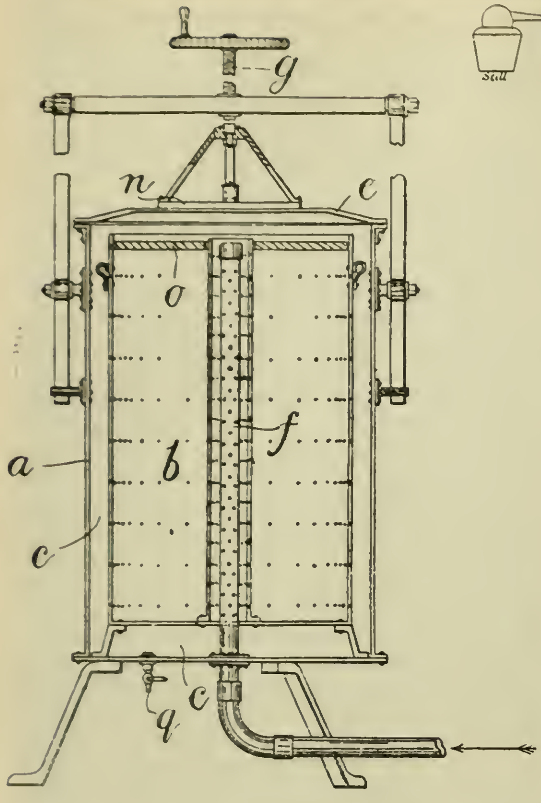
ENGLISH PATENTS.

Wort ; Process and apparatus for obtaining —— *from unmalted grain.* R. D. Bailey, Leeds. Eng. Pat. 27,343, Dec. 1, 1906.

DE-HUSKED and de-germed maize is boiled with acidulated water in a glass-lined cylinder, the product is neutralised in either the conversion cylinder or a separate one, by the addition of lime, and is then filtered under air-pressure so that it can be passed directly, without decolorising or concentrating, into the brewer's copper to be boiled with the ordinary hopped wort. The process may be modified by running off one portion of the acid conversion mixture before the remainder so as to produce two different products, one consisting of maltose and dextrin only and the other of dextrose, the two being separately neutralised, filtered, and passed to the brewer's copper. The conversion cylinder is mounted on a horizontal shaft carrying rakes, and is provided with pipes for introducing hot or cold water or steam, with an inlet for sparge water, and with an air-inlet for the application of compressed air to force the contents through an outlet pipe and through a filter. A wash-out pipe and cock, a pressure-gauge, a gauge-glass, and thermometers are also provided.—T. H. P.

Hops ; Process and apparatus for extracting ——. F. S. Davidson and W. P. Burra, Ashford, Kent. Eng. Pat. 23,113. Oct. 18, 1906.

THE hops are placed in the perforated holder, *b*, (see fig.) preferably with a small quantity of yeast, the holder is then placed in the case, *a*, in which it fits loosely, with an annular space, *c*, between the two vessels, the cover, *e*, is put on, and fixed in position by the plate, *n*, screwed up by the hand-wheel, *g*. Steam is then admitted by the central pipe, *f*, and, passing through the perforations, it penetrates uniformly through the hops in the holder. The steam emerges into the space, *c*, where the volatile



matters are condensed and, collecting at the bottom, are drawn off through the cock, *q*. A treatment of 1½ hour under a steam pressure of about 25 lb. is sufficient for extracting the essential oils of the hops. The cover is then removed and the hops are compressed by means of the plate, *o*, operated by the hand-wheel, *g*. The holder, *b*, is finally removed and the hops are discharged into the wort-copper.—J. F. B.

Brewing process. R. Kubessa, Kalk, Germany. Eng. Pat. 15,966, July 14, 1906. Under Int. Conv., July 15, 1905.

See Addition of July 13, 1906, to Fr. Pat. 333,939 of 1903; this J., 1907, 29.—T. F. B.

United States Patents.

Diastatic malt extracts; Solidified ——. I. Pollak, Assignor to Erste Wiener Export-Malzfabrik Hauser und Sobotka, Vienna. U.S. Pat. 853,934, May 14, 1907.

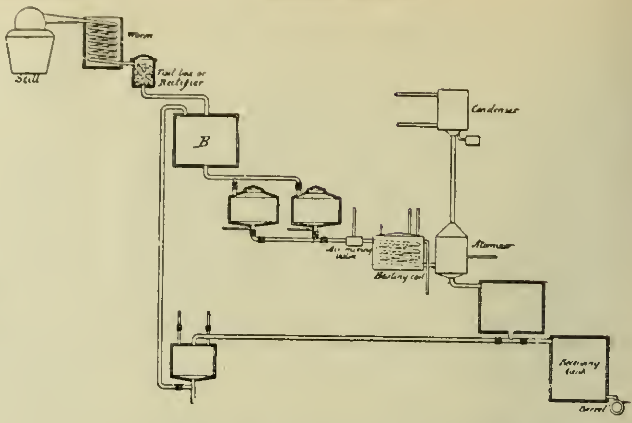
See Eng. Pat. 9886 of 1906; this J., 1906, 1061.—T. F. B.

Malting grain. K. I. Somló, Temesvár, Austria-Hungary. U.S. Pat. 854,003, May 21, 1907.

See Addition to Fr. Pat. 331,578 of 1903; this J., 1906, 773.—T. F. B.

Alcoholic liquors; Apparatus for refining, ageing, mellowing, and purifying ——. J. F. Duffy, Assignor to J. A. Duffy and J. F. Duffy, Chicago, Ill. U.S. Pat. 853,071, May 7, 1907.

Equalising and aerating tanks are placed between the rectifier and receiving tank of the apparatus, and heating arrangements are interposed in the connection between the receiving tank and the equalising tank, B. Compressed air is supplied to an atomiser connected with a worm leading from the aerating tank, means are provided for supplying heat to the worm, and a condenser is connected to the atomiser, and the atomiser with the receiving tank.—W. P. S.



French Patents.

Beer worts; Preparation of —— *in the dry or nearly dry state.* J. G. Maardt. Addition, dated Dec. 18, 1906 (Under Int. Conv., Dec. 19, 1905), to Fr. Pat. 371,650, Nov. 2, 1906 (this J., 1907, 428).

Malt mashed with a convenient quantity of water, is diluted so that most of the starch and diastase dissolve or may be washed out, the grains being separated. The purified starch is added to one-half of this malt extract, the mixture being heated to its boiling point and kept at that temperature for about 1½ hours. When the liquid has cooled to 50° C., the remainder of the malt extract is added, and the temperature maintained at 50° C. for about 2 hours and then raised to 70° C., at which point it is kept for about an hour. The subsequent procedure is the same as in the original specification.—T. H. P.

Sugar juices; Process for the sulphitation and desulphitation of ——, *and its applications to different fermentation industries.* E. A. Barbet. Second Addition, dated Mar. 16, 1906, to Fr. Pat. 361,869, Oct. 27, 1905. (See this J., 1906, 1229; 1907, 109.)

The improvements here described consist of: (1) The addition of a special regulator designed to admit to the heater just sufficient air to maintain a constant pressure. (2) Modifications in the condenser through which the sulphurous acid and other volatile substances pass, and in the column containing the regenerator tubes.—T. H. P.

Cells [yeast]; Extraction and preparation of the substances contained in organic ——. H. C. Empis. First addition, dated Dec. 28, 1906, to Fr. Pat. 346,862, Oct. 7, 1904. (This J. 1905, 247).

After subjecting the cells to the mechanical treatment described in the original specification, they are exposed to a reduced pressure for a more or less prolonged period of time, in order to extract the contents of the cells more thoroughly.—W. P. S.

Alcoholic and saccharine liquids; Process and apparatus for concentrating ——. J. Vitale. Fr. Pat. 373,046, Dec. 28, 1906.

The alcoholic or saccharine liquid is cooled and constantly agitated until it assumes a semi-liquid or pasty consistency owing to the separation of fine ice-crystals. The more liquid portion having been drained away from the pasty crystalline mass, the latter is treated in a centrifugal drying apparatus, and when the drying is completed, the last traces of liquid are eliminated by injecting a jet of steam or of pulverised water into the drying chamber. The liquid obtained by this last operation may be added to either that in the refrigerating vessels or the concentrated liquid, as may be desirable. The process is applicable to the concentration of wines, spirits, worts, and similar alcoholic or saccharine products. The apparatus consists of a reservoir containing the liquid, which is distributed, by means of a pipe furnished with cocks, to receivers arranged in a freezing tank and fitted with stirring apparatus. The lower part of each receiver opens to allow of the discharge of the pasty mass into cars, which carry it to the drying apparatus; the bottoms of the cars are perforated to allow the more liquid part to drain off into a channel, along which it passes to a trough placed between the two drying chambers.—T. H. P.

Sparkling wines; Clarification of ——. L. E. Mazure. Fr. Pat. 373,134, Dec. 31, 1906.

Sparkling wines are clarified by introducing into the bottle, with the wine, a small quantity of a pulverulent, insoluble substance or mixture of substances, such as kaolin, Spanish white (whiting), etc., in order to form an artificial sediment which will deposit on but not adhere to the bottle and will act as a support for the natural wine sediment, thus preventing the latter from adhering to the glass. The sediment can then be easily removed.—T. H. P.

Beverages similar to wine; Manufacture of ——, by means of pure hæmoglobin free from serum. P. Höpfner. Fr. Pat. 373,403, Jan. 9, 1907. Under Int. Conv., Jan. 10, 1906.

An aqueous solution of pure hæmoglobin free from serum is mixed with sucrose, dextrose, or other fermentable sugar, and the liquid fermented by means of a suitable yeast. Tartaric acid or some similar acid is added during the last third of the period of fermentation, under which conditions the hæmoglobin is not coagulated by the acid. Different characters may be imparted to the beverages by using different yeasts.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*Continued from page* 633.)

(*A.*)—FOODS.

Yebb nuts from Somaliland. Bull. Imp. Inst. 1907, 5, 19—20.

These nuts have formed the chief food of the Somalis in the famines caused by the drought. Selected kernels gave the following analytical results:—Moisture, 9·3; ash, 3·1; reducing sugars, 2·3; sucrose, 21·6; carbohydrates (other than sugars), 37·1; albuminoids, 11·8; amides, 1·3; fibre, 2·7; and oil, 10·8 per cent. Nutrient ratio, 1 : 6·5; and nutrient value, 92. No alkaloids or glucosides were detected. The plant producing these nuts has not been identified.—C. A. M.

Casein and paracasein; "Salting-out" of —— by common salt. S. Schmidt-Nielsen. Beitr. z. chem. Physiol. u. Pathol., 1907, **9**, 311—321. Chem. Zentr., 1907, **1**, 1543—1544.

Pure neutral solutions (2 per cent.) of sodium caseinate and paracaseinate are not precipitated on saturation with sodium chloride. On saturating such solutions with common salt (containing 0·4 per cent. of calcium and 0·05 per cent. of magnesium), however, the casein is precipitated as alkaline-earth caseinate. For complete precipitation, casein needs about 6·5 per cent. and paracasein, about 3 per cent. of its weight of calcium. Barium and magnesium ions may be used in place of calcium ions, but are only about one-third as effective as the latter in causing precipitation.—A. S.

Meat extract; Study of Liebig's ——. Kutscher. Zentralbl. f. Physiol., 1907, **21**, 33—35. Chem. Zentr., 1907, **1**, 1593.

The meat extract was purified by means of tannin, baryta, and "lead," and from the solution, creatine, creatinine, ignotine, and methylguanidine were precipitated by silver nitrate and barium hydroxide solution. After removing the excess of barium and silver, phosphotungstic acid was added to the solution. The precipitated phosphotungstates were converted into chlorides, and the latter dissolved in alcohol, and treated with an alcoholic solution of mercuric chloride. After filtering, the solution was evaporated, when crystals separated. The mother liquor on treatment with sodium acetate solution yielded a precipitate containing histidine and a new compound, to which the name, *vitiatine* is given. This was isolated from the mother liquor from histidine dichloride, after addition of a 30 per cent. solution of gold chloride, in broad, glistening plates, of the composition, $C_5H_{14}N_6,2HCl,2AuCl_3$. Vitiatine appears to have the constitution,

$$NH_2.C(:NH).N(CH_3).CH_2.CH_2.NH.C(:NH).NH_2$$

—A. S.

Meat extracts; Testing ——. O. Hehner. Pharm. J., 1907, **78**, 683—684.

The Jaffé reaction depending upon the formation of creatinine picrate, $C_4H_7N_3O$, $C_6H_3N_3O_7$, which dissolves in sodium hydroxide with a blood-red colour, affords the only reliable means of distinguishing between meat extract and yeast extract, the latter being practically devoid of creatinine. The test has been recently applied quantitatively by Baur and Barschall (Z. physiol. Chem., **10**, 399) and Grindley and Woods (J. Biol. Chem., **2**, [4]), but whereas it has proved quite satisfactory in the case of meat, which contains only a small proportion of creatine, widely differing results have been obtained by different investigators on using the method for the examination of meat extracts. The author shows that the varying results in the latter case are due to the use of an insufficient quantity of picric acid. As ordinarily carried out, the method consists in heating 10 grms. of the meat extract for at least 4 hours with dilute hydrochloric acid in order to convert creatine into creatinine, then making the solution up to 100 c.c., and treating 10 c.c. with 15 c.c. of a saturated solution of picric acid and 5 c.c. of a 10 per cent. solution of sodium hydroxide, and diluting to a suitable volume, the colour produced being compared with that obtained in a similar manner from a standard solution of creatinine. The author finds that the coloration produced in this way corresponds to about 6—7 per cent. of creatine in meat extract, but it is deepened by further addition of picric acid. If, however, 25 c.c. of picric acid, or more, be used, a colour is obtained, which is not altered by further addition of picric acid, and which corresponds to 10—11 per cent. of creatine. Working with the larger quantity of picric acid, different brands of meat extract were found to contain 10·4, 10·7, 10·4, 11·1, 10·6, 11·4, 10·2, 10·8, 12·2, 11·3, and 10·6 per cent. respectively of creatine.—A. S.

Cocoanut oil; Detection of —— in butter. W. Ludwig and H. Haupt. XXIII., page 720.

Lard; Detection of adulteration of —— with cocoanut oil. L. Robin. XXIII., page 720.

United States Patents.

Milk, concentrated [Milk powder] containing cream; Process of obtaining ——. C. H. Campbell, New York. Assignor to National Nutrient Co., Jersey City, N.J. Re-issue, No. 12,649, dated May 14, 1907, of U.S. Pat. 786,626, Apr. 4, 1905 (this J., 1905, 510).

Skimmed milk is heated at a low temperature, and a current of air is blown over its surface until it is concentrated to about one-sixth of its original volume. Unsterilised cream is then added, and the mixture is further concentrated, and dried if required, at a temperature below 120° F.—W. P. S.

Butter; Method for the manufacture of process ——. R. Roos, Chicago, Ill., Assignor to American Farm Products Co., Jersey City, N.J. U.S. Pat. 854,383, May 21, 1907.

A mixture of equal parts of acidified skimmed milk and fresh full milk is churned at a temperature of 60° F. "Butter oil" heated to a temperature of from 108° to 110° F. is then added, in the proportion of about 5 parts of oil to 3 parts of milk, and the mixture is emulsified. The emulsion is allowed to crystallise in cold water, an excessive quantity of salt is added to the crystals, and the latter are "cured" by exposing them in small quantities to air at a temperature of 60° F. for a considerable time. The crystalline mass is then "worked" to remove the excess of milk and salt.—W. P. S.

Lard; Process of refining ——, and recovering waste lard from spent fullers' earth. S. T. Lockwood, Buffalo, N.Y. U.S. Pat. 852,441, May 7, 1907.

Lard is refined by mixing it with fullers' earth, heating the mixture, and pressing it into cakes in a filter-press. These cakes are heated with carbon tetrachloride in a tank and the solution obtained is run through a filter-press, which retains the fullers' earth. The filtrate is distilled to recover the carbon tetrachloride and the lard.—A. G. L.

Lard; Process of refining ——, and recovering waste lard from spent fullers' earth. S. T. Lockwood, Buffalo, N.Y. U.S. Pat. 852,442, May 7, 1907.

The lard is mixed with an insoluble clarifying agent (*e.g.* fullers' earth) and heated until it is liquid, when it is forced into a filter-press whilst still warm. Carbon tetrachloride or other solvent is then forced through the filter-press under pressure, and the filtrate is distilled to remove and recover the solvent, and to deposit the lard. The exhausted fullers' earth is used over again.—A. G. L.

Corn or its products; Procedure for bleaching and sterilising ——. O. Zimmermann, Ludwigshafen on Rhine, Germany. U.S. Pat. 853,940, May 14, 1907.

See Eng. Pat. 25,010 of 1905; this J., 1906, 387.—T. F. B.

Bleaching, sterilising, or conditioning agent [for flour, &c.]; Process for producing a ——. S. Leetham, York, Assignor to The Ozonized Oxygen Co., Ltd., Manchester. U.S. Pat. 854,508, May 21, 1907.

See Eng. Pat. 5789 of 1904; this J., 1905, 341.—T. F. B.

French Patents.

Coffee or chicory substitute; Process of preparing a ——. S. Rigaut. Fr. Pat. 373,106, Mar. 9, 1906.

Starchy material, such as bread, flour, or even starch, is roasted until converted into caramel, and is then extracted with water at a temperature of about 80° C. The extract is mixed with ground and roasted beetroot pulp, or with exhausted coffee, and the mixture is dried. —W. P. S.

Starch or alcohol; Process of extracting —— from potatoes, together with a paste rich in nutritive matter. C. Steffen. First Addition, dated Dec. 17, 1906, to Fr. Pat. 368,002, July 12, 1906 (this J., 1906, 1230).

Water alone, or water that has been used for washing starch, is used for extracting the potato slices instead of the potato juice recommended in the original specification. The water is used repeatedly, after separation of the starch, until a concentrated juice is obtained. The potato slices, after extraction are only slightly pressed or drained, before being dried.—W. P. S.

Drying vegetable materials [potato slices, &c.]; Apparatus for ——. H. von Schütz and L. Gottscho. Fr. Pat. 373,619, Jan. 16, 1907. Under Int. Conv., Jan. 17, 1906.

A vertical drying chamber is built on each side of the air heating apparatus and chimney, the whole forming a compact building in order that the loss of heat by radiation and the ground space occupied, may be as small as possible. In each drying chamber four superposed slightly inclined drums provided with rotary stirrers are arranged. The materials to be dried are fed from a hopper into the top drum of the chamber on one side and pass downwards from drum to drum, and finally on to a screw conveyor and elevator by which they are lifted to the top drum of the chamber on the other side of the heater. Each of the three upper drums on each side receives a separate supply of heated air, the amount of which can be regulated by suitable dampers.—W. H. C.

Drying process for fruits, vegetables, tubers, pulp, &c., and apparatus therefor. O. Ardibus. Fr. Pat. 373,641, Jan. 16, 1907.

The materials to be dried are placed on trays supported by frames, provided with wheels, in an annular chamber. The annulus is broken at one point, and warm dry air is aspirated by a fan, forced through a heater and delivered into one end of the broken annular chamber. The warm air is forced to pass in close contact with the materials on the trays by suitable partitions arranged within the chamber, and an exhaust fan is provided at the other end of the chamber to extract the moisture-laden air.—W. H. C.

Fat; Edible —— [Lard substitute]. E. Mérian. Fr. Pat. 373,136, Dec. 31, 1906.

Milk, or diluted condensed milk, is emulsified with a white fat such as cocoanut oil. From 5 to 30 per cent. of milk may be used in the mixture.—W. P. S.

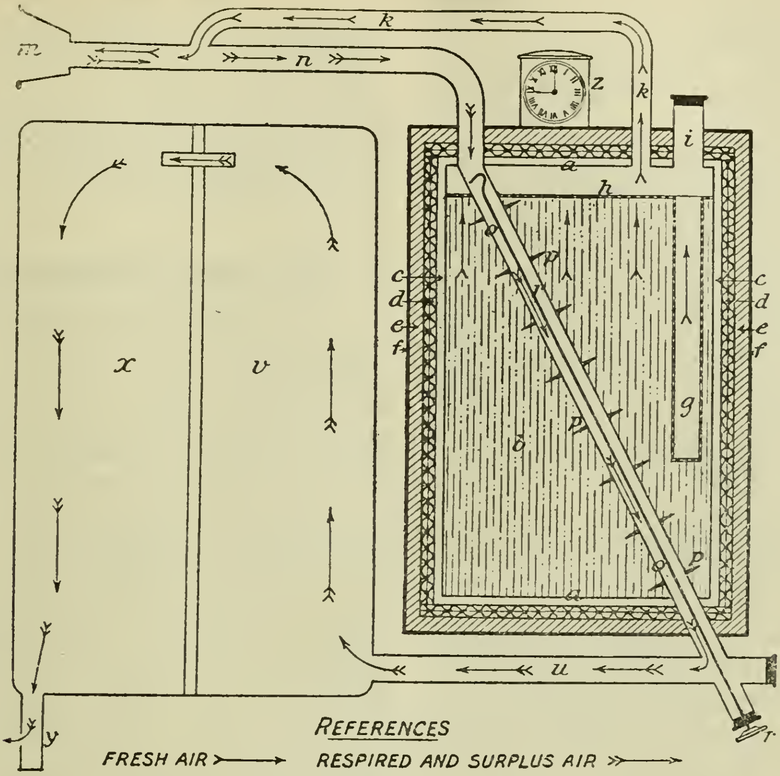
Butter; Process of preserving —— without salting, or the addition of any other substance. P. A. Sparre. First Addition, dated Jan. 7, 1907, to Fr. Pat. 371,091, Nov. 5, 1906.

The butter is wrapped first in parchment paper and then in paper impregnated with glycerol, vaseline, cinnamic acid, or a mixture of the same. This paper, or other convenient material, is prepared by applying the antiseptic to a single sheet which is then placed between two other sheets, so as to form a sandwich.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Liquid air, and its use in rescue-apparatus. O. Simonis. Trans. North of Eng. Inst. Mining and Mech. Eng., 1907, **57**, 78—94.

The author points out the disadvantages of the so-called regenerating appliances in which the expired air is regenerated by a chemical process. The air is always more or less heated and there is the danger that particles of the absorbent may be carried into the lungs. The liquid-air rescue-apparatus which the author describes is said to be free from such objections. The entire apparatus weighs only about 14 lb., gives 3 hours' supply of pure cool air, and is free from valves. It consists of a solid nickel container, *a*, packed with asbestos-wool, *b*, and insulated by a vacuum-space, *c*, an air-space, *d*, a layer of felt, *e*, and an outer leather cover, *f*. It holds about one gallon of liquid air which is poured in through the tube, *i*, and is quickly distributed over the asbestos by the perforated cylinder, *g*, and the plate, *h*. As the air evaporates, it passes from the container by the flexible pipe, *k*, to the mouthpiece, *m*, which forms part of a mask worn over the face of the user, and the expired air along with any excess of fresh air passes along the pipe, *n*, through the tube, *o*, provided with radiators, *p*, which passes diagonally through the container, *a*. It then passes by the pipe, *u*, through the two gas-bags, *v*, *x*, to the outlet, *y*. The tube, *o*, can be freed from obstruction by the cleaning rod, *r*, and an alarm clock, *z*, gives warning when the supply of air is getting exhausted. The heat of the expired air passing through the pipe, *o*, serves to evaporate the liquid-air in the container. The supply of fresh air is consequently automatic, because the faster the wearer breathes, the more rapidly the liquid air is evaporated. Liquid air, stored in the vacuum vessels designed by Sir James Dewar only loses from 5 to 10% by evaporation per day. It can now be bought for 5s. per gall. and can be produced by a small plant at a cost of 1s., and by a large installation at 6d., 3d., or even less per gall. A plant to produce one gallon of liquid air per hour requires about 8 h.-p., occupies about 45 sq. ft. of ground space, and costs about £400. A rescue sub-



Scale, 6 Inches to 1 Inch.

station requiring 4·4 galls. of liquid air always in store, would have a loss through evaporation of 0·22 gall. per day. A liquefying plant which would cost, including erection, from £500 to £600, and would produce 1·1 gall. per hour, would, if worked 60 hours per week, be sufficient to supply 12 sub-stations with enough liquid air to make up the daily loss and to provide for 4 practices of 2 hours duration per week at each station, as required in Austria and Germany.—W. H. C.

Sewage; Adsorption of colloidal matters from ——. W. Biltz and O. Kröhnke. Z. angew. Chem., 1907, **20**, 883—887.

Immiscible solvents have the property of removing colloidal substances from sewage, the solvent and adsorbed albuminoid separating as an oil-like emulsion (this J. 1906, 1177). Benzene removes 20 per cent. of the oxidisable matter from dialysed sewage, carbon bisulphide 47 per cent., nitrobenzene 27 per cent., and petroleum, 34 per cent. Freshly prepared ferric hydroxide adsorbs colloids in definite proportion from sewage, which has been submitted to dialysis in order to remove oxidisable crystalloids. From experiments with bacteria and the adsorption caused by specific agglutinins and bacteria, it is considered that the biological purification of sewage is brought about, in the first place, by the formation of a colloidal substratum which is especially favourable to the growth of micro-organisms. (See also this J. 1907, 428.)—W. P. S.

Water; Improvement of —— for domestic and industrial purposes by means of aluminate-silicates or artificial zeolites. R. Gans. Mitt. aus. d. Königl. Prüfungsanst. f. Wasserversorgung u. Abwasserbeseitigung zu Berlin, 1907, Heft 8; Woch. f. Brau., 1907, **24**, 270—271. (See also this J., 1907, 481.)

The aluminate-silicates exchange their bases, not only for alkalis and alkaline-earths, but also for iron, manganese, lead, silver, and presumably for all metals. A filter of such material can be regenerated after use, by washing with alkali, by which the metals separated from the water are re-dissolved. By fusing aluminium silicates with alkali (sodium) carbonate and sufficient quartz to decompose all the carbonate, aluminate-silicates are obtained which are excellent filtering media and contain 12—15 per cent. of soda (Na_2O). The soda content is of the greatest importance, since it is this which is exchanged for the bases present in the water.

In one test made by the author, well-water which rapidly became turbid in the air owing to the separation of ferric oxide, was filtered through a 10 cm. layer of calcium aluminate, the water level falling 10 cm. per hour. The whole of the iron was removed from the water by the filter, which was afterwards freed from iron and so rendered fit for further use by washing with salt solution.

Successful experiments were also made in the softening of water for boiler-feed purposes. The water was treated with sodium aluminate-silicate, which was found to remove the lime and magnesia quantitatively, the only salts subsequently present being alkali carbonates, sulphates, and chlorides, together with the small proportions of silicates contained in the original water. If only three-fourths of the sodium of the sodium aluminium silicate is replaceable, 2 kilos. of the material will remove from 1 cb. m. of water having a hardness of 20 degrees (German), all salts capable of forming boiler incrustation. —T. H. P.

English Patents.

Water; Apparatus for softening and purifying ——. H J. Fox, Forest Gate. Eng. Pat., 11,066, May 11, 1906.

The lime tank described in Eng. Pat. 10,355 of 1904 is provided with two layers of lime of the same strength, so that the lime water may remain constant in strength for a considerable time without the necessity of recharging. A suitable tank claimed for this purpose is in the form of an inverted conical casing containing lime. The water introduced into the bottom of this overflows the upper edge into an exterior jacket also containing lime, whilst a second vessel is provided in which the water leaving the lime tank may be mixed with water or with water containing sodium carbonate.—C. A. M.

Water; Appliances for purifying [separating scum, etc. from] ——. A. D. Watson, Birmingham. Eng. Pat. 20,773, Sep. 19, 1906.

FOR the removal of scum and other impurities from water which has been used for washing grain, or for similar purposes, the dirty water is first passed through a sieve to remove grains, and then falls from a height into a tank provided with an overflow lip leading to an adjacent tank. In the first tank, and at a short distance from the overflow, is placed a division piece, the top of which is at a lower level than the overflow. A flap, or shutter, is pivoted to the overflow lip and extends over the shorter division piece in such a manner that the scum flows over the lip, and the water passes under the flap, falling into the space between the division piece and the wall of the tank, whence it is led away. The scum flowing over the lip is collected in the second tank at the further end of which is a floating shutter; the aqueous portion of the scum passes under this and then through a filter before being discharged. A float is placed in the scum tank and is connected by levers to the flap or shutter in the first tank, so that, if too much water passes over with the scum, the flap is raised and more water allowed to flow under it. Air may be blown into the first tank to aid in the separation of the scum, and a supplementary division plate may be provided in this tank.—W. P. S.

Filter-beds and the like. G. W. and J. F. Naylor, Denby Dale, Huddersfield. Eng. Pat., 20,440, Sep. 14, 1906.

WITH the object of obtaining better ventilation of the filter-bed, the central chamber into which the liquid is introduced is provided with 3, 4, or more main channels communicating with each other by means of parallel passages connected with the channels at an angle other than a right angle. The main channels and auxiliary passages may be made to slope downwards towards the central chamber, so that the whole filter-bed will be of conical shape. In this way the pressure of the wind may be utilised, since it can enter through any of the openings and pass freely across the central chamber to the other side of the filter bed.—C. A. M.

UNITED STATES PATENTS.

Faecal matter; Apparatus for the automatic destruction of —— and purification of residual liquids. V. Bordigoni, Paris. U.S. Pat. 853,217, May 14, 1907.

SEE Eng. Pat. 24,332 of 1905; this J., 1906, 492.—T. F. B.

Air; Process of regenerating and purifying ——. R. v. Foregger, New York, and G. F. Brindley, Niagara Falls. Assignors to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 853,402, May 14, 1907.

SEE Fr. Pat. 366,525 of 1906; this J., 1906, 1063.—T. F. B.

(*C*)—DISINFECTANTS.

ENGLISH PATENT.

Disinfectants [phenols with oxalic acid]; Manufacture of ——. H. Schneider, Berlin. Eng. Pat. 3789, Feb. 15, 1907. Under Int. Conv., Feb. 16, 1906.

THE disinfectants claimed consist of mixtures of phenols, or phenol derivatives, with oxalic acid, and may be prepared either as solutions or in a solid form. Thus, crystallised oxalic acid is dehydrated by heating, and is then sprinkled with about 25 per cent. of its weight of cresol or crude carbolic acid. After mixing and allowing to stand for a few days, the dry powder is compressed into tablets. Under the term "phenols," the patentee includes hydroxyl derivatives of benzene, naphthalene, and quinoline; sulphonic-acids, sulphuric acid esters, and aldehydes, such as formaldehyde, may also be used. —W. P. S.

UNITED STATES PATENT.

Formaldehyde [in soap solution]; Method of preventing oxidation of ——. L. H. Reuter, New York. U.S. Pat. 853,265, May 14, 1907.

OXIDATION of formaldehyde in soap solution is prevented by adding the neutral (normal) sulphite of an alkali metal. For example, 0·07 part by weight of sodium sulphite, previously dissolved in water, may be added for each part of formaldehyde contained in the soap solution. —F. SODN.

XIX.—PAPER, PASTEBOARD, &c.

(*Continued from page* 634.)

Paper pulp; Bleaching —— *with electrolytic hypochlorite solutions.* W. P. Digby. Electrochem. and Metall. Ind., 1907, 5, 178—182.

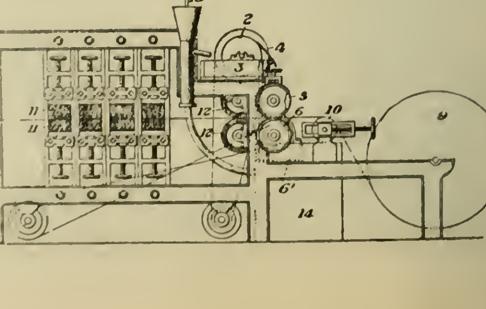
THE results of large scale tests in which a mixture of esparto and wood pulp was bleached in "mill potchers" by means of electrolytic hypochlorite solution and bleaching powder respectively, showed that the rapidity and effectiveness of the bleaching depend upon the concentration of available chlorine. The initial concentration of available chlorine in the contents of the "mill potcher" should be between 350 and 500 grains per gallon. If the pulp to be bleached, be first freed from some of its moisture, it becomes possible to use hypochlorite solutions containing 3—4 grms. of available chlorine per litre (210—280 grains per gallon), which can be produced at a high electrochemical efficiency. Electrolytic hypochlorite solutions can be used at lower temperatures than bleaching powder solutions; moreover, one atomic proportion of chlorine is more effective in the former than in the latter; in the author's experiments this increased effectiveness was in the ratio, 1·5:1. No general statement can be made as to the relative cost of bleaching with electrolytic hypochlorite solutions and with bleaching powder, this depending entirely upon local conditions with regard to cost of electrical energy and of common salt on the one hand, and of bleaching powder on the other.—A. S.

ENGLISH PATENTS.

Paper pulp [from flax-straw, etc.]; Preparation of ——. E. M. V. Fleury, Tunis. Eng. Pat. 11,103, May 11, 1906. Under Int. Conv., Oct. 6, 1905.

THE straw is first crushed and dusted, and is then treated either by retting or by steaming in presence of air so as to loosen the adhesion of the fibres to one another and to the wood of the stem. Next, the material is subjected to the action of a hypochlorite in presence of steam, the operation being stopped at the moment when the wood is sufficiently oxidised, whilst the fibre has not yet been attacked. Finally, the oxidised material is boiled with an alkaline liquor, containing caustic soda, sodium carbonate, sulphate, and sulphite, at a temperature of 150° C., in order to purify the cellulose.—J. F. B.

Paper; Machine for coating ——. M. Cantine, Saugerties, N.Y., U.S.A. Eng. Pat. 2770. Feb. 4, 1907.



The paper is unwound from the reel, 9, and passes over the guide-roll, 10, into the coating machine, which applies colour to both sides of the paper simultaneously. The colour is applied by the two felt-covered rolls, 5 and 6, which are geared together and between which the paper passes. The composition employed is stored in the colour-tub, 14, whence it is lifted by the pump, 13, into the box, 3. A roll, 2, revolves in this colour-box and picks up a uniform layer of the composition, which is transferred by means of the scraper blade, 4, on to the upper coating roll, 5. The excess of colour pumped up overflows from the box, 3, into the box, 6¹, in which the lower coating roll, 6, revolves, and the excess from this flows back into the cistern, 14. After passing the coating rolls, the paper travels between a pair of revolving brushes, 12, 12, and then between a series of reciprocating brushes, 11, 11, which spread the coating in a uniform layer.
—J. F. B.

Cork; Method of and apparatus for purifying, cleansing, and bleaching ——. H. Coale, Baltimore, U.S.A. Eng. Pat. 11,632A, May 18, 1906.

See Fr. Pat. 366,586 of 1906; this J., 1906, 1064.—T. F. B.

United States Patents.

Cornstalks, sugar-cane, etc.; Process of manufacturing products [for paper-making] from ——. V. Drewsen, New York. U.S. Pat. 853,943, May 14, 1907.

The stalks are cut into pieces and boiled in an alkali solution to separate the fibres of the shell and the pith cells from other matters; the fibrous matter is then separated from the cells by washing and screening. After allowing the pith cells to settle out of the wash-water, they are collected, as is also the fibrous material. (See also U.S. Pats. 731,290 of 1903 and 789,416, of 1905; this J. 1903, 876; 1905, 633).—W. P. S.

Cellulose ester [acetate]. H. S. Mork, Assignor to Chemical Products Co., Boston, Mass. U.S. Pat. 854,374, May 21, 1907.

Hydrocellulose prepared from cellulose by the action of acetic acid and a condensing agent, is acetylated at the ordinary temperature by means of acetic anhydride dissolved in benzene. The triacetate formed retains the shape of the fibre from which it was derived.—W. P. S.

French Patents.

Straw; Process and apparatus for treatment of —— for making pulp for boards or paper. Soc. Haemers et Van den Bavière. Fr. Pat. 373,668, March 23, 1906.

The chopped straw is loaded into a spherical revolving boiler together with milk of lime, and is there treated, under a water-pressure of about 5 atmospheres, for a period of 10 hours. The liquid may be either quite cold or more or less heated; the pressure is communicated to the vessel by means of an external pump, through the hollow trunnion of the revolving boiler.—J. F. B.

Straw, hemp-waste, etc.; Manufacture of cellulose from ——, and the preparation of liquor for boiling the materials. E. Némethy. Fr. Pat. 373,721, Dec. 18, 1906.

Straw, hemp-waste, and similar material, which cannot be fully resolved by boiling with calcium bisulphite, are converted into cellulose by means of a solution of magnesium bisulphite and monosulphite. The liquor is prepared by calcining *magnesite* so as to form magnesia and by treating the hard lumps with sulphur dioxide and water in an ordinary absorption tower and packing the soft, friable portions in a basket and lixiviating with a solution of sulphurous acid in a vat.—J. F. B.

Bleaching of fibres and rags of all colours employed in paper making. R. Schuehmacher. Fr. Pat. 373,327, Jan. 4, 1907.

After a treatment with sodium carbonate or lime and subsequent souring, the material is treated with a solution of a permanganate or manganate, the bath being kept acid, and the temperature varying according to the material treated. When this treatment is concluded, the material, which is now brown, is treated with a solution of sodium or calcium hyposulphite (hydrosulphite) ($NaHSO_2$ or $CaH_2(SO_2)_2$), to destroy the brown colour. Bisulphites may be employed in the place of hyposulphites.
—A. B. S.

Waste waters from paper machines; Utilisation of ——. C. Gerard. First Addition, dated Jan. 8, 1907, to Fr. Pat. 364,720, Mar. 29, 1906 (this J., 1906, 950).

In order to recover the suspended matters which have passed through the wire-cloth of the "pulp saver," the waste waters from the latter are collected in a pit and are elevated alternately, into one of two tanks situated at a high level. The bottoms of these tanks slope downwards towards the discharge end. The greater portion of the suspended matters settle to the bottom of the tanks, and the supernatant water is run off by decantation. The residue is discharged into a tank, the walls of which are provided with fine sieves or other filtering material by which the solid matters are retained.—J. F. B.

Insulating product with cellulose basis; New ——. E. and M. Lamort. Fr. Pat. 373,407, Jan. 9, 1907. XI., page 698.

Cellulose products; Manufacture of brilliant ——. C. F. Müller. Fr. Pat. 373,429, Jan. 9, 1907.

In the manufacture of cellulose articles, threads, films, etc. from cellulose in cuprammonium solution, a coagulating bath consisting of a mixture of milk of lime and sodium hydroxide solution is employed. This mixture has a higher coagulating power than either of the components separately. An advantage is also obtained by adding sodium carbonate to the solution of cellulose employed.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

(Continued from page 638.)

Kola seeds from the Gold Coast. Bull. Imp. Inst., 1907, 5, 20—22.

Samples of red and white seeds were examined with the following results:—

	Moisture	Total alkaloids, principally caffeine.	
		Calculated on original substance.	Calculated on dry substance.
	Per cent.	Per cent.	Per cent.
Fresh seeds, white ..	67·7	0·76	2·36
,, ,, red	55·9	0·88	2·00
Dry seeds, white	11·8	2·19	2·48
,, ,, red	15·6	1·97	2·33

These results do not support the native opinion that the seeds lose a considerable proportion of their toxic quality in drying, or that the white seeds are inferior to the red. The sample was valued at 1½d. per lb. the current price for good qualities being 2¼ to 2½d. per lb.—C. A. M.

Kola; A new crystalline principle from fresh ——. [*kolatin*]. Goris. Compt. rend., 1907, **144**, 1162—1164. (See this J. 1906, 280.)

Fresh kola nuts, previously sterilised by heating to 105° C. for 10 mins., are extracted with boiling 95 per cent. alcohol, and the liquid evaporated in a vacuum. The residue is extracted several times with chloroform, and then allowed to stand under chloroform for several days, when a crystalline mass is obtained which contains caffeine and a new tannin, *kolatin*. It is recrystallised from dilute alcohol, dissolved in water and shaken with chloroform to remove the caffeine, which is loosely combined with the kolatin. The aqueous portion is evaporated in a vacuum. to obtain crystals of kolatin, $C_{10}H_8O_4$, which is a phenolic compound, crystallising in prismatic needles: and yielding, on oxidation, a red insoluble powder (kola red). The dried nuts, and galenical extracts do not contain kolatin, which disappears during the drying. Kola nuts containing 50—60 per cent. of water yield 6—7·5 per cent. of the caffeine-kolatin compound. The caffeine cannot be removed from this compound by means of chloroform unless water is present.—F. Shdn.

Merremia ficifolia; Cyanogenetic glucoside in ——. Weehuizen. Pharm. Weekblad, 1906; Pharm. Centralh., 1907, **48**, 364.

The freshly crushed leaves of this convolvulaceous plant when digested at 35 to 40° C. and then distilled, yield about 0·04 per cent. of hydrocyanic acid. This is evidently due to the action of an enzyme on a glucoside, for if the leaves be momentarily plunged into boiling water, so as to destroy the ferment, no hydrocyanic acid is obtained on subsequent distillation.—J. O. B.

Tephrosia vogellii; Active principles of ——. M. Hanriot. Compt. rend., 1907, **144**, 150—152, 498—500.

The leaves of *Tephrosia vogellii* and of allied species are employed in Madagascar as fish poisons. The plant still retains its toxicity when dried, but the fresh material is much more active. Three definite bodies have been isolated from the leaves: *tephrosal*, a volatile oil, with the empirical formula, $C_{10}H_{16}O$; *tephrosin*, a neutral body, $C_{31}H_{26}O_{10}$, m. pt. 187° C., which is the toxic principle, and a yellow substance crystallising in needles. Tephrosal is isolated by distilling the alcoholic extract of the leaves with steam: it separates from the aqueous distillate as an oily liquid. It is readily polymerised. *In vacuo*, it commences to distil at 60° C., but the major portion passes over at a higher temperature without a definite b. pt. It has a powerful odour and exhibits aldehydic reactions; it is but slightly soluble in water.

Tephrosin is isolated from the non-volatile residue after separation of tephrosal, by evaporating to dryness *in vacuo*, powdering the residue, and extracting it with chloroform. The chloroform solution is treated with 2 vols. of ether, filtered, and shaken out with potassium hydroxide solution to remove resinous impurity By further treatment tephrosin is obtained in colourless shining prisms; the yield is about 0·1 per cent. It is almost insoluble in water, slightly soluble in 96 per cent. alcohol (0·542 : 100 parts by weight at 19° C.; 3·89 : 100 on boiling), more soluble in acetone (6·02 : 100 at 18·5° C.); and in chloroform (8·6 : 100) at the same temperature.—J. O. B.

Eucalyptus carnea; Essential oil of ——. R. T. Baker. Proc. Linn. Soc. N.S.W. **1906**, [2], 303. Schimmel's Report, 1907, April, 52.

The essential oil of this new species of Eucalyptus consists chiefly of *d*-pinene; no phellandrene and only about 5 per cent. of cineol are present. The yield of oil is only 0·155 per cent.—J. O. B.

Eupatorium triplinerve; Essential oil of ——. [*Ayapana oil*]. Schimmel's Report, 1907, April, 106—107.

The oil, distilled in the Comoro islands, was pale green and had a peculiar odour: Sp. gr. 0·9808 at 15° C.; $\alpha_D = +3° 10'$; ester value, 8·0; ester value after acetylation, 23·4; solubility in 90 per cent. alcohol, 2 : 3; it is practically insoluble in 80 per cent. alcohol. Except about 5·6 per cent. of terpenes the oil consists mainly of a single substance, b. pt. 104—105° C. under 3·5 mm. pressure. When rectified over sodium this fraction had the b. pt. 237°—238° C. at 750 mm.; $\alpha_D = +0° 14'$; it was soluble in all proportions in 90 per cent. alcohol. —J. O. B.

Mentha rotundifolia, Essential oil of ——. Schimmel's Report, 1907, April, 107.

The oil, distilled in Algeria, was dark orange yellow in colour, with a musty, faint and somewhat pungent odour; sp. gr. 0·9777 at 15° C.; $\alpha_D = -37° 30'$; acid value, 1·5; ester value, 71·2; ester value after acetylation, 209. It was miscible in all proportions in 90 per cent. alcohol, and soluble in an equal volume of 80 per cent. alcohol. —J. O. B.

Terpenes and essential oils. 84. Carboxylic acids of cyclic hydrocarbons, and their transformation products. 85. Behaviour of nitrites of primary bases, and enlargement of rings in carbocyclic systems. O. Wallach. Annalen, 1907, **353**, 284—317, 318—334.

The 84th communication deals with:—I. Compounds of cyclohexanone:—isomeric cyclohexene-acetic acids; isolation of $\Delta^{1 \cdot 7}$-cyclohexeneacetic acid (m. pt. 91° C.); transformations of the cyclohexeneacetic acid of m. pt. 38° C.; cyclohexylacetic acid; β-cyclohexylethylamine; cyclohexylmethylamine (hexahydrobenzylamine). Ketones from cyclohexylacetic acid:—completely hydrogenised dibenzylketone; cyclohexylacetone (methylhexahydrobenzylketone). II. Compounds from suberone:—suberylacetic acid (cycloheptylacetic acid); suberylacetamide; suberylmethylamine. III. Compounds from cyclopentanone:—cyclopentylacetic acid; cyclopentylacetamide; cyclopentylmethylamine; cyclopentene-iso-butyric acid; monohalogencyclopentylisobutyric acids; hydrocarbon, C_8H_{14}, from destructive distillation of cyclopentene-isobutyric acid. IV. Compounds from 1·4-methylcyclohexanone:—1·4-cyclomethylhexeneacetic acid and cyclomethylhexylacetic acid and their derivatives. V. Compounds from menthone:—mentholacetic acid and its derivatives. The 85th communication relates to the:—(1) Conversion of cyclopentanone into cyclohexanone. (2) Conversion of cyclohexanone into cycloheptanone (suberone). (3). Conversion of suberone into cyclooctanone (azelaïnketone) and properties of the latter. —A. S.

Barbaloin, its distribution, composition, and formula. E. Léger. J. Pharm. Chim., 1907, **25**, 513—517.

Barbaloin is found in all kinds of aloes except those from Zanzibar, the aloin obtained from which (zanaloin) is, according to Tschirch and Hoffbauer (Archiv-Pharm., 1905, **243**, 399), less soluble in methyl alcohol than barbaloin, and melts at 210—212° C. The author's original formula for barbaloin, $C_{21}H_{20}O_9$, is adhered to, since it is the only one of those proposed which is compatible with the observed optical activity of barbaloin, and with the formation of the compound, $C_{15}H_6Cl_4O_5$, from chlorobarbaloin, $C_{16}H_{13}Cl_3O_7$. According to this formula, moreover, barbaloin is isomeric with frangulin; and may be regarded as a derivative of aloemodin and a methylaldopentose, which is in accord with the decomposition of barbaloin in alcoholic solution into methylisohydroxychrysazin and the sugar, aloinose. The formula is also confirmed by the cryoscopic determination of the molecular weight of acetylchlorobarbaloin.—J. O. B.

Adrenaline; A new characteristic reaction of ——. A. Gunn and E. F. Harrison. Pharm. J., 1907, **78**, 718.

If a small quantity of dry adrenaline or a few drops of a 1 : 1000 solution be treated with 5 or 6 drops of a 10 per cent. solution of sodium hydroxide, the mixture gradually becomes coloured reddish-brown, and a characteristic odour, resembling that of hydrogen phosphide, develops in a few seconds. The odour is well marked with one drop of a 1 : 1000 solution of adrenaline and 5—6 drops of the sodium hydroxide solution.—A. S.

Ether and air; Explosive mixtures of ——. J. Meunier. Compt. rend., 1907, **144**, 1107—1108.

The author had not seen the note of Le Chatelier and Boudouard on this subject when he published his former paper (this J. 1907. 486.). He has now modified his method by varying the size of the explosion tube till the limiting result is obtained with 1 drop of ether. The lower limit with drops of 11 and 15 mgrms., respectively, is obtained with tubes of 190 and 252 c.c., corresponding to 58 and 59 mgrms. of ether per litre—closely agreeing with Le Chatelier and Boudouard's result of 60 mgrms. At the limit there is slow noiseless inflammation; if the amount of ether be 1—2 mgrms. less, the taper will burn in the mixture without any communication of flame.

Explosion becomes violent at 100 mgrms. per litre, reaches a maximum at 120—150 mgrms., is still violent at 175 mgrms., and ceases at 200 mgrms., above which amount the taper is extinguished by the mixture.—J. T. D.

Alcohols; Catalytic dehydration of —— by amorphous phosphorus and by phosphates. J. B. Senderens. Compt. rend., 1907, **144**, 1109—1111.

The amorphous phosphorus used, was of the kind offered to the trade as a fine powder, unctuous to the touch, of violet colour, and a sp. gr. 2·165. When heated with aliphatic alcohols to 180°—240° C., it yields the corresponding olefines, with production of a certain amount of phosphine. Different makes of amorphous phosphorus, however, differ greatly in this respect. The same reaction is effected with much greater regularity by certain phosphates, more especially aluminium phosphate. Using this reagent, excellent yields of olefine have been obtained from the various 2-, 3-, 4-, 5-, and 8-carbon alcohols. Alcohols of the cyclic series (cyclo-hexanol, mono- and di-methylcyclohexanols, menthol) also yield the corresponding hydrocarbons when treated in this way. Other substances, amongst them silica and silicates, also exert this dehydrating action.—J. T. D.

Aldehydes; Action of magnesium amalgam on ——. A. Kling and P. Roy. Compt. rend., 1907, **144**, 1111—1114.

Meunier found (this J. 1902, 429) that magnesium amalgam reduces acetaldehyde, with formation of butyleneglycol. The authors find that this reaction is general with fatty aldehydes, except formaldehyde. Chloral is not acted on, and from benzaldehyde there are obtained only benzyl alcohol, benzoic acid, and a little isohydrobenzoïn. The authors consider that the reaction consists in the formation and subsequent reduction of the aldol corresponding to the aldehyde.—J. T. D.

Yttrium earths; New method for the separation of the ——. C. James. J. Amer. Chem. Soc., 1907, **29**, 495—499.

The method is based upon the solubility of the oxalates of the metals of the yttrium group in ammonium carbonate solution. The oxalates are treated with a solution of ammonium carbonate prepared by saturating a dilute (1 : 4) solution of ammonia with the solid salt. The solution is heated on the water-bath, and the precipitate which gradually forms is collected in fractions. In the experiments described, five fractions were obtained, the last one by evaporating the solution to dryness. The metals separate in the following order:—Cerium group, yttrium, terbium, dysprosium, holmium, erbium, thulium, ytterbium. It is stated that pure erbium can be separated from holmium, dysprosium, and terbium, in a shorter time by this method than in any other way. The author states that erbium is probably a mixture (compare Auer v. Welsbach, Monatsh. Chem., **27**, 935).—A. S.

Cerous to ceric compounds; Oxidation of ——. G. A. Barbieri. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 395—399. Chem. Zentr., 1907, **1**, 1529.

Cupric and mercuric salts are reduced by cerous hydroxide, as also is auric chloride in potassium bicarbonate solution; in the latter case metallic gold is precipitated, and the yellow solution contains dissolved ceric carbonate. Cerous salts precipitate cuprous oxide from Fehling's solution at 90° C., the cerium remaining in solution as ceric tartrate. This reducing action in alkaline solution distinguishes cerous salts from salts of other rare earths. Notwithstanding the instability and the strong oxidising power of ceric ions, it is possible to oxidise cerous nitrate to ceric nitrate. On heating a solution of 20 grms. of cerous nitrate and 20 grms. of ammonium nitrate in concentrated nitric acid on the water-bath till of syrupy consistence, and then repeatedly evaporating after fresh additions of nitric acid, a red liquid is obtained, which, on cooling, deposits crystals of ammonium-ceric nitrate, $(NH_4)_2Ce(NO_3)_6$.—A. S.

Rare earths; Catalytic properties of the elements of the ——. G. A. Barbieri and A. Volpino. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 399—403. Chem. Zentr., 1907, **1**, 1529—1530.

A. Villiers (this J., 1897, 833) found that no gas is evolved on heating a mixture of equal volumes of a saturated solution of oxalic acid, hydrochloric acid, and 25 per cent. nitric acid, but that a vigorous reaction sets in after addition of a few drops of manganous sulphate solution. The authors find, contrary to R. J. Meyer and E. Marckwald (this J., 1901, 62), that ceric salts also strongly accelerate the oxidation of oxalic acid by nitric acid; salts of lanthanum, praseodymium, neodymium, and yttrium, on the other hand, have no perceptible effect on the reaction. The effect of ceric sulphate is intermediate between that of manganous sulphate and that of ferrous sulphate, whilst cobalt sulphate is between ferrous sulphate and nickel sulphate. Cerous salts are oxidised more readily by permanganate than by nitric acid. In the acceleration of the oxidation of oxalic acid by permanganate in sulphuric acid solution, also, ceric sulphate behaves similarly to manganous sulphate, whilst the action of sulphates of praseodymium, neodymium, and lanthanum is similar to that of cobalt and nickel sulphates.—A. S.

Calcium p-hydroxybenzoate. Œ. de Coninck. Compt. rend., 1907, **144**, 1118—1119.

When the anhydrous salt is shaken with a little water, it forms a crystalline hydrate, which dissolves only slowly in excess of water, the disappearance of the last particles being often accompanied by triboluminescence. From a solution which was cooled from 17° to 5° C., some of the salt separated in the form of a perhydrate. Mixtures of hydrates gradually separate from aqueous solutions of the salt. The salt combines with methyl alcohol, but not with ethyl alcohol.—J. T. D.

Sucrose in plant tissues; Detection of —— by means of invertase. E. Bourquelot. XXIII., page 720.

Glucosides in plants; Detection of —— by means of emulsin. E. Bourquelot. XXIII., page 721.

Ammonia, monomethylamine, and other fatty amines; Separation, detection, and determination of ——. M. François. XXIII., page 721.

Essential oils in India. U.S. Cons. Rep. Oil, Paint, and Drug Rep., May 27, 1907. [T.R.]

The annual exports of rusa-grass oil from India during the decade, 1896–7 to 1906–7, increased from 6,199 gallons to 23,436 gallons, and in value from $49,651 to $183.808. Indian geranium oil of late years has been put on the market unadulterated with oil from grasses, and commands better prices than it did when adulterated. There is a demand for all this class of oil produced in India by the manufacturers of perfumes and fancy soaps. The price last year for geraniol was the lowest yet realized, but the producers were satisfied with the net results, and are preparing to increase the production by greater acreage, by improved methods of cultivation and harvesting, and by using more modern apparatus in distilling the oil.

The lemon-grass oil, made from what is usually called *Andropogon citratus*, is made in Southern India during the time of year when the grass is sufficiently green and juicy to render it profitable to work. The larger portion of the oil is used in the manufacture of citral and ionone. The perfume is sold in America at an exorbitant price, which has run up prices in India, but they are not likely to go much higher.

Citronella oil is distilled from grass grown in Ceylon, with an estimated 60,000 acres now in cultivation. Two crops are grown in a year, and the harvests occur in July or August and in December. The average yield of oil to the acre is from 368 to 460 ounces in the summer and about half that in winter. The record year of exports was 1899, when they amounted to 1,500,000 pounds.

English Patent.

o-Nitrotoluene ; Manufacture of mercurial compounds of ——, and the manufacture of o-nitrobenzaldehyde therefrom. G. W. Johnson, London. From Kalle und Co., A.-G., Biebrich on Rhine, Germany. Eng. Pat. 22,336, Oct. 9, 1906.

See Fr. Pat. 370,522 of 1906 ; this J., 1907, 278.—T. F. B.

United States Patents.

Aromatic alcohols and their derivatives ; Process for the production of ——. C. Mettler, Munich, Germany. Reissue No. 12,654, dated May 21, 1907, of U.S. Pat. 815,548, March 20, 1906.

See Fr. Pat. 348,951 of 1904 ; this J., 1905, 559.—T. F. B.

Formaldehyde preparation. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 854,452, May 21, 1907.

Formaldehyde is kept in contact with an anhydrous ester of the aromatic series, such as methyl benzoate, under pressure, until it becomes associated with or occluded in the ester. The addition of an inert diluent, for instance camphor oil, is also claimed.—F. Sodn.

Glycerophosphates, especially crystallised sodium glycerophosphate ; Manufacture of ——. Soc. anon. des Établ. Poulenc Frères. Fr. Pat. 373,112, Mar. 10, 1906.

Glycerophosphates are prepared by heating two molecular proportions of glycerol with one molecular proportion of monosodium or monoammonium phosphate in a vacuum. The mixture contains a glycerophosphate represented as $(C_3H_7O_2)_2PO_4M$. This is saponified by means of sodium hydroxide. On concentration, disodium glycerophosphate separates out. This substance can be used as a source of other glycerophosphates.—F. Shdn.

Oxalic acid ; Manufacture of ——. J. Effront. Fr. Pat. 373,157, Nov. 23, 1906.

Materials containing cellulose such as peat, vinasses, sawdust, etc., are treated with caustic soda or potash in the presence of lime, nitrates, metallic oxides, and air, at a temperature of 170° to 190° C. The best yields can be obtained by the simultaneous use of metallic salts, nitrates, and lime, in conjunction with the alkali ; but any one of them can be used along with the alkali. —F. Shdn.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

(Continued from page 638.)

Emulsions ; Colour-sensitising of gelatin and collodion ——. T. T. Baker. Phot. J., 1907, **47**, 207—214.

As a result of the study of the sensitising action of dyestuffs on gelatin and collodion emulsions, it is concluded that all dyestuffs are capable of enhancing the colour-sensitiveness of silver bromide to some portion of the spectrum. If the ammoniacal solutions of the dyestuffs are only slightly active, they may be rendered much more useful by addition of silver nitrate. Dyestuffs whose solutions exhibit several absorption bands are generally more active than those with only one band : dyestuffs confer as many maxima of colour-sensitiveness as they possess transmission bands. Metallic salts in solution (other than silver salts) do not influence the sensitising action of dyestuffs unless they are alkaline, or act as mordants or otherwise alter the transmission spectra of the dyestuffs.—T. F. B.

Fixing solutions ; The limits of usefulness of ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1907, **23**, 104—109.

Increasing quantities of pure silver bromide, prepared in darkness, were dissolved in solutions of sodium thiosulphate of strengths varying from 5 to 45 per cent., in order to ascertain : (*a*), the amount of bromide soluble, and (*b*), the maximum amount which could be dissolved before the solution became sensitive to the action of light. Similar experiments were also made with solutions of thiosulphate containing sodium bisulphite and chrome alum. It was found that the ratio between the amount of bromide necessary for complete saturation and the maximum amount which produced a stable solution passed from 100 : 62 for a 5 per cent. solution of thiosulphate, to 100 : 60 for a 15 per cent. solution, and 100 : 24 for a 45 per cent. solution. It is concluded not to be expedient to fix more than 100 " quarter-plates " in one litre of 15 per cent. thiosulphate solution, nor more than 50 in a litre of the same solution containing 1·5 per cent. of sodium bisulphite, nor more than 75 in a solution containing also 0·5 per cent. of chrome alum. —T. F. B.

Silver prints on paper ; Use of a solution of ammonia for the fixation of ——. R. H. Bow. Phot. J., 1907, **47**, 245—246.

Silver prints assume a rich brown tone if immersed for five minutes in a 2 per cent. solution of ammonia, washed, treated with a very dilute solution of an alkali sulphide, washed, and dried.—T. F. B.

Gelatin rendered insoluble by quinone. A. L. Lumière and A. Seyewetz. XIV., page 703.

English Patents.

Photographic developer. K. Buisson, Emmendingen, Germany. Eng. Pat. 10,284, May 2, 1906.

If molecular proportions of *p*-aminophenol (or diaminophenol) and quinol (or catechol) are mixed together in glycerin and poured into water, and the solution precipitated with an alkali carbonate, a compound of the two substances is obtained which is stated to have superior developing properties to those of a mixture of the two constituents, *e.g.*, the temperature of the developing solution is said to be of little importance. The compounds are employed together with sodium carbonate, sulphite, and metasulphite in the usual manner.

Reference is directed under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pat. 27,931 of 1896 (see this J., 1897, 260).—T. F. B.

United States Patent.

Photographic paper. A. and L. Lumière, Lyon-Monplaisir, France. U.S. Pat. 853,643, May 14, 1907.

See Fr. Pat. 361,720 of 1905 ; this J., 1906, 1117.—T. F. B.

French Patents.

Paper for receiving a silver photographic emulsion ; Preliminary treatment of ——. Y. Schwartz. Fr. Pat. 373,699, Jan. 18, 1907.

Inferior qualities of paper may be rendered suitable for receiving photographic emulsions by coating them with a mixture of a neutral phosphate and gelatin, albumin, or the like. The mixture of dicalcium phosphate and tricalcium phosphate known as *Calcium phosphoricum* (German Codex, Vol. IV.) is stated as suitable, 40 grms. being sufficient for each square metre of paper.—T. F. B.

Silver images ; Process and apparatus for converting —— into catalytic platinum images. Neue Photographische Ges. Fr. Pat. 373,060, Dec. 28, 1906.

Silver photographic images are converted into platinum images by treatment with a solution of a platinum salt: the images thus obtained are made capable of catalytic action by treatment with oxidising agents and with ammonia. In cases when a precipitate is formed which has a catalytic action towards hydrogen peroxide (*e.g.*, when permanganate is used), this must be removed, for example, by treatment with an oxalic acid solution, containing alum to harden the gelatin. After use in the catatype process, the images are again treated with oxidising agents and with ammonia or ammonium salts (*e.g.*, with ammoniacal permanganate solution). The apparatus claimed, is designed for treating several plates or papers simultaneously.—T. F. B.

Photographs on plastic substances. P. E. Manvillin. Fr. Pat. 373,530, Jan. 8, 1907.

Plates or other surfaces of plastic material, such as "fibro-cement" (calcareous materials and sawdust, cork, &c., with an agglutinant) are covered with bichromated gelatin and exposed to light, or they are coated with a hard varnish ; they are then painted or coloured if desired, after which the photograph is applied, preferably by the "carbon" process, and the whole is finally protected by a coating of a transparent varnish.—T. F. B.

Photographs on metal, glass, porcelain, or similar substances ; Process for producing ——. A. Hans. Fr. Pat. 373,652, Jan. 17, 1907. Under Int. Conv., Jan. 20, 1906.

The surface of the metal, glass, &c., to receive the photograph is coated with a mixture of fish glue, ammonium bichromate, and a substance containing sugar (e.g., malt extract), and dried. The photograph is printed on this surface, and developed by washing with water, after which it is "tanned" by treatment with a 5 to 10 per cent. solution of quinol. If very dark images are desired, an animal or vegetable colouring matter is added to the quinol solution. The tanned image is now heated strongly in a closed chamber, and finally, if required, covered with silver, a metallic oxide, &c. Gum arabic or casein can be used instead of, or in conjunction with the fish glue.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

(*Continued from page* 641.)

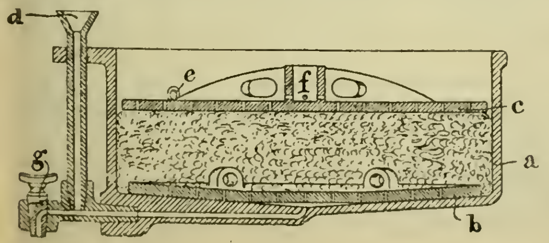
English Patents.

Explosives ; Process for the manufacture of safety ——. F. Volpert, Dortmund, Germany. Eng. Pat. 10,424, May 3, 1906.

See Fr. Pat. 365,709 of 1906 ; this J., 1906, 1006.—T. F. B.

Nitrocellulose ; Manufacture of ——. A. T. Cocking and Kynoch Ltd., Birmingham. Eng. Pat. 16,676, July 24 1906.

A charge of nitrating acid is run into the nitrating vessel (*a*), and a charge of dry cotton immersed in the acid above the false bottom (*b*). The upper plate (*c*) is now put in position, and the plant left for several hours until nitration is complete. The acid is now drained off as far as is possible by the cock (*g*). Sulphuric acid, preferably containing about 2 per cent. of nitric acid, is run in through the funnel (*d*), and is uniformly distributed by the perforations in the false bottom, finally flowing away by the cock (*e*). The sulphuric acid used contains approximately the same percentage of water as the nitrating acid which it displaces. The rate of flow is about 2½ ins. vertical height per hour. The sulphuric acid is next displaced by running water on to the top plate (*c*) through the central pipe (*f*), the sulphuric acid being drawn off through the cock (*g*), which is so adjusted that the rates of flow through *f* and *g* are the same.—G. W. McD.



United States Patents.

Powder ; Process of making smokeless ——. M. A. G. Himalaya, Washington. U.S. Pat. 853,085, May 7, 1907.

Potassium chlorate is mixed to a paste with about one-third of its weight of water. A second paste is formed by mixing starch with an equal weight of water. These two pastes are incorporated together at 80° C. with the addition of manganese dioxide and a drying oil, and then pressed into the required form and dried.—G. W. McD.

Explosive ; Nitroglycerin ——. F. J. H. Reewer, Hamburg, Germany. U.S. Pat. 853,830, May 14, 1907.

See Fr. Pat. 351,805 of 1905 ; this J., 1905, 903.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

(*Continued from page* 646.)

APPARATUS, &c.

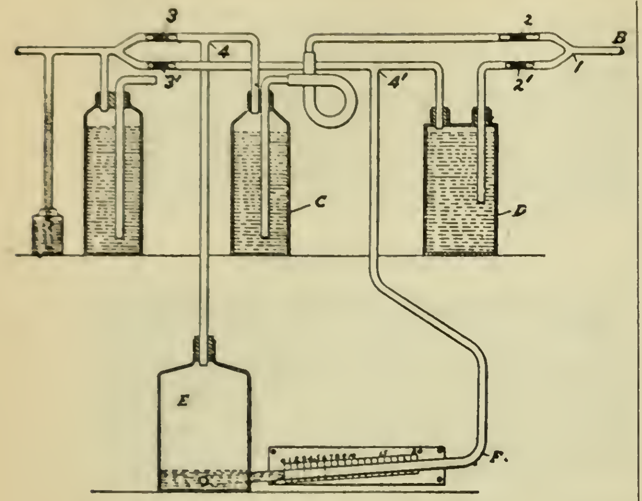
Calorimetric bomb ; Rate of combustion and pressure developed in a ——. F. G. Benedict and F. P. Fletcher. J. Amer. Chem. Soc., 1907, 29, 739—757.

The authors burned different substances (gunpowder, cellulose, benzoic acid, fat from fæces, edestin, sugar, plasmon, fæces, alcohol, bituminous coal, and anthracite in a Berthelot-Atwater bomb calorimeter, and determined the rate of combustion and maximum pressure developed. The results, given in tables, show that with an initial pressure of 300 lb., the maximum pressure developed rarely exceeds 700 lb. With increase of the quantity of material burned and of the initial pressure, the maximum pressure rises, but not proportionally. The use of a medium-size capsule to contain the material causes a decrease both in the maximum pressure and the rate of combustion ; smaller and larger capsules have a similar but much less marked effect. A similar effect is also observed when solid materials are used in the form of pellets. The addition of inert material (powdered quartz or sodium chloride) to the combustible substance, considerably retards the rate of combustion, but is practically without effect on the maximum pressure developed. Comparative experiments with bituminous coal and anthracite showed that with the latter, the maximum pressures are low and the rate of combustion extremely slow.—A. S.

United States Patent.

Gases ; Apparatus for analysing ——. W. Jones, Assignor to Jones-Julia Manufacturing Co., New York. U.S. Pat. 854,696, May 21, 1907.

The mixture of gases is drawn into the apparatus at B, and distributed into two streams by the Y-piece, 1, 2, 2′. The stream of gas passing through 2′, is drawn through the vessel, D, which contains a liquid capable of absorbing one constituent of the gaseous mixture, and the stream passing through 2, is drawn through the vessel, C, which contains a liquid which does not absorb any of the gases present. The streams of gas issuing from the vessels, D, C, are united at 3, 3′, and the tube is connected to the suction apparatus, each stream of gas being previously connected as shown at 4′, and 4, with one side of a differential manometer, F, E. The indications of the manometer show the difference in the tensions of the



original and the residual gas, and from these indications the percentage of the absorbed constituent can be deduced. —W. H. C.

French Patents.

Calorimeter ; Thermo-electric ——. C. Féry. Fr. Pat. 373,230, Nov. 26, 1906.

Fig. 1.

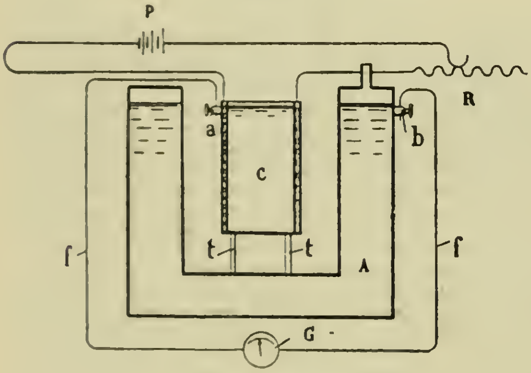
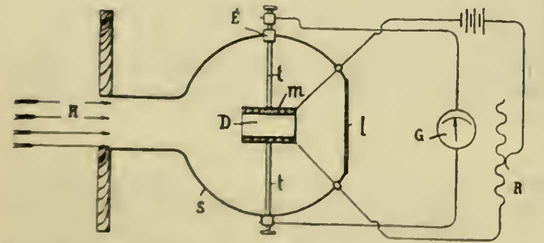


Fig. 2.



The rise in temperature is measured by a thermo-couple, the warmed junction of which forms the calorimetric part proper of the apparatus. The instrument is standardised by utilising the heating effect of an electric current of known and easily reproducible amount. If it is desired to measure the heat given off by a chemical reaction, or the rise in temperature of a liquid when a warm body is immersed in it, the apparatus shown in Fig. 1. is used. The calorimeter vessel, *c*, is supported within the outer protecting vessel, A, by rods of "constantan," *t*, *t*. The latter is an alloy of copper and nickel of high thermo-electric power. The points, *a*, *b*, are connected by the wires, *f*, *f*, to the galvanometer, G, and the temperature is found from the indications of the latter. The apparatus is standardised by passing a current from the battery, *p*, regulated by the rheostat, R, through the coil imbedded in the walls of the vessel, *c*. An apparatus is also shown for measuring the heat of combustion of a gas. By the use of a modified lamp, the heat of combustion of oils can also be determined. Radiant heat is measured by the apparatus shown in Fig. 2. The heat rays, H, are received in the blackened cylinder, D, supported in the sphere, S, by the rods of "constantan," *t*, *t*, insulated at E. A ground glass plate, *l*, allows the instrument to be accurately pointed at the source of radiant heat, and the readings are taken on the galvanometer, G. The calibration is effected by heating the coil, *m*, imbedded in the walls of the cylinder, D, by a current from the battery, P, regulated by the rheostat, R.—W. H. C.

INORGANIC—QUALITATIVE.

Willemite ; Detection of —— *by phosphorescence.* E. K. Judd. X., page 695.

INORGANIC—QUANTITATIVE.

Nickel ; A new method of determining ——, *and its application in the separation of nickel from cobalt and zinc.* H. Grossmann and B. Schück. Chem.-Zeit., 1907, 31, 535—536.

The method is based upon the authors' qualitative test for nickel (this J. 1906, 1120) by means of a solution of dicyanodiamidine sulphate, which is capable of detecting 0·005 part of nickel in 1000. The concentrated solution of the nickel salt is treated with the reagent (about 2 to 3 grms. either in solid form, or, preferably, in solution, to 0·5 grm. of nickel sulphate), a few c.c. of a solution of ammonium chloride added, and the liquid rendered strongly alkaline with ammonia. To the blue solution there is added, with stirring, a 10 per cent. solution of sodium hydroxide in slight excess, and the resulting crystalline precipitate is allowed to stand 6 hours, and then collected, washed with ammoniacal water, ignited (apart from the filter), and weighed as sulphate. Or, the precipitate may be dissolved in acid, the solution rendered alkaline with ammonia, and the nickel precipitated electrolytically.

Separation of nickel from cobalt.—In order to prevent a simultaneous precipitation of cobalt with the nickel, it is essential to convert the former into the tervalent condition. The following method is recommended:—The solution of the nickel and cobalt salts is treated with a few drops of ammonium chloride solution, and ammonia added until any precipitate is redissolved, and the liquid has a preceptible ammoniacal odour. A few c.c. of a 10 per cent. solution of hydrogen peroxide are now introduced, and the beaker set aside for half an hour, after which the nickel is precipitated as described. The cobalt in the filtrate can be determined electrolytically, though not by precipitation with potassium nitrite and acetic acid. It may also be precipitated as sulphide, which is converted into sulphate and weighed. The method affords an easy means of detecting nickel and cobalt together. For this purpose the sulphides are dissolved in *aqua regia*, and the solution evaporated nearly to dryness and treated as in the quantitative method. In the presence of nickel and cobalt the liquid above the precipitate has more or less of a red colour. In this way the authors detected traces of nickel in highly purified cobalt oxide, whilst impure samples contained 0·93 and 1·39 per cent. of nickel respectively.

Separation of nickel from zinc:—The method of separation is practically the same as in the case of cobalt. —C. A. M.

Tin ; Electrolytic determination of —— *with the use of a rotating anode.* L. F. Witmer. J. Amer. Chem. Soc., 1907, 29, 473—477.

The author finds that up to 0·8 grm. of tin can be determined accurately from an ammonium sulphide electrolyte by the use of Exner's rotating anode (this J., 1903, 1150). The speed of rotation of the anode has little or no effect on the character of the tin deposit. An adherent deposit of sulphur forms on the anode. The deposition of the tin is hastened by heating the electrolyte, but retarded by polysulphides.—A. S.

Cadmium from zinc as sulphide in the presence of trichloroacetic acid; Separation of ——. J. J. Fox. Chem. Soc. Proc. 1907, **23**, 147.

A CONVENIENT method of separating cadmium from zinc as sulphide is furnished by the use of trichloroacetic acid. The quantity of trichloroacetic acid required is at least 10 grms. per 100 c.c. of solution, but much greater concentrations can be used without affecting the precipitation of cadmium as sulphide. Even when the amount of the cadmium is small (5 mgrms. per 100 c.c.), concentrations of trichloroacetic acid as great as 30 grms. of acid per 100 c.c. do not prevent the whole of the cadmium being precipitated. In this respect, trichloroacetic acid differs from both hydrochloric and sulphuric acids. For the complete separation of cadmium and zinc, two precipitations are desirable; this is unnecessary, however, when the proportions of cadmium and zinc are about equal, or when the cadmium is present in excess. If the presence of trichloroacetic acid is objectionable in the subsequent treatment of the solutions, a first partial separation of zinc and cadmium may be effected by the use of 1 grm. of hydrogen chloride per 100 c.c. of solution.

Mercury; A volumetric method of determining ——. P. W. Robertson. Chem. News, 1907, **95**, 253—254.

THE double thiocyanate of mercury and zinc, $ZnHg(CNS)_4$, prepared by Clève about 50 years ago, (J. prakt. Chem., **91**, 227), is practically insoluble in solution of a zinc salt, and the author utilises this fact for the volumetric determination of mercury. A solution of the mercuric salt (containing about 0·04 grm. of mercury), free from chlorides, is treated with 10 c.c. of $N/10$ ammonium thiocyanate solution and excess of zinc sulphate solution. The precipitate is filtered off and washed several times with dilute zinc sulphate solution, the filtrate is treated with 10 c.c. of $N/10$ silver nitrate solution, and the excess of silver is titrated with thiocyanate; 1 c.c. of thiocyanate is equivalent to 0·005 grm. of mercury. Mercurous salts are first oxidised by boiling with nitric acid, which does not affect the results.—A. S.

Titanium; Colorimetric determination of ——. J. H. Walton, jun. J. Amer. Chem. Soc., 1907, **29**, 481—485.

IT has been observed previously that in an alkaline solution containing excess of hydrogen peroxide, titanium remains dissolved. A soluble compound of titanium is also formed when substances containing this metal are fused with sodium peroxide, and the author makes use of this for the colorimetric determination of small quantities of the metal. In presence of iron, the results are too low; this difficulty can be avoided by the addition of phosphoric acid, but as the latter weakens the yellow colour of the titanium solution, it is necessary to add an equal amount to the standard solution. Hydrofluoric acid also weakens the colour of titanium solutions. One grm. of the substance containing titanium is fused with 8 grms. of sodium peroxide in an iron, nickel, or silver crucible, and, after cooling, the mass is extracted with 200 c.c. of water (the temperature must not be allowed to rise too high in this operation, otherwise some titanium is precipitated), the solution is treated with 15 c.c. of sulphuric acid of sp. gr. 1·4, and 6 c.c. of 50 per cent. phosphoric acid, then made up to 250 c.c., and the colour compared with that of a standard solution of titanium to which a corresponding quantity of phosphoric acid has been added.—A. S.

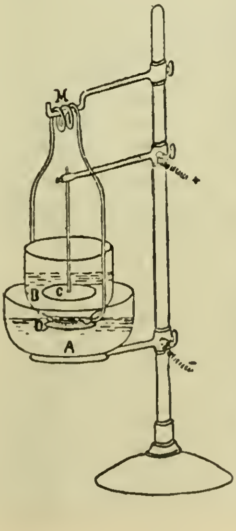
Titanium; Volumetric determination of ——. G. Gallo. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 325—330. Chem. Zentr., 1907, **1**, 1600—1601.

THE method is based upon the reduction of titanic acid and its salts to titanium sesquioxide by metallic zinc in a solution containing 10 c.c. of sulphuric acid (sp. gr. 1·3) per 100 c.c. The reduction is effected in an atmosphere of carbon dioxide in a flask fitted with a Bunsen valve, and at a temperature not exceeding 10° C. The zinc is added gradually. After 12 hours, the solution is filtered through glass-wool into a flask through which carbon dioxide is passing, and the residue washed 2 or 3 times with cold, boiled water, saturated with carbon dioxide. The filtrate is treated with 3 c.c. of a saturated solution of potassium thiocyanate, and titrated cold with ferric ammonium sulphate solution.

$$Ti_2(SO_4)_3 + Fe_2(SO_4)_3 = 2Ti(SO_4)_2 + 2FeSO_4.$$

If iron be present, the solution, after the reduction, is divided into two portions, in one of which the titanium is determined, and in the other the two metals together by means of permanganate; a blank experiment with permanganate is always necessary. For the determination of titanium in cast iron and steel, 5—10 grms. of the metal are dissolved in 40—80 cc. of nitric acid of sp. gr. 1·2, the solution evaporated to dryness, and the residue ignited with 5 grms. of ammonium nitrate, and dissolved in 30—50 cc. of hydrochloric acid. The solution is boiled, diluted with water, and the solution decanted off and evaporated to dryness. The residue is fused with 4 parts of potassium bisulphate for about ¼ hour, the cooled mass dissolved in cold water, with the aid of a current of air, the filtered solution acidified with sulphuric acid and reduced with zinc, and the titanium determined as described above. In the analysis of silicates, iron, aluminium, and titanium are precipitated by ammonium chloride and ammonia in the filtrate from the silica, and the precipitate is washed, dried, ignited, and weighed. It is then fused with 4—5 times its weight of potassium bisulphate, and the iron and titanium determined as above. For the analysis of bauxite, 0·5 grm. of the powdered material is fused with 8 grms. of potassium bisulphate, the cooled mass is extracted with cold water, and the solution filtered. Any platinum dissolved from the crucible is precipitated by hydrogen sulphide, and, after filtering, the hydrogen sulphide is expelled, and iron and titanium are determined volumetrically in one portion of the solution, and iron, titanium, and aluminium precipitated by ammonia in another portion. If zirconium be present, the precipitate produced with ammonia is boiled with excess of potassium hydroxide solution, and after acidifying with nitric acid, the aluminium is precipitated with ammonia in the filtrate, whilst the residue is dissolved in hydrochloric acid, the iron, titanium, and zirconium re-precipitated with ammonia, the precipitate washed, dried, and weighed, then fused with potassium bisulphate, and the iron and titanium determined volumetrically.
—A. S.

Iron; Quantitative separation of —— *from titanium and aluminium. Use of a diaphragm in electrolytic analysis.* G. Magri and G. Ercolini. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 331—336. Chem. Zentr., 1907, **1**, 1705—1706.



THE substance is fused with potassium bisulphate, the mass dissolved in cold water, and evaporated repeatedly (but not at too high a temperature) with concentrated sulphuric acid. The resulting syrupy liquid is poured into water, filtered, excess of potassium-sodium tartrate and ammonia added, and after again filtering, the iron is separated electrolytically. The apparatus used is shown in the figure. The platinum dish, A, forms the cathode, whilst the platinum anode, C, is suspended within the glass vessel, B, which is closed by parchment paper, D, and carried by the glass support, M. The solution containing the iron, aluminium, and titanium is placed in A, and water rendered conductive by means of sodium hydroxide, in B. The iron is separated in a compact form, free from carbon, by using an E.M.F. of 110 volts, the current density at the cathode being ND$_{100}$ = 0·39 rising to 0·78; the separation may take 24 hours, and care must be taken that the anode liquid does not become too acid, nor the cathode liquid too alkaline. The dish, A, with the deposited iron, is washed with water and then with alcohol, and dried at 90° C. The solution from both A and B, together with the diaphragm and washings, is acidified with sulphuric acid and evaporated until the tartaric acid and the diaphragm are completely carbonised; the residue is dissolved in concentrated sulphuric acid, and poured into water containing ammonia and ammonium chloride. The precipitated aluminium and titanium are filtered off, washed, the aluminium hydroxide dissolved by heating with sodium hydroxide solution of 26° B., and the residual titanic anhydride washed, dried and weighed.—A. S.

Beryllium; Separation and determination of ——. C. L. Parsons and S. K. Barnes. Z. anal. Chem., 1907, **46**, 292—298.

An almost perfect separation of beryllium from aluminium (and iron) is obtained by pouring a boiling solution of the mixed chlorides, neutralised with ammonia, into a nearly boiling 10 per cent. solution of sodium bicarbonate, boiling the whole for one-half minute, quickly cooling, and filtering off the precipitated aluminium hydroxide, which is dissolved in hydrochloric acid, and reprecipitated as above. The beryllium is recovered from the filtrates by acidifying, boiling off the carbon dioxide, and precipitating with ammonia. It should be washed with ammonium acetate to prevent it from passing through the filter.—A. G. L.

Tungsten in steel; Alkalimetric method for the determination of ——. S. C. Lind and B. C. Trueblood. X., page 695.

Lithopone; Analysis of ——. F. Repiton. XIIIA., page 700.

ORGANIC—QUALITATIVE.

Cocoanut oil; Detection of —— *in butter.* W. Ludwig and H. Haupt. Z. Untersuch. Nahr. Genussm., 1907, **13**, 605—610.

A solution of furfuramide may be used for the detection of cocoanut oil in butter. When furfural reacts with aniline hydrochloride, there is formed an intense red coloration due to furfuraniline, $C_4H_3OCH(C_6H_4.NH_2)_2$. This substance is decomposed by an aqueous solution of ammonia, with formation of furfuramide, $(C_5H_4O)_3N_2$. In preparing the reagent, a solution of 0·5 grm. of aniline hydrochloride in 25 c.c. of 96 per cent. alcohol is treated with a mixture of 5 c.c. of a 1 per cent. alcoholic solution of furfural and 1 c.c. of phenol (to act as a catalytic agent) and the liquid titrated with a 5 per cent. solution of ammonia (about 10 drops being required) of which 2 drops are added in excess of the amount needed to change the red colour to reddish-yellow. After standing for 2 hours, the reagent is ready for use. About 20 drops of the mixed fatty acids of the fat under examination are dissolved in 5 c.c. of 96 per cent. alcohol, the solution shaken once with 0·5 c.c. of the reagent, and the open test-tube set aside. All fatty acids of the series $C_nH_{2n}O_2$, react with the furfuramide reagent, combining with ammonia and causing the formation of furfuraniline, and the lower the molecular weight of the fatty acid, the more energetic is the reaction. In the case of oleic acid, however, the reaction goes further; not only is the ammonia of the furfuramide dissolved, but the formation of the furfuraniline is also prevented, owing to its combining whilst in the nascent state with the oleic acid, and the liquid becomes yellow instead of red. Oleic acid is also able to prevent saturated fatty acids yielding the red-coloured furfuraniline, provided it be present in sufficient excess. In the case of mixtures of butter-fat with cocoanut oil, oleic and lauric acids are in conflict, and on the relative proportions of the two in the mixed fatty acids depend both the rise or fall in the optical refraction, and also the occurrence or absence of the colour reaction with the furfuramide reagent. A reduction in the amount of oleic acid in butter fatty acids points to the presence of lauric acid derived from the cocoanut oil, the result being a lowering of the refraction and the production of the colour reaction in the test. Thus, the addition of 20 per cent. of cocoanut oil to butter lowers the refractometer reading of the fatty acids from about 29°—31° at 40° C. to about 25·9°, and causes the appearance of the red coloration with the furfuramide reagent.—C. A. M.

Lard; Detection of adulteration of —— *with cocoanut oil.* L. Robin. Ann. Chim. anal. appl., 1907, **12**, 87—89. Chem. Zentr., 1907, **1**, 1513—1514.

The method proposed by the author for the detection of cocoanut oil in butter (this J., 1906, 1055), can also be employed in the examination of lard. The following results have been obtained:—

	Pure lard.	Lard to which cocoanut oil had been added to the extent of:		
		5 per cent.	10 per cent.	15 per cent.
Acids soluble in alcohol	2·46—2·65	3·54—3·60	4·38—4·58	5·76
Acids insoluble in water (a)	2·40—2·55	3·19—3·29	3·90—4·02	5·16
Acids soluble in water (b)	0·06—0·12	0·25—0·40	0·42—0·56	0·60
Ratio number, $\frac{a}{b} \times 10$	205—410	79—124	67—94	86

If a lard is adulterated with cocoanut oil, the value for the fatty acids soluble in alcohol is greater than 3, the ratio number is much less than 200, and the ratio of the saponification value to the value of the acids soluble in alcohol is less than 65.—A. S.

Adrenaline; A new characteristic reaction of ——. A. Gunn and E. F. Harrison. XX., page 714.

Sucrose in plant tissues; Detection of —— *by means of invertase.* E. Bourquelot. Arch. Pharm., 1907, **245**, 164—171.

Pure top yeast, free from contamination with bacteria, is washed with sterilised water, drained, stirred with 8 to 10 times its weight of 95 per cent. alcohol, and set aside for 12—15 hours. The mass is then collected, drained with the aid of a filter-pump, washed first with a little alcohol, then with ether, and dried quickly at 30°—35° C. The residue so obtained containing the invertase must be carefully protected from moisture. One grm. of it, rubbed down with 100 c.c. of water to which thymol has been added, and filtered, gives a clear, very active solution, which may be kept for a week. 250 grms. of the fresh plant tissues are sliced over a vessel containing boiling 95 per cent. alcohol, so that the slices fall into the boiling spirit without stopping the ebullition; the flask is then attached to a vertical condenser, and boiling continued for about 20 minutes in order to destroy the natural enzymes and oxydases of the plant. Calcium carbonate is then added to the alcoholic solution, the spirit is distilled off, and the residue is made up to 250 c.c. with "thymolised water." This aqueous solution is divided into two portions, one of 50 c.c. to be used in a blank experiment, the other of 200 c.c. to be hydrolysed. To the latter, 1 grm. of the powder containing invertase is added, and both solutions, in suitable flasks, are maintained at 25°—30° C. for two days. Twenty c.c. are then withdrawn from each flask, and treated with 4 c.c. of lead acetate solution; both are filtered, and the optical rotation of the two filtrates determined. Out of 64 species of plants thus examined, indication of the presence of free sucrose was obtained with 57; whilst in five others, the presence of combined, or a mixture of free and combined sucrose was found. Only two species, *Fucus* and *Selaginella*, gave negative results. Harlay (*Thèse doct. de l'Univers. de Paris*, 1905) found sucrose in 39 species out of 50 examined; J. Vintilesco detected it in six out of seven species of Oleaceous plants; Bourquelot and Danjou in five species of *Sambucus* and three of *Viburnum*, and Danjou later in three Caprifoliaceous plants, *Symphoricarpus*, *Diervillia* and *Lonicera*. O. Remeaud (*Compt. rend. Biol.*, 1906, **61**, 400) in 10 species of the N.O. *Ranunculaceæ*. Sucrose appears to be a widely distributed and essential reserve material in all plants containing chlorophyll, and is present constantly in all organs of the plant. It is not directly assimilable but is hydrolysed in the plant by an invertase which accompanies it.—J. O. B.

Glucosides in plants ; Detection of —— by means of emulsin. E. Bourquelot. Arch. Pharm., 1907, **245**, 172—180.

EMULSIN, from sweet almonds, has recently been employed for demonstrating the presence of glucosides in a large number of plants. The blanched almonds are finely crushed in a mortar, and each 100 grms. of the paste obtained, are macerated with 200 c.c. of equal volumes of distilled water and saturated chloroform water, for about 24 hours at the normal temperature. The mixture is strained, pressed, and the liquid obtained treated with 10 drops of glacial acetic acid to precipitate casein. After filtering, 500 c.c. of 95 per cent. alcohol are added, the precipitate is collected, drained, washed with a mixture of equal volumes of ether and alcohol, and dried, *in vacuo*, over sulphuric acid. The emulsin preparation is thus obtained in horny translucent flakes which give an almost white powder ; it retains its activity for a prolonged period, if stored in a well closed bottle. To detect glucosides in plant tissues, the material is treated with boiling alcohol, as described, for the detection of sucrose by means of invertase (see preceding abstract). Since the emulsin preparation is not a simple substance, but contains lactase, gentiobiase, and often invertase, the aqueous solution of the alcoholic extract of the material under examination must first be hydrolysed with yeast invertase, to eliminate the effects of the action of the invertase contained in the emulsin. When this hydrolysis is complete, the liquid is heated to 100° C. for 10 minutes to destroy the invertase, cooled, and then treated with the emulsin preparation. After this second hydrolysis, the optical rotation, if any, occasioned by the emulsin is observed in the usual manner.

Operating in this manner, the presence of glucosides has been indicated in the following plants :—Fresh subterranean organs : *Aucuba japonica, Colchicum autumnale, Digitalis purpurea, Dipsacus pilosus, Jasminium nudiflorum, Loroglossum hircinum, Scrophularia nodosa, Valeriana officinalis, Verbascum thapsus.* Fresh barks :—*Betula alba, Fraxinus excelsior, Ligustrum lucidum, L. spicatum, L. vulgare, Syringa vulgaris, Sambucus nigra,* Dried seeds :—*Aucuba japonica, Hibiscus esculentus, Strychnos bakanko, S. ignatia, S. nux-vomica, S. potatorum.* Leaves :—*Diervilla japonica, Lonicera periclymenum, Sambucus ebulus, S. laciniata, S. pyramidalis, S. nigra, S. racemosa, Symphoricarpus racemosa, Viburnum lantana, V. opulus, V. tinus, Jasminium nudiflorum, Ligustrum japonicum, L. lucidum, L. spicatum, L. vulgare, Syringa persica, S. vulgaris, Anemone nemorosa, A. pulsatilla ; Aquilegia vulgaris, Delphinium elatum, Ficaria ranunculoides, Helleborus fetidus, Ranunculus bulbosus, R. repens, Taxus baccata ; Cephalotaxus drupacea, C. pedunculata ; Podocarpus sinensis, Torreya myristica ; Juniperus sabina, J. virginiana.*—J. O. B.

ORGANIC—QUANTITATIVE.

Ammonia, monomethylamine, and other fatty amines ; Separation, detection, and determination of ——. M. François. J. Pharm. Chim., 1907, **25**, 517—522, 523—528.

THE aqueous solution of ammonia and methylamine, containing approximately 7 grms. of the former and 70 grms. of the latter in 2 litres, is shaken for one hour with excess of mercuric oxide ; it is then filtered, and the insoluble portion is washed with a little water. The filtrate is treated with 40 c.c. of sodium hydroxide solution, 40 c.c. of saturated solution of sodium carbonate, and 100 grms. of mercuric oxide. Agitation is repeated for 1 hour and the mixture is filtered, and the filter allowed to drain. The filtrate is free from ammonia, and only requires to be distilled to recover the methylamine.

Detection of ammonia in methylamine. A reagent is prepared by dissolving in water 22·7 grms. of mercuric iodide, 33 grms. of potassium iodide, and 35 grms. of sodium hydroxide free from ammonia, and adjusting the volume to 1 litre. 0·1 grm. of the methylamine hydrochloride is dissolved in 15 c.c. of water, 5 c.c of the reagent are added, and the mixture is slowly warmed. In the presence of 1:500 of ammonium chloride, a copious reddish-brown precipitate is formed. If more than this quantity be present, the precipitate is formed in the cold.

Determination of ammonia and methylamine Not more than 0·5 grm. of the mixed hydrochlorides, dried at 110° C, is dissolved in water ; 7 c.c. of 30 per cent. solution of sodium hydroxide, 10 c.c. of 20 per cent. solution of crystallised sodium carbonate, and 5 grms. of mercuric oxide are added and the volume adjusted to exactly 250 c.c. The mixture, protected from light, is continuously shaken for one hour. The vessel is then set aside for an hour. In 50 c.c. of the clear solution, the methylamine is determined by distilling with excess of sodium hydroxide, and collecting the vapours in $N/1$ sulphuric acid. The ammonia in the precipitate is determined by washing the latter by decantation with water containing 20 c.c. of 30 per cent. sodium hydroxide solution and 40 c.c. of 40 per cent. sodium carbonate solution, adding 50 grms. of potassium iodide to liberate the ammonia and distilling in the usual manner. The methods are applicable to mixtures of ammonia with dimethylamine, trimethylamine, and the ethylamines, but with di- and trimethylamine, the detection of the ammonia is rendered more certain by substituting 5 c.c. of $N/1$ sodium hydroxide for 5 c.c. of the water.—J. O. B.

Lignitic and sub-bituminous coals ; Analysis of ——. A. J. Cox. II., page 674.

Tannin analysis ; Report of the Chairman (H. R. Procter) to the members of the International Commission on ——. XIV., page 702.

Tannins ; Action of formaldehyde on ——. F. Jean and C. Frabot, XIV., page 702.

Glue testing by means of Cambon's "fusiometer." S. Küttner and C. Ulrich. XIV., page 703.

Syrup ; Determination of capillary —— in sugar products. A. Herzfeld. XVI., page 704.

Protein-content of barley ; Colorimetric determination of the —— by means of Millon's reagent. C. J. Lintner. XVII., page 705.

Beer analysis ; Report on methods of ——. H. E. Barnard. XVII., page 707.

Meat extracts ; Testing ——. O. Hehner. XVIII*A*., page 709.

ERRATUM. This J. 1907, 645, col. 2, l. 23 and 24 from bottom, *for* " barium " *read* " bismuth."

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

(*Continued from page* 647.)

Radium emanation and its products ; Effect of high temperatures on ——. W. Makower and S. Russ. Roy. Soc. Proc., 1907, *A*, **79**, 158—166.

THE change in activity observed when radium emanation is heated, is not due to any alteration in the emanation itself, since its " time period " is not altered when it is kept at a temperature of 1100° C. The change is due to a change either in radium *B* or in radium *C*, since the activity of a mixture of the two is altered by heating ; it is probably due to some influence of temperature on radium *C*. (Compare this J., 1907, 436.)—T. F. B.

Trade Report.

Patents, Designs and Trade Marks. Twenty-fourth Report of the Comptroller-General. 164. Wyman & Sons, Fetter Lane, London, E.C. Price 6d.

THIS report deals with the work of the Patent Office during the year 1906. The number of applications for patents during that year, as compared with the two preceding years, is shown by the following table:—

—	1904.	1905.	1906.
Patents—			
Applications	29,702	27,577	30,002
Specifications—			
Provisional	22,461	19,862	21,012
Complete	15,925	18,806	18,228
Sealed	15,089	14,786	14,707

Omitting the figures for 1905, on account of certain disturbing factors, the total number of applications in 1906 is 1 per cent. higher than that of 1904, and the number of complete specifications is 14 per cent. higher. This would appear to indicate that the provisions of the Patents Act, 1902, have materially increased the substantiality of a patent, and, in the words of the report, that "inventors generally have appreciated the benefits which the official search has conferred upon them." Of the 15,369 cases accepted after search, 8·5 per cent. were reported as wholly anticipated and 53·6 per cent. as anticipated in part, the remaining 37·9 per cent. being free from anticipation. Amendment to meet the matter revealed by the search was made in 8,785 cases, and specific references to prior patents inserted (under Rule 10) in 556 cases. This last figure is 3·6 per cent. of the total number searched, and shows a marked advance on the 1·4 per cent. for 1905. The hearings held at the Patent Office in connexion with cases under search, as prescribed by section 1 (vi.) of the Act, number 2,308, three of which have been further carried on appeal to the law officer, who has upheld the Comptroller's decision twice and reversed it once. As in 1905, no petition for the grant of a compulsory licence has been filed, a fact which shows section 3 of the Act to have fallen absolutely short of its predicted effects, and demonstrates the urgent need for an altered procedure in this connexion, such as is contemplated in Mr. Lloyd-George's Bill, now on the eve of becoming law.

With regard to subject matter of inventions, advances are seen in metals and alloys, centrifugal drying, and indiarubber. Telegraphs and electrolysis are the only two electrical classes which have maintained their previous figures. Gas manufacture, on the other hand, has risen by 6 per cent., the improvements being mostly relevant to inverted incandescent burners. The report only contains one reference to the chemical industry in respect of the trend of invention in 1906. This is to the effect that a considerable increase in connection with dyes comprising new sulphur analogues of the indigo series marks an important advance due to scientific research.

CHEMICAL TRADE OF BORDEAUX.

Pharm. J., June 15, 1907.

THE following table shows the quantity of chemical products exported from Bordeaux in 1906:—

Chemicals.	Quantity.	Increase or Decrease (1905).	Average, Five Years, 1902–06.
	Cwts.	Cwts.	Cwts.
Acids	18,070	—13,559	21,403
Tannin extracts	364,780	+17,440	302,072
Oxides	9,957	+ 4,800	5,847
Salts, etc.	13,502	—18,660	29,878
Acetates of copper	1,641	— 220	2,442
Glycerin	2,614	— 4,402	5,191
Kermes (mineral)	1,901	— 1,185	1,670
Wine lees	4,970	— 3,280	8,006
Crude tartar	59,688	— 8,071	45,980
Cream of tartar	31,238	—19,736	40,544
Tartar crystals	758	+ 758	196
Superphosphate of lime	128,210	—64,076	93,158
Coal-tar products	8,797	+ 7,974	2,895

Exports of chemicals to the United Kingdom in 1906 were:—

Chemicals.	Quantity.	Increase or Decrease (1905).	Average, Five Years, 1902–06.
	Cwts.	Cwts.	Cwts.
Acids	2,866	— 1,194	6,258
Tannin extracts	307,659	+ 41,654	227,519
Oxides	1,665	— 823	1,539
Acetates of copper	327	+ 10	434
Glycerin	309	— 2,571	1,982
Kermes (mineral)	111	+ 91	82
Crude tartar	14,101	— 16,279	15,859
Cream of tartar	27,377	— 18,817	37,282
Tartar crystals	758	+ 758	163

The Customs Returns show the following total importation of chemicals during 1906:—

Chemicals.	Quantity.	Increase or Decrease (1905).	Average, Five Years, 1902–06.
	Cwts.	Cwts.	Cwts.
Acids	3,476	+ 1,829	5,455
Oxides	3,824	+ 1,025	2,267
Tannin extracts	19,555	+ 15,863	6,287
Salts, etc.	59,253	+ 51,673	106,697
Carbonates, nitrates, chlorides, etc.	59,028	— 86,050	82,995
Sulphates, tartrates, superphosphates, etc.	396,618	+ 50,546	383,734
Chemical manures	113,738	+ 22,236	132,299
Prepared dyes	1,607	— 235	1,999
Colours, etc.	4,120	+ 623	4,457
Coal-tar products	64,645	— 25,089	108,839

The following chemicals were imported from the United Kingdom in 1906:—

Chemicals.	Quantity.	Increase or Decrease (1905).	Average, Five years, 1902–06.
	Cwts.	Cwts.	Cwts.
Acids	545	— 63	545
Oxides	113	+ 53	86
Tannin extracts	1,167	+ 1,147	332
Salts, etc.	2,506	+ 1,592	2,130
Carbonates, nitrates, kermes mineral, etc.	1,298	— 271	1,567
Sulphates, tartrates, superphosphates, etc.	169,869	—109,874	257,821
Chemical manures	23,597	— 24,058	45,419
Prepared dyes	1,244	+ 100	40
Colours, etc.	1,989	+ 164	1,742
Coal-tar products	63,190	— 13,073	98,206

New Books.

LABORATORIUMSBUCH FÜR DEN EISENHÜTTENCHEMIKER. Von MAX ORTHEY. Verlag von Wilhelm Knapp, Halle a. S. 1907. Price M. 1.80.

8vo volume, containing 49 pages of subject-matter with 11 illustrations. The table of contents serves as index, and gives also the scheme of arrangement:—I. Ores. II. Iron and Steel. III. Copper, Antimony and Tin. IV. Nickel and Cobalt. V. Chromium. VI. Vanadium. Tungsten. Molybdenum. Aluminium. Titanium. VII. Slags. VIII. Basic Additions. IX. Acid Additions or Mixtures, and Fireproof Products. X. Coals and Cokes. XI. Gases.

MERCEOLOGIA TECNICA. VOLUME I. MATERIE PRIME. Greggio o Semi-Lavorate di uso commerciale ed industriale. Dr. P. E. ALESSANDRI. Ulrico Hoepli, Milan. 1907. Price L.6.

SMALL 8vo containing 508 pages of subject matter, with 142 tables, and 93 illustrations, with alphabetical index.

The following subjects are treated of:—I. Fuels. II. Metals. III. Alloys. IV. Building Materials. V. Timber. VI. Dyewoods. VII. Tanning Materials. VIII. Tanning Hides, Skins, &c. IX. Animal Textile Fibres. X. Vegetable Textile Fibres. XI. Paper. XII. Gums, Starch, Gelatin, Glues, &c. XIII. Fats. XIV. Mineral Oils, Lubricants, &c. XV. Varnishes. XVI. Perfumery. XVII. Saccharine Matters. XVIII. a. Coffee, Tea and Cocoa. b. Spices and Aromatics. XIX. Preserved and Dried Fruits, Citric Fruits, &c. XX. Cereals, and Leguminous Products. XXI. Wheat and other Flours, Bran and Starch. XXII. Milk and Cream. XXIII. Milk, Butter, Cheese, &c. XXIV. Fresh and Preserved Meats.

Volume II. Prodotti Chimici Inorganice ed Organici di uso commerciale ed industriale. Price L.6.

Like the foregoing, but containing 492 pages of subject matter, with alphabetical index, and 83 tables; also 16 illustrations. The following subjects are considered:—I. Mineral Acids. II. Organic Acids. III. Acidimetry. IV. Fatty Products. V. Alkaline Products. VI. Alkalimetry. VII. Soaps and Saponification. VIII. Mordants. IX. Pigments, Paints, &c. X. Colouring and Staining Glass and Porcelain, Enamels. XI. Coal Tar Dyestuffs. XII. Bleaching Materials. XIII. Photographic and Galvanoplastic Materials. XIV. Metals superficially deposited. XV. Explosives. XVI. Inorganic Antiseptics, Disinfectants, and Germicides. XVII. *Ditto*, Organic and Organometallic. XVIII. Fertilising Materials. XIX. Glucose and Alcoholic Fermentations. XX. Commercial Spirits and their Products. XXI. Alcoholimetry. XXII. Other Industrial Alcohols and their Derivatives. XXIII. Wines. XXIV. Beer, and Vinegars. XXV. Diseases of Trades and Industries.

Caoutchouc e Gutta-Percha. Dr. Luigi Settimj, Chimico nel Laboratorio Centrale delle Gabelle, Roma. Ulrico Hoepli, Editore Libraio della Real Casa, Milano. 1907. Price L.3.

Small 8vo volume, containing 253 pages of subject matter, with 14 illustrations. The subject matter is arranged under the following heads:—Part I.—Caoutchouc. i. Introduction. ii. Botanical Origin. Process of Collecting, &c. iii. Properties. Chemical Composition of the Latex, &c. iv. Vulcanizing. v. Various Processes of Manufacturing India-Rubber. vi. Ingredients Employed in the Vulcanisation of Rubber. vii. Imitations of Caoutchouc and Gutta-Percha. viii. Oils, Vegetable, Animal and Mineral used with Caoutchouc and Its Solutions. ix. Solvents used in Preparing Objects with a Caoutchouc Base. x. Pigments used for Colouring Caoutchouc. xi. Processes for Waterproofing, and Miscellaneous Purposes. xii. General Methods for the Analysis of Caoutchouc, Raw and Manufactured. Part II.—Gutta Percha. i. Introduction. ii. Botanical Origin. iii. Properties. Chemical Composition. iv. Gutta-Percha Manufacture. v. Chemical Analysis of Gutta-Percha. Part III.—General Considerations on the Caoutchouc and Gutta-Percha Industries. Duties and Trade Returns in Italy with regard to Caoutchouc and Gutta-Percha.

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1906. Vol. II. [Cd. 3,529]. Price 3s. 4d.

This, the second volume of the Annual Statement of Trade, contains statements of the trade of the United Kingdom with each foreign country and British Possession during each of the years from 1902 to 1906 inclusive, and of the imports and exports at various British and Irish ports during the same periods, as well as accounts of transhipment, warehousing, and goods passing in transit.

Japanese Paper Mills. For. Off. Misc. Ser., No. 660.

This is a report by the Second Assistant in H.M. Consular Service in Japan on the activity recently shown in the development of the paper-making industry in Japan. The majority of the mills use steam for the necessary motive power. The steady increase in the price of rags is the cause of the increasing use of wood pulp, large quantities of which have to be imported owing to the insufficient native supply; consequently a considerable reduction in the import duty has been made. The discovery of a method of making wood pulp from bamboo-grass, which is very common in Japan, is also referred to.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

12,781. Planckh. Distilling and boiling apparatus. June 3.

12,880. Hamilton. Evaporators. June 4.

13,058. Lübecker Apparatebau, and Köhn. Method of vaporising liquids.* June 5.

13,128. Caygill. Drying furnaces. June 6.

13,357. Macherski and Koperski. Improvement or refining of liquids.* June 8.

13,501. Coward. Concentrators. June 11.

13,510. Sepulchre. Freeing gases from solid and liquid particles.* June 11.

13,515. Lindskog. Evaporation of liquids and power production. June 11.

13,529. Place. Apparatus for liquefying air.* June 11.

13,569. Fitzpatrick (Leslie). Automatic filtering machine. June 12.

13,585. Wolff. Liquid filters. [Ger. Appl., June 16, 1906.]* June 12.

13,598. Mazza. Apparatus for separating the constituent elements of gaseous mixtures.* June 12.

13,790. Hildebrandt. Apparatus for liquefying gases having low boiling points, or for distilling such liquefied gases.* June 14.

Complete Specifications Accepted.

16,248 (1906). Morse. Determining high temperatures. June 12.

17,081 (1906). Trottier. Apparatus for classifying solids by their dimensions and specific gravity. June 12.

26,464 (1906). Bergmann. Surface apparatus for heating and cooling fluids. June 19.

2775 (1907). Clements and Wheeler. Drying chambers. June 12.

2795 (1907). Daiber and Gammel. Drying apparatus. June 19.

II.—FUEL, GAS, AND LIGHT.

Applications.

342a. Clarke, Chapman, and Co., Ltd., and Robson. Combined gas producer and ammonia or equivalent generator.* June 7.

12,841. Cowper-Coles. Production of smokeless fuel. June 3.

13,149. Terrell. Manufacture of incandescent mantles. June 6.

13,413. Cowper-Coles. Manufacture of smokeless fuel. June 10.

13,435. McKay and Duncan. Utilising the product from small coke, small iron and other ores, blast furnace flue dust, &c. June 10.

13,550. Bentley and Hopkinson. Removing tar and other impurities from gases. June 12.

13,615. Cowper-Coles. Manufacture of coal briquettes. June 12.

13,620. Siemens. Regenerative gas furnaces.* June 12.

13,668. Wahlen and Caro. Utilising waste coal or coke.* June 13.

13,669. Caro. Utilising waste coal.* June 13.

13,728. Warmsley. Apparatus for producing combustible gas from petrol or other spirit or oil. June 13.

13,766. Southworth. Coking furnaces. June 14.

13,804. Siemens. Regenerative gas furnaces. June 14.

Complete Specifications Accepted.

13,598 (1906). Newton. Gas producers. June 12.

13,956 (1906). Justice (Deuts. Gasglühlicht A.-G.). Metallic filament for electric glow lamps. June 19.

14,496 (1906). Flössel. *See under* X.

18,256 (1906). Clark (Dellwik-Fleischer Wassergas Ges.). Water-gas producers. June 19.

29,471 (1906). Wilson. Gas washing machines. June 12.

2123 (1907). Siemens und Halske A.-G. Manufacture of incandescence filaments for electric lamps from thorium. June 12.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

12,829. Hood and Salamon. Purification of mineral oils. June 3.

13,508. Pagès, Camus, and Duchemin. Manufacture of acetone. [Fr. Appl., July 27, 1906.]* June 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

13,148. Imray (Soc. Chem. Ind. in Basle). Manufacture of monochloromonobromo derivatives of indigo. June 6.

13,164. Tompkins, and The Clayton Aniline Co., Ltd. Manufacture of red colouring matter. June 6.

13,176. Imbert. Production of aromatic glycin derivatives.* June 6.

13,406. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the safranine series. June 10.

13,428. Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of indophenol-like condensation products. [Ger. Appl., June 27, 1906.]* June 10.

13,686. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series and the employment thereof in dyeing and printing. June 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

12,831. Ransford (Cassella und Co.). Method of dyeing wool. June 3.

12,863. Smith. Manufacture of warp printed fabrics. June 4.

12,928. Mayer. Dyeing apparatus. June 4.

13,132. Newton (Bayer und Co.). Production of multicoloured effects on mixed wool and cotton goods by dyeing with sulphur colouring matters. June 6.

13,518. Ratignier, and Pervilhac et Cie. Manufacture of artificial fabrics. [Fr. Appl., Feb. 19, 1907.]* June 11.

13,539. Dreaper. Manufacture of filaments from cellulose. June 12.

13,567. Beer. Printing on woven fabric or paper. June 12.

13,686. Newton (Bayer und Co.). *See under* IV.

13,831. Giesler. Apparatus for treating wool and the like.* June 14.

13,868. Dreaper. Machinery suitable for the preparation of artificial silk and the like. June 15.

Complete Specifications Accepted.

14,918 (1906). Spenle. Bleaching kiers. June 19.

16,142 (1906). Blachon and Peretmère. Treatment of fibrous plants for the obtainment of the fibres therefrom. June 12.

20,494 (1906). Hunt and Moscrop. Means for bleaching, scouring, dyeing, or otherwise treating fabrics in the open condition. June 19.

28,982 (1906). Simon. Process of weighting silks. June 19.

1193 (1907). Blumenthal and Wolff. Mordanting fibrous materials. June 19.

3500 (1907). Ges. f. Chem. Ind. in Basel. Dyeing with sulphurised dyestuffs cotton mixed with wool or silk. June 19.

VII.—ACIDS, ALKALIS, AND SALTS.

Application.

342A. Clarke, Chapman, and Co., and Robson. *See under* II.

Complete Specifications Accepted.

17,461 (1906). Morton, and United Alkali Co. Furnaces for burning pyrites or the like. June 12.

23,130 (1906). Raschen, Shores, Wareing, and United Alkali Co. Purification of sulphuric acid and recovery of by products therefrom. June 19.

3811 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable solid zinc hydrosulphite. June 19.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

13,533. Twyford and Moore. Gas-fired pottery and other kilns or ovens. June 11.

Complete Specifications Accepted.

12,603 (1906). Fourcault. Apparatus for drawing glass. June 12.

12,815 (1906). Fourcault. Apparatus for drawing glass. June 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Application.

13,811. Associated Portland Cement Manufacturers (1900), Ltd., and Butchard. Manufacture of concrete.* June 14.

Complete Specifications Accepted.

14,030 (1906). Hamblet. Arched kilns for burning bricks. June 12.

15,677 (1906). Thwaite. Burning or calcining calcareous or argillaceous substances in rotary furnaces or kilns. June 12.

15,734 (1906). Collins. Refractory materials. June 19.

20,125 (1906). Schnell, Mayer, and Hartwich. Substitute for wood. June 12.

22,442 (1906). Tuke. Kiln for burning bricks. June 12.

X.—METALLURGY.

Applications.

13,254. Snyder. Treatment of ores.* June 7.

13,266. Woodbury. Ore concentrating machines.* June 7.

13,268. Hoover and Sulman. Ore concentration. June 7.

13,415. Moore and Heskett. Direct reduction of iron ore and its subsequent treatment for the manufacture of wrought iron and steel. June 10.

13,435. McKay and Duncan. *See under* II.

13,689. Mrazsek. Soldering aluminium and its alloys. June 13.

13,692. Kauffmann. Ore roasting furnaces.* June 13.

13,696. Küpper's Metallwerke. Soldering aluminium and alloys containing aluminium. [Ger. Appl., June 13, 1906.]* June 13.

13,901. Freygang. Apparatus for washing or extracting minerals. June 15.

Complete Specifications Accepted.

13,935 (1906). Cattaneo and Schlesinger. Apparatus for drying blast air for metallurgical purposes. June 19.

14,496 (1906). Flössel. Apparatus for purifying blast-furnace and other impure gases. June 19.

22,166 (1906). Carrick and Pattison. Smelting ores containing sulphides. June 12.

414 (1907). Jumau. Metallurgical and electrometallurgical process for the production of pure copper. June 12.

590 and 591 (1907). Jumau. Extraction of copper from its ores. June 12.

6522 (1907). Nya Ackumulator Aktiebolaget Jungner. Alloys for the metallic parts of accumulators with invariable electrolyte. June 19.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

13,137. Wheatley and Lark. Disposition of metallic alloys by electrolysis. June 6.

13,342. Richardson and Vaughan. Electrical treatment of gases or vapours, especially air or oxygen. June 8.

13,891. Tate. Apparatus for treating liquids electrolytically.* June 15.

Complete Specifications Accepted.

13,023 (1906). De Hemptinne. Oxidising liquids with aid of electrical discharges. June 12.

18,435 (1906). Pauling. Production of electric discharges. June 19.

414. (1907) Jumau. *See under* X.

5887 (1907). Dekker. Apparatus for treating minerals by electrolysis. June 12.

6522 (1907). Nya Ackumulator Aktiebolaget Jungner. *See under* X.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

12,849. Finlay. Production of soap. June 3.

13,042. Crosfield and Sons, Ltd., and Markel. Manufacture of soap.* June 5.

13,701. Verein. Chem. Werke. Bleaching fats, oils, resins, waxes, and the like. [Ger. Appl., Aug. 11, 1906.] June 13.

Complete Specification Accepted.

10,960 (1906). Field. Process for refining oils, fats, waxes, or the like. June 19.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Application.

13,136. Lörincz Festékgyár Betéti Tarsaság, Gyula, and Konstantin. Production of paints, coverings, &c.* June 6.

Complete Specification Accepted.

22,781 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of colour lakes. June 19.

(*B.*)—Resins, Varnishes.

Application.

13,701. Verein. Chem. Werke. *See under* XII.

Complete Specification Accepted.

12,885 (1906). Groppler. Method of obtaining copal. June 12.

(*C.*)—India-Rubber.

Application.

13,908. Kempter. Apparatus for washing caoutchouc, guttapercha, and similar substances.* June 15.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Application.

13,475. Dunn and Dunn. Manufacture of Russia leather. June 11.

XVI.—SUGAR, STARCH, GUM, Etc.

Application.

12,762. Eastick. Process of purifying and making invert sugar and syrup. June 3.

XVII.—BREWING, WINES, SPIRITS, Etc.

Complete Specifications Accepted.

16,510 (1906). Newlands. Production of alcohol from wood. June 19.

18,611 (1906). Grosfils. Process of fermenting worts. June 12.

24,093 (1906). Fritsche. Process of fermenting distillery washes. June 12.

27,417 (1906). Orval. Malt kilns and other drying sheds. June 19.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Complete Specifications Accepted.

18,292 (1906). Miles and von Romocki. Manufacture of human food from fruit kernels. June 19.

28,707 (1906). Hearson (Moenninghoff). Pasteurising gas-containing liquids under pressure. June 12.

4289 (1907). Finan. Composition for preserving foods. June 12.

(*B.*)—Sanitation; Water Purification.

Applications.

13,357. Koperski and Macherski. *See under* I.

13,522. Harris. Process and apparatus for purifying liquids.* June 11.

Complete Specifications Accepted.

13,264 (1906). Travis. Purification of sewage or other liquids. June 12.

25,940 (1906). Hinkson, and Hinkson Electric Liquid Purifying Co. Water purifiers. June 12.

1079 (1907). Ryder and Wilson. Materials for purifying air. June 19.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

13,023. Rouxeville. Substitute for celluloid and the like. [Fr. Appl., June 5, 1906.]* June 5.

13,744. Caldwell. Apparatus for treating pulp. June 14.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

12,889. Scheitlin. Production of 1-phenyl-2.3-dimethyl-4-sulphaminopyrazolone. [Ger. Appl., Feb. 13, 1907.]* June 4.

13,045. Weizmann, and The Clayton Aniline Co. Treatment of turpentine for use in the manufacture of pinene hydrochloride. June 5.

13,383. Scheitlin. Production of 1-phenyl-2.3-dimethyl-4-dimethylaminopyrazolone. [Ger. Appl., Feb. 13, 1907.]* June 10.

13,411. Johnson (Chem. Fabr. Griesheim-Elektron). Manufacture of acetylene tetrachloride. June 10.

13,599. Zimmermann (Chem. Fabr. auf Aktien, orm. E. Schering). Manufacture of 3.4-dioxyphenylglyoxime and 3.4-dioxyphenylalkylglyoximes. June 12.

13,600. Zimmermann (Chem. Fabr. auf Aktien, vorm. E. Schering). Manufacture of substances useful in therapeutics. June 12.

Complete Specifications Accepted.

13,054 (1906). Dreyfus, and Clayton Aniline Co. Manufacture of aromatic sulphinic acids. June 12.

23,648a (1906). Newton (Bayer und Co.). Manufacture of monoiodobehenic acid. June 19.

23,875a (1906). Weizmann, and Clayton Aniline Co. Manufacture of isobornyl esters and by-products. June 19.

24,826 (1906). Uhlmann. Manufacture of the sodium salts of aromatic sulphonic acids. June 19.

5542 (1907). Vilmar. Production of an arbutin derivative. June 12.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

13,736. De Ruiter. Production of preparations sensitive to light and suitable for photographic purposes. June 13.

13,835. Kelly. Photographic sensitive surfaces. June 14.

13,874. Donisthorpe. Colour photography and photographic printing. June 15.

XXII.—EXPLOSIVES, MATCHES, Etc.

Complete Specification Accepted.

791 (1907). Duttenhofer. Manufacture of explosives. June 12.

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MR. R. J. FRISWELL IN THE CHAIR.

THE NATURE OF THE CHANGES INVOLVED IN THE PRODUCTION AND SETTING OF PLASTER OF PARIS.

BY W. A. DAVIS.

Introductory.

In the history of chemistry plaster of Paris holds a position of exceptional interest, inasmuch as it afforded to Lavoisier the subject of his first scientific investigation. In two papers (1) presented to the Academy of Sciences in 1765 and 1766, Lavoisier concluded

(1) That the crystallised gypsum of Montmartre or "specular stone" is a "salt," formed by the union of the "acid of vitriol" with the earth of lime, containing water of crystallisation which can be driven off by a gentle heat, the product being the so called Plaster of Paris;

(2) That overheated plaster will not set with water;

(3) That the setting of plaster of Paris with water "is nothing more than a simple crystallisation"; gypsum deprived of its water by fire reabsorbs it with avidity and again becomes crystalline.

Lavoisier considered that his experiments no longer "left any doubt as to the cause of the hardening of plaster" and that there remained "rien à désirer sur l'explication de ce phénomène." Since that time however, the problem has proved to be one of extraordinary difficulty, and, in spite of many investigations made by such well known chemists as Marignac, Le Chatelier, and Van't Hoff, an amount of confusion exists with regard to the subject which is almost without parallel in inorganic chemistry. During the past six years alone more than a dozen papers have appeared presenting new results. In the present communication I wish to consider first the data already available for discussing the problem and then to present certain results which throw a new light on the question. Whilst it cannot be claimed that the problem is entirely elucidated and although many details yet remain to be investigated, I believe that its general nature is now made clear.

During more than a century after Lavoisier's papers, no further systematic study of plaster was attempted. In 1884, however, Le Chatelier (2) made an investigation of the conditions under which plaster is formed. He first determined the time rate of rise of temperature of a quantity of powdered gypsum heated in a glass tube immersed in a bath of paraffin, the temperature of which was raised at a steady rate. I have plotted the results obtained in Figure I. Up to 128° the temperature rose steadily but at this point a long interval was observed (about ¼ hour) during which the temperature remained constant; a further steady rise then occurred until 163° was reached when a second but shorter break was observed, followed by another continuous rise. Another set of experiments was then made to determine the loss of weight experienced by gypsum when heated at 155°: the results are plotted in Figure II. At 155° water was given off continuously until a loss of 15·6 per cent. of the weight of gypsum had occurred, the residue corresponding in composition with the formula, $CaSO_4,\frac{1}{2}H_2O$. No further change of weight occurred until the material was heated at 194° (Figure III.), when the residual water was driven off, the product left being anhydrous.

From these experiments Le Chatelier concluded

(1) "That the dehydration of gypsum is incomplete at 155°, but can be completed by heating at 194°":

(2) "That the loss of water during the first stage is quite definite and corresponds exactly with 1·5 mols. H_2O." The product formed is identical with the so called half-hydrate, $CaSO_4,\frac{1}{2}H_2O$, the formation of which had been observed previously by Johnston (3) in a steam boiler working at a temperature of 121°. and by Hoppe Seyler (4) on heating gypsum with water at 140—160°.

Le Chatelier showed, moreover, that the half-hydrate can be prepared by heating a saturated solution of calcium sulphate in a sealed tube at 130—150°, but the method has the disadvantage that, unless special precautions are taken to remove the water rapidly before it cools much below 130°, the half-hydrate rapidly undergoes re-hydration.

To Le Chatelier is due the explanation of the setting of plaster of Paris which is now generally accepted. He utilised the observation of Marignac (5) that plaster of Paris when stirred with water gives a much more concentrated solution of calcium sulphate than can be prepared from powdered gypsum; the solution so obtained, being supersaturated with regard to gypsum, in a short time deposits crystals consisting of this substance. Le Chatelier considers that in the setting of plaster a supersaturated solution is formed between the particles, that minute crystals of gypsum then separate, followed by the dissolution of more plaster and the subsequent separation of more gypsum; this process being repeated until the whole of the plaster is converted into a compact mass made up of minute crystals of gypsum. The probability that this is a correct explanation appears enhanced by the fact, cited by Le Chatelier, that anhydrous sodium sulphate, which gives with water at the ordinary temperature a solution supersaturated with regard to $Na_2SO_4,10H_2O$, from which the latter salt soon separates in a coherent mass, also "sets" when moistened with water. The "hardening" of zinc oxide in contact with a solution of zinc chloride in like manner appears to be preceded by the formation of a "supersaturated" solution from which crystals of zinc oxychloride subsequently separate.

The relationship between gypsum and the half-hydrate was first studied in a systematic manner in 1899 by E. F. Armstrong[6], who took up the question in connection with the problem of the formation of oceanic salt deposits, exemplified by the Strassfurt beds. A simple method was devised for preparing the half-hydrate in well defined crystals, which consisted in leaving powdered gypsum in contact with nitric acid of sp. gr. 1·4 during 18 hours at 40°—50°; by this treatment the half-hydrate was obtained in well formed, minute needles. Measurements were made by a number of ingenious methods of the vapour pressure of the water of crystallisation of gypsum in equilibrium with the half-hydrate at different temperatures. From these measurements it would appear that the vapour pressure of gypsum in forming half-hydrate becomes equal to 1 atmosphere at a temperature of 101°·45 C., whilst at a temperature of about 107°, the vapour pressure of the water of crystallisation of gypsum becomes greater than the vapour pressure of water itself. The temperature of 107° is therefore the transformation point of gypsum into half-hydrate when in contact with water: that is to say, when gypsum is heated (under pressure) with water at a higher temperature than 107°, the half-hydrate should be formed: below 107°, water should convert half hydrate into gypsum. In presence of aqueous solutions having a lower vapour pressure than water, the temperature of transformation of gypsum into half-hydrate is lowered: thus, a saturated solution of common salt converts gypsum into half-hydrate above 77°, the temperature at which the vapour pressure of the system gypsum—half-hydrate becomes equal to the vapour pressure of the saturated solution. In contact with a saturated solution of magnesium chloride, the conversion of gypsum into half-hydrate occurs at so low a temperature as 11°.

In 1901, Van't Hoff, Hinrichsen, and Weigert (6) stated that although at 107° gypsum in presence of water is converted into half-hydrate, at lower temperatures it gives rise under certain special circumstances[*] to an anhydrous calcium sulphate that differs from natural anhydrite (which does not "set" with water) in being fairly readily soluble in water, and in "setting" even more rapidly than the half-hydrate. This anhydrous form was considered to be formed directly from gypsum, and not through the half-hydrate: the vapour pressure of gypsum in equilibrium with this so called "soluble anhydrite" being greater than that of gypsum in equilibrium with half-hydrate. From the vapour tension measurements which were made, it would appear that the transformation temperature of gypsum into soluble anhydrite in contact with water is lower, *viz.* 93°, than the temperature of transformation of gypsum into half-hydrate (*viz.* 107°). The production from gypsum of the half-hydrate in Armstrong's experiments, in preference to soluble anhydrite, is explained by assuming that, for some reason not properly defined, a "suspension" of the change gypsum→soluble anhydrite occurs.

Van't Hoff considers that a second transformation of gypsum, namely that which gives rise to natural anhydrite, should theoretically occur at an even lower temperature, but is also prevented normally from taking place; the data given by Van't Hoff and his co-workers would indicate that the temperature of transformation of gypsum in contact with water into natural, non-setting anhydrite, is as low as 63°·5. The following table summarises Van't Hoff's results (8) of the measurement of the vapour pressures of gypsum in equilibrium with half-hydrate, soluble anhydrite and ordinary anhydrite: the vapour pressure of water and of saturated solutions of common salt and magnesium chloride are given for comparison :—

Temp.	Vapour pressure of water.	Saturated solution of		Pressure of gypsum in forming		
		Sodium chloride.	Magnesium chloride.	Half Hydrate.	Soluble Anhydrite.	Ordinary Anhydrite.
0°	4·57	4·2	1·34	1·17	1·52	2·06
10	9·14	6·9	2·82	2·78	3·55	4·79
20	17·4	13·0	5·6	6·24	7·77	10·5
30	31·5	23·4		12·7	16·1	21·6
40	54·9	40·8		26·3	31·8	42·5
50	92	68·3		50	59·9	79·7
60	149	111		91·4	108	143
70	233	173		161	188	63½=175
80	355	263		272	316	
90	526			446	513	
100	760			711	93°=588	
110	1073			107°=971		

Conversion temperatures of gypsum into

	In presence of		Pressure of water in mm.
	Water.	Saturated sodium chloride.	
	°C.	°C.	
Natural anhydrite	63·5	36	17·5
Soluble do.	93	62	588
Half-hydrate[†]	107	76	971

In the present paper the work of other investigators will also be referred to.

Discussion of previous work.

My attention was first drawn to the study of gypsum whilst working on the basic carbonates of magnesium, an account of which has already been given to this Society (this J., 1906, 788). Certain phenomena of supersaturation and "setting" were then encountered which closely resembled those known to occur in the case of calcium sulphate. In reading the literature of the subject, several points appeared to present difficulty and uncertainty, particularly in the work of Van't Hoff and his associates: a brief account of these will now be given.

In the first place the manner in which dry gypsum undergoes complete dehydration is very uncertain (see Appendix I.).[*] According to Le Chatelier, dehydration occurs in two stages, the half-hydrate, $CaSO_4,\frac{1}{2}H_2O$, being formed at 128°, and subsequently undergoing decomposition at about 163°. Other workers maintain, however, that gypsum can be completely dehydrated at so low a temperature as 70° C. Van't Hoff's views would lead one to form the opinion that the production of the anhydrous substance at this temperature is exceptional and due to the transformation of gypsum directly into one or other of the two forms of anhydrite: the change of gypsum into ordinary anhydrite (in presence of water) occurring theoretically at 63°·5 C., the change into soluble anhydrite at 93°. But the conditions which serve to determine the production from gypsum of either the half hydrate, soluble anhydrite, or ordinary anhydrite respectively appear to be very ill defined, action occurring in one or the other direction more or less fitfully (see Appendix II.). That the half-hydrate is nearly always formed when dry gypsum is heated appears remarkable in view of the fact that, at any given temperature the vapour pressure of gypsum in forming natural anhydrite very much exceeds, according to the data given by Van't Hoff and his co-workers, that of gypsum in forming the half-hydrate. One would infer indeed that natural anhydrite should, in the ordinary processes of plaster making, be formed in preference to either the half-hydrate or soluble anhydrite, whereas the half-hydrate is almost invariably produced, soluble anhydrite being, however, obtained in some rare instances (Cloez converted 20 grams of gypsum into soluble anhydrite by heating it during 4 hours at 145°). Ordinary non-setting anhydrite is formed, on the other hand, only when gypsum is heated for a prolonged period at a very high temperature. The reason brought forward by Van't Hoff to explain the production of the half-hydrate in preference to one of the anhydrites—that it is due to "suspended transformation"—itself needs an explanation. From his data, moreover, Van't Hoff has calculated that the half-hydrate should undergo transformation into natural anhydrite at so low a temperature as —70° C. In the ordinary process of making plaster, the temperature used (150° to 200° C.) is from 220° to 270° above this transformation point and the comparative stability of the half-hydrate—even its formation at all—are difficult to understand under such conditions. When moreover an anhydrous product is obtained at low temperatures, as in Cloez's experiments, it is invariably soluble anhydrite (*i.e.*, a material capable of setting rapidly like ordinary plaster), not the non-setting anhydrite identical with the naturally occurring mineral of that name. Natural anhydrite is, however, formed on strongly igniting such a product.

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[*] Soluble anhydrite is formed according to Van't Hoff when precipitated gypsum is heated in a vacuum over concentrated sulphuric acid at 60—90°, or when gypsum, regenerated from plaster by the action of water, is heated at 100°.

[†] Under atmospheric pressure, 101½° C. In presence of saturated $MgCl_2.6H_2O$, 11° C.

[*] In order to maintain a clear narrative a number of points of detail likely to obscure the issues are relegated to the appendix; a reference is given to the latter where necessary.

The difficulties enumerated do not stand alone. From the vapour pressure relations of the system gypsum-natural anhydrite and the solubility of gypsum, Van't Hoff deduces an expression (p. 292*)

$$\log c' = 45{\cdot}3815 - 16{\cdot}25\left(\frac{103.9}{T} + \log T\right)$$

to give the solubility of natural anhydrite in water at different temperatures. Whilst this formula gives for 200° C. a value for the solubility in fair agreement with that actually observed, it is altogether inapplicable at low temperatures. At 20° C. the theoretical solubility calculated from the formula is 3·408 grams per litre which is not only far greater than has actually been observed for natural anhydrite† but is considerably greater than the solubility of gypsum itself at this temperature. One would therefore anticipate that, as in the case of the half-hydrate (or soluble anhydrite) natural anhydrite would readily give a solution supersaturated with regard to gypsum; in virtue of this fact, and in accordance with Le Chatelier's explanation of the "setting" of plaster of Paris, it should, like the half-hydrate or soluble anhydrite, "set" when moistened with water. As a matter of fact, natural anhydrite cannot be made to set in this way, and it only changes into gypsum in contact with water after a very prolonged period. Van't Hoff himself seems to be uncertain on this point, and speaks in contradictory terms of the solubility of natural anhydrite. At one place (p. 276) he states that it "sich äusserst schwer löst und entsprechend sehr langsam Gips bildet," whilst elsewhere (p. 297) he regards the same anhydrite as "bedeutend löslicher als Gips."

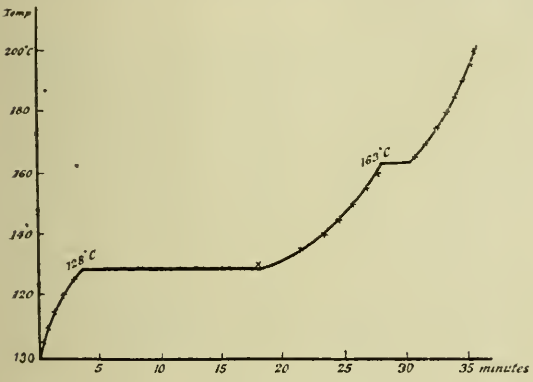

Fig. 1

A theoretical formula, giving the supposed solubility of the half-hydrate at different temperatures, was also deduced by Van't Hoff thermo-dynamically from the vapour pressure relations of the system gypsum—half-hydrate. This expression gives for the solubility of the half-hydrate at 25°, a value of 4·20 grms. per litre. Now Marignac observed at the same temperature an actual solubility for the half-hydrate of 10 to 12 grams per litre, the true solubility being perhaps even greater than this. Such a discrepancy between the "theoretical" and observed solubility appeared to me to require some other explanation than that given by Van't Hoff—that it is due to "incomplete ionisation."

Another point concerning which considerable uncertainty exists is the relationship between "soluble anhydrite" and the half-hydrate. Cloez (⁹) was the first to recognise that soluble anhydrite is very hygroscopic, and that it rapidly absorbs about 8 per cent. of its weight of moisture from the atmosphere: beyond this point no further absorption occurred. Although the amount of water so taken up only slightly exceeds that corresponding with the formation of the half-hydrate (*viz.* 6·6 per cent.), Cloez considered that "cette limite ne correspond à aucun hydrate défini." On the other hand Van't Hoff held that the half-hydrate is produced in this case, together with some gypsum, but overlooked the important fact that, if such an assumption were true, it would entirely invalidate the method he used to determine the vapour pressure of the system gypsum—soluble anhydrite. For, in order that the pressures attributed to this system should be really applicable to it, it is necessary that the change expressed by the equation,

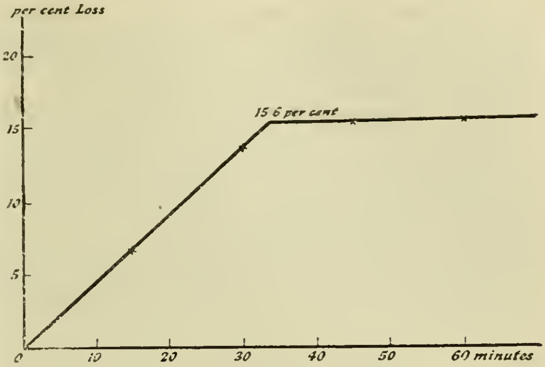

Fig. 2.

$$CaSO_4,\ 2H_2O \rightleftarrows \underset{\text{Soluble anhydrite}}{CaSO_4} + 2H_2O$$

should be strictly reversible: that is, the re-hydration of soluble anhydrite by water vapour should give gypsum directly. If, as Van't Hoff himself assumes, soluble anhydrite forms the half-hydrate when exposed to water vapour, the method he adopted to determine the vapour pressure of the system, gypsum-soluble anhydrite (which consisted in bringing the soluble anhydrite contained in a tensimeter in contact with half the quantity of water vapour theoretically necessary to convert it into gypsum), would give the pressure corresponding to the system dihydrate—half-hydrate. Actually, however, the values observed were found to be different from those obtained by Armstrong for this pair of substances.

In view of the difficulties presented in the foregoing account, it appeared desirable to make some fresh experiments to ascertain more precisely the nature of the changes occurring during the dehydration of gypsum, and in particular to establish the relationship of soluble anhydrite and the half-hydrate.

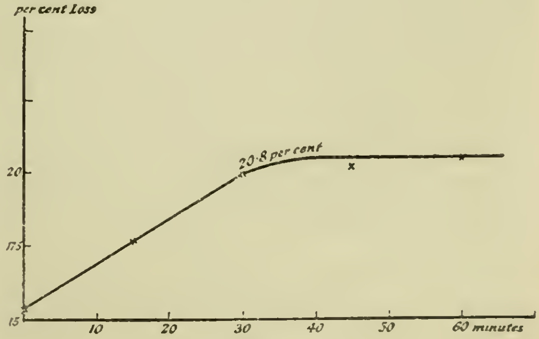

Fig. 3.

Dehydration of gypsum at different temperatures in a current of dry air.—A series of experiments was made by heating 2 grms. of gypsum at fixed temperatures between 98° and 130° C. in a small glass flask, through which a slow stream of dry air was passed at a constant rate (for details see Appendix III.). Fig. 4 summarises the results obtained, the curves showing the rate of dehydration of the gypsum under different conditions (see Appendix, Table I.).

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* The references to pages refer to the complete résumé of the work of Van't Hoff and his associates in the Zeitschrift für Physikalische Chemie (1903, 45, 257).

† The solubility of natural anhydrite is not known with certainty, but it would appear to be exceedingly small. Marignac has shown that it passes into solution only very slowly, at the same time being gradually (in the course of months) converted into gypsum. Solubility determinations are in progress.

Curve A = Thin flakes of selenite at 98°.
Curve B = Duplicate of A with a fresh lot of selenite flakes.
Curve C = Finely powdered "massive" gypsum (sifted through a sieve with 70 meshes to the inch) heated at 98°.
Curve D = Duplicate of C at 98°.
Curve E = Selenite flakes at 108°.
Curve F = Powdered massive gypsum (70 mesh sieve) at 108°.
Curve G = Powdered massive gypsum (70 mesh sieve) at 130°.

as compared with its subsequent progress. In one experiment at 100°, practically no water was lost up to the 9th hour, but subsequently the water was expelled fairly rapidly, half of the total water being lost during the next nine hours. Shenstone and Cundall's results were obtained with apparatus essentially similar to that which I employed, although slightly different in detail. In explanation of the initial reluctance of gypsum to give up water, Shenstone and Cundall suggested that in this substance we have to deal with "molecular aggregates of great stability, and that it is only after the gradual breaking up of these that dissociation can take place."

It is now generally recognised that a "period of induction" at the beginning of a change is an indication that the latter is not of a simple character, but takes place in a series of stages (compare Mellor, Chemical Statics and Dynamics, p. 116 *et seq*). Evidence will now be brought forward to show that the first change which occurs when gypsum is heated is its transformation into a second form of the dihydrate $CaSO_4,2H_2O$, which differs from gypsum by crystallising in the orthorhombic instead of the monosymmetric system. It would, indeed, appear that gypsum as such does not undergo dehydration, but has first to change (during the "period of induction") into this new form. This view is supported not only by the inflection in the curves of dehydration already referred to, but by the peculiar changes which are known to occur in the optical properties of crystals of gypsum when heated. At the ordinary temperature, the optic axes of gypsum lie in the plane of symmetry of the crystal, but on heating they revolve, so as to take up a position at right angles to this plane at a temperature slightly above 100°, and before dehydration begins. The formation of (apparently) orthorhombic needles within the crystals of gypsum can, indeed, be actually observed: according to Lacroix(11), on heating a plate of gypsum, "long needles appear, elongated in the direction of the vertical axis of gypsum and giving a rigidly longitudinal extinction." These observations, for which an explanation is wanting, are in accord with my view that the dehydration of gypsum is preceded by a change from the monosymmetric to the orthorhombic system. It is, moreover, a noteworthy fact that all the products of the dehydration of gypsum (*viz.* half-hydrate, soluble anhydrite and ordinary anhydrite) are orthorhombic in symmetry (see Appendix IV.), and that in the dehydration of the half-hydrate to soluble anhydrite, which is unattended by any change of system, no "period of induction" has been detected, the loss of water beginning immediately the material is heated.

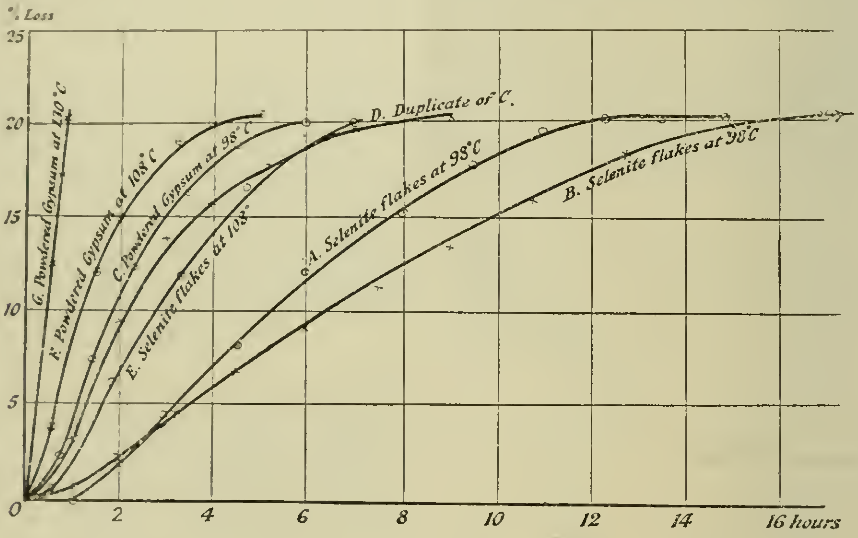

Fig. 4.

In all cases the loss of water took place continuously and in every case dehydration was complete, the product invariably being soluble anhydrite, characterised by its rapidly absorbing water from the air (so as to cause an increase in weight of about 7·0 per cent.), and by its power of setting rapidly when moistened with water. The comparison of duplicate experiments A, B, C, and D shows that, although the general character of the dehydration remains the same, considerable influence is exerted on the rate by the nature of the surface and the fineness of division of the material. In experiments A and B, the same selenite was used, the difference in the slope of the curves being due to a difference in the average size of the flakes. Curves C and D, obtained with the same powdered gypsum, resemble each other more closely. The influence of the state of division of the gypsum on the rate of dehydration is well seen by comparing curves D and E; the loss of water takes place more quickly from powdered gypsum at 98° than from thin flakes of selenite at 108°.

The most striking point with regard to the dehydration is that in all cases the loss of water does not begin immediately the material is heated. This is particularly noticeable in the case of flake selenite: in one experiment, no water was expelled after an hour's heating whilst in the third hour, the loss was nearly 3 per cent. In all the curves there is an inflection showing a "period of induction" at the commencement of the heating, this period being most marked at the lower temperatures. After the experiments were completed, I found that the same observation had been made in 1888 by Shenstone and Cundall,(10), who observed that the loss of water from gypsum heated in a stream of dry air, is complete at 70°, and that it takes place very slowly at the beginning

The remarkable behaviour of the half-hydrate (or soluble anhydrite) on "setting" has been found to afford direct evidence in favour of the view that an orthorhombic form of the dihydrate, $CaSO_4,2H_2O$, exists. It has always been assumed that the setting of plaster is due to the regeneration of gypsum by the action of water on the half-hydrate. If, however, the setting of the half-hydrate be carefully observed by means of the polarising microscope, not a single gypsum crystal can at first be detected in the set mass; the cake of set material, during the first quarter of an hour after it has hardened to a coherent mass, which is only slightly indented by the finger nail, is made up of crystals showing a straight extinction only, and therefore probably orthorhombic. The first product of the setting of the half-hydrate (or soluble anhydrite) is, indeed, the same orthorhombic dihydrate as is produced in the first stage of the dehydration of gypsum. Gypsum crystals subsequently make their appearance within the set mass owing to the fact that the orthorhombic form of the dihydrate is labile at the ordinary temperature, and undergoes change, more or less rapidly—during the course of several hours or several days, the time varying greatly—into the more stable form gypsum. The series of changes

$$\alpha\ CaSO_4.2H_2O \rightleftarrows \beta\ CaSO_4.2H_2O \rightleftarrows CaSO_4.\tfrac{1}{2}H_2O$$

Gypsum (monosymmetric). Orthorhombic. Half-hydrate (orthorhombic).

is, indeed, strictly reversible. Before gypsum can undergo dehydration to form the half hydrate, it passes into the orthorhombic form of the dihydrate, and the latter is also the first product of the hydration of the half-hydrate.*

The foregoing evidence clearly shows that the dihydrate $CaSO_4,2H_2O$ exists in two forms. Calcium sulphate is, indeed, dimorphous, not only as regards the anhydrous substance (two forms of which, "soluble" and natural anhydrite, are known), but also as regards its dihydrate. After this conclusion had been arrived at, I found that Mylius and von Wrochem (12) had recently shown that dihydrated calcium chromate is also dimorphous, this substance existing in two forms: an α-$CaCrO_4,2H_2O$, which separates in monosymmetric crystals and is isomorphous with gypsum; and a β-$CaCrO_4,2H_2O$, which crystallises in the orthorhombic system, and at the time of its discovery had no analogue in the case of calcium sulphate. There can be little doubt that this form is isomorphous with the new orthorhombic variety of the dihydrate referred to above† and that calcium chromate and calcium sulphate are isodimorphous substances: a fact which not only well illustrates the very close relationship existing between sulphur and chromium, but may even be adduced as a strong argument in favour of the view that an orthorhombic variety of the dihydrate exists in the case of calcium sulphate. It is remarkable that, whereas in the case of calcium sulphate the monosymmetric variety, gypsum, is the stable form at the ordinary temperature (the orthorhombic crystals undergoing change into gypsum), in the case of the chromate the reverse is true—the monosymmetric α-dihydrate changing into the orthorhombic β-dihydrate in contact with its saturated solution.*

Relationship between half-hydrate and soluble anhydrite.—A primary assumption made by Van't Hoff in his investigations, was that "soluble anhydrite" (obtained by heating gypsum in a vacuum over sulphuric acid at 60°—90° C.) is formed directly from gypsum, the half-hydrate not being an intermediate product. The continuity of the curves given in Fig. 4, showing the rate of dehydration of gypsum to soluble anhydrite in a stream of dry air at temperatures between 98° and 130°, would at first sight appear to be in favour of the same view. But an experiment made by heating the half-hydrate (prepared by the nitric acid method, and containing 6·57 per cent. H_2O) in a current of dry air at 98° showed (Fig. 5) that dehydration is complete in less than four hours, the product being soluble anhydrite (see Appendix V.). It is clear, therefore, that the half-hydrate could have been produced initially in the previous cases, and subsequently have lost water, giving soluble anhydrite, the two dehydrations

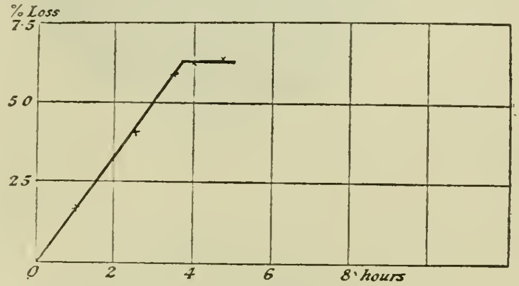

FIG. 5

$$\text{i. } CaSO_4,2H_2O \rightarrow CaSO_4,\tfrac{1}{2}H_2O + 1\tfrac{1}{2}H_2O$$
$$\text{ii. } CaSO_4,\tfrac{1}{2}H_2O \rightarrow \underset{\text{Soluble anhydrite}}{CaSO_4,} + \tfrac{1}{2}H_2O$$

taking place side by side. The correctness of this view became apparent when it was found that on heating gypsum in an open crucible (not in a current of air), in a Victor Meyer vapour bath at 98°, only the half-hydrate was formed, the weight becoming constant after 9 hours (with a loss of 15·2 per cent. of water), and remaining so, even after prolonged heating (8 hours more). Conformably with this, it was found that the half-hydrate (made by the nitric acid method), when heated in an open crucible under the same conditions, did not lose any of its water, even after eighteen hours heating. Shenstone and Cundall, it may be observed, also found that gypsum, which could be completely dehydrated at 70° in a current of dry air, lost only so much water as corresponded with the formation of half-hydrate when heated at 100° in a current of ordinary (undried) air.

It is clear, therefore, that in the formation of soluble anhydrite by heating gypsum, the half-hydrate is produced as an intermediate product. Experiment has, moreover, shown that although the half-hydrate obtained in this way does not lose water when heated in an open vessel at 98°, it gives soluble anhydrite when heated (during about 9 hours) under similar conditions in a toluene vapour bath, registering a temperature of 107°—108°; the dehydration of gypsum (1 grm.) to soluble anhydrite is also complete at the same temperature in about the same time. At 129° (xylene bath), the loss of water takes place much more rapidly, 1 grm. of half-hydrate being completely dehydrated in less than 2 hours, soluble anhydrite being formed; whilst at 145°, as shown by Cloez, 20 grms. of gypsum can be entirely converted into soluble anhydrite in 4 hours.

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* This view would also explain two peculiar phenomena. (1) In spite of the fact that theoretically the setting of plaster is accompanied by a diminution of volume, glass vessels in which plaster is allowed to set are often broken in the process. Van't Hoff has shown by measurements with the dilatometer that in the hydration of plaster a large contraction takes place during the first half hour, and is succeeded by a subsequent but smaller expansion, which continues during several hours. The contraction would correspond with the formation of the orthorhombic $CaSO_4,2H_2O$; the expansion with the conversion of the latter into gypsum. The period of expansion is of considerable practical importance, as it ensures the sharpness of outline so desirable in plaster casts. (2) In attempting to measure the equilibrium pressure of the system gypsum—half-hydrate at 72°, Donnan found that the pressure at first gradually rose until it attained a nearly constant value of 245 mm. after 10 days; subsequent to this the pressure fell, until after another 45 days it again became nearly constant at 186 mm. In the first period, the monosymmetric gypsum was changing into the orthorhombic dihydrate, in the second, equilibrium was established between the latter and the half-hydrate.

† I find that in the final paragraph of a paper on the "Formation of Marine Anhydrite" (Sitzungsber. K. Preuss. Akad., 1900, 294), H. Vater suggested, by analogy with calcium chromate, the possible existence of an orthorhombic form of $CaSO_4.2H_2O$. The suggestion, apparently, has been overlooked by subsequent workers in this field (*added during correction of proof*).

* It is a striking fact and one which probably has a deep significance that nearly all the hydrated sulphates of bivalent metals are dimorphous; thus, for example, $MnSO_4,4H_2O$; $MnSO_4,7H_2O$; $FeSO_4,4H_2O$; $FeSO_4,7H_2O$; $MgSO_4,7H_2O$; $ZnSO_4,6H_2O$; $ZnSO_4,7H_2O$; $NiSO_4,6H_2O$; $NiSO_4,7H_2O$; $CoSO_4.7H_2O$; $CuSO_4,5H_2O$. It is particularly noteworthy that the dimorphism extends to the different hydrates of the same sulphate (*e.g.*, in the case of Mn, Fe, Zn and Ni). In nearly all cases, the two forms crystallise in different systems, generally the orthorhombic and monosymmetric.

From the experiments made in an open crucible, it is clear that, at a temperature below 100°, the vapour pressure of the system, gypsum—half-hydrate, becomes sufficiently great to allow of the loss of water from gypsum to form the half-hydrate—probably because the pressure of the system becomes equal to an atmosphere; but it is only above 100°—between 100° and 108°—that the pressure of the system, half-hydrate—soluble anhydrite, becomes sufficient to allow of the loss of water from the half-hydrate when heated under atmospheric pressure.[*]

It remains to consider the influence of a stream of dry air in modifying the dehydration of gypsum so that it can be made complete at so low temperature as 70°, according to the observations of Shenstone and Cundall, or 98°, according the curves given in Fig. 4. There is little doubt that the complete dehydration under such circumstances is due to the current of dry air removing the water vapour as fast as it is produced, thus preventing its accumulation and the establishment of an equilibrium. The case is, indeed, analogous to the evaporation of water below its boiling point; the complete dehydration of gypsum (or of half-hydrate) at 70° in a stream of air corresponds with the fairly rapid evaporation of water by a stream of dry air at the same temperature. Even at 40°, as observed by Shenstone and Cundall, gypsum loses water to the extent of 3 per cent. in 144 hours when heated in a current of dry air.

Formation of the half-hydrate from soluble anhydrite.—The change, half-hydrate ⇄ soluble anhydrite + water vapour, has been found to be completely reversible. Soluble anhydrite is hygroscopic at the ordinary temperature, and takes up from 7 to 7·5 per cent. of moisture from the air, instead of the 6·62 per cent. calculated for the formation of the half-hydrate. That the excess of water taken up beyond that corresponding with the half-hydrate is, however, only mechanically retained appears evident from the fact that its amount is variable depending on the humidity of the air; no gypsum can be detected in the material formed in this way. If dry air be passed over the material at the ordinary temperature, the excess of water is removed, and the actual absorption of water by the soluble anhydrite becomes equal to 6·4 to 6·6 per cent. If dry air be then passed for a very prolonged period, no further change of weight occurs. Gypsum also, when similarly treated, fails to show any loss of weight. If a known quantity of half-hydrate be converted into soluble anhydrite at 100°, and the product be reconverted into half-hydrate, observing the precautions described to remove the excess of water, the original weight is exactly regenerated. Fig. 6 shows the rate of absorption of water by soluble anhydrite in a stream of ordinary undried air at the ordinary temperature. (See Appendix VI.)

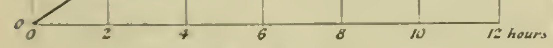

FIG. 6.

It is clear, therefore, that the action of water vapour on soluble anhydrite is to produce the half-hydrate. Several experiments have shown that this action invariably occurs, so that the objections raised on p. 729 to the method used by Van't Hoff in determining the equilibrium pressures of the system, gypsum—soluble anhydrite, are fully justified. It is difficult, as matters stand, to attach any real significance to the results obtained in this way. The foregoing results show, in addition, that Cloez's opinion that a definite hydrate is not formed when soluble anhydrite absorbs water vapour is incorrect.

Nature of ordinary plaster.—The remarks in the present paragraph must be understood to apply only to ordinary plasters, and not to the so-called "hard finish" or "flooring plasters," which need a separate investigation.

From the fact that gypsum loses the whole of its water giving soluble anhydrite at so low a temperature as 106°, it is clear that freshly prepared plaster of Paris may in certain cases consist wholly or partly of soluble anhydrite. Cloez, indeed, considered that the half-hydrate "ne se formait pas pendant la cuisson du plâtre," and also that "it plays no part in the setting of plaster." But the analysis of plaster as usually prepared, either by the "baking" or "boiling" processes, and bottled hot immediately on its removal from the kiln, shows it to contain (see Appendix VII.) from 6 to 8 per cent. of water. One sample, however, was found to contain 3·0 per cent. of water, and to be rapidly hygroscopic, like soluble anhydrite: it no doubt consisted of a mixture of the latter with half-hydrate. Cloez has stated that he found samples of plaster, taken directly from the oven, to be completely anhydrous, and yet to set rapidly with water; these obviously consisted of soluble anhydrite.

The facts already recorded show that, even if soluble anhydrite were to be formed in the manufacture of plaster, it would absorb moisture rapidly from the air, so as to produce the half-hydrate. There can be little doubt that, contrary to Cloez's opinion and in conformity with that of Le Chatelier, the half-hydrate is the essential constituent of ordinary plaster, though it may be accompanied, in exceptional cases, by soluble anhydrite. The fact that the dehydration of gypsum is not usually complete in the ordinary process of manufacture is probably due to the slow rate of change, at the temperature used, of the half-hydrate into soluble anhydrite as compared with that of gypsum into half-hydrate. While water vapour is being emitted from gypsum in the formation of the half-hydrate, the further dehydration of the latter is hardly likely to occur, and it would appear that, in ordinary manufacture, the heating is stopped as soon as no more gypsum remains.

Freshly made plasters may be conveniently grouped according to their character into four divisions:

(1) Those consisting mainly of half-hydrate, containing 6—8 per cent. H_2O. These may contain about 1½ per cent. of moisture held mechanically and removed by a current of dry air. They are not hygroscopic. This class comprises most of the ordinary commercial plasters.

(2) Those containing soluble anhydrite and therefore very hygroscopic, sometimes increasing in weight nearly 1 per cent. in 5 minutes when exposed to the air. Such plasters contain less than 6 per cent. of water.

(3) Plasters containing more than 7·5 per cent. of water, and consisting of half-hydrate mixed with more or less unchanged gypsum.

(4) "Dead burnt plasters," containing less than 6 per cent. of water, but not hygroscopic, and setting only very slowly; these contain ordinary anhydrite.[*]

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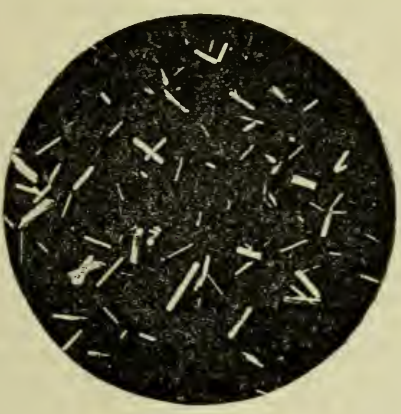
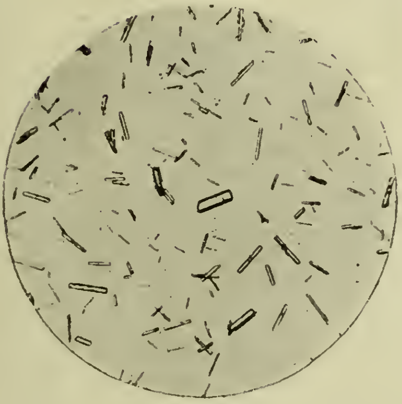
[*] E. F. Armstrong considered that the pressure of the system gypsum—half-hydrate, became equal to 1 atmosphere at a temperature of 101°·45. I am provisionally of opinion that this temperature really applies to the system, half-hydrate—soluble anhydrite, in view of the fact that gypsum can be converted into half hydrate at 93°, and half hydrate into soluble anhydrite above 100° and below 108°. There is no certainty that soluble anhydrite was not formed in Armstrong's experiments. It is true the microscope was used as a check in all cases, but at the time when the experiments referred to were made, the existence of soluble anhydrite was not known, nor was it recognised that half-hydrate, soluble anhydrite, and natural anhydrite are indistinguishable under the microscope. The very hygroscopic nature of soluble anhydrite was, moreover, a possible source of error in the analysis. For if soluble anhydrite be left to "dry" in the air, or even in an ordinary desiccator, it rapidly takes up moisture, and gives results corresponding to the half-hydrate. I have found this change to occur in soluble anhydrite when left for a single night in a desiccator over calcium chloride or sulphuric acid.

[*] The materials known as Keen's Cement, "Hard finish plaster," "Estrichgips," &c., are of an uncertain nature, and still require investigation.

Quick setting "half-hydrate" obtained by action of nitric acid on gypsum.

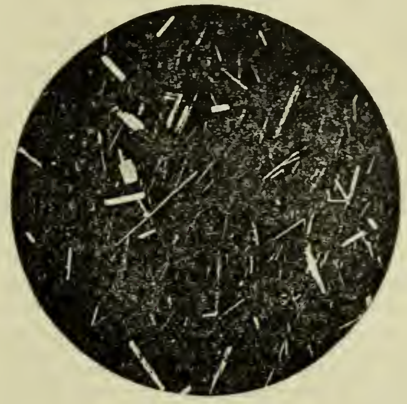


1.—Crossed Nicols.

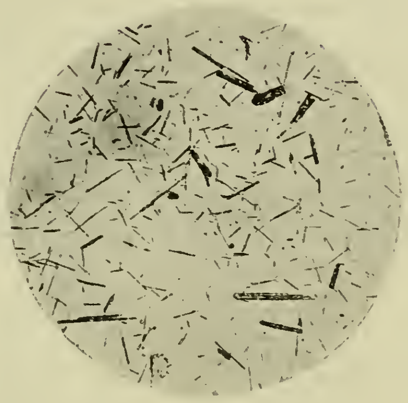


2.—Ordinary light.

Slow setting "half-hydrate" obtained by action of boiling water on gypsum.



3.—Crossed Nicols.



4.—Ordinary light.

Prolonged action of water at 100° *on gypsum—Existence of a second form of the half-hydrate.*—In view of the fact that gypsum loses water to form the half-hydrate when heated in an open crucible at 98°, it appeared desirable to ascertain the effect of heating it with boiling water during a prolonged period. Marignac has stated that when gypsum is heated with boiling water, it does not undergo any change in its state of hydration, and E. F. Armstrong was unable[*] to transform gypsum into the half-hydrate by heating it with water at 100°, concluding from his experiments that this change only takes place above 107°. In my experiments, 4 grms. of the half-hydrate (made by the nitric acid method) was shaken with 500 c.c. of distilled water, in which nearly the whole dissolved. On heating this solution, minute crystals separated, which, on examination with the polarising microscope, were seen to consist entirely of gypsum, showing the oblique extinction of $52\frac{1}{2}$°, and the twin forms characteristic of this substance. The finely divided gypsum was then heated with boiling water under an inverted condenser during about 3 hours. At the end of this period the crystals in the flask had entirely changed their character, consisting of long thin needles with a straight extinction and apparently orthorhombic. Not a single gypsum crystal remained. The product, rapidly filtered on the pump whilst the liquid was still at about 90°,[*] was washed with alcohol pressed between filter papers, and analysed. It was found to contain 6·47 per cent. of water and therefore consisted of a half-hydrate, $CaSO_4,\frac{1}{2}H_2O$ (theory requires 6·2 per cent. H_2O). The experiment was repeated varying the time of boiling from 2 to 4 hours with the same result (analysis 6·30 per cent. and 6·9 per cent. H_2O). Photos 3 and 4 show the crystals of the half-hydrate so obtained as they appear in ordinary light and in polarised light between crossed Nicols. Photos. 1 and 2 show under similar conditions crystals of the half-hydrate obtained by the nitric acid method. For these photographs I am indebted to Mr. R. J. Whymper.

A striking feature of the half-hydrate prepared by the prolonged action of boiling water on gypsum is that it sets very slowly and incompletely when moistened with water: it is true that a "set" is obtained after an hour or two, but the product is not very coherent. In this respect it resembles the half-hydrate obtained by Le Chatelier on heating gypsum with water at 130°—150°, the setting of which is described as "moins rapide et moins complète qu'avec le plâtre." The rate of setting is not appreciably altered by moistening it with very dilute acid instead of water. I am inclined to regard this slow-setting half-hydrate, provisionally at least, as a new form, distinct from the ordinary quick-setting half hydrate (obtained by the partial dehydration of dry gypsum at 100°, by the absorption of water vapour by soluble anhydrite, or by the action of nitric acid on gypsum), and bearing to the latter the same relation as natural anhydrite does to soluble anhydrite: that is, in having a smaller solubility and consequently a slower rate of transformation into dihydrate in presence of water. It is possible it may undergo direct change into natural anhydrite on further dehydration, but its behaviour in this respect has not yet been studied. Van't Hoff (p. 282) has stated that soluble anhydrite, on being heated with boiling water, changes into ordinary anhydrite, which does not set with water. I have not been able to confirm this: the action of boiling water on soluble anhydrite, on the ordinary form of half-hydrate, or on the "specially active form of gypsum obtained by the hydration of alabaster plaster," being such as to give only the slow setting half-hydrate described above.

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[*] Dr. E. F. Armstrong informs me that the heating was not prolonged more than an hour or two.

[*] It cannot be argued here that the production of the half-hydrate is due to the initial formation of soluble anhydrite (which according to Van't Hoff's data should take place at 93°), followed by re-hydration of the latter to half-hydrate: the half-hydrate obtained from soluble anhydrite always sets rapidly with water, whereas the product in this case is very slow setting. Moreover, if a real significance is to be attached to Van't Hoff's transformation temperatures, the action of water on soluble anhydrite should not take place above 37°; in the actual experiments made, the water was pressed from the crystals before it had cooled below 90°, and the solid immediately washed with alcohol, dried quickly, and analysed.

De Forcrand(13) has recently criticised Van't Hoff's results from a thermochemical standpoint, and has contended that, in order to bring these into harmony with facts, it is necessary to assume the existence of three forms of the half-hydrate. But the existence of two forms of the dihydrate, and the fact that the measurements of vapour pressure supposed to correspond with the system, gypsum—soluble anhydrite, are in reality not applicable to this system, greatly modifies the nature of the premises on which this conclusion is based.

Dimorphism of the hydrates of calcium sulphate and calcium chromate.—The facts already recorded show that calcium sulphate is dimorphous, not only when anhydrous, but also when hydrated—the half-hydrate and the dihydrate each existing in two forms. The different forms of calcium sulphate can be divided into two series:

	α Series. (Sparingly soluble and slow-setting).	β Series. (More soluble and "setting" rapidly)
$CaSO_4$	Natural anhydrite.	Soluble anhydrite.
$CaSO_4 + \frac{1}{2}H_2O$	Slow setting half-hydrate (by action of water at 100° on gypsum)	Rapidly setting half-hydrate (obtained by heating dry gypsum at 100°, or by action of nitric acid on gypsum)
$CaSO_4 + 2H_2O$	Gypsum	Orthorhombic dihydrate

The members of the β-series (being more soluble) are necessarily labile with regard to the corresponding α-forms.

Calcium chromate is isodimorphous with calcium sulphate, and the following table shows the relationship of the two substances from this standpoint. The dimorphism of calcium chromate has, as yet, been observed only in the case of the dihydrate and it is remarkable that the most stable hydrate of calcium chromate is the monohydrate, whereas a monohydrate of calcium sulphate is not known. The difference between the dihydrates of calcium sulphate and chromate as regards stability at the ordinary temperature has already been referred to (p. 731).

	$CaSO_4$.	$CaCrO_4$.
$+ 2H_2O$	α-form: monosymmetric (gypsum) ↑ β-form: orthorhombic (labile)	α-form: monosymmetric (labile) ↓ β-form: orthorhombic
$+ 1H_2O$	Not known	Orthorhombic
$+ \frac{1}{2}H_2O$	α-form; orthorhombic (slow-setting) β-form: orthorhombic (sets rapidly)	One form only observed
Anhydrous ..	α-form: orthorhombic (natural anhydrite) β-form: orthorhombic (soluble anhydrite)	α-form only known (obtained by igniting the hydrated forms)

Solubility of the different forms of calcium sulpha and calcium chromate.—Before the investigation of th setting of plaster of Paris can be considered as complet it will be necessary to determine the solubility of th different forms of calcium sulphate and its hydrate in the same way as Mylius and van Wrochem have alread determined that of the hydrates of calcium chromat The curves obtained in the latter case are shown in Fig. and are of considerable interest in throwing light on question concerning which much uncertainty exist in spite of its apparently simple nature—the solubility gypsum. This question has been the subject of numerou investigations(14), notably by Poggiale, Church, Marigna Cossa, Droez, and finally by Hulett and Allen. On great difficulty, not properly guarded against unt Marignac made his determinations, is due to the extraordinary readiness with which gypsum gives rise to supersaturated solutions, even when in contact with the soli substance. Marignac took precautions to obviate thi source of error, but, according to Hulett and Allen did not realise that another difficulty arises, owing t the solubility of gypsum depending on the size of th particles in contact with the solvent. The differenc between Marignac's results and those of Hulett and Alle is seen in Fig. 8, which gives the curves connecting solubility and temperature as plotted from the values obtaine by these workers. Whilst in both cases the curves ar well defined and unbroken, there is a wide differenc between the values for the solubility at the same temperature, in some cases amounting to as much as 8 pe cent. Hulett's explanation to account for the difference—that the solubility depends on the size of the particles—appears to me open to objection on two grounds. First one would anticipate that this peculiarity would show itself on an exaggerated scale in the case of substance having a greater solubility than gypsum, which experience hardly appears to confirm; and, secondly, if only sufficient time be allowed for equilibrium to be attained, it is clear that the smaller particles will all go into solution to form a supersaturated solution, from which material will be deposited on the larger crystals until saturation corresponding with the true solubility is reached. If Hulett's view were correct, greater irregularity would be anticipated in the curve obtained by Marignac than is actually found; instead of lying on a continuous curve, the observed values should give points irregularly disposed with regard to such a curve. It appears to me that the differences are to be attributed to differences in the nature of the gypsum used, to the presence of impurities modifying changes in the gypsum, concerning which we as yet know little. One very important point in this connection is that Hulett and Allen's curve has a bend at the summit, whereas the values obtained by Marignac point to a maximum at the intersection of two distinct curves; and, what is very striking, on producing the two limbs of Hulett and Allen's curve they intersect at exactly the same point as that given by the intersection on Marignac's curve—*viz.*, at a temperature of 38°. It may be pointed out that in all the solubility determinations hitherto made with gypsum, the crystallographic character of the solid phase has never been properly taken into account and it is not certain that the two branches of the curve actually correspond with the same form of the dihydrate. From analogy with calcium chromate, one would infer that the two branches of the gypsum curve really belong to the α and β forms of the dihydrate, a transition of one form into the other occurring at 38°; for the solubility of α-$CaCrO_4,2H_2O$ decreases with temperature, and that of the β-form increases (see Fig. 7). Moreover, the formation of a monohydrate or half-hydrate is not excluded; it is certain that a form of the half-hydrate can be produced from gypsum at 100°, instead of 107° as formerly supposed. In view of our ignorance of the exact conditions determining the transformation of the different hydrated forms of calcium sulphate, it is, perhaps, not surprising that the determination of the solubility of gypsum has presented unforeseen difficulties. Whether the suggestions I have put forward are correct or not, experiment alone can show: and I regret that time has not yet allowed me to put them to this test. If they be correct, an explanation will be afforded of a point which has hitherto remained obscure, *viz.*, the change

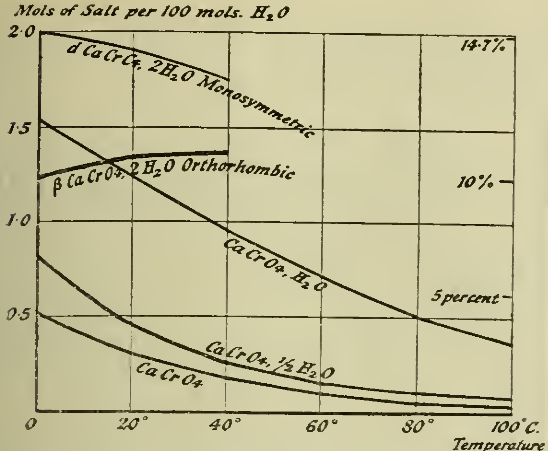

FIG. 7.

in the slope of the solubility curve from an upward to a downward direction between 35 and 40°. Thermodynamically, it is supposed that a change in the sign of the heat of solution occurs between these temperatures: but even for this an explanation is required and this view predicates that the curve forms a continuous bend at its summit. which, in the conflicting state of the data now available, is by no means certain.

Summary and conclusion.—In the present paper it has been shown, contrary to the opinion expressed by Van't Hoff, that the complete dehydration of gypsum to form soluble anhydrite takes place in two stages, the half-hydrate being formed as intermediate product of the change. The hygroscopic character of soluble anhydrite and the fact that the latter, in contact with water vapour, regenerates the half-hydrate, invalidates Van't Hoff's measurements of the vapour pressure of gypsum in equilibrium with soluble anhydrite. The existence of a second form of the dihydrate and probably also of the half-hydrate, leaves the real significance of the remainder of Van't Hoff's results uncertain. The problem is, indeed, more complicated than was originally supposed and further work will be necessary before the entire relationship of the many forms of calcium sulphate is elucidated.

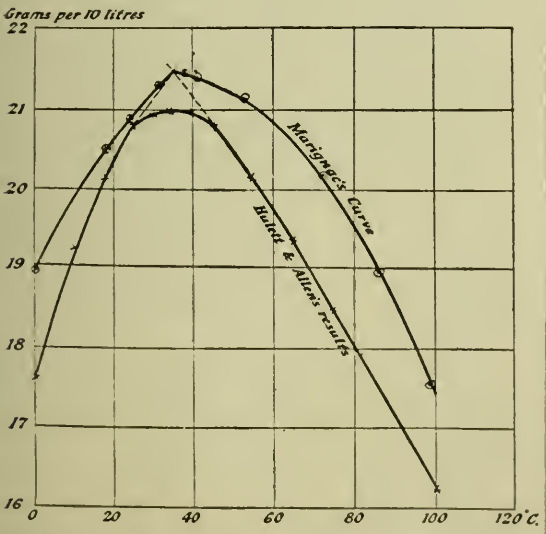

FIG. 8.

Appendix.

I. *Dehydration of solid gypsum.*—Le Chatelier considered that the dehydration of gypsum is complete at 155°, the half-hydrate only being formed at this temperature; the decomposition of the half-hydrate was thought to begin at 163°. This view is generally accepted in treatises on plaster of Paris. In 1877 Hannay(16) stated that gypsum does not begin to lose water, when heated in a current of dry air, until a temperature of 118° is reached, but that subsequently it proceeds at so low a temperature as 100°, until 15 per cent. of water is expelled (barometer = 760 mm.). In 1888, Shenstone and Cundall stated that, when selenite or artificially prepared $CaSO_4,2H_2O$ is heated in a current of dry air, the material loses the whole of its water at 70° C. Lacroix, in 1898, independently observed that gypsum can be completely dehydrated at 80°, the product being crystallographically different from ordinary anhydrite. Cloez, in 1903, stated that when gypsum was heated at 145° in an open vessel, it was completely dehydrated, the product being able to set rapidly with water; it was hygroscopic, and absorbed 8 per cent. of its weight of moisture from the air. Van't Hoff considered that the dehydration of gypsum usually gives rise to half-hydrate, but that it can, in certain circumstances (not accurately defined, see under II.), give rise also to either soluble anhydrite or natural anhydrite; both of these were regarded as being formed directly from gypsum, and not owing to the half-hydrate being produced as an intermediate product.

II. *Indefiniteness of the conditions determining the formation of half-hydrate, soluble anhydrite, or ordinary anhydrite from gypsum.*—In one experiment (p. 269) a saturated solution of salt converted gypsum into the half-hydrate at 77°, whilst in another experiment (p. 283), the same solution, at 68°, converted gypsum into ordinary anhydrite: in the former case, the solution is only 1° above the temperature of transformation of gypsum into half-hydrate, whilst it is 41° above the transition temperature of gypsum into ordinary anhydrite, and 15° above the temperature at which soluble anhydrite is supposed to be formed. Why in the first case did "suspended transformation" occur causing the half-hydrate to be produced instead of anhydrite, seeing that at the lower temperature of 68° anhydrite was actually produced? Van't Hoff emphasises the necessity of using a "specially suitable" form of gypsum, obtained by the hydration of alabaster plaster (Alabastergips), in order to observe the conversion into anhydrite. Why should this material differ from the other varieties of gypsum? Moreover, is there any reason for supposing that two actions may not occur simultaneously: for example, the production of one of the anhydrites with the half-hydrate or of the two anhydrites together? Again, to take another case, the transformation temperature of gypsum into half-hydrate in contact with water was determined, by means of the dilatometer, to be 107°, an expansion occurring above this temperature, a contraction below. But, in an experiment made under similar conditions to ascertain the transition temperature of gypsum into soluble anhydrite, an expansion occurred when gypsum was heated with water at 105° (p. 279). In the latter case, re-hydrated "alabaster plaster" was used,—that is the same material from which natural and not soluble anhydrite was formed in the case of the salt solution.

Van't Hoff also states that, in order to obtain soluble anhydrite by heating dry gypsum at 100°, neither the natural nor the precipitated material is suitable. although the gypsum obtained by shaking plaster of Paris with much water gives good results. This material is said to give soluble anhydrite when heated. whereas precipitated gypsum is affirmed usually to give the half-hydrate[*]. It is difficult to realise why this difference should occur, seeing that, if it be merely a question of the state of division of the material, precipitated gypsum can be obtained in as minute needles as the "regenerated" gypsum.

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[*] My own experiments. as well as the earlier ones of Shenstone and Cundall, show that soluble anhydrite is invariably obtained when natural gypsum (massive gypsum or thin flakes of selenite) is heated at 100° in a stream of dry air. Specially prepared material is not required.

Van't Hoff considers that, in the absence of a "lag" (Verzögerung), the change of gypsum into anhydrite (either soluble or natural) should precede the change into half-hydrate. The experiment from which this conclusion is drawn (p. 274) in no way proves that the formation of anhydrite from gypsum precedes that of half-hydrate, but would indicate instead that the half-hydrate is further changed by the nitric acid used (which was originally assumed not to act upon it), so as to give rise to soluble anhydrite; it would, indeed, indicate (as I have actually shown) that soluble anhydrite is formed by the further dehydration of the half-hydrate. The apparent equilibrium between gypsum and half-hydrate in contact with nitric acid is only temporary (compare p. 261); the second change, giving soluble anhydrite, occurring, however, only slowly.

III. *Dehydration experiments.*—The apparatus used is shown in Fig. 9.

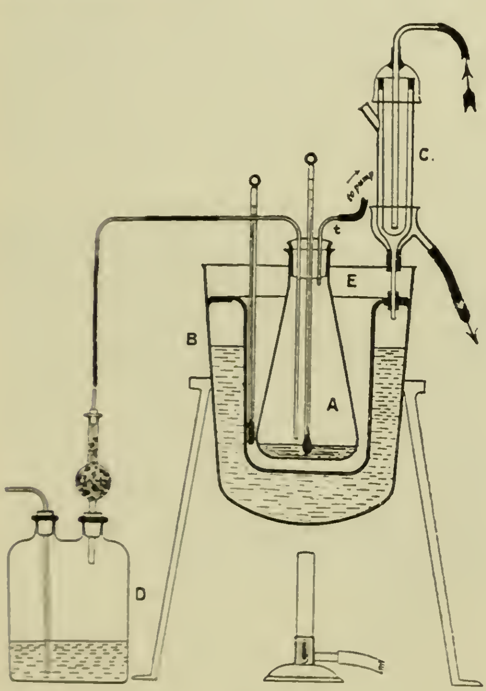

Fig. 9.

2 grms. of the gypsum used were heated in the glass flask, A, fitted with a ground-in glass stopper, provided with two side tubes, as shown, and a central tubulure, into which a thermometer could be fixed. The flask could be closed by means of glass plugs whilst cooling after being heated; when cold, it was weighed (to the nearest milligram), wiping away moisture from the surface of the glass by means of a piece of wash leather. The heating was effected by a Victor Meyer vapour bath with an asbestos lid, E, bored centrally to admit the neck of the glass flask, A. The temperature was checked by two thermometers, one inside the flask, the other in the hot air space around it. The condenser, C, served to prevent evaporation of the liquid used. Air, previously dried by passing through concentrated sulphuric acid in D, was sucked through the flask by means of an aspirator attached at *t*; the aspirator was regulated so that 20—22 bubbles of air passed through the acid in 10 seconds. After placing the flask in position in the hot vapour jacket the temperature was allowed to become practically constant within it before beginning to take the time readings. This happened generally within 5 to 10 minutes.

Table I.

Dehydration in current of dry air.

Loss of weight per 100 grms. gypsum at different temperatures. See Figure 4.

Time.	Curve A. Selenite flakes at 98°.	Curve B. Selenite flakes at 98°.	Curve C. Powdered gypsum at 98°.	Curve D. Duplicate of C.	Curve E. Selenite at 108°.	Curve F. Powdered gypsum at 108°.
30 mins.	—	—	—	—	—	3·75
35 mins.	—	—	—	—	0·4	—
45 mins.	—	—	—	2·55	—	—
1 hour	0·0	0·8	3·02	—	—	—
1½ hours	—	—	—	7·55	—	12·1
2 hours	1·85	2·3	8·8	—	6·7	15·0
2¼ ,,	—	—	—	12·35	—	—
3 ,,	4·42	—	13·9	—	—	—
3¼ ,,	—	4·5	—	16·0	11·9	19·1
4 ,,	—	—	15·9	—	—	20·0
4½ ,,	8·05	6·7	—	18·9	—	—
4¾ ,,	—	—	—	—	16·6	—
5 ,,	—	—	17·7	—	—	20·5
6 ,,	12·10	9·02	—	20·2	—	20·5
7 ,,	—	—	19·9	20·3	20·0	
7½ ,,	—	11·2	—	—	—	
8 ,,	15·4	—	—	—	—	
9 ,,	—	13·2	20·4	20·4	20·3	
9½ ,,	17·8	—	—		20·3	
10 ,,	—	—	20·4			
11 ,,	19·5	16·2				
12 ,,	20·0	—				
13 ,,	—	18·5				
13½ ,,	20·4	—				
15 ,,	20·4	19·95				
17 ,,		20·3				
19½ ,,		20·3				

G. Selenite flakes at 130°		
	30 mins.	12·5 per cent.
	40 ,,	17·3 per cent.
	50 ,,	20·4 per cent.

IV. *Characteristics of gypsum, half-hydrate, etc.*—Under the microscope, gypsum consists of small plates with oblique ends (often twinned) or long needles, showing an extinction between crossed Nicols at an angle of 52½° to the long direction. Half-hydrate (both forms), soluble anhydrite, and natural anhydrite all form needles with rectangular ends and have a straight extinction Half-hydrate (made by the nitric acid method) has a density of 2·75 grms. per c.c.; natural anhydrite, 2·9; gypsum, 2·32.

Lacroix considered soluble anhydrite to be probably "anorthic with intimate internal grouping imitating a higher symmetry." The close relationship with the half-hydrate and its undoubtedly straight extinction appear to me to show that it is, like the latter, orthorhombic. It is interesting to note that the optical properties of the half-hydrate do not seem to be affected by its conversion into soluble anhydrite on heating; the outline and transparency of the crystals are retained, and the product shows a straight extinction; similarly, when soluble anhydrite takes up moisture from the air to form the half-hydrate, no change is apparent in the crystals.

Setting of the half-hydrate.—The observations were made as follows:—The half-hydrate was moistened with water and allowed to set; this generally happened after ¼ hour. After another quarter of an hour, a piece of the hard cake was broken off, moistened with glycerine, and powdered carefully by means of a spatula on a microscope slide; a cover glass was then pressed down on the finely crystalline material, and the latter examined between crossed Nicols.

V. *Dehydration of half-hydrate (made by Armstrong's nitric acid method) at 98° in a current of dry air.* See Figure 5.—Loss of weight after 1 hour = 1·7 per cent.; 2½ hours, 4·10 per cent.; 3½ hours, 5·90 per cent.; 4 hours, 6·25 per cent.; 5 hours, 6·25 per cent. Theory for $CaSO_4,\frac{1}{2}H_2O$, Loss = 6·20 per cent.

VI. *Absorption of water from ordinary air by soluble anhydrite* (obtained in preceding experiment).—Gain of weight after 2 hours, 1·71 per cent.; 3½ hours, 3·00 per cent.; 6½ hours, 5·24 per cent.; 8 hours, 6·20 per cent.; 11 hours, 7·00 per cent. (constant). Then dry air was passed over the product; after $2\frac{1}{2}$ hours the gain in weight on the soluble anhydrite became 6·66 per cent. After passing dry air during another $3\frac{1}{2}$ hours, the weight was not changed. Theory requires for the change $CaSO_4 + \frac{1}{2} H_2O \rightarrow CaSO_4,\frac{1}{2}H_2O$, a gain of 6·62 per cent.

VII. Analyses of commercial plasters, bottled immediately after being taken from the oven or "kettle" and while still hot; bottles sealed with paraffin wax to exclude moisture. Samples kindly provided by Mr. Kemp of the Gypsum Mines, Ltd., Robertsbridge, Sussex.

Boiled plasters.—Seven samples gave respectively 6·77, 7·12, 6·32, 7·66, 6·26, 6·36, and 7·91 per cent. H_2O.

Baked plasters.—Sample 1 gave 6·80 per cent. of water. Sample 2 had not been sealed with paraffin wax, and was hygroscopic. Portion at top of bottle (which had apparently taken up some water from the air) contained 4·80 per cent. of water. A portion taken from the middle of bottle contained only 3·05 per cent. of water.

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(6) E. F. Armstrong, Dissertation, Berlin 1901; Van't Hoff and Armstrong, Sitzungsber. K. Akad. Wiss., 1900, 570.

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(15) Engel, Compt. rend., 1899, **129**, 598.

(16) Hannay, J. Chem. Soc., 1877, 381.

DISCUSSION.

Dr. E. F. Armstrong said the author had referred to work which he carried out on this subject some years ago in Van't Hoff's laboratory, and had shown that some of his conclusions were probably incorrect. When they began work in Berlin, the existence of the half-hydrate was doubtful, and therefore on obtaining the crystalline half-hydrate in definite form, they naturally relied on the microscopic characteristics for identification. The author, however, had shown now that one of the forms of soluble anhydrite was crystallographically almost identical with the half-hydrate. Here possibly a fallacy had occurred, and what microscopically they regarded as the half-hydrate had been sometimes perhaps anhydrite. He suspected that his own figures for the transition points referred to the change from the half-hydrate into anhydrite. The figures subsequently obtained by Van't Hoff referred more probably to the earlier change of dihydrate to half-hydrate than to the direct change into anhydrite.

An interesting point which Mr. Davis had thrown some light upon was the remarkable lag in the reactivity of gypsum when heated. Gypsum had to be heated for some time before change takes place, and a similar delay is observed on boiling with water. That explained why early observers were able to heat gypsum, prepared in the ordinary way by precipitation, for a considerable period, without being able to induce change. The paper had shown that what took place during this delay is the conversion of ordinary gypsum into the ortho-rhombic dihydrate. The author's gypsum, used in the experiments with boiling water, was specially prepared from the half-hydrate and therefore more reactive. He had always entertained the view that what happened was a gradual simplification of the molecule. In preparing the half-hydrate by means of warm nitric acid, the highly polymerised gypsum was changed into the less highly polymerised half-hydrate. Prof. Miers and Miss Isaacs had lately published a series of papers dealing with the converse of this problem: super-saturated solutions can be cooled much below the ordinary crystallising point in the absence of a nucleus without crystallisation taking place, the curve giving points at which solutions crystallise spontaneously below the ordinary freezing point curve. He considered that in the region between the two curves repolymerisation took place, and the simple molecules which were ready to separate out at the point of saturation were slowly polymerised whilst the solution cools, until they arrive at the state when they could form a crystal. In these two instances, there was on the one hand simplification of the molecule, and on the other its aggregation to form a crystal, and it appeared to him this explanation would afford a clue to many of the phenomena which Van't Hoff had classed together under the general term of lag.

Prof. H. E. Armstrong called attention to this paper as an illustration of the amount of knowledge required at the present day in investigating apparently simple problems and carrying them to a practical issue. A great many scientific points were raised which were of practical importance in connection with such an ordinary matter as the preparation and setting of plaster of Paris. It showed the amount of education needed at the present day by the works chemist.

Mr. A. C. Chapman said he was not clear at what temperature the gypsum passed into the anhydrous condition. He had incidentally made for many years a number of observations as to the temperature at which the half-hydrate was formed. It was his practice to dry water-solids at a temperature of about 130° to 140° C., and when that was done, the difference between the sum of the acids and bases, as determined in the ordinary way and the amount of total solid matter determined by evaporation, was, in all waters containing much calcium sulphate, almost exactly that which corresponded to the formation of the half-hydrate, and, therefore, under the conditions under which water solids were dried, the half-hydrate was certainly formed. It was commonly supposed that one reason why the calcium sulphate deposited on boiler plates was so hard was that there was a change in the crystalline form subsequent to its deposition, gypsum being first deposited on the plate and then undergoing, at the temperature of the plate, some crystalline transformation. He should like to know what that transformation was.

Dr. E. Divers raised the objection that transformation of the orthorhombic crystals into the monoclinic crystals should be expected to break up the already set plaster, by the expansion attending the transformation.

The Chairman said the initial contraction and subsequent expansion of plaster was evidently well known in Persia, for up to 30 years ago, as he knew from a frequent eyewitness, it was used as a means of executing criminals. They were placed in a hollow stone column and surrounded with wet plaster of Paris. At first they suffered but little inconvenience, then they would suddenly begin to show signs of distress and finally would scream loudly, appeared to be paralysed and die. This no doubt occurred when the expansion compressed the thorax and abdomen, &c.

Mr. Davis in reply said he substantially agreed with Dr. E. F. Armstrong's remarks. With regard to the question of temperature at which dehydration took place, in a stream of dry air, loss of water began below 70° C.: in an ordinary open crucible it took place pretty quickly at 98° C., and one grm. of gypsum could be brought down to the state of the half-hydrate in about six hours. Dehydration took place more rapidly at 130°, and the dehydration of one grm. of gypsum to form soluble anhydrite was complete in about $1\frac{1}{2}$ hours. The amount and the rate of dehydration depended mainly on the temperature. The lowest temperature in an open vessel at which the half-hydrate went into soluble anhydrite was somewhere between 98° and 108° C. Soluble anhydrite was so hygroscopic that it would take up water even from the sulphuric acid of a desiccator. With regard to the changes which occurred in a boiler, the formation of the half-hydrate had been observed on many occasions in boilers working under low pressure; in a high pressure boiler it had been stated that the formation of natural anhydrite could also be observed. The setting of plaster took place in two stages: the half-hydrate, on first hydrating, went into the orthorhombic form of the dihydrate, and subsequently into gypsum. There was a contraction in the first part of the process, and an expansion in the second part. Van't Hoff's measurements with a dilatometer had shown these two periods to exist. The total change of the half-hydrate to gypsum was accompanied by contraction.

THE FIXATION OF NITROGEN.

BY NORMAN WHITEHOUSE.*

The object of this research was to obtain a workable commercial process by which the nitrogen of the atmosphere could be obtained combined as ammonia or nitrate, and was undertaken at the suggestion of Sir William Ramsay, K.C.B. It is obvious that if any commercial process is to be worked out using a metallic nitride as the nitrogen carrier, then one of the following methods of treatment must be possible:—

1. The nitride chosen must be directly reducible with hydrogen, giving ammonia together with the metal, a lower nitride, or a hydride.
2. A nitride, when treated with steam will always give ammonia and the oxide of the metal; but if this reaction is used, the oxide produced should be one which is conveniently reducible with hydrogen or carbon.
3. If the nitride will react with hydrogen sulphide or hydrogen chloride, this reaction may be employed, provided the sulphide or chloride is reducible.

The reasons for the failure to work out a commercial process on these lines may be summarized as follows:—

1. With certain exceptions, such as cerium, metals which combine with atmospheric nitrogen were found not to be directly reducible with hydrogen.
2. The oxides of metals which will react with molecular nitrogen are also non-reducible with hydrogen or carbon at a reasonably low temperature, that is to say under about 1500° C., above which temperature the working becomes both difficult and costly.
3. In some cases hydrogen sulphide and hydrogen chloride do not react with the nitrides of those elements which combine directly with nitrogen. But when they do, the resulting compounds are not themselves easily reducible.

The first experiments were carried out with magnesium nitride, as it is common knowledge that magnesium, if strongly heated, combines with nitrogen giving this compound. As is well known, it reacts with water with violence, giving rise to ammonia and the hydroxide of the metal. $Mg_3N_2 + 6HOH = 2NH_3 + 3Mg(OH)_2$.

It also burns if strongly heated in air, forming oxide and free nitrogen. It was obvious that if any commercial process was to be worked out using magnesium nitride as the nitrogen-carrier, it would be necessary to prevent the magnesium changing to oxide in its cycle of reactions. With this in mind, some experiments were undertaken to find out if it were possible to effect the reduction of magnesium nitride directly with hydrogen at various temperatures between 400° C. and about 1000° C. An iron tube was used to contain the porcelain boat holding the nitride, and the whole was heated in an electric tube-furnace. After repeated experiments, it was found that if the hydrogen were freed from every trace of oxygen by passing the gas over red-hot copper, and from moisture by bubbling it through sulphuric acid drying tubes, then no appreciable reduction took place. The difficulty experienced in these experiments of getting rid of every trace of air brought home the unsuitability of magnesium nitride for a commercial process; it was also evident that in any commercial undertaking "water gas" would have to be employed. Now as hydrogen and carbon monoxide cannot be completely separated from one another by any cheap process, the gas would have to be used as a whole. This was found to be impossible, as the magnesium was oxidised, free carbon, cyanamide, and other products being formed.

Attention was then turned to titanium, the affinity of
which for oxygen is not so pronounced as that of magn
sium. while that for nitrogen is at least equally grea
Experiments were made with two nitrides of this elemen
namely, titanic nitride, a bronze-brown powder (Ti_3N
according to Wöhler), and titanium dinitride, TiN
an amorphous blue powder. The dinitride was prepare
by heating the dioxide in a current of ammonia gas
about 600° C. Titanic nitride is obtained when the met
is heated in nitrogen. It is also and was actually obtaine
for these experiments by the ignition of ammoni
titanium tetrachloride in a stream of ammonia gas.

$$3(TiCl_4 4NH_3) = Ti_3N_4 + 8NH_4Cl + 4HCl.$$

Strong ammonia was added to a concentrated solutic
of commercial titanous chloride, and the resulting blu
black precipitate was dried and ignited in a current
air, when the dioxide was obtained as a yellowish-whi
powder. The average amount of titanium dioxic
obtained was 51 grms. per lb. of the concentrated solutic
of titanous chloride. The preparation of the ammoniu
titanium tetrachloride was a somewhat lengthy proces
It consisted of heating the dioxide in a current of carbc
tetrachloride at about 450° C. A mixture consistir
mainly of titanium tetrachloride and carbon tetrachloric
was obtained in the cooled receiver, and by fraction
distillation the titanium tetrachloride of b. p. 136°
was separated. Dry ammonia gas was passed into tl
titanium tetrachloride, and the solid canary-yello
double salt was obtained. As before mentioned, thi
on ignition, gives titanic nitride.

An analysis was made as follows:—1·647 grms. of titan
nitride was weighed in a porcelain boat. The titaniu
oxide, estimated by igniting the nitride in air, weighe
1·927 grms., corresponding to 70·2 per cent. of titaniu
in the nitride. As the nitride was prepared fro
commercial oxide an accurate analysis was impossibl
but this percentage agrees fairly well with the 72·0 p
cent. of titanium in pure Ti_3N_4. A similar analysis wa
made with the dinitride. The percentage of titaniu
was found to be 64·2 per cent., as compared with 63·3 p
cent. required by the formula, TiN_2.

The direct reduction of these nitrides with hydroge
was attempted first in an iron tube, and afterwards i
hard glass. The use of the iron tube was given up a
although the nitride in the boat did not lose weigh
enough ammonia was formed to turn litmus paper blu
and even to be smelt. As this could only have com
from the iron tube, it seemed probable that in passin
the current of ammonia previously through the tul
over the titanium dioxide to form the dinitride, som
of the iron had become converted into iron nitride, whic
was subsequently reduced by hydrogen, giving ammoni
In hard Jena glass, and using a gas furnace, and up t
the highest temperatures attainable with this combination, no reduction of either of the nitrides of titaniu
was observed.

As ammonia gas passed over the oxide at a red hea
gave the dinitride, the possibility of being able to atta
the same result by passing a mixture of nitrogen an
hydrogen over the dioxide at a red or white heat suggeste
itself. This was tried at temperatures ranging from
low red heat to 1500° C., using a silica tube, but no nitrid
was formed, the dioxide being simply reduced to blac
titanous oxide. As this experiment was not successfu
and as hydrogen is more active as a reducing agent i
the presence of finely divided nickel, another simila
experiment was performed in which the titanium dioxid
was mixed with an equal weight of nickel oxide, and th
whole finely ground and then reduced with hydrogen a
350° C. A mixture of hydrogen and nitrogen was passe
over it at this temperature, but no nitride was obtaine
although a small trace of ammonia was present in th
issuing gas.

An attempt was also made to produce a nitride o
titanium by heating the sulphide in a mixture of hydroge
and nitrogen. The sulphide was obtained by heatin
titanium dioxide in a current of carbon bisulphide vapou
to a red heat. 2·073 grms. of the sulphide ignited t
dioxide gave 1·495 grms., equal to 43·2 per cent. o
titanium; this agrees approximately with the 42·8 p
cent. required for the formula TiS_2. During the attemp
to produce the nitride by this method, hydrogen sulphid

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* Taken as read.

was evolved but no nitride obtained, only a lower titanium sulphide, the percentage composition of which agreed with the formula, Ti_2S_3. The experiment was conducted with 2·196 grms. of the sulphide, during which a loss of 0·284 grm. took place, which corresponds to a loss of 12·9 per cent. of sulphur.

As boron compounds are cheap, it was decided to make a few experiments involving the use of this element before proceeding any farther with the rarer materials of the earth's crust. The result of the first set of experiments may be summarized as follows:—Boron nitride cannot be produced by heating boron trioxide in a mixture of hydrogen and nitrogen, but if carbon is used as the reducing agent instead of hydrogen, then a certain quantity of nitride is formed. This quantity may be considerably increased if a mixture of carbon and iron, prepared by heating pitch and iron together, was employed instead of the carbon alone. A temperature of about 1200° C. was used. However, even under the best conditions, only such a small quantity of nitrogen was "fixed" that the method is of no technical importance.

A quantity of boron nitride was prepared by the well known method of heating a mixture of borax and ammonium chloride. The direct reduction of this nitride was attempted by heating it at various temperatures up to a white heat in a stream of dry hydrogen, but without success. Dry hydrogen sulphide was passed over boron nitride at the highest temperature attainable, using a gas furnace and hard Jena-glass tubing, but they were entirely without action on one another. A still more striking instance of the great stability of boron nitride was shown by passing dry hydrogen chloride over the nitride at a temperature of 1470° C. The nitride was entirely unaffected by this treatment. From these experiments it is obvious that it is impossible to use boron nitride as a carrier between atmospheric nitrogen and ammonia, as the only reasonable way to obtain ammonia from the nitride is to heat it in a current of steam; but if this is done, it is impossible to re-form the nitride from the trioxide and atmospheric nitrogen, as was demonstrated by the first experiments undertaken with boron.

The next experiments were made with cerium nitride, prepared by means of the thermite reaction. The calculated quantity of cerium dioxide was mixed with the equivalent quantity of powdered magnesium and heated in an atmosphere of nitrogen. By this means a mixture consisting principally of cerium nitride and magnesia was obtained. The direct reduction of cerium nitride with hydrogen was tried and it was found that at a dull red heat ammonia was slowly evolved, the cerium combining at the same time with excess of hydrogen forming cerium hydride. Experiments were now performed to find out whether the reverse action could be induced to take place, namely, the conversion of the cerium hydride by means of nitrogen into cerium nitride and ammonia. Cerium hydride was therefore prepared by an exactly analogous method to that used in the preparation of the nitride, namely, by heating a mixture of cerium dioxide and magnesium powder in an atmosphere of hydrogen; this gave a mixture of cerium hydride and magnesia. A rapid current of nitrogen was then passed over the hydride, and the temperature gradually raised to a bright red heat. During the experiment small quantities of ammonia were evolved, while it was subsequently found that the hydride had been converted into nitride. The small yield of ammonia was probably due to the high temperature having decomposed the greater part of it into its elements, for ammonia begins to decompose at 500° C. (Ramsay & Young, Trans. Chem. Soc., 1884.)

On a laboratory scale, and using hydrogen and nitrogen absolutely free from oxygen, carbon monoxide, and water, the oscillation from cerium hydride to cerium nitride and back again can be made to go on indefinitely; during each cycle small quantities of ammonia are produced. The difficulty of obtaining hydrogen and nitrogen perfectly free from oxygen would go far to bar this process from being a commercial success.

Another process of purely theoretical interest could be carried out with vanadium, columbium, or tantalum. It has been shown by von Bolton (Zeits. Elektrochemie, 1905) that the metal is produced if any one of the oxides is heated to a white heat in a vacuum of less than 20 mm. pressure. Nitrogen instantly reacts with the white hot metal giving the nitride (VN). This nitride reacts with steam at 400° C. giving ammonia and the oxide.

Experiments with molybdenum and tungsten were no more successful, as far as working out a "fixing" process was concerned, for although both these elements form nitrides, neither appears capable of combining directly with molecular nitrogen. Working with finely divided tungsten, and at temperatures as high as 1500° C., no appreciable quantity of nitride was formed.

The elements thus divide themselves naturally into two groups. As an example of the one class may be mentioned the element tungsten, the nitride of which, though directly reducible, cannot be formed directly from its elements; while magnesium, boron, and titanium afford examples of elements which combine directly with nitrogen, but of which nitrides are not reducible directly, so that the only way to obtain ammonia from these nitrides is to act upon them with steam; nevertheless, as these oxides are not reducible, the cycle cannot be completed.

It may be urged at first sight that the experiments with cerium contradict this view; but that is only apparent, for the reduction in this case is probably due to the extraordinary affinity of cerium for hydrogen, which displaces the nitrogen, forming cerium hydride, while the production of ammonia may be looked upon as a secondary reaction in which the displaced and nascent nitrogen combines with the excess of hydrogen present.

I have to express my thanks to Sir William Ramsay and Dr. Collie for suggestions and advice during the research.

Manchester Section.

Meeting held at Manchester on May 3, 1907.

DR. G. H. BAILEY IN THE CHAIR.

THE TIME OF PASSAGE OF LIQUID THROUGH PERCOLATING BEDS.

BY WILLIAM CLIFFORD, A.M.I.C.E.

The time taken by liquid to pass through percolating beds has been variously stated from two to eight or more minutes; generally it is referred to as "occupying a few minutes," or as "the rapid passage of liquid through the bed." The method of determining this time appears to have been simply to pour a quantity of coloured liquid on the surface of the bed while in action, and noting the time between the pouring of the liquid and the first appearance of colour at the outlet. By this method the time of passage of a comparatively small portion of the dose or added liquid is measured. It takes no account of the bulk of coloured liquid poured over the surface. Now, there appears to be no reason why the first trace of a given dose appearing at the outlet should be taken to indicate the time of passage of that dose, any more than the last trace. It will, therefore, be necessary to define what is meant by the time of passage of liquid through a bed. The time of passage of any portion of liquid may be defined as the average time of passage of all the molecules of that portion of liquid. For practical purposes, it will be sufficient to find the general distribution of the observed liquid in the effluent, and from this to calculate the mean distribution; this gives the average time. The following experiment will illustrate the method of determining the average time. A solution of common salt was used for observation, instead of a coloured liquid. An 18″ earthenware pipe, filled with clean, washed and screened gravel, which passed a 1″, and remained on a ¾″ mesh riddle, formed a circular bed 18″ diameter and 2·4 feet deep. A tipping trough, arranged above, emptied its contents into a perforated tray, which distributed the water over the medium. Tap water was used, instead of sewage or tank effluent, in order to obviate the disturbing action of the organic matter, and a variable chlorine content. The water was obtained from an elevated tank which gave a constant head. In this particular experiment, the flow of water into the tipping trough was 124 c.c. per minute, (equal to 200 gallons per sq. yd. per day). The trough held 465 c.c. before tipping, and, therefore, an intermittent dose of this amount was poured into the tray and distributed over the medium every 3¾ minutes. Each distribution or sprinkle lasted five seconds. After a few doses the amount of water leaving the bed in intervals of distribution became equal to that distributed over the surface. When the bed had been in action for one hour, the water flowing into the tipping trough was intercepted, and received into a graduated cylinder. This took place immediately after a turn of the trough. The now empty trough, instead of receiving water, was filled with a solution of common salt, of known chlorine content, and held from tipping until an equal quantity (*i.e.* 465 c.c.) of the inflowing water was collected in the cylinder. At this point the trough was turned, the chloride solution distributed over the medium, and the flow of water into the trough continued as before. Samples of the effluent were then taken, every fifth minute. In the earlier experiments samples were taken every minute, but a sample taken every fifth minute was found to give a result sufficiently accurate for all practical purposes. The combined chlorine in the samples (shown in the second column of the following table) gives the distribution of the chloride in the effluent. The average time of passage is obtained by calculating by the method of moments the mean frequency of the combined chlorine, after first reducing the amount by that present in the water previous to the addition of the solution, it is given by

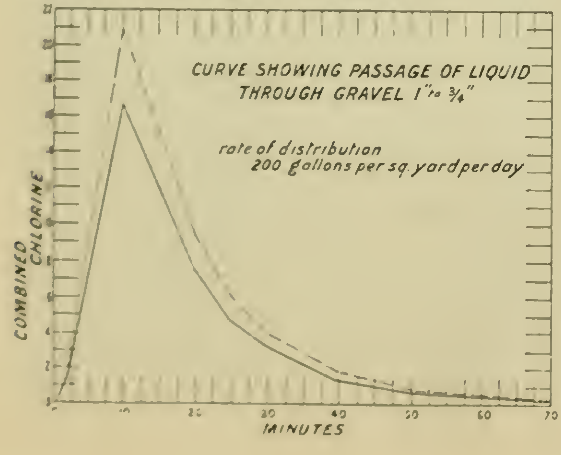
$$\frac{\Sigma\ P.Q}{\Sigma\ Q},$$

where P is the minute corresponding to the combined chlorine Q.

Time. (P.)	Combined chlorine in sample. parts per 100,000	Combined chlorine, less 3·8. (Q.)	Product of P.Q.
Previous ..	3·8	—	—
5th minute	11·6	7·8	39·0
10th ,,	20·5	16·7	167·0
15th ,,	16·2	12·4	187·0
20th ,,	11·2	7·4	148·0
25th ,,	8·6	4·8	120·0
30th ,,	7·0	3·2	96·0
35th ,,	6·1	2·3	80·5
40th ,,	5·2	1·4	56·0
45th ,,	4·8	1·0	45·0
50th ,,	4 4	·6	30·0
55th ,,	4·3	·5	27·5
60th ,,	4 1	·3	18·0
65th ,,	4·0	·2	13·0
70th ,,	3·9	·1	7·0
		58·7	1033·0

Whence the average time, $\frac{\Sigma\ P\ Q}{\Sigma\ Q}$, is 17·6 minutes. This result is obtained with clean, coarse gravel, and a distribution of 200 gallons per sq. yd. per day.

The accompanying curve shows the position of centroid vertical, corresponding to the "mean frequency":—



The following table shows the results obtained wit various grades of medium and rates of sprinkling, th depth in each case being 2·4 feet.

Medium.	Grade.	Rate of working in gallons per sq. yd. per day.	Average time of passage. Minutes.
Coal ..	¾″ — ⅝	239	24 3
		180	31·7
		105	45·6
	½″ — ⅜″	307	26·4
		134	49·4
	⅜″ — ¼″	228	34·0
		191	39·0
		129	63·6
	¼″ — ⅛″	236	54·7
		181	64·3
Gravel	1″ — ¾″	245	15·0
		200	17·6
		154	22·0
	¾″ — ⅝″	259	20·1
		194	31·5
		137	35·8
	⅝″ — ½″	250	31·2
		192	37·2
		166	40·0
	½″ — ¼″	246	33·7
		197	40·0
		155	44·1

A word of explanation may be permitted with rega to the seemingly long time of passage. In the first pla the idea of mere trickling requires to be eliminat A bed, even when draining, retains a considerable amou of water ; now, suppose for the moment there are eig gallons of water in each cubic yard of medium, exclusi of that in the pores of the medium, then a perfect d tribution of eight gallons per hour (192 gallons per sq. y per day) would be only sufficient to change the water on an hour, assuming simple displacement. The displaceme is really accompanied by a very considerable amount mixing.

In conclusion I wish to thank my assistant, Mr. Har Wilson, for help in sampling and in the chlorine det minations.

THE INTERACTION OF DILUTE SOLUTIONS O AMMONIUM SALTS AND VARIOUS FILTE ING MEDIA.

BY GILBERT JOHN FOWLER, D.SC., F.I.C., AND PERCY GAU
ASSOC.M.S.T.

The following research is part of a general inquiry in the conditions under which sewage matter is oxidis in bacterial filters.

The greater number of the exact investigations whi have been made on the course of change resulting in t nitrification of organic compounds, have been carri out in solutions, under conditions where the effect extended surfaces did not enter into the question. As example may be mentioned the careful and prolong series of experiments by Adeney.[*] More recent Boulanger and Massol[†] have shown the effect of extend surfaces in increasing the efficiency of the nitrifyi organism.

Before exact quantitative work can be undertak in this direction, it is, however, important to determi the precise changes, if any, which take place when t nitrifiable substance is brought in contact with surface under conditions when biological action is excluded. The simplest nitrifiable substance occurring in sewage, and which, indeed, is the main source of the production of the nitrate, is, of course, the ammonia produced by the fermentation of urea.

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[*] Trans. Royal Dublin Society, 1897. Proc. Royal Ir Academy, 1905.

[†] Recherches sur l'Epuration Biologique et Chimique Eaux d'Egout, Vol. 1, p. 31. Calmette & Colleagues. Par Masson & Cie., 1905.

The following experiments have therefore been confined to a study of the changes taking place when solutions containing quantities of ammonia, varying from that present in ordinary sewage to about 0·2 per cent., are brought into contact with various materials, representing in their physical and chemical characters those used in the construction of bacterial filter beds. The question of the interaction of ammonium salts and solid substances has received a large amount of attention in connection with the so-called "adsorption" of ammonia by the soil, the most recent researches being those of Hall and Gimingham.[*] The conditions, both physical and chemical, differ, however, very considerably from those obtaining in a sewage filter, where the smallest size of particle will be about ⅛″ diameter and where the material is chosen as far as possible for its hardness and its resistance to chemical change. In a paper by Kattein and Lübbert[†] on the absorption phenomena occurring in sewage filter beds, a full account is given of previous researches on kindred questions. The experiments of Kattein and Lübbert were confined to the absorption of certain colouring matters by clinker of various sizes. Two interesting papers by Dreaper on the theory of dyeing have a bearing on this question, and especially in Part II.,[‡] a number of references will be found, among which may be mentioned a paper by Gore.[§] Gore observed that finely divided silica, alumina, magnesium carbonate, ferric oxide, and titanic acid all possessed in varying degrees the property of abstracting from their dilute solutions appreciable proportions of a variety of compounds (principally inorganic). He found no accompanying solution of the solid in the majority of cases, and considered the phenomenon to be purely physical. In general, his experimental methods differed to such an extent from those made use of in the following work, that systematic comparison is impossible, but in such cases as are in some degree comparable, the results show a corresponding agreement. Since this work has been in progress, some experiments have been published by Dr. Harriette Chick,[¶] which were undertaken to determine whether absorption of ammonia by the medium was a necessary preliminary to nitrification in sewage filters. She concluded that no appreciable absorption took place, or if it did, that it was so insignificant as to have no bearing on nitrification. She states, however, that further research is necessary. It is to be noted that in her earlier experiments the volume of solid was very small in relation to the volume of liquid, yet in the case of sand and clinker, a definite percentage absorption did after all take place, although not comparable with the loss of ammonia by nitrification. In further experiments with coke, no absorption was noted, but in this case also the volume of liquid considerably exceeded the volume of solid.

Dr. Chick describes a negative experiment where a fairly strong solution of ammonium chloride (10 parts NH_3 per 100,000) was allowed to percolate slowly through coke. It is possible that the coke in this and her other experiments was of a physical character akin to the electric light carbon used in our experiments, with which also no absorption was noted.

Finally a paper has recently been published by Dzierzgowsky,[**] in which, among other interesting experiments, bearing on the chemistry of sewage filter beds, a large number of determinations are given of the absorptive properties of various media in relation to numerous substances, both of a colloidal, and crystalloidal character. With aqueous solutions of free ammonia, appreciable absorption was noted with coke-breeze, Marten slag, and destructor clinker; in the case of the first mentioned substance practically 70% being taken up in one case. He brings forward evidence to show that the presence of oxides of the iron group increases the tendency to the absorption of ammonia.

The preliminary experiments in connection with the present research were made by one of us in October 1904. Dilute solutions of ammonium chloride were brought into contact with broken clinker of about ⅛ inch diameter, both solution and clinker being carefully sterilised, and it was established—

(*a*) That appreciable absorption of the ammonia did take place.

(*b*) That not more than a certain maximum percentage was absorbed even on prolonged contact.

(*c*) That if the solution was poured away from the clinkers and replaced by distilled water, the absorbed ammonia could be largely redissolved.

(*d*) That the absorption took place from the liquid immediately in contact with the clinker, any supernatant liquid being unaffected. This has an important bearing on Dr. Chick's results, as even in her last experiments with coke 50 c.c. of liquid were taken to 30 c.c. of solid.

In the more exact experiments now to be recorded a solution of ammonium chloride was generally used in preference to a solution of ammonia, as it may be assumed that owing to the simultaneous presence of chlorides and ammonium carbonate in sewage, a solution of ammonium chloride best represents actual conditions. Moreover, solutions of an exact strength can be prepared and kept rather more readily.

The following general method of experiment was employed to determine the extent to which certain filtering media and kindred substances possessed the property of removing ammonia from dilute solutions of ammonium chloride under sterile conditions. The solid was broken down to a convenient size (approaching ⅛″), cleaned by suitable means, boiled with water until free from ammonia, and finally dried and sterilised in a stoppered bottle at 150° C. The solution of ammonium chloride was sterilised by boiling. The solution was poured on to the solid in just sufficient quantity to cover it. The relation of the volume of the solid to that of the solution was in general about 3 to 2. The bottle was stoppered, and allowed to stand at the laboratory temperature for the selected period. A portion of the solution was then withdrawn, and the ammonia determined, in the case of the dilute solutions by Nessler's test, and in the stronger solution by distillation into decinormal sulphuric acid and titration with decinormal potassium hydroxide.

A parallel determination was made in the original ammonium chloride solution. The liquid was also examined to determine any elements which might have gone into solution from the media, and in several cases chloride determinations were made before and after contact of the ammonium chloride solution. The general results are recorded in the following table:—

	Medium.	Parts ammonia per 100,000 before contact.	Parts ammonia per 100,000 after contact.	Percentage absorption.
1	Clinker	2	·44	78
2	Gravel	2	·37	81·5
3	,, ...	20	8·7	56·5
4	,, ...	200	166·6	16·7
5	Coal	2	1·77	11·7
6	Polarite	200	156·6	21·7
7	Pumice	200	188·8	5·6
8	Porous pot	200	178·0	11·0
9	Oyster shell	200	191·4	4·3
10	Quartz	200	—	nil.
11	,, +calc.carbonate	200	—	nil.
12	,, +ferric hydroxide	200	199	·5
13	,, +calc. carb. and ferric hydroxide	200	194·4	2·8
14	,, +slurry	200	—	1·86 2·95
15	Carbon	200	—	nil.
16	,, +calc. carbonate	200	181·8	9·1
17	,, +calc. chloride	200	199·3	·35
18	,, +iron	200	—	nil.
19	,, +iron	2	1·85	7·5
20	Broken "saggars" ...	2	1·57	21·5

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[*] Journ. Chem. Soc. Trans., 1907, p. 677.

[†] Gesundheits Ingenieur, 1903, No. 25.

[‡] This J., 1905, p. 223.

[§] Birmingham Nat. Hist. and Phil. Soc., 1893.

[¶] Proc. Roy. Soc., B, 77, 1906, p. 254 *et seq.*

[**] "Zur Theorie Künstlicher Biologischer Filter," Gesundheits Ingenieur, 1907.

The following further details are of importance in connection with specific media which are referred to under the above numbers.

The *clinker* was ordinary hard boiler clinker as used in the construction of filter beds, broken and sieved to ⅛" diameter. 2. The *gravel* consisted of sea gravel, (flint containing a certain proportion of oxide of iron, accompanied by fragments of *shell*). 11. The *quartz* was such as is used in mechanical high-pressure water-works filters. It was thoroughly mixed by shaking with 1% by weight of precipitated calcium carbonate, both before, and after the addition of the ammonium chloride. 12. *Quartz + Ferric hydroxide.* The quartz was moistened with ferric chloride and heated on a water-bath with excess of caustic potash. The product was washed by decantation in the cold until neutral, and dried at a low temperature.

14. *Quartz and slurry.*—This experiment was made to determine whether the gelatinous earthy deposit or "slurry" which forms on the medium of a biological filter after a period of use would exercise an absorptive effect. This possibility was suggested by one of the present authors to Dr. Chick, but hitherto she has not published any experiment on the point.* An attempt was made to determine the effect of this slurry sterilised to inhibit biological action on dilute ammonium chloride solutions in the following way:—Slurry, obtained by washing the material of a mature 2nd contact bed, was passed through a sieve of 90 meshes to the inch (to remove disintegrated clinker) and sterilised with steam. From the product a paste of even consistency was made, and weighed portions were taken as follows:—(*a*) For determination of moisture, (*b*) For ammonia determination, after standing with ammonia-free water and quartz, (*c*) For mixture with quartz, with which after further sterilisation, ammonium chloride (representing 200 parts of NH_3 per 100,000) was placed in contact for 24 hrs. After contact, a portion of the liquid from (*c*) was withdrawn and filtered; and it was found to contain 165 pts. of ammonia per 100,000. The liquid mixture of ammonium chloride and slurry originally placed in contact with the quartz, was calculated, by means of the moisture and ammonia determinations (*a*) and (*b*), to contain 170 parts per 100,000 of ammonia. The indicated loss of ammonia was thus 2·94 %. Another experiment, in which a slight variation of method was adopted, showed a loss of 1·86%.

A certain amount of absorption, equivalent to nearly 5 parts per 100,000 of ammonia, did therefore take place. The experiment is, however, hardly conclusive as to what happens in actual practice, as the necessary heating for sterilising purposes must considerably alter the physical character of the deposit. Certain experiments of Adeney (*loc. cit.*) indicate that ammonia is absorbed by peaty matter before being oxidised†.

15. The *carbon* consisted of electric light carbons, broken and sieved to the required size. 16. *Carbon + calcium carbonate* was prepared in a similar manner to the quartz and calcium carbonate. 17. *Carbon + calcium chloride.* The carbon was boiled with 5% calcium chloride solution until saturated, then drained and dried at a moderate temperature. 18 and 19. *Carbon + iron.* The carbon was boiled with 5% ferric chloride solution until saturated, drained and dried slowly, and finally heated in a large crucible over a Fletcher burner. It is probable that this treatment results in the production of some metallic iron, mixed with magnetic oxide. 20 *Broken "saggars."*—This material consists of broken stoneware and is used in the "Potteries" as material for biological filters The sample tested was specially supplied. The absorption in this case was slow. The result quoted was obtained after 72 hours' contact, only 5 % reduction taking place in 24 hours.

The foregoing experiments, taken in conjunction with the preliminary work above referred to, led to the following conclusions:—

(*a*) In the majority of cases, an appreciable amount of absorption did take place.

(*b*) In almost all cases the action was completed after 24 hours' contact.

(*c*) The action was confined to such portions of the liquid as were in intimate contact with the solid, the presence of supernatant liquid tending to reduce considerably the apparent proportion of ammonia removed from solution.

(*d*) In those cases where absorption of the ammonia took place, the action was accompanied by the solution in appreciable quantities of one or more of such of the following as were constituents of the medium viz.:—Iron, calcium, magnesium, and silica.*

(*e*) The acid radicle of the ammonium salt was not absorbed, since no diminution of the combined chlorine in solution took place.*

(*f*) The absolute quantity of ammonia removed increased with the concentration of the solution, but the proportionate quantity diminished. (*Cf.*, 2, 3, and 4).

Parts ammonia per 100,000 before Contact.	Parts ammonia per 100,000 removed from Solution.	Percentage ammonia removed from Solution.
2	1·60	81·5
20	11·30	56·5
200	33·0	16·5

(*g*) The greatest amount of absorption appeared to take place when the material afforded a certain combination of physical structure and chemical composition.

Having established the fact that in many cases diminution of the ammonia does take place, the following questions suggested themselves:—

1. Is it possible that, in spite of the conditions of the experiment, some small amount of biological action may have taken place?

2. As it would appear possible from the non-absorption of the chlorine, that the ammonia was combined in the medium in a less stable manner than in the original solution, is it possible that a certain amount of free ammonia would pass off from the medium by volatilisation?

3. Does a chemical oxidation of ammonia to nitrite or nitrate occur?†

1. The foregoing experiments indicated that the diminution of ammonia was due to purely physico-chemical causes, but with a view to determining finally whether the action was in any degree biological, the following experiment was made:—Gravel and ammonium chloride were first sterilised separately in flasks, the former by heating at 170° C. on two successive days, and the latter by boiling on two successive days. The two flasks were then connected by a glass syphon tube (previously filled with ammonium chloride solution, and having the end in the gravel flask drawn out to a fine point and sealed) and the necks plugged with cotton wool. The entire apparatus was then sterilised by steam, for two hours on three successive days. After allowing to cool, the tip of the syphon tube was fractured, and sufficient ammonium chloride to cover the gravel was allowed to run over. The syphonage was then stopped by raising the flask containing the gravel. The apparatus was left undisturbed for 24 hours, side by side with a bottle containing ammonia-free water in contact with gravel. At the end of this time plate cultures were made, containing:—

(*a*) 1 c.c. of ammonium chloride solution from the ammonium chloride flask.

(*b*) 1 c.c. of the solution from contact with the gravel. At the end of five days, no development had occurred in the cultures. An examination of the two solutions and of the water, made immediately after the withdrawal of the above samples, yielded the following results :—

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* Dr. H. Chick, *loc. cit.*, p. 257.

† *Cf.* also Wernicke & Weldert, "Verfahren der gegenseitigen Enteisenung u. Entbräunen von Grundwässern," Kgl. Prüfungsanstalt f. Wasserversorgung u. Abwässerbeseitigung, Heft 8, 1907, p. 13. The experiments of J. A. Craw, "On the Filtration of Crystalloids and Colloids through Gelatin," Proc. Roy. Soc., B 77, have a bearing on the question.

* *Cf.* Hall and Gimingham, *loc. cit.*

† *Cf.* Norman Smith, Chem. Soc. Trans., 1906, p. 473.

	Parts per 100,000.		Ammonia Nitrate.
	Ammonia.	Nitrite.	
I. Ammonium chloride before contact	218·96	nil.	·20
II. Ammonium chloride after contact	182·92	·02	·28
III. Ammonia-free water after contact	0·87	·02	·08

The ammonia removed was thus 16·85% agreeing with the disappearance observed under ordinary conditions. (See Exp 4, Table I.)

2. With the object of finding whether the removal of the ammonia from solution was caused by volatilisation, ammonium chloride was placed in contact with gravel in a wide tube, so arranged that a wetted surface of the gravel was exposed to the air. A gentle stream of air was then drawn over the surface of the gravel, and bubbled through a known volume of decinormal sulphuric acid. The subsequent titration of the acid showed no evidence of any ammonia passing from the tube.

3. The following experiment indicates that no appreciable loss of ammonia is due to oxidation. A quantity of gravel was placed in a distillation flask with a known volume of ammonium chloride solution (200 parts ammonia per 100,000), the quantities being so arranged that the surface of the gravel was just covered. After allowing 24 hours for the absorption to take place, 300 c.c. of water, and a minimum quantity of decinormal potassium hydroxide, only slightly more than the equivalent of the ammonia, were added, and the ammonia distilled off and estimated. It was found that the whole of the ammonia placed upon the gravel, could be removed in this way and thus, that the disappearance (absorption), was not due to conversion of the nitrogen from the ammoniacal state.

The following experiment showed finally that the whole of the ammonia removed from solution could be recovered from the gravel, by washing in the cold.

A stoppered separating funnel was filled with gravel, and a measured volume of an ammonium chloride solution of known strength, run on to the level of the gravel. After 24 hours contact as much as possible of the solution was run off, its volume noted, and an equal volume of ammonia-free water was placed on the gravel. After a further 24 hrs. contact, this was removed and replaced by a further quantity.

This process was continued, until the quantities of ammonia removed were practically negligible.

The total quantity of ammonia in each extract was determined. It should be noted that in preparing the medium for this experiment special pains were taken to render the medium free from ammonia before adding the solution.

The following are the principal data of the experiment.

The original volume of ammonium chloride used was 133 c.c. containing ammonium chloride equivalent to 0·2682 grm. of ammonia.

The volume of liquid withdrawn and subsequently replaced in each extraction was 105 c.c., and the amounts of ammonia present in the various portions withdrawn were as follows.

	grm.	
1st withdrawal removed ..	0·1817	
2nd „ „ ..	0·0398	
3rd „ „ ..	0·0133	
4th to 17th, inclusive, withdrawals removed	0·0333	Average per withdrawal =0·0024
18th withdrawal removed ..	0·0004	
Total ammonia removed	0·2685	

It is clear that the total amount of ammonia finally recoverable from the medium is practically identical with the quantity added. It is of interest to observe that the first few washings appear to remove merely the ammonia contained in the interstitial liquid; the remaining washings account approximately for the quantity which was originally absorbed (*Cf.* Exp. 4, Table I.), indicating that this portion is more firmly retained by the medium than the unabsorbed portion.

Effect of temperature.—Having established the fact that the absorption is due to physico-chemical causes, it becomes of interest to study the effect of temperature, as it might be assumed that the action would increase as the temperature rises. The influence of temperature upon the interaction was therefore studied in the following manner :—Ammonium chloride (equivalent to 20 parts of ammonia per 100,000) was placed, in contact with gravel, in a number of stoppered bottles. The stoppers were securely fastened, and the bottles treated variously as follows, the heating referred to being effected by the immersion of the body of the bottle in a water-bath, at 90° to 95° C. I. Heated for 24 hours. II. Allowed to stand 24 hours at room temperature. III. 6 hours heating, 18 hrs. at room temperature. IV. 6 hours at room temperature, 18 hours heating. V. Heated 6 hours and cooled immediately. VI. 6 hours at room temperature. VII. In addition, a stoppered bottle, filled with the original ammonium chloride solution, was heated for 24 hours. After making the correction for the slight concentration of the ammonium chloride solution caused by heating (determined in Case VII.), the results showed that change of temperature did not influence the phenomenon.

Other Ammonium Salts.—A few experiments were made with salts of ammonium other than the chloride, when placed in contact with gravel. Ammonium nitrate solution (equiv. 20 pts. ammonia per 100,000) lost 55% (equiv. ammonium chloride solution lost 56·5). Ammonium oxalate solution (equiv. 149·6 pts. ammonia per 100,000) lost 32·7%. There was evidence in the case of ammonium oxalate that small quantities of lime and iron went into solution, but the action of this and other ammonium salts and mixtures of salts, is matter for further investigation.

The practical importance of the foregoing results appears at first sight to be minimised by the fact that when sewage or effluent is turned upon a fresh bed of clinker no diminution of ammonia occurs, in fact, an increase may sometimes take place. This would seem to negative the idea of any appreciable absorption taking place. It was found upon investigation, however, that fresh clinkers, as they are usually put into a filter bed, contain already a quantity of ammonium salts sufficient to more than compensate for any absorption which may occur. Moreover, there is always a tendency for an increase of ammonia to take place due to continued fermentation of the effluent, until this is more than balanced by the setting in of nitrification. The fact, then, that there is no diminution of ammonia when an effluent passes on to a new filter bed is not an argument against the occurrence of absorption. Nor does it appear to follow, as has been suggested, that absorption should be greater in a contact bed than in a continuous filter. It has been shown that the percentage absorption of ammonia is greater the more dilute the solution, and that only a certain maximum quantity is absorbed under any circumstances. It may be assumed, therefore, that if absorption takes place in the upper layers of a continuous filter, it would continue further as the unabsorbed remainder passes down the filter. As a matter of fact, by submitting the ammonium chloride solution, after contact with gravel, to the further action of a fresh quantity of the latter, and repeating the same process, we have been able in four contacts to reduce the ammonia from 2·65 parts per 100,000 to 0·24 parts, equivalent to over 90 per cent.

In Dr. Chick's experiments with strong sewage, nitrification was found to begin in the lower parts of the filter. This would be quite consistent with the idea of a progressive absorption of ammonia in the descending layers of the filter, and of nitrification beginning where ammonia was in least excess. On the other hand, Reid[*] has shown that, with dilute sewage, nitrification takes place in the upper layers of the filter-bed. In the presence of unfermented albuminoid matter capable of yielding ammonia, and of itself exercising absorptive properties, definite conclusions are, however, very hard to draw.

An attempt to settle the question as to what part, if any, is played by absorption in the process of nitrification, has been made in the following manner:—Two small laboratory filters of a total volume of 750 c.c. each were set up, one being composed of gravel and the other of quartz, the two materials being of approximately the same dimensions. To each was applied the same volume of "drainings" from a 2nd contact filter in which nitrification was well developed. This liquid was quite free from matter in suspension, which might exercise a disturbing action. To avoid any inequality of distribution, the contact method was used in the experiment. In the first few trials a definite amount of absorption of ammonia took place in the case of the gravel filter, but not with the quartz but no consistent increase was observed in the amount of nitrate present in the filtrate from either the gravel or quartz as compared with the amount present in the original liquid. After a number of fillings, however, the absorption of ammonia by the gravel apparently ceased, but while there was still no appreciable increase of nitrate in the filtrate from the quartz, a steady difference was apparent in the case of the gravel. The results are given in Table II., it being noted that the first filling was held in contact 24 hours, the remaining fillings having only 2 hours' contact.

TABLE II.

A = original liquid, B = quartz, C = gravel. Results in parts per 100,000.

Date. April, 1907.	No. of filling.	Free Ammonia.			Ammonia from Nitrites.			Ammonia from Nitrates.		
		A.	B.	C.	A.	B.	C.	A.	B.	C.
10th	1	1·04	1·14	0·60	—	—	—	2·65	2·85	2·65
12th	2	·86	·93	·65	·03	·03	·07	2·55	2·65	2·61
15th	4	1·21	1·07	·86	·05	·065	·065	2·43	2·29	2·36
16th	5	1·00	·93	·82	·04	·04	·03	3·30	3·14	3·14
17th	6	1·07	1·04	·96	·65	·65	·06	2·80	2·80	2·70
25th	13	—	—	—	·06	·07	·065	2·43	2·50	2·57
26th	14	1·14	1·07	1·07	·07	·06	·065	1·93	1·93	2·21
29th	16	1·07	1·00	1·00	·04	·06	·06	—	2·14	2·50
Average of 5 fillings during "absorption" period									2·74	2·69
" " 3 " after " "									2·19	2·42

The above results, although indicating that absorption tends to accelerate the commencement of nitrification, are not in themselves sufficient to warrant a final conclusion, as it might be contended that the favourable result from the gravel was due to the fact that rather more liquid was retained in the interstitial space of the gravel, and that this underwent oxidation during the period of rest. The experiments are being continued, using, in addition, a quartz filter of rather finer grade, so that any difference due to the increased amount of retained liquid would be in favour of the quartz. Under these circumstances it has been found that little difference is observable between the gravel and the fine quartz, but both continued to yield more nitrate than the larger quartz. No "absorption" of ammonia was observed in the case of the fine quartz It would therefore appear that the greater power of the fine medium to hold liquid within its interstices was equivalent to the absorptive effect of the gravel, in regard to facilitating nitrification.

General Conclusions.—On reviewing the general results of our experiments, together with those of the other workers referred to, it appears reasonable to conclude that, although the "absorption" of ammonia is not a necessary preliminary to nitrification in biological filters, it may not be without effect, especially during the initial stages of nitrification, when the number of organisms may be assumed to be comparatively small. Under such conditions, the experiments of Boulanger and Massol have shown that an excess of ammonia may exercise an inhibiting effect on the development of the organism, which is not apparent when an abundant growth has established itself. The longer period of retention effected by "absorption" may, therefore, be advantageous, in the former case. That small differences in the structure and composition of the medium may have surprisingly important effects, apart from the biological conditions, is shown by the fact, which was first mentioned by Lübbert, that a 2 per cent. alcoholic solution of dimethylaniline develops a violet colour on standing in contact with clinker. We have found that the same effect is produced by gravel, but that no such result is obtained with quartz of a size comparable with the gravel. A very slight effect is produced on prolonged contact with finely divided quartz in presence of air. It is evident, at any rate, that quartz is the most suitable medium for the exact study of nitrification in contact with surfaces, as the action is not complicated by absorption phenomena.

When once nitrification has set in no doubt its rate depends chiefly on the amount of surface in simultaneous contact with air and liquid. The experiments described in the paper just read by Mr. Clifford show, however, that even at this stage the process is one requiring an appreciable time for its completion, much more than is occupied by the mere passage of the first portions of a given volume of liquid through the filter.

Incidentally it may be remarked that the solvent action of ammonium chloride solution affords a means of comparing different media, in respect to their resistance to breaking down on prolonged use for filtering purposes. Even with solutions of ammonium chloride containing approximately 2 parts of ammonia per 100,000, an appreciably greater action is obtained than by simple immersion in water.

In conclusion we should like to express our indebtedness to Mr. Edward Ardern, M.Sc., for valuable suggestions and assistance, especially during the temporary absence of one of us in India.

DISCUSSION.

Mr. E. **HALLIWELL** fully agreed with Dr. Fowler's comment upon Mr. Clifford's experiments that there would be a great difference in the time of percolation through the experimental filter if, instead of clean and newly screened coke or gravel, he had used material from a bed which had been in use for, say, six months. A large amount of fine and slimy matter would accumulate in and round the larger particles of the original material, and as Mr. Clifford had shown that the length of time of flow increased with the decrease in size of the material, so would the rate of flow through the filter be decreased by this slimy matter. The time taken to percolate through a bed had two important bearings upon purification ; on the one hand it was a measure of the opportunity of either absorption or direct bacteriological purification ; on the other it was a measure of the fineness of the film of liquid in direct contact with the material of the bed. Had Dr. Fowler noted the absorption of ammonium nitrate or nitrates generally by the different materials ? Was the rate of absorption of ammonia affected by the presence of a solution containing nitrates, or were the nitrates removed from the material immediately after their formation ? He would emphasise Dr. Fowler's statement that nitrification can be got without contact, and therefore without absorption of ammonia by the material. That was proved by the frequency with which in good effluents the nitrates were increased during incubation.

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[*] Proc. Roy. Soc., 1906.

Mr. F. R. O'Shaughnessy said he was curious to see in what way Mr. Clifford would test this problem of investigating the rate of percolation through bacteria beds. More recently they had instituted a particular enquiry into the conditions regulating the flow of sewage through percolation filters. In view of the important bearing the matter had on the cost of construction of bacteria beds, he deprecated strongly the loose statements made in this connection by some sewage experts. These statements were not merely worthless, but often altogether misleading. Mr. Clifford's method of investigation was distinctly ingenious but the terms he used, viz. :—" rate of distribution " of the chlorine through the liquid was not a good one, and would lead to confusion, as this word " distribution " had already a definite and well understood meaning in sewage terminology. It was interesting to see from the curve the minimum and maximum times taken by the molecules of chlorine to pass through a filter. In actual practice, however, it was the average time and average concentrations after equilibrium was established which were of importance. He hoped soon to publish the results of an investigation of this interesting problem. The subject was one which lent itself to mathematical treatment, and indicated that the rate of passage downwards of liquid over particles of hard impervious material was governed by a number of factors, the most important of which seemed to be the size of the particles, or in other words the amount of surface over which the liquid had to pass. In fact a formula could be deducted shewing that when all other conditions remained the same, and the quantity of liquid was varied, the resisting power (friction) of the bed was within limits a fairly constant quantity. With regard to the curve representing the absorption of the ammonia, he presumed that the bulk of the ammonia which the author had shown could be recovered from the medium by washing with distilled water was present in a loose state of physical association with the medium, whilst the small residue of ammonia which remained was actually combined chemically with the substance of the medium ; the fact that small quantities of the material went into solution lent support to this view. The chemical reactions taking place in the bacteria bed with such a complex fluid as sewage were so very complicated that the question was probably best attacked from a mathematical point of view, dealing with broad issues under ideal conditions.

Dr. F. W. Skirrow supposed that the solution would not become acid owing to the liberation of the hydrochloric acid. In the case of calcium carbonate, the amount of calcium which would go into solution would be exactly equivalent to the ammonia which is removed from the solution. They were told that the establishment of equilibrium between the solution and the solid substance took only a short time, and then all action ceased. This might possibly be explained in the following manner :—The ammonium chloride and calcium carbonate interacted, giving ammonium carbonate, which possibly formed some double compound with the calcium carbonate which was more difficultly soluble than ammonium carbonate. This formed a protective coating on the surface of the material, and thus prevented further action, in which case, on washing with a large excess of water, the whole of the ammonia would be naturally recovered.

Dr. E. Knecht drew attention to a remarkable phenomenon which had first been noticed by Mr. Watson Smith in connection with the action of wool on ammonium sulphate solutions. At a boiling temperature exactly the reverse action took place to that mentioned in the paper, i.e. the ammonia was slowly driven off. He had tried the effect of acid colours on wool thus treated, and found that they were taken up without any acid being added to the dye bath. He suggested that the interesting formation of Methyl Violet from dimethylaniline solution in contact with clinker was possibly due to the presence of iron or of traces of copper in the clinker.

Mr. E. Ardern said that the author naturally worked with clean washed material and consequently it was obvious that minimum results would be obtained, still, they afforded a sound basis to work upon. It was interesting to note the effect of the finer sized material on the rate of percolation. In actual practice, after a filter had become mature, the time taken by a liquid to pass through the material would be considerably retarded by the accumulated slurry, organic growths, and disintegrated medium. The estimation of the average length of time which any given portion of the sewage was in contact with the filtering medium would be undoubtedly a difficult matter, owing to the different rates of diffusion of various liquids and the possibilities of considerable osmotic action.

Dr. B. W. Gerland said the disappearance of ammonia in the liquor under treatment was one of the most striking points in the paper. It might be caused by the action of the effluent upon the mineral matter of the filter bed, by which the ammonia became replaced by soda. Zeolites were, as has been shewn repeatedly, subject to such a change. If the ammonia were oxidised to elementary nitrogen, or still further to nitrogen oxides a perceptible increase of acidity would be caused ; a contact substance for this process was certainly present. As far as he knew, no nitrogenising organism had been observed in the effluent, nor had their absence been proved. It would be of great interest to try the effect of nitraline or some other nitrifying bacterial cultivation in the oxidizing beds and filters.

The Chairman said he had not gathered from Mr. Clifford's paper that any attempt had been made to measure the interstitial spaces. Friction of surface was a very large factor in determining the rate of flow through the filter, but although the surface might be estimated in certain cases, it would usually be difficult in practice. It might be interesting to know whether there was not some connection between the rate of flow and the interstitial space of which an estimate could be easily made. With regard to the paper of Dr. Fowler and Mr. Gaunt he should like to know whether they had found the liquors to become acid. Mr. Hall's results were to the effect that the acid combined with the basic substance present, or a double decomposition ensued. Dr. Fowler had remarked that the materials became more basic after treatment. He (the Chairman) could not understand how this could be the case. The paper was a most interesting one, in that it brought out the parts played by both chemical and physical action, and it would be interesting to know how far the authors might be prepared to classify their observations under each of these heads. If absorption did take place, then it must be a factor of the amount of surface, and if so, then surely two samples of the same substances—one coarse and the other fine—must give some indication of a difference, though it did not seem to have done so. That a marked physical action was to be expected might reasonably be held in view of such investigations as that of Bunsen on condensation upon solid surfaces. It might be that the behaviour in liquids was entirely different, for carbon did not shew any tendency to the absorption spoken of by Dr. Fowler although it was well known to be an excellent absorbent for gases. The paper showed how much there was yet to be learnt regarding phenomena of constant occurrence affecting very deeply the changes which are continually going on around us.

Mr. Julius Hübner asked what colouring matter was used for the purpose of testing ? It was well known that a number of these media attracted some of the colouring matters very strongly, and in this respect he thought might be misleading, especially if weak solutions were used.

Mr. W. H. **Coleman** remarked that Dr. Fowler might possibly know that in the experiments carried out by Prof. Liversedge, quartz absorbed a considerable quantity of potassium cyanide solution, which showed that the particular salt had a considerable effect on the experiment.

Mr. **Clifford**, in reply, said that the average time of passage through a working bed would no doubt be prolonged by the presence of colloidal and organic matters present. The times given in the table would (as Mr. Ardern pointed out) represent minimum average times. It was unfortunate the word distribution was used in two senses, indicating the average rate of distribution of liquid over the surface of the bed, and the mean distribution or frequency (mathematical sense) of the chloride on the effluent. Replying to Dr. Gerland, the colour method had been tried, but there were several objections to its use, one as pointed out by Mr. Hübner was the possibly selective absorption by substances present in the bed; another was the difficulty of quantitative measurement. As to the first trace of colour measuring the rate of flow, it would be seen from the chloride curve, that the first trace could only possibly represent the passage of a very small portion of the given dose. The total volume of the interstitial space had been determined, in each case, but it did not appear to be directly connected with the time function. There was however a close connection between the grade of the medium and the time of passage through the bed. The greater, the aggregate area of the particles, the greater the amount of water retained by the medium. Each dose or sprinkle mixed with and displaced a certain amount of interstitial water, and the greater the amount of interstitial water, the longer would be the average time of passage through the bed. The present practice of constructing deep beds with coarse medium and shallow beds with fine, had a rational explanation in the average time of percolation. The average time of passage through three feet of coal, ¼ to ⅛ inch, worked out the same as through 6 ft. 3 in. of the same material, ¾ to ⅝ inch grade.

Dr. **Fowler**, in reply, said these experiments could be carried on to an unlimited extent. Mr. Halliwell had made an interesting suggestion as to whether the simultaneous action of other salts would increase the amount of absorption of ammonia. They had thought that possibly calcium chloride might have this effect, and had tried it in connection with electric light carbon, but the results were not very conclusive. As regards the theory of what exactly happened in regard to absorption, he had tried to avoid making any statements in the paper which were not proved. In reply to Dr. Knecht, he was quite of opinion that the oxidation of dimethyl aniline was probably a catalytic phenomenon due possibly to oxide of iron, and he intended to follow up the question. He was unaware of the experiments referred to by Mr. Coleman, but thought it possible that some amount of iron might have been present in the quartz used. The quartz used in their experiments was pure granulated quartz, such as is used in high pressure water filters, and had been kindly furnished them by Messrs. Mather and Platt. The gravel used was screened to about ⅛ inch, and included particles of stone and shell.

In reply to the Chairman, he admitted that he had rather loosely stated that the material became more basic; what he had in mind was the production of ammonium carbonate by interaction of ammonium chloride and calcium carbonate. As a matter of fact, he was inclined to think that the reactions observed were of the same class as those described by Hall and Gimingham. But while a certain chemical composition appeared to be necessary, there was required also a certain physical structure. It did not seem to be entirely a question of extent of surface, but rather of the character of the surface. A powdered substance did not, *e.g.*, act in the same way as one consisting of larger pieces with striated surfaces. The surface tension within these crevices appeared to have some influence on the results. With reference to the non-absorption by electric light carbon it must be remembered that they were not dealing with free ammonia, but with ammonium chloride. In conclusion he might repeat that the experiments were made to find out something of the physical and chemical conditions under which nitrification took place. They knew that nitrification took place more rapidly on extended surfaces, and he wished to carefully study the nitrification of simple substances in contact with surfaces, but before entering upon such work it was necessary to find out if any purely physical or chemical effect was produced, apart from biological action, and they found that in almost every case except quartz some such physicochemical inter-action did take place.

New York Section.

Meeting held at Chemists' Club on Friday, May 24, 1907.

MR. GEO. C. STONE IN THE CHAIR.

THE TOWNSEND ELECTROLYTIC CELL.

BY L. H. BAEKELAND, SC.D.

In 1902, C. P. Townsend (*) outlined the theoretical principles and problems involved in the electrolytic production of alkali and chlorine. In logical harmony with his theory, he found an original method for perfecting diaphragm cells. Up till then the latter had not been a great commercial success. Many believe that this was due to the rapid deterioration of the diaphragm itself, and the patent records of different countries furnish a long list of inventions, having in view improvements of diaphragms, either by modifying their construction, or by introducing new materials. Some inventors went so far as to entirely do away with diaphragms. This was accomplished, for instance, in the gravity cell, where the anolyte and catholyte are kept separate by their difference in specific gravity; or, again, by selecting a liquid metal cathode, as in the mercury or molten lead cells. In any of these cells, the main problem remains—how to avoid the tendency toward recombination of the alkali hydroxide, liberated at the cathode, with the chlorine set free at the anode. This recombination is rendered possible by the phenomenon of diffusion. Whatever will restrict diffusion will retard recombination; whatever will favour diffusion will, at the same time, hasten recombination. Recombination does not involve merely a loss of energy efficiency, by allowing some of the valuable products set free by the electric current to recombine; it also means that the chlorine, on acting on the alkali hydroxide, produces a mixture of alkali chloride and alkali hypochlorite (or chlorate, at higher temperatures). Both of these oxygen compounds are harmful, and may become fatal to the proper operation of the cell. In their turn, they will undergo electrolysis and oxidise the graphite anodes: the latter will undergo rapid corrosion, vitiate the functions of the cell, and increase the cost of operation, maintenance, and renewals. This is clearly established by the fact that, for a given cell, the amount of hypochlorite or chlorate in the anode liquor is in direct proportion to the ampere efficiency. As a corrollary to this, it has been proved that the rapid corrosion of the graphite anodes is a sure indication of low efficiencies.

In this matter, the exertions of inventors have not always been guided by the proper understanding of the following principles:

First: The rate of diffusion between anolyte and catholyte is a function of the concentration of the diffusing solutions.

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* "Electrochemical Industry," 1, 23.

Second: The amount of diffusion is a function of the time during which the given solutions remain in contact.

Third: The alkaline hydroxide, in contact with the cathode, takes part in the electrolysis, and the liberated hydroxyl ions tend to migrate towards the anode.

For these reasons, gravity cells, working with an acceptable ampere-efficiency, give necessarily a weak caustic liquor.

Several attempts have been made to circumvent recombination, by transforming the liberated sodium hydroxide into less soluble or chemically less active compounds. One of the methods conceived, with this end in view, consists of submitting the cathode liquor to the action of carbon dioxide, so as to form carbonate or bicarbonate of sodium. From a commercial standpoint, this process is rather a backward step, because it transforms high priced sodium hydroxide into the less valuable carbonates.

I shall not attempt to undertake the critical examination of the different types of mercury, or other liquid-cathode cells that have been proposed, or that have been in more or less successful commercial use. But I desire to emphasise the fact that, from a commercial standpoint, it is not sufficient that a cell should have high ampere efficiencies, or high energy efficiencies. Indispensable as these qualities are, they represent but partially the qualifications of a successful cell. A cell giving an almost theoretical energy efficiency, may yet prove a commercial impossibility, if initial cost of installation, or maintenance, are too high, or if the cell is too delicate to be operated by workmen of average skill. And here, as in other branches of chemical industry, it has frequently happened that experts, called upon to give an opinion on electrolytic cells, have accorded an exaggerated importance to theoretical efficiencies, while neglecting to put enough stress to initial cost of plant, amortisation, cost of maintenance, and regularity of operation. In other terms, instead of determining how good a given cell is under the best conditions, if they had tried to discover what "hard knocks" the apparatus can stand, they might have found out inherent causes of future insuccess and saved disastrous failure, by remedying the weak points, provided a remedy was possible.

In the Townsend cell, diffusion and subsequent recombination of cathions and anions is almost entirely prevented by automatically removing all cathode liquor as soon as it appears, and surrounding it with a chemically inactive and physically immiscible liquid. The liquid preferred in practice is kerosene.

How this result is obtained is best seen from the diagram of a vertical cross-section of the Townsend cell, in its simplest form (Fig. 1). An anode compartment is enclosed between a lid (C), two vertical diaphragms (D), and a U-shaped non-conducting body (H), of which only the section of the lower part is shown. Through the lid of the cell pass the graphite anodes (G), by the upper parts of which are connected with the electric generator. The diaphragms adhere closely to two perforated iron plates, which form the cathodes (S). The latter are fastened to two iron sides (I), bulging outwards in the middle, so as to form a cathode compartment. The anode compartment is kept filled with saturated brine (T), while the cathode compartment contains kerosene oil (K). Even if the two liquids were situated at the same level, there would be a hydrostatic pressure from the anode compartment towards the cathode compartment. Under these conditions, the brine is pressed from the anode chamber, through the diaphragm. As soon as the electric current is turned on, the percolating brine becomes cathode liquid, and the strength in caustic hydroxide of the latter will increase, according to the number of amperes. But all the liquid, as soon as it traverses the diaphragm, runs through the perforations of the anode plate, and there, meeting a body of immiscible oily liquid, acquires, by a capillary phenomenon, a globular shape. It soon detaches itself from the cathode plate, and sinks rapidly to the bottom of the oil, into the caustic pocket (A), where henceforth it is removed from all possible chemical or physical action. This simple, yet elegant, method removes the caustic soda almost instantaneously from the zone of perturbation. The inflow and overflow of the brine in the anode compartment are so arranged that the level of this liquid can be quickly raised or lowered, and kept automatically constant. This method furnishes a ready means for augmenting the hydrostatic pressure, and thereby increasing the rate of percolation, in accordance with the density of the electric current, or in compliance with the desired strength of caustic liquor: thus weak or strong cathode liquid can be obtained at will by merely raising the level of the brine.

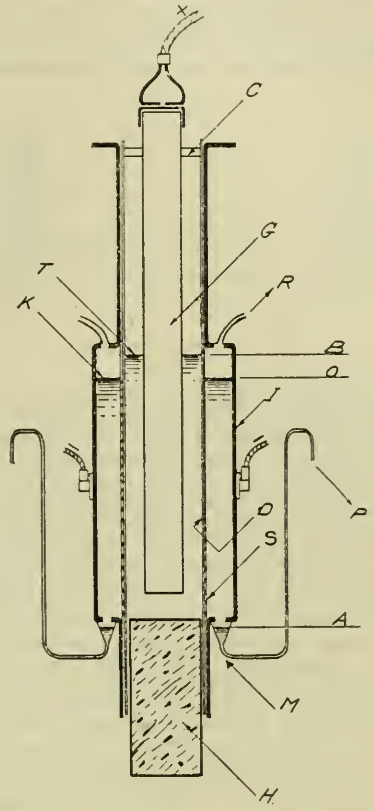

Fig. 1.—Diagram of Townsend cell.

This is, in substance, the way in which the cell was first conceived by C. P. Townsend, aided by Elmer A. Sperry. After operating the cell in large units for some time, some mechanical modifications suggested themselves, which have been successfully carried out, although, on the whole, the original idea was entirely respected. We found, for instance, that several new contrivances were advisable, so as to render the operation of large units more regular.

The cells which I am to describe now are those which have been in continuous operation, on a large scale, since the beginning of January, 1906. Each of these has been carrying from 2,000 to 2,300 amperes per cell; new cells are now under construction which will carry over 4,000 amperes each. All these cells are operated under the extremely high current density of about one ampere per square inch of anode surface. The cells measure about 8 feet long by 3 feet high by 12 inches wide. The U-shaped non-conducting body, which has been mentioned before, is cast of cement concrete. The two large iron side-plates, bulging out in the middle, are provided with flat borders, and to each of them is fastened inside a perforated sheet of iron, which forms the cathode. Against the latter is applied the diaphragm, which I will describe later on. The flat borders of the iron sides are properly planed and dressed, and, by means of a rubber gasket, they fit tightly against the smooth surface of the concrete (U). Strong steel clamps hold the whole system rigidly in position.

The latter are designed so that it takes but a very few minutes to take the cell apart, or to put it together; this allows easy inspection and quick cleaning. The inflow and overflow of the brine in the anode compartment are so arranged that the level of the liquid can be instantly raised or lowered and maintained automatically at the desired height. For this purpose, a system of stoneware channels is imbedded in the concrete body, as shown by the diagram (Fig. 2). These are two horizontal cross channels, intercommunicating with a vertical one. The upper cross-channel, A, serves as an exit for the gas, while the lower one, B, provides a flush hole for cleaning the bottom of the cell. A glass tube, C, slides in the vertical channel through a perforated stopper, D, at the lower end. This tube can be raised or lowered, and affords a ready means for modifying the height of the overflow, so as to control the hydrostatic pressure in the anode chamber. This allows the making of strong or weak caustic liquor, merely by moving the glass tube, an operation which requires but a couple of minutes.

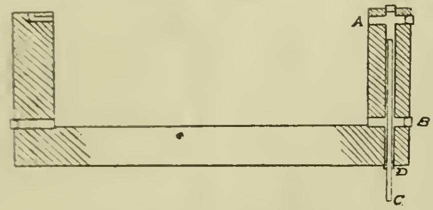

Fig. 2.—Townsend cell.

The overflowing brine of all the cells is sent to a common reservoir. At the bottom of each cathode compartment, there is a slight depression or caustic pocket, where the separated cathode liquor collects. But this liquid does not accumulate beyond a few cubic centimeters; it is steadily drained by means of an adjustable iron pipe, which carries the caustic liquor from underneath the kerosene, in about the same way as the goose-neck tube of a Florentine flask. In this manner, the rich cathode liquor runs out from both sides of the cell, in two continuous streams, and is conveyed into a general storage tank, whence it goes to the evaporating pans. All the cells work automatically, and one man is sufficient for supervising a cell plant producing daily tens of tons of caustic soda. Losses of kerosene are slight; they are due partially to evaporation, and also to mechanical waste—this amounts to about two dollars daily for a large plant, and only once in a while is it necessary to replenish the oil compartment, so as to keep a steady level. After this description, it becomes evident that the whole cell is relatively inexpensive in construction. This means a considerable reduction in the initial cost of a plant, as compared to that of mercury cells, of which the mercury alone represents several times the cost of a complete Townsend cell; this means, furthermore, a lesser cost of amortisation and maintenance.

An essential part of a diaphragm cell is the diaphragm itself, and, therefore, a word as to the nature of this diaphragm will not be out of place. At first, the diaphragms of the Townsend cell were made of two or more thicknesses of asbestos paper, but this involved rather delicate handling and considerable expense for renewals. I was therefore led to substitute another form of diaphragm, for which patent protection has been obtained. It consists, essentially, of a woven sheet of asbestos cloth, of which the pores are filled with a special paint, made of a mixture of oxide of iron, asbestos fibre, and gummy iron hydroxide. Iron oxide resists chlorine and sodium hydroxide; on the other hand, the semi-colloidal iron hydroxide provides an inorganic binder for the asbestos fibre—it acts in about the same way as the organic size, which is used in the manufacture of asbestos paper, but it has the advantage of not becoming gummy in contact with sodium hydroxide. Whenever the diaphragm has to be renewed, the cloth is simply scrubbed and washed, and a new coat of paint is applied; after the latter is dry, this renovated diaphragm is again ready for use. All this takes but little time. The frequency of renewals of diaphragms depends very much on the conditions of the brine; with very clear and pure brine, a diaphragm may not require repainting for several months, but, in practice, this is not easily obtainable: nevertheless, even with impure or unsettled brine, the diaphragms only require repainting about once in five weeks.

Acheson graphite blocks are used as anodes. Under proper conditions of operation, these anodes will last an astonishingly long time without the slightest signs of deterioration. But even under the worst conditions, they only require partial renewal after about one year's continuous hard service.

One of the numerous problems, with which we were confronted in the operating of a large cell plant, was to provide practical means for insuring a quick resaturation and filtration of the spent anode liquor, as it leaves the cell by the overflow. That liquor has to be returned to the general brine system, and this is no small problem of chemical engineering; indeed, the spent anode liquor has to be brought up quickly from specific gravity 1·18 to specific gravity 1·2. This liquid is warm, and carries an uncomfortable amount of chlorine gas that should not be lost. Many hundreds of thousands of gallons of this liquor every day have to be resaturated, filtered, and kept in continuous circulation, in a plant which is supposed to run day and night from the beginning to the end of the year, without stopping. How I have endeavoured to solve this difficulty, I may better describe by referring to the text of my American Patent (see Fig. 3).

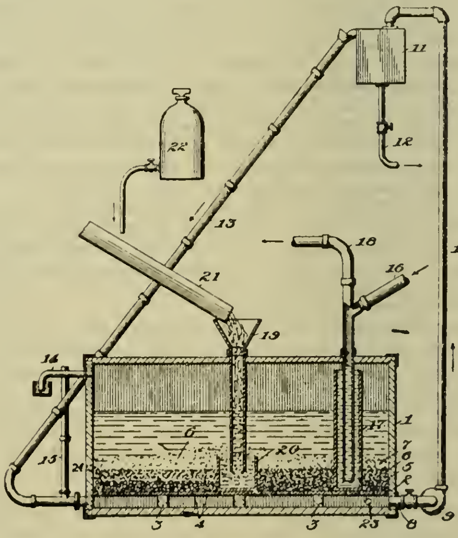

Fig. 3.

"1 represents a covered regenerating-tank of size proportionate to the volume of electrolyte to be treated, and constructed of material which is substantially unaffected by chlorinated brine. I prefer to construct this tank of slate or of concrete lined with slate, the joints being waterproofed by an acid-proof cementing material, such as pitch or asphalt. All portions of the tank and its appurtenances, as well as of the circulating system, should be constructed of acid-proof stoneware, hard rubber, or other material not injuriously affected by chlorinated brine. A false bottom, 2, is suitably supported, as by blocks, 3, above the tank-bottom, and is provided with a multiplicity of apertures, 4. This false bottom may consist of perforated slate, as shown, of spaced parallel bars or strips, of "drainer-blocks" such as are commonly used in pulp manufacture, or of equivalent materials. Over this false bottom I preferably distribute acid-proof gravel or crushed stone, 5, upon which I may, if desired, spread a layer, 6, of sand. This serves to support a bed, 7, of salt, which should be of a high degree of purity, and which is replenished as dissolved. The thickness of the layer of gravel or of gravel and sand may vary according to requirements, and any equivalent permeable support for the salt may be substituted therefor. 8 represents the inlet-pipe of a rotary pump, 9, a cock being preferably interposed between the pump and the tank. This pump discharges through pipe, 10, into a supply tank, 11, serving as a source of supply through overflow-pipe, 12, to the several electrolytic cells, and located at a height sufficient to give the pressure required. The supply tank, 11, is provided with an overflow, whereby any excess of liquid above that required for the cells is returned through pipe, 13, to the side of the tank, 1, opposite the pipe, 8. The pump 9 should have a capacity somewhat exceeding the maximum requirements of the cells. Tank 1 is provided with a liquid-sealed overflow, 14, and I preferably provide also a safety overflow-pipe, 15, extending from the horizontal member of pipe, 13, to a point somewhat above the level of the overflow, 14, but below the top of the tank. The chlorinated and spent brine from the electrolytic cells is permitted to flow to the regenerating-tank, 1, through a conduit, 16, discharging into a well, 17, within the tank. The construction is such as to permit the free escape of chlorine dissolved or otherwise conveyed by the liquid in conduit, 16, and a branch pipe, 18, is provided for conveying the separated chlorine to the bleach-chambers or other points of utilisation.

"The salt is introduced, preferably continuously, through a charging-hopper, 19, which extends below the normal liquid surface. A sealing-well, 20, surrounds the lower portion of the sealed inlet, and serves to prevent escape of chlorine therethrough in case the liquid is withdrawn from the tank. The salt is introduced to hopper, 19, through a trough or chute, 21, which may be of wood, and is conveyed by saturated brine in quantity sufficient to maintain the proper volume of liquid in the system. This brine flowing upwardly from the sealing-wall, 20, into the body of the tank 1 carries with it the salt and distributes the same over the surface of its supporting-bed. It will be noted that the spent brine is introduced into the tank above this body of salt and percolates through the same and through its supporting-bed, whereby any suspended impurities are removed. In case the salt from which the brine is prepared contains impurities which are precipitated in alkaline solution, it is preferably preliminarily rendered slightly alkaline and decanted or filtered from the precipitate. In such case it is desirable to neutralise any alkalinity by the addition of hydrochloric acid in theoretical proportions or in slight excess thereof. I have indicated for this purpose an acid-supply, 22, arranged above the chute, 1, and discharging into the brine flowing therein. Acid introduced into the brine at this point is quickly and thoroughly commingled therewith. 23 represents an aperture, normally closed, of which a number may be provided for the purpose of flushing out the tank 1 when required. 24 are similar apertures for the flushing out of impurities which may have accumulated on the top of the filtering-bed."

The system, as described, has been in operation for about sixteen months, with only two or three short stoppages for cleaning. A word might be said as to the products of the cell. The chlorine gas is used for the manufacture of bleaching powder, in ordinary lead chambers. The caustic liquor, on leaving the cell, still contains more or less large quantities of unconverted chloride of sodium. For instance, a cathode liquor containing 150 grms. of sodium hydroxide per litre will contain also 213 grms. of sodium chloride. By reducing percolation, the strength of the cathode liquor can be increased to 25% of hydroxide or over, and even then it will contain 14% of chloride. But in practice it is found more economical to run at lower strength; evaporation in a series of vacuum pans and open kettles separates the salt, and the remaining caustic lye is further concentrated in large cast-iron finishing pots. When, finally, almost all water has been driven off, the molten caustic is ladled into steel drums. The latter stand on a train of little railway trucks, where they are filled with the molten mass. Finally, the whole train is pulled out of the evaporating building, so as to hasten cooling in the open air.

Thus far, I have said nothing as to the efficiencies of the cell. In special tests, where the cell was operated under very favourable conditions, it has been possible to maintain the ampere efficiency quite close to 100%, the voltage not exceeding 3·4 to 3·6 volts, but in practice these ideal conditions are seldom realised, where a large set of cells have to be operated at the same time, and where efficiency has often to be sacrificed to expediency. But even then, ampere efficiencies ranging between 96% and 97% are not unusual. Under abnormally defective conditions, brought about by some temporary disturbances in the plant which were not under the control of the cell-room, the ampere efficiency has seldom fallen below 90%. Under more normal working conditions, the average ampere efficiencies, in a row of cells, can easily be maintained around 96%.

As to the energy efficiencies, they decrease when the voltage increases; as the latter augments with the number of amperes sent through the cell, it stands to reason that cells running with light current densities will also indicate a high current efficiency. This shows how absurd it is to speak about energy efficiencies without mentioning current densities. For instance, a density of one-half ampere per square inch, which, in comparison to other electrolytic cells, is very high, allows the cell to be run at as low a voltage as 3·4 volts, but in practice it has been found more economical to sacrifice some of the energy efficiency and run at high current densities. Even then, when running at the very high rate of one ampere per square inch, the voltage averages 4·7 volts per cell.

The Niagara Falls plant, where the Townsend cells have been in continuous operation for sixteen months, is producing daily about five tons of caustic and eleven tons of high-grade bleaching powder, and, on the strength of what has been accomplished, it has been decided to increase the installation to four times its present size.

Journal and Patent Literature.

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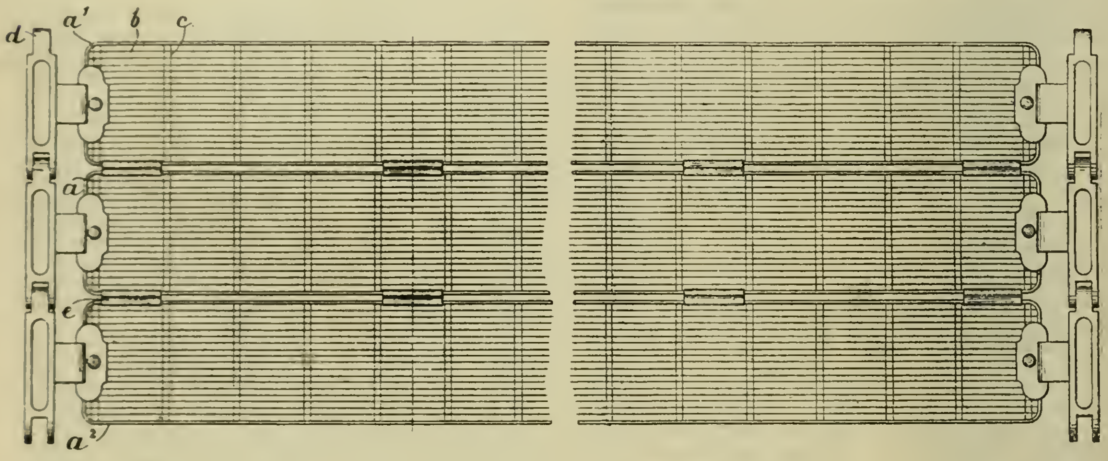
I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Drying machines. J. B. and G. Whiteley, and W. Peace, Huddersfield. Eng. Pat. 15,947, July 14, 1906.



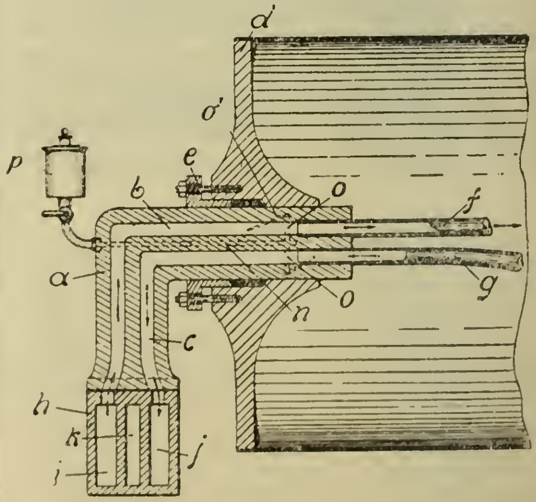
THE travelling band on which the materials are carried, is divided into sections, *a*, a^1, a^2, formed of wires, *b*, strengthened by cross-bars, *c*. Each section corresponds in width with the length of a link of the endless chain, *d*, by which they are supported. The sections are hinged together by pieces of metal, *e*, as shown. The object of the invention is to avoid the danger of breaking the band when it passes over the rollers.—W. H. C.

Regulating the respective quantities of two fluids to be mixed with each other as they flow; Means for ——. W. B. Baron and The Fuel Saving and Water Treating Co., Ltd., Manchester. Eng. Pat. 20,813, Sept. 19, 1906.

THE flow of the added liquid is regulated by an adjustable weir consisting of a slotted pipe which is raised or lowered in the reservoir in which that liquid is contained. The movement of the slotted pipe is effected by a lever and float, or by other suitable means, so that it is raised or lowered as the level of the principal liquid flowing over a fixed weir rises or falls.—W. H. C.

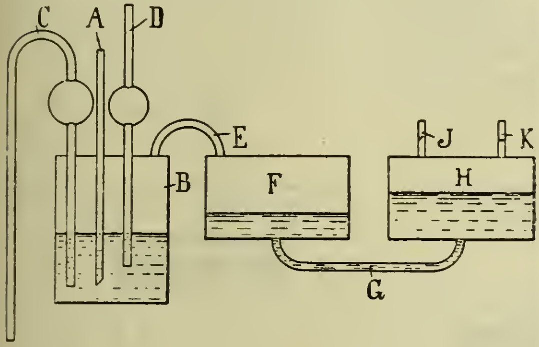
Drying and like machines; Steam-heated cylinders for ——. D. J. Bunschoten, Goor, Holland. Eng. Pat. 22,643, Oct. 12, 1906.

THE steam inlet, *b*, and the outlet, *c*, for condensed water from the drying cylinder, *d*, both pass through the same casting, *a*, so that there is only one joint, *e*, to be made. The casting, *a*, is attached to a compound conduit, *h*, which serves for a number of cylinders. This conduit has three channels: *i*, for steam; *j*, for condensed water: and another, *k*, between the two former, to isolate them from one another. The steam travels in the direction shown by the arrows into the pipe, *f*, which extends horizontally to the far end of the cylinder, and the condensed water escapes by the pipe, *g*, which is bent downwards to nearly the bottom of the cylinder. The lubricating oil is fed from the cup, *p*, through the channel, *n*, to the ducts, *o*, *o*, in the channels, *b*, and *c*, which are bent as shown to deliver the lubricant in a direction contrary to that in which the fluid passing through the channels, *b*, and *c*, is travelling. —W. H. C.



Pumping or moving gases; Apparatus for raising and lowering the level of liquids for the purpose of ——. Allgemeine Feuertechnische Ges.m.b.H., Berlin. Eng. Pat. 24,427, Nov. 1, 1906. Under Int. Conv., Nov. 2, 1905.

Water caused to flow through the pipe, A, into the closed vessel, B, drives the air or gas in B, through the pipe, E, into the vessel, F, and forces the "sealing liquid" in F, through the pipe, G, into the vessel, H, where it forces the gas in H, through the valved pipe, J. As soon as the level of the liquid in B, reaches the top of the siphon, C, the latter acts, and the level of the liquid falls, the bore of C, being greater than that of A. The motion is transmitted to the liquid in H, so that gas is drawn in through the valved pipe, K. The special claims are for:—1, the transmission of the motion of the liquid in B, to a second "sealing-liquid" in F, and H, which has no action on the gas pumped; 2, the transmission of the motion from B, to F, by a buffer of air or inert gas, which, owing to the length of the pipe, E, acts as a thermal-insulator in order that the temperature of the water used, may have no effect on the gas pumped; 3, the provision of an air-pipe, D, so that atmospheric pressure may be re-established in B, after each stroke; and 4, the formation of an enlargement on the siphon-pipe, C, to cause it to always begin to act at the same level.—W. H. C.



Separating liquids; Centrifugal machines for ——. H. B. E. Frost, Copenhagen, Denmark. Eng. Pat. 26,833, Nov. 26, 1906.

Channel-shaped indentations are provided in the neck of the funnel, (or conical division plate), for the escape of the heavier liquid. The lighter liquid escapes through a hole bored eccentrically in a screw plug in the closed upper end of the neck of the funnel. The plug can be turned so that the distance of the outlet opening from the axis of the drum may be varied.—W. H. C.

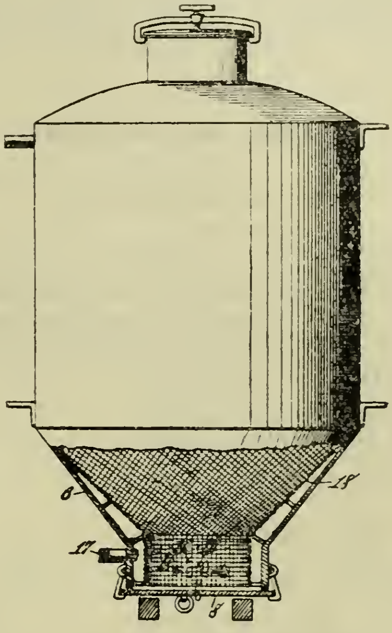
Washing machines [for filtering-material]. A. J. Boult, London. From E. Goldman and Co., Chicago, U.S.A. Eng. Pat. 27,958, Dec. 7, 1906.

The material is washed in a trough, into the lower part of which water and air are forced by a steam injector. At one end of the trough is a funnel placed horizontally, with a propeller rotating within it, to ensure thorough mixing and agitation of the wash-water and the material. A perforated "eduction" pipe is rotated horizontally in the upper part of the trough to allow the dirty wash water to escape.—W. H. C.

Fans; Centrifugal ——. P. Kestner, Lille, France. Eng. Pat. 929, Jan. 14, 1907.

Two or more fan-wheels of the same outside diameter and having blades of the same axial length, are mounted on the same end-plate, or disc, so as to form a centrifugal fan with axial intake and circumferential discharge. The blades of each fan-wheel from the intake to the disc are successively fewer in number but of greater radial depth.
—W. H. C.

Extracting-retort. J. G. Gardner, Lake Butler, Fla. U.S. Pat. 856,049, June 4, 1907.



An extraction-vessel of the form shown (see Fig.) is closed below by the sliding door, 8, and has a perforated lining, 18, spaced apart from the conical portion, 6, of the shell. The liquid is withdrawn through the pipe, 17, which opens into the space between the shell and the lining.—W. H. C.

Press; Autoclave —— *with independent and movable press-plate.* E. Decauville. Fr. Pat. 373,859, March 28, 1906.

A hydraulic press is surrounded by a vessel which acts as an autoclave. In order that the press may be charged easily, and that the autoclave may expand freely, the bottom press-plate is mounted on a carriage. The materials to be treated are placed on the press-plate, and the latter is then run under the press-frame, the autoclave cover is lowered and fixed tightly to the truck-plate, and the ram set to work. The latter engages a projection on the bottom plate which passes through the truck-plate, and the ram presses the bottom plate upwards within the autoclave against the top plate, which is supported by pillars or rods.—W. H. C.

Drying or carbonising apparatus; Intensive and recuperative ——. Soc. Péronne et Humbert. Fr. Pat. 373,934, Jan. 26, 1907.

The material to be treated is placed in a series of chambers connected by flues, or conduits. The steam given off, is withdrawn from the lower part of each chamber into a common conduit by a fan, and drawn through a superheater where it is dried. The dry steam is then returned by a flue to the upper part of each chamber, and becomes saturated with moisture from the materials under treatment. The doors of the chambers are only loosely closed, so that the excess of steam can escape.—W. H. C.

Separating liquids from gases or vapours by means of hollow bars arranged transversely to the current of gas. Soc. Brunner und Bühring, Ges.m.b.H. Fr. Pat. 374,300, Feb. 5, 1907.

Hollow bars of triangular or other convenient cross-section are grouped in a chamber through which the gas or vapour to be treated, is passed. The sides of the bars which face the direction from which the gas is coming are perforated and provided with ridges and projections. The mixture of gas holding the particles of liquid in suspension, enters the hollow bars, where the liquid is deposited and flows down the inside of the bars, which are inclined, to a separating chamber.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Thoria-ceria mixtures. R. J. Meyer and A. Anschütz. Ber., 1907, 40, 2639—2647.

An ignited mixture of thoria and ceria, such as occurs in incandescence mantles, is regarded as consisting of a solid solution of the ceria in the thoria. By ascertaining the weight of the oxides obtained, when a carefully analysed aqueous solution of the mixed nitrates was evaporated and the residue strongly ignited, the authors have shown, that in such a solid solution the cerium is present as the dioxide, CeO_2, and not as the sesquioxide, Ce_2O_3, or other lower oxide. But on distilling the ignited mixture with potassium iodide and hydrochloric acid, and taking the liberated iodine as a measure of the proportion of "active" oxygen present, it is found that only a part of the ceria reacts with liberation of iodine; the remainder must therefore be in a "passive" state. The authors regard the inactive portion as dissolved in the thoria, the active portion being undissolved. In a thoria-ceria mixture containing 1 per cent. of cerium dioxide, CeO_2, nine-tenths of the latter were found to be in the inactive form. Experiments were made with ignited mixtures containing from 1 to 41·8 per cent. of ceria, and it was found that the proportion of inactive ceria increased until a concentration of about 6—7 grms. per 100 grms. of thoria was reached. At this point, in the authors' opinion, a homogeneous, saturated solution of ceria in the thoria is formed; with higher proportions of ceria, the excess remains undissolved, in the active form, whilst with lower proportions, unsaturated solutions are obtained. According to this view, the ordinary incandescent mantle consists of a highly diluted solution of ceria in thoria. On igniting the mixtures at 500° C., only 3·3 grms. of ceria per 100 of thoria were "dissolved"; but at 650° or upwards, the saturation figure amounted to 6—7 grms. per 100.—H. B.

Patents.

Briquettes of coal, turf, peat and the like; Process for making ——. J. Buss, Munich, and C. Fohr, Schloss Wallenburg, Germany. Eng. Pat. 28,576, Dec. 14, 1906.

See Fr. Pat. 372,744 of 1906; this J., 1907, 520.—T. F. B.

Arsenic in gas or other coke; Reducing the ——. T. W. Drinkwater and H. O'Connor, Edinburgh. Eng. Pat. 29,599, Dec. 29, 1906.

The coal, before coking, is sprinkled with common salt, or some other chloride volatile on heating. When the coal is heated, the arsenic is volatilised as arsenic chloride instead of being retained in the coke.—W. H. C.

Combustion; Preparation for perfecting ——, and rendering coal smokeless. L. Wilkinson and E. J. Ellis, London. Eng. Pat. 1154, Jan. 16, 1907.

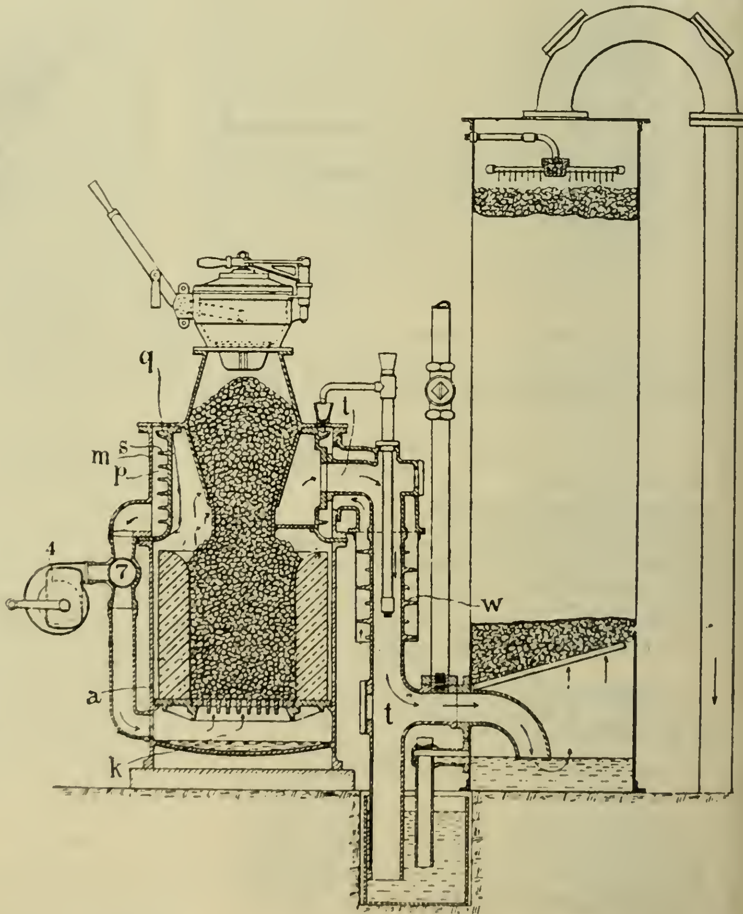
A mixture of approximately 42 parts of sodium nitrate, 42 of sodium chloride, 11 of calcium hypochlorite, 4 of slaked lime, and 1 part of camphor, is dissolved in the proportion of about 2 oz. to a gallon of water, and employed to treat coal in the proportion of about one quart of solution per cwt. of coal.—C. S.

Gas for illuminating, heating, or power purposes; Manufacture of ——. E. G. Elworthy, St. Albans. Eng. Pat. 13,480, June 12, 1906. Under Int. Conv., June 17, 1905.

See Fr. Pat. 355,324 of 1905; this J., 1905, 1164.—T. F. B.

Gas producing plant of the suction type. H. N. Bickerton, P. W. Robson, and The National Gas Engine Co. Ltd., Ashton-under-Lyne. Eng. Pat. 13,703, June 14, 1906.

The upper part of the producer, *a*, is surrounded by a detachable casing, *m*, so as to form a vaporising chamber, *p*. The chamber is provided with troughs, *q*, projecting from the upper part of the producer, and with a number of more or less horizontal flanges or ribs, *s*, each preferably wider than the one above it, so that water delivered to the troughs, flows down the side of the producer and is spread out horizontally along the ribs, which thus prevent



vertical drip. The air supply is fed to the vaporiser through an annular space round the gas-outlet pipe, *t*, which is encased and provided with external (preferably spiral) ribs, W, the air feed being heated by the escaping gases. The discharge pipe of a fan, 4, is connected to the outlet of the vaporiser, and a deflector, 7, is provided, for closing the latter in starting and connecting the fan with the ash-pit, *k*.—C. S.

Gas-analysis apparatus; Portable ——. South Staffordshire Mond Gas (Power and Heating) Co. and H. T. Pinnock. Eng. Pat. 24,405, Nov. 1, 1906. *See* XXIII.

Mantles; [Self-lighting] Incandescent gas ——. T. N. Atkinson, London. Eng. Pat. 22,571, Jan. 12, 1907.

The top of the mantle is treated with a solution of calcium chloride, ammonium chloride, glucose, and platinum chloride: below the treated portion there is attached a fine platinum wire carrying a small igniting pellet composed of the above-mentioned substances; and the mantle is finally stiffened by means of a mixture of ammonia, gum arabic, glucose, and vermilion.—H. B.

Gas generating furnace. L. Bemelmans, Schaerbeek, Belgium. U.S. Pat. 855,749, June 4, 1907.

See Eng. Pat. 19,617 of 1905; this J., 1906, 1033.—T. F. B.

Mixtures of gases or of gas and air for illuminating purposes; Apparatus for producing ——. H. L. Karger, Assignor to Selas Gesellschaft m.b.H., Berlin. U.S. Pat. 855,953, June 4, 1907.

See Fr. Pat. 333,033 of 1903; this J., 1903, 1287.—T. F. B.

Combustibles [Briquettes]; Process of manufacture of agglomerated ——. H. Haulot and G. Dugauquier. Fr. Pat. 373,931, Jan. 26, 1907. Under Int. Conv., Jan. 26, 1906.

The agglutination of the combustible material is effected by the use of linseed or linseed meal, either before or after extraction of the oil. The linseed is mixed with the combustible, and sufficient water added to obtain a mucilage, which ensures the cohesion of the particles of the combustible.—W. C. H.

"Live charcoal" (la braise) and wood charcoal; Regenerative furnace with double grate for the manufacture of —— J. J. Didier. Fr. Pat. 373,991, Jan. 28, 1907.

The furnace described is for the production of wood charcoal and of "live charcoal," *viz.*, the product obtained from wood that has been converted into glowing embers. Two grates are arranged side by side, behind each of which is a carbonising chamber. At the back of the furnace is a chamber, divided into two compartments by a horizontal partition; in the lower compartment there are two boilers, connected by tubes with a heater or boiler in the upper compartment. The hot gases from the carbonising chambers pass into the lower compartment, and through holes in the partition into the upper, and thence escape to the air, having given up their sensible heat to the boilers.—W. C. H.

Fuel; Treatment of —— *to render its combustion more complete and smokeless.* L. Wilkinson and E. J. Ellis. Fr. Pat. 374,079, Jan. 30, 1907.

See Eng. Pat. 1154 of 1907; preceding these.—T. F. B.

Hydrogen and carbon monoxide separately from coal and steam; Process of obtaining ——, *and the manufacture of lighting gas.* J. F. G. Lahousse. Second Addition, dated March 31, 1906, to Fr. Pat. 361,866, Oct. 24, 1905 (this J., 1907, 13).

In order to economise labour in carrying out the process described in the principal patent and first addition thereto, the alkaline-earth sulphate is reduced to sulphide by heating it with producer gas (instead of solid fuel), the gas which has passed over the sulphate being subsequently burned in the furnace. By this process the contamination of the sulphate with fuel ash is also avoided. Instead of sulphate of barium or strontium, calcium sulphate may be used, but the reaction is then more delicate than with the former.—H. B.

Gas producer. E. Bardot. First Addition, dated Jan. 18, 1907, to Fr. Pat. 369,540, Sept. 7, 1906 (this J., 1907, 85).

The "pulveriser" for the water supply, described in the principal patent, is connected to a vaporising chamber which surrounds the furnace, the connecting pipe being enclosed within the exit pipe for the hot gases; by this arrangement the spray of water carried by the air is vaporised before entering the producer. The lower part of the combustion chamber is formed of a hollow body of cast steel, having the shape of an inverted truncated cone, the heat-conductivity of which leads to an extension of the combustion zone. The fuel hopper is provided at the bottom with a cylindrical extension, which prevents tarry matters, liberated from the freshly-charged fuel, from escaping undecomposed along with the hot gases. —H. B.

Water-gas; [Electrical] Process and apparatus for the manufacture of ——. Soc. Anon. Electrométallurgic (Procédés P. Girod). Fr. Pat. 373,780, Jan. 21, 1907.

For the manufacture of water-gas by a continuous process, without intermittent blast periods, the producer is so constructed that heat may be applied to the fuel by electrical means, whereby the fuel is maintained at the necessary temperature. For example, current may be passed through the fuel by means of well-cooled electrodes of metal or carbon inserted through the walls of the producer, the whole constituting a sort of resistance furnace.—H. B.

Gas for lighting, heating, and motive purposes; Manufacture of ——, *with simultaneous production of nitrogen compounds.* Soc. Nickel et Méthane. Fr. Pat. 373,876, Jan. 24, 1907.

Producer gas obtained from a generator during the blast period, steam, and water-gas rich in carbon monoxide, are caused to act in succession upon a heated catalytic mixture consisting of an alkali or alkaline-earth carbonate, finely-divided carbon, and a metal reduced from its oxide, such as iron, nickel, or cobalt, whereby a continuous cycle of reactions is effected, resulting in the production of combustible gas and ammonium and cyanogen compounds, with continuous regeneration of the catalytic mixture. The catalyser is preferably composed of barium carbonate, 450; reduced nickel, 450; and pulverised wood charcoal, 100 parts. During the first phase, this mixture is heated at 800° C.; the carbon monoxide in the gas is partly decomposed, with deposition of very finely-divided carbon; the barium carbonate reacts with the fine carbon and nitrogen, producing barium cyanide and carbon monoxide; and the latter then deposits a further quantity of carbon. During the second phase, steam is passed over the catalyser at 300°—400° C.; the barium cyanide is decomposed, with formation of barium hydroxide, carbon monoxide, and ammonia; part of the fine carbon reacts with the steam, producing hydrogen, methane, and carbon dioxide; and the resulting gaseous mixture consists of ammonium carbonate, methane, hydrogen, and carbon monoxide. In the third phase, water-gas is passed over the catalyser at a temperature rising gradually from 400° to 800° C.; the carbon monoxide is partly converted into fine carbon and carbon dioxide, the former replacing the carbon used up in the preceding phases, and the latter converting the barium hydroxide into the carbonate; a further quantity of methane is also produced at this stage. The gas is then purified as required. Apparatus for carrying out the above operations systematically is described. —H. B.

Gas for motors; Process for making a —— *free from tar, by means of a bituminous fuel.* G. L. Morton. Fr. Pat. 373,896, Jan. 25, 1907. Under Int. Conv., Jan. 26, 1906.

See Eng. Pat. 1980 of 1906; this J., 1907, 41.—T. F. B.

Blast-furnace gases and the like; Process and apparatus for purifying ——. C. Flössel. Fr. Pat. 373,998, June 21, 1906. Under Int. Conv., June 22, 1905.

THE apparatus consists of a turbine wheel arranged within a casing, through which the gas to be purified flows. Water under pressure, or a mixture of compressed air and "pulverised" water, is directed upon the periphery of the turbine, the curved vanes within which are so disposed that both the water and the gas enter it without shock. By this means the water stream serves for rotating the wheel as well as for cooling and cleansing the gas; the wheel acts as a turbine towards the water, and as a driving fan towards the purified gas. Various arrangements of curved vanes and directing ribs are described, having for their object the intimate mixing of the gas and water, without much loss of the energy derived from the water current.—H. B.

Gases produced by distilling coal and other carbonaceous substances; Process and apparatus for purifying ——. G. Wilton. Fr. Pat. 374,285. Feb. 4, 1907. Under Int. Conv., Feb. 6, 1906.

SEE Eng. Pat. 2907 of 1906; this J., 1906, 747.—T. F. B.

Filaments of metallic tungsten for electric incandescence lamps; Process of making ——. J. Lux. Fr. Pat. 373,950, March 31, 1906.

SEE Eng. Pat. 7803 of 1906; this J., 1907, 83.—T. F. B.

Filaments for electric incandescence and arc lamps. H. Rubert. Fr. Pat. 373,827, Jan. 23, 1907.

"CHEMICALLY pure" graphite is mixed with silicon (the graphite preponderating) and an agglutinant such as gum arabic; the mixture is moulded into filaments or electrodes, which are baked at about 200° C., and then heated by the passage of an electric current through them *in vacuo*.—H. B.

Tungsten; Process of manufacturing ——, *specially applicable for the manufacture of incandescence lamps.* Comp. Française pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 373,923, Jan. 26, 1907. Under Int. Conv., Jan. 27, April 23, and May 21, 1906.

SEE Eng. Pat. 11,409, March 16, 1906 (this J., 1907, 462). In addition to the nitrogen compounds of tungsten therein directed to be used, the present specification describes the use of the oxides and sulphides, with or without the addition of metallic tungsten.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Bitumens and asphaltums; Production of —— *by the action of sulphur chloride on the products of distillation of crude petroleum.* G. A. Le Roy. Sealed note, 856, Feb. 24, 1896. Bull. Soc. Ind. Mulhouse, 1907, **77**, 147—148.

THE yellow or orange-coloured "gums," obtained as residual products in the distillation of crude petroleum, yield black bitumen-like products when they are treated in the fused state with 1—5 per cent. or more of sulphur chloride, the proportion of the latter being varied according to the degree of hardness it is desired to give to the product. The sulphur chloride may be dissolved in 10—20 per cent. of its weight of carbon bisulphide, coal-tar naphtha, etc. Heat is applied to the mixture until the evolution of gas has ceased. The fused mass is then run into moulds. The melting point of the product is 20—40° C. higher than that of the "gum" employed. Chlorine and sulphur dissolved in carbon bisulphide act less rapidly and are less economical for this purpose than sulphur chloride.—E. B.

Petroleum Acts. "Times," June 22, 1907. [T.R.]

THE "Gazette" of June 21st contained an Order in Council in pursuance of the Petroleum Act, 1871, making certain provisions of the Petroleum Acts, 1871 to 1881, apply to any mixture of petroleum with any other substance, which, when tested in a manner scheduled under this Order, gives off an inflammable vapour at a temperature of less than 73 deg. Fahr., in the same manner as if the mixture were petroleum to which the said Acts apply.

Roumanian petroleum industry. Oil and Col. Tr. J., June 29, 1907. [T.R.]

THE total production of petroleum in 1906 was 887,091 tons, an increase of about 45 per cent. over 1905, when the production was 614,870 tons. Each month there was a steady progress.

Year.	Quantity.	Value.
	Tons.	Francs.
1899	250,000	10,000,000
1904	500,561	22,525,245
1905	614,870	27,669,155
1906	887,091	39,919,095
1857–1906	4,707,871	200,248,210

The following was the production of the refineries, in metric tons:—

	1905.	1906.
Benzine	78,182	114,428
Lamp oil	153,499	221,683
Mineral oils	17,255	53,588
Residues	237,677	333,714

There is an increasing demand for residues for factories. The following are the exports, in metric tons:—

	1904.	1905.	1906.
Crude gas oil, distilled, &c.	45,204	49,515	53,374
Refined (lamp oil)	78,270	118,134	196,631
Benzine	36,969	46,699	71,114
Total	160,443	214,348	321,119

The United Kingdom was the chief purchaser of petroleum products, and took 28·4 per cent. of the whole export

PATENTS.

Coals and other hydrocarbonaceous substances; Process of distilling ——. C. A. Allison, London. From The American Chemical Eduction Co., New York. Eng. Pat. 11,925, May 22, 1906.

THE coal is arranged in relatively small quantities on trays in an air-tight chamber, to facilitate exposure to currents of neutral gases, which are heated to a temperature below incandescence (700—800° C.) and traverse the said chamber (downwards preferably) in a zigzag course in consequence of the provision of passages arranged "at opposite ends of adjoining surfaces" and connected with the spaces above and below the trays. The products of distillation are drawn off and forced to a condenser by an exhaust fan. The low distillation temperature prevents dissociation of the distillation products, which

consist chiefly of phenols, cresols, and other homologues, free from tar, naphthalene, benzene, and permanent gases.
—C. S.

Lubricating oils and similar products; Method and apparatus for purifying ——. C. Steimel. Fr. Pat. 373,858, Jan. 24, 1907. *See* XII.

Ammonium sulphate and ammonium chloride manufacture; Process for the utilisation and purification of waste gases from ——. A. J. van Eyndhoven. Ger. Pat. 170,554, April 21, 1905. *See* VII.

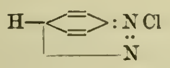
IV.—COLOURING MATTERS AND DYESTUFFS.

Sulphonation in presence of mercury. O. Dimroth and W. v. Schmaedel. Ber., 1907, **40**, 2411—2415.

The authors have studied the sulphonation of benzoic acid (30 grms.) by concentrated sulphuric acid (180 grms.) with and without the addition of mercuric sulphate (3 grms.). Parallel experiments were made, and the mixtures were heated for 45 hours to 135° C. After separating the unchanged benzoic acid, the sulphonic acids were fused with caustic soda, the salicylic acid extracted with chloroform, and the mixture of *m*- and *p*-hydroxybenzoic acids treated with diazobenzene chloride in alkaline solution under a layer of ether. The meta acid remained in solution as sodium benzeneazohydroxybenzoate, whilst the para acid yielded *p*-hydroxyazobenzene which was dissolved in the ether. The benzeneazo-*m*-hydroxybenzoic acid was precipitated by acid and weighed. It was found that with sulphuric acid alone, 35·7 per cent. of the benzoic acid remained unaltered, and the mixture of hydroxybenzoic acids consisted of 84 per cent. of the meta and 16 per cent. of the para compound. In presence of mercuric sulphate, 6·5 per cent. of the benzoic acid remained unaltered, and there were formed, 5 per cent. of ortho-, 83 of meta-, and 12 per cent. of para-hydroxybenzoic acid. By the ordinary sulphonation of benzoic acid, the *m*- and *p*- acids are obtained, but when mercury is present, *o*-sulphatomercuribenzoic acid is formed which reacts with sulphuric acid to furnish the *o*-acid. The rate at which these latter two reactions proceed determines the proportion of *o*-acid formed; in the present instance the rate of the indirect sulphonation is the slower, so that only a small quantity of the *o*-acid is produced.—J. C. C.

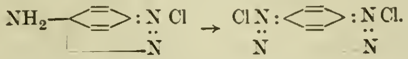
Diazo-compounds; Constitution of ——. J. C. Cain. Chem. Soc. Proc., 1907, **23**, 158—159.

None of the formulæ hitherto proposed for the diazo-salts can account for the great ease with which such compounds lose their diazo-nitrogen. Nitrogen attached to the benzene ring, as, for example, in the case of aniline, is readily eliminated only by oxidation, and it has recently been shown (this J. 1907, 604) that in this process, aniline probably assumes the tautomeric form, $H_2 : C_6H_4 : NH$. As the diazotisation process closely resembles this reaction, the author proposes for diazobenzene salts (chloride) the quinonoid formula



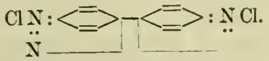
$$H-\langle\overline{=}\rangle:\ddot{N}Cl \quad \underline{\quad\quad} N$$

this bears much analogy to the formula of quinone-chlorimide, which also loses nitrogen on boiling with water. The new formula explains why, in compounds where the atom in the para-position to the amino-group is already saturated, no diazo-salt can be formed, thus, for example, *ac*-tetrahydronaphthylamine and 4-aminoquinoline yield no diazo-salts. For a similar reason no aliphatic diazo-chlorides are known. The well-known difficulty of converting *p*-phenylenediamine into the tetrazo-compound is considered to be due to the circumstance that the linking of the second nitrogen with the para-carbon atom in the monodiazo-compound must first be broken in order to allow the second aminic nitrogen to become attached by two bonds, the final condition probably being that the second nitrogen atoms in each case are united thus:



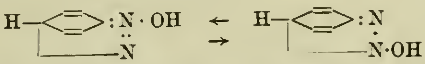
$$NH_2-\langle\overline{=}\rangle:\ddot{N}Cl \rightarrow Cl\ddot{N}:\langle\overline{=}\rangle:\ddot{N}Cl. \quad N \quad N \quad N$$

On the other hand, benzidine behaves normally, the tetrazo-compound being



$$Cl\ddot{N}:\langle\overline{=}\rangle-\langle\overline{=}\rangle:\ddot{N}Cl. \quad N$$

The corresponding formula for the diazohydroxide may, unlike the chloride, give rise to two tautomeric forms:



$$H-\langle\overline{=}\rangle:\ddot{N}\cdot OH \rightleftarrows H-\langle\overline{=}\rangle:\dot{N} \quad N \quad N\cdot OH$$

the latter of which represents the constitution of the normal or *syn*-diazo-compounds and is closely related to the formula for the *iso*- or *anti*-compounds: $C_6H_5.N : N.OH$. As these formulæ fully explain the reactions of the diazo-compounds, the author considers that the stereochemical theory is rendered unnecessary. The following recommendations as to nomenclature are suggested. (i) The word "diazonium" should be retained for the diazo-salts. (ii) The normal or *syn*-metallic diazo-compounds should be called normal diazo-oxides or diazo-oxides. (iii) The *iso*- or *anti*-compounds should be called *iso*-diazo-oxides.—J. C. C.

3-*Nitro*-4-*dimethylamino*-1-*benzoic acid.* F. Reverdin. Ber., 1907, **40**, 2442—2448.

When dimethylaminobenzoic acid is nitrated, it yields a nitro-derivative which is identical with the acid prepared by Noelting and Demant by the same process and also with that obtained by Baudisch by treating the substance with nitrous acid. The methyl ester is the same as that prepared by nitrating methyldimethylaminobenzoate (this J. 1906, 423). The nitro-acid is therefore 3-nitro-4-dimethylaminobenzoic acid. As a by-product in the nitration is obtained 2.4-dinitrodimethylaniline, and when a larger quantity of nitric acid is employed at 60—70° C., the corresponding dinitromonomethylaniline is produced. In nitrating with a mixture of sulphuric and nitric acids, *p*-mononitrodimethylaniline, m. pt. 161—162° C., is obtained in small quantity. When mono-nitrodimethylaminobenzoic acid is treated with nitric acid, the chief product is the above dinitromonomethylaniline, but 2.4.6-trinitrodimethylaniline is also produced. If the reaction is carried on with a mixture of nitric and sulphuric acids, half the product consists of 2.4.6-trinitrophenylmethylnitramine; the other half of the product contains unchanged mononitrodimethylaminobenzoic acid and probably a trinitrodimethylaminobenzoic acid, m. pt. 193° C.—J. C. C.

Aniline Black. I. R. Willstätter and C. W. Moore. Ber., 1907, **40**, 2665—2689.

By gentle oxidation of aniline in cold aqueous alkaline solution, or by treating an aqueous suspension of *p*-aminodiphenylamine with lead peroxide, Caro obtained a yellow substance which with acids yielded Emeraldine, and which was regarded as quinonephenyldi-imine, $C_6H_5.N : C_6H_4 : NH$. This was, however, probably a mixture of equal parts of quinonephenyldi-imine and quinonephenylmono-imine, $C_6H_5.N : C_6H_4 : O$, as the di-imine is very readily hydrolysed by cold water. The authors have prepared the latter in the pure state by treating an ethereal solution of aminodiphenylamine with dry silver oxide: yellow prisms, m. pt. 88—89° C. were obtained. The compound polymerises to Emeraldine when treated with acids, but the latter is much more readily obtained by oxidising *p*-aminodiphenylamine with hydrogen peroxide and a trace of ferrous sulphate. Emeraldine base (Azurine) was obtained in blue prisms, m. pt. 165° C., from its solution in hexane; its formula is $C_{24}H_{20}N_4$, and it is formed from two molecules of the quinonedi-imine. On oxidising its cold benzene solution with lead peroxide, a red quinone-imine, $C_{24}H_{18}N_4$, is obtained. Both this compound and Azurine yield the same leuco-base, $C_{24}H_{22}N_4$, on reduction. When Emeraldine is oxidised with lead peroxide, in addition to the red imine, there is obtained a weaker base, $C_{24}H_{17}ON_3$, which can be reduced to a leuco-base, $C_{24}H_{21}ON_3$; this on oxidation with silver oxide gives first a blue imine analogous to Emeraldine, which on further oxidation, yields the red imine. These compounds are designated as Series I of the oxidation products of Emeraldine. On oxidising an equimolecular mixture of *p*-hydroxy- and *p*-amino-diphenylamine with hydrogen peroxide, a dark green product is obtained which is the salt of a base, $C_{24}H_{19}ON_3$; this yields a red imine on oxidation and also gives a leuco-compound, but these compounds could not be identified with those just described as Series I, and are accordingly classified as Series II of the oxygen derivatives of Emeraldine. It is suggested that the constitution of Emeraldine may be best represented by the formula, $C_6H_5.N:C_6H_4:N.C_6H_4.NH.C_6H_4.NH_2$, and that of its red oxidation product as $C_6H_5.N:C_6H_4:N.C_6H_4.N:C_6H_4:NH$, the benzene nuclei being linked in the para position throughout. Although Emeraldino is considered as the intermediate substance in the Aniline Black process, it is the red oxidation product which polymerises directly to a black compound. This is called "polymerisation black" and preparations by different methods (fusion, boiling with water or acids, action of cold dilute acids, heating with water in a sealed tube) from the red imine, differ slightly. The composition of the black produced by the last-mentioned method is $(C_6H_{4\frac{1}{2}}N)x$. It resembles Aniline, Black, but the two are not identical, and from the fact that so many Blacks have been obtained, the authors conclude that there is not only one, but a whole group of Aniline Blacks. Moreover, just as the red imine of the Emeraldine series is produced by the multiplication of the simple phenylquinonedi-imine molecule, so must the molecule of Aniline Black be regarded as a multiplication of the semi-quinonoid blue Emeraldine base, and it is considered that the formula of Aniline Black may probably be $(C_6H_{4\frac{1}{2}}N)x$, where x is at least equal to 8: the simplest formula would therefore be $C_{48}H_{36}N_8$.—J. C. C.

Isatin; Group of blue dyestuffs similar to indigo from ——. C. Liebermann and R. Krauss. Ber., 1907, **40**, 2492—2515.

IN continuation of earlier work on the Pyrrol Blues (this J. 1905, 1104), the authors have now prepared the dibromo-derivative of Pyrrol Blue A and the dichloro-derivative of Pyrrol Blue B, which resemble the parent compounds. The dibenzoyl-derivative of Pyrrol Blue A when treated with boiling pyridine, is partly converted into the B form, which with sulphuric acid loses the benzoyl groups and yields the disulphonic acid of Pyrrol Blue B. The authors consider that the Pyrrol Blue compounds have the same structure as the Indophenines. A number of mono- and di-piperides of isatin were prepared, and the Isatinpiperide Blues obtained from the latter by treating a boiling suspension of the dipiperide (3 grms.) in toluene (50—60 c.c.) with acetic anhydride (2 grms.). After 15 minutes a further quantity of the latter agent (2 grms.) was added; the reaction was complete in 15 minutes more. The resulting dyestuff was boiled with alcohol and washed with ether; from 3 grms. of bromoisatindipiperide about 1·3 grms. of dyestuff were obtained. These dyestuffs are blue powders with a copper-red reflex, resembling indigo; from Isatinpiperide Blue a good "vat" is obtained with dextrose, alcohol, and a little alkali.—J. C. C.

Acetyl nitrate. A. Pictet and E. Khotinsky. *See* XX.

PATENTS.

Anthracene compounds; Manufacture of —— *and of colouring matters therefrom.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 20,837, Sept 19, 1906.

SEE Addition of Oct. 1, 1906, to Fr. Pat. 349,531 of 1904; this J., 1907, 251.—T. F. B.

Sulphur dyes [sulphide dyestuffs]; Manufacture of ——. G. E. Junius, Hagen, Germany. Eng. Pat. 21,926, Oct. 4, 1906. Under Int. Conv., Nov. 7, 1905.

SEE Fr. Pat. 371,119 of 1906; this J., 1907, 251.—T. F. B.

Azo dyestuffs capable of being chromed on the fibre; Production of ——. Soc. pour. l'Ind. Chim. à Bâle. Fourth Addition, dated Mar. 27, 1906, to Fr. Pat. 351,125, Jan. 4, 1905 (this J. 1905, 840).

INSTEAD of using alcohol, aniline, pyridine, etc., as recommended in the second addition to the chief patent (this J. 1906, 922), it is now found that the formation of azo dyestuffs from *o*-diazonaphtholsulphonic acids is rendered easy and quantitative by working in strongly alkaline solution, for example in presence of caustic soda (10 — 40° B.) or a saturated solution of sodium carbonate. (See also this J. 1905, 1108; 1906, 1089).—J. C. C.

Sulphide dyestuffs of the quinophthalone series; Production of yellow ——. Ges. f. Chem. Ind. in Basle. Fr. Pat. 373,892, Jan. 24, 1907. Under Int. Conv., Dec. 24, 1906.

SEE Eng. Pat. 4159 of 1907; this J., 1907, 605.—T. F. B.

2-*Chloro-4-nitrodiphenylamine and its derivatives; Production of* ——. Act. Ges. f. Anilinfabr. Fr. Pat. 373,885, Jan. 24, 1907.

1.2-DICHLORO-4-NITROBENZENE condenses readily with primary aromatic amines in presence of sodium acetate, carbonate, etc., to form diphenylamine derivatives. Example: 91 parts of dichloronitrobenzene, 150 parts of aniline, and a solution of 55 parts of sodium carbonate in 250 parts of water are heated in a closed vessel to 150° C. for 8 hours. The mass is treated with hydrochloric acid, and the resulting red precipitate is rendered alkaline and distilled in steam; excess of aniline and dichloronitrobenzene are thus removed, and the deep yellow residue, which consists of *o*-chloro-*p*-nitrodiphenylamine is obtained, on crystallisation from alcohol, in orange needles, m. pt. 112—113° C.—J. C. C.

Diphenylamine and its substitution products; Method of preparation of ——. Act. Ges. f. Anilinfabr. Fr. Pat. 374,385, Feb. 7, 1907.

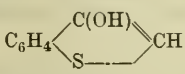
WHEN aromatic amines are heated with bromobenzene in presence of small amounts of cuprous iodide, derivatives of diphenylamine are obtained. Example: 30 parts of aniline and 1 part of cuprous iodide are heated in an apparatus, fitted with a reflux condenser, with an excess of bromobenzene and a little potassium carbonate for 15 hours. The excess of bromobenzene and unattacked aniline are removed by steam, and pure diphenylamine remains. Other examples are given in which bromobenzene is condensed with acetanilide, the nitranilines, *o*-anisidine, anthranilic acid, and 1-aminoanthraquinone in presence, where necessary, of suitable solvents, such as nitrobenzene or amyl alcohol.—J. C. C.

Dyestuffs; Production of vat-dyeing —— *[from anthracene].* Badische Anilin und Soda Fabrik. Fr. Pat. 374,286, Feb. 4, 1907. Under Int. Conv., March 22, 1906.

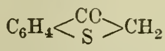
SEE Eng. Pat. 20,132 of 1906; this J., 1907, 313.—T. F. B.

β-Hydroxythionaphthene and αβ-diketodihydrothionaphthene derivatives and dyestuffs derived therefrom ; Production of ——. Badische Anilin-und Soda-Fabrik. Fr. Pat. 374,287, Feb. 4, 1907. Under Int. Conv., Sept. 4, Oct. 11 and 22, Nov. 2 and 7, 1906.

When β-hydroxythionaphthene,

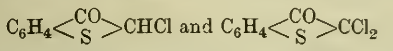


or β-ketodihydrothionaphthene



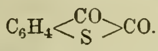
$$\mathrm{C_6H_4}<\genfrac{}{}{0pt}{}{\mathrm{CO}}{\mathrm{S}}>\mathrm{CH_2}$$

is treated with halogens, mono- or di-substitution products of the formulæ (for the chloro-derivative)



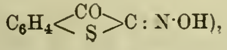
$$\mathrm{C_6H_4}<\genfrac{}{}{0pt}{}{\mathrm{CO}}{\mathrm{S}}>\mathrm{CHCl}\text{ and }\mathrm{C_6H_4}<\genfrac{}{}{0pt}{}{\mathrm{CO}}{\mathrm{S}}>\mathrm{CCl_2}$$

are obtained, the latter of which readily pass, by the action of water or hydrolytic agents, into αβ-diketodihydrothionaphthene,



$$\mathrm{C_6H_4}<\genfrac{}{}{0pt}{}{\mathrm{CO}}{\mathrm{S}}>\mathrm{CO}.$$

If this reaction takes place in presence of compounds containing a primary amino-group, such as amines, hydrazines, hydroxylamine, etc., corresponding derivatives of the αβ-diketodihydrothionaphthenes are formed. These diketo-derivatives may also be prepared by treating β-hydroxythionaphthene with nitrous acid, whereby a yellow substance is obtained (probably the oxime,



$$\mathrm{C_6H_4}<\genfrac{}{}{0pt}{}{\mathrm{CO}}{\mathrm{S}}>\mathrm{C:N{\cdot}OH}),$$

and hydrolysing this. It is, however, preferable to reduce this oxime to the corresponding amine, and then to oxidise the latter to the diketone. Both the halogen derivatives just described and the αβ-diketodihydrothionaphthenes furnish vat dyestuffs containing sulphur. The monohalogen derivatives gradually lose the hydro-halogen acid on standing, with formation of thioindigo, but the transformation of both these and the dihalogen derivatives is effected more rapidly and completely by heating them either alone or in presence of an indifferent diluent such as alcohol, naphthalene, etc., or by treating them with acids or alkalis or finely-divided metals. The dihalogen compounds can also be converted into vat dyestuffs by acid, alkaline, or neutral reducing agents, and they can also be condensed with β-hydroxythionaphthene or indoxyl and its derivatives with formation of vat dyestuffs. Similarly, αβ-diketodihydrothionaphthene and its derivatives condense with indoxyl, β-hydroxythionaphthene, or their derivatives to furnish vat dyestuffs varying from blue to red. In certain cases the β-hydroxythionaphthenes may be replaced by the corresponding arylthioglycollic or arylthioglycol-o-carboxylic acids. The new dyestuffs can be converted by sulphonating agents into sulphonic acids which dye animal fibres in an acid bath, shades varying from red to blue.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Corchorus fibre. Bull. Imp. Inst., 1907, 5, 2—4.

THESE fibres, from Sierra Leone, were from 3 to 4 feet in length, and were found by microscopic examination to belong to the jute class, though containing more moisture, and being weaker than good jute. The following results were obtained :—Moisture, 11·9 ; ash, 0·4 ; *α-hydrolysis (loss), 7·4 ; β-hydrolysis (loss), 10·5 : and cellulose, 79·9 per cent. Length of ultimate fibre, 1·4 to 3·0 mm.—C. A. M.

Fibre of Hibiscus lasiocarpus (?). *Ibid.*, 5, 4—5.

THE plant yielding this fibre grows in all parts of Sierra Leone and is believed to be *Hibiscus lasiocarpus.* The fibre is lustrous and of a pale buff colour, and varies in length from 3 feet to 5 ft. 8 ins. A sample cleaned by hackling, gave the following results :—Moisture, 9·2 ; ash, 0·7 ; α-hydrolysis (loss), 12·5 ; β-hydrolysis (loss), 17·5 ; acid purification, (loss), 3·1 ; and cellulose, 75·7 per cent. Length of ultimate fibre, 2·1 to 3·05 mm. The fibre resembles jute, and is very similar in composition to *H. cannabinus.* According to the valuation of experts it would fetch from £15 to £16 per ton, if shipped in quantities of 20 to 50 tons.—C. A. M.

Fibre of Hibiscus quinquelobus. Ibid., 5, 5—6.

A SMALL export trade in this fibre has been started, and with systematic cultivation could be largely developed. The plant is termed " Kowe " in Sierra Leone, " Corwey " in Mendi, and " Nassim " in Timani, and is also known as " West African jute." The sample examined, was fine, fairly soft, of a pale buff colour ; and had a fair lustre. It varied in length from 3 ft. to 7 ft. 9 ins., the average being about 5 feet. Chemical examination gave the following results :—Moisture, 9·8 ; ash, 0·45 ; α-hydrolysis (loss), 7·9 ; β-hydrolysis (loss), 11·0 ; acid purification (loss) 1·1 ; and cellulose, 76·3 per cent. Length of ultimate fibre, 1·0 to 3·2 mm. Commercial valuation £25 to £26 per ton.—C. A. M.

Fibre of Hibiscus esculentus. Ibid., 5, 8—9.

THE plant yielding this fibre is known as " Awkraw " or " Okra," and is grown as a vegetable in all parts of West Africa. The sample examined was, in general, 2 feet to 2 feet 8 inches in length, but the strength was uneven and poor. Reported to be a brittle jute-like fibre, of good colour, but tender and weak. Value, about £15 per ton.—C. A. M.

Fibre of Honckenya ficifolia. Ibid., 5, 6—7.

THIS plant is abundant in the swamps of Sierra Leone and with careful cutting would yield a constant supply of stalks for retting. The sample examined was white to brown in colour, and varied from 4 to 10 feet in length. It was of poor strength, and contained :—Moisture, 9·6 ; ash, 0·3. α-hydrolysis (loss), 6·0 ; β-hydrolysis, (loss) 9·7 ; acid purification (loss), 0·4 ; and cellulose, 78·3 per cent. Length of ultimate fibre, 2·0 to 3·6 mm. Commercial valuation about £20 per ton.—C. A. M.

" Borfroko " or " Abala " fibre. Bull. Imp. Inst., 1907, 5, 7—8.

THE sample, from an unidentified Sierra Leone plant, varied from white to reddish-brown in colour, and from 10 inches to 6 feet in length. Moisture, 9·6 ; ash, 0·4 ; α-hydrolysis (loss), 9·3 ; β-hydrolysis (loss), 14·4 ; acid purification (loss), 1·0 ; and cellulose, 76·3 per cent. Length of ultimate fibre, 1·0 to 3·6 mm. Commercial valuation, £17 to £18 per ton.—C. A. M.

α-Naphthylamine Claret ; Discharges on ——. D. Ritermann and E. Felli. Sealed notes, 1597 and 1644, Jan. 27 and June 30, 1906. Bull. Soc. Ind. Mulhouse, 1907, 77, 141—142, 142—144, and 144—146.

THE tissues are padded in an alkaline solution of β-naphthol (12 grms. per litre) and 2·7-naphtholsulphonic acid (4 grms. per litre), and are then passed into a bath of diazotised α-naphthylamine. The discharge of the tissues thus dyed is effected by means of Rongalite C, assisted by "Monopol soap," the printed tissues being steamed for 5 minutes at a temperature of 105° C. H. Schmid reports that the presence of the sulphonic acid group in the Claret dyestuff, like that of the nitro group in Paranitraniline Red, renders it more easily dischargeable by reducing agents. The mixed sulphonated and unsulphonated Claret dyestuff is of deeper and more bluish shade than the ordinary Naphthylamine Claret, but its fastness to soaping is inferior to that of the latter. (See also Fr. Pat. 372,884; this J. 1907, 525.)—E. B.

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* " *α-Hydrolysis* " :—The fibre is boiled for five minutes with dilute solution of sodium hydroxide (1 per cent. of Na_2O) and is then washed free from alkali, dried and weighed.

" *β-Hydrolysis* " :—Another portion of the fibre is boiled for an hour with alkali of the same strength.

" *Acid purification.*" :—The fibre is placed in acetic acid (20 per cent.), which is slowly heated to boiling. The fibre is then removed, washed, first with alcohol and afterwards in water, then dried and weighed.

Pleochroism of silicates coloured by basic tar dyes. F. Cornu. Tsch. Min. und Petrogr. Mitt. 25, 453—55.

Senarmont first observed that normally colourless salts, when crystallised from solutions containing organic dyestuffs, acquired an artificial pleochroism. W. Suida later found that silicates containing acidic hydroxyl groups became strongly coloured when treated with basic aniline dyestuffs. The author has examined Suida's preparations in the expectation of finding some of them to be pleochroic, that is the doubly refracting ones. Serpentine asbestos, serpentine, muscovite, leucophyllite and lepidolite were found to be so, also a Canadian crysotile coloured by the author. Hence the colouring is due to chemical action and not to mere adsorption. Further conclusions are: (1) The absorption scheme is independent of the chosen dyestuff and appears to coincide with the original scheme of the particular mineral; further investigations are desirable here. (2) With different minerals, coloured by the same dyestuffs, the same or very similar colour tones recur, a fact consonant with the observations of Ambronn on the artificial pleochroism in animal and vegetable fibres.

Factory and Workshop Act, 1901. *Draft Regulations for the Heading of Yarn dyed by means of a Lead Compound. Home Office Circular—June 22nd,* 1907.

The Secretary of State proposes to make Regulations under section 79 of the Factory and Workshop Act, 1901, for the process of heading of yarn dyed by means of a lead compound. The Regulations will supersede the existing Special Rules for Factories and Workshops in which yellow chromate of lead is used, or in which goods dyed with it undergo the processes of bundling or noddling, winding, reeling, weaving or any other treatment.

The chief points in which the proposed regulations differ from the existing rules are as follows: (1) the application of the regulations is limited to the particular process in which danger of lead poisoning has been found to be serious, namely, heading of yarn which has been dyed by means of a lead compound: (2) the requirements as to exhaust ventilation for the removal of dust and as to the provision of washing accommodation, are made more precise; (3) a periodical medical examination of persons employed on the dangerous process is established. On the last two points, the regulations follow the requirements which have been inserted in a number of other recent codes for dangerous trades. Provision is made for exemption from some of the regulations in cases where the process is only carried on occasionally.

Any person desiring the Regulations to be further considered should lodge objection in accordance with section 80 of the Factory and Workshop Act, 1901, with the Secretary of State within 40 days from the date of this notice. Every such objection must be in writing, and must state (a) the draft Regulation or portions of draft Regulations objected to; (b) the specific grounds of objection; and (c) the omissions, additions or modifications asked for.

Patents.

Shrinking piece goods; Method of and apparatus for ——. S. Lees, and W. and A. Eastwood, Huddersfield. Eng. Pat. 14,115, June 20, 1906.

The machine consists of two large horizontal damping rollers covered with felt or the like. These are mounted at some distance one above the other in bearings and each is partly immersed in a trough containing water. Engaging with each roller on the side at which it leaves the water, and at a point a little above the surface of the latter, are small rubber-covered rollers which remove the surplus water from the large damping rollers. The pressure of these small rollers can be adjusted as required. Above each large roller is placed a pressing roller mounted in sliding bearings.

The cloth to be shrunk passes over stretching bars and between the lower damping and pressure rollers and then in the reverse direction through the upper pair, so that it is damped on both sides. It then passes over two heated cylinders which heat both faces of the cloth and so drive some of the moisture into the material. It is next "cuttled" down and allowed to remain for some time in the partially dried condition in order to complete the shrinking.—A. B. S.

Drying textile material of any kind put round perforated hollow cylinders or the like; Devices for ——. O. Venter, Chemnitz, Saxony. Eng. Pat. 28,995, Dec. 19, 1906. Under Int. Conv., Dec. 19, 1905.

See U.S. Pat. 847,383 of 1907; this J., 1907, 468.—T. F. B.

Viscose [for artificial fibres]; Manufacture of ——. M. Waddell, Assignor to S. W. Pettit. U.S. Pat. 855,213, May 28, 1907. *See* XIX.

Vegetable fibres; Method of preparing ——. H. R. Bonny, Brooklyn, Assignor to R. L. Pritchard, New York. U.S. Pat. 855,751, June 4, 1907.

See Eng. Pat. 15,618 of 1906; this J., 1907, 45.—T. F. B.

Dyeing machine. N. Labonty, Pawtucket, R.I. U.S. Pat. 853,700, May 14, 1907.

A perforated carrier "for the material to be dyed" is moved backwards and forwards in the closed, horizontal dyeing tank by means of a piston rod arrangement connected with an engine cylinder placed in axial alignment with the dyeing tank. At each end of the dyeing tank is placed a sliding pin which engages with the sliding carrier as soon as it reaches the end of its path. These pins are connected by pivots with the slide-valve of the engine cylinder, and reverse the direction of motion automatically. The dye tank is connected with a steam pipe for heating purposes and with a storage tank for dye liquor. The dye liquor can be removed through openings placed in the floor of the tank, and forced up into the storage tank by a steam injector.

As the material is moved from one end of the tank to the other, the dye liquor passes through it alternately in opposite directions.—A. B. S.

Dyeing apparatus. L. Destrée, Haren, Belgium. U.S. Pat. 856,134, June 4, 1907.

See Fr. Pat. 373,450 of 1907; this J., 1907, 683.—T. F. B.

[Artificial silk] Brilliant fibres from acetonic pastes; Process for obtaining ——. C. Bouillot. Fr. Pat. 373,947, Mar. 31, 1906.

In order to obviate the opacity (due to the presence of water vapour) of the artificial fibres produced from solutions of guncotton in acetone, the filaments, on issuing from the capillary tubes, are received on a polished heated cylinder made of glass or metal, and revolving at a speed corresponding with the rate of production of the fibre. From this cylinder the filaments pass, a certain number at a time, through a forked guide which moves transversely across the surface of a revolving bobbin and so winds the compound thread in a spiral manner. This bobbin rests on another cylinder which revolves at a similar lineal velocity to the drying cylinder and drives the bobbin by friction. The whole apparatus is enclosed in a metal box from which the evolved vapour can be removed by aspiration. The box is provided with a glazed opening through which the operation can be watched and which also serves for the removal of the bobbins when these are full.—A. B. S.

Fibres, artificial, and analogous products ; Arrangement of spinning apparatus for the production of ——. Gocher Oelmühle Gebr. van Den Bosch. Fr. Pat. 373,887, Jan. 24, 1907.

THE solution of viscose or other substance is passed, under pressure, into a cylindrical box, the bottom of which is furnished with a number of openings for the production of the fibres. Surrounding the upper part of this box is another receptacle in connection with the supply of precipitating liquid and furnished with a number of fine openings above the level of the capillaries by which the filaments are formed. The whole arrangement is placed at the top of a vertical cylinder, of a length corresponding to the time required for the fibre to set, and filled with the precipitating solution to just above the level of the openings from which the filaments issue. The filaments pass downwards through this cylinder in contact with a descending current of precipitant, and pass out at the bottom of the cylinder on to suitable bobbins. This arrangement is stated to give uniform filaments owing to there being no irregular movements of the precipitant.—A. B. S.

Broom plant ; Utilisation of the ——. Westdeutsche Thomasphosphat-Werke, G.m.b.H. Fr. Pat. 374,037, Jan. 29, 1907.

THE bark is removed from the plant, and the portion containing the fibre is treated under steam pressure with dilute solutions of an alkali such as sodium carbonate or of an acid such as hydrochloric acid. As soon as the incrusting substances have been removed, the mass is washed, dried, bleached if necessary, and is then ready for spinning.—A. B. S.

Sulphide dyestuffs ; Method of dyeing mixtures of cotton with wool or silk by means of ——. Ges. für Chem. Industrie in Basel. Fr. Pat. 373,871, Jan. 24, 1907. Under Int. Conv., Dec. 24, 1906.

THE wool or silk is protected from the action of the sodium sulphide in the dye-liquor by the addition of potassium or sodium "polysilicate" (soluble glass) to the dye-bath. For example, to obtain a black on the cotton in a material containing wool or silk, it may be dyed on the jigger for 30—35 minutes at 30°—40° C. in the following bath. For each litre of water, 10 grms. of Thiophenol Black DD extra, 10 grms. of crystallised sodium sulphide, 25 c.c. of soluble glass at 36° B., and 25 grms. of crystallised sodium sulphate. After dyeing, the material is well rinsed. The animal fibres are left practically white.—A. B. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Ammonio-mercuric oxide. H. Gaudechon. Compt. rend., 1907, **144**, 1268—1270.

AMMONIO-MERCURIC oxide, $(NHg_2)_2O, xH_2O$, is formed instantaneously when precipitated mercuric oxide and ammonia solution react. Of the various hydrates which have been described, that with one mol. of water is stable in a dry atmosphere at the ordinary temperature, and that with four mols. in an atmosphere saturated with water vapour at the same temperature. That with five mols. of water can only exist in presence of liquid water. Water at 100° C. decomposes the base completely into ammonia and mercuric oxide. The mercuric oxide so formed is brown, and crystallises in a form different from those of the yellow and red modifications.—J. T. D.

Nitric oxide ; Absorption of —— *by ferrous, nickel, cobalt, and manganous salts.* G. Hüfner. Z. physik. Chem., 1907, **59**, 416—423.

THE nitric oxide absorbed by solutions of ferrous salts is held partly in simple solution, and this part follows Henry's law ; the other part is combined with the ferrous salt to form a ferric compound. The amount of gas held in the "dissolved" state is greater than in the case of pure water at the same temperature and pressure. Solutions of cobaltous salts and nickelous salts absorb 1½ times more nitric oxide than ferrous solutions, whilst manganous solutions do not absorb as much as ferrous solutions. The absorption of nitric oxide by salts of other metals than iron does not appear to have been noticed hitherto, probably because no marked colour change is produced. —C. E. F.

Potassium ferricyanide ; Preparation of ——. W. J. Karslake. Amer. Chem. J., 1907, **37**, 637—638.

To 50 grms. of crystallised potassium ferrocyanide dissolved in 750 c.c of water, are added 7 grms. of potassium permanganate, previously dissolved in 250 c.c. of water. The mixture is heated on the water-bath for about an hour, the precipitated manganese dioxide is filtered off, and the filtrate concentrated, filtered again if necessary, and allowed to crystallise. The yield is about 75 per cent. —L. E.

Salts in the solid state ; Chemical reaction between ——. E. P. Perman. Roy. Soc. Proc., 1907, **79A**, 310—319.

CHEMICAL reaction takes place when salts in the solid state, without special drying, are mixed. An immediate reaction was observed in the case of mixtures of potassium iodide with lead nitrate or chloride or mercuric chloride. With mixtures of lead formate and potassium iodide and of mercuric chloride and potassium chromate, the action was slower, whilst with lead sulphate and potassium iodide, the action was still slower. There was no appreciable action in the case of mixtures of potassium iodide with litharge, lead carbonate, or mercuric cyanide. No action takes place in complete absence of water or other ionising solvent (*e.g.*, methyl alcohol). Reaction is accelerated by heat, pressure, and shaking. The rate of decomposition is influenced by the solubility and volatility of the salts. For example, the reaction between potassium iodide and mercuric chloride proceeds much more rapidly than that between potassium iodide and lead chloride, the volatility of the mercuric salt causing a more intimate contact with the potassium iodide. In experiments with a mixture of sodium carbonate and barium sulphate dried over sulphuric acid, the greatest amount of decomposition observed, was 17·92 per cent. on heating for 65 hours at 444° C. The reaction in the reverse direction, *i.e.*, with a mixture of sodium sulphate and barium carbonate, appears to be very much slower. As showing the effect of pressure, when a mixture of two mols. of sodium carbonate and 1 mol. of barium sulphate was placed in a steel mortar, and hammered vigorously for 30 minutes (about 900 strokes), 4·87 per cent. of the sodium carbonate was converted into sulphate.—A. S.

Phosphorus nitride. A. Stock and H. Grüneberg. Ber., 1907, **40**, 2573—2578.

THE authors have improved the method for the preparation of phosphorus nitride, P_3N_5, described by Stock and Hoffmann (Ber., 1903, **36**, 314). It is advisable to carefully purify the reagents used. Liquid ammonia is allowed to slowly evaporate and the vapour passed over phosphorus pentasulphide at the ordinary temperature for four hours. The mixture of ammonium thiophosphates formed is then slowly heated to 850° C., likewise in a steady stream of ammonia. The nitride thus produced has a specific gravity of 2·51 at 18° C., and the colour varies from white to a dark brown, possibly due to traces of free red phosphorus.—E. F. A.

Ozone; Fractional distillation of liquid ——. C. Harries. Chem.-Zeit., 1907, **31**, 609—610.

Ozonised oxygen was condensed with liquid air, and the lower-boiling oxygen allowed to evaporate. In this way, ozone of up to 93·86 per cent. strength was obtained. The amount of ozone in the liquid so obtained was determined both by direct weighing of the vapour in glass bulbs and also iodometrically. It was found, however, that these numbers agreed only up to a concentration of 50 per cent. of ozone; beyond this, the values obtained iodometrically, assuming the equation,

$$O_3 + 2HI = O_2 + H_2O + I_2$$

to be correct, were always smaller than those obtained by direct weighing.

Moreover, there was an increase in volume amounting in one case to 14 c.c. on 476 c.c., on treating the gas with neutral potassium iodide solution, although, from the equation cited, this volume should remain constant.
—C. A. W.

Antimony in hard lead; Determination of ——. H. Beckmann. *See* X.

Ferrocyanides, ferricyanides, and thiocyanates; Detection and separation of ——. P. E. Browning and H. E. Palmer. *See* XXIII.

Nitrate of soda statistics. W. Montgomery and Co., Ltd., June 29, 1907. [T.R.]

					1905.	1906.	1907.
Shipments from South American Ports to all parts for the six months ending 30th June..	Tons				689,000	710,000	743,000
Ditto do. for the twelve months ending 30th June	,,				1,587,000	1,644,000	1,734,000
Afloat for Europe on 30th June	,,				232,000	220,000	175,000
Stocks in U.K. Ports :—							
		1905.	1906.	1907.			
Liverpool	Tons	4,500	5,000	6,000			
London	,,	1,800	1,000	3,700			
Out Ports	,,	4,900	4,000	8,300			
					11,200	10,000	18,000
Stocks in Continental Ports on 30th June	Tons				36,800	39,000	113,000
Consumption in U.K. for the six months ending 30th June	,,				67,000	71,000	75,000
Do. in Continent do. do.	,,				820,000	852,000	870,000
Do. in U.K. for the twelve months do.	,,				110,000	105,000	112,000
Do. in Continent do. do.	,,				1,081,000	1,121,000	1,153,000
Do. in United States do. do.	,,				264,000	338,000	354,000
Do. in other Countries do. do.	,,				55,000	40,000	42,000
Do. in the World do. do.	,,				1,510,000	1,604,000	1,661,000
Visible supply on 30th June (including the quantity afloat for Europe and Stocks in U.K. and Continent)	,,				280,000	269,000	306,000
Price on 30th June	per Cwt.				11/-	10/10½	11/-

Adulterated white lead. Australian Commonwealth Order No. 916. Bd. of Tr. J., June 27, 1907. [T.R.]

It is stated in this Order that a recent importation of white lead, adulterated with barium, was described on the kegs as "Ground White Lead, reduced." The term "reduced" does not, in this case, sufficiently denote "adulteration" for purposes of the Commerce Act, and it is laid down that in future the percentage of barium, or any other adulterant in white lead, must be as clearly and as permanently shown on the coverings of the goods as the ordinary trade description applied thereto, and delivery is not to be permitted until this condition is fulfilled.

Graphite deposit in Queensland. Bd. of Trade J., June 27, 1907. [T.R.]

The "Queenslander" (Brisbane) calls attention to the existence of an extensive deposit of graphite four miles from Netherby railway station, on the North Coast line, Queensland, with a railage of only 30 miles to the port of Maryborough. The Queensland graphite (plumbago) mine was opened up three years ago. The development of the mine is extensive, showing a good body of the material about 30 ft. thick, with bands of other material through it. The great difficulty was to cut a road down the mountain, which has been done.

Patents.

Nitric acid; Concentration of dilute ——. R. Wolffenstein and O. Boeters, Charlottenburg, Germany. Eng. Pat. 28,449, Dec. 13, 1906. Under Int. Conv., Dec. 18, 1905.

See Fr. Pat. 371,797 of 1906; this J., 1907, 407.—T. F. B.

Beryllia; Separation of —— *from alumina and iron.* F. Bran and G. van Oordt, Mannheim, Germany. Eng. Pat. 15,973, July 14, 1906. Under Int. Conv., July 15, 1905.

See Fr. Pat. 367,861 of 1906; this J., 1906, 1147.—T. F. B

Arsenic; Effecting the separation of —— *from gases or liquids.* G. W. Johnson, London. From Verein Chem. Fabr., Mannheim, Germany. Eng. Pat. 16,910, July 26, 1906.

See Fr. Pat. 368,452 of 1906; this J., 1906, 1219.—T. F. B.

Sulphuric acid; Apparatus for concentrating ——. A. Gaillard, Barcelona, Spain. U.S. Pat. 856,048, June 4, 1907.

See Fr. Pat. 367,376 of 1906; this J., 1906, 1146.—T. F. B.

Salt; Art of making ——. A. E. McClain, Syracuse, N.Y., Assignor to T. M. Dix, Chelmsford, Mass. U.S. Pat. 856,597, June 11, 1907.

Saturated brine is maintained continuously and uniformly at a temperature of approximately 90° F. in a protected tank, and the salt is removed as required.
—A. S.

Nitric acid; Process for making pure, concentrated ——. Salpetersäure Industrie-Ges. Fr. Pat. 374,237, April 11, 1906.

See Eng. Pat. 7871 of 1906; this J., 1906, 758.—T. F. B.

Aluminium hydroxide; Calcination of ——. Cie des Prod. Chim. D'Alais et de la Camargue. First Addition, dated March 30, 1906, to Fr. Pat, 349,709, April 8, 1904 (this J., 1905, 732.)

Bricks, slabs, etc., are made by mixing powdered bauxite with fluorides, preferably of aluminium or of calcium (fluorspar), in such quantity that the mixture contains several parts per cent. of fluorine. The mixture is then burnt at about 1200° C.—A. G. L.

Zinc oxide and salts, hydrogen, nitrogen, and ammonia; Continuous manufacture of —— by aid of a Bessemer converter. E. Jolicard. Fr. Pat. 373,953, April 2, 1906.

Molten zinc is treated, in a vessel similar to a Bessemer converter, with a current of any desired gas or vapour, introduced near the bottom. If it be desired to make zinc oxide, steam or a mixture of steam and air is forced in, the by-products being hydrogen and a mixture of hydrogen and nitrogen, respectively. The outgoing vapours are led away, and the zinc oxide deposited may, if desired, be reduced by carbon, and the metal returned to the crucible to make the process continuous. The hydrogen may be utilised as fuel. To obtain zinc sulphide or sulphite, hydrogen sulphide or sulphur dioxide is blown through the molten zinc. When it is desired to obtain ammonia, the temperature of the molten zinc is kept as low as possible, and the zinc is preferably alloyed with tin, or lead, etc., excess of steam with air being blown through.—E. S.

Copper hydroxide; Preparation of concentrated solutions of pure colloidal ammoniacal ——. A. Lecœur. Fr. Pat. 374,277, April 12, 1906. (See Fr. Pats. 362,986 and 365,099 of 1906, this J., 1906, 808, 925).

Pure solutions of cuprammonium hydroxide are obtained by oxidising metallic copper in contact with ammonia solution by means of atmospheric oxygen, the nitrites which are formed at the same time being decomposed by the addition of sodium hydroxide (4 grms. per litre of solution containing 35 grms. of copper oxide). The ammoniacal solution is then dialysed as previously described.—A. G. L.

Sodium metasilicate, and its amorphous and crystallised hydrates; Manufacture of ——. A. H. Verrier. Fr. Pat. 373,884, Jan. 24, 1907.

Vitreous sodium silicates are heated with fused sodium hydroxide to prepare anhydrous sodium metasilicate (Na_2SiO_3); or, the substances are mixed in solution to obtain the hydrated metasilicate, $Na_2SiO_3.nH_2O$. By agitation of the more or less concentrated solution as it is cooling, the hydrated metasilicates containing 5, 6, or 7, etc. molecules of water, may be obtained in crystalline form.—E. S.

Magnesia (MgO); Process for the rapid and cheap extraction of —— from dolomite. H. Auzies and A. Ségoffin. Fr. Pat. 374,216, Jan. 24, 1907.

The dolomite is burnt, the resulting oxides are slaked, and the product is levigated by a current of water in a main reservoir which is connected with a series of basins. The magnesia being lighter than the lime, is carried furthest, the deposit in the further of the series of basins being nearly pure magnesia.—A. G. L.

Calcium sulphocyanide [Thiocyanates] and other sulphocyanides; Process of making ——. Fabr. de Prod. Chim. de Thann et de Mulhouse. Fr. Pat. 373,986, Jan. 26, 1907. Under Int. Conv., Feb. 3, 1906.

See Eng. Pat. 2708 of 1906; this J., 1906, 427.—T. F. B.

Chromates; Process for the manufacture of —— from chrome iron ore. Chem. Fabr. in Billwärder vorm. Hell und Sthamer, A.G. Ger. Pat. 171,089, March 30, 1904. Addition to Ger. Pat. 163,814, Feb. 28, 1904.

The chrome iron ore is fused with sufficient caustic soda to form an easily fusible mass, through which air is forced in a state of fine division at a temperature of 500°—600° C. It is stated that, under these conditions, the ferrous and manganese oxides present, act as oxygen-carriers, and accelerate the formation of chromates.—A. S.

Ammonium sulphate and ammonium chloride manufacture; Process for the utilisation and purification of waste gases from ——. A. J. van Eyndhoven. Ger. Pat. 170,554, April 21, 1905.

The waste gases from the saturator are passed first through a condenser for the removal of steam, then through a suitable scrubber for the separation of cyanogen compounds, and finally through a Claus sulphur-recovery apparatus.—A. S.

Phosphorus; Process for the preparation of finely-divided red ——. F. Todtenhaupt. Ger. Pat. 171,364, June 5, 1904.

Iodine is added to a solution of yellow phosphorus in a suitable solvent, such as benzene, toluene, xylene, naphthalene, or similar hydrocarbons, and the mixture is heated. Phosphorus tri-iodide is first formed, but, on heating, decomposes into red phosphorus and iodine; the latter combines with a further quantity of yellow phosphorus.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

Porcelain colours; Liquid hard ——. H. Zimmer. Sprechsaal, 1907, 7, 85—87.

The work was done for the purpose of determining the colour effects obtained by applying solutions of various metallic salts upon the body and glaze, and carrying the temperature to cone 13. The body and glaze used, had the following compositions respectively:—*Body:* China clay, 44·9; quartz, 27·0; and felspar, 28·1 per cent. *Glaze:* China clay, 22·1; quartz, 51·7; felspar 15·3; and calcspar, 10·9 per cent. With regard to the salts, nitrates were found to be most suitable, inasmuch as they produced the clearest colours. When the solution was applied to a biscuit body, the latter was subsequently heated to cone ·05 for the purpose of expelling the organic substances with which it was necessary to coat the porous body previous to the painting with the solution. When the solution was put on to the glazed surface, not yet glost burned, the raw glazes were first treated with gum arabic or dextrin. The following table contains the results obtained:—

Salt.	Strength of Solution.	Burned in small gas-fired kiln, under oxidizing conditions; applied under the glaze.	Burned in large porcelain kiln.	
			Under the glaze, protected from smoke.	Over the glaze, protected from smoke.
Ruthenium chloride	1 : 100	grayish black	light to medium gray	light gray
Rhodium chloride	1 : 100	dark gray	dark gray	dark gray
Iridium chloride	1 : 100	grayish black	light gray to gray	light gray
Palladium chloride	1 : 100	black gray	dark gray to black	dark gray
Platinum chloride	1 : 100	,, ,,	gray to black	grayish black
Copper nitrate..............	1 : 5	gray	gray to blackish brown, blistered	blackish gray, blistered
Gold chloride	1 : 100	intense red-brown	rose colour to violet	rose colour to violet
Vanadium chloride	1 : 10	light gray	light gray	dark gray
Chromic acid	1 : 1	green	green	intense yellowish green
Ammonium molybdate	1 : 3	black, yellow edges	dark gray, yellow spots	black with film of grayish blue.
Sodium tungstate	1 : 1	weak yellow	weak yellow to light orange brown	fine orange-brown
Uranium nitrate	1 : 1	yellow to gray-brown	grayish black	black
Manganese nitrate	1 : 1	nearly colourless	light cream colour	ivory colour
Ferric nitrate	1 : 1	light gray	brown	dark brown
Nickel nitrate	1 : 100	fine brown	light brown to grayish brown	brown
Cobalt nitrate	1 : 1	blue	dark blue	dark blue
Praseodymium nitrate	1 : 1	weak yellow	light sulphur-yellow	......
Neodymium nitrate	1 : 1	light blue	light bluish gray	......

Additional remarks following the foregoing table are as follows:—In a strong reducing fire, the colours became perceptibly lighter and frequently assumed a brownish tinge. The ammonium molybdate solution was prepared by dissolving the salt in hot water, and evaporating with glycerin. At a concentration of 1:1, the solution is only partially stable. Up to the present, no good results have been attained with titanium compounds, but the experiments are being continued.

Patents.

Glass; Apparatus for drawing ——. E. Fourcault, Lodelinsart, Belgium. Eng. Pat. 12,431, May 28, 1906. Under Int. Conv., June 8, 1905.

See Fr. Pat. 366,383 of 1906; this J., 1906, 985.—T. F. B.

Magnetic separators [for china, earthenware, etc.]. C. A., H., and R. Newton, Derby. Eng. Pat. 13,845, June 16, 1906.

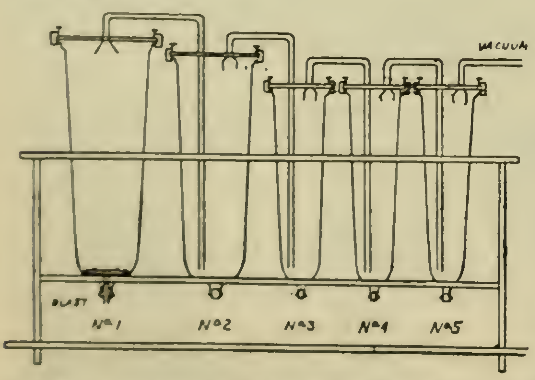
To remove iron oxide from slips for making china, etc., electro-magnets are used having cheeks or plates placed in a trough through which the slip is made to pass. Spikes or bars project from either cheek towards the other, in order to distribute the magnetic lines of force throughout the material. If the electric current actuating the electro-magnets fails from any cause, a valve normally held above the trough by a separate electro-magnet is dropped into the trough, thus preventing any magnetic material which may be washed off the electro-magnets from passing again into the purified slip.—A. G. L.

Pottery and other kilns and ovens; Gas-fired ——. T. W. Twyford, Hanley, and T. C. Moore, Stoke-on-Trent. Eng. Pat. 18,769, Aug. 22, 1906.

The gas and air are heated on their way to the combustion spaces of the kiln, by causing them to pass through separate vertical flues, of inverted U-shape, (constructed of moulded earthenware sections), arranged in pairs round the wall of the kiln, one flue of each pair being connected with the gas main and the other with the air main, and each pair discharging into a combustion space in such a manner as to ensure thorough mixture of the gas and air.—C. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Powders [cement, etc.]; Air elutriation of fine ——. A. S. Cushman and P. Hubbard. J. Amer. Chem. Soc., 1907, **29**, 589—597.



In the cement and fertilizer industries, in which the material is susceptible to the action of water, wet elutriation methods are useless. The authors describe an apparatus for the pneumatic separation of such finely-ground materials. It consists of five percolating jars set in a wooden frame and connected by glass tubes, passing through close-fitting caps tightly clamped to the tops of the jars, as shown in the figure. The capacities of the first and second jars are three and two gallons respectively, those of the remaining three jars, one gallon each. In the bottom of No. 1, is placed a flat spiral tube closed at one end, but with a number of very small openings through small jets soldered into the upper surface of the spiral at an angle of 30°. The open end of the spiral passes through a rubber stopper in the neck of the jar, and is connected to the air supply. Connection between the various jars is made by means of inverted funnels, attached to the ends of the glass tubes, as shown in the diagram, the exit tube of No. 5, being connected to a vacuum. Rubber stoppers close the necks of the jars, and are removed when it is desired to draw off the charges of powder which have accumulated during a run. About 1 kilo. of dry powder is placed in jar No. 1. Blast and vacuum are then turned on, and adjusted so that a steady stream of air passes through the powder, and raises a dense white cloud, which assumes a vortex motion as it ascends. The heavier particles continually fall in a ring near the walls of the vessel, whilst the lighter particles are carried into jar No. 2, through the funnel tube. Here the heavier portions are retained, whilst the lighter pass into jar No. 3, and so on. The blast is supplied from a compressor, and is dried by means of pumice impregnated with sulphuric acid. To arrive at an approximate estimate of the actual areas presented by definite weights of material sifted to different degrees of fineness, the use of a surface factor has been proposed. (See Binns, this J. 1907, 321.) —O. R.

Patents.

Dust on roads, streets, and the like; Manufacturing means from wood tar for preventing ——. S. Mattar, Leipzig, and R. Funcke, Lorch, Germany. U.S. Pat. 855,860, June 4, 1907.

See Fr. Pat. 371,521 of 1906; this J., 1907, 411.—T. F. B.

Wood; Process and apparatus for injecting [liquids into] ——. M. Boucherie. Fr. Pat. 373,992, Jan. 28, 1907.

In this process any liquid can be injected into blocks of wood, by pressure, or by a vacuum, or by both. The apparatus consists of a cylinder mounted so that it can be turned in a horizontal or vertical position, for the purpose of loading and unloading the wood, and for removing the filling material used to form a tight joint between the wood and the wall of the cylinder. This material consists of a mixture of water or other liquid, especially the liquid to be injected, and very fine sand, broken brick, powdered charcoal, sawdust, or any other suitable insoluble substance, which can pass into the smallest interstices, and form a joint sufficiently tight to support pressure, suction, or both.—W. C. H.

Cement mortar; Process of preserving completely prepared ——, *without the loss of its property of setting.* J. H. Magens. Fr. Pat. 373,834, Jan. 23, 1907.

The mortar is cooled, at the time of its manufacture, below the temperature of the surrounding air, and is kept in a state of movement or shaking, up to the time of its use, in order to retard the setting, so that it is possible to transport the mortar over long distances, in consequence of the retardation of the setting produced by the shaking and concussion arising during the transport. —W. C. H.

X.—METALLURGY.

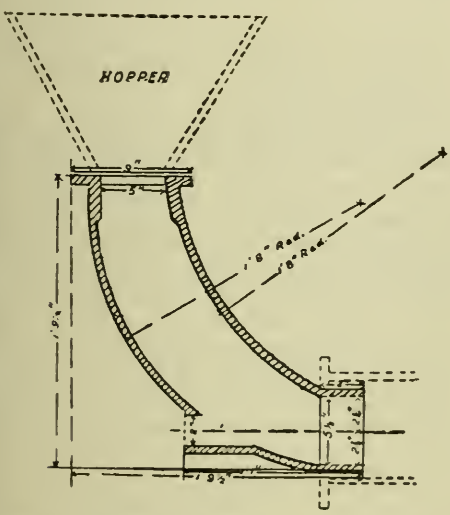
Steel; Behaviour of carbon and phosphorus in ——. H. M. Howe. Eng. and Mining J., 1907, 83, 1087—1089.

The author discusses Stead's explanation of the banding of carbon and phosphorus in steel, and the theory of incompatibility (this J. 1906, 988). When steel free from phosphorus is rolled at temperatures but little above or lower than the A_1-point (temperature of recalescence), the hard *pearlite* and soft *ferrite* are drawn out unequally, giving rise to bands alternately rich and poor in carbon. If this rolled steel be reheated, the *pearlite* first of all passes into *austenite* (in which the constituents, *pearlite, ferrite* and *cementite*, can no longer be distinguished) at the A_1-temperature, and then, at a higher temperature (the A_3-point), the excess of *ferrite* also dissolves and passes into the *austenite*, the bands disappearing completely. On cooling the steel below the A_1-point, the original structure of evenly mixed *ferrite* and *pearlite* will reappear. If a steel containing phosphorus is subjected to the same treatment, on the other hand, the bands once formed persist, owing to an apparent "incompatibility" of carbon and phosphorus. The bands in this case consists of layers rich in carbon and poor in phosphorus, and of other layers poor in carbon but rich in phosphorus. On welding together at a white heat plates of pure iron, between which some iron phosphocarbide was placed, Stead found that the carbon diffused completely into the plates, leaving the joints quite free from carbon and rich in phosphorus.—A. G. L.

Nickel- and carbon-steel; Recovery of —— from overstrain. E. L. Hancock. Phil. Mag., 1907, **13**, 688—693.

The elasticity of nickel- and carbon-steel, destroyed by overstrain in either tension or torsion, gradually returns when the metal is allowed to rest, the elastic limit becoming, in some cases, greater than its original value. The elastic properties may be restored by immersion for a short time in boiling water, but recovery is not aided by repeated blows from a light hammer. It was also found that materials overstrained in either tension or compression lose their elasticity for stress of the opposite kind, but the elasticity is completely restored by rest. Carbon-steel seems to recover more quickly than nickel-steel.—O. F. H.

Tube-mill practice; Notes on some recent improvements in ——. K. L. Graham. J. Chem. Metall. and Min. Soc., S. Africa, 1907, **7**, 317—320.



The author compared the efficiency of a tube-mill loaded with quartz (171·5 tons at a cost of £17) with that of a similar mill loaded with Danish pebbles (10 tons at a cost of £60), and found that the grinding done by the former was superior, 63·99 per cent. of the product passing a 90-mesh sieve as against 61·44 per cent. with the pebbles. The life of the quartz-fed mill was 140 days as against 124 days for the other. As about 2 tons of quartz per hour required handling however, a mechanical feeder was necessary. This consisted of a cast-iron bend as shown (see Fig.), 5 in. in internal diameter at its narrowest point, and widening out towards its lower portion to prevent choking. The lower end projects 3 in. into the hollow trunnion of the tube-mill. The pulp from the "dewaterer" is passed in through the 1½ in. orifice at the back of the casting. Quartz lumps of up to 4½ in. diameter are fed by a belt to the hopper. The author believes that with one tube-mill for every 350 to 400 tons milled per 24 hours, using 100 to 300 screening with apertures 0·07 to 0·03 in., the size of the nozzle should be 1¼ in. With a head of 6 ft. of water, this will pass 250 to 270 tons per day, the proportion of water to solids being 1 : 1. Using quartz in the mill, an automatic device for catching particles discharged through the holes in the outlet plate of the mill is necessary. This may take the form of a perforated "trommel" (drum) fixed to and revolving with the mill, buckets being attached to the inside of the periphery which elevate the quartz particles and discharge them down a shoot, whence they pass by a pipe through the bottom of the launder to a bucket, to be returned to the battery for further crushing. As a lining for tube-mills, silex has so far proved superior to any local substitute. The average cost of 3 linings of silex, put into a mill, 22 × 5 ft., in blocks of 6 × 6 × 4 in., including labour, was £155, which, with a life of 4 months, works out at £1 5s. per day.—A. G. L.

Argentiferous cobalt-nickel arsenides of Temiskaming, Ontario, Canada; Roasting of the ——. H. M. Howe, W. Campbell and C. W. Knight. Bull. Am. Inst. Min. Engin., 1907, 53—61.

On roasting cobalt arsenides it was sought to determine at what temperatures the arsenic was most rapidly expelled, the degree of thoroughness of expulsion by maintaining this roasting temperature, and also the effect of the addition of charcoal at the beginning and end of the roasting process. It was found that:—1. The percentage of silver as determined by the scorification method is about 4 per cent. higher than as determined by the crucible method. 2. The ore neither frits nor clogs at or even somewhat above 960° C., the melting point of silver. 3. The arsenic can be reduced from 56 to 41 per cent. or by 15 per cent. by roasting below 700°. 4. It can be further reduced by about 24 per cent., *viz.*, to 17 per cent. by roasting at temperatures above 840°, the arsenic being removed much faster than at lower temperatures. 5. Charcoal, whether added at the beginning or towards the end of the roasting process, fails to increase the expulsion of arsenic. 6. It is doubtful whether it will pay to reduce the arsenic content below 20 per cent., even by roasting at temperatures above 890° C., because its further reduction is very slow. Finer grinding of the material did not seem to assist in eliminating the arsenic.

Silicon tetrachloride; Action of —— on silver and copper. E. Vigouroux. Compt. rend., 1907, **144**, 1214—1216.

Silver, when treated with silicon chloride in the same way as chromium (this J. 1907, 154) forms no silicide, though the silicon compound is decomposed with formation of silver chloride. Copper, under the same circumstances, yields a fused mass containing 2·3—2·5 per cent. of silicon, which the author thinks is probably a mixture of the compound, $Cu_{16}Si$ (2·7 per cent. of silicon) with excess of copper.—J. T. D.

Calcium; Reduction of some oxides and sulphides by means of metallic ——. F. M. Perkin. Faraday Soc., May 28, 1907. [Advance proof].

Metallic calcium, when used in the form of fine turnings, has a more powerful reducing action on metallic oxides than aluminium, the reaction being so violent that it is necessary to control it by adding varying proportions of calcium fluoride or calcium oxide to the mixture of oxide to be reduced. Thus, 30—40 per cent. of calcium fluoride or 10—20 per cent. of calcium oxide is required in the reduction of ferric oxide. Boron may be obtained by reduction with metallic calcium from boron trioxide, and also from borax, but always contains calcium as an impurity, while silicon can only be obtained from sand by using considerably less than the theoretical quantity of calcium. Sulphur and calcium react vigorously giving calcium sulphide, but attempts to obtain metallic lead from galena were unsuccessful.—O. F. H.

Lead sulphide ; Equilibrium between —— and its oxidation products. R. Schenck and W. Rassbach. Ber., 1907, **40**, 2185—2201.

By a method similar to that used in investigating the chemical relations of iron, carbon, and oxygen (this J., 1907, 692) the authors have examined the equilibrium of the four univariant systems:—$Pb,PbS,PbSO_4,SO_2$; Pb,PbS,PbO,SO_2 ; $PbS,PbSO_4,PbO,SO_2$; and $Pb,PbSO_4,PbO,SO_2$. The three solid substances in each system were heated to determined temperatures, in one series of experiments in a vacuum apparatus, in a second series, in an apparatus containing sulphur dioxide at, or above atmospheric pressure, the limiting value of the pressure of the gas at each temperature being measured. In the first system the results were very sharp and accurate ; equilibrium was quickly attained, and the limiting pressures closely agreed, whether they resulted from evolution or absorption of sulphur dioxide, and whether the gradations of temperature were upward or downward. The pressure rose from 39 mm. at 600° C. to 735 mm. at 723° C., the rate of increase becoming much more rapid as the temperature rose. In the second system, equilibrium is much slower of attainment, and the results of different determinations do not agree so closely. This is due partly to the solubility of lead sulphide in metallic lead, partly to the production of small quantities of lead sulphate and their solution in lead oxide. As a result, whilst the graphic representation of the figures obtained in the first system, shows a clean curve, that of the figures obtained in the second, shows a band limited by two curves generally similar to the first one, but further away from the axis of pressures. The pressures in the second system rise from 6 mm. at 692° C. to 857 mm. at 870° C. In the third system there is no equilibrium ; a small quantity of metallic lead is formed, and then the pressures adjust themselves to those of the first system, the presence of lead oxide in that system appearing not to produce any effect. The same remark applies to the fourth system, in which lead sulphide is formed, which then resolves itself, at moderate temperatures, into the first system. As the temperature rises the pressures gradually fall off till they approach those of the second system ; no doubt because of the disappearance of lead sulphate as a separate phase, in consequence of its solution in lead oxide. The whole field (in the graphic representation of the results) is divided into three parts :—1. Between the pressure axis and the curve of the first system. In this the original reactions that occur are: $2Pb+2SO_2=PbS+PbSO_4$, and $3Pb+SO_2=PbS+2PbO$; and, derived from the reaction of the products of these, $4PbO+4SO_2=PbS+3PbSO_4$. The substances which can stably coexist are lead sulphide and lead sulphate. 2. *a.* Between the curve of the first system and the nearer limit of the band of the second system. Here PbS and PbO can coexist, the latter saturated with lead sulphate. *b.* Between the limits of the band of the second system. Here too lead sulphide and lead oxide coexist, the latter either containing no lead sulphate, or at least not being saturated with it. In both of these regions of part 2, the reactions that occur are $PbS+PbSO_4=2Pb+2SO_2$, and $3Pb+SO_2=PbS+2PbO$; and the derived reaction is $PbS+3PbSO_4=4PbO+4SO_2$. 3. Beyond the farther limit of the band of the second system. Here the reactions occurring are $PbS+PbSO_4=2Pb+2SO_2$ and $PbS+2PbO=3Pb+SO_2$; and the stably coexisting substances are PbS and Pb. It thus appears that to produce metallic lead by the reaction of sulphide, sulphate and oxide, the temperature must be very high, above 900° C., risking loss of sulphide by volatilisation, or the pressure of sulphur dioxide must be kept very low. To produce oxide, a lower temperature is necessary. Direct experiments on the reactions between sulphur dioxide and lead, lead sulphate and excess of lead in presence of lead sulphide, and sulphur dioxide and lead oxide, showed that they all occurred in agreement with the deductions made from the equilibrium-diagram. Calculation, by means of Van't Hoff's equation, of the heat evolved in the reaction: $PbSO_4+PbS=2Pb+2SO_2$, gave, for different series of the experiments, figures lying between 34,000 and 40,000 calories; the figure calculated from the heats of formation of the separate substances, is 41,200 calories.—J. T. D.

Antimony in hard lead ; Determination of ——. H. Beckmann. Z. angew. Chem., 1907, **20**, 997—998.

A DETERMINATION of the solidifying point of the alloy affords an approximately correct measure of the amount of antimony present. A special thermometer is used for the determination, the instrument being provided with two scales, one giving ordinary degrees of temperature and the other direct percentages of antimony. In the case of alloys containing from 0 to 13 per cent. of antimony, the solidifying point sinks from 326° C. to 228° C. and then rises again as the quantity of antimony is increased. A difference of 7·5° C. corresponds, therefore, with 1 per cent. of antimony. The beginning of the solidification is easily observed, as lead crystals separate out, the molten alloy becomes thick, and a rim of lead forms at the side of the containing vessel. As alloys containing 12 and 14 per cent. of antimony have the same solidifying point, it is advisable, if there be reason to suspect the presence of much antimony in the alloy, to mix the latter with a known quantity of pure lead and to take the solidifying point of the mixture.—W. P. S.

Metals free from silicon or poor in silicon, and metallic silicides ; Production of —— from ores. J. Weckbecker. Metallurgie, 1907, **4**, 317. Chem.-Zeit., 1907, **31**, Rep., 291.

MANGANESE ore was smelted in an electric furnace with only as much reduction mixture as sufficed for the reduction of the iron and a part of the manganese. In one experiment an alloy containing manganese, 78·2 ; iron, 15·7 ; and silicon, 0·1 per cent. was produced. The slag mixed with silica and coke was now smelted in a second furnace, a manganese silicide containing 74·5 per cent. of manganese and 21·8 per cent. of silicon being produced. This silicide, almost free from iron, should be suitable for use in refining other metals.
—C. A. W.

Binary alloys ; Relations between the diagrams of —— and their malleability. L. Guillet. Compt. rend., 1907, **144**. 1273—1275.

Case 1 : The metals separate in the pure state on solidifying. If both be malleable, all of the alloys are so, and if neither be malleable, none of the alloys is. If one be malleable, the malleability of the alloys depends on that of the eutectic. This is malleable or not, according as the eutectic point in the diagram is nearer to the figurative point of the malleable or of the non-malleable metal. Alloys of a malleable metal and a malleable eutectic are malleable ; those of a non-malleable eutectic and a non-malleable metal are not ; those of a malleable eutectic and a non-malleable metal are malleable only if the metal be present in very small proportion. *Case* 2 : Either metal is miscible only in small proportion with the other, and they form no compounds. If one metal is malleable, the solid solution rich in this metal is malleable. No solid solutions rich in a non-malleable metal have been observed. The malleability of the other alloys follows the same rules as in the former case, bearing in mind that the eutectic here is formed of two solid solutions. *Case* 3.—The metals form compounds or solid solutions solidifying at a constant temperature : All the alloys containing the pure compound or the pure solid solution are non-malleable. Only the alloys at the extremities of the diagrams, *i.e.* those containing one or the other metal, can be malleable. *Case* 4.—The alloys form compounds or solid solutions which if pure are decomposed on fusion. The general conditions are the same as in Case 3 ; the alloys are not malleable save where a malleable metal is a large, and the compound or solid solution a small constituent. Where, however, a solid solution is malleable hot, alloys of this with another, malleable cold, will be malleable when hot or when cold according to the proportions of the two. *Case* 5.—The metals are miscible in all proportions. Here, if we start from a malleable metal, the solid solution will be malleable, and hence all the alloys will be so. Two isomorphous metals should be either both malleable or

both non-malleable. *Case* 6.—Transformations can occur in the solid state: By breaking up the diagram into a number of zones, it can be seen that the solid solutions can never correspond to the extremities of the curve, and the alloys cannot be malleable, at least when cold.
—J. T. D.

Patents.

Basic Bessemer process; Manufacture of iron or steel by the ——. J. Flohr, Dudelange, Luxembourg. Eng. Pat. 16,440, July 20, 1906.

The claim is for the manufacture of iron or steel by the basic Bessemer process, wherein an addition is made to the charge in the converter preferably after decarburisation, "of a briquetted or non-briquetted mixture of hammer scale, rolling-mill dross or other suitable substance containing ferric oxide together with slaked lime" or limestone, which is "capable of producing a sudden intense cooling, and effecting a better dephosphorisation of the charge."—O. F. H.

Steel; Apparatus for hardening or otherwise modifying the crystalline structure of articles of ——. R. E. B. Crompton, London. Eng. Pat. 20,445, Sept. 14, 1906.

The apparatus consists of groups of two or three heating tanks and one cooling tank arranged symmetrically around a central column, so as to allow of the rapid transfer, by means of an arm revolving around the column, of an article from one bath to another. Means are provided for observing the exact temperature of each bath. The articles to be hardened are fixed in a chuck attached to a plunger-spindle, which can be made to rise and fall vertically, and to which a revolving motion can be given, the whole being attached to the revolving arm. In this way the articles enter the quenching tank with a spiral motion, ensuring even cooling, and preventing the entrance of air-bubbles.—A. G. L.

Silver; Production of alloys of ——. S. O. Cowper-Coles, London. Eng. Pat. 28,587, Dec. 14, 1906.

An alloy of silver and zinc is made by heating a known quantity of silver in a closed receptacle filled with zinc dust or finely-divided zinc mixed with chalk or other refractory substance. A standard silver, which will not tarnish so easily as the usual standard alloy of silver and copper, is then made from silver and a calculated amount of the silver-zinc alloy.—O. F. H.

Metals or metallic articles; Deposition of metals upon, and their combination with, ——. F. W. Gauntlett and The Sherardizing Syndicate, Ltd., London. Eng. Pat. 9959, April 28, 1906. (See Eng. Pats. 9927 of 1901, 28,590 of 1903, and 15,759 of 1904; this J. 1902, 917; 1905, 93.)

In the process of sherardizing, an addition of about 9 parts by volume of an inert material, *e.g.*, silica or carbon, to one part of the coating material, *e.g.*, zinc, copper, or antimony (with or without a proportion of the oxides of these metals), is made in order to improve the coating.
—A. G. L.

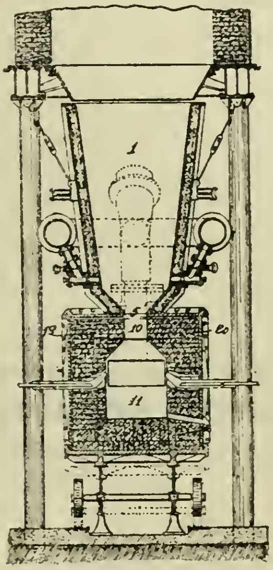
Inlaying, ornamenting, and case-hardening metallic surfaces; Process for ——. S. O. Cowper-Coles, London. Eng. Pat. 12,452, May 29, 1906.

The surface to be treated is covered with a composition consisting of "whitening" mixed with an adhesive substance, such as treacle or molasses; the design is cut out, and the surface sand-blasted, when necessary. The article is then placed in a closed vessel connected with a crucible containing molten zinc or other easily volatilised metal, and hydrogen is passed through or over this molten metal.—O. F. H.

Desulphurising and subsequently smelting; Process of ——. W. G. Perkins, San Francisco, Cal. U.S. Pat. 852,612, May 7, 1907.

Ores in a finely-divided condition are treated by introducing gaseous fuel into a heated space below the smelting zone, passing this fuel mixed with air up through the smelting zone, and at the same time introducing air into the smelting zone. (See following abstract.)—A. G. L.

Smelting-furnace. W. G. Perkins, San Francisco, Cal. U.S. Pat. 852,613, May 7, 1907. (See preceding abstract.)



The furnace consists of a hollow structure in two sections, the upper one (1) being contracted and provided with an opening (5) at the lower end. The lower section is removable, and consists of an outer shell (20) and an inner lining (19), which also is removable, and forms an arched chamber (11). A passage (10) leads from the arch of this chamber to the contracted end of the upper section. Means are provided for introducing a blast of air into the upper section, as well as means for connecting this blast of air with the lower chamber, and means for introducing an inflammable gas into the lower chamber.—A. G. L.

Smelting furnace. E. Bosshardt, Cologne, Assignor to H. Garda, Leipzig, Germany. U.S. Pat. 855,927, June 4, 1907.

See Eng. Pat. 15,015 of 1906; this J., 1907, 472.—T. F. B.

Metals from their ores; Process of extracting ——. W. L. George, Williams, Ariz., Assignor to George Metal Extracting Company. U.S. Pat. 854,998, May 28, 1907.

The ore is crushed, and heated in contact with carbon to a temperature and for a length of time sufficient to cause the reduction of the metallic minerals to the metallic state in the form of small grains or globules. The metal is then separated by concentration.—O. F. H.

[*Blast-furnace dust, etc.*] *Comminuted substances; Production of coherent bodies from* ——. W. Schumacher, Osnabrück, Germany, Assignor to E. Thalmann, New York. U.S. Pat. 855,419, May 28, 1907.

Fine ores, blast-furnace dust, and the like are mixed with finely-divided calcium silicate, or calcium silicate and lime, and the mixture subjected to the action of steam under pressure.—O. F. H.

Detinning; Process of ——. C. E. Acker, Niagara Falls, N.Y. U.S. Pat. 855,491, June 4, 1907.

Tin-scrap is subjected in a closed vessel to the action of a de-tinning agent, the pressure in the vessel being successively increased and decreased so as to force the reagent into the interstices of the scrap.—A. G. L.

Blast-furnace gases and the like; Process and apparatus for purifying ——. C. Flössel. Fr. Pat. 373,998, June 21, 1906. *See* II.

Zinc as oxide from poor calamines; Chemico-metallurgical process for extracting the ——. F. S. Moyano. Fr. Pat. 373,864, Oct. 20, 1906 Under Int. Conv., June 12, 1906.

See Eng. Pat. 24,526 of 1906; this J., 1907, 477.—T. F. B.

Metallic pieces; Process and apparatus for making compound ——. J. F. Monnot. Fr. Pat. 373,971, Jan. 14, 1907

See Eng. Pat. 8913 of 1906; this J., 1907, 532.—T. F. B.

Alloy of iron, silicon, and manganese; Process of manufacturing a triple —— *in an electric furnace.* C. A. Keller. First Addition, dated Jan. 24, 1907, to Fr. Pat. 334,504, Aug. 8, 1903 (this J., 1904, 68).

The alloy may be produced in an ordinary blast-furnace instead of in an electric furnace, provided that a certain amount of silicon is introduced into the charge. The more silicon is used, the lower is the temperature at which the alloy is formed.—A. G. L.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Patents.

Electrodes. C. C. Connor, Belfast, and J. W. Stubbs, Middlewich, Cheshire. Eng. Pat. 22,752, Oct. 15, 1906.

The metallic conductors, connecting the carbon blocks used as electrodes, to the source of current, are protected from the action of the electrolyte by means of a plastic mass, consisting of a mixture of powdered carbon or graphite, resin, and carbon tetrachloride. The mass may be moulded into any required shape, and, being of high electrical conductivity, serves to connect together the metallic conductors and carbon electrodes.—B. N.

Furnaces; Electric resistance ——. C. Féry and C. Langlet, Paris. Eng. Pat. 3803, Feb. 15, 1907. Under Int. Conv., Feb. 17, 1906.

See Fr. Pat. 363,437 of 1906; this J., 1906, 854.—T. F. B.

Calcium carbide; [Electrical] Process of producing ——. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 855,476, June 4, 1907.

The charge is progressively smelted by interposing it as a resistance-conductor in an electric circuit, the current density being increased along the path of the current in the charge. A body of the carbide is thus accumulated, partly within a movable receptacle, which, when full, can be removed, and replaced by an empty receptacle. Fresh charge materials are supplied to the furnace as required.—B. N.

Calcium carbide; [Electrical] Process of producing ——. E. F. Price, Assignor to Union Carbide Co., Niagara Falls, N.Y. U.S. Pat. 855,477, June 4, 1907.

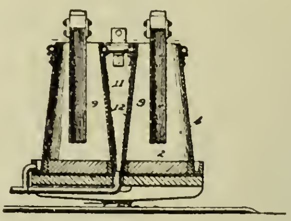
The process is similar to that described in the preceding abstract, an electric arc being used for smelting the charge instead of a resistance-conductor.—B. N.

Furnace; Electric resistance ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 855,480, June 4, 1907.

The smelting chamber of the furnace is provided below with a discharge opening, and is heated by passing an electric current through the charge, which serves as a resistance-conductor. A number of movable abutting receptacles are so disposed that any one of them can be made to register with the discharge opening, in such a manner as to retain a molten body within the smelting chamber. The furnace may comprise a shaft converging downwards and having an open bottom, below which is one of the movable receptacles. Superposed electrodes are placed in position to contact with the charge in the smelting chamber and thus cause the latter to act as a resistance-conductor.—B. N.

Furnace; Electric ——. A. C. Higgins, Worcester, Mass. U.S. Pat. 856,061, June 4, 1907.

The furnace chamber is long and narrow, and comprises a hearth, 2, and a separable casing with inclined walls, 4. Spaced electrodes, 9, 9, of opposite polarity, within the chamber, provide an intermediate heating zone, and an open well, 11, is provided within the furnace between the electrodes. Means are provided for cooling the walls, 12, of the well and the exterior walls of the furnace. A comparatively uniform temperature is thus obtained throughout the furnace chamber, resulting in the production of a commercially uniform product.—B. N.



Electrolytic tank. J. F. Miller, Trail, British Columbia. U.S. Pat. 856,277, June 11, 1907.

The side walls, bottom, and end walls of the tank are each built up of longitudinal sections. In the side walls is a series of vertical openings passing through all of the sections; in like manner, the bottom has a series of transverse openings, and the end walls, both vertical and horizontal openings. Each end of the tank is fitted with a ⊔-shaped stay-iron passing round the ends of the bottom and the side walls. Tie-rods extend: (1), through the vertical openings in the side walls; (2), through the transverse openings of the bottom and the lowest sections of the side walls; (3), through the horizontal openings in the end walls, the ends of the side walls, and the vertical portions of the stay-irons; and (4), through the vertical openings in the end walls, the bottom, and the horizontal portions of the stay-irons.—A. S.

Albuminoid substances, especially casein; Electrolytic treatment of ——. [*Artificial horn, etc.*]. R. Desgeorge and F. Lebreil. Fr. Pat. 373,756, March 27, 1906. *See* XIV.

Arcs; Production of electric —— *for the treatment of air or gases.* Salpetersäure Industrie-Ges. m.b.H. Fr. Pat. 374,238, April 11, 1906.

The air or gaseous mixture is brought to the electrodes under pressure or in the form of a current of sufficient speed, in order to accelerate the extinction of the arc flame, and, at the same time, prevent the formation of short-circuits at the point where the arc is produced. A portion only of the gaseous mixture may be introduced under pressure in order to transform the arc into a heating arc, whilst the greater portion is introduced under a relatively low pressure.—B. N.

Voltaic arcs; Production of relatively long, strong-current ——. Salpetersäure Industrie-Ges. Fr. Pat. 374,278, April 12, 1906.

See Eng. Pat. 7869 of 1906; this J, 1906, 935.—T. F. B.

Water-gas; [Electrical] Process and apparatus for the manufacture of ——. Soc. Anon. Electrometallurgie (Procédés P. Girod). Fr. Pat. 373,780, Jan. 21, 1907. *See* II.

Filaments for electric incandescence and arc lamps. H. Rubert. Fr. Pat. 373,827, Jan. 23, 1907. *See* II.

Tungsten; Process of manufacturing —— specially applicable for the manufacture of incandescence lamps. Comp. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 373,923, Jan. 26, 1907. *See* II.

Non-conductors of electricity; Process for converting substances into impermeable and acid-proof ——. W. Appleyard. Fr. Pat. 374,114, Feb. 1, 1907.

PAPER, pasteboard, or similar material of a porous nature, is saturated with a solution containing, approximately, 3 parts of asphaltum and 1 part of resin, in a closed receptacle under pressure. The saturated material is afterwards pressed by mechanical means, and finally dried. —B. N.

(*B.*)—ELECTRO-METALLURGY.

Report on the experiments made at Saulte Ste. Marie, Ontario, under Government auspices, in the smelting of Canadian iron ores by the electro-thermic process. Eugene Haanel. Abstract by F. W. Harbord. Times Eng. Suppl., June 19, 1907.

THREE questions have been settled by these experiments—first, that charcoal, even of inferior quality, can be satisfactorily used in the electric furnace as a reducing agent without briquetting; secondly, that ores containing a considerable percentage of sulphur, and practically no manganese, can be used to produce pig iron low in sulphur; and thirdly, as was generally anticipated, magnetite iron ore offers no special difficulties, and is easily reduced. From one run with titaniferous iron sand, it also appears that there will be no insurmountable difficulty in smelting this refractory material, as a pig iron containing only 0·40 per cent. of titanium was produced from sand containing 17·0 per cent. of titanium oxide.

The furnace used for the experiments was of the ordinary resistance type employed for the manufacture of ferro-silicon, ferro-chrome, and similar alloys, the sole of the furnace consisting of a carbon block forming one electrode, the other being a vertical movable electrode in the shaft of the furnace, suspended from an overhead pulley. Difficulties were encountered with failures of the linings, &c., which seriously interfered with continuous working, and the details of the furnace had to be modified from time to time. The electric installation would not give a current of more than 5,000 amperes at from 35 to 40 volts, and consequently the important question of the most suitable current and voltage for a given charge could not be determined. In the earlier experiments an attempt was made to utilise the gases generated in the furnace by their combustion in the upper part of the furnace, and this seriously interfered with the working of the furnace, owing to the softening of the charge, which then refused to descend. In the later experiments, the attempt to utilise these gases was abandoned. The results as to the main points at issue must be regarded as very satisfactory. Excellent pig iron, low in sulphur, was made from magnetite containing as much as 0·40 per cent. of sulphur, and a nickel pig iron practically free from sulphur was obtained from roasted pyrrhotite containing 1·5 per cent. of sulphur, without the addition of any manganese ore, and with a resulting slag which only showed traces of manganese. The experiments with coke briquettes and charcoal all gave good results, and pig iron from grey to white, and containing from 4 per cent. to 0·10 per cent. of silicon was produced, without the sulphur increasing appreciably, with a low consumption of electric energy. These results were largely obtained by keeping the slags basic, but it is not clear from the experiments to what extent they were able to control the grade of the product and make grey or white iron at will; it seems probable that the electric installation, owing to its limitations, prevented experiments on these lines, except to a very restricted extent, without considerable risk of the charge setting in the furnace.

The report contains details of each experimental run, with analyses of materials used, products obtained, and energy consumed, with particulars of all the electrical measurements taken. The carbon, coke, and fuel used were somewhat higher per ton of pig iron produced than indicated by the results obtained in the experiments at Livet by the Canadian Commission, but the electric energy consumed was less, being only an average of about 0·240 e.h.p. year per ton of pig iron obtained. The furnace employed in these experiments was on their completion sold to the Lake Superior Corporation, who have been using it for the production of nickel pig iron from roasted pyrrhotite, and during a four months' continuous run they have produced 154 short tons, with a consumption of about 0·46 e.h.p. year per ton of pig.

The fact that charcoal can be economically used, and pig iron low in sulphur produced from ores high in sulphur is important. The smelting of titaniferous sands also opens a wide field, as there is little probability of this material being satisfactorily smelted in the blast furnace. The metallurgical side of electric smelting has now been fairly well demonstrated, and the commercial production of pig iron is now chiefly a matter of furnace construction. In this direction there is room for considerable improvement, as the present form of resistance furnace has many practical drawbacks which must be overcome before it can be regarded as satisfactory, and it is to improvement in furnace design we must look for substantial advance in electric smelting.

There is an interesting comparison at the end of the report between the electric furnace and the blast furnace, and in an appendix a description is given of various new forms of furnaces showing the recent developments and suggestions made by patentees and inventors, and some of these are well worth consideration. One double-shaft furnace, in which the electrode is separated from the descending charge, is the outcome of these Canadian experiments, and there are several others which possess future possibilities.

PATENTS.

Furnaces; Electric ——. S. O. Cowper-Coles, London. Eng. Pat. 596, Jan. 9, 1907.

THE furnace comprises a lower body of fireproof material, and a detachable cover, provided with a feed opening. One electrode passes up through the bottom of the furnace, and several other electrodes, of opposite polarity to the first, enter the body portion horizontally at different heights. The furnace is provided below with a discharge hole, beneath which is a revolving table or disc, on to which the material falls. The latter is thus cooled and disintegrated.—B. N.

Furnace; Electric —— and process. P. L. T. Héroult, La Praz, Assignor to Sté. Electro Metallurgique Francaise, Froges, Isère, France. Re-issue, No. 12,658, June 4, 1907 of U.S. Pat. 721,703, March 3, 1903.

THE furnace, which is for the manufacture of metals, such as chromium, manganese, iron, etc., having a strong affinity for carbon, comprises a crucible adapted to carry a bath of molten material, with two carbon electrodes supported above it, and arranged to form arcs in series by the passing of the current from one electrode to the molten metal, and from the latter to the second electrode. A voltmeter is connected in shunt between each electrode and the metal in the furnace, for the purpose of indicating separately the length of each arc. The connection of the voltmeter with the molten metal is made by means of a rod passing through the refractory material of the crucible. Inside the crucible, "the portion of the rod which is melted is replaced by molten material, which fills up the space and thus insures good conductivity." Means are provided for regulating the position of each electrode, in order to avoid contact with the metal, and a layer of non-conducting slag is maintained between the lower ends of the carbon electrodes and the molten material, so as to prevent the carbon of the electrode combining with the metal.—B. N.

Gold from magnetic sands; Apparatus for separating ——. E. Gates, Chevy Chase, Md., Assignor to Washington Loan and Trust Co. U.S. Pat. 854,997, May 28, 1907.

THE magnetic sands are fed on to an inclined screen or apron in the field of an electro-magnet. The screen has a roughened surface and a "double incline," the lower end forming a lateral shoot for the separate collection of the gold particles. Rapid but slight vibrations are imparted to the screen, and a supplementary magnetic element, consisting of a number of electro-magnets mounted on a rotating shaft, is placed beneath the lower end of the screen to remove any remaining magnetic particles from the recovered gold.—O. F. H.

Metallic sulphides [Molybdenite]; Process of reducing ——. F. M. Becket, Niagara Falls, N.Y. U.S. Pat. 855,157, May 28, 1907.

METALLIC sulphides, such as molybdenum sulphide, are mixed with silicon or a silicon alloy, such as ferro-silicon, and smelted electrically. The process may be made continuous by withdrawing the product as desired, and adding fresh charges of the smelting mixture. The claims are for a metal of low silicon and carbon content, obtained by using an amount of silicon in the charge just sufficient to combine with the sulphur of the sulphide. —O. F. H.

Ores; [Electrical] Process of smelting refractory ——, and producing ferro-alloys. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 855,478, June 4, 1907.

FERRO-ALLOYS, such as ferro-chromium, are prepared by a process similar to that described in U.S. Pat. 855,476 (see XI.A.), the charge containing a refractory ore of the alloying metal, such as a chromium compound, a reducing agent, such as carbon, and a source of iron.—B. N.

Ores; [Electrical] Process of smelting refractory ——, and producing ferro-alloys. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 855,479, June 4, 1907.

THE process is similar to that described in U.S. Pat. 855,478 (see preceding abstract), an electric arc being used for smelting the charge; ferrosilicon may be obtained by using a charge containing silica.—B. N.

Scale; Process of electrolytically removing ——, and producing iron sulphate. C. J. Reed, Philadelphia, Pa. U.S. Pat. 855,667, June 4, 1907.

A DIAPHRAGM is interposed between the cathode and anode electrolytes, which consist of a heated strong aqueous solution of sulphuric acid, and an electric current, of sufficient density to rapidly remove the scale, is passed to the metal to be treated, acting as the cathode. An oxidisable sulphur-bearing material, such as iron sulphide, is supplied to the anode liquid. The cathode liquid is removed and cooled, in order to precipitate the ferrous sulphate, and the residual solution is returned to the anode compartment.—B. N.

Minerals; Method of separating ——. A. F. Kirschner, Pittsburg, Pa. U.S. Pat. 855,895, June 4, 1907.

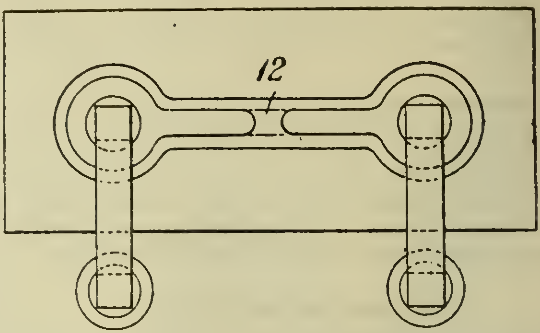
THE ores are subjected to electro-magnetic action whilst suspended in a closed chamber filled with a gas having a higher permeability than air.—A. G. L.

Calcium alloys; Production of ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. U.S. Pat. 856,475, June 11, 1907.

AN alloy of calcium and zinc is obtained by electrolysing fused calcium chloride in the presence of a cathode of molten zinc.—A. S.

Furnace; Electric melting ——. Aktiebolaget Elektrometall. Fr. Pat. 373,799, Jan. 22, 1907. Under Int. Conv. Jan. 26 and March 15 and 20, 1906, and Jan. 8, 1907.

THIS invention refers to a form of electric furnace described in Eng. Pat. 1658 of 1907 (this J. 1907, 622), but in addition, a form is described in which the channel surrounds two transformer cores as shown in the figure, the channel being continuous as shown by the dotted lines, or forming a neutral point, 12, as shown by the full lines. An alternative form is also described in which the primary winding and the channel of fusion surround the same arm of the transformer core.—B. N.



Metallic silicides; Manufacture of metals, alloys, and definite metallic compounds such as ——. L. E. Muller, dit L. d'Emile Muller, and L. H. Baraduc. First Addition dated Jan. 23, 1907, to Fr. Pat. 361,950, Nov. 29, 1905.

METALLIC oxides, either pure or in the form of minerals, are heated in an electric furnace with "carbosilicon," Si_2C, carbonaceous materials such as coke, and fluxes. Carborundum, SiC, and siloxicon, Si_2C_2O, may also be added.—A. G. L.

Tin; Electrolytic refining of ——, more especially for the recovery of pure tin from alloys, waste, residues, etc., with simultaneous recovery of foreign metals. H. Mennicke and O. Steiner. Fr. Pat. 374,116, Feb. 1, 1907.

CATHODES of pure tin are employed, with anodes of the metal to be refined, in an electrolyte, consisting of a filtered 10 per cent. solution of alkali sulphide, to which has been added 1 per cent. of flowers of sulphur. The E.M.F. is maintained below 0·2 volt, with a current-density of 0·5 ampère per sq. dm. of electrode surface. The electrodes are about 1·5 cm. apart, and the temperature of the electrolyte is maintained at about 90° C. Pure tin is obtained on the cathodes as a compact deposit, and the foreign metals form a mud which adheres largely to the anodes.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cholesterol. IX. A. Windaus. *See* XXIV.

PATENTS.

Lubricating oils and similar products; Method and apparatus for purifying ——. C. Steimel. Fr. Pat. 373,858, Jan. 24, 1907.

PURIFICATION is effected by centrifugal force in a drum of special construction revolving on a vertical axis. The impure oil is introduced through a central pipe, and falls on to a curved plate, the edge of which is within a conical chamber inside the drum. The upper edge of the cone extends above the level at which oil is introduced, whilst the lower part, connected with the wall of the drum, is perforated with a number of holes. The liquid is thus forced in a continuous current through the most active centrifugal zone, and heavier solid impurities are arrested, whilst lighter solid particles are retained by a filter or sieve of suitable form There is also a separation-plate and pipe at the top or bottom of the drum for the continual removal of water, the curved pipe being introduced further into the drum when necessary. The purified oil leaves the drum through a tube near the top.—C. A. M.

Fats, fatty substances, or other similar melted material; Process for cooling ——, *also applicable for other similar purposes.* A. E. Iveson. Fr. Pat. 374,322, Feb. 5, 1907. Under Int. Conv., Feb. 13, 1906.

SEE Eng. Pat. 3521 of 1906; this J., 1907, 263.—T. F. B.

Soaps of every kind; Apparatus and process for making ——. L. Rivière. Fr. Pat. 374,179, Jan. 12, 1907. Under Int. Conv., Nov. 3, 1906.

THE apparatus consists of a series of communicating vessels provided with perforated false bottoms and fed from reservoirs containing the substances required for the reactions. Each of these vessels has a pipe at the bottom for the introduction of gas, air, etc., through the orifices of the false bottom, and a pipe in the cover for the removal of the products of the partial evaporation of the liquids circulating over the perforated surfaces. The apparatus may be employed: (*a*), in the conversion of alkali carbonates into caustic alkali by treatment with milk of lime, and in concentrating the lyes; (*b*), in the manufacture of soluble potassium or sodium soaps by direct saponification of fats; (*c*), for making insoluble (calcium, barium, magnesium, etc.) soaps, which may afterwards be transformed by double decomposition into sodium or potassium soaps; and (*d*) in concentrating the glycerin solutions. Special claim is made for the manufacture of tablets formed of straight, zig-zag, or twisted bands of soap, of different colours, united together by any suitable means, but preferably by being passed through an orifice receiving the differently coloured strands.—C. A. M.

Soap; Manufacture of a solid rosin ——. F. Arledter. Fr. Pat. 374,225, Jan. 26, 1907.

ROSIN, etc., is boiled with the necessary amount of alkali to form a neutral soap in a closed vessel under pressure, the proportion of water to be added being thus reduced to about 15 to 25 per cent. Or, the water in the neutral soap may be expelled after the saponification by opening the valves of the vessel and allowing the vapour to escape. Rosin soaps thus prepared may contain as little as 6 per cent. of water.—C. A. M.

Soaps and lyes containing pyrophosphates; Manufacture of ——. G. F. Bernard. Fr. Pat. 374,351, Feb. 6, 1907.

PYROPHOSPHATES of any desired base may be incorporated with soap, during or after saponification, in the proportion of, say, 10 to 25 per cent., to act as a detergent. Or, substances capable of yielding basic pyrophosphates with ingredients of the soap or lye may be added. Glycerin or similar substances may also be introduced to counteract the irritant action of pyrophosphates upon the skin.—C. A. M.

Oleic acid and fatty acids containing oleic acid; Process for transforming —— *into solid acids.* A. Knorre. Ger. Pat. 172,690, Dec. 19, 1903.

THE liquid fatty acids are treated with liquid or gaseous formaldehyde and then with finely-divided metals with or without metallic oxides or salts. The fatty acids are subsequently separated in the usual manner.—A. S

Fatty acids in soaps and soap-lyes; Apparatus for the gravimetric determination of ——. M. Pitsch and G. Lotterhos. Ger. Pat. 170,444, April 6, 1904. *See* XXIII.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—PIGMENTS, PAINTS.

PATENTS.

Sewage sludge; Preparation of valuable products [paint basis] from ——. A. McLean and W. Paterson. Eng. Pat. 24,945, Nov. 6, 1906. *See* XVIII*B*.

Emulsions for mixing with pigments [paints]; Preparation of stable ——. G. Parrot. Fr. Pat. 373,904, Dec. 19, 1906.

LINSEED or similar oil, obtained by expression, is heated in a current of air at a temperature not exceeding about 80° C., so as to effect coagulation and separation of albuminoid substances without darkening the oil. The air may advantageously be passed through an ozoniser to impart decolorising properties. The "blowing" must be continued for not less than 60 hours, and may be extended to 100 hours when the current of air is not too strong. By this treatment the oil acquires the property of forming a stable emulsion with water.—C. A. M.

White paint; Process for the manufacture of a ——. G. von Rockenthien. Ger. Pat. 171,460, May 7, 1904.

FINELY-DIVIDED lead sulphate, suspended in water, is treated with caustic soda solution, and, after warming, a hot solution of barium hydroxide is added.—A. S.

Oil colours or pastes; Process for the preparation of —— *from zinc oxide or other pigments.* G. Parrot. Ger. Pat. 175,402, May 13, 1905.

LINSEED oil is treated with air for 50—60 hours at a temperature of about 75° C., and the oxidised oil is made into an emulsion with zinc oxide previously mixed with water (13—15 kilos. of oxidised oil, 74—75 kilos of zinc white, 10—12 kilos. of water). The product is stated to combine the good qualities of white lead with those of zinc white.—A. S.

White lead, lithopone, and zinc sulphide; Process for the manufacture of ——. J. Frölich. Ger. Pat. 178,983, Nov. 8, 1905.

CLAIM is made for the addition of colloidal substances (gelatin, glue, gum, etc.) in the preparation of white lead, lithopone, and zinc sulphide by precipitation processes. Pigments obtained in this way are stated to possess superior covering power to that of colours prepared by the ordinary methods.—A. S.

(*B*.)—RESINS, VARNISHES.

PATENT.

Pine oil; Process for the purification of ——. C. Kaas. Ger. Pat. 170,543, Sept. 11, 1902.

THE pine oil is treated in succession with: (1), an aqueous solution of an alkali or alkaline-earth; (2), alcoholic alkali; and (3), dilute acid. It is stated that the treatment with alcoholic alkali destroys those empyreumatic impurities which resist the action of aqueous alkali. The product has a mild odour, is readily volatile, and is stated to be completely suitable as a substitute for oil of turpentine.—A. S.

(*C*.)—INDIA-RUBBER, &c.

Para rubber tree (Hevea brasiliensis); Note on the constituents of the seeds of the ——. Wyndham R. Dunstan. Chem. Soc. Proc. 1907, 23, 168—169. *See* this J., 1904, 68.

IN the future there is likely to be an enormous production of these seeds not required for planting, and their commercial utilisation is, therefore, a matter of importance (Bull. Imp. Inst., 1903, 1, 156, and 1904, 2, 22). The seed kernels, when ground with water, evolved small quantities of hydrocyanic acid and acetone, whence it appears that a cyanogenetic glucoside is present, similar to if not identical with the phaseolunatin first obtained from the beans of *Phaseolus lunatus* (Dunstan and Henry, this J., 1903, 1255), and subsequently isolated from flax and cassava (Dunstan, Henry, and Auld, Proc. Roy. Soc., 1906, **78**, 145). A mixture of enzymes was prepared from the seeds which possessed the property of hydrolysing the oil present and also olive oil. These enzymes probably include, besides a lipase-like enzyme, one capable of decomposing the cyanogenetic glucoside, since the kernels yield hydrocyanic acid by mere contact with water. The nature of the fixed oil, of the cyanogenetic glucoside, and of the enzymes is being fully investigated. Van Romburgh has shown (Ann. Jard. Bot. Buitenzorg, 1899, **16**, 15) that the leaves of *Hevea brasiliensis* also yield hydrocyanic acid and acetone when crushed with water, and Harrison has recorded the production of hydrocyanic acid under similar conditions from the seeds of the related species *Hevea pauciflora* and *Hevea confusa* (Rep. Govt. Lab. Brit. Guiana, 1896—1902, Part II, p. 11).

PATENTS.

Rubber waste; Process for the regeneration of ——, or improving the quality of caoutchouc. G. B. Ellis, London. From Les Produits Chimiques de Croissy, J. Basler et Cie., Paris. Eng. Pat. 23,681, Oct. 24, 1906.

SEE Fr. Pat. 370,619 of 1906; this J., 1907, 265.—T. F. B.

Rubber; Utilisation of waste ——. A. Gentzsch, Vienna. Eng. Pat. 24,970, Nov. 6, 1906. Under Int. Conv., Feb. 2, 1906.

SEE Fr. Pat. 370,872 of 1906; this J., 1907, 265.—T. F. B.

Elastic product suitable for tyres, and process of making the same. L. C. G. Lesage and Comp. Générale des Pneumatiques "Increvable." Fr. Pat. 374,347, Feb. 6, 1907.

GELATIN, ossein, or cellulose, or a mixture of the same, in a powdered condition, is well mixed with a substance or substances capable of rendering it durable, such as chromium salts, tannin, formaldehyde, etc., also in a finely-divided condition, and the mass is introduced into a suitable solvent, such as glycerin (with or without addition of stearic acid, boiled linseed oil, etc.) heated to 60°—90° C., and the whole worked until it is quite homogeneous.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning products: U.S. Census of ——. Oil, Paint, and Drug Rep., June 17, 1907. [T.R.]

THE total cost of the tanning materials consumed in the United States during the census year 1905 was $25,029,994, as compared with $17,017,447 in 1900. The distribution of this sum during the two census periods was as follows:—

		1905.	1900.
Hemlock bark	cords	1,000,328	1,170,131
	Cost	$8,471,292	$7,347,242
Oak bark	cords	422,269	445,934
	Cost	$3,765,509	$3,174,995
Gambier	bales	80,610	128,425
	Cost	$752,347	$890,066
Hemlock bark ext.	bbls.	21,776	12,812
	Cost	$265,665	$150,914
Oak bark ext.	bbls.	214,391	54,231
	Cost	$2,300,395	$550,065
Quebracho	Cost	$2,490,487	$292,133
Sumac	tons	7,958	8,531
	Cost	$338,614	$434,447
Chemicals	Cost	$2,847,441	$2,257,751
All other materials used in tanning	Cost	$3,798,244	$1,919,834
Total		$25,029,994	$17,017,447

PATENTS.

"*Pseudo-tannic extracts*" [*from waste sulphite-cellulose lyes*]; *Process of obtaining ——.* F. Jean. Fr. Pat. 374,162, April 10, 1906.

TANNING extracts are prepared from waste sulphite-cellulose lyes by evaporating them to dryness, and heating the residue with 15 per cent. of nitric acid (36—40° B.) at 90° C., until nitrous fumes are no longer evolved. The residue is dissolved in from six to seven times its weight of water, and treated with a solution of 0·7—1 per cent. (on the weight of dry substance) of potassium ferrocyanide; after several hours, the clear liquid is decanted off, and concentrated. An alternative method consists in treating the lye first with chlorine, or bleaching powder, or nitrous fumes, and then with barium carbonate, filtering, and concentrating the filtrate.—A. S.

Tanning hides and skins; Process of ——. W. G. and A. C. Roach. Fr. Pat. 374,007, Dec. 24, 1906.

SEE U.S. Pats. 839,204, 839,205, and 839,206 of 1906; this J., 1907, 265.—T. F. B.

Albuminoid substances, especially casein; Electrolytic treatment of ——. [*Artificial horn, etc.*] R. Desgeorge and F. Lebreil. Fr. Pat. 373,756, March 27, 1906.

THE process relates to a method of obtaining artificial horn, ivory, etc., from albuminoid substances such as casein. The casein is mixed with about five times its weight of water, and a solution of chlorine (200 grms. per kilo. of casein) added. The whole is then subjected to the action of an electric current between metallic electrodes, whereby metallic oxides combine with the casein and render it insoluble. If copper electrodes are used, the casein is coloured green; when lead or aluminium electrodes are employed, the casein is not coloured by the treatment, but aniline colouring matters may be added to the bath. The modified casein is formed into plates, etc., in the usual manner. A design may be imprinted on these plates by suspending them, in an electrolytic bath, between suitable metallic electrodes on which the desired design is executed in relief. The modified casein may be treated with tannin, formaldehyde, glycerin, fats, or other substances.—A. S.

XV.—MANURES, &c.

PATENT.

Nitrated calcium superphosphates; Manufacture of ——. Savigny, père et fils. Fr. Pat. 373,951, Mar. 31, 1906.

TRICALCIUM phosphates are treated with nitric acid, instead of with sulphuric acid, the procedure being otherwise similar to that usual in the manufacture of superphosphate. The product consists of an intimate mixture of calcium superphosphate with calcium nitrate, suitable for application to soils as a manure.—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot slices; Determination of sugar in exhausted ——. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1367—1369.

EXPERIMENTS made at Elsdorf have shown that the determination of sugar in exhausted beetroot slices cannot be made accurately by the indirect method. The tests made by the direct method of hot aqueous digestion (which may advantageously be replaced by the cold method) gave almost in every case higher results than the indirect method. Owing to varying conditions, it is not advisable to determine by a few tests the factor by means of which the result obtained by the indirect method should be corrected; the direct method presents no difficulty and is as quick as the indirect method. The apparent loss of sugar in diffusion is to be attributed to the low result for sugar content in the exhausted slices given by the indirect method.—L. J. de W.

[*Beetroot*] *Juices of different alkalinities; Concentration of* ——. Besson and Rosset. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1338—1342.

By comparing the rates of concentration of beetroot juices, when carbonated to different degrees, it was found that evaporation proceeded a little more quickly when the alkalinity to phenolphthalein was equal to 0·35 grm. of calcium oxide per litre than when it was 0·15 grm., and the colour of the resulting syrup was lighter. There was a continuous fall in alkalinity, at first very rapid, as evaporation proceeded, especially with the more alkaline juice. The differences in the variation of the alkalinity may be explained by the dissociation of the bicarbonates formed when carbonatation is continued beyond the point of the total precipitation of the lime. In order to simplify the interpretation of the results obtained in the direct determination of the carbon dioxide, and avoid as far as possible fluctuations caused by the alkalinity due to ammonia, which occur when working with juice, a syrup was diluted to the density of juice, limed to 5 grms. of calcium oxide per litre, carbonated at 60°—70° C., heated to 80° C., and filtered. The quantity of carbon dioxide was found to be insufficient even to convert the alkalis contained in the diluted syrup into carbonates. It was found, however, that of 0·56 grm. of total alkalis present, only 0·25 was capable of being causticised with lime. Taking account of this fraction of residual alkalis, the amount of carbon dioxide was sufficient to transform the alkalis liberated by lime not merely into normal carbonates but into bicarbonates. Dilute syrups and a solution of pure sugar were found to be capable of reducing the alkalinity of an added portion of solution of sodium carbonate. In the case of sulphited juice, the rate of evaporation is greater than that of juice carbonated to the same degree of alkalinity, but the alkalinity also falls more rapidly during concentration. The syrup however is always much less coloured than that from carbonated juice.
—L. J. de W.

Syrups and drainings; Neutralisation of —— by different acids. Besson and Rosset. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1332—1334.

Nitric and phosphoric acids are the only other acids, which, when used to lessen the alkalinity of a syrup, reduce the viscosity to the same degree as sulphurous acid. If superphosphate be added in the solid state to the syrup, the viscosity is not reduced to such an extent as when sulphurous acid is used, but the improvement in colour is as good as that produced by the latter, and the treatment costs practically nothing, since the filter-press cake obtained has an enhanced fertilising value.
—L. J. de W.

Fucose and other methylpentosans; Determination of ——. W. Mayer and B. Tollens. *See* XXIII.

Patent.

Alkaline-earth aluminate-silicates or artificial zeoliths; Process for the manufacture of hydrated ——. R. Gans. Ger. Pat. 174,097, Jan. 12, 1905.

Artificial zeoliths or alkaline-earth aluminate-silicates for the purification of molasses, need to be free from uncombined lime (this J., 1907, 215, 481, 711). They are prepared by treating silicic acid with an alkali aluminate solution containing no free alkali, and subsequently adding a solution of an alkaline-earth chloride, or by treating an insoluble alkaline-earth aluminate with an alkali solution containing silicic acid in partial or complete solution.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley; Some influences affecting the germination of ——. S. Blaber. Brewers' J. 1907, **43**, 359—362.

The author has studied the influence of various factors on the germination of barley in a small germinating apparatus adapted to afford results strictly comparable with those obtained on the large scale. The effect of temperature on the germination is variable; although in many cases there is little or no difference in the germinative capacity at temperatures of 65°—70° F. as compared with 50°—55° F., in some cases the higher temperature has a distinct effect not only in making germination uneven, but in actually preventing some corns from germinating at all. The duration of steeping which gives the best results depends on circumstances, but if the steeping be too prolonged, the germination becomes more and more uneven, and the germinative capacity is decreased. Aeration has a very invigorating effect on germination, but it appears to have also a distinct "forcing" tendency, and the growth is more uneven. A very low temperature of the steep-water (35° F.) does not make any material difference to germination except that it slightly retards the growth, and the malt consequently requires a longer time on the floor. An abnormally high temperature of the steep-water (74° F.) considerably impairs the vitality of the grain. Barley can be dried on the kiln at a temperature of 180°—210° F. for 20 hours without suffering any very serious decrease of its germinative capacity, and even when this is somewhat lowered at first, it is very largely recovered on storage. Barley, kiln-dried at a temperature of 120° F., can be steeped at once, and germinates just as well as after several months' storage.—J. F. B.

Aspergillus niger; Alcoholic fermentation by ——. S. Kostytschew. Ber. deutsch. botan. Ges., 1907, **25**, 44—50.

The anaërobic production of carbon dioxide from sugar by *Aspergillus niger* is insignificant, "if the mould is present in a medium containing gas." If the mould however be completely immersed in a sugar solution, then it brings about a decomposition of the dissolved sugar such that carbon dioxide and ethyl alcohol are formed in the ratio $CO_2 : C_2H_5OH$, just as in alcoholic fermentation.—A. S.

Brewery waste discharges; Disposal and treatment of ——. W. Fairley. J. Inst. Brewing, 1907, **13**, 206—225.

The author describes how brewery wastes can be treated by sedimentation and aërobic bacterial purification. It is important that the wastes should be collected and dealt with as quickly as possible, before souring and decomposition have set in. Within certain limits, the more dilute wastes should be mixed with the more impure liquors so as to yield a mixture of approximately constant composition; in no case should rain-water drainage be admitted to the system. As far as possible, all yeasty matter other than that unavoidably carried into the drains in the ordinary operations of washing down, should be rigidly excluded, as it readily forms a layer on the oxidising filters. The liquors are carefully screened and passed into wells in which the suspended solid matters are deposited. They are then pumped up to the filter-level and are again passed through finer screens and through catch-pits before flowing on to the oxidising filters. These filters are built in concrete and are filled to a depth of three feet with coke or clinker carefully graded, washed, and screened with screens of ¼-in. and 1¼-in. meshes. Channels are arranged on the surface of the filter-beds to distribute the liquid, and similar channels or pipes are let into the floors for collecting the discharge. Two or sometimes three sets of filters are employed in series. The first series of filters is filled with liquor, which after one or two hours' contact is slowly discharged by siphons; in the second series of filters one hour's contact is allowed. It is extremely important that the filters should be sufficiently large to avoid overworking, and they must not be filled more than twice a day. If over-worked, the filters gradually clog up and become useless. In many cases a small gradual loss of filtering capacity takes place, but this can be recovered by working the filters well below their full capacity for a certain time. The author gives plans of a plant in actual use and the following representative analyses of wastes before and after treatment.

Analyses of Brewery Discharges. (*Parts per million.*)

	No. 1.			No. 2.			No. 3.	
	Brewery discharge before filtration.	Filtrate from 1st contact bed after 1 hour's contact.	Filtrate from 2nd contact bed after 1 hour's contact.	Brewery discharge before filtration.	Filtrate from 1st contact bed after 1 hour's contact.	Filtrate from 2nd contact bed after 1 hour's contact.	Brewery discharge before filtration.	Filtrate from 2nd contact bed after 2 hours' contact.
Total solids	950·00	570·00	540·00	1380·00	600·00	510·00	Mixture of Nos. 1 and 2.	420·00
Solids in solution	750·00	500·00	500·00	1250·00	490·00	480·00		400·00
,, suspension	200·00	70·00	40·00	130·00	110·00	30·00		20·00
Chlorine	38·00	38·00	36·00	41·00	38·00	36·00		34·00
Free ammonia	0·60	0·30	0·00	0·90	0·00	0·00		0·00
Albuminoid ammonia	3·40	2·50	1·70	7·20	2·50	1·70		1·20
Oxygen consumed at 27° C. in 15 minutes	22·36	10·44	7·16	28·80	14·68	8·80		4·40
Oxygen consumed at 27° C. in 4 hours	64·56	25·16	13·16	82·08	28·48	18·20		10·40

—J. F. B.

Rums and commercial spirits ; Action of aluminium on ——. Kohn Abrest. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1395—1401.

Sheets of aluminium when placed in contact with certain alcoholic liquids of sufficient acidity, charged with colouring matters, tannins, gallates of iron, and caramel, cause the partial precipitation of the colouring matters. This precipitation has been observed with genuine rums but not with spurious rums. A cognac blackened by an organic salt of iron, recovered its normal tint in contact with aluminium without taking up any considerable amount of the metal. The liquids are not completely decolorised, the final tint being golden yellow. The action of aluminium is explained by the author as follows :—Aluminium oxidises slowly in alcoholic liquids. When the acidity of the medium is sufficient, aluminium acetate is formed and passes into solution ; in contact with pectic and tannic matters, it forms a precipitate entraining the greater part of these bodies in the form of a lake, a variable quantity of aluminium simultaneously passing into solution. This quantity was never found to exceed 0·3 grm. per litre. The colouring matters present in solution prevent rapid oxidation of the aluminium, which is only slightly altered during a fortnight's immersion, but as soon as these bodies are precipitated, the protection ceases, and there is an abundant formation of gelatinous aluminium hydroxide.— L. J. de W.

Batata spirit in the island of Hachijo, Japan ; Microbiological studies on the manufacture of ——. K. Saito. Centr. Bakt., 1907, **18**, 30 ; Z. Spiritusind., 1907, **30**, 255—256.

For the preparation of the "koji," a mixture of roasted barley and millet is steamed in small vessels and spread out in a warm place. After three days the mass is turned over, and after one week it becomes covered with a blackish growth of mould fungi. The mash, called "moromi" is prepared by mixing one part of the ripe "koji" with six parts of steamed batata tubers. This mash is stirred until it is liquefied by the fungus and is then allowed to undergo alcoholic fermentation. The fermented product consists of a thick, acid, aromatic, alcoholic liquid, containing yeasts and bacteria; the acid is lactic acid. After 5—7 days the fermented "moromi" is distilled. The active fungus of the "koji" is a new species : *Aspergillus batatæ ;* besides this, *Rhizopus chinensis* and another species of *Aspergillus* are present. *A. batatæ* possesses amylolytic properties. The ripe conidiæ are arranged in long chains ; they are spherical, brownish in colour, and have a finely granulated surface, resembling those of *A. niger* rather than those of *A. Wentii.* The fungus grows most vigorously at 37° C. ; it forms oxalic acid but produces no alcohol. The fermentative yeast is a new species called *S. batatæ ;* it grows vigorously and produces up to 3 per cent. of alcohol. Dextrose, lævulose, sucrose, and maltose are readily fermented ; galactose and raffinose with difficulty ; melibiose lactose, inulin, and α-methylglucoside not at all.— J. F. B.

Patents.

Yeast ; Apparatus for drying ——. E. W. Foll, London. Eng. Pat. 15,179, July 4, 1906.

The yeast is fed into a hopper which is jacketed so that it can be heated. From this it passes into a jacketed cylinder provided with stirring arms or conveyor blades, which may be hollow for the circulation of steam or hot gases. A portion of the moisture of the yeast is expelled by the heat in the hopper and cylinder. From the cylinder the yeast emerges into a hopper, one edge of which fits tightly against a revolving steam-heated drum, whilst the opposite edge is situated at an adjustable distance from the surface of the drum. Since the hopper extends the entire length of the drum, the latter becomes coated, as it revolves, with a uniform layer of yeast from the hopper. The yeast is dried during the revolution and is scraped off finally by a blade pressing against the drum.— J. F. B.

Beer ; Production of sterilised or pasteurised non-deposit ——. D. Bailey, Swillington, Yorks. Eng. Pat. 15,254, July 5, 1906.

Beer is stored at a low temperature so as to precipitate the hop-resins and yeast cells ; it is then filtered, and pasteurised in a glass-lined cylinder. The beer is next transferred to another cylinder in which it is cooled and saturated with the carbon dioxide and alcohol which had been expelled during the process of pasteurisation. The pasteurised beer is finally filtered into casks or bottles.
—J. F. B.

Cooling wort ; Process of ——. J. W. Mackenzie, London. From H. E. Deckebach, Cincinnati, U.S.A. Eng. Pat. 1101, Jan. 15, 1907.

See U.S. Pat. 841,126 of 1907 ; this J., 1907, 336.—T. F. B.

Casks for beer, etc.; [Protective lining for] cement or concrete ——. R. Rostock, Klosterneuburg, Austria. Eng. Pat. 4021, Feb. 18, 1907.

The cement or concrete casks are first provided with a coating of plaster mixed with fibres, which adheres to the cement. After this, a very fluid material is applied, such as asphaltum or tar, which readily soaks into the plaster lining. Finally, the real protective coating of resin, varnish, or the like is applied. As an alternative process, the plaster lining may be impregnated with liquefied ozokerite or ceresin instead of with tar or asphaltum, in which case the protective coating of resin or varnish may be dispensed with if desired.—J. F. B.

Nitrogen contained in distillers' washes; Process of utilising ——. J. Effront, Brussels. Eng. Pat. 28,108, Dec. 10, 1906.

See Fr. Pat. 369,630 of 1906; this J., 1907, 109.—T. F. B.

Brewing material. T. B. Wagner, Chicago. U.S. Pat. 855,599, June 4, 1907.

See Eng. Pat. 2242 of 1906; this J., 1906, 1229.—T. F. B.

Beer; Apparatus for cooling or heating ——. E. A. Appell, New York. U.S. Pat. 856,015, June 4, 1907.

The apparatus consists of a tank having a shaft journaled horizontally. The shaft contains a number of hollow sections, each of which is divided into an inlet chamber and an outlet chamber. Each outlet chamber of the shaft is connected with the succeeding inlet chamber by means of a number of spiral tubes extending into the tank. A hot or cold fluid is introduced at one end of the shaft and circulates through the spiral tubes, being discharged at the other end of the shaft.—J. F. B.

Wines and spirits; Process of ameliorating —— *and of sterilising liquids.* V. Dorn, Wilmersdorf. Germany. U.S. Pat. 855,449, June 4, 1907.

See Fr. Pat. 341,671 of 1904; this J., 1904, 878.—T. F. B.

Distillery musts and molasses; Process of sterilising —— *by filtration.* G. Meunier. Fr. Pat. 373,758, Mar. 27, 1906.

The must, or molasses, is diluted with water at a temperature of 60° C. until the density of the solution is about 20° B., and is then treated with either: (1), the ash obtained by incinerating molasses-vinasse; (2), potassium or sodium hydroxide or carbonate; or (3), an iron salt together with potassium or sodium phosphate. The proportion of these added is about 1 kilo. per 100 kilos. of molasses. The precipitate produced forms a layer on the filter and clarifies the solution rapidly, bacteria being also retained.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Tyrosinase; Existence of a —— *in wheat bran.* G. Bertrand and Muttermilch. Compt. rend., 1907, **144**, 1285—1288.

The colour of brown bread, originally thought to be due to a colouring matter contained in the bran, was shewn by Mège-Mouriès to arise during baking, as the result of fermentative action. As his experiments left it in doubt whether organisms or an enzyme caused this action, the authors have studied the subject, and find it to be due to a ferment contained in the bran. They have isolated this ferment, which is not laccase, but for the most part the *tyrosinase* discovered by one of the authors (this J., 1896, 565). It is accompanied by other ferments, among them Raciborsky's leptomine or *peroxydiastase.*—J. T. D.

Meat essences kept for several years in tins; Changes in certain ——. Report to the Local Government Board by G. S. Buchanan and S. B. Schryver. Wyman and Sons, Ltd., London, Oliver and Boyd, Edinburgh, or E. Ponsonby, Dublin. Price, 3d.

The report deals with the examination of certain tins of meat essence shipped to South Africa between October, 1899, and June, 1902, and recently re-shipped to England. The samples of the meat essences examined were all somewhat turbid and of a lighter colour than freshly-made essence; they were also quite liquid at the ordinary temperature. No substantial difference in the physical characters and chemical composition of the samples and of freshly-made meat essence could be detected, except that the former contained appreciable quantities of metal (tin, with traces of lead), which had been dissolved from the containing vessel and re-precipitated in an insoluble form. The worst sample contained 0·253 grm. of tin or 0·31 per cent.; in the remaining samples, the proportion of tin was about 0·025 per cent. The organic constituents of the meat essences had suffered little change, and it is concluded that if such products were kept in sealed glass vessels, there is no reason why they should not remain in good condition for an indefinite period after sterilisation. —A. S.

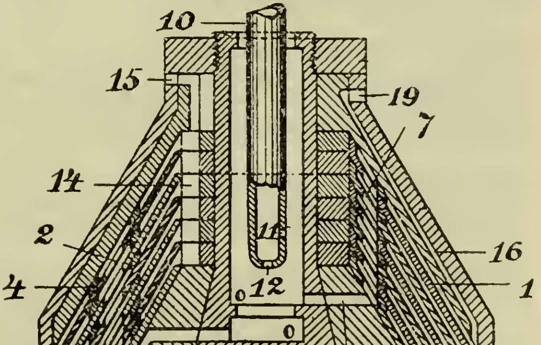
Proteids; Formaldehyde colour test for ——. *I.* S. F. Acree. *See* XXIII.

Patents.

Milk; Method of concentrating ——, *and apparatus therefor.* A. Wurm, Barmen, Germany. Eng. Pat. 15,173, July 4, 1906.

See Fr. Pat. 367,846 of 1906; this J., 1906, 1169.—T. F. B.

[*Milk*] *Separators; Centrifugal liquid* ——. C. D. Hellström, Belgviken, Sweden. Eng. Pat. 27,691, Dec. 5, 1906. Under Int. Conv., Dec. 9, 1905.



The milk enters by the pipe, 10, and passes out of the openings, 11, 12, to the passages, 8, and 3, respectively. From the latter it flows upwards through the openings, 7, and 2, formed in the conical discs, 1. The milk is discharged between the discs, in the direction of rotation, by the ridges, 4. The cream is discharged through the passage, 14, and the outlet, 15, and the "blue milk" by the channel, 16, to the outlet, 19.—W. H. C.

Liquids; Apparatus for carbonating ——. S. Twitchell, Bryn Mawr, Pa., and C. O'Connor, Camden, N.J., U.S.A. Eng. Pat. 444, Jan. 7, 1907.

The apparatus consists essentially of a storage chamber and a receiving chamber, the two being connected by means of a pump. The chambers have the form of vertical cylinders, and the storage chamber is provided at its upper part with a pipe which is connected with the supply of carbon dioxide and at the bottom with an inlet for the supply of liquid, this inlet being fitted with a ball-valve inside the chamber. The gas is admitted at a predetermined pressure, and pipes, leading from the top and bottom, respectively, of the chamber, conduct the gas and partially charged liquid to the pump, which forces the mixture into the receiving chamber. The inlet to the latter chamber consists of a spraying device, and the necessary taps for discharging the liquid into bottles, etc., are provided. Both chambers are fitted with pressure- and water-gauges, and, if the liquid be not drawn off from the receiving chamber, a valved pipe is provided so that the liquid as it rises, is conducted back to the storage chamber. The upper part of the storage chamber is also provided with an indicator for showing when the supply of gas is exhausted, and with an air-vent.—W. P. S.

Butter; Manufacture of ——. Aktiebolaget Baltic-Separator, Stockholm. Eng. Pat. 8708, April 15, 1907. Under Int. Conv., April 20, 1906.

Cream is introduced into the lower part of a centrifugal drum, provided inside with a ring or annular plate extending nearly to the wall of the drum. The layer of cream collecting at the periphery of the drum, below the ring, is caused to pass, by the centrifugal force, up through a "stripping" pipe into a helical channel outside the drum. In its passage through this channel, which is provided with obstructing pegs or ribs, the cream is subjected to a churning process, the duration and intensity of which vary according to the size of the channel. The cream, together with the globules of butter, returns from the channel into the upper part of the drum, whence the lighter butter passes out over the upper edge of the drum, near the centre, whilst the heavier cream flows down between the wall of the drum and the annular plate mentioned above, and again up through the "stripping" pipe into the helical channel.—A. S.

Food product; Process of manufacturing a sugarless ——. J. Bouma, Assignor to S. B. Selhorst, The Hague, Netherlands. U.S. Pat. 855,928, June 4, 1907.

See Eng. Pat. 17,818 of 1904; this J., 1905, 937.—T. F. B.

Milk; Process for the preservation of —— for a short time. P. Breteau. First Addition, dated April 2, 1906, to Fr. Pat. 360,679, Dec. 19, 1907 (this J. 1906, 554).

The milk, after repeated treatment with an inert gas and subjection to a low pressure, as described in the original patent, is heated to a temperature of from 60° to 65° C., for the purpose of inhibiting lactic fermentation. The inert gas employed may be carbon dioxide, nitrogen, or hydrogen.—W. P. S.

Milk, butter, cream, and the like; Process and apparatus for sterilising ——. P. Breteau. Fr. Pat. 373,954, April 2, 1906.

The milk, etc., is deprived of all its dissolved oxygen by any agent or means which will not alter the character of the fluid. For example, the milk is allowed to run from an upper containing vessel into the bottom of a cylindrical chamber where it is charged with carbon dioxide, the gas being introduced through a perforated pipe at the bottom of the chamber. The excess of carbon dioxide passes through a pipe connecting the top of the chamber with a second chamber capable of being heated and containing receptacles for the carbonated milk. The taps on the supply pipes for the milk and for the carbon dioxide are then closed, and a tap on a branch of the carbon dioxide pipe is opened so that the gas is introduced into the top of the chamber, the pressure produced forcing the milk through a pipe extending upwards from the bottom of the chamber and delivering the milk into the receptacles in the second chamber. The gas is then exhausted from the latter, carbon dioxide is again admitted, and once more exhausted. The milk is now heated to a temperature of from 60° to 65° C., and, after cooling, carbon dioxide is again introduced rapidly so as to close the coverings of the receptacles containing the milk.—W. P. S.

Concentrating liquids [milk &c.]; Apparatus for ——. A. Gaulin. Fr. Pat. 374,457, Jan. 24, 1907.

The liquid to be concentrated is sprayed into a chamber through which superheated steam is passed. The superheated steam is rapidly saturated with moisture abstracted from the liquid, which is consequently concentrated. After the first introduction of the steam, the apparatus is worked as a closed system. The steam passes first through a superheater where it is dried, next through the evaporator where it becomes saturated with water vapour, then it passes through a tubular condenser where the water it has taken up is condensed to the liquid state and is removed by a pump. The steam is withdrawn from the condenser by a fan and returned to the superheater to be utilised again. As air is excluded from the apparatus, bodies that are easily liable to oxidation and alteration can be safely concentrated in it.—W. H. C.

Coffee and tea [and other substances]; Preparation of soluble extracts of ——. A. Rupeau. First Addition, dated Jan. 24, 1907, to Fr. Pat. 370,506, Oct. 15, 1906 (this J. 1907, 272).

The process described in the original specification for the preparation of coffee and tea extracts may also be applied to the extraction of chamomile, vervain, chicory, and various cereals, but the substances are simply dried, and not roasted, before being extracted. A suitable solvent for use in the process consists of petroleum spirit, 30 parts; ether, 35; acetone, 20; and "chlorethylic ether," 15 parts.—W. P. S.

Food product from gluten; Process for preparing a ——. V. Dumitriu. Ger. Pat. 175,333, Dec. 11, 1903.

Gluten is treated for a few days with concentrated nitric acid, or a mixture of nitric and sulphuric acids, at a temperature not exceeding 40° C., the mass is diluted and filtered, and the residue dissolved in alkali. The new product is precipitated from the alkaline solution by addition of acid.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Sewage sludge; Preparation of valuable products [paint basis] from ——. A. McLean, London, and W. Paterson, Dumfries. Eng. Pat. 24,945, Nov. 6, 1906.

Dry sewage sludge is heated to a red-heat for about one hour, and the residue is disintegrated and sifted to remove grit. The powder obtained may be used as a substitute for white-lead in the preparation of paints.
—W. P. S.

Water for industrial purposes; Purification of ——. H. Bellanger. Fr. Pat. 373,830, Jan. 23, 1907.

The water is run into a tank having a funnel-shaped bottom containing purifying agents, air being at the same time blown into the tank. The water- and air-pipes reach nearly to the bottom of the tank and stir up continuously the purifying agents (barium carbonate, and cement free from soluble lime, with or without barium aluminate). The water rises in the tank, passes upwards through a filter, and is collected in an upper chamber connected with a reservoir for the purified water. Openings for introducing the purifying agents, and a pressure gauge, are provided.—W. P. S.

Water [*Trade effluents*]*; Process and apparatus for purifying* ——. V. Antoine. Fr. Pat. 374,040, Jan. 29, 1907. Under Int. Conv., Aug. 28, 1906.

The effluent, such as that from paper works, is led through a pipe into a funnel, the stem of which reaches nearly to the bottom of a conical tank. In the funnel is a perforated plate on which is placed a layer of aluminium sulphate, the position of this layer being a little below the upper edge of the tank. The water rises in the tank and overflows into a circular channel, whence it is led off through a pipe. At the bottom of the tank is a pipe for drawing off the sediment, and a sludge cock is also provided at a short distance from the bottom of the tank. —W. P. S.

Water, potable; Process and apparatus for sterilising —— by means of ozone. A. de Bouillanne. Fr. Pat. 374,152, Feb. 2, 1907.

The water is projected in a fine spray into a bell- or dome-shaped vessel, the jet being of such form that the spray of water takes a circular motion as it ascends the dome. Ozonised air is admitted to the top of the dome, and the water is collected at the bottom of the latter in a chamber, whence it is drawn off by means of a siphon or through a side tube over the opening of which is placed a plate extending downwards.—W. P. S.

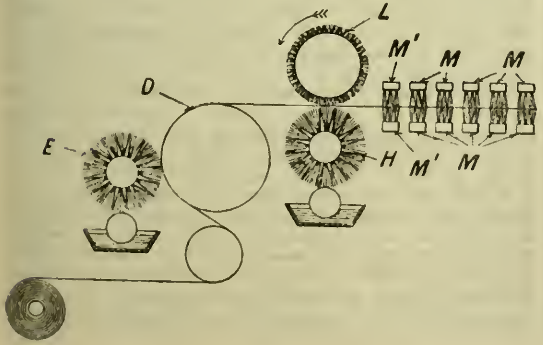
XIX.—PAPER, PASTEBOARD, &c.

Lignocelluloses; New colour reaction of the ——. E. Grandmougin. Ber., 1907, **40**, 2453.

The author points out that the colour reaction of *p*-nitraniline with the lignocelluloses described by Wheeler (this J. 1907, 633) had been previously studied by Bergé (this J. 1906, 912) and by himself. The coloration with *o*-nitraniline is not so intense as that yielded by the para compound. *p*-Aminodiphenylamine yields a brownish Bordeaux red coloration, which resists acids and is more delicate than the nitraniline test. It is noted that the conversion of the amines into the diazo derivatives inhibits the production of coloured compounds with lignocelluloses. The substitution of methyl groups for the hydrogen in the amino group also inhibits the colour reactions: dimethylaniline gives no coloration and *p*-nitrodimethylaniline gives only a faint yellow tint.—J. F. B.

Patents.

Paper; Coating machine for ——. H. H. Lake, London. From Pepperell Card and Paper Co., Pepperell, Mass., U.S.A. Eng. Pat. 29,404, Dec. 24, 1906.



The machine for coating both sides of the paper at a single operation is illustrated diagramatically in the figure. The upper side of the paper is coated by the circular brush, E, whilst the paper is supported by the cylinder, D. The paper then passes along horizontally, and colour is applied to the under side by the coating brush, H. The necessary support for this operation is afforded by the cylindrical brush, L, the bristles of which are very short and very fine, whilst those of the coating brushes are very long. The supporting brush, L, moves in the same direction and at the same speed as the paper, and, owing to its special structure, does not injure the coating applied to the top of the paper. Both coatings are finally smoothed by the stationary brushes, M'M', and the reciprocating brushes, M M.—J. F. B.

Paper or other surfaces; Process and apparatus for covering —— with gelatine. J. L. L. Langheck, A. Stahl, and H. Kahler, Esslingen, Germany. Eng. Pat. 1314, Jan. 18, 1907. Under Int. Conv., May 18, 1906.

The layer of gelatin is spread on a glass plate, and the sheet of paper is passed through an oblique slot in a frame to the lower end of which is attached a strip of rubber. The end of the paper is pressed against the glass plate by means of the rubber strip, and the frame, held in an inclined position, is drawn along the glass plate. This movement draws the paper through the slot and presses it against the gelatin on the plate in such a manner that no air bubbles are produced.—J. F. B.

Cellulose; Production of ——. J. S. Cochran, Philadelphia, U.S.A. Eng. Pat. 12,920, June 2, 1906.

See U.S. Pat. 822,430 of 1906; this J., 1906, 653.—T. F. B.

Viscose [*for artificial fibres*]*; Manufacture of* ——. M. Waddell, New York, Assignor to S. W. Pettit, Philadelphia. U.S. Pat. 855,213, May 28, 1907.

Alkali cellulose is treated with carbon bisulphide, in absence of air, until it is converted into cellulose xanthate; the excess of carbon bisulphide is drained from the product, which is then covered with an aqueous solution of a solvent, such as sodium hydroxide, and agitated until it is of the necessary consistency for forming filaments, when the remaining carbon bisulphide is removed from it as vapour, by creating a partial vacuum in the containing vessel. —T. F. B.

Straw; Process and apparatus for the treatment of —— for making pulp for boards or paper. Soc. Haemers et van Den Bavière. First Addition, dated Aug. 31, 1906, to Fr. Pat. 373,668, Mar. 23, 1906 (this J., 1907, 713).

The process described in the original specification for straw may be extended to the treatment of wood, rags, and all other materials of vegetable origin.—J. F. B.

"*Pseudo-tannic extracts*" [*from waste sulphite-cellulose lyes*]*; Process of obtaining* ——. F. Jean. Fr. Pat. 374,162, April 10, 1906. *See* XIV.

Viscose; Process of maturing, concentrating, and purifying ——. Soc. franç. de la Viscose. Fr. Pat. 374,123, April 9, 1906.

Viscose is treated in a vacuum in a jacketed vessel provided with stirring arms. A current of hot or artificially cooled water can be circulated through the jacket. The process of "maturing," *i.e.*, the partial decomposition of the cellulose xanthate, which is necessary for the industrial utilisation of the viscose, can be effected in this apparatus at a temperature of 60° C. in 30—40 minutes. At the same time the water in the viscose boils under the reduced pressure, and the volatile sulphur compounds produced in the operation of maturing are expelled. The viscose is thus simultaneously concentrated and purified. When maturing is complete, the contents of the vessel are rapidly cooled by the circulation of cold water in the jacket.—J. F. B.

Celluloid ; A new ——. E. Peyrusson. Fr. Pat. 374,395, April 14, 1906.

Nitrocellulose is incorporated, by means of acetone, methyl alcohol, or other suitable solvent, with metallic ricinoleates, especially the ricinoleates of magnesium, zinc, aluminium, and lead. These compounds are said to have an action on nitrocellulose similar to that of camphor. The celluloid prepared in this manner possesses the property of combining with certain metallic salts, *e.g.*, the chlorides of zinc, magnesium, manganese, copper, etc., to give a product which is only slightly inflammable and which is translucent, firm, and unaltered on exposure to the atmosphere.—J. F. B.

Celluloid waste ; Treatment of —— for recovery of the constituent materials. M. Tortelli. Fr. Pat. 373,273, Jan. 2, 1907. Under Int. Conv., April 24, 1906.

The celluloid refuse is ground to powder and treated with a dilute solution of a denitrating agent, *e.g.*, a sulphide or thiocarbonate of an alkali or alkaline-earth. After digestion for 12—15 hours, the denitrating agent is removed, and the cellulose residue is washed. This latter is then subjected to distillation with steam to recover the camphor. The denitrating solution is used repeatedly until it has become sufficiently rich in nitric acid, and it is then treated for the recovery of that acid.—J. F. B.

Cellulose esters ; Process of manufacturing ——. Knoll et Cie. Fr. Pat. 373,994, Jan. 28, 1907.

Esters of cellulose and its derivatives are prepared by the action of acetic anhydride in the presence of neutral salts or of monobasic, volatile mineral acids. Neutral salts which induce the reaction are: ferrous sulphate, hydrated ferric chloride, zinc chloride, dimethylamine hydrochloride, diethylamine sulphate; suitable mineral acids are hydrochloric acid, nitric acid, and a mixture of the two. The quantities of these catalysts employed range from 0·1 to 0·3 per cent. of the weight of the cellulose. The reaction takes place at temperatures of about 70° C., and the time required is from 6 hours to 6 days.—J. F. B.

Cellulose esters ; Preparation of —— without change in the form of the cellulose employed. L. Lederer. Fr. Pat. 374,370, Feb. 7, 1907.

The esterification of cellulose, *e.g.*, by means of a mixture of acetic anhydride, glacial acetic acid, and sulphuric acid, is carried out in the presence of carbon tetrachloride as a diluting agent. This liquid not being a solvent of the esters of cellulose, the latter preserve unchanged the form of the original material employed, *e.g.*, loose cotton, yarn, cloth, etc.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Berberine and canadine ; Homologues of ——. M. Freund and F Mayer. Ber. 1907, **40**, 2604—2614.

a-Methyltetrahydroberberine hydrochloride, $C_{21}H_{24}NO_4Cl$, was obtained by the action of hydrochloric acid upon the base, which had been prepared by the method of Freund and Beck (Ber., 1905, **38**, 2652); this salt melts at 264° C. and crystallises in white needles. *a*-Methylberberine hydriodide, $C_{21}H_{20}NO_4I$, can be most easily obtained by the action of bromine upon a hot solution of *a*-methyldihydroberberine hydriodide in glacial acetic acid; the substance crystallises in fine golden yellow matted needles, decomposing at 255°—260° C. *a*-Ethyldihydroberberine was prepared by the method described by Freund and Beck (Ber., 1904, **37**, 4673). Magnesium was allowed to act upon a mixture of ethyl iodide and anhydrous berberine hydrochloride dissolved in ether. The resulting *a*-ethyldihydroberberine hydriodide, $C_{22}H_{23}NO_4,HI$, crystallises from alcohol in brownish-yellow leaflets melting at 223° C. On treating with ammonia, the base is obtained, crystallising in leaflets from alcohol and melting at 164°—165° C. This base was dissolved in 30 per cent. sulphuric acid and alcohol, and reduced electrolytically with lead electrodes. The hydrochloride of *a*-ethyltetrahydroberberine, $C_{22}H_{25}NO_4,HCl$, obtained in this way crystallises from dilute alcohol in nearly white, matted needles, m. pt. 245° C. The base, *a*-ethyltetrahydroberberine, is obtained by the action of ammonia, and crystallises from alcohol in columns or leaflets, m. pt. 151°—152° C. *a*-Ethylberberine hydriodide, $C_{22}H_{22}NO_4I$, obtained by heating *a*-ethyldihydroberberine with iodine and alcohol under pressure, crystallises from dilute alcohol in fine golden-yellow needles, decomposing at 248° C. The corresponding nitrate forms yellow needles decomposing at 240° C. *a*-Propyldihydroberberine was obtained by the interaction of magnesium-propyl iodide and berberine hydrochloride in ether. The hydriodide, $C_{23}H_{25}NO_4HI$, separates, and after crystallisation, appears as yellow leaflets, m. pt. 207° C. The base, liberated by means of ammonia, crystallises from alcohol in nodular masses, m. pt. 132° C. This was reduced electrolytically by the method described above, two isomeric tetrahydrobases being formed. As the tetrahydro compound possesses two asymmetric carbon atoms, these isomerides correspond to the two racemic modifications. The mixed bases were liberated by the addition of sodium carbonate and separated by crystallisation from alcohol. *a*-Propyltetrahydroberberine, $C_{23}H_{27}NO_4$, is the more soluble in alcohol of the two. It exhibits a slight greenish-yellow fluorescence, and crystallises in flattened columns melting at 111°—114° C. The isomeric *pseudo*-base when crystallised from benzene and alcohol has the form of pure white flat tablets, and melts at 177°—179° C. When propyldihydroberberine is oxidised with bromine, *a*-propylberberine is produced, of which the hydriodide, $C_{23}H_{24}NO_4I$, forms golden-yellow needles decomposing at 246° C.
—F. Shdn.

Terpenes ; Two new —— [Preliminary communication]. O. Aschan. Ber., 1907, **40**, 2750—2755.

Crude American pinene was saturated with hydrochloric acid, and the resulting fluid hydrochlorides heated with bases at a high temperature, and fractionated. In this way, "pinolene," $C_{10}H_{16}$, was obtained boiling at 145°—148° C.; sp. gr. at 20°/4° C., 0·8599; $n = 1{\cdot}45768$; $[a]_D = +1{\cdot}63°$. The constants show that pinolene is bicyclic, with one ethylenic linking. The hydrochloride, $C_{10}H_{17}Cl$, formed by the action of hydrochloric acid at —10° C., melts at 38° C., and has sp. gr. at 20°/4° C., 0·9006, and $[a]_D = +9{\cdot}78°$. The terpene is not changed by heating with aqueous oxalic or sulphuric acids. On heating with acetic and sulphuric acids, an alcohol, $C_{10}H_{17}OH$, can be obtained; this boils at 202°—203° C., and is solid at the ordinary temperature. On oxidation, a ketone boiling at about 200° C. is produced, the semicarbazone from which forms large glassy laminæ, melting at 220°—225° C. Pinolene hydrochloride was decomposed with aniline, and the resulting hydrocarbon, "isopinene," $C_{10}H_{16}$, separated into two fractions. The first boiled at 154°—155° C., had sp. gr. at 20°/4° C., 0·8648, and $[a]_D$ 19° C. $= +5{\cdot}46°$. The second fraction boiled at 155°—156° C., and had sp. gr. at 20°/4° C., 0·8669, $n = 1{\cdot}47055$, and $[a]_D$ 19° C. $= +6{\cdot}46°$. Camphene and pinene were shewn to be absent. Isopinene is a bicyclic terpene with one ethylenic linking. The hydrochloride of isopinene, $C_{10}H_{17}Cl$, formed by the same method as pinolene hydrochloride, melts at 36°—37° C., and has sp. gr. at 20°/4° C., 0·8994, and $[a]_D$ 22° C $= +9{\cdot}18°$. It is decomposed by aniline, forming isopinene again. Isopinene can be converted by means of acetic and sulphuric acids into an alcohol boiling at 202°—203° C., possibly identical with the alcohol obtained from pinolene. The ketone boils at 200° C., and the semicarbazone crystallises from hot alcohol in large, glassy, quadrangular laminæ, melting at 221° C. Isopinene is not affected by heating with 10 per cent. sulphuric acid.—F. Shdn.

Fractional distillation by means of steam. H. Hardy and B. E. Richens. Analyst, 1907, **32**, 197—200.

Such mixtures as limonene and citral, limonene and eugenol, cineol and citral, chloroform and carbon tetrachloride, benzene and acetic acid were examined by fractionation. Some of the results are shewn graphically. The mixtures were fractionated by the following methods. (1). Passing steam through the mixture contained in an ordinary distillation flask; (2), using a distillation flask with three bulbs in the neck; (3), using a Young-Thomas still-head with three compartments; (4), distilling with steam at 11—15 mm.; (5), distilling the mixture of oil with water in the same flask; (6), returning the distilled water to the distillation flask. For comparison the mixtures were distilled by dry heat at ordinary and reduced pressures. In many cases distillation with steam produces a more complete separation of the constituents of a mixture than distillation by dry heat, but it is not an efficient method if the constituents of the mixture boil much below 100° C. The influence of a fractionating head is markedly less than when dry heat is used. The rate of distillation makes but little difference to the result, except that in many cases the more rapid passage of the steam gives the best result. A specially good fractionation can often be obtained with steam under reduced pressure.—F. Shdn.

a-Bromo-esters of the acetic series; Conversion of—— into a-iodo-esters. F. Bodroux and F. Taboury. Compt. rend., 1907, **144**, 1216—1217.

Magnesium iodide is formed in ethereal solution by allowing iodine to react on magnesium drillings in a large excess of ether, and the bromo-ester is quickly introduced. Vigorous action occurs, and half an hour after it has ceased, the mixture is treated with water. The ethereal layer, washed, decanted, and freed from iodine by agitation with mercury, is then distilled to remove the ether, and the residual ester is distilled under reduced pressure. The authors have thus prepared ethyl iodo-acetate (b.p. 85° C. at 25 mm., sp. gr. at 24° C., 1·762), α-iodopropionate (b.p. 85° C. at 38 mm., sp. gr. at 17° C., 1·662), and α-iodobutyrate (b.p. 100° C. at 21 mm., sp. gr. at 17° C., 1·570). They have previously shown that these iodo-esters can be similarly prepared from the chloro-compounds.—J. T. D.

Acetyl nitrate. A. Pictet and E. Khotinsky. Compt. rend., 1907, **144**, 210—212.

Acetyl nitrate, $C_2H_3O_2.NO_2$, was obtained by dissolving nitric anhydride in cold acetic anhydride, and fractionating the resulting liquid under diminished pressure. It distils at 22° C. under a pressure of 70 mm., and forms a colourless, very hygroscopic liquid, which fumes in the air, and explodes when heated. It reacts with alcohols to form acetic or nitric esters, according to the nature of the alcohol and the temperature. It converts aniline into an equimolecular mixture of acetanilide and aniline nitrate. It acts as a powerful nitrating agent on aromatic compounds, and may be used for the preparation of certain nitro-compounds difficult to obtain otherwise. Benzene, toluene, anthracene, and thiophene can be nitrated by means of acetyl nitrate below 0° C. When substitution derivatives are nitrated by means of acetyl nitrate, the nitro-group enters, preferably, in the ortho position to the substituting group. With toluene, for example, the reaction product contains ten times more of the ortho than of the para nitro-compound, and acetanilide is converted exclusively into *o*-nitroacetanilide.—A. S.

Stannous formate and its distillation products. M. Goldschmidt. Chem.-Zeit., 1907, **31**, 608.

Stannous formate may be easily prepared by dissolving precipitated stannous hydroxide in dilute formic acid (30 to 40 per cent.). The solution is concentrated preferably in a vacuum, at a low temperature, until the formate separates in white anhydrous crystals belonging to the monoclinic system. The salt is somewhat soluble in warm dilute formic acid; on boiling, however, the solution decomposes. It readily absorbs oxygen from the air, forming a basic stannic salt. On heating the dry salt to between 100° C. and 180° C., decomposition sets in, formaldehyde (chiefly as paraformaldehyde) carbon dioxide, stannous oxide, and methyl formate being formed:

$$3Sn(COOH)_2 = 3CO_2 + 3SnO + H.CHO + H.COOCH_3.$$

This reaction can be applied to the preparation, not only of formaldehyde but (since methyl formate can be easily saponified) also of methyl alcohol.—C. A. W.

Light; Chemical action of——. XI. G. Ciamician and P. Silber. Ber., 1907, **40**, 2415—2424.

In continuation of their study of the hydrolyses effected by the action of light upon substances in aqueous solution (this J., 1906, 563), the authors find that the aldehyde, $C_{10}H_{18}O$, formed (together with decylic acid) from menthone, differs from citronellal in yielding a semicarbazone melting at 88° to 89° C., whilst the corresponding derivative of citronellal melts at 81° to 82° C. The aldehyde from menthone is probably identical with the mentho-citronellal prepared by Wallach (Annalen, **296**, 131, 132). An aqueous alcoholic solution of menthone showed an acid reaction and an altered odour even after two months' exposure to light, whereas a solution kept in the dark was unaltered after six months. Levulinic acid in aqueous solution is hydrolysed by light with the formation of propionic acid and, probably, formic acid (but not acetic acid). On substituting ethyl alcohol for water, part of the levulinic acid is converted into γ-hydroxyvaleric acid (which may be separated in the form of a lactone), whilst another portion is esterified. The lactone of γ-hydroxyvaleric acid boils at 205° C.—C. A. M.

Ibean camphor tree. Chem. and Drug., June 29, 1907. [T.R.]

In a report on the forests of Kenia (East Africa Protectorate) by D. E. Hutchins, it is stated that the most valuable species is a tree about which little has been known up to the present, and which, for convenience, may be termed Ibean camphor. The appearance of these trees is very striking, many of them being of gigantic size, measuring from 8 ft. to 11¼ ft. in diameter and from 120 ft. to 130 ft. in height. The green bark, the green wood, and all the herbaceous parts of this tree have a camphoraceous smell, and the structure of the timber and the seed-vessel point to the tree being allied botanically to the true camphor (*Cinnamomum Camphora*). There was an average of 2·8 camphor-trees per acre in the Embu linear sample area, but 51 per cent. of all the timber in the linear sample area was camphor. In the maximum sample area exactly one-third of the number of trees was camphor, while 78 per cent. of the cubic contents of all the timber was camphor. The area of the Kenia Forest is estimated at 1,000,000 acres, the total circumference being about 287 miles; and the value of the many kinds of timber it contains is placed at 23,000,000*l.*, the most valuable being the cedar. The investigation was undertaken at the instance of the Colonial Office.

Patents.

Camphor [from isoborneol]; Manufacture of——. J. N. Goldsmith and The British Xylonite Co. Ltd., Brantham, Suffolk. Eng. Pat. 17,573, Aug. 3, 1906.

Camphor is prepared by subjecting isoborneol to the catalytic action of finely-divided copper in the absence of air or oxygen. For example, isoborneol vapour is passed over finely-divided copper heated to about 300° C., with the aid of a current of an inert gas such as carbon dioxide. (See Eng. Pat. 9008 of 1905, this J., 1906, 89.) —F. Shdn.

Fatty acids; Manufacture of halogen substitution derivatives of——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,648, Oct. 24, 1906.

See Addition of Oct. 23, 1906, to Fr. Pat. 362,370 of 1906; this J., 1907, 278.—T. F. B.

Trichlorethylene and hexachlorbenzene; Manufacture of ——. H. K. Tompkins and The Clayton Aniline Co., Manchester. Eng. Pat. 23,780, Oct. 25, 1906.

The vapour of acetylene tetrachloride is passed through a tube of a suitable length, *e.g.*, about 20 times the diameter, which contains a contact material such as pumice heated to dull redness (400°—500° C.). The vapour should be passed at such a rate that it has a faint brown colour when discharged. The issuing vapour is condensed and washed in order to remove the hydrochloric acid produced by the decomposition. The products are trichlorethylene or hexachlorbenzene, according to the rate of passage, together with a little unaltered acetylene tetrachloride. Trichlorethylene is produced at a lower and hexachlorbenzene at a higher temperature.—J. F. B.

Tartar; Process for treating substances containing crude ——. V. J. Garin, Annemasse, and F. David, Cette, France. Eng. Pat. 8375, April 10, 1907. Under Int. Conv., April 12, 1906.

Substances (*e.g.*, wine lees), either "green" or dry, containing crude tartar, are ground up with 1—2 per cent. of formalin or trioxymethylene, and dried. The liquids obtained by extracting the residue have very little colour and yield white crystals.—F. Shdn.

Uranyl salt; Preparation of an ——, *and application of the same in the production of luminous effects.* C. M. J. Germe. Fr. Pat. 374,011, April 5, 1906.

Uranium sulphate and potassium sulphate, in equivalent proportions, are dissolved in twice their weight of boiling water, and the crystalline crusts which form on cooling, are dried, powdered, and digested in alcohol for some hours. The powder that remains on removing the alcohol is dried, and formed into a paste with collodion dissolved in acetone and amyl acetate. The paste may be used upon objects which it is desired to render fluorescent, when exposed to the electric light transmitted through violet coloured glass, dark shades being preferably used about the illuminated object. The paste may be rendered more fluid, for the impregnation of fabrics, or paper, etc.; or the fluorescent preparation may be incorporated during their manufacture.—E. S.

Pine oils; Process for purifying ——. A. Hesse. Fr. Pat. 374,164, April 10, 1906.

See Eng. Pat. 7934 of 1906; this J., 1906, 1161.—T. F. B.

Tartaric material; Process for treating crude —— *in order to render the colouring matter insoluble.* V. Garin and F. David. Fr. Pat. 374,276, April 12, 1906.

See Eng. Pat. 8375 of 1907; preceding these.—T. F. B.

Potassium bitartrate [cream of tartar] and other salts; Process for the rapid crystallisation, out of contact with metal, of solutions of ——. Cie. Française des Produits Tartriques. Fr. Pat. 374,321, Feb. 5, 1907.

The solutions to be crystallised are run through a number of hemicylindrical channels exposed to the air and arranged side by side. These channels slope gently (about 1 mm. per metre); they are built of a cement not attacked by the particular solution.—A. G. L.

Isoborneol; Manufacture of ——. Fabr. Bâloise de Prod. Chim. First Addition, dated Jan. 24, 1907, to Fr. Pat. 369,257, Aug. 27, 1906.

See Eng. Pat. 1948 of 1907; this J., 1907, 343.—T. F. B.

Terpene alcohols of the formula, $C_{10}H_{17}OH$, by means of volatile oils containing linalool, coriandrol, or their ethers; Process for making ——. F. O. Zeitschel. Fr. Pat. 374,405, Feb. 8, 1907. Under Int. Conv., Feb. 9, 1906.

See Eng. Pat. 3176 of 1907; this J., 1907, 551.—T. F. B.

Glyceryl salicylate; Preparation of ——. C. Sorger. Fr. Pat. 373,854, Jan. 24, 1907.

The glyceryl ester of salicylic acid is prepared by heating glycerol with the methyl or ethyl ester of salicylic acid to a temperature of about 200° C., the alkyl group being replaced by the glyceryl radical. The reaction is facilitated by the presence of a small quantity of a salt of sodium such as the carbonate, acetate, or salicylate.—F. Shdn.

Silver compounds [silver nucleinic acids]; Process for producing soluble ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 374,066, Jan. 29, 1907. Under Int. Conv., March 27, 1906.

See Eng. Pat. 8407 of 1906; this J., 1907, 551.—T. F. B.

Antitoxin for swine fever; Production of an ——. M. Dorset. Fr. Pat. 374,085, Jan. 30, 1907. Under Int. Conv., Feb. 7, 1906.

An antitoxin for protection against, or cure of swine fever is made by injecting into healthy pigs, defibrinated blood drawn from pigs suffering from swine fever. Blood is drawn from the pigs after this treatment, the serum separated from the corpuscles, and a preservative added. —F. Shdn.

Esters of mono-iodo derivatives of higher fatty acids; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 374,231, Jan. 30, 1907. Under Int. Conv., March 3, 1906.

Alkyl esters of the mono-iodo derivatives of higher fatty acids can be prepared from the acids, their salts or derivatives by the usual methods of esterification. (See this J. 1906, 714 and 1173.)—F. Shdn.

Alkylated ethers of the aromatic series; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 374,378, Feb. 7, 1907. Under Int. Conv., April 4, 1906.

Hydroxy derivatives of the aromatic series are converted into alkyl ethers by treating them with the nitroso compound of an alkylated urea in the presence of an alkaline substance.—F. Shdn.

5-Dialkyl-2-cyanimino-4.6-di-iminopyrimidines; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pats. 175,588, March 19, 1904, and 175,589, July 6, 1904.

5-Dialkyl-2-cyanimino-4.6-di-iminopyrimidines are obtained by the action of dicyanodiamide on dialkylmalonitriles in presence of alkaline condensing agents. Better yields are obtained by conducting the reaction at an elevated temperature and under pressure. The products are converted by saponification into dialkylbarbituric acids.—T. F. B.

C.C-Dialkylbarbituric acids; Process for preparing ——. O. Wolfes. Ger. Pat. 175,592, Feb. 11, 1905.

Dialkylbarbituric acids may be prepared by the action of alkyl nitrites on C.C-dialkylmono-, -di-, or -tri-iminobarbituric acids, or the 2-cyanimino or 2-alkylimino derivatives of these. Water is not essential for the success of the reaction, nor is the process simply a hydrolytic one, hence it is probable that an intermediate nitroso compound is formed.—T. F. B.

Morphine alkyl ethers; Process for preparing bromalkylates of ——. J. D. Riedel A.-G. Ger. Pat. 175,796, July 20, 1904. Addition to Ger. Pat. 166,362, May 28, 1904. (See this J., 1906, 443.)

A metallic bromide is added to the addition-product of a dialkyl sulphate and a morphine alkyl ether in aqueous solution, the solution is evaporated to dryness, and the residue extracted with acetone or methyl or ethyl alcohol: the solution containing the addition-product and the bromide may also be heated under pressure.—T. F. B.

Ergot; Process for preparing a crystalline, nitrogenous compound, soluble in water, from ——. E. Vahlen. Ger. Pats. 175,590 and 175,591, Aug. 10, 1904.

Aqueous ergot extract is treated with barium hydroxide, the solution is filtered, and the barium hydroxide precipitated from it; it is then concentrated to a syrupy consistency, absolute alcohol is added, and it is allowed to crystallise. The product is a definite compound, stated to possess the therapeutic properties of ergot. —T. F. B.

Berberine derivatives; Process for preparing ——. E. Merck. Ger. Pat. 179,212, Nov. 10, 1904.

New compounds, of value in medicine, are obtained by the action of organomagnesium compounds on berberine salts. They are yellow substances, and form well-defined salts, whose solutions are precipitated by ammonia and other alkalis.—T. F. B.

Bark of Rhamnus frangula or Cascara sagrada; Process for the preparation of the active principles of ——. H. E. Knopf. Ger. Pat. 175,862, April 27, 1905.

The process is based upon the discovery that the active constituents exist in the barks chiefly in the form of potassium salts. The aqueous extract of the bark is evaporated to dryness, and the residue treated with absolute alcohol; or, the precipitate produced by acids in the aqueous extract is dissolved in absolute alcohol, and converted into a potassium salt by means of alcoholic potassium hydroxide. The product thus obtained is said not to have a bitter taste.—A. S.

Haemoglobin preparations; Process for preparing clear, stable, red ——. "Sicco" Med. Chem. Institut Friedrich Gustav Sauer. Ger. Pat. 178,902, Oct. 17, 1905.

Hæmoglobin, obtained from blood by centrifugal action, is stated to be very pure, and quite free from serum-albumin; it is converted into clear, stable preparations by mixing it with pure, cold glycerol. Preparations containing as much as 35 per cent. of hæmoglobin may be obtained thus, and they may be concentrated to contain up to 60 per cent.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Salts formed during the fixing of gelatinochloride or gelatinobromide plates; Composition and properties of the ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franc. Phot., 1907, 23, 249—255.

Solutions of sodium thiosulphate were saturated with silver bromide, and either evaporated slowly, or precipitated by addition of alcohol; in each case, a substance was obtained, having the composition, $Ag_2S_2O_3,2Na_2S_2O_3,2H_2O$. It dissolves to the extent of 60 per cent. in cold water; solutions containing 5 per cent. or less of the salt are stable, but more concentrated solutions deposit masses of insoluble crystals, having the composition, $Ag_2S_2O_3,Na_2S_2O_3,H_2O$. The solution of silver bromide in 15 per cent. thiosulphate contains the former compound only, together with excess of sodium thiosulphate, whilst a solution in 45 per cent. sodium thiosulphate appears to contain an unstable compound of the two double salts. The solution obtained by dissolving 58 grms. of silver chloride in 1 litre of a 15 per cent. sodium thiosulphate solution gradually deposits crystals of the compound, $Ag_2S_2O_3,Na_2S_2O_3,2H_2O$, which is insoluble in water: by precipitating the solution with alcohol, a mixture of this compound, and that containing one molecule more of sodium thiosulphate is produced.—T. F. B.

Patents.

Photographic plates. E. E. Burnett, Cricklewood. Eng. Pat. 13,561, June 13, 1906.

In order that the isochromatic screens necessary with orthochromatic or isochromatic plates, may be dispensed with, a yellow dyestuff, such as Naphthol Yellow, is added to the emulsion; about 0·2 per cent. of the dyestuff on the weight of emulsion is given as a suitable quantity. —T. F. B.

Films for photographic and other purposes; Manufacture of ——. J. H. Smith, Zurich, Switzerland. Eng. Pat. 1454, Jan. 19, 1907. Under Int. Conv., Jan. 19, 1906.

One or more coatings of gelatin are so applied to a smooth support, such as glass, as to be capable of easy removal when necessary. When dry, the gelatin is coated with a solution of a substance impervious to water and ordinary photographic solutions, *e.g.*, nitrocellulose, gutta-percha, resin, fat, etc.; when this coating is dry, the film is sensitised if desired, and then stripped from the support, and the other side coated with a similar waterproof layer. (See Eng. Pat. 10,372 of 1905; this J., 1905, 1083). —T. F. B.

Etching process; Photographic ——. A. Dillmann, Wiesbaden, Germany. Eng. Pat. 18,217, Aug. 14, 1906.

The surface to be furnished with the design or picture is coated with a substance sensitive to light, such as asphaltum, and exposed behind a negative. It is then developed with turpentine or other suitable substance, to which alcohol has been added. The plate is finally etched with acid in the usual way.—T. F. B.

Films for photography and other purposes; Process of making ——. J. H. Smith. First Addition, dated Jan. 18, 1907, to Fr. Pat. 354,330, May 16, 1905. Under Int. Conv., Jan. 19, 1906.

See Eng. Pat. 1454 of 1907; preceding these.—T. F. B.

Sensitisers for colouring matters [for photography]. J. H. Smith and W. Merckens. Fr. Pat. 373,907, Jan. 25, 1907. Under Int. Conv., Feb. 3, 1906.

The addition of halogen derivatives of alcohols, aldehydes, ketones, and organic acids, and also of phenol ethers, is found to increase to a notable extent the sensitising power (to light) of various dyestuffs. Substitution products of glycerol and glycol are especially mentioned. Iodo-derivatives are more powerful in this respect than the corresponding bromo-derivatives, and the latter are stronger than the chloro-derivatives.—T. F. B.

Photography in colour; Process of ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Third Addition, dated April 5, 1906, to Fr. Pat. 339,223, Dec. 17, 1903.

See Eng. Pat. 9100 of 1906; this J., 1906, 867.—T. F. B.

Sulphurous acid and developing bases easily decomposed by air; Use in photography of compounds of ——. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 374,357, April 14, 1906.

Compounds of sulphurous acid with unstable developing bases, such as aminophenols or phenylenediamines, are utilised for photographic development. (See this J., 1907, 33.)—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Cordite and modified cordite; Constants of explosion of ——. R. Robertson. Proc. Roy. Soc., 1907, **79A**, 320—321.

Modified cordite contains a much greater percentage of guncotton, and, consequently, retains a greater quantity of volatile matter (acetone) than ordinary cordite. The heat developed by the explosion of modified cordite is 200 calories less, and the temperature of explosion is

300° C. lower, than in the case of mark I cordite. There is a decrease in erosion and an increase in the volume of gas with the modified explosive. In the latter, the proportion of water in the volatile matter is practically constant, but the retained acetone causes differences in the gases of decomposition. Note is also made of the alterations in the constants of explosion due to increasing the density loading from 0·1 to 0·2.—O. R.

Patents.

Detonating compound for use in torpedoes, mining and blasting cartridges or charges and the like. W. C. White, Sidcup, Kent. Eng. Pat. 13,983, June 19, 1906.

The compound consists of mercury fulminate (87½ parts) and silver fulminate (12½ parts).—G. W. McD.

Matches; Igniting compositions for the manufacture of ——. E. W. Wheelwright, Birmingham. Eng. Pat. 21,866, Oct. 3, 1906.

Solid phosphorus hydride, or its derivative phosphenylhydride, is claimed as an ingredient in the composition for matches. The two following examples are given:—(a) Solid phosphorus hydride (8 parts), potassium chlorate (40), plaster of Paris (10), chalk (10), glass (20), and glue (12 parts). (b). Phosphenylhydride (10 parts), potassium chlorate (45), plaster of Paris (10), chalk (7), glass (20), and glue (12 parts).—G. W. McD.

Explosives; Process of manufacturing nitroglycerin —— of reduced freezing-point. O. E. W. Stöhrer, Charlottenburg, Germany. U.S. Pat. 855,595, June 4, 1907.

See Eng. Pat. 6314 of 1906; this J., 1906, 778.—T. F. B.

Nitrating cellulose; Process of ——. A. Voigt, Hamm-on-the-Sieg, Germany. U.S. Pat. 855,869, June 4, 1907.

Cellulose is immersed, at a temperature of 2—3° C., in a mixture of sulphuric acid (97 parts) and nitric acid (3 parts). Disintegration of the fibre is thus effected, and the mass is then nitrated with strong nitric acid, and washed.—G. W. McD.

Phosphorus; Process for the preparation of finely-divided red ——. F. Todtenhaupt. Ger. Pat. 171,364, June 5, 1904. *See* VII.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Gas-analysis apparatus; Portable ——. South Staffordshire Mond Gas (Power and Heating) Co. and H. T. Pinnock, Dudley Port, Staffs. Eng. Pat. 24,405, Nov. 1, 1906.

The apparatus consists of a modified Orsat apparatus, enclosed in a portable case along with a secondary battery and coil for effecting the explosion.—H. L.

Gas current; Process and apparatus for analysing a continuous ——. Jones Julia Manufacturing Co. Fr. Pat. 374,406, Feb. 8, 1907.

See U.S. Pat. 854,696 of 1907; this J., 1907, 717.—T. F. B.

Fatty acids in soaps and soap-lyes; Apparatus for the gravimetric determination of ——. M. Pitsch and G. Lotterhos. Ger. Pat. 170,444, April 6, 1904.

The apparatus consists of a flask or bottle to the neck of which is fastened a vertical tube open at both ends. Five grms. of the soap are decomposed by warming with dilute sulphuric acid in the flask, the tube is fastened on, and hot water is introduced until the liquid reaches a mark on the tube. The upper end of the latter is now closed with a rubber stopper, and the flask and tube are placed in a centrifugal machine in order to separate the fatty acids, which, as the liquid cools, solidify in the tube. The latter is finally removed, dried, and weighed.—A. S.

INORGANIC—QUALITATIVE.

Moisture; New test for traces of ——. W. Biltz. Ber., 1907, 40, 2182—2184.

Colourless potassium-lead iodide is decomposed by water, forming yellow lead iodide, the reaction being extraordinarily sensitive. The yellow precipitate formed on mixing warm aqueous solutions of lead nitrate and potassium iodide is changed on standing to a mass of colourless needles of the double salt, which are filtered off, and dissolved in acetone. The filtered acetone solution is yellow; filter-paper impregnated with it remains colourless in dry air, but immediately becomes yellow in presence of the smallest traces of moisture. The salt is obtained dry by precipitation with ether from the acetone solution. The reagent discriminates between air dried by bubbling through 98 per cent. and 78 per cent. sulphuric acid respectively, the latter concentration corresponding to a water vapour tension of 0·3 mm. It becomes yellow in the most carefully dried alcohol, but remains unaltered in ether dried over sodium wire. It is hoped to use the salt for the preparation of absolutely anhydrous liquids.—E. F. A.

Ferrocyanides, ferricyanides, and thiocyanates; Detection and separation of ——. P. E. Browning and H. E. Palmer. Amer. J. Sci., 1907, 23, 448—450.

The solution (5—10 c.c.) is made faintly acid with acetic or hydrochloric acid, and ferrocyanides are completely precipitated by means of a soluble thorium salt. A little finely-shredded asbestos is then added, the whole is well shaken and filtered, and the precipitate washed, decomposed on the filter by means of strong solution of sodium hydroxide, and the alkaline solution tested with hydrochloric acid and ferric chloride. To the filtrate from the ferrocyanide precipitate, is added a soluble cadmium salt till all ferricyanide is precipitated, asbestos added, and the precipitate filtered off and washed as above. The precipitate is decomposed by alkali, and the alkaline solution tested with hydrochloric acid and a ferrous salt. The filtrate from the ferricyanide precipitate is acidified further with hydrochloric acid and tested with ferric chloride for thiocyanate.—J. T. D.

INORGANIC—QUANTITATIVE.

Antimony in hard lead; Determination of ——. H. Beckmann. *See* X.

ORGANIC—QUALITATIVE.

Proteids; Formaldehyde colour test for ——. I. S. F. Acree. Amer. Chem. J., 1907, 37, 604—619.

The author suggests that the biuret reaction should be replaced by the colour reaction obtained when a proteid is treated with dilute formaldehyde (1 : 5000) and then with concentrated, commercial sulphuric acid. 0·01 grm. of the proteid substance was treated with 0·10 c.c. of a 1 : 5000 formaldehyde solution for two or three minutes, and to this was then added about 0·5 c.c. of concentrated commercial sulphuric acid so that there were two layers. The proteids gave a violet coloured zone between the two liquids. In addition to numerous proteids, a large number of substances of varying chemical character were tested, but no other classes of substances than proteids gave this reaction. In a few cases, substances, other than proteids, gave a violet colour, but exactly the same colour was obtained in check experiments without formaldehyde, whereas the proteids never gave the violet colour unless formaldehyde was present. The author considers that the mechanism of the reaction consists in a combination of the formaldehyde with the proteid, the resulting aldehyde-proteid compound being subsequently oxidised.—L. E.

Lignocelluloses ; New colour reaction of the ——. E. Grandmougin. *See* XIX.

ORGANIC—QUANTITATIVE.

Fucose and other methylpentosans ; Determination of ——. W. Mayer and B. Tollens. Ber., 1907, **40**, 2441—2442. (This J., 1905, 212.) Z. Ver. d. Zucker-Ind. 1907, 620.

The authors have determined the yields of methylfurfural phloroglucide obtained by distilling various amounts of fucose (from 0·04 to 0·1 grm.) with hydrochloric acid of sp. gr. 1·06, and precipitating the distillate with phloroglucinol. From the results, an equation and a table were obtained, by means of which, the quantity of fucose, corresponding to a given weight of phloroglucide, may be found. The equation is as follows :—Mgrms. fucose = 2·6595 Ph.—0·01226 Ph^2 + 0·586, in which Ph = mgrms. of phloroglucide. The quantities of phloroglucide obtained from fucose, are somewhat less than those obtained from rhamnose, owing to the fact that fucose is decomposed more slowly than rhamnose by hydrochloric acid, the methylfurfural thus being subjected to the decomposing action of the acid for a longer time. Since, as a rule, one does not know what methylpentosans are present in materials containing these compounds, the average of the values obtained for rhamnose (*loc. cit.*), and of those obtained for fucose, should be taken. In the above-mentioned table for fucose, these average values have been included ; the table also gives the amounts of fucosan corresponding to given weights of fucose. The method of Ellet and Tollens (*ibid.*) for the analysis of mixtures of pentosans and methylpentosans was found to give fairly good results in the case of a mixture of arabinose and fucose.—L. E.

Beetroot slices ; Determination of sugar in exhausted ——. H. Pellet. *See* XVI.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Metals subjected to Röntgen radiation ; The fatigue of ——. L. T. More. Phil. Mag., 1907, **13**, 708—721.

"Fatigue," or a decrease in the amount of secondary radiation, was observed when unpolished plates of iron, lead, nickel, zinc, copper, and aluminium were subjected to Röntgen radiation for a long period of time. The metals, however, recovered their activity after a comparatively short rest, and in the case of freshly polished iron and lead, an increase in the amount of secondary radiation was observed. The presence of ozone in the air increased the fatigue, but an atmosphere of hydrogen apparently tended to prevent changes in activity. The author is of the opinion that the fatigue is caused by changes of the gas in or on the plates rather than by any change in the metals themselves.—O. F. H.

Colloidal metals of the platinum group ; Catalytic effects produced by ——. C. Paal and C. Amberger. Ber. 1907, **40**, 2201—2208.

The authors have examined the effect on hydrogen peroxide of solutions of the metals : platinum, iridium, palladium and osmium, prepared by reducing them from their salts in presence of sodium protalbinate or lysalbinate. The amounts of hydrogen peroxide reduced after 1, 20, 120, and 1200 minutes by solutions containing 1 gramme-atom of each metal in 2100 litres of water, and by solutions 10, 100, and 1000 times more dilute, were measured and compared with the amounts reduced in similar periods, in solutions containing the sodium albinates, but no colloidal metal. All of the metals produced very strong catalytic effects, osmium in much the highest degree, followed in order by palladium, platinum, and iridium. The colloidal metals which had been kept for some time and which were used without any preparation, were much less active than when, previously to using them, hydrogen was passed over them or through their solutions. Minute quantities of cyanides (and no doubt of many other substances) destroy or greatly lessen the catalytic reactivity of these colloidal metals.—J. T. D.

Colloidal metals ; Catalytic effects produced by ——. C. Paal and J. Gerum. Ber. 1907, **40**, 2209—2220.

Colloidal palladium, platinum and iridium, in aqueous solution were mixed with nitrobenzene in alcoholic solution, and hydrogen passed through, at various temperatures between 65° and 85° C. Reduction to aniline occurred in all cases. About 0·05 grm. of the hydrosol was used, and 2 grms. of nitrobenzene, and after 5—6 hours passage of hydrogen, in some cases as much as 50 per cent. of the nitrobenzene was reduced. Different preparations of the same metal differed very greatly in activity. On the whole, comparing equal volumes of the hydrosols, platinum and iridium shewed rather greater activity than palladium, but comparing equal weights, palladium proved the most active. Colloidal silver and osmium were much less active, producing only traces of aniline, which could be detected but not determined. Colloidal copper and gold produced no effect.—J. T. D.

Graphite ; Oxidising and decolorising properties of ——. H. L. Dejust. Compt. rend., 1907, **144**, 1264—1265.

Graphite, in its natural state (79 per cent. of carbon) exerts a very considerable decolorising power on a solution of litmus. The same graphite purified (93 per cent. of carbon) shows a diminution in this power. Slight acidity or alkalinity of the litmus solution has no effect on the decolorising power of the purified graphite, though animal charcoal decolorises a neutral or acid solution much more readily than an alkaline solution of litmus. Graphite exerts an oxidising influence ; a solution of phenylenediamine, for example, mixed with graphite and exposed to the air, oxidises much more rapidly than when graphite is not present. The decolorising action of graphite on litmus solution is, however, independent of any oxidation. —J. T. D.

Salts ; Hydrolysis of ——. A. Rosenstiehl. Compt. rend., 1907, **144**, 1284—1285.

The author compares the behaviour of salts with those of esters, and adduces a number of facts to prove that salts are hydrolysed in aqueous solution, one part of the solvent thus reacting chemically on the salt (or ester), the other serving as diluent. This hydrolysis is a purely chemical phenomenon, and renders the hypothesis of ionisation useless as far as salts and esters are concerned. —J. T. D.

Nickel acetate ; A modified —— *: new type of exciter of the oxidation of quinol (hydroquinone).* A. Job. Compt. rend., 1907, **144**, 1266—1267.

Nickel acetate heated for a long while to 100° C. loses some acetic acid, but remains completely soluble in water ; and the solution excites strongly the oxidation of quinol, surpassing even manganese acetate in this respect. The action is probably due to the small amount of hydroxide or basic salt produced by the decomposition during the heating, for either dilution or the addition of a small amount of acetic acid reduces the intensity of the action considerably.—J. T. D.

Solubility. E. C. Bingham. Amer. Chem. J., 1907, **37**, 549—557.

The author has investigated the miscibility of a number of liquids, in pairs, at various temperatures. In each experiment, equal volumes of the two liquids were mixed together, and precautions were taken to prevent the introduction of moisture. The results, which are tabulated (the substances being arranged in the order of their molecular volumes). show that substances of small molecular volume are often immiscible with those of large molecular volume. Thus, water is completely miscible with lower members of the alcohol and fatty acid series ; it is only miscible with the intermediate alcohols and acids above certain temperatures, and it is immiscible with the higher alcohols and acids at all the temperatures employed. The results also show that sulphuric acid, glycerol, and stannic chloride, substances possessing a great affinity for water, are not miscible with substances which dissolve water very sparingly; whereas, no substance, which is miscible with water, is immiscible with sulphuric acid, glycerol, or stannic chloride. Again, many substances in which water is only moderately soluble, are miscible with all three of these compounds in the state of dehydration in which the author used them. Hence, the presence of small amounts of water may often account for the immiscibility of substances; the author points out that it may be possible to use substances, in which water is very sparingly soluble, to test the dehydration of organic liquids and easily fusible solids.—L. E.

Cholesterol. IX. A. Windaus. Ber., 1907, **40**, 2637—2639.

In previous communications (this J., 1906, 717, 780) the author concluded that a series of oxidation products was apparently derived from a cyclic transformation product of cholesterol, and he has now succeeded in preparing from cholesterol an isomeric cyclic substance by heating cholestorol with sodium amylate, a yield of 15 to 20 per cent. being obtained. Apparently, the double bond of cholesterol is converted into a cyclic bond. "Cyclocholesterol" has the formula, $C_{27}H_{46}O$. It crystallises in long thin prisms which begin to melt at 118° C. and are completely liquid at 126°—127° C. It differs from cholesterol in being completely saturated, and no longer giving the characteristic colour reactions. Abderhalden and Diels (Ber., **39**, 885 and 1371) and Neuberg (this J., 1906, 382) treated cholesterol with boiling amyl alcohol and metallic sodium and obtained a saturated alcohol, which they concluded to have been formed by hydrogenation of the double bond and to contain two atoms more hydrogen than cholesterol. The author finds that this product, described as *a*-cholestanol or dihydrocholesterol is identical with his "cyclocholesterol." He concludes that the reduction of cholesterol has not yet been artificially effected (although hydrogenised cholesterol is found in the animal organism). With respect to the discussion between Diels and Abderhalden and Neuberg as to the identity of *a*-cholestanol (cyclocholesterol) with the naturally occurring coprosterol, the author finds that a mixture of coprosterol (m. pt. 97° C.) with *a*-cholestanol (m. pt. 119°—126° C.) begins to melt at 77° C. and is completely melted at 88° C., and he points out that this does not support Neuberg's view that coprosterol is impure *a*-cholestanol.—C. A. M.

Trade Report.

Indian Chemical Trade.

Oil and Col. Tr. J., June 29, 1907.

The value of the imports of chemicals into India in 1906-07 was Rs. 68.7 lakhs against Rs. 68.9 lakhs in 1905-06. The heading "Chemicals for Paper-making," which represented Rs. 7.74 lakhs in 1904-5, was abolished in 1905-06, and the following new sub-heads were introduced:—Bleaching materials advanced to Rs. 3.39 lakhs as compared with Rs. 2.21 lakhs in 1905-06. Calcium carbide increased from Rs. 1.11 lakhs to Rs. 1.13 lakhs. Potassium cyanide amounted to Rs. 2.92 lakhs against Rs. 2.60 lakhs in the previous year. Disinfectants dropped to Rs. 2.75 lakhs from Rs. 2.44 lakhs. Caustic soda developed from Rs. 5.86 lakhs to Rs. 7.03 lakhs. Bicarbonate of soda also improved from Rs. 3.99 lakhs to Rs. 4.28 lakhs; while soda, other sorts, at Rs. 1.18 lakhs showed a gain of Rs. 24,000. "Chemicals—other sorts" represents 43 per cent. of the total, in place of 48.4 per cent. in 1905-06. The year was, on the whole, one of notably high values in the chemical trade. Saltpetre, together with borax, practically represents the exports of chemicals from India The quantity increased from 336,429 cwts. to 353,378 cwts., while the value rose from Rs. 38.5 lakhs to Rs. 41.4 lakhs. The quantitative expansion of 5 per cent., in conjunction with a 7·5 per cent. rise in value, marks a further increase of 2·36 per cent. in the declared value of the article. Borax was exported to the extent of 5,613 cwts., with a value of Rs. 115,300, its average value having risen by 5·7 per cent.

New Books.

Traité Complet d'Analyse Chimique Appliquée aux Essais Industriels. Par J. Post et B. Neumann, avec la collaboration de nombreux Chimistes et Spécialistes. Deuxième édition française entièrement refondue. traduite d'après la troisième édition allemande, par le Dr. L. Gautier. Tome Premier. Premier Fascicule. A. Hermann, Librairie Scientifique, Libraire de S. M. le Roi de Suède, 6, rue de la Sorbonne, Paris. 1907. Price 5s. 6d.

8vo volume, containing 217 pages of subject matter and a Table of Contents. The text is illustrated with 104 engravings. The subjects treated of are arranged as follows:—I. Water, and Aqueous Effluents, Residuary Waters, &c. II. Combustibles. III. Pyrometry. IV. Smoke Gases, Heating Gas, Power Gas, Gas of Mines, Natural Gases, &c.

Laboratoriumsbuch für den Eisenhüttenchemiker. (Laboratoriumsbücher für die Chemische und verwandte Industrien. Band I.) Von Max Orthey. Verlag von Wilhelm Knapp, Halle a. S. 1907. Price M. 1.80.

Pamphlet-volume of 8vo size, containing 49 pages of subject matter, and eleven illustrations. The subjects treated of in the present number relate to the Analyses of:—I. Ores. II. Iron and Steel, Copper, Antimony and Tin, Nickel and Cobalt, Chromium, Vanadium, Tungsten, Molybdenum, Aluminium, Titanium. III. Slags. IV. Basic Charge Materials and Fireproof Products. V. Acid Charge Materials and Fireproof Products. VI. Coals and Cokes. VII. Gases.

Denatured or Industrial Alcohol. A Treatise on the History, Manufacture, Composition, Uses, and Possibilities of Industrial Alcohol in the Various Countries permitting its Use, and the Laws and Regulations governing the same, including the United States. With concise Tables, Methods, and Notes for the use of the Engineer, Chemist, Manufacturers of Alcohol and Alcohol Making and Using Apparatus, including Alcohol Motors, Engines, Illuminating Lamps, and Heating and Cooking Stoves. By Rufus Frost Herrick, Consulting Chemist and Chemical Engineer, &c. John Wiley and Sons, New York, U.S.A. 1907. Price 17s. net. Messrs. Chapman and Hall, Limited, London.

8vo volume, containing 492 pages of subject matter, Bibliography of Denatured Alcohol and Books of Reference, List of Patents on the Manufacture of Alcohol and Apparatus for Distilling it, and Alphabetical Indexes. The text is illustrated with 163 engravings, and is classified as follows:—I. Composition, History, and Use of Denatured Alcohol. II. Manufacture of Alcohol. III. Distillation and Rectification of Alcohol. IV. Alcoholometry. V. Cost of Alcohol and of Alcohol Distilling Plants. VI. Alcohol as an Illuminant. VII. Fuel Value of Alcohol compared with the other usual Liquid Fuels. VIII. Alcohol as a Source of Power. IX. Laws and Regulations for Denatured Alcohol. X. Denatured Alcohol in the United States.

Appendix.—*a.* United States Regulations and Instructions concerning the Denaturing of Alcohol and the Handling and Use of same under the Act of Congress of June 7th, 1906. *b.* Amendments to the Act of Congress of June 7th, 1906. *c.* Report of the British Departmental Committee on Industrial Alcohol, Presented to both Houses of Parliament by command of His Majesty, March 23rd, 1905, &c.

Lubrication and Lubricants. A Treatise on the Theory and Practice of Lubrication, and on the Nature, Properties, and Testing of Lubricants. By Leonard Archbutt, Chemist to the Midland Railway Company, and R. Mountford Deeley, Locomotive Superintendent, Midland Railway. Second Edition. Revised and Enlarged. Chas. Griffin & Company, Limited, Exeter Street, Strand, London. 1907. Price 21s. net.

8vo volume, containing 500 pages of subject matter, with 157 illustrations. The subject matter is classified into the following groups :—I. Friction of Solids. II. Internal Friction, or Viscosity of Liquids, Plastic Friction. III. Superficial Tension. IV. Theory of Lubrication. V. Lubricants—Their Sources, Preparation, and Chief Properties. a. Mineral Oils. b. Fixed Oils and Fats. c. "Blown" or Thickened Oils. d. Rosin Oil. e. Lubricants containing Soap, Greases. VI. Physical Properties and Methods of Examination of Lubricants. a. Viscosity and Viscometry. b. Specific Gravity and Density. c. Flashing Point. d. Volatility. e. Setting Point or Cold Test of Lubricating Oils. f. Melting Points of Fats and Lubricating Greases, &c. VII. Chemical Properties and Methods of Examination of Lubricants. VIII. Systematic Testing of Lubricants by Physical and Chemical Methods. IX. Mechanical Testing of Lubricants. X. Design and Lubrication of Bearings and other Friction Surfaces. XI. Lubrication of Machinery. The text is illustrated with ninety-seven tables.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

14,024. Suzuki. Evaporators.* June 18.

14,093. Warren. Rotary kilns.* June 18.

14,097. Meurs-Gerkin. Separation of one or more vapours from mixtures of vapour and gas.* June 18.

14,141. Brunner. Heating or cooling fluids, gases, or liquids.* June 19.

14,528. Volland. Apparatus for drying materials. June 24.

14,675. Black and Lennox. Apparatus for washing smoke or for evaporating or cooling liquid. June 25.

14,789. Bland. Blast or other furnaces, kilns, ovens, etc. June 27.

14,790. Bland. *See under* II.

14,844. Huillard. Drying apparatus. [Span. Appl., July 11, 1906.]* June 27.

14,981. Candy. Filtering apparatus. July 29.

Complete Specifications Accepted.

14,616 (1906). Reimann. Heat insulating coverings for pipes and the like. June 26.

14,637 (1906). Brooke. Regenerator furnaces. June 26.

15,297 (1906). Tobelmann. Furnaces. July 3.

15,744 (1906). Sutton. Hydro-extractors. July 3.

16,827 (1906). Koeber and Koeber. Filter press plates. June 26.

19,001 (1906). Mayor, Aldermen, and Citizens of Bradford, Wyld, and Shepherd. Towers for absorbing or eliminating chemical vapours. June 26.

25,327 (1906). Knudsen. Centrifugal separators. July 3.

26,285a (1906). Niclausse. Furnaces. June 26.

4407 (1907). Guttmann. Apparatus for mixing, attemperating, condensing, or effecting reactions between liquids and/or gases. June 26.

II.—FUEL, GAS, AND LIGHT.

Applications.

13,955. Brückmann. Gas producers. June 17.

13,986. Haddan (Bergmann Elekt.-Werke A.G.). Manufacture of metallic filaments for electric glow lamps.* June 17.

14,239. Bouck. Treatment of coal. June 20.

14,341. Ries. Gas retort furnaces.* June 21.

14,348. Thwaite. Coal distillation process and apparatus. June 21.

14,371. Carpenter. Distillation of coal.* June 21.

14,553. Cowper-Coles. Manufacture of smokeless fuel. June 24.

14,671. Hense. *See under* III.

14,678. Cowper-Coles. Apparatus for making smokeless fuel. June 25.

14,713. Hatfield and Lewis. Arc lamp electrodes. June 26.

14,714. White. Treatment and distillation of coal. June 26.

14,790. Bland. Coke and other ovens, blast furnaces, kilns, &c. June 27.

14,795. Tavernier. Manufacture of briquettes or agglomerate fuel.* June 27.

Complete Specifications Accepted.

12,467 (1906). Wilkie and Hutchins. Producer gas generators. July 3.

13,861 (1906). Sabatier. Preparation of pure methane or a gaseous mixture rich in methane. June 26.

14,816 (1906). Deuts. Gasglühlicht A.-G. Production of metallic incandescence bodies for electric glow lamps. July 3.

16,498 (1906). Thomas and Thomas. Production of coal and water gas. June 26.

20,209 (1906). Lederer. Metallic glow bodies. June 26.

7650 (1907). Collin. Horizontal regenerative coke ovens. June 26.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

14,671. Hense. Manufacture of liquid combustibles and solvents from mineral oils. June 25.

15,036. Wells and Wells. Process of fractionating petroleum.* June 29.

Complete Specifications Accepted.

2314 (1907). Wynne. Process for purifying petroleum oils. July 3.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

14,167. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-nitro- and *p*-amidodiphenylamine and derivatives thereof.

14,248. Newton (Bayer und Co.). Manufacture of azo colouring matters. June 20.

14,532. Newton (Unger). *See under* XIV.

14,746. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of brown sulphurised dyestuffs. June 26.

14,846. Imray (Meister, Lucius, und Brüning). Manufacture of dyestuffs of the thioindigo series. June 27.

Complete Specifications Accepted.

17,164 (1906). Johnson (Kalle und Co.). Manufacture of reduction products of *o*-nitrophenylglycollic acid and of isatin. June 26.

17,743 (1906). Newton (Bayer und Co.). Manufacture of azo colouring matters. June 26.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

13,948. Imray (Soc. Chem. Ind. in Basle). Dyeing with sulphurised dyestuffs cotton mixed with wool or silk. June 17.

14,003. Knowles and Yates. Apparatus for bleaching, dyeing, mercerising, &c., yarns or threads of fibrous substances. June 18.

14,400. Rothwell-Jackson. Closed kiers for bleaching. June 22.

14,655. Lake (Soc. Gén. de la Soie Artific. Linkmeyer). Apparatus for the manufacture of artificial silk threads. June 25.

14,715. Rothwell-Jackson and Rothwell-Jackson. Kiers for bleaching and otherwise treating piece goods in the open state.* June 26.

14,780. Halliwell, and Mather and Platt, Ltd. Apparatus for dyeing, bleaching, and treating fibrous materials. June 27.

Complete Specifications Accepted.

27,438 (1906). Sagar. Apparatus for mercerising and sizing fibrous material. June 26.

4550 (1907). Gin and Courtecuisse. Singeing threads and yarns. July 3.

6963 (1907). Cowper-Coles. Cylinders for printing textile fabrics and paper. June 26.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

13,938. Pichard and Pichard. Dyeing and secreting of hides, skins, and hair. [Fr. Appl., Aug. 8, 1906.]* June 17.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

13,946. Crowther. Manufacture of ferric sulphate. June 17.

13,952. Raschen, Higgins, and United Alkali Co. Manufacture of formic acid and of acetic acid. June 17.

13,953. Raschen, Higgins, and United Alkali Co. Manufacture of formates. June 17.

13,954. Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of catalytic bodies, especially for use in making nitric acid. June 17.

13,989. Hausser. Production of oxide of nitrogen by explosions. [Ger. Appl., July 2, 1906.]* June 17.

14,280. Barton and McGhie. Manufacture of sodium sulphide. June 20.

14,414. Watson. *See under* XVIII*B*.

Complete Specifications Accepted.

13,828 (1906). Wolffenstein. Manufacture of hydrogen peroxide. June 26.

14,601 (1906). Machtolf. Manufacture of amorphous carbon. June 26.

25,976 (1906). Tyers, Hedley, and United Alkali Co. Obtainment of sulphur from sulphuretted hydrogen or gases containing sulphuretted hydrogen. June 26.

4193 (1907). Liverpool Borax Co., and Fry. Utilisation of by-products obtained in the manufacture of borax. June 26.

6405 (1907). Salzbergwerk Neustassfurt und Theilnehmer. Production of crystalline hydrate of potash. July 3.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

14,107. Le Poidevin. Manufacturing pottery. June 19.

14,417. Menzel und Soehne. Glass furnaces. [Ger. Appl., July 25, 1906.]* June 22.

14,587. Menzel. Apparatus for drawing plate glass. [Ger. Appl., April 10, 1907.]* June 25.

Complete Specifications Accepted.

9281 (1906). Jones. Glazing or enamelling kilns. June 26.

20,955 (1906). Deselle. Regenerative gas furnaces for glass, &c. July 3.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

14,389. Cowper-Coles. Manufacture of cement. June 21.

14,452. Latham. Utilisation of old plaster and other hydrated sulphate of lime. June 22.

14,458. Ford. Manufacture of artificial stone. June 22.

Complete Specifications Accepted.

15,808 (1906). Simonsen. Cement mixture for buildings, &c. June 26.

21,576 (1906). Hippe. Hardening and rendering durable objects of stone, plaster, cement, magnesite, &c. June 26.

6863 (1907). Morgan and Armstrong. Utilisation of slate waste. June 26.

X.—METALLURGY.

Applications.

13,956. Carrick and Pattison. Smelting pyritic copper ores. June 17.

13,977. Cowper-Coles. Manufacture of zinc dust and recovery of copper and zinc from alloys.* June 17.

13,978. Cowper-Coles. Production of vanadium alloys.* June 17.

13,979. Cowper-Coles. Manufacture of iron and steel.* June 17.

14,055. Angel. Reduction of complex sulphide and other ores. June 18.

14,064. Woods and Schmidt. Separating refuse metals. June 18.

14,157. Payne. Soldering aluminium. June 19.

14,279. Barton and McGhie. Smelting antimony ores. June 20.

14,538. Wedekind (Dünkelberg). Briquetting iron and other ores, blast furnace flue dust, &c.* June 24.

14,612. Darby and Stead. Manufacture of steel. June 25.

14,625. Tompkins. Production of metallic vapours. June 25.

14,755. Wheatley. Production of red-coloured metallic alloy. June 26.

14,806. Norris. Concentration of metallic ores.* June 27.

14,829. Wheatley. White metal alloy. June 27.

14,830. Wheatley. Aluminium alloy. June 27.

14,856. Churchward. Alloy of steel or iron. June 27.

14,924. Lindeman. Crucible furnace.* June 29.

15,039. Jensen. (Mühlinghaus). Treatment of tin ores or tin slag. June 29.

Complete Specifications Accepted.

15,612 (1906). Callow. Compound flux for all metals. June 26.

17,256 (1906). Taylor. Apparatus for concentrating and washing minerals. June 26.

17,758 (1906). Centralstelle f. Wissensch.-Techn. Untersuchungen. Manufacture of brass. June 26.

21,770 (1906). Simpson and Bourcoud. Production of iron. July 3.

23,664 (1906). Cowper-Coles. Removal of scale and oxide from metallic surfaces. July 3.

25,966 (1906). Cowper-Coles. Rendering silver non-tarnishable. July 3.

1344 (1907). Merralls. Process of cyaniding and apparatus therefor. July 3.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

14,265. Cowper-Coles. Manufacture of insulating compounds, varnishes, lacquers, paints, and the like. June 20.

14,285. Cowper-Coles. Electric hydrogen and oxygen generators. June 20.

14,372. Siemens und Halske A.-G. Electrolytic winning of zinc from solutions of zinc sulphate. [Ger. Appl., Aug. 29, 1906.]* June 21.

14,881. Somers and Crowley. Excitant for primary batteries. June 29.

Complete Specifications Accepted.

13,949 and 13,949A (1906). De Ferranti. Electric furnaces. June 26.

14,259 (1906). Moscicki. Electric plant for producing chemical reactions. June 26.

17,981 (1906). Wetter (Elektricitäts A.-G. vorm. Schuckert und Co.). Apparatus for electrolytic production and separate collection of gases. July 3.

18,835 (1906). Wynne. Heating molten or semi-molten materials by electricity. July 3.

29,271 (1906). Frick. Electric transformer furnaces. July 3.

1080 (1907). Soc. des Proc. Gin pour la Metallurgie Electrique. Electric induction furnaces. July 3.

1201 (1907). Marks (A.-G. f. Automatische Zund und Losch Apparate). Device for igniting a gas or gaseous mixture by electric sparks. July 3.

6193 (1907). Grönwall, Lindblad, and Stalhane. Electric transformer furnaces. July 3.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Complete Specifications Accepted.

14,784 (1906). Henderson. Manufacture of soap. July 3.

9733 (1907). Phillips. Extraction of palm oil from the chaff of palm nuts. July 3.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

14,188. Marchand and others. Paint.* June 19.
14,265. Cowper-Coles. *See under* XI.

(*B.*)—Resins, Varnishes.

Application.

14,265. Cowper-Coles. *See under* XI.

(*C.*)—India-Rubber.

Application.

13,976. Dupont. Manufacture or regeneration of caoutchouc. June 17.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

13,938. Pichard and Pichard. *See under* VI.

14,098. Goldsmith. Casein compounds or articles. [U.S. Appl., Aug. 28, 1906.]* June 18.

14,532. Newton (Unger). Production of black solid tannin, black dye, and black cutch. June 24.

Complete Specifications Accepted.

14,319 (1906). Betz. Producing a compact mass from casein or albuminous substances. June 26.

3433 (1907). Harrison (Ferraguti). Substitute for leather. June 26.

XV.—MANURES, &c.

Application.

13,970. Meakin. Artificial manure. June 17.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

15,054. Lapp. Production of worts and apparatus therefor. June 29.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

14,149. Stevenson and Cox. Preservative for foodstuffs. June 19.

14,342. Gebhardt. Manufacture of fluid drinkable substances.* June 21.

Complete Specifications Accepted.

20,832 (1906). Schmidt. Manufacture of cattle or like food from yeast. July 3.

23,346 (1906). Gothard. Food for horses, cows, &c. June 26.

5226 (1907). Keller and Keller. Production of malted whole dough or whole meal. June 26.

6080 (1907). Marks (Schwartz). Food substitute having the same nutrition as whole milk. July 3.

6394 (1907). Borgstrom. Manufacture of butter. June 26.

(*B.*)—Sanitation; Water Purification.

Applications.

14,414. Watson. Destructive distillation of sewage sludge for the recovery of by-products such as ammonia and oil and the utilisation of the residue. June 22.

14,704. Ellis. Combined tanks and filtering appliances for treating and purifying sewage. June 26.

Complete Specification Accepted.

16,558 (1906). Ellis and Slade. Manufacture and treatment of filtering and deodorising material. July 3.

(*C.*)—Disinfectants.

Complete Specification Accepted.

20,651 (1906). Hume. Composition for dipping or pouring animals. June 26.

XIX.—PAPER, PASTEBOARD, &c.

Complete Specifications Accepted.

26,962 (1906). Beck. Manufacture of paper, paper board, and moulded products. July 3.

27,125 (1906). Beck. Apparatus for making half-stuff from peat turf. June 26.

27,126 (1906). Beck. Production of half-stuff from peat. June 26.

28,697 (1906). Kirfel. Calendering machine for producing a linen finish on paper. July 3.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

14,247. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. June 20.

14,379. Dubosc. Manufacture of formic ethers of borneol and isoborneol, and manufacture of borneol and camphor. [Fr. Appl., Oct. 6, 1906.]* June 21.

14,549. Verley, Urbain, and Feige. Manufacture of ethers of borneol and isoborneol.* June 24.

14,550. Verley, Urbain, and Feige. Oxidising borneol or isoborneol for the manufacture of camphor.* June 24.

Complete Specifications Accepted.

26,838 (1906). Johnson (Verein. Chininfabr. Zimmer und Co.). Manufacture of a new pharmaceutical product. July 3.

5014 (1907). Imbert. Production of dichlorethoxyethylene. July 3.

9857 (1907). Basler Chem. Fabrik. Manufacture of camphor from isoborneol. June 26.

10,025 (1907). Meister, Lucius, und Brüning. Manufacturer of 4-antipyryldimethylamine. July 3.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

25,188 (1906). Stevens and Stevens. Photographic films. July 3.

XXII.—EXPLOSIVES, MATCHES, &c.

Application.

14,366. Lake (Boyd). Explosive compositions. June 21.

Complete Specifications Accepted.

8156 (1907). Von Schroetter. Manufacturer of explosives. June 26.

8157 (1907). Von Schroetter. Method of detonating wet guncotton. July 3.

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Canadian Section.

Chairman: W. Hodgson Ellis.

Vice-Chairmen:
M. L. Hersey, A. McGill, Harold Van der Linde.

Committee:

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W. P. Cohoe.
J. A De Cew.
W. L. Goodwin.
Robt. Harcourt.
W. R. Lang.
W. Lash Miller.
Jas. P. Murray.
A. Neighorn.
R. F. Ruttan.
F. J. Smale.

Hon. Treasurer: J. W. Bain, 90, Charles Street, Toronto.

Hon. Local Secretary:
Alfred Burton, 44, York Street, Toronto.

Liverpool Section.

Chairman : J. T. Conroy.

Vice-Chairman : Eustace Carey.

Committee :

J. Campbell Brown.
Arthur Carey.
H. E. Davies.
F. G. Donnan.

Max Muspratt.
W. Ramsay.
H. J. L. Rawlins.
W. H. Roberts.

J. M. Taylor.
Alex. Watt.
W. Collingwood Williams.

Hon. Treasurer : W. P. Thompson.

Hon. Local Secretary :

W. R. Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

London Section.

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Vice-Chairman : J. Lewkowitsch.

Committee :

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T. C. Cloud.
M. O. Forster.
W. R. Hodgkinson.
E. Grant Hooper.

G. C. Jones.
C. A. Keane.
A. R. Ling.
G. T. Morgan.
Sir Fred. Nathan.

A. Gordon Salamon.
P. Schidrowitz.
F. Napier Sutton.
Thos. Tyrer.

Hon. Local Secretary :

Julian L. Baker, Stainesbury Holt, Kingston Road, Staines.

Manchester Section.

Chairman : K. E. Markel.

Vice-Chairman :

Committee :

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G. H. Bailey.
H. Benfey.
Wm. Burton.
G. H. Clayton.

W. H. Coleman.
G. J. Fowler.
B. Hart.
R. S. Hutton.

W. E. Kay.
E. Knecht.
H. Levinstein.
W. J. Pope.

Hon. Local Secretary :

Julius Hübner, Ash Villa, Cheadle Hulme, Cheshire.

Newcastle Section.

Chairman : N. H. Martin.

Vice-Chairman : H. Louis.

Committee :

Alf. Allhusen.
P. P. Bedson.
J. T. Dunn.
John Pattinson.

C. J. Potter.
A. Short.
Geo. Sisson.
Harry Smith.

W. H. Sodeau.
A. Spiller.
C. E. Stuart.

Hon. Treasurer : J. A. Smythe.

Hon. Local Secretary :

F. C. Garrett, Armstrong College, Newcastle-on-Tyne.

New England Section.

Chairman F. E. Atteaux.

Vice-Chairman :

Committee :

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Godfrey L. Cabot.
R. L. Chase.
A. Y. Davison.
H. S. Duckworth.

W. D. Hartshorne.
John C. Hebden.
Henry Howard.
W. H. Parker.

F. C. Robinson.
Charles R. Sanger.
W. H. Walker.
F. T. Walsh.

Hon. Local Treasurer : Robert W. Neff, 22, India Square, Boston, Mass., U.S.A.

Hon. Local Secretary :

A. A. Claflin, Box 1157, Boston, Mass., U.S.A.

New York Section.

Chairman : Geo. C. Stone.

Vice-Chairman : Maximilian Toch.

Committee :

C. Baskerville.
Howard B. Bishop.
Walker Bowman.
F. D. Dodge.
Bernhard C. Hesse.

W. D. Horne.
L. S. Kohnstamm.
Geo. F. Kunz.
R. W. Moore.

T. J. Parker.
A. Plaut.
G. A. Prochazka.
Samuel A. Tucker.

Hon. Treasurer : Frank C. R. Hemingway.

Hon. Local Secretary :

H. Schweitzer, 128, Duane Street, New York, U.S.A.

Nottingham Section.

Chairman : Oliver Quibell.

Vice-Chairman : J. M. C. Paton.

Committee :

L. Archbutt.
F. J. R. Carulla.
R. M. Caven.
H. S. Garry.

J. Golding.
T. F. Harvey.
F. Stanley Kipping.
T. H. Lloyd.

G. J. Ward.
J. White.
J. T. Wood.

Hon. Treasurer : S. J. Pentecost, Sherwood Rise, Nottingham.

Hon. Local Secretary :

S. R. Trotman, King's Walk Chambers, Nottingham.

Scottish Section.

Chairman : J. S. Macarthur.

Vice-Chairman : Thos. Gray.

Committee :

A. Campion.
R. M. Clark.
W. S. Curphey.
Jas. J. Dobbie.
L. Dobbin.
Harry Dunlop.

Jas. Faill.
Jno. S. Ford.
R. Hamilton.
F. W. Harris.
Jas. McLeod.

T. L. Patterson.
David Perry.
C. F. Ratcliffe.
R. T. Thomson.
Chas. W. Townsend.

Hon. Secretary and Treasurer :

Chas. E. Fawsitt, The University, Glasgow.

Sydney, N.S.W., Section.

Chairman : R. Greig Smith.

Vice-Chairman : A. Liversidge.

Committee ;

E. Dearman.
G. Harker.
L. Meggitt.

J. Morison.
Jas. M. Petrie.
J. A. Schofield.

S. E. Sibley.
H. G. Smith.
T. Steel.

Hon. Local Secretary and Treasurer :

T. U. Walton, Colonial Sugar Co., O'Connell Street, Sydney, N.S.W.

Yorkshire Section.

Chairman : F. W. Branson.

Vice-Chairman : A. G. Perkin.

Committee :

W. A. Bone.
E. M. Chaplin.
S. H. Davies.
W. M. Gardner.

J. Garfield.
W. Basil Hill.
H. R. Hirst.
W. McD. Mackey.

B. North.
H. R. Procter.
G. E. Scott-Smith.
G. W. Slatter.

Hon. Local Secretary and Treasurer :

T. Fairley, 17, East Parade, Leeds.

PROCEEDINGS
OF THE
TWENTY-SIXTH ANNUAL MEETING.

BIRMINGHAM.

Wednesday, July 10, 1907.

The Twenty-sixth Annual General Meeting of the Society was held in the University, Birmingham, on July 10th, the chair being occupied by the President, Mr. Eustace Carey.

Among those present were Sir Boverton Redwood (President-Elect), The Lord Mayor of Birmingham, Sir Oliver Lodge (Principal of Birmingham University), Sir Samuel Sadler, Prof. Percy F. Frankland, F.R.S. Dr. Edward Divers, F.R.S., Mr. Charles E. Groves, F.R.S., Alderman Clayton (Pro Vice Chancellor of the University of Birmingham), Prof. W. R. E. Hodgkinson, Drs. C. E. Fawsitt, Alex. Findlay, R. Greig Smith, J. T. Conroy, D. B. Hewitt, J. T. Dunn, and Harold Colman, Messrs. Samuel Hall, Thomas Tyrer, John Brock, B. E. R. Newlands, A. Gordon Salamon, E. Grant Hooper, Frank Tate, Thos. Fairley, N. H. Martin, A. E. Fletcher, H. Hemingway, Harry Silvester, F. R. O'Shaughnessy, Max Muspratt, Arthur Carey, T. W. Stuart, A. E. Tucker, Thos. Turner, R. B. Batty, F. H. Alcock, W. W. Butler, Frank E. Lott, and Watson Smith.

Letters of regret for non-attendance were received from Drs. J. Lewkowitsch, K. E. Markel, and L. T. Thorne, and Messrs. D. Howard, J. Hübner, R. J. Friswell, and Walter F. Reid.

There was a large attendance of members.

The Lord Mayor of Birmingham (The Right Hon. Henry J. Sayer) extended to the Society, on behalf of the city, the most cordial welcome to Birmingham, adding that the Town Hall and Art Gallery were open to them, and would well repay a visit.

Sir Oliver Lodge, Principal of the University of Birmingham, said it gave him great pleasure to welcome the Society on behalf of the University. A distinguished gathering of that kind was frequently welcomed by a University, by the conferring of honorary degrees on some of its leaders, but hitherto it had not been their way; they had not, as yet, given any honorary degrees; they thought they would do better to acquire some antiquity and dignity before attempting to confer it on others. All the arrangements for the study of chemistry in Mason College were temporary. At the new site at Edgbaston, there were twenty-five acres on which buildings had arisen or were rising, for applied science work. About half-a-million had been spent already on buildings. They would particularly appreciate a visit to their new buildings, as they are doing all they were able for the instruction in science on a more extensive scale than anywhere else in the country. They had not yet started on the building for applied chemistry; possibly the Society might give them some assistance.

Sir Oliver Lodge then gave a sketch of the new buildings of the University at Bournbrook. He showed the relative placing and purpose of the buildings already in existence, and indicated the sites of the departments yet to come.

The departments of metallurgy and mining metallurgy would be under the direction of Prof. Thos. Turner; that of mining, under Professor Redmayne; the electrical engineering department under Professor Kapp; that of civil engineering, including hydraulics, under Professor Dixon; while mechanical engineering was under Professor Burstall, who also had control of the power house, his chief engineer being Mr. R. C. Porter.

In conclusion, they were very pleased to welcome the meeting to Birmingham, and were honoured in receiving this visit at the new University buildings.

The President expressed to the Lord Mayor the very hearty thanks of the Society for so kindly welcoming them to Birmingham; and to Sir Oliver Lodge for his dissertation on the present and the future of the buildings of the University. His hint would probably be taken up by some wealthy individual. He then called upon the Secretary to read the minutes of the last annual meeting.

The General Secretary, Mr. Charles G. Cresswell, read the minutes of the previous meeting, held at Manchester, which were confirmed.

The President said it gave him great pleasure to announce that His Majesty the King had been pleased to grant the Society a Royal Charter of Incorporation. The Society owed its grateful thanks to the Incorporation Committee who had taken this matter in hand, and especially to the Chairman of that Committee, Sir Boverton Redwood. It had been a matter of continuous hard work. He then called upon Sir Boverton Redwood to say a few words on the subject of the Charter, as he had had so much to do with it.

Sir Boverton Redwood said he only wished to suggest, in their satisfaction at the culmination of their labours, that they should continually bear in mind that the honour which had been conferred upon them carried with it a corresponding responsibility. The Society had been built up by strenuous efforts of the Council in past years, and, as they had heard, His Majesty had been good enough to express his approval of the result of those labours, but the granting of this Charter should lead them to put before them a higher ideal, and to stimulate them to further effort.

The President then called upon the Secretary to read the list of new members elected to serve on the Council.

The Secretary then read the list. The new President under the Charter of Incorporation was Sir Boverton Redwood. The new Vice-Presidents were: Mr. Eustace Carey, Professor Percy F. Frankland, Professor R. Meldola, and Mr. Walter F. Reid, and the new ordinary members of Council were: Professor W. R. E. Hodgkinson, Dr. Chas. A. Keane, Mr. C. T. Kingzett, Mr. Frank H. Tate, and Dr. Leonard T. Thorne. The new *ex officio* members of the Council, viz.:—the Chairman of the various sections, were:—Birmingham, Mr. Harry Silvester; Manchester, Dr. K. E. Markel; Newcastle, Mr. N. H. Martin; New England, Mr. F. E. Atteaux; Nottingham, Mr. Oliver Quibell.

The Secretary read the Report of the Council of the Society for the past year, as follows:—

REPORT OF COUNCIL.

The number of members on the register is 4521 as compared with 4429 at the last Annual Meeting. During the year 323 members have been elected as compared with 356 last year; the losses have been 231 as against 253. There were 42 deaths as compared with 33 last year.

The names of those who have died are: A. C. Bealey, Joseph Bernays, Col. S. B. Bevington, Edward Blass, S. Cabot, James E. Campbell, Dr. W. H. Chandler, W. H. Cowburn, George E. Davis, T. Sebastian Davis, M. G. Dearing, Sir David Gamble, Bart., Wm. Garroway, T. A Gerard, Wm. Glenn, F. H. Gossage, J. G. Hepburn, Prof. A. S. Herschel, J. S. Heywood, Otto Isler, E. Jenner, H. Jonker, A. E. Lewis, Thos. Macfarlane, S. L. Morison, F. J. Odling, Robert Orr, Cornelius O'Sullivan, Ira L. Pierce, Hermann Poole, Jos. T. Potts, A. Ernest Powell, W. L. Rennoldson, Benjamin Roy, John Shaw, W. B. Skerten, Oscar Unglaub, E. Cecil Wren, F. Yates, F. F. Zehetmayr, and H. B. Zimmele.

The Hon. Treasurer's financial report was issued in the Journal for June 29th, and will be laid before the meeting.

The Journal for 1906, together with the Supplements, numbered 1358 pages, equal to 56·6 pages for each issue, as compared with 55·6 in 1905. To this must be added an Index of 130 pages, a List of Members of 60 pages, and a List of Journals Abstracted of 4 pages.

During the past session 111 original papers, with discussions, have appeared in the Journal as compared with 78 in the previous session; of these, 24 have been recast, amended, or condensed. Four papers have been withdrawn and 19 refused.

It has been decided to issue the Authors' Names portion of the Decennial Index separately. This is now ready and will be in the hands of the subscribers in the course of the present month.

The Revenue Act of 1906, which grants facilities for the use, without payment of duty, of spirits in arts and manufactures, received the Royal Assent soon after last meeting; it will be remembered that the Society had taken an active part in the promotion of this Bill. Congress has passed an Act for the United States on somewhat similar lines. An exhibit of plant of all kinds for the utilisation of denatured alcohol, under the direction of Prof. Munroe, is a special feature of the Jamestown Exposition.

A Bill has been introduced into the House of Commons to amend the existing Patent laws in the direction urged upon the Government by the Council in April, 1906, when it took part in a deputation to the President of the Board of Trade.

Evidence has been given, at the instance of the Council, before the Departmental Committee appointed to consider the participation of this country in international exhibitions, and before the Committee appointed to consider what industrial diseases should be scheduled in the Workman's Compensation Act; and evidence is about to be given before the Royal Commission on Canals and Waterways.

The Council is also represented on a joint committee of scientific and technical societies, formed for the purpose of securing for their publications postal rates not less favourable than those charged on registered newspapers.

Addresses were presented on the occasion of the Jubilees of Sir William Perkin's discovery of the first coal tar colour, and on that of the foundation of the Société Chimique de France.

In accordance with the recommendations of the Departmental Committee on the Royal College of Science, the Council, on the invitation of the President of the Board of Education, has nominated Dr. Edward Divers, F.R.S., to represent the Society on the Governing Body of the Imperial College of Science and Technology.

His Majesty the King has been graciously pleased to grant to this Society a Royal Charter of Incorporation. By-laws under the charter are now in preparation and will be submitted for approval early next year to the members in general meeting assembled.

An invitation to meet in Newcastle on Tyne in 1908 will be laid before the meeting.

Alderman F. C. **Clayton**, said that after hearing the Report one could not help being struck by the fact that the year had been a red-letter one in the history of the Society. Considering the number of applications for Charters, which were not granted, that they came out of the ordeal so well showed that they occupied a useful place in the world. The number of new members elected, compared with the previous year, was, perhaps, at first sight, a little discouraging, but they could not expect to go on sweeping in the same number, seeing that they had so large a body of members already. The fact that last year they had 78 original papers, whereas whilst this year they had had 111, was distinctly encouraging. He was very glad to see that the Committee had been able to obtain the alteration of the law with regard to denatured alcohol. That had been wanted for very many years. He only hoped it would put many of their English manufacturers in a more favourable position with regard to their competitors, than they had been in, in the past. He had very great pleasure in moving the adoption of the Report.

Dr. D. B. **Hewitt**, in seconding the motion for the adoption of the Report, said that he was one of those who met first at Owens College when the Society was formed, and he was glad to have lived to see it obtain a Royal Charter from the King.

The motion was carried unanimously.

Report of Hon. Treasurer.

The Hon. Treasurer, Mr. **Samuel Hall**, said it was his duty as well as his pleasure to report to them on the finances of 1906. As the detailed accounts had been published in the last number of the Journal, that of the 29th of June, he would not read them item by item. The yearly account of income and expenditure on page 664, was very similar to that of 1905. There had been an increase of £153 from subscriptions, which amounted to £5,187. Entrance and life composition fees amounted to £390, being £55 less than the year before. These fees were always put aside and invested, while the income from these investments was included in the receipts, which now gave them £536, an increase of £51. Advertisements and sales were £15 less. He was sorry to see that there was a misprint in the amount from advertisements; it should be £201 and not £231. The total, £743 9s. 0d., was correct. The total available income showed an increase of £240, making £6,495 3s. 5d. On the other side of the account, the expenses had also increased to the extent of £280, the whole of which, except £10, was due to the increased cost of the Journal, although, by an arrangement with the assistant, there was a saving of £75 in making the index. The other items, though slightly different among themselves from the year before, came to practically the same amount, making a total of £6,109 6s. 9d., with a balance of £385 16s. 8d. The cost of the Journal was engaging the very careful attention of the Publication Committee. The printers were asking them to reconsider questions of corrections and other matters which might involve some £200 or £300 a year increase. This would leave a very small margin between income and expenditure, and it was evident that were it not for the income from former savings, there would be a deficit. The number of patents was increasing; the classified list of these was invaluable and up to date. With an increase of the Sections, more papers were received for publication, in other words, more useful information was received from various parts of the world, which the Society distributed to the world. The Journal, with its very full index, contained over 1,500 pages; more than double its early numbers. In this relation, he ought to point out the very large amount of voluntary work the Publication Committee gave. It met twice monthly, each member bringing to it the proof slips already corrected by him at home, belonging to those subjects which had been allocated to his expert knowledge. Then, very various questions arose which had to be considered generally. Many members of Publication Committee frequently attended meetings of Council on the same day, thus giving four or five hours of continuous work. Looking forward to the present year and the prospect of a balance at the end of it, there would be some large amounts to pay. Although nearly £800 had been paid in various years towards the Decennial Index, it would cost over £2,000. There would also be the Charter, a very valuable asset, to pay for. He hoped to be able to pay without trenching to any great extent on the investments as they stood. The meeting would be glad to know that the names portion of the Decennial Index would be ready to deliver in the next week. Some complete copies had been received. It was a valuable, but very costly and tedious work to produce, and as Treasurer, he could not but feel that its usefulness was not sufficiently appreciated by the members to induce them to subscribe for copies as freely as was expected. Possibly, now that a portion was being delivered, a fresh circular might bring further sales. At present, they had not amounted to £500. He asked all responsible for the expenditure of the various sections of the Society to keep the expenses as small as possible, with, of course, a due regard to efficiency. There was a tendency for these expenses to increase, but from what had already been said, it was plain that there was but very little margin to spare. The Committee on Expenses were looking very carefully after ways and means with a view to keeping the Journal and the Society thoroughly well up to the objects of the Society as defined in the Charter, and its world-wide character. He would be pleased to answer any questions respecting the accounts on which any member might wish for further information.

The President remarked that before he asked Mr. Gordon Salamon to propose a vote of thanks to their Treasurer, he would like to corroborate what he had said about the Publication Committee. It had been his duty to attend those meetings, and he had no idea of the work it entailed. He thought the Committee were to be heartily congratulated.

Mr. A. Gordon Salamon said it was gratifying to be able to propose a resolution which did not admit of hostile criticism. The resolution which he would submit to them was, that the thanks of the Society be passed to their Treasurer for the lucid statement to which they had listened. Mr. Samuel Hall was not only the treasurer of that Society; he was one of its pillars. He had for years been working for them with great devotion and zeal, and they valued his work.

Mr. Thomas Tyrer, in seconding the motion, said that he need not amplify the feeling of the meeting towards Mr. Hall. With regard to the work done by the Publication Committee, Mr. Hall had been the watchful guardian of the Society's financial interests, but the members of the Publication Committee themselves had also done great work. Almost from the very beginning of the Society, except by abstraction in the case of death, there had been nearly the same men. The work was not done solely by the London members, who came to the meetings; but to every member who sent in part of that slip-proof for which he was responsible it counted for an attendance, and the absent members did an immense amount of work, and credit for it should be given to them. Economy was absolutely necessary. That Expenses Committee had been impressing upon them the necessity of looking very closely into the spending departments, the Publication Committee and the printers; and, as a matter of business, they must see clearly what they paid for. It was obvious that a bit of careless writing made costs mount up when the matter had to be corrected, and that was what the Expenses Committee, referred to by Mr. Hall, meant, in saying that they did not spend any more money than was necessary, and that they had in every department as much care as if they were conducting their own business.

The resolution was carried unanimously.

Mr. Hall thanked Mr. Gordon Salamon and the meeting for the way they had received the motion. It was an honour to be Treasurer of a great Society, in which he had taken much interest from the commencement. He felt that it did a great work in the world, and he was very glad to give what aid he could.

THE PRESIDENT'S ADDRESS.

The President then read his address as follows on:

TECHNICAL TRAINING AND MANUFACTURING METHODS.

Since you did me the honour of electing me to be the President of our Society I have been, as is very natural, much exercised and very anxious about the subject upon which I might venture to address you to-day. I hope that the few observations upon technical training and manufacturing methods which I propose to submit to you may prove acceptable. The subject is anything but new. Nevertheless, the interest is ever new, and always increasing. The ramifications even of a manufacture so simple as that of alkali are now so numerous that but few can have an intimate practical knowledge of all the processes involved when by-products are taken into account.

At first sight it perhaps might appear that the object of the alkali manufacturer is only to dissociate sodium and chlorine to take into partnership oxygen and carbon dioxide, and to accept in the Leblanc process the temporary services of sulphur, and in the ammonia-soda process the temporary assistance of ammonia, and to produce three or four heavy chemicals as they are called; but that is not the modern position. The compounds of sodium and chlorine are now very numerous in themselves, and when we add that, by whichever process alkali may be produced, heat and power are required, that gas from coke ovens and other producers is now beginning to replace solid fuel, the production of ammonia and of coal tar products comes at once into view. In addition to this, in the Leblanc branch of alkali manufacture, the field is wider still, involving, besides almost all the foregoing, metallurgy for the recovery of several metals and their compounds from the pyrites used in the sulphuric acid part of that process.

The field is very wide, the industry increasingly interesting, calling now for chemical and engineering knowledge hardly thought of fifty years ago. Those were the days of a rapidly growing industry. Costs were of course important but quantity was more so. We had the world for our market, and exports increased by leaps and bounds. The good old ignorant and jealous practical man was generally in command, and his rule, not always genial, was rule of thumb. By-products by which some of us now make our scanty living were thrown away.

During the time that has elapsed since then the struggle for existence has continually increased in intensity. That everyone will admit, but I affirm that the scientific interest has increased in at least the same proportion, and that though technologists engaged in an old trade cannot expect the rapid money-making success of fifty or more years ago, I believe the triumphs of skill and wide scientific training will be far more brilliant in the future than in the past. As my practical experience during the past fifty years has been almost entirely connected with alkali manufacture I shall not venture far outside the alkali field for my facts and figures.

I will endeavour very briefly to deal with the following parts of my subject:—

1. Processes and markets.
2. Transport facilities.
3. Fuel.
4. Labour conditions.
5. Education and training of managers, chemists, foremen and men.

1.—Processes and Markets.

Mr. E. K. Muspratt, in his Presidential Address in 1885, described very thoroughly the principal technical changes that had taken place in the British alkali trade up to that date; including of course the most interesting history of the Leblanc process from small beginnings, when, in 1823, salt was freed from the shackles of the Inland Revenue Office, through the celebrated times of invention and enterprise inseparably associated, as we here all know, with the names of Muspratt and of Tennant; including in fact practically the first half of the period to which I refer.

Mr. Muspratt's review enumerated very important improvements, such as the combination of Glover and Gay Lussac towers, which reduced the consumption of nitre in sulphuric acid manufacture to one fourth of the figure at which it had stood previously; the black ash revolver, which both increased production and decreased cost of alkali; the Weldon manganese recovery process, which reduced the cost of bleaching powder by £2 a ton; the Deacon chlorine process; and, last but not least, the introduction of the ammonia-soda process, the great and successful rival of the older Leblanc; also the introduction of Spanish cupreous pyrites and the wet copper extraction process. Of all these it is not necessary for me to speak. I will confine my remarks under my first head to the period subsequent to 1886.

Since 1886 there have been very material advances in the manufacture of sulphuric acid. The special conditions obtaining in Germany and the great demand there for sulphuric anhydride, consequent upon the enormous development of the German colour industry, lead to some splendid researches on the contact method of oxidising sulphur dioxide into sulphuric anhydride with which the names of Dr. Rudolf Messel, the Badische

Anilin & Soda Fabrik, the Mannheim Chemische Verein, and Haenisch and Schröder, will always be associated. Their success has been won after years of laborious and disappointing work, with how many delays due to ambiguous or apparently contradictory results perhaps only those who have assisted in working out large scale contact processes can guess. The contact process is now universally employed for the manufacture of sulphuric anhydride and in many cases for the manufacture of the higher strengths of ordinary sulphuric acid. Whether or not in the future the contact process will replace the lead chamber method it is hard to say. Before it does so however material advances will have to be made with respect to the life and cost for renewal of the contact material and the completeness of the reaction. We must on the other hand bear in mind that, during the last fifteen years, improvements have been effected in the old lead chamber process. This process, after the adoption of the Glover and Gay Lussac tower combination, appeared to be a process leaving little room for improvement. The production from the sulphur employed was readily maintained at over 96%, the repairs were small and the working costs low, the only drawback being the heavy capital expenditure. In France I believe, first, and then in Germany and the United States determined efforts were made to reduce this drawback. In other words, to increase the production of sulphuric acid from a given chamber space.

The lines on which this has been effected are contained in the following sentence which I quote from a paper read in 1882 by the late Dr. Ferdinand Hurter:—

"The reaction in the chamber produces a great quantity of heat which must be dissipated, as condensation can only proceed in proportion to the amount of heat removed";—and Dr. Hurter proceeds to remark that "the introduction of the Sprengel water spray will probably lead to a reduction in chamber space."

Success in this direction has been attained by the use of water sprays in the leading chambers instead of the steam formerly employed to supply the necessary moisture and by the use of intermediate towers in which the gases are cooled while passing from one chamber to another. By means of these devices the output of sulphuric acid chambers has been increased by about 40% without any material increase in the cost of manufacture. This intensified working is now very general on the Continent and in the United States and is being slowly introduced into Great Britain.

Another very important improvement is the now well-known method of sulphur recovery which we owe to Mr. A. M. Chance of this city and which is known as the Chance-Claus process, whereby the old trouble of vat waste has been finally vanquished. The Claus kiln part of the process is not yet perfect, as about 15% of the sulphur entering the kiln escapes, but considerable improvements are in sight and it is reasonable to expect that the loss will be reduced before long. In the meantime, Chance's beautiful process enables us to place upon the market sulphur of the highest degree of purity. With this addition, the history of the sulphur used in the Leblanc process forms a cycle of operations commencing from the sulphur in the pyrites and passing through, successively, the conditions of sulphur dioxide, sulphuric acid, sodium sulphate, calcium sulphide, hydrogen sulphide and finally emerging as sulphur itself.

At one time it appeared that the rapid development of electrolysis would furnish a cheaper method of separating sodium from chlorine than a purely chemical process such as the Leblanc. Since the date of Mr. Muspratt's paper, two very ingenious electrical processes have been worked out on a manufacturing scale, and are now in force in large works, *viz.*, the Castner-Kellner and the Hargreaves-Bird. It seems to me, however, that there are two conditions which militate against any great development of electrolysis in soda manufacture in this country, neither of which are likely to be removed, the first is the low equivalent weight of sodium and the second the rising price of fuel.

The later period has been less rich than the earlier period in sensational technical developments, partly no doubt, because the process is older and the more obvious improvements were already worked, but, in addition I think, very much from the fact that, the period having been one, in the Leblanc industry at any rate, of severe struggle, there has been less money available for expensive experiments which must always precede any great technical improvement. This period has been one of attention to details, improvement in yields and in fuel economy, and not one of striking originality.

It always seems to me that, in the alkali manufacture, it is in times of prosperity and not of adversity that great advances have been made. The old text "to him that hath shall be given" has here again an application, that is, if he who hath does not wrap his talent in the napkin of sloth.

The fact is that the last twenty years has, in the main, been a period of depression for the Alkali and, indeed generally, for the chemical trades of this country, a fact of which individual experience has made the majority of us painfully aware. This period of depression, occurring simultaneously with great progress and expansion in other countries, notably in Germany and the United States, naturally turned the British mind from that condition of industrial satisfaction which, in the mid-Victorian age, coined the phrase "England the Workshop of the World," and which, in our more sober senses to-day, we are forced to recognise as one of industrial jingoism.

The rapidity with which Britain's rivals have reduced the British industrial lead is due, I consider, in the case of the group of industries with which I am connected, to three causes, all of which have been dealt with over and over again. My only excuse for again bringing them forward is that I think they have not yet been sufficiently driven home to us. The three causes to which I refer are:

1. The failure of Great Britain in the nineteenth century to keep abreast of modern progress, not only in the giving of education but, worse still, in the appreciation of it when given.

2. The grotesque failure of the British patent law to secure for the general good that "consideration" for which alone the monopoly is granted.

3. The loss of markets due to the protection and tariffs adopted by many of our old and important customers.

With the education question I shall deal later and will now pass on for a few moments to our patent law.

It is quite unnecessary for me to detain you by repeating the facts and arguments which have been already so well expressed on many occasions, but I must refer with pride to the fact that in the agitation for the reform of our pernicious patent laws the Society of Chemical Industry has played an important part in which a Past-President, Mr. Ivan Levinstein, has been a moving spirit. This agitation led, as we all know, to the appointment of a deputation from the Associated Chambers of Commerce which in April 1906 waited upon the President of the Board of Trade. A verbatim report of the proceedings has been published in pamphlet form by the Manchester Chamber. No sane man can, I think, read this report, especially the speeches of Mr. Levinstein and Sir Joseph Lawrence, without being convinced of the vital importance of reform. The case presented by the deputation was much strengthened by the speakers emphasising on our behalf that we are willing that our own and the foreign patentees shall be treated absolutely alike, each being subject to exactly the same regulations; for instance those with respect to compulsory licenses and compulsory working which embody the most important of the changes required.

A Bill has been introduced by Mr. Lloyd George which appears to me to deal effectively with the subject. This Bill has passed through the committee stage of the House of Commons and if passed into law, which there is every reason to hope, the British inventor and the foreign inventor will for the first time each of them have a fair field and no favour, and the British public will receive the "consideration" for which the monopoly is granted, *viz.:* that the invention, if protected, shall be worked in this country.

Loss of Markets.

I give below a table of figures shewing our exports and imports of alkali and bleaching powder for a series of years:

Year.	Bleach.		Alkali.		Caustic Soda.	
	Exports.	Imports.	Exports.	Imports.	Exports.	Imports.
	tons.	tons.	tons.	tons.	tons.	
1870	18,236		111,021		21,813	
1871	23,421		121,137		26,879	
1872	28,410		131,805		27,121	
1873	30,843		133,779		33,465	
1874	32,072		123,928		40,990	
1875	40,306		118,184		38,562	
1876	46,929		143,578		42,818	
1877	50,374		145,012		45,501	
1878	55,167		141,266		50,488	
1879	58,256		158,698		53,650	
1880	72,692		180,649		62,993	
1881	74,016		164,617		64,966	
1882	78,470		176,922		75,933	
1883	78,891		188,478		78,793	
1884	80,542		160,538		87,437	
1885	76,036		162,596		89,280	
1886	75,358		157,282		84,890	
1887	75,835		148,586		101,193	
1888	78,405		163,260		100,670	
1889	74,944		167,395		98,749	
1890	85,149		176,158	1,867	97,361	
1891	75,361		179,857	4,359	98,214	
1892	73,606		182,847	2,385	78,350	
1893	66,351		180,814	4,385	72,396	
1894	63,273		177,144	7,782	78,623	
1895	69,624		179,576	9,206	91,388	
1896	59,643		124,355	8,808	76,181	
1897	58,249		121,218	11,370	89,081	
1898	55,950		87,375	11,987	74,513	
1899	64,336		88,819	11 888	74,129	
1900	64,662		82,422	16,103	71,169	
1901	49,854	12,418	64,338	13,107	54,164	
1902	42,838	13,168	67,097	12,456	66,841	
1903	58,840	12,045	65,460	15,726	65,023	
1904	37,125	11,882	68,119	15,771	69,294	
1905	47,031	11,904	75,632	17,587	73,872	
1906	50,025	11,874	98,483	15,015	80,272	

We see that the exports of alkali and bleaching powder increased steadily and rapidly up to about 1880, after which they remained stationary until the early nineties and then quickly fell away, while after 1900 a small but quite appreciable tonnage of imports of both alkali and bleaching powder made their appearance.

The reduction in exports is well shewn by the following average figures:

	Soda Ash. Net exports.	Bleaching Powder. Net exports.	Caustic Soda. Exports.
	tons.	tons.	tons.
Yearly average for six years ending 1885 .	164,385	77,509	97,013
Yearly average for six years ending 1906 .	58,211	34,732	77,509

These reductions in export are explained, not that we have been beaten by our former customers being able to manufacture more cheaply than we can, but simply by their fiscal policy which practically excludes us from their markets.

The following table shews the import duties against which we have to contend in some of the countries which used to be our important customers:

Import Duties.

	Bleaching Powder.	Soda Ash.	Caustic Soda.
	£ s. d.	£ s. d.	£ s. d.
Germany............	0 10 2	0 15 3	1 15 7
France..............	1 9 0	1 13 4	2 12 10
Spain	1 4 4	1 4 4	1 16 7
Russia	7 11 9	5 19 3	9 15 1
United States	0 18 8	1 14 6	3 10 0

2.—Transport Facilities.

Mr. Muspratt in 1886 read the signs of change very accurately when he pointed to the probability that industry in this country would be hampered by inferiority of transport facilities as compared with those enjoyed by other countries, our industrial rivals.

I am glad to think that our Society is taking its part in pointing out the defects of our present system. You are probably aware that our Council in 1903 appointed a Committee (called the Internal Transport Committee) to keep watch and to collect information upon the subject. This Committee published a Report which appeared in the Journal, dated Feb. 29th, 1904, and which gives briefly the only reliable figures that I have seen indicating for a number of chemical manufactures the proportion which the total freight charges on raw materials and finished products bear to the sale price of the finished goods. I think that few of us realised before these figures were known how important this proportion is. The Committee have lately been engaged in the preparation of evidence to be offered by the Society to the Royal Commission which is at present investigating the question.

I am sure that we are all glad to see that among the many able and distinguished men who are members of this Commission—and in whose hands an important factor in the industrial future of this country may be said to rest—is one of the original members of the Society of Chemical Industry, the Right Hon. Sir John Brunner, who has for years been deeply impressed with the importance of removing from our industries the handicap of inferior means of transport.

From the figures collected by the Committee I find that, if the cost of transport in this country were as low as it is in Germany and Belgium to-day, chemical products would be cheaper to produce by on the average 10% of the sale price; 10%, just think of it! Here is a possibility of 10% rise in price for the manufacturer with no disadvantage to the consumer.

The reasons for the German and Belgian superiority appear to be twofold:

Firstly the railway charges themselves are [much lower there than here for goods in Class C. of our railway classification. The rates there are only 60% of the rates here.

Secondly. The fact that a large part of the goods traffic both in Germany and Belgium is carried by river and canal on which the rates are materially less than by rail.

Sir Cecil Hertslet, the British Consul General in Belgium, in his evidence before the present Canal Commission, gives a comparison in tabular form of the cost of transport in Belgium by rail and canal respectively. The table comprises a large number of examples varying in mileage from 30 to 94 miles for a number of different classes of goods. The general result shews that their canal rate for the same service is only 57% of their railway rate or say about 30% of our general railway rate.

In support of this I may add an extract from a letter on the subject addressed to the United Alkali Co. from Messrs. J. P. Best & Co., the well known forwarding agents of Antwerp, Ghent, Flushing and other places.

"In a word we consider the facilities offered in Belgium for carriage by water are of immense value to commerce and industry. It is not an exaggeration to say that there must be a saving of at least 25 to 50% in favour of water carriage."

Great Britain has railways and canals. Why are the results so poor from the manufacturer's point of view? We are proud of our railways. The permanent way and passenger rolling stock are at least as good as any in the world. The administration is pure, and, in their dealing with traders, my experience is that the railway companies are fair, reasonable and conciliatory. But the fact is patent to all that the carriage by rail of our raw materials and products is too costly. Why? I am not a railway expert, but no one can fail to notice that the German and Belgian lines have cost less than ours, notably in connection with the terminals and the small goods traffic. Further, that they are state owned and, while they shew a profit, they are actually worked with the object of developing their country's resources and fostering her industries. The railways in these two countries are further stimulated by the very real and effective competition of a splendid and ever improving system of inland waterways.

In Great Britain, with very few exceptions, the waterways have remained unaltered and in the condition they were before the days of railway development. As a result, our present canal system suffers generally from being of too small a gauge to allow of economical conveyance of goods and worse still, the gauge varies. Though some of the canals forming the several through routes are of sufficiently large size to take barges carrying 60 to 100 tons cargo, there are links on each of the through routes which prevent the transit of boats carrying more than 25 or even 18 tons of cargo.

Again this is not all. Suppose for instance goods are to be brought from Birmingham to Liverpool for shipment. They will have to start in an 18-ton long boat and then be transhipped into a larger and more seaworthy vessel before passing out on to the rougher water of the Mersey estuary. The canals were made originally in small lengths each by a separate and independent company, and so to the present day do they remain.

There is no canal clearing house, and great difficulties are experienced in getting through rates. When through rates are obtained it is invariably found that even for journeys of considerable length the distance travelled on any one canal is not sufficient to give any advantage from the reduction per mile, after the first thirty miles, on a single canal. The whole through toll is really at the mercy of individual links, and sometimes very small links in the chain forming the through route.

The following table shews what I mean and presents an analysis of the through toll charged on a considerable acid trade between the Weston works of the United Alkali Co. and Wolverhampton, a distance of 77 miles:

From	To	Miles.	Canal.	Toll including returned empties.	
				Per ton.	Per ton mile.
				d.	d.
Weston	Anderton	11½	Weaver	8½	·74
Anderton	Wardle Lock	10	N. Staffordshire	7	·7
Wardle	Antherley	53	Shropshire Union	38	·72
Antherley	Aldesley	½	Staffs. and Worcester	6	12·
Aldesley	Wolverhampton	2	Birmingham	3½	1·75
Weston	Wolverhampton	77		63	·82

It is hopeless to compare our canals with those on the Continent when for a journey of 77 miles the toll works out at ·82d. per ton mile, and the biggest boat that can be employed is one carrying an 18-ton cargo.

Naturally we have a great advantage over continental countries from the fact that we live on an island and that the distance from our great manufacturing centres to one or more of our chief ports, viz.: London, Liverpool, Bristol and Hull does not exceed 100 miles. This advantage is at present to a great extent thrown away through the economic inefficiency of our canals and of our overcapitalised railways.

We can only hope that the real hard work being performed and the genuine enthusiasm for reform shewn by the present Royal Commission will be productive of practical results. These results depend largely on bodies such as Chambers of Commerce and Societies such as ours to supply the outside pressure without which no Royal Commission can hope to carry its conclusions to a legislative or administrative reform. Let us then as individuals and as a Society see to it that nothing within our power is left undone to remind British manufacturers of the handicap from which they suffer and the possibility, if not of removing it altogether, at any rate of reducing it very considerably.

3.—Fuel.

Another instance of the changing conditions is afforded by the gradual rise in the value of fuel. Fifty years ago alkali manufacturers situated in this country, always within short distances of the collieries, possessed an apparently inexhaustible supply of cheap and excellent small coal or "slack." The following table gives the yearly approximate average price paid in S.W. Lancashire for firing slack delivered at the consumers' works.

Average prices firing slack delivered at works in S.W. Lancashire.

Year.	s. d.	Year.	s. d.	Year.	s. d.
1855	4 9	1872	5 3	1889	4 3
1856	4 3	1873	13 0	1890	6 6
1857	4 3	1874	8 9	1891	7 7
1858	3 9	1875	5 9	1892	5 9
1859	3 9	1876	5 0	*1893	5 5
1860	4 9	1877	4 6	1894	6 3
1861	5 0	1878	4 3	1895	5 7
1862	4 3	1879	4 0	1896	5 0
1863	4 3	1880	4 3	1897	5 1
1864	2 9	1881	4 9	1898	5 1½
1865	3 6	1882	4 9	1899	6 3
1866	3 9	1883	4 9	1900	8 7
1867	5 0	1884	4 6	1901	8 10
1868	5 3	1885	4 3	1902	7 3
1869	4 3	1886	4 3	1903	6 11
1870	3 9	1887	4 0	1904	6 10¾
1871	4 0	1888	3 9	1905	6 9
				1906	6 11¼

* 1893, the year of a great strike, 5/5 was average price of contracts, but slack from outside districts had to be purchased at an average price of about 14/-.

The average price of firing slack for the six years ending 1860 was 4/3 per ton, whilst for the six years ending 1906 it was 7/3 per ton. Such a rise (70 per cent.) in price of one of the most important raw materials is a factor of enormous importance in any industry, and necessitates a complete change of method.

Fifty years ago fuel economy for all purposes, whether for power, for concentration of liquids, or for furnace work, was of comparatively little importance, and in my early days, the days of rapidly increasing demand, when every effort was turned to increased production, fuel economy received small attention. The Continental manufacturers, on the other hand, especially in Germany, were from the start handicapped by fuel prices two to three times as high as our own. As is naturally to be expected, then, it is to Germany we have to look for the development of fuel-saving devices, which in my opinion are destined to play an ever-increasing part in our own technology. In the production of economical steam engines and efficient boilers the mechanical engineers of Great Britain have held their own, thanks largely to the experience in and requirements of marine engineering.

British manufacturers have, however, up to very recently, especially in the Leblanc industries, been far behind their German competitors in adapting to technical purposes the successes of mechanical engineering and in developing the possibilities of the economical concentration of liquids. I cannot say, however, that I consider the home manufacturers to be blamed for their slowness in adopting what are certainly technical improvements, but which involve so heavy an expenditure of capital, because with fuel at about 5/- a ton, as it was with one notable exception till 1898, the return on the expenditure was small. Now, however, that fuel prices have risen to 7/- a ton, the situation is changed, the inducement to scrap old inefficient plant and replace it by modern types is sufficient, and I look forward to rapid changes in the methods of fuel consumption in this country. From the manufacturers' point of view it is a misfortune to be forced to expend a serious amount of capital simply to place ourselves in the position, so far as fuel charges are concerned, in which we were 10 years ago. But we have this advantage over Continental manufacturers in the past that in many directions the pioneer work has been already done, and expensive experiments have been made and finished.

4.—Labour.

I now come to the fourth division of my subject, and perhaps the most difficult of all, *viz.*: the question of Labour.

The last half century has been marked by an advance in the rate of wages all round, but I believe that, taken on the whole, the advance in the rate of wages has not been accompanied by a corresponding increase in the wages paid per ton of product owing to the improvements in apparatus and conditions of labour.

Mr. Joseph Morrison has kindly furnished me with figures showing the rise that has taken place in wages of process men and artisans in Widnes, during the period between 1868 and 1906:

Process men, about 25%. Artisans, with whom the working day is now 9 instead of 10 hours in length: Joiners, 12%; bricksetters, 11%; plumbers, 12%; labourers, 14%.

Throughout my period there have been a succession of what have proved to be on the whole wise and salutory measures taken by the Government to improve the condition of the workers. I do not think that, apart from a few questions of detail and in rare cases of administration, any manufacturer is inclined to grumble at the working of the Factory Acts.

With respect to the Workmen's Compensation Act which came into force on the 1st of this month, it is far too early yet to say what the effect will be upon the industries of the country, and upon the working men themselves. I do not think that we can fail to see that the Workmen's Compensation Act, with its somewhat unexpected development to cover the domestic servant, is a step in the direction of universal national insurance. In the meantime, especially as the tendency for large employers of labour is to take the risk themselves, and not to employ insurance companies, it will, I fear, add to the temptation given by the Act itself, to weed out the weak and ailing, the partially crippled and the elderly. If this is so, there will be additional suffering among those whom nature has not so well equipped for the struggle of life. Again, it does not appear to me satisfactory, that of two men equally qualified for a particular job, it should be to the employer's interest to take the unmarried man rather than the married. While the law is as it is at present with respect to Workmen's Compensation, involving, so far as we can see at present, a not very large charge on the employer, a charge which I do not think the employers should grudge, and which I do not think they do grudge, still I hope the day is not far off when universal State insurance will spread the risk over the whole community, and remove finally the temptation to make the lot of the weak, the elderly, or the married man or woman harder than is necessary.

The great question of shorter hours of labour, in other words of a universal eight-hours day, is, through the steady continuous pressure of the Labour Unions and the now comparatively large number of Labour Members of Parliament, being slowly drawn within the range of practical politics. Here we come across what I think might become a serious danger to any but the most successful manufacturer. While no thinking man can help sympathising with, and wherever possible aiding his employees to obtain more time for themselves, more time to live in their homes with their families and their hobbies, I do not think that the excellence of the object should blind us to the practical dangers of sweeping changes. I know from our own experience that in some departments, where the work involves heavy physical or mental strain, the change from two shifts of twelve hours to three shifts of eight hours, even though it entails the employment each 24 hours of an extra man on the same apparatus, results in a reduction of the labour cost per ton of product, and better yields. I know, on the other hand, that in many instances, I fear perhaps in most, the compensating increase in output or reduction of waste, is not, and cannot be obtained. Mr. Arthur Shadwell, in his book on Industrial Efficiency, states that "At the Trades Union Congress in the autumn of 1905, acquiescence in a resolution in favour of the eight hour day was expressly refused on behalf of the Lancashire Cotton Workers on the ground that they could not afford to shorten hours until they are reduced in other countries." In the case of the industry with which I am personally connected, with the best will in the world, we have been unable to put more than about one-third of our process men on the eight-hour shift. In some instances, indeed, after once going on to the eight hours, we have been forced to return to the twelve hours, with all the admitted evils of the double shift at the week end. It is well to remember that by far the largest part of the cost of materials represents ultimately a labour charge, and if by legislation a change is enforced in any one country, which practically increases the cost of labour, the price of all commodities will rise of necessity almost *pro rata*. Our country would, as a result, be most seriously hampered in the international fight for industrial existence. It is not easy to conceive, on the other hand, a practical measure which would produce more generally beneficent results on the physical and moral well-being of the human race than an international eight-hours law throughout the civilised world for certain occupations for which from time to time the eight hours system may be considered suitable. Perhaps some day such a subject may fall within the limits of a "Hague Tribunal."

In a word, the general labour conditions are all tending by actual rise in wages, by restriction of hours of labour, and by the extension of the legal obligations of the employer, to raise the total labour cost of our products. The same tendency is showing itself in an even more marked degree in Germany. It is within my knowledge that, in the course of the last fourteen years, the average wages of process men and labourers in two large chemical works in the Rhineland district have risen 30%, and are now practically the same as our Lancashire wages. In addition, the legal charges and liabilities of the employers for insurance and compensation are greater than ours are. The result will be undoubtedly, both in this country and in Germany, that there will be a large extension in the use of labour-saving machinery and in devices which already have been developed with so much ingenuity and skill in the United States of America.

No. 5.—Education.

I feel most seriously that in attempting to discuss this much debated question, that question above all others which has received the anxious consideration of and which has been illuminated by the weighty utterances of so many intellectual giants of the day, I am rash even to the verge of presumption. Still, there are some points on which I feel strongly, and I propose with the greatest diffidence to place them before you.

For many years past, the excellence of the scientific training in the German universities and technical high schools has been held up to us as a standard for this country to emulate. No one doubts to-day that much of the development of the German chemical industry is due to the large supply of highly trained men available in that country for technical purposes. From figures very kindly obtained for me by Mr. Fritz Vorster, of Cologne, from Professor Duisberg, of Elberfeld, I am able to give, for 1904 and 1905, the number of chemical students who obtained the doctor's diploma and the technical high school diplomas in Germany:—1904, summer and winter terms, 421; 1905, do., 376. The figures are, I understand, abstracted from a statistical Report, prepared by the secretary of the Society of German Chemists. This is a very large supply of trained men, and Professor Duisberg goes on to say that of these men, as they leave the University and High School, the majority become professors at high schools, and the remainder become works' chemists, analytical chemists, research chemists, and works' managers. Considerable light is thrown upon the number and distribution of the chemists who select a technical career by the following table, which I have abstracted from a most interesting and exhaustive paper by Professor Duisberg, published in 1896. The table is ten years old, but is none the less interesting on that account. We have every reason to believe that a similar table, prepared to illustrate the conditions to-day, would be even more striking :—

Branches of Chemical Industry.	Number of Works.	Number of Chemists.	Chemists who passed College matric.	Chemists trained in Universities only.	Ditto in technical high schools only.	Ditto trained in both.	Ditto obtained technical diploma.	Ditto obtained Dr.'s diploma.	Ditto obtained both diplomas.	Ditto University Education. No diploma.	Works who ask for diplomas.	Ditto who don't make it conditional.	Works who require additional engineering knowledge.	Works not requiring technical training at all.
Metallurgy	5	24	18	8	6	6	5	9	1	1	3	2	—	—
Heavy Chemicals	13	90	57	27	27	37	9	42	2	5	3	6	3	—
Manure Works .	4	8	6	6	2	—	—	6	1	—	3	1	—	—
Salt Works	4	25	14	8	4	13	—	16	—	3	2	1	1	—
Inorganic Products	2	7	6	5	1	1	—	5	—	—	1	1	—	—
Mineral Colours, &c.	1	3	1	2	1	—	—	1	—	1	1	—	—	—
Fine Chemicals .	6	26	16	18	2	5	2	17	1	5	6	—	—	—
Organic, Aniline, Glycerine, &c.	14	56	45	28	11	16	7	41	3	2	9	2	1	1
Tar Distillation	10	26	23	9	7	10	4	15	1	—	6	3	1	—
Explosives	4	28	23	8	10	7	1	8	2	3	1	2	1	—
Tar Colours	9	241	182	115	28	93	24	194	20	12	3	5	1	—
Pharmaceutical .	7	81	45	40	10	25	9	58	2	13	3	—	2	—
Essential Oils ..	3	13	9	9	—	3	—	12	—	1	2	—	—	—
Textile printers	1	5	3	1	—	3	1	2	1	1	1	—	—	—
Grand Total .	83	633	448	284	109	219	62	426	34	47	44	23	10	1

Mr. Max Hasenclever has very kindly given me the following most useful information on the utilisation and training of chemists in the German heavy chemical trade :—" In our industry every process is placed under the management of a duly trained chemist, who has to take the responsibility for good working. For these chemists we provide residences in the neighbourhood of our works, in order that they may be at hand when necessary." Mr. Paul Kestner has very kindly obtained for me the following very interesting information as to the output of trained chemists in France :—" The following is the information that I have been able to obtain to this date concerning the young men who each year pass into business having the diploma of chemist or engineer-chemist :—

Number of Diplomas given yearly :—

Université de Rennes, 1.
Ecole des Htes. Etudes Industrielles, Lille, 2.
Ecole de Chimie de Lyon, 16 (11 years average).
Ecole de Chimie de Rouen, 6.
Université de Lille, 7 (3 years av.).
Institut Chimique de Nancy, 26 (6 years av.).
Université de Paris, 30 (8 years av.).
Ecole des Arts & Manufactures de Paris, 15.
Ecole de Physique & de Chimie de Paris, 20.
Ecole de Physique & de Chimie de Paris, 20 (6 years av.).
Institut Industriel du Nord, Lille, 19.
Institut Agronomique de Paris, 73 (11 years av.).
Université de Toulouse, 3.
Ecole d Ingénieurs de Marseille, 10.
Institut Technique Roubaisien, Roubaix, 6.
Ecole Nationale des Arts Industriels de Roubaix (Nord), 5.

The situation with regard to higher scientific education as far as this country is concerned, is, I consider, very well summed up by Mr. Shadwell in his " Industrial Efficiency." Mr. Shadwell says that German High Schools are represented in England by the Universities and Special Colleges of Science. " Here again a marked development has taken place in recent years, both in the establishment of science departments in the old universities, particularly of Cambridge, and still more in the growth of the new universities London, Manchester, Liverpool, Birmingham, Leeds, Sheffield, and South Wales. I understand from the highest authorities that in equipment and teaching, our higher science schools are not inferior, sometimes they are superior, to similar schools elsewhere. When comparisons are made between the number of students of engineering, for instance, at science schools here and in Germany, it is putting the boot on the wrong leg to call for more schools. The real difference lies in the lack of scholars, and the reason is that the manufacturers in Germany and elsewhere have long ago realised the value of highly trained men in industry, and have created a demand for them."

Elementary and Technical Education.—Considerable as are the changes which have taken place in education of the staff in our manufactories since the time when I first entered the chemical trade, they are entirely dwarfed by those which have taken place in the education of the men. I have watched one or two generations of boys grow up to men in our works in Widnes, and whatever may be the deterioration in physique and stamina that have been produced by exhausting work and town or even slum life, there is no doubt that the boys and young men of to-day are intellectually brighter than the boys and young men of fifty years ago. Defects there have undoubtedly been in the educational organisation, defects due to lack of system, and especially to lack of adequately trained teachers, but the final result is a distinct improvement in mental acuteness or the power to grasp, to appreciate, and to meet new conditions. Whether the average product of our elementary schools is even yet equal to the average product of the German schools, with their superior and better trained teaching staff, I have little means of judging, but I can certainly testify to a distinct and marked improvement in this country.

In connection with the elementary education, I particularly want to make a few remarks on the evening continuation classes in the so-called technical schools, which are a marked feature of the modern system, especially in Lancashire. In the first place, these continuation classes are intended for the boys who have left the elementary school, and in some capacity or other are starting to earn their own daily bread. They tend not only to add to the meagre knowledge the elementary school has managed to instil, but perhaps, which is more important, they prevent, during the first thoughtless years of youth, the loss of what has been already learnt. This country, and of course other countries as well are spending in the aggregate enormous sums of money on elementary education, and there is a very serious risk of a large proportion of this expenditure becoming unproductive if at the age of 14 the children pass direct into the struggle of daily life with no compulsion and little inducement to maintain this meagre store of knowledge. In Germany, these evening continuation schools are also established in many places, and in some, attendance is compulsory for a few hours a week from the ages of 14 to 17. No doubt it seems hard on the youngsters that, while still practically children, they should be forced to attend classes in the evenings after the close of their day's work, but I wish very seriously to commend to your consideration the question, whether it would not be wiser, in the interests of the boys themselves and of the community who have already made so many sacrifices for elementary education, to make the attendance compulsory. I cannot think that two hours two evenings a week in the winter months for the two years after leaving the elementary school would constitute a great hardship or a great additional expense to the community, and I feel strongly that the country would reap the benefit. So keenly do many manufacturers of my acquaintance feel as to the desirability of the continuation classes, that they have made it a condition of employment when engaging boys that they shall attend a certain number of evening classes during the winter, the employers, of course, in these cases paying the fees.

Mr. Shadwell, in his interesting book to which I have before referred, points out a most important difference between the technical school development in Germany and in this country. In Germany, he states, "the technical schools supply the large industries mainly from above, they train men who have previously had a superior general education as heads, officials, and experts. In England they supply mainly from below; they educate boys belonging to the working classes, boys at work in the mill or at the forge, into foremen, overlookers, managers, and experts. In Germany, the real work of the technical schools is done in day classes, in England, in evening ones." This is a most important difference, and I understand that in Germany they have no such phenomena as the evening classes in the technical schools of the North of England, which are crowded with boys and men of the working classes. It really appears to me as if England were about to take the lead in a movement, the importance of which in chemical manufacture cannot be exaggerated, a movement to develop a better type of foreman. It is difficult to adequately appreciate the importance of the part played by these non-commissioned officers of industry, a part at least as important as that played by their highly trained prototype in the army.

I should like to conclude my remarks on education by still another quotation from Mr. Shadwell, who says:—

> "Summing up this comparison (between Germany and England), we may say that while England has long been backward in technical education, it has of late years righted itself with so much energy that the provision from below is already greatly superior to that of Germany, and the provision from above has at least equal potentiality if the same use is made of it."

Before leaving altogether the question of education, I should like in the strongest terms to give my support to the principles underlying Professor Meldola's recent presidential address to the Chemical Society. The work of the pure scientist is inseparably connected with every department of material progress, and every progressive country owes it to its own fair fame to bear its part in the advancement of knowledge of nature's laws. The maintenance and endowment of institutions and organisations for pure research whether physical, chemical, or physiological is, in my opinion, not only the duty of the community as a whole, but pre-eminently so of those to whom technical success has brought material prosperity. We have in this country a number of institutions devoted to research, but in my opinion one and all are insufficiently supported.

Dr. Mond's princely gift to the Royal Institution is an example we should all like to see imitated, and I feel confident that an extension of the public and private support, not only to the Royal Institution, but to the National Physical Laboratory and the Research Fund of the Chemical Society, would not only increase our prestige as an enlightened and progressive people, but from the more sordid point of view of material prosperity prove a good investment.

I must now draw my desultory remarks to a close, and in doing so, apologise for their inordinate length. I only hope that some of the points I have mentioned may, from the very fact of their having been once again raised and discussed, be brought by ever so little nearer to a satisfactory solution. In the highly complex system of modern industry in which so many agents and factors, government, capital, technical training, labour, supplies of raw materials, transport, and markets each play an important and essential part, it is no easy matter to adjudicate the respective praise or blame for prosperity or adversity. While on the whole I do not wish to acquit the manufacturer or capitalist for the share he has undoubtedly taken in delaying the progress of our industries by the failure to demand the highest educational facilities for his staff, or even to make use of highly-trained brains when such have been available, it appears to me that want of foresight on the part of Parliament is responsible for a great portion of the disadvantages under which we have laboured.

Before I sit down I wish to offer my hearty thanks to Mr. Fritz Vorster, Mr. Max Hasenclever, Mr. Paul Kestner, and Dr. Hawliczek for the very valuable information which they have so generously given to me, and which has been of the greatest assistance to me in the preparation of my Address.

Sir **Boverton Redwood** said he was sure they were all agreed that that eminently practical and most suggestive address to which they had just listened, was well worthy to rank with those which had preceded it. He supposed that they must admit that there was room for differences of opinion respecting the causes of the unsatisfactory features of the country's position in the chemical industry, to which the President had alluded. But it was clear that nothing but benefit could result from a careful study of the review which had been presented to them with all Mr. Carey's long experience justifying the remarks which he had made. And there again they saw in that address an illustration of the public benefits conferred by that Society in furnishing an opportunity for the periodical dissemination, through addresses, of highly specialised knowledge. Mr. Carey had not hesitated to point out directions in which they could move, with the object of placing themselves in a better position to meet the ever-increasing keenness of competition from other nations. The causes of their difficulties which Mr. Carey had put before them, would, undoubtedly, receive the most serious consideration. Such weighty remarks were deserving of the widest possible publicity. It was true that this country occupied a position of great advantage as a centre of manufactures, but they must all now admit that they had relied too much on their natural advantages. They were, he trusted, awakening to the fact that those advantages were not alone sufficient for the maintenance of commercial supremacy, and to think there was reason that their lost ground might be regained. He proposed, for their acceptance, a very cordial vote of thanks to Mr. Carey for his presidential address.

Professor **Frankland**, in seconding the vote of thanks, said what an exceptional opportunity it was to listen to the experience of a man who, like the President, had been associated almost entirely with one industry, and that one of the most important industries of the country, for a period of fifty years. Mr. Carey had touched on subjects, social and political, interesting to an even wider circle. Indeed, he would like to see that address put into the hands of every member of Parliament to commit to heart. Academic teachers of chemistry should be very grateful to Mr. Carey for his remarks on the scientific training needed to-day. He had not complained, on the other hand, that manufacturers were not taking advantage of the men who had been trained in the schools. The address was a most valuable contribution to chemical industry.

The vote of thanks was passed by acclamation.

The **President** thanked Sir Boverton Redwood and Professor Frankland heartily for the very kind way in which they had spoken of his address, and also the meeting for the way in which they had received the too kind words of those who had proposed and seconded the vote.

Re-appointment of Auditors

Mr. C. **Rawson** proposed that the auditors, Messrs. Miall, Wilkins, Randall & Co., who had done their work so well in the past, be re-appointed at a remuneration of ten guineas. Mr. J. M. Gibson seconded, and the resolution was carried unanimously.

Place of Next Meeting.

Dr. J. T. Dunn (Newcastle-on-Tyne), as Vice-Chairman of the Newcastle Section, said he had first to express his regret that the Chairman of the Section, Professor Louis, was not there to make the proposition which he had to submit to them, but he had been called out of the country. He had to propose that the next meeting of the Society be held at Newcastle. Newcastle was not unknown to them. It was at Newcastle that one of the first meetings was held, twenty-three years ago. Chemical industries were by no means the same as they were in 1884. There had, indeed, been changes, to which the President had referred, but there were signs that the phœnix was now rising from its ashes; there were new industries on the Tyne which were not there then, and it might be, that next year, Newcastle would have something novel to show the Society.

Mr. N. H. Martin, as Chairman-elect of the Section, heartily concurred with all that Dr. Dunn had said. They would have the cordial co-operation of the civic authorities and of the University of Newcastle. Their Section had been in other directions so industrious that he could assure the members, and the ladies especially, that they would not find them so "dour" as they supposed. He had the greatest pleasure in seconding the resolution.

Sir Samuel Sadler supported the resolution. They did not look upon Middlesborough as a thing of beauty or a joy for ever, but he could assure them they would be able to show them some wonderful improvements which had taken place in the town in the last twenty or thirty years. They in Middlesborough were not connected with that rule-of-thumb which had been a disgrace for so many years. They were only fifty or sixty years old but they had done a good deal in that time; they had built up a great town. Their motto was *Erimus*. To-day with that motto in their hearts and a good deal to encourage them in their lives, they challenged the world in cheap steel and other things they were interested in, and if the Society came, they then would be shown a town that had only some fifty years over it, but that had learned something in that short period.

On the motion being put to the meeting, it was unanimously carried.

Votes of Thanks.

Dr. E. Divers was very pleased to have been intrusted with the proposal of a vote of thanks to the University for lending the room for the purpose of that meeting. At their annual meetings they were so entirely dependent on the kindness and hospitality of those they visited, that without it, their visits would be practically a failure. In proposing the vote of thanks, he would like to congratulate Birmingham on the great success which had attended its efforts in regard to the University, in which respect it was not behind any other city of England. Forty years ago he used to lecture on Materia Medica at Queen's College, the fore-runner of Mason College, which had become the University. He had also had to do with the founding of another great University, the principal University in Japan. When he went out to that country, it was in connection with a College which, like the Mason College of Birmingham, was to become, by affiliation with other institutions, the University of Tokyo. The vast success of Japan in its wars and manufactures and financial affairs was due to the fact that it had fully recognised that importance of science in all departments of public life, the recognition of which in this country had brought about the organisation of the Science Guild, which was not to encourage special sciences, but to bring science into all parts of social life. They had a considerable number of Japanese members of the Society. In no part of the world was the Society of Chemical Industry more keenly appreciated. He had very great pleasure in proposing a vote of thanks to the University authorities for allowing them to hold their meeting in that building.

Dr. R. Greig-Smith, as representing a Section in a land beyond the seas, begged to second the vote of thanks.

The vote was passed unanimously, and the proceedings terminated.

The members and the guests now adjourned to the Grand Hotel, where they were entertained at luncheon, by the Committee.

The Luncheon.

The luncheon was served in the Grosvenor Room, the banqueting hall of the Grand Hotel. The President, Mr. Eustace Carey presided. After the luncheon:

Professor Frankland extended a hearty welcome to all in the name of the Committee and the local gentlemen who were associated with them as a Reception Committee; it was a matter of great satisfaction to see so many with whom he had been associated for five-and-twenty years at least, and identified with that Society since its foundation. In the name of the Section and of the Reception Committee he would express the hope that the meeting would be a great success.

VISITS TO WORKS AND PLACES OF LOCAL INTEREST.

First Day.—Wednesday, July 10th.

Glass-Works of Messrs. F. and C. Osler, Limited.

Leader: H. L. Heathcote.

This firm was established in the year 1807. At first its work was confined to glass cutting, and among its productions the crystal fountain, exhibited at the International Exhibition of 1851, stands pre-eminent. In later years glass-blowing works were established.

During the past fifteen years the firm has considerably extended the scope of its work, especially in the direction of brass-working. This was revealed by an inspection of the show room of the firm, where ornamental and decorative work, more particularly electric light fittings, occupied a prominent place.

Works of Messrs. Elkington and Co., Ltd.

Leaders: A. E. Tucker and W. A. S. Calder.

This firm holds warrants as Silversmiths to the King and most of the Royal and Imperial families of Europe. The complete process for the electro-deposition of metals was patented and secured by Messrs. G. R. and Henry Elkington in the year 1840, and its application to the manufacture of articles of everyday utility led to the founding of the firm of Elkington and Co., now holding for upwards of half a century the principal position in the trade. One of the specialities of the firm is the manufacture of table plate for hotel and steamship use. On account of the beauty and durability of silver and gold, large quantities of metal fittings of every variety are yearly plated by the firm with these metals. Plating with other metals, tin, copper, bronze, nickel, &c., is also extensively carried out.

Of especial interest is the application of the process of electro-deposition to the reproduction of works of art, and the firm holds the right from the State Department of Science and Art at South Kensington for the reproduction of the Art treasures of the National Museums.

The firm has a large department devoted to the production of solid silver ware of every description, with a staff of skilled artists continually employed in designing and modelling.

As an alternative entertainment an

Organ Recital was given on the Grand Organ of the Birmingham Town Hall

By Mr. C. W. Perkins, the City Organist.

In this Hall are held the series of triennial musical festivals for which since 1768, Birmingham has been noted. Here Mendelssohn's "Elijah" was produced on Aug. 25th, 1846, and conducted by the composer himself. The organ, a famous instrument, was built by Hill of London, in 1834, and cost about £3,000, a similar sum having been expended since, in additions to it.

Reception at the New University Buildings, at Bournbrook.

On arriving at the new buildings of the University, the members were conducted to its Great Hall, where they were received by the Vice-Chancellor, and the Principal of the University, Alderman C. G. Beale, M.A., J.P., and Sir Oliver Lodge, LL.D., F.R.S. After the Reception they were conducted, in parties of about thirty, to the different departments of the University, where they were received by the professors and lecturers, who explained the work carried on in the different laboratories. After the tour of inspection tea was served in the refectory.

The following notes, supplied by the respective Professors, indicate the work which will be carried on in the different departments.

Department of Mining and Metallurgy.—In the lower floor there is a coal mining laboratory, and draughting room, together with a metal mining laboratory for treating gold, silver, lead, and copper ores.

On the first floor is the metallurgical department. For lecture purposes, and for the teaching of assaying and analysis, provision is made in a large laboratory, where are the necessary rooms for dry assaying and for preparing and sampling metals and ores for testing, together with a balance room, store rooms, and room for the instructors in assaying. In addition, there are separate rooms for the electro-deposition of metals, the microscopic examination of metals and alloys, and the measurement of high temperatures. In the same block are rooms respectively for research students, the departmental library, and the Professor's private work. Above the smaller rooms, and lighted from above, is the metallurgical teaching museum, which already contains upwards of one thousand samples.

The other portion of the metallurgical department is in a separate building near to the power station. It is divided into two sections, one dealing with steel, and the other with gold, silver, copper, lead, and with alloys. The apparatus, all on a practical working scale, includes a two-ton Siemens steel furnace with electric hoist, crane, and boiler; a water-jacketed blast-furnace; roasting furnaces; a cyanide plant; a chlorination barrel, and an ore crusher. This plant is the most complete, for purposes of instruction, of its kind at present in the United Kingdom.

The Experimental Mine.—At the corner of the site there is an experimental mine which is unique in this country. It consists of about two acres of land under which is built an exact copy of the workings of a coal mine, illustrating the different methods of operation. Its purpose is to give practical illustration to the teaching of underground surveying and levelling, and connecting surface and underground surveys, and for demonstrating and investigating the peculiarities of mine ventilation, such as the splitting of air currents, losses due to pressure, and the characteristics of mechanically produced ventilation.

The Power Station contains three high-pressure boilers of 150-h.p. each, and two large heating boilers which are fitted with mechanical stokers. The engine room contains four samples of high-class modern practice in steam engine work, each engine being of about 100-h.p., and driving dynamos. In addition, there are two large gas engines, an oil engine, and an ammonia plant, so that the power station answers the double purpose of generating power and providing the laboratory for the instruction of students on the subject of heat engines. The foundry and forge are equipped with modern appliances for demonstrating foundry practice, and the general principles of smiths' work.

Mechanical Engineering.—In the basement there is a large machine shop furnished with all modern tools, and also a pattern shop. On the first floor is the large drawing office capable of seating some 120 students. There is also a Hall of machines, which it is hoped will contain examples of those machines which specially illustrate the industries of the locality.

Electrical Engineering and Civil Engineering.—This department contains a number of dynamos and motors of various types, and is equipped with complete arrangements for experimental work. Current is received from the power-station, and is transformed into a great variety of currents, all the circuits being controlled from the main switchboard. The currents are distributed by mains throughout both laboratories, so that students can get exactly the kind of current required for any particular work. The working places are fitted with supports for the instruments, and provision is made by which the accuracy of any instrument used by the student can be tested *in situ*. Students will thus be enabled to do accurate work. The present equipment, costing about £9,000, is sufficient to enable 20 students in each laboratory (or 40 students in all) to work simultaneously.

Civil Engineering Department.—Here is a complete hydraulic installation for experimental work on pumps, turbines, and the flow of water through pipes, this plant being capable of dealing with 600 gallons of water per minute. There is also a number of testing machines of different types, including a 50-ton Buckton machine, and there will shortly be put in an Avery machine of 300 tons capacity capable of testing bars up to 25 feet long, and a 100 ton Riehle machine. On the first floor are the cement testing rooms, drawing office, and standards room.

After an inspection of the buildings, laboratories, and installations of apparatus and machinery on a large scale which have already been made, and which were well explained by the lecturers and demonstrators of the several branches, the party partook of afternoon tea in the refectory.

Reception at the Council House.

In the evening, the Lord Mayor (the Right Hon. Henry J. Sayer, J.P.) and the Lady Mayoress held a reception and conversazione at the Council House, at which upwards of 300 ladies and gentlemen were present. A band was in attendance, and the reception rooms were tastefully decorated with flowers. Members of the City Council and of the staffs of the municipal secondary school, King Edward's school, and of the science faculties at the University were amongst those invited to meet the members of the Society.

Second Day.—Thursday, July 11th.

Morning Visits.

Works of Messrs. The British Thomson-Houston Co., Limited, Rugby.

Leaders: Messrs. Hall and Jackson.

A party of about 50 paid a visit to the extensive works of this firm, which cover a site of twenty-five and a half acres. There are fifteen large buildings, with a total floor space of 337,855 sq. ft. Power is obtained by means of Babcock & Wilcox boilers, each with a heating surface of 2530 sq. ft. and electrical generators with a total capacity of 1500 kilowatts.

Arrangements had been so made that this party could take train for Coventry so as to join there the afternoon party proceeding directly thither from Birmingham. (See Visit to the Coventry works.)

The Earl of Dudley's Round Oak Works.

Leader: A. E. Tucker.

In the blast-furnaces two grades of pig-iron are made *viz.*, basic pig iron, for use in the steel works, and best Staffordshire cold blast iron for roll making and other special engineering purposes. There is a large gas-heated metal mixer, in which the basic iron is stored between the blast-furnaces and the steel works, and which, when in regular work, contains some 200/300 tons of molten iron. The molten iron, which is carried in a ladle, and is brought to the mixer by means of a locomotive, is transferred to the mixer by means of a 50-ton travelling crane electrically driven overhead. The iron from the mixer is conveyed in a ladle by means of a locomotive to the steel works, which works consist of five Siemens open-hearth furnaces—the process being the Bertrand-Thiel modification of the basic open-hearth process. The ingots are heated in gas-furnaces, and are cogged down into blooms, and subsequently rolled into finished sections, such as angles, tees, channels, joists, &c.

In the iron works is made the well-known brand of iron—L Crown W. R. O. Iron also is manufactured for chain and cable making.

In the chain works, chains and anchors of all sizes are manufactured, *viz.*, from ¼in. chain up to mooring cables made from iron 4½in. diameter. The works are supplied with fuel from the Earl of Dudley's collieries, and a considerable portion of them have been in operation since the year 1857.

The party was conducted round the works by the managing-director, Mr. George Hatton, who also provided lunch for the members, before they returned to Birmingham.

THE SPRING VALE BLAST-FURNACES, AND THE STAFFORDSHIRE STEEL AND INGOT IRON WORKS OF ALFRED HICKMAN LIMITED (BASIC BESSEMER PROCESS).

Leader: H. SILVESTER.

These works are situated at Bilston, some 2½ miles from Wolverhampton. The premises, including the adjacent collieries and brickworks, cover an area of some 200 acres, and are traversed by about ten miles of railway and tram lines. There are five blast furnaces (five in blast) 60 feet in height, seventeen large stoves and seven steam and gas blowing engines. The output of pig iron is upwards of 2600 tons per week, and this is largely used in the steel works.

A mixer has recently been erected for receiving the hot metal from the blast-furnaces, prior to its being used in the converters. The Bessemer process plant comprises three converters, with an output capacity of upwards of 2000 tons of steel ingots per week. There are six Siemens new form re-heating furnaces and a cogging mill fitted with hydraulic tilting gear.

The plate mill produces plates up to the largest size for engineering and constructive work, some of these measuring 6 ft. in width and weighing up to three tons. The 24 inch bar-mill rolls large sections in bar, up to 16 in. in "flats," 8 in. in "rounds," and 8 in. by 8 in. in "angles." The 15 in. bar-mill is used for rolling small sections. In the slag-grinding works the basic slag is reduced to the consistency of fine grade flour, from 85 to 90 per cent. being fine meal which passes through a sieve of 10,000 holes to the square inch. This is used as a fertiliser.

The works are lighted throughout by electricity, and nearly all the auxiliary machinery is electrically driven. The dynamos are driven by gas-engines using blast-furnace gas, and consist of three Premier tandem gas engines each of 320 horse power, driving three generators of 150 kilowatts and two Premier tandem gas engines of 500 horse-power, driving two generators of 235 kilowatts. The gas-driven blowing engines, at the blast furnaces, consist of a Crossley, a Premier, and a Cockerill blowing engine. The party was entertained at luncheon by the firm.

MESSRS. MITCHELL AND BUTLER'S BREWERY.

Leader: F. R. O'SHAUGHNESSY.

The works of Messrs. Mitchell and Butler, formed by the amalgamation in 1897 of Mr. William Butler with Mr. Henry Mitchell, are situated at Cape Hill, Smethwick, and cover an area of 22 acres. Besides the buildings devoted to the various operations connected with the brewing industry there are also wine and spirit stores, said to be the finest in the Midlands. The brewing department is equipped with machinery for the cleansing, grading, and "sweating" of barley, and also for elevating and conveying wet and dry grain. There are eleven large maltings, which supply about one-third of the malt used in the brewery.

The growing floors have a concrete foundation, upon which Woolliscroft tiles are laid; the walls are of glazed brick, and suspended from the roof are tramways for moving the grain. There are also mechanical devices for turning the grain. The drying kilns are fitted with automatic temperature regulators. The visitors had an opportunity of seeing in operation the different processes involved in the production of beer, all the appliances being of the latest type. These were:—The crushing of the malt, the mashing, and the boiling of the wort with hops; then the cooling of the wort by its passage over water-cooled copper tubes, and its fermentation. The copper fermenting vats are provided with copper coils through which water is circulated to control the temperature, and also with an agitator to ensure thorough mixing of the contents.

The barm rooms were visited, and also the racking room and the bottling stores, with all their appliances for the washing and filling of the bottles. Previous to being filled into bottles, the beer is kept in a cold store, maintained at a low temperature by means of brine cooled through the agency of the ammonia compression system.

The water used in the brewery, which is of great purity, is supplied from artesian wells on the premises, capable of yielding a supply of 22,000 gallons per hour.

Lunch was provided for the visitors by the firm.

BIRMINGHAM SEWAGE WORKS AND DESTRUCTOR, SALTLEY.

Leader: A. BRYAN.

The average dry weather flow of sewage is 23,000,000 gallons per day, and contains a large volume of trade wastes, there being within the district some 354 works discharging into the sewers spent and waste acid liquors equal to 2746 carboys of acids per week, of which it is estimated 1100 carboys are of hydrochloric, 1000 carboys of sulphuric, and 646 carboys of nitric acid; in addition, there are about 100 tons of lime per week from fellmongers, paper works, &c.; these in addition to the ordinary filth from a large industrial centre, combine to form a very complex liquid. The Board's works may be roughly divided into three portions: 1st, the outfall works at Saltley, where the preliminary treatment in tanks by septic action is carried out; 2nd, the irrigation and filtration areas of land extending along the valley of the Tame; 3rd, the biological percolation beds on which a large proportion of the volume of partially treated sewage is purified. The area of the Drainage Board's estate is 2803 acres, and it extends from Saltley to Curdworth, which is situated about 1 mile east of Water Orton Station on the Midland Railway; the confluence of the main effluent channel and the River Tame takes place some distance further east near Forge Mills Station. The sewage enters the outfall works at Saltley by means of 5 large main sewers which converge into a common channel, which in turn discharges into "roughing" tanks, in which the heavier suspended matter is eliminated, the sewage flowing onwards through a series of large tanks having a total capacity of 5 million gallons, in which septic action commences and in which the bulk of the light putrid sludge is deposited; this sludge is for the most part pumped into a further installation of septic or digesting tanks having a combined capacity of 7½ million gallons, in which the solids are still further broken up and hydrolysed, the septic liquor passing into the main distributing conduit, 8 feet in diameter, which traverses the lands of the Board. The septic sewage which is of an inodorous character, is pumped through a pipe extending some 4 miles down the valley and distributed over various suitable portions of the farm lands. A portion of the septic liquor is pumped at Saltley into a series of silt tanks, which diminish the suspended solids by about 80 per cent., the resultant liquid, containing about 5 parts per 100,000 of suspended solids, being sprayed over an area of 4 acres of percolation beds.

The purified effluent is collected in a series of tanks, first used at Birmingham and known as the "Birmingham Separator." The sediment is removed to such an extent that only 1½ parts per 100,000 are present in the final effluent, which is purified to the extent of about 93 per cent. before being discharged into the River Tame.

The Destructor.—The Corporation Destructor and Wharf at Nechells were erected in 1905 for the purpose of dealing with house refuse collected in the Nechells and Saltley Districts. During the year ended March 31st, 1907, the house refuse collected in the districts referred to and delivered at Nechells Wharf amounted to 14,721 tons. The heat obtained from the combustion of the refuse is used for generating steam, and is sold to the Birmingham Tame and Rea District Drainage Board for nominal sum.

City Gas Works, Saltley.

Leader: W. B. Davidson.

The gasworks at Saltley and Nechells produce only a little more than half the gas manufactured by the Corporation of Birmingham. Together, the two works are capable of carbonising 1600 tons of coal per day, giving a yield of about 17,000,000 cubic feet of gas. In addition there is, at Nechells, a carburetted water-gas plant having a capacity of 6,000,000 cubic feet per day.

Of the retorts two-thirds are "inclined," and all are heated by regenerative producer furnaces. The "horizontal" retorts at Saltley are charged and drawn by "West" compressed air machines. The carburetted water gas machines, six in number, are of the "Economical" type. Visitors had the opportunity of seeing the cyanogen plant, where crystallised sodium ferrocyanide is manufactured (Saltley); the coal testing works, carbonising 21 tons of coal per day (Saltley); the plant for preventing naphthalene stoppages (Saltley and Nechells); and the central laboratory and testing station (Nechells).

Works of Messrs. Cadbury Brothers, Bournville.

Leader: W. A. S. Calder.

The visit to Bournville included not only the inspection of the large works of Messrs. Cadbury Bros., but also an opportunity of seeing the "Garden City." The firm of Cadbury Brothers was converted into a private limited liability company in 1899, and some idea of the size and importance of the works will be gained from the statement that about one-third of the raw material imported into England is used by this firm in the manufacture of its goods.

A striking feature in the firm's methods is their progressive attitude towards a co-operative system of management, and many committees exist for the management of various sections of work; among them are the two Works' Committees (men's and girls' departments), two members on each body being elected by the foremen of the departments under the presidency of a director; the Sales Committee, a committee meeting weekly for the consideration of all matters affecting the sale and distribution of goods; and many other committees meeting periodically in connection with the working of the different departments, the organisation of new schemes, and the improvement of the conditions.

The picturesque village of Bournville lies four miles to the south-west of Birmingham, and the greater part of it dates from 1895. The property is now in the hands of the "Bournville Village Trust," by whom it is administered, but the whole scheme owes its existence to Mr. George Cadbury. Considerably over five hundred houses have now been erected. The rent of the houses varies from four shillings and sixpence up to eight shillings per week, exclusive of rates, which amount to about six shillings and fourpence in the £ (exclusive of water rate). Less than half the residents are employed in the works of Messrs. Cadbury, about 60 per cent. being drawn from Birmingham and the districts in the neighbourhood of Bournville. The village is well provided with open spaces, recreation grounds, swimming baths, sports' fields, reading rooms, &c. There are also schools and a Meeting House, the gift, in addition to many others of a like kind, of Mr. and Mrs. George Cadbury. Bournville has also its own Village Council.

A system of technical and general education is in force which embraces a system of obligatory education for boys and girls under sixteen at local evening continuation schools, and classes are held on the works premises and facilities afforded for the continuation of the studies of those over that age. In connection with the obligatory education of those under 16, the firm pay the whole of the class fees, and in the case of those over 16 and under 19, fees up to 7s. 6d. per session.

Electric Power Station.

Leader: Mr. Shaw.

This station, which was opened on the 10th October, 1906, was arranged and designed by Mr. R. A. Chattock, M.I.E.E., the Corporation Electrical Engineer. It was laid out to supply (1) direct current for lighting and private power purposes in the neighbourhood of the station, at a pressure of 220 and 440 volts; (2) direct current to the distributing switchboards at Dale End and Water Street generating stations, to meet the increased demand in those districts; (3) direct current to the overhead electric tramways within a radius of about two miles from the station, at a pressure of 550 volts; and (4) an extra high tension three-phase alternating current to the sub-stations which have been erected in the outlying districts of the city, at a pressure of 5000 volts.

In the engine room the direct current plant is all kept on one side, and the high tension alternating current plant on the other side of a line drawn down the centre, the switchboards controlling each class of supply being also kept distinct in the same manner. Accommodation was provided for a first equipment of plant having a capacity of 11,500 k.w.; and an ultimate equipment having a capacity of 26,500 k.w. There are four D.C. engines and generators having a full load capacity of 1500 k.w., two Parsons steam turbo-generators, each with a capacity of 500 k.w. at full load, and two A.C. engines and generators, each with a capacity of 1500 k.w., besides various subsidiary generators, balancers and boosters.

There is also a large overhead electrically-driven four motor crane capable of lifting 40 tons weight on one lift, and 10 tons weight on a second lift.

Thursday Afternoon.

Visit to Coventry and the Historic Charter House, &c.

Leaders: Messrs. F. R. O'Shaughnessy, H. L. Heathcote, and Platten.

The Coventry programme included visits to the Daimler Motor Company's Works, to Herbert's Automatic Machine Works, and to the Rudge-Whitworth Cycle Works. At the Coventry Works, the visitors were shown the processes of metal moulding, brazing, nickel-plating, enamelling, cleaning by sand-blast and electricity, and rim-rolling, &c. The chemical and physical laboratories attached to these works were also thrown open for inspection. Subsequently, the party drove to the historic Charter House, where they were received by Colonel W. F. Wyley and Mrs. Wyley, and entertained to tea.

For those who remained in Birmingham during the afternoon there was much that was interesting to see at the Central Fire Station. The party was led by Mr. A. S. Calder. It was met by Superintendent Tozer, who conducted the visitors over the premises, and explained the mechanism of the various engines and appliances. For their benefit a mock fire alarm was arranged, and the smartness with which the men paraded with the new motor engine was the subject of general comment. Mr. Tozer was congratulated on the evidence of efficiency shown. Leaving the Fire Station, the visitors had a pleasant drive through Edgbaston to Warley Woods, where tea was served in the Abbey. The weather was delightfully fine, and the visitors were charmed with the beauty of Birmingham's new park.

Thursday, July 11th.

THE ANNUAL DINNER.

The Annual Dinner took place on the evening of Thursday, July 11th, in the Grosvenor Room of the Grand Hotel.

The President submitted the toasts of "The King," and "The Queen and Royal Family," which were duly honoured.

The toast of "The Society of Chemical Industry" was next proposed by Sir Oliver Lodge.

Sir Oliver Lodge said he was glad to be present on that occasion, and to propose the toast of the Society, which had done so much to help chemical industry in this country. They had a most distinguished list of Presidents, many of whom were still living. But there was one subject he wished to bring before the notice of that audience, that was the subject of the combustion of smoke. About eighteen years ago he wrote, in the first number of "Industries," on the theory of combustion and the method whereby it was possible to heat water without the emission of smoke. It was a very difficult problem; there were cases in which the furnaces need not smoke; where the surfaces to be heated were incandescent; in the firing of pottery, for instance. When they came to heating large masses of metal in the annealing process, the chilling of armour plates, or the boiling of water, the surface itself could not be heated, and was bound to put the flame out. No flame could come into contact with water surfaces, as, with the water on either side of it, the flame was necessarily extinguished. The flame had to pass across a film of gas. The whole principle of tubular boilers, he ventured to say, was wrong; it was the principle of putting cold surfaces in the flame, which interfered with combustion. The flame only reached those surfaces by radiation across the film. Now, a Bunsen burner, as everyone knew, radiated very little. In order to radiate they must have a luminous flame, and a luminous flame involved a smoky flame. In avoiding the smoke, they did not get real efficiency. There were two ways of getting it: one, to make the walls of the boiler so thick that they got red hot; the other, Friedrich Siemens' way, using luminous flame, and not allowing it to come in contact with the surfaces at all. But there was another method recently invented which was more like incandescent gas lighting. In the old days they used to use the carbon with the gas to give radiation; now they introduce a radiating substance into the flame. So, with the heating of boilers, there was a method only recently devised, which he had got permission from the University to have tried at the power station at Bournbrook. It would be tried in one boiler, and the other method in the other. The invention could also be seen working at the British Mills, Cornwall Road, Smethwick. It consisted in taking the gases, aflame, along an inner tube of fire clay where the combustion could be completed, because the walls were red hot, and those walls radiated heat to the boilers. The hot gases, when the combustion was completed, came in contact with the boiler, but the flame did not, and the smoke was reduced to a minimum. He regarded the smokelessness of the air as a matter of most vital importance in the condition of the life of the people, especially in towns. So long as smoke was thought to be a sign of commercial prosperity and to be necessary for economic heating, so long it was bound to be maintained; but as soon as it was found feasible to suppress the smoke, then the atmosphere of large towns would improve. There had been two important pronouncements by leaders of chemistry during the last few months: one was the instructive discourse by Professor Meldola before the Chemical Society; the other was the paper read on the previous day by their President, Mr. Carey. Both those gentlemen lamented the departure of some of their chemical industries to other countries. He thought Mr. Carey's a most important address, and would recommend every one to study it, if they had not had an opportunity of hearing it. Although in Birmingham they had received great support in the matter of buildings and equipment, they wanted support for the students whom they turned out. It was no use for a University to turn out a number of well-equipped and well-trained students, unless they were appreciated by the manufacturers, their future employers. In Germany manufacturers did realise, they were told, the value of highly-trained men in industry, and there was a demand for them. The appreciation of education by employers was, he thought, a thing which was badly wanted. The technical schools in this country were training men from below, who were working to become better foremen and non-commissioned officers of industry; these were of the utmost importance, and he thought that he saw great signs of the workmen of this country becoming eager for education. It was a warning to some of the easy-going youths of the middle and upper classes, that they would not have things their own way quite as much as they had, and that some of the lucrative appointments would be going to those who were really keen about education, and not to those who were contented with passing examinations because their parents had sent them to places of learning. He coupled with the toast of the Society of Chemical Industry the name of the President, Mr. Eustace Carey.

The **President** said that before replying formally to the toast of "The Society of Chemical Industry" he would like to say how very profoundly he was interested on the previous afternoon with the possibilities of Birmingham University. Sooner or later, probably sooner, the technical school at Birmingham University would be one of the best, if not certainly the very best school in the world. He was sure Birmingham was proud of its University, as he was perfectly certain it was proud of its Principal. Sir Oliver Lodge had said that the Society of Chemical Industry was doing what its founders hoped it would do. The Society hoped to do a great deal more than it had done. In many respects Germans and Americans were much more communicative than the English were. In Germany, when one went to a works, host and guest would compare notes, and so they would in America. At a zinc works about a hundred miles from Chicago, they told the manager that they were engaged in the same line of business as himself, and felt some delicacy in going in. He said, "Oh, by no means; come into my works and see what you will." So it was in Germany. He hoped the Society would do away with that old hesitation in comparing notes about practical matters. They all wished great success to the process of boiler firing to which Sir Oliver Lodge alluded, but they knew that for some years past experiments had been made with dust firing. Finely divided coal could be burnt in such a way that there was hardly any waste; the dust was ground very fine, and was entirely burnt, and they avoided by that means difficulties to which Sir Oliver Lodge had alluded. He agreed that manufacturers did not appreciate the students who were being turned out from the Universities, but they were improving in that direction, and in a short time the manufacturers would show the same spirit as was shown in Germany.

Sir **Boverton Redwood** (President-Elect), in proposing the toast of "The Guests," said that when their honorary local secretary announced to him that he was to have the honour of proposing that toast, he was reminded of a reply made by Mark Twain at a recent Royal garden party when he was told that the King and Queen wished to speak to him: "Well, the responsibility is on them." The Lord Mayor of London had placed on record his opinion that the only persons who enjoyed after-dinner speaking were the persons who made the speeches. He must dissent absolutely from that proposition. Some time ago, at a public dinner of great importance, after a most eloquent speech by a member of the late Government, his neighbour turned to the Chinese Minister, who was sitting next to him, with radiant satisfaction in his face and said: "What do you think of that for an oratorical effort?" The Chinese Minister, without a smile, replied "We abolished after-dinner speaking in China three thousand years ago." But it was an enduring characteristic of the Anglo-Saxon race to delight in having their friends round them at the festive board, and to express that delight in words, however inadequate those words might be. Sir Boverton concluded by giving them in all confidence, the toast of "Our Guests," and coupled with it the name of Alderman F. C. Clayton, Pro-Vice-Chancellor of the University.

Alderman F. C. **Clayton** said that on the previous afternoon he had the honour of standing as one of the hosts, being one of the Council of the University, in entertaining the visitors from a distance. That evening, the *role* was changed, but he thought he was equal to the task. Whenever one was present at a gathering of the Society of Chemical Industry, it was one's own fault if one were not happy. He thought the guests had been extremely well treated by the Executive Committee in the arrangements which had been made to facilitate the non-business part of that meeting. The handbook explaining what there was to be seen in the different districts which they visited was an example to be imitated.

Mr. **Thomas Tyrer** next proposed the toast of "The Birmingham and Midland Section." He had proposed the toast of the Section twenty times, and if he were spared for twenty years longer he hoped he might still have the honour of proposing it. The reason was, that he knew, with perhaps one exception, more than anyone about the difficulties and the anxieties of the officers of the Society who did the Sectional work, and who conducted meetings of that kind. That exception was the President himself, for the President and himself were respectively the Northern and Metropolitan Secretaries of the Society in its early days. Mr. Carey's connection with that Society antedated anything that himself or anyone of them had done; for in Sir Henry Roscoe's book it was recorded that Sir Henry Roscoe, Dr. Ludwig Mond, Mr. E. K. Muspratt, and Mr. Eustace Carey laid the foundations of that organisation which afterwards became the Society. Dr. Mond moved the resolution that the Society should be a cosmopolitan one. One of the desires of those early days was that the Society should be cosmopolitan, and the President would admit, with members present from Australia and Canada, that it was a cosmopolitan Society. He believed it was unique, that a Charter should be granted to a Society which had so very large a proportion of its members not British; but the idea of exclusiveness was soon dispelled, and the Charter was granted. When that Section of the Society was revived, Birmingham identified the revival with the honoured and esteemed name of Frankland. No pleasure could be greater to Prof. Frankland than to know that they appreciated their welcome, and that appreciation would represent not the least honour of his life. They could not do without their subalterns and non-commissioned officers, who had received their *afflatus* from their superior officers. He would mention especially their active and energetic secretary, Mr. O'Shaughnessy. He proposed the toast of "The Birmingham and Midland Section," and joined with it the names of Professor Frankland and Mr. O'Shaughnessy.

Professor FRANKLAND, in responding, said that the work of organising a meeting like that was undeniably great, but it fell far more on the secretary of the Section than it did on the Chairman. He could assure them that, of the gentlemen who had had that organisation on hand, none had done more than Mr. O'Shaughnessy, without whose indomitable and cheerful optimism and zeal they would have been quite unable to revive that Section, and Dr. Findlay and Mr. Alcock, who had been at work for weeks past. Mr. Tyrer had spoken about that Section being revived. That, as they all knew, was the case. They were not a new-born child of the Society of Chemical Industry. For twenty years they had slept. In the two years of their revival they had received nothing but kindness. This had culminated during that week, when they had the great privilege of entertaining that great united gathering in their own home. Mr. Tyrer had referred to the Charter which had been recently granted to the Society. He would like to offer the Society the most hearty congratulations. He rejoiced in everything which was calculated to increase the professional prestige of chemists, whether theoretical or industrial, because he earnestly believed that the inadequate recognition which was accorded by their country to science was one of the most sinister and threatening clouds of their national life. He trusted that the three chartered societies of chemists, the Chemical Society, the Institute of Chemistry, and the Society of Chemical Industry, would co-operate in harmonious solidarity, and urge their claims insistently on an ignorant public, and on a frequently ignorant and unsympathetic legislature. He thanked the gathering for the very kind way in which the toast had been received.

Mr. F. R. O'SHAUGHNESSY said that a very high ideal had always been held before him by the two gentlemen who had addressed them on that toast. Those ideals appealed to him immensely, and he had tried to carry them out, with his colleagues in Birmingham. He had received nothing but kindness and generosity for the last two years. If it had not been for that, it would have been impossible to do what had been done. They had other motives, and one of them was the personal devotion which was excited by their Chairman. In addition to one or two very flattering reviews of the handbook in the press, there had been favourable criticisms from those who had done work of the kind over and over again, and they told him, without exception, that they had not seen anything to compare with it before. That book was the work of his two colleagues, Dr. Findlay and Mr. Alcock, his assistant secretaries, aided by all the members of his committee. He would not do justice if he did not refer to all those with whom he had to deal, especially to those manufacturers who had shown such great generosity. He had not realised how good his fellow members were until he had tried to get something out of them during the last two years. He closed his remarks by again expressing his thanks for the toast.

THIRD DAY.—FRIDAY, JULY 12TH.

The party travelled by special saloon train to Stratford-on-Avon, where the members were shown over the various places of interest in Shakespeare's native town. Leaving Stratford the party proceeded to Warwick, where lunch was provided in a marquee in the grounds of Warwick Castle. After lunch the party was photographed,* and much of the afternoon was spent in visiting the Castle, its grounds, and sundry local places of interest. At 4 p.m. tea was partaken of in the marquée, the return train leaving at five for Birmingham. In the evening, favoured by beautiful weather, at 8 p.m., a Garden Party was held at the Botanical Gardens, Edgbaston, and the guests were received by the Chairman of the Birmingham and Midland Section, Professor Percy F. Frankland, J.P., LL.D., F.R.S., and Mrs. Frankland, F.R.M.S., F.L.S., and the members of the Reception Committee, among whom were the Lord Mayor (Councillor H. J. Sayer) and the Deputy-Mayor (Alderman A. J. Reynolds). Over two thousand invitations had been issued, and there was a very large gathering. The grounds and the conservatories were effectively illuminated with fairy lamps and Japanese lanterns, the arrangement of lights being extremely beautiful. The band of the Coldstream Guards was in attendance, under the direction of Lieutenant J. Mackenzie-Rogan, and in the Concert Hall an enjoyable musical entertainment was given. A fine display of fireworks on the lawn closed a very successful and agreeable function.

Canadian Section.

Meeting held at Toronto on 16th May, 1907.

PROFESSOR W. H. ELLIS IN THE CHAIR.

THE ESTIMATION OF BORIC ACID AND BORATES IN FOODSTUFFS AND COMMERCIAL PRODUCTS.

BY R. J. MANNING AND W. R. LANG.

In a previous paper (Manning and Lang; this J., 1906, 397), a new method of estimating boric acid was described, which was found to give results in some cases to within 0·05% of the theoretical. Since the completion of this work the method has been used in the University Laboratory of Applied Chemistry and pronounced satisfactory. Its application to the determination of borates in such articles as milk, common salt, etc., is the object of this present paper, these substances being found to contain small quantities of boric acid in some form or other.

The results of this investigation are now given arranged as follows:—

(1) Two methods for the determination of borates in milk.

(2) Two methods for their determination in common methylated spirits.

(3) Two methods for their determination in commercial common salt.

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* Copies of the photographic picture may be purchased on application to the photographers, Messrs. H. J. Whitlock & Sons, Ltd, 11, New Street, Birmingham.

Estimation of Boric Acid in Milk.

Method I.—Distillation and precipitation as barium borate.—This method is almost exactly similar to that previously published (*loc. cit.*), only, of course, adapted to the needs of the case. The first precaution necessary was to obtain milk absolutely free from boric acid and borates. About 300 c.c. of pure milk was introduced into a distilling flask and some boric acid dissolved in it, or else it was introduced in the alcohol, of which 400 c.c. were at first taken. Additions of more alcohol were made from time to time to ensure the complete distillation of the tri-ethyl or tri-methyl borate. It was now found that no matter how much boric acid was introduced in the milk that no precipitate whatever of barium borate was formed. In order to have the tri-methyl borate formed the introduction of sulphuric acid was necessary. A long series of experiments were therefore undertaken to determine what amount of sulphuric acid was necessary with 300 c.c. of milk, as a result of which it was found that at least 70 c.c. of concentrated sulphuric acid are necessary; the large amount of water in the milk decomposes the tri-methyl compound into boric acid and alcohol. In this case the boric acid will distil over only at a very high temperature. The sulphuric acid appears to prevent this decomposition. After distilling for half an hour, the distillate was treated with a few drops of a concentrated solution of barium chloride. At this stage a slight precipitate sometimes occurred. The fats in the milk contain three esters, those of palmitic, stearic, and oleic acids. These all form compounds with barium chloride which are insoluble in water and in cold dilute hydrochloric acid. It was found that if the temperature in the distilling flask rose about 80° C., a small portion of these (probably oleic acid) was carried over. Therefore, on the addition of barium chloride, a flocculent precipitate of barium oleate appeared. This had to be removed by filtration before the experiment could be proceeded with. The distillate was now titrated against a freshly prepared concentrated sodium hydroxide solution, prepared, as before described, by dissolving newly cut pieces of sodium in water in a silver dish; phenolphthalein was used as indicator. Care had to be taken to guard against overstepping the neutral point as the excess of the alkali united with the barium chloride to form the hydroxide. The precipitate of barium borate was now filtered off on a tared filter paper, washed carefully with alcohol, dried at 110° C., and weighed.

First of all a test series was made in order to see how small a quantity of boric acid would, on neutralisation of the distillate, give a precipitate distinctly seen by the naked eye. To this end, 50, 40, 30, 20, 10 parts boric acid were introduced into 10,000 parts of milk. The precipitate of 50 parts boric acid in 10,000 parts milk was quite heavy, the 40 less so. In this manner a gradation was obtained until when 10 parts in 10,000 was reached only a faint milkiness was obtained. This last was repeated several times with precisely the same result. Below this point traces of precipitate became untrustworthy, especially as a trace of boron compounds could be obtained from impure methylated spirits. This, however, will be dealt with later.

The results obtained from weighed precipitates were:—

Boric acid introduced.	Barium borate.	Yield.
grms.	grms.	Per cent.
1·50	2·6890	99·5
1·50	2·6830	99·3
0·50	0·8941	99·25
0·15	0·2649	98·0
0·12	0·1970	91·1
0·09	0·1414	87·2
0·06	0·0879	81·3
0·03	0·0340	63·33

Method II.—Distillation and titration.—Instead of precipitating the boric acid from the distillate as in Method I., the distillate was diluted with water up to one litre. Portions of 100 c.c. were neutralized with $N/10$ potassium hydroxide in presence of phenolphthalein. About 30 c.c. of glycerin were then added, and the titration continued until a permanent shade of pink was obtained.

Boric acid introduced.	Yield.
grms.	Per cent.
1·50	99·6
1·50	99·5
0·50	99·47
0·15	98·43
0·12	92·1
0·09	88·7
0·06	83·0
0·03	69·2

Method III.—The milk was first evaporated and afterwards charred. The charred mass was then treated with water and titrated in the presence of glycerin against potash, using phenolphthalein as indicator. The method is not yet complete and the results are temporarily withheld.

Estimation of Borates in Methylated Spirits.

Method I.—By distillation and precipitation.—The method was exactly similar to that used in the case of milk; 300 c.c. of methylated spirits and 25 c.c. of concentrated sulphuric acid were distilled until the temperature rose to 75°, when the boron compound was precipitated by barium chloride and weighed as before. One litre of methylated spirits was found to contain 0·0183 grm. boric acid as a borate of some sort.

Method II.—By distillation and titration.—Owing to the exceedingly small amounts of boric acid in the alcohol it was very difficult to obtain results that agreed. The large distillate was diluted to a known volume (500 c.c. usually), and portions of 100 c.c. taken out at a time and titrated against $N/10$ potassium hydroxide with 30 c.c. glycerin and a few drops of phenolphthalein. One litre of methylated spirits was found to contain 0·0160 grm. boric acid.

Estimation of Borates in Salt.

Method I.—By Distillation and Precipitation.—A weighed amount of common packing salt (preferably about 5 grms.) were dissolved in the necessary amount of concentrated sulphuric acid. This salt solution was now introduced with 300 c.c. of methylated spirit into a distilling flask. From this point on, the experiments were exactly similar to the previous ones. From the estimations it was found that 100 grms. salt contain 0·88 grm. of boric acid as a borate.

Method II.—By Distillation and Titration.—Instead of precipitating the boric acid as barium borate, it was titrated against $N/10$ potassium hydroxide in the usual manner. 100 grms. of packing salt were found to contain 0·874 grm. of boric acid as a borate.

Liverpool Section.

Meeting held at the University on Wednesday, Feb. 13, 1907.

DR. JAMES T. CONROY IN THE CHAIR.

THE COMBUSTION PROCESSES IN THE LOCOMOTIVE FIRE BOX.

BY F. J. BRISLEE, D.SC. (LIV.).

Introduction.

One of the chief initial difficulties encountered in maintaining the temperature necessary for rapid steam production in the locomotive fire box was the draught. This was produced in the earliest locomotives in a variety of ways, such as relying on natural draught, or by employing a bellows, or a fan. It was to Stevenson that the idea of employing the waste steam from the cylinders to accelerate the draught first occurred. He noticed the very great difference between the velocities of the steam issuing from the cylinders and of the smoke leaving the funnel and forthwith he utilised the exhaust steam from the cylinders to increase the draught by placing the exhaust steam pipe in the funnel, so effecting a reduction of pressure in the funnel and consequently increasing the velocity of the air which flowed through the fire. The result was a complete success so far as steam raising was concerned. The fire was urged by a strong draught, which produced a high temperature and rendered possible the production of sufficient steam to enable the engine to travel at a high speed. To this brilliant device the success of Stevenson's "Rocket" at the Rainhill trials in 1829 was in no small measure due. Very many experiments have been made upon the combustion processes in marine and other stationary boilers, but few have been made upon those taking place in a locomotive during actual running, and although the employment of the steam blast to increase the draught in locomotives is universal, the efficiency of the combustion processes taking place in the locomotive fire box have not been investigated from a physico-chemical standpoint. The following investigation was undertaken with a view to determine—(1) The efficiency of the combustion of the fuel; (2) To measure the loss of carbon due to the production and loss of carbon monoxide; (3) To follow the variation in the products of combustion due to variation in the demands made upon the engine, *e.g.*, weight of train drawn, speed, gradient; (4) To study the conditions of the combustion so as to determine whether equilibrium conditions corresponding to the temperature are ever attained.

The essential parts of a locomotive fire box consist of a copper box which is water jacketted above and closed by iron fire bars below. The fire box is connected with the boiler, through which the products of combustion are led to the smoke box and funnel, by the fire tubes. On the side of the fire box nearest to the foot plate is the fire door, through which fresh coal is introduced, and opposite to this is a brick arch, inclined upwards, which serves to mix the gases before they enter the fire tubes. Below the fire bars is the ash pan, which is closed in front and behind by dampers. The fire is placed upon the fire bars and the fire box is filled with the fuel nearly to a level with the door, the top surface of the fire being roughly parallel with the brick arch. The air necessary for the combustion is admitted from below by means of the dampers placed in front and behind the ash pan and thence through the fire bars. The air is drawn through the fire by the escape of the exhaust steam up the funnel (primary air), and then a further quantity of air is admitted through the fire door, which is partly opened (secondary air) so as to burn any gaseous products, mixing being effected by the gases whirling round the end of the brick arch on the way to the fire tubes and ultimately to the smoke box and chimney. When coal, containing carbon and hydrogen as combustible constituents, and wetted with water, is employed, the reactions taking place in the fire box are:—(1) The drying of the coal and the production of the volatile distillation products of the coal, and their subsequent combustion by the supply of secondary air. (2) The combustion of the carbon of the coal by the primary air, producing carbon dioxide and carbon monoxide; the proportion of each present depends upon the temperature and upon the quantity of oxygen. The carbon monoxide may be due to a primary action of oxygen on carbon or to a reaction of the carbon dioxide with the strongly heated carbon, the carbon dioxide being the primary product. (3) When moist air is employed, the water vapour present is decomposed by the strongly heated carbon, *i.e.*, the carbon is burnt by the water vapour, thus, $C+H_2O=CO+H_2$; $CO+H_2O=CO_2+H_2$. In order to render the combustion complete, these combustible products must be burned by the supply of secondary air. By limiting the supply of secondary air, and when the fire is thick and dense, the fire box acts as a gas producer, the carbon being chiefly burnt to carbon monoxide.

Now from the two thermochemical equations, $[C]+(O_2)=CO_2+97{,}000$ Cal. $(CO)+(\frac{1}{2}O_2)=CO_2+68{,}000$ Cal., the heat of the reaction, $[C]+(\frac{1}{2}O_2)=CO+29{,}000$ Cal., is found, and hence 1 grm.-molecule of carbon burning to carbon monoxide yields only 0·29 of the heat evolved when it burns to carbon dioxide. Investigations of the equilibria in a gas generator have shown that the ratio of the carbon monoxide to the carbon dioxide, in equilibrium with solid carbon, is constant for each temperature, and the higher the temperature, the greater is the amount of carbon monoxide. At a temperature of about 900° C., the carbon monoxide in equilibrium with solid carbon has reached a maximum. When carbon is burnt with a rapid current of air, it burns to carbon dioxide, even at a white heat, while the equilibrium composition above 800° and below 1000° C. shows that only carbon monoxide is present. The products of combustion, therefore, depend upon the velocity of the air supply, and this dependence is made use of in certain forms of gas producers, such as the Dellwik-Fleischer.

One can assume that the first product of the combustion of carbon is carbon monoxide in practically the maximum amount possible corresponding to the equilibrium conditions at the particular temperature, and that this carbon monoxide is then burnt to carbon dioxide by the excess of air admitted, or it may be assumed that, as in all autoxidation processes, the products of the combustion of a substance is that which contains one molecule of oxygen, then the primary reaction is the formation of carbon dioxide, and the attainment of equilibrium, $C+CO_2 \rightleftarrows 2CO$, is a secondary reaction. This second reaction will or will not take place according as the carbon and the carbon dioxide are in contact for a sufficient time for the reaction to be completed. The velocity constant is at present unknown, but Boudouard (Compt. rend., 1900, **130**, 132; Bull. Soc. Chim., 1899, **21**, 712) has shown that when air is led over carbon heated to 800° C., the quantity of carbon monoxide decreases with increasing velocity of the current of air. This points to the conclusion that the carbon dioxide was in contact with the carbon for an insufficient length of time for the secondary action, forming carbon monoxide, to take place.

In the combustion of coal in the fire box, the quantity of carbon monoxide and carbon dioxide in the gaseous products of combustion will depend upon (1) The temperature, (2) the velocity of the draught, (3) the depth of the fire, (4) the pressure. For the sake of simplicity, the combustion of coal in the locomotive fire box will be considered as the combustion of carbon, since upon the introduction of fresh coal into the fire, there results a coking of the coal, the volatile products being distilled off and burnt by the supply of secondary air, or lost as smoke. The coked coal then sinks down in the fire box, forming a thick and fairly dense layer, through which the air is drawn by the escape of the exhaust steam up the funnel. The equilibrium which is of great importance for consideration at present is that denoted by the equation,

$$C+CO_2 \rightleftarrows 2CO \ldots\ldots\ldots\ldots\ldots \text{(1.)}$$

The equilibrium,

$$CO_2 \rightleftarrows CO+\tfrac{1}{2}O_2 \ldots\ldots\ldots\ldots \text{(2.)}$$

need not be considered, as the amount of dissociation of the carbon dioxide is small at the temperature of the fire box.

Le Chatelier developed the following equation for equilibrium,

$$\frac{1}{R}\int Q_T \frac{dT}{T^2} + (N''-N')\log_e P + \log_e K = \text{constant},$$

where R is the gas constant $=2{\cdot}0$ grm.-calories, or more exactly, 1·989, Q_T is the heat of the reaction, T the absolute temperature, P the pressure, and K the constant of the law of mass action, in the above case (1),

$$\log_e K = 2\log_e C_{co} - \log_e C_{co_2}$$

or

$$K = \frac{C_{co}^{2}}{C_{co_2}}$$

The heat of reaction changes with the temperature according to Kirchoff's law, $Q_T=Q_0+(C_1-C_{11})T$, where Q_0 is the heat of the reaction at absolute zero, C_1 and C_{11} the specific heats in the initial and final states. By substituting the numerical values for Q_T, C_1, and C_{11}, and solving the equation for Q_0, the result $Q_0=40{,}100$ cal. is obtained and then, $Q_T=40{,}100-3{\cdot}76T+0{\cdot}005T^2$.

In the equilibrium, $C + CO_2 \rightleftarrows 2CO$,

$Q_T = -40{,}100 + 3{\cdot}76\,T - 0{\cdot}005T^2$; $N'' = 2$; $N' = 1$; $(N'' - N') = 1$; and $K = \frac{C^2_{co}}{C_{co_2}}$; and hence the equation for equilibrium becomes

$$\frac{1}{R}\int \frac{-40{,}100 + 3{\cdot}76T - 0{\cdot}005T^2}{T^2}dT + \log_e P + \log_e K = \text{constant.}$$

Substituting $\frac{1}{R} = 0{\cdot}5$, integrating, and converting the $\log_e$ into $\log_{10}$, the equation becomes—

$$\frac{20{,}050}{T} + 4{\cdot}329\log_{10}T - 0{\cdot}0025T + 2{\cdot}30259(\log_{10}P - \log_{10}R) = \text{constant.}$$

Boudouard determined the constant for a number of different temperatures and pressures, and found as a mean the figure 31·5. Substituting this value in the last equation, and solving it for $\log_{10}K$ for the combustion of carbon with pure oxygen at one atmosphere pressure, then:

$$\log_{10}K = \frac{31{\cdot}5}{2{\cdot}3026} + \frac{0{\cdot}0025T}{2{\cdot}3026} - \frac{20{,}050}{2{\cdot}3026T} - \frac{4{\cdot}329}{2{\cdot}3026}\log_{10}T - \log_{10}P$$

or—

$$\log_{10}K = 13{\cdot}68 + 0{\cdot}001086T - \frac{8707}{T} - 1{\cdot}88005\log_{10}T - \log P.$$

Again, $C^2_{co} = KC_{co_2}$, and since the concentrations of the carbon dioxide and carbon monoxide are proportional to their partial pressures and $P_{co} + P_{co_2} = 1$ atmosphere, then, $P_{co_2} = (1 - P_{co})$ and, $P^2_{co} = K(1 - P_{co_2})$; therefore

$$P_{co} = \frac{-K \pm \sqrt{K^2 + 4K}}{2};$$

hence the ideal composition of the gas can be calculated.

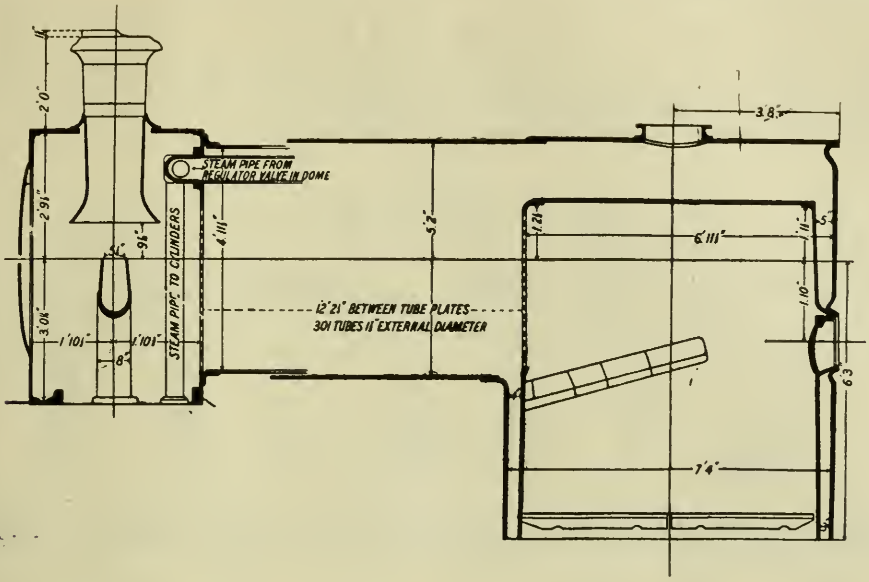
The ratio $\frac{C_{co}}{C_{co_2}}$ is of great importance in the present instance, as it gives the ratio of the weight of the partially burnt carbon to that completely burnt, and the ratio $\frac{CO}{CO + CO_2}$ is a measure of the carbon partially burnt compared to the total amount consumed. The ratio $\frac{C_{co}}{C_{co_2}}$ can vary between the limits of zero and infinity, and the ratio $\frac{CO}{CO + CO_2}$ between the limits of zero and unity.

For efficient combustion, these two ratios should be as small as possible, the maximum of efficient combustion being reached when they are both zero. When the combustion takes place in atmospheric air (21 per cent. oxygen and 79 per cent. nitrogen), the proportion of carbon monoxide can vary between the limits of 0 and 34·71 per cent., while the carbon dioxide can vary between 0 and 21 per cent. When coal is employed the percentage is usually between 9 and 14 per cent. Strache (J. Gasbeleucht., 1903) explained the combustion changes in a gas producer in a manner which can be applied, with a little modification, to the locomotive fire-box combustion processes. The fire can be considered to be made up of a number of parallel layers. Each layer consists of pieces of coal or coke in the lower portions, and between the pieces air spaces which are greater, the greater is the size of the pieces used. With pieces about the size of a fist these spaces constitute one-fifth to one-fourth of the total cross section. Each piece of fuel is surrounded by a layer of air a few millimetres thick in some cases and several centimetres thick in others. On the size of these spaces depends the amount of air drawn through the fire. At the point of contact between the fuel and air the combustion takes place, and here the combustion temperature must be reached, which, according to Le Chatelier, is about 1200° C. for cold coke, if burnt to carbon monoxide, or 2040° if burnt to carbon dioxide. For previously warmed coke the combustion temperature is about 1700° C. At the surface of contact between the coke and air, all the conditions are fulfilled for the formation of carbon dioxide, viz., carbon at a high temperature and air at a high velocity. If it is assumed that carbon monoxide is the first product of the combustion of carbon with air, then this is burnt by the air in the spaces between the fuel, and hence the product of combustion in the lowest layer is carbon dioxide (this has been found to be the case in gas generators). The spaces between the fuel contain large quantities of oxygen which do not come into contact with the surfaces of the fuel, since the velocity of flow of the air in these spaces is 4 to 5 times as great as that calculated for the whole of the fire box, and there is no time for the air to get into contact with the carbon. This air serves to burn the next layer of fuel producing carbon dioxide, and further the carbon dioxide coming up from the lowest layer reacts with the carbon to a greater or lesser extent according to the rate of flow, forming carbon monoxide (again in the case of a gas generator the existence of carbon monoxide and dioxide and oxygen together has been proved). As the gases make their way through the fire they are mixed together by striking against the fuel, so that no carbon monoxide can exist in the presence of free oxygen in the gases as they reach the higher layers of the fuel. If the temperature of the upper layers is high, then reduction of the carbon dioxide coming up from below takes place. When the combustion products reach the top surface of the fuel, they are met by the supply of secondary air entering through the fire door, and the complete combustion of the combustible gases depends upon (1) the thorough mixing of the gases and air, and (2) the velocity with which the gases are swept into the fire tubes and cooled to the temperature at which the rate of combustion is slight. Boudouard (*loc. cit.*) has shown that when air is led over carbon heated to 800° C. at different velocities, carbon monoxide and oxygen are found existing together in the products of combustion. The following table gives Boudouard's results :—

Velocities : litres per minute.	Volume per cent.			
	Carbon dioxide.	Carbon monoxide.	Oxygen.	Nitrogen, by diff.
0·10	18·2	5·2	—	76·6
0·27	18·43	3·8	0·47	77·30
1·30	18·92	1·88	0·94	78·26
1·465	19·9	1·83	—	78·27
3·20	19·4	0·93	0·93	78·74

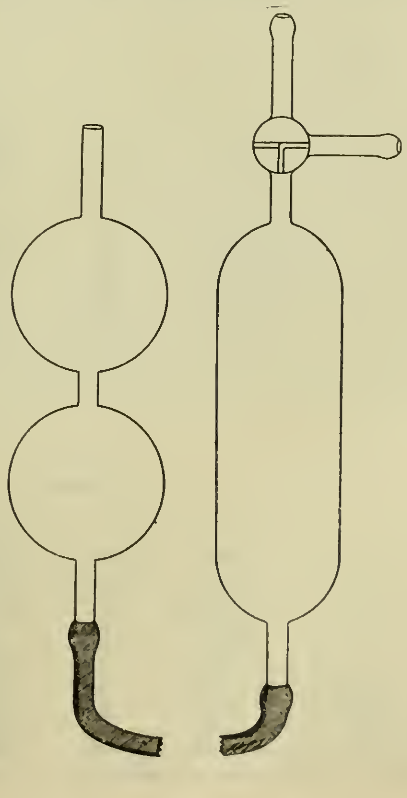
The equilibrium composition corresponding to this temperature, 800° C., is carbon dioxide, 0·92 per cent., carbon monoxide, 34·32 per cent., nitrogen, 74·76 per cent. From these results it is evident that when the velocity of the air is high equilibrium is not attained, and the quantity of carbon dioxide and carbon monoxide in the products of combustion, depends upon the velocity of the air. In the locomotive fire box it is extremely unlikely that equilibrium corresponding to the temperature, which is estimated at 1000°—1200° C., is ever attained, since the products of combustion and the carbon are in contact too short a time for equilibrium to be reached. A large number of samples of the products of combustion, taken from the smoke box, have been analysed; the samples were taken under different conditions of weight of train, speed, and gradient. The method employed in sampling the gaseous products of combustion will now be described.

The products of combustion of the fuel in the locomotive fire box were made in the following way. The locomotive was one of the L. & N. W. Ry. "Precursor" class, first introduced in 1904. The diagram shows the general plan of the smoke box and fire box, together with the chief dimensions. The gases were drawn out of the smoke box on the right hand side by means of a wrought iron pipe 1 in. in diameter, reaching to about the centre of the smoke box. The tube was well clear of the exhaust steam and the steam blower. The inside end of the tube was closed, and a saw cut ⅛ in. wide was made in the tube on the side facing the fire tubes. Outside the smoke box the 1 in. pipe was connected with a ½ in.



wrought iron pipe, which was carried along the hand rail on the right hand side of the engine, to the cab, where it terminated in a well-fitting tap which served to close the tube when not in use. All the joints were made air-tight by means of red lead. The gases were collected in glass tubes having a capacity of about 100 c.c., and fitted at each end with a well ground glass tap. At first it was attempted to use a mercury aspirator to draw the gases from the smoke box to the sample tubes, the aspirator being fitted into a wooden case attached to the side of the cab, but although it served to aspirate the gases, the drawbacks of a mercury aspirator became only too apparent for satisfactory working, especially when the engine was travelling at high speeds, and after a single run it was discarded, and replaced by one of Fletcher's collapsible bellows aspirators, by means of which large quantities of the products of combustion could be drawn from the smoke box and collected in a very short time. The samples were taken thus :—The end of the tap on the cab was fitted with a " dust filter," consisting of a glass tube containing a plug of asbestos fibre between two plugs of glass wool, which served to remove the dust from the gases drawn from the smoke box. The dust filter was then connected with the sample tube and to the bellows aspirator by means of a stout rubber tubing. Ten strokes of the bellows aspirator sufficed to draw 1 cubic foot of the products of combustion from the smoke box and through the collecting tube, and since the capacity of the apparatus between the smoke box and cab was only about 0·03 cubic foot, this more than sufficed to remove all the gases from the " dead space " between smoke box and cab, and also to ensure that the sample taken was a representative sample of the products of combustion at the time of sampling. At the time of taking the sample the speed and gradient were noted, and in the later work, the partial vacuum in the smoke box was also measured. All the samples were taken (with one or two exceptions) with the fire door closed, so as to regulate the supply of secondary air. When the fire door is open most of the air enters through it, since the least resistance is offered to its passage *via* the open door, and comparatively little air passes through the fire. In no case was the ordinary working of the engine departed from, the stoking being left entirely to the fireman. The samples were taken during the intervals between firing, a few minutes being allowed after firing for the fire to clear ; each sample is therefore representative of the conditions prevailing in the fire box during that particular period of working. The samples were analysed by pumping the gases out of the sample tubes with a Töpler pump and analysing them in a gas burette, using mercury as the containing liquid, and a modified form of Huntley's pipette for the reagents The chief constituents of the products of combustion were carbon dioxide, oxygen, carbon monoxide and nitrogen, only the merest traces of hydrogen and hydrocarbons being found in the gases. The samples represent the mean composition of the products of combustion at the time of sampling.

The first point investigated was the variation of the products of combustion with varying speeds, weight of train taken, and gradients. These results are given in Tables 1 to 6. In the first column, the number of the sample is given, in the second, the number of cars forming the train, in the third the gradient, in the fourth the



speed in miles per hour, in the fifth, sixth, seventh, and eighth, the percentage by volume of carbon dioxide, oxygen, carbon monoxide and nitrogen respectively. In the ninth column the ratio of the carbon monoxide to carbon dioxide is given, which shows the ratio of the weight of carbon partially burnt to that completely burnt ; in the tenth column is the ratio of the carbon monoxide to carbon monoxide plus carbon dioxide, which gives the weight of carbon partially burnt compared with the total amount consumed. The last column multiplied by 100 gives the percentage of the carbon of the fuel lost as carbon monoxide.

TABLE I.

Liverpool to Shrewsbury and back to Crewe.

No.	†Load.	Gradient.	Speed in miles per hour.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1		level	60	10·0	7·2	0·5	82·3	0·020	0·020
2		rising	45	11·5	4·7	0·7	83·1	0·060	0·056
3			55–6	13·5	2·1	1·0	83·4	0·074	0·069
4		rising	varying	12·2	5·1	1·1	81·6	0·090	0·083
*5			45	9·3	5·6	2·3	82·8	0·24	0·200
6		1 in 687 down	75	16·0	5·1	0·3	78·6	0·02	0·018
7		falling	60	13·5	2·0	0·0	84·5	0·000	0·000
8		1 in 137 down	60	14·5	2·3	0·2	82·0	0·013	0·013
9		1 in 230 down	75	14·1	2·8	0·1	83·0	0·007	0·007

* Fire door open for firing during sampling.

† A six-wheeled coach is counted as one car, an eight-wheeled coach as one and a half, and a dining car or sleeping saloon as two cars.

TABLE II.

Crewe to Rugby and back.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1	10 cars	1 in 176 up	40	14·0	3·0	0·9	82·1	0·064	0·060
2	..	level	65	11·8	3·9	0·2	84·1	0·017	0·016
3	17 cars	level	60	13·2	3·6	0·5	82·7	0·037	0·036
4	..	—	61	11·7	1·3	0·7	86·3	0·060	0·056
5	..	rising	53	12·5	1·2	2·3	84·0	0·184	0·155
6	14 cars	—	50	12·4	2·8	0·7	84·1	0·056	0·053
7	..	falling	66	13·8	1·6	0·1	84·5	0·007	0·007
8	..	1 in 505 up	58	17·1	1·5	0·2	81·2	0·011	0·011

TABLE 3.

Holyhead to Chester.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1	13	1 in 97 down	60	12·4	5·1	2·1	80·4	0·170	0·145
2	..	1 in 350–370 up	48	13·9	3·7	0·4	82·0	0·029	0·028
3	..	1 in 176 up	51	12·1	2·0	1·1	84·8	0·090	0·083
4	..	1 in 97 up	62	12·4	1·1	0·8	85·7	0·064	0·060
5*	..	1 in 1527 down	62	9·2	8·2	0·0	82·0	0·000	0·000
6*	..	1 in 687 down	69·2	6·8	10·2	0·0	83·0	0·000	0·000
7	..	1 in 100 up	53	13·8	0·0	0·5	85·7	0·036	0·034
8	..	level	53·7	16·1	1·6	0·2	82·1	0·012	0·012
9	..	level	60·0	15·1	3·2	0·0	81·7	0·000	0·000

* Fire door open.

TABLE 4.

Preston to Carlisle and Carlisle to Crewe.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1	17½ cars	1 in 1042 up	60	15·0	2·0	0·0	83·0	0·000	0·000
2		1 in 104 up	36	13·4	1·8	2·8	82·0	0·209	0·172
3	..	1 in 75 up	37	15·7	0·2	2·2	81·9	0·141	0·123
4	..	1 in 75 up	38·3	15·6	0·4	1·8	82·2	0·116	0·103
5	..	1 in 75 up	37·4	15·1	0·8	1·6	82·5	0·106	0·096
6	12½ cars	1 in 150 up	41·4	15·9	0·1	1·6	82·4	0·100	0·091
7		1 in 100 up	44·0	12·3	5·3	0·0	82·4	0·000	0·000
8	19 cars	1 in 110 up	36·0	13·2	2·5	0·8	83·5	0·060	0·057
9		1 in 142 up	45·0	15·1	1·9	0·7	82·3	0·045	0·044
10	..	1 in 100 up	50	12·8	4·1	0·0	83·1	0·000	0·000

TABLE 5.

Liverpool to Shrewsbury and back.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1	17½	1 in 660 down	60	5·4	12·2	0·0	82·4	0·000	0·000
2	cars	1 in 2220 up	48·6	14·3	3·7	0·6	81·4	0·041	0·040
3	,,	1 in 411 up	53	14·4	0·7	4·2	80·7	0·291	0·215
4	10	1 in 97 up	60	10·7	6·8	1·7	80·8	0·158	0·137
5	cars	1 in 284 up	60	11·4	1·2	3·8	83·6	0·333	0·250
6	,,	1 in 687 down	69·2	15·8	4·1	0·4	79·7	0·025	0·024
7	,,	—	60	15·7	1·1	1·1	82·1	0·070	0·065
8	,,	1 in 137 down	62	14·3	3·3	0·4	82·0	0·028	0·027
9	,,	1 in 230 down	75	16·3	0·4	0·4	82·9	0·024	0·023
10	,,	1 in 100 down	75	15·2	2·1	0·0	82·7	0·000	0·000

TABLE 6.

Crewe to Rugby and back.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$
1	17 cars	1 in 177 up	37·5	12·7	2·7	4·1	80·5	0·324	0·244
2	,,	1 in 384 up	41·0	11·7	3·0	2·2	83·1	0·188	0·165
3	,,	1 in 766 up	54·5	14·1	3·1	2·1	80·7	0·149	0·130
4	,,	1 in 463 down	45·5	10·8	3·8	2·3	83·1	0·213	0·175
5*	,,	1 in 654 up	56·2	6·3	8·6	1·5	83·6	0·238	0·192
6	,,	1 in 330 up	47·3	13·1	1·3	4·1	81·5	0·313	0·238
7	15½	1 in 330 up	39·1	13·0	2·3	3·1	81·6	0·238	0·192
8	cars	1 in 517 up	44·0	13·8	3·3	0·4	82·5	0·030	0·028
9	,,	1 in 177 down	68·0	12·5	5·4	0·0	82·1	0·000	0·000

* Firing.

From these results it is evident that the loss due to the formation and escape of carbon monoxide is greatest at comparatively low speeds, and at speeds of about sixty miles an hour the quantity of carbon monoxide is practically *nil*. Further, in most cases there was more than sufficient oxygen present to completely burn the carbon monoxide to carbon dioxide, and this is probably due to the extremely rapid rate at which the gases were swept through the tubes and cooled down, so that the complete combustion of the carbon monoxide had no time to occur. The presence of carbon monoxide in the products of combustion at low speeds is, in all probability, due to the intermittent character of the air supply. The escape of the exhaust steam up the funnel takes place in a series of "puffs," and the interval between each "puff" is greater the slower is the speed of the train, and hence the products of combustion are left in contact with the strongly heated fuel for an interval of time, and partial reduction of the carbon dioxide to carbon monoxide ensues, then at the next "puff" the gases are drawn out of the fire box, along the fire tubes, and into the smoke box before the carbon monoxide has time to burn completely. The effect of the gradient seems to be to increase the interval between each "puff" by reducing the speed of the train and so increasing the time during which the products of combustion are in contact with the heated fuel. The heavier the train, the greater is this effect, and hence the loss of carbon monoxide is greatest when the engine is working heavily. The vacuum in the smoke box was next measured. The sampling pipe was connected with a U-shaped gauge, filled with coloured water, at the back of which was a graduated glass scale. The vacuum measured was the mean vacuum in the section of the smoke box from which the gas samples were drawn. The first measurements of the vacuum in the smoke box showed that it varied with the time of cut off in the slide valve as well as with the extent to which the regulator was opened. It depended also upon the resistance of the fire to the passage of the air. The vacuum reached, under certain conditions, was 10 to 12 inches of water, but on the average it was 5—7 inches of water, the higher figures being only very occasionally reached, and were never steady. When the fire door was opened, the vacuum sank from 5—7 inches to 1—2 inches, the air entering freely through the open fire door. At high speeds the vacuum was small, as a rule, but steady, and then the air supply approximated to a steady current, and the combustion was complete, the amount of carbon monoxide being very small. The results are given in Tables 7, 8, and 9, the data given being the same as in the preceding tables, except that in the last column the partial vacuum in the smoke box, in inches of water, is given.

TABLE 7.

Preston to Carlisle and back.

No.	Load.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$	Vacuum.
1	18cars	1 in 1199 up	61	16·3	0·2	1·6	81·9	0·100	0·089	7·5
2	9 cars	1 in 75 up	64·3	16·1	1·1	0·7	82·1	0·043	0·041	7·5
3	,,	1 in 75 up	42·8	13·6	3·0	1·6	81·8	0·117	0·105	8·0
4	,,	1 in 125 down	75·0	15·0	1·0	1·0	83·0	0·066	0·062	4·1
5	12½	1 in 184 up	42·8	13·5	0·0	2·2	84·3	0·163	0·140	6·0
6	cars	1 in 186 up	51·4	15·0	1·6	2·2	81·2	0·147	0·128	5·0
7	,,	1 in 125 up	42·0	15·8	0·0	1·0	83·2	0·063	0·060	5·9
8	,,	1 in 104 down	69·2	15·9	2·8	0·2	81·1	0·012	0·012	6·4
9	,,	1 in 90 up	22·0	14·6	3·6	0·0	82·8	0·000	0·000	4·9

TABLE 8.

London to Liverpool.

Load 15 Cars.

No.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$	Vacuum.
1	1 in 341 up	54·5	15·5	0·0	4·0	80·5	0·260	0·205	8·8
2	1 in 330 up	50·0	14·4	2·2	1·9	81·5	0·132	0·116	5·9
3	1 in 334 up	53·0	15·1	0·7	1·5	82·7	0·100	0·090	5·8
4	1 in 330 up	60·0	15·7	1·8	0·2	82·3	0·012	0·012	5·8
5	1 in 406 up	60·0	16·6	0·8	0·0	82·6	0·000	0·000	5·8
6	1 in 300 up	50·0	14·9	3·7	0·0	81·4	0·000	0·000	5·8
7	1 in 505 up	58·0	13·3	4·1	0·2	82·4	0·015	0·015	5·8
8	1 in 391 up	60·0	13·9	3·6	0·7	81·8	0·050	0·048	5·8
9	1 in 101 up	58·0	14·4	3·9	0·0	81·7	0·000	0·000	5·8

TABLE 9.

Crewe to London.

Load 19 Cars.

No.	Gradient.	Speed.	Carbon dioxide.	Oxygen.	Carbon monoxide.	Nitrogen, &c.	$\frac{CO}{CO_2}$	$\frac{CO}{CO+CO_2}$	Vacuum.
1	1 in 177 up	50·0	15·3	0·6	2·1	82·0	0·137	0·120	5·2
2	1 in 320 up	64·3	16·2	0·7	1·3	81·8	0·080	0·074	5·7
3	1 in 321 up	57·1	14·0	3·6	0·9	81·5	0·064	0·060	5·7
4	1 in 320 up	51·4	15·1	0·6	1·7	82·6	0·113	0·101	5·4
5	1 in 354 up	45·0	14·7	0·7	2·1	82·5	0·142	0·128	6·9
6	1 in 320 up	53·7	14·2	0·9	3·0	81·9	0·211	0·174	5·9
7	1 in 440 up	62·0	12·4	0·6	4·2	82·8	0·338	0·253	6·4
8	1 in 660 up	58·1	12·7	3·2	1·2	82·9	0·094	0·086	6·4
9	1 in 333 up	55·4	15·0	1·1	3·7	80·2	0·246	0·200	6·2
10	1 in 333 up	47·3	14·6	0·9	2·5	82·0	0·171	0·146	6·0

From these tables it will be seen that the most efficient combustion takes place when the vacuum is relatively small and the speed high. As a rule, the higher vacua are only obtained as a series of jerks, while the lower ones are steady. The conditions for most efficient combustion would therefore seem to be a steady current of air in sufficient amount to render the velocity of combustion great enough for the production of the necessary steam. The figures in the foregoing tables represent the combustion taking place in first class locomotive practice, and on express trains of high average speeds. The loss due to the formation of carbon monoxide must necessarily be greater with low speed trains, owing to the intermittent character of the air supply. These investigations are being continued with a view to determine the effect of working with a thinner fire, and also to measure the temperature generated in the fire box during actual running. I wish to express my very great indebtedness and thanks to Mr. G. Whale, Chief Mechanical Engineer to the L. & N. W. Ry. Co. for the splendid facilities which he has given me for carrying out the above investigations, and also to Mr. T. E. Goodeve, who assisted me during the journeys, and by making the very numerous arrangements necessary for the work. My best thanks are due also to Professor Donnan for constant advice and criticism during the progress of the research, and to the Treasury for a grant to defray a portion of the apparatus expenses.

DISCUSSION.

The PRESIDENT said that Dr. Brislee's results were extremely interesting, not only from a locomotive point of view, but also with respect to boiler work of all kinds, whether on land or sea. He understood that the fire box was really a combustion chamber; if so, was it wise to water jacket that combustion chamber? He would have thought that the comparatively cold sides coming in contact with gases which were only partially burnt would have put out the gases, as is perpetually the case with the fire-places in Lancashire or other boilers. The great trouble was to get perfect combustion, because the products of combustion touched comparatively cold surfaces. He had noticed men firing locomotive boilers in what seemed to him a very unwise way, *viz.*, with large lumps of coal mixed with small coal. He thought the ideal coal with which to fire would be one of uniform size, and the air should be admitted with absolute regularity, which could not be the case with large pieces of coal. He was very much struck when in America in 1904, by the great care taken by manufacturers to have the coal for their boilers one uniform size—some the size of small beans, others the size of walnuts—with no dust. How much water was evaporated per lb. of fuel, and how much fuel per hour was burnt in a locomotive such as Dr. Brislee had described? Had dust-firing been tried on locomotives? He had never heard of such an experiment being made.

Prof. J. CAMPBELL BROWN asked whether anything had been ascertained with regard to the temperature of the water inside the boiler as well as the furnace which was keeping up the temperature. The steam was, he supposed, under very high pressure, and the water would, of course, be heated to considerably over 100° C.; it was quite probable, he thought, that the water in the tubes was never so low as 100° C. Had anything been ascertained regarding those points?

Professor F. G. DONNAN asked whether the carbon was burnt first to carbon monoxide or dioxide, and also how far the fire-box acted as a gas generator?

Mr. H. J. L. RAWLINS asked whether the secondary supply of air was left to the discretion of the fireman, or was it automatically arranged in some way? Had Dr. Brislee noticed any very great difference with different firemen in different locomotives?

The CHAIRMAN asked whether the coal was specially damped before being fed to the fire. If so, what was the percentage of moisture, and if it was specially damped, why was it so?

Dr. BRISLEE said, in reply to the Chairman, the coal was wetted for the purpose of keeping the dust down. The dust was pretty bad on the foot-plate even with wet coal. The amount of moisture was probably 10 per cent. The fire box was water jacketted for one very important reason. It was necessary for a locomotive boiler, which is limited both in height and in breadth, to produce steam at a sufficiently fast rate to render high velocity travelling possible. He had it on the authority of experienced engineers that 80 per cent. of the steam used was generated in the neighbourhood of the fire box although possibly some gain might be made from a combustion standpoint, he was afraid from a steam-raising standpoint it might be a doubtful one. He was unable to give any definite information with respect to the amount of water evaporated per lb. of fuel. The coal consumption was anything up to between 50—60 lb. of coal per mile, the amount varying with the weight of train, condition of rails, etc.

Dust firing would be a remarkably interesting experiment. He did not see how it could be effected. The steam blast itself carried through pieces of coal out of the fire tubes and away out of the funnel. He was not sufficiently acquainted with the details of dust-firing to know how that could be overcome. The temperature of the boiler steam was about 150 to 170° C., with 175 to 180 lb. pressure on the safety valve.

The secondary supply of air was to a large extent a personal factor, but it was remarkable that with different firemen, uniform results were obtained.

New England Section.

Meeting held at Boston on Oct. 5th, 1906.

MR. HENRY HOWARD IN THE CHAIR.

TURPENTINE FROM WASTE WOOD.

BY J. E. TEEPLE, PH.D.

The name turpentine is stated to be of Persian origin and was probably first applied to the resinous exudation from some member of the sumac family. It is now confined to the resinous exudation of the conifer family, more particularly those of the genus *Pinus*, the pine proper. During recent years, efforts have been made by interested parties, and particularly by some of the State Legislatures, notably those of Georgia and New York, to restrict the name turpentine and oil (spirit) of turpentine to the resins and their distillates coming from the live tree as opposed to distillates of resins from waste wood. But this attempt has not met with general approval.

What may be called the old process oil of turpentine, or gum spirits of turpentine, is derived mainly from South Western France, North Western Russia, and Southern United States. In the United States the most productive tree is *Pinus palustris*, or long leaf pine, although the Cuban loblolly pine, and in many cases, even the short leaf pine give paying yields. In France. the *pinus maritima*, and in Russia, the *pinus sylvestris* are the trees most commonly worked. The well known procedure in the United States is to prepare the tree by "boxing," *i.e.*, cutting a receptacle in the base and "facing" or preparing this receptacle for the gum. Then every week throughout the turpentine season, during the summer months, the tree is subjected to the hacking process, which consists in inflicting a fresh wound by cutting off a narrow section of the bark and outer sap wood of the tree. This process of wounding the tree has two effects. First, there is an exudation of the normal sap of the tree which might be compared to bleeding when an animal is wounded ; and second, there is a pathological production of resinous material in the neighbourhood of the wound which might be compared to the formation of a scab. This latter material probably makes up the greater part of the flow of gum, and to keep the process in operation it is necessary to re-wound the tree every week. As the resinous material flows out from the tree into the boxes, it is dipped at intervals of about three weeks, and conveyed to stills where distillation with water or steam drives off the spirit of turpentine, amounting to approximately 20 per cent. of the total, and leaves the non-volatile material, which after drying and filtering, becomes the rosin of commerce. The yield from any tree depends on the season, weather, vitality of the tree, expanse of tree top, etc., and as the vitality is certainly decreased by the system of boxing, the cup and gutter system which obviates boxing has been coming into more extensive use within the last few years. This is a modification of a system that has been in use in France for over forty years. The greater part of the resinous material from the tree may be looked upon as a pathological product resulting from the wound, and not a normal product of the tree. Wounding a tree causes the formation of quite a large number of rosin ducts in the neighbourhood of the wound, which gradually become stopped up with the resinous exudation, so that when a tree has been worked for several years, the whole body of the tree up to a height of 10 to 15 feet, or at least as high as it has been chipped, becomes thoroughly saturated with this resinous material, which apparently does not differ in any appreciable degree from the resinous material that has been collected in the boxes, excepting that it contains a smaller percentage of spirit of turpentine and a larger percentage of rosin. This wood saturated with the resinous product from the tree is known as "light wood," and when we consider the rapidity with which turpentine orchards are disappearing, it is obvious that we must look to light wood as the future source of turpentine. When a tree is blown down by any of the frequent winds, or dies from loss of vitality, due to boxing, the sap wood rots away, leaving this light wood and the heart of the tree thoroughly saturated with resinous material, and capable of resisting the action of the elements for decades. Roots and stumps also become rich in these resinous products, and they were the first to be utilised in North Carolina, for the production of pine tar, by distillation. It soon became evident that there were considerable quantities of turpentine in the pine stumps, and many attempts were made to recover this, the earliest patent dating as far back as 1841. Very little was accomplished in a commercial way, however, until a plant was built in 1872 at Wilmington, N.C., for the destructive distillation of "light wood" and stumps. "Light wood" is exceedingly heavy, weighing 4,000 or 5,000 lb. per cord, and probably derives its name from the fact that it is particularly desired by the negroes for making their fires and for use as torches. When distilled, it should give all the products of "hard wood"; *viz.*, charcoal, acetic acid (recovered as acetate of lime), wood alcohol, gas and tar ; but the tar being "pine tar," is much more valuable than the corresponding product from hard wood, and there is a much larger yield, due to the production of tar from the rosin present. In addition to all these products, there are obtained from 6 to 30 gallons per cord of spirits, depending on the quality of the "light wood." The tar, by further distillation, produces pitch, which finds a steady market, and tar oil, which, on account of its creosote contents, is worked up into disinfectants, cable-coating, sheep dip, wood preservative, shingle stain, etc. There is also a varying yield of wood oils, which find some market in the drug and essential oil trade. By basing their estimates of production of charcoal, acetate of lime and wood alcohol on the yields commonly known to be obtained from "hard wood," and for those of oil of turpentine, tar, tar oils, and "specialities" on the richest stumps and "light wood," it was easy to show on paper at least, a net profit of $50 per cord, which in a plant of ten cords per day meant $500 daily profit. With some such figures as a basis, a great many people were persuaded to embark in the destructive distillation of "light wood," but as soon as these plants were under way, a great many drawbacks appeared. (1) Their yield of wood alcohol proved to be only one or two gallons per cord, instead of 10 gallons per cord as commonly obtained from hard wood, and the cost of manufacturing wood alcohol from this source was found to be considerably in excess of the selling price. (2) The acetate of lime produced, was found to be comparatively small in quantity and poor in quality, the usual product being a brown acetate, which commanded a very much lower price than the regular commercial grey acetate, produced from hard wood. (3) The yields of oil of turpentine fell far below the estimates in most cases, and proved to have a very strong odour of creosote and aldehyde products, and great difficulty was found in marketing it at a satisfactory price. The objectionable odour could be removed in the main by treatment with sulphuric acid and caustic soda, but the yield was very much decreased by this treatment, and the resulting product, while having a fair odour, had lost noticeably in the valuable drying properties. (4) The various "specialities," from which so much was expected, usually overstocked the market after the first few gallons were sold. (5) The charcoal was ordinarily produced far away from blast furnaces, where the only consumption was that required for domestic heating in some not too distant city.

Many of these plants were finally abandoned; many more were accidentally burned; some are still standing practically in ruins. One which was built not many years ago at the cost of about $200,000, was sold as scrap within the last year for $20,000 or less. Of course, vigorous attempts were made to overcome the various defects, such as heating very gently until the spirits of turpentine had been distilled off and then increasing the heat; taking off the various products at different levels in the retort; regulating the heating by various devices, so that it should be evenly distributed throughout the retort; installing a great variety of patent separators to make the refining easier and more accurate. A few such plants are still in operation. The claim of some to be running at a financial profit, is probably due to the fact that these particular plants have worked up their tar oil into secret special compounds for which they have found a market.

So far as the writer knows, none of them is attempting to make wood alcohol; one at least is still making acetate of lime, and showed recently a net profit of 1c. per cord and a capacity of 7 cords per day. One small plant is using an asbestos-covered vertical retort in an endeavour to regulate the heat; another attempted to accomplish the same object by surrounding the retort by a huge oil bath. In the latter case material lying nearest the sides of the retort is charred before that in the centre has been warmed up appreciably. The retorts used have been mainly of iron, varying in size from half a cord up to five cords capacity, and requiring from 36 hours to 5 days for the distillation of a single charge.

It seems to be evident from the above that primary destructive distillation is not the proper method to apply from a financial point of view.

The use of a hot bath in the retort instead of round it was patented by Johnson in 1865. This idea has been re-discovered and re-patented within the last three or four years, and at least three plants working on this system are now in operation. The method usually adopted is to charge the retort with wood and then pump it nearly full of melted rosin, keeping the temperature of the rosin sufficiently high by blowing in superheated steam. When steam is allowed to blow through, it carries off the spirits of turpentine and with it a certain amount of wood oil and rosin oil. It has been stated that the yields from this process are as high as 30 gallons of spirits of turpentine and 40 gallons of heavy oil and rosin oil per cord, but in tests which the writer has witnessed, from 12 to 15 gallons of spirits of turpentine, 2 to 3 gallons of oil and 5 gallons of rosin oil might be considered average figures. The defects of this system are obviously danger of fires and high cost of the process.

The next system to be generally exploited was the use of superheated steam, for which the oldest patent was granted to Hull in 1864. This process has been repeatedly re-patented since, and there are now at least 6 such plants in operation. The usual method is to grind the wood in a chipping or edging grinder, place it in fairly large vertical retorts, and pass superheated steam through it until the spirits of turpentine and some of the oils have been entirely distilled off. In ordinary practice the superheaters are not regulated accurately, and the fires are very often allowed to die out. The method seems to have no particular advantages, and has the decided drawback of charring the wood where the superheated steam first enters the retort and so contaminating the spirits of turpentine with products of destructive distillation.

The first patent for removing the oil of turpentine from "light wood" by the use of steam without superheating was granted to Leffler in 1864. This apparently received no consideration for a great many years, and was rejuvenated by Krug a few years ago. Most of the plants which have recently been built, have used primary steam distillation to recover the spirit of turpentine, postponing destructive distillation or any other methods of recovering the other products from the wood until the spirit was removed. Future developments will probably be along similar lines. The principle used in this method is quite different from that of all the other systems, which heat the product in the wood high enough to boil off the spirit of turpentine. The success of a steam distillation plant depends first on the quality of wood; second, on the price for which it can be delivered at the retorts; third, the keeping of labour costs at the lowest possible figure by use of suitable retorts and machinery; and fourth, the proper penetration of the steam into the wood. The main development in recent years has been in the selection of suitable machinery and proper co-ordination of the different parts of the plant, and particularly in the designing of a retort which could be rapidly charged and discharged, and which would insure that the steam penetrated all parts of the wood without forming channels through it. Of the many retorts suggested, some are horizontal, charging through the top and discharging at one end; some are vertical, with various devices, more or less successful, for opening a large discharging door at the bottom; some use either a horizontal or vertical retort in which a cylindrical basket is placed containing the charge; and some have even attempted a continuous operation by charging and discharging all the time by mechanical devices; others still have used the idea of a retort hung on trunnions turned up to be charged and turned over for discharge; and others a horizontal retort with mechanical discharging device. At least two plants have attempted to use the system of running cars into retorts, something like the method used in "hard wood" distillation.

Many patents have been taken out covering the direction the steam moves in the retort, whether down or up, the introduction of the steam at various levels, and the agitation of the charge during the run; but the value of all these points is still doubtful. The time required for steaming out spirits of turpentine by this method varies from 1 to 12 hours in different plants. Yields vary from 6 to 25 gallons per cord, depending on the quality of "light wood" and the character of the plant, a fair average being from 12 to 15 gallons. When steam distillation is properly operated and the product is suitably refined, it would appear that the spirits of turpentine produced should not differ in any appreciable way from the old process spirits of turpentine or gum spirits of turpentine, the low temperature preventing action on the wood, just as in the case of the material which exudes from the tree in the old process.

There are now perhaps 80 plants in the United States for recovering spirits of turpentine from "light wood," and from mill waste. The writer is fairly familiar with the operations of about 50, and very intimately acquainted with from 12 to 15. The products from the various plants vary not only on account of different methods employed in the plants, but mainly because the attempt is not made to produce material of a perfectly uniform standard; and in cases where this is attempted the standards of different plants are different. When success has been attained along the line of standardizing the various methods of manufacturing, a spirit of turpentine produced in this way should be not at all inferior to gum spirits of turpentine; in fact, it should be superior on account of its uniformity.

After the wood has been treated by the steam process, it remains in almost exactly the condition in which it entered the retorts, excepting that the spirit of turpentine has been removed. A part of this refuse is used for fuel. The disposition of the remainder is a serious problem, because it cannot be destructively distilled in the ordinary retort without agitation on account of its poor conducting power. Some fairly successful attempts have been made to utilise it for manufacturing a low grade of paper, and for recovering the resinous material, but most of these attempts are still in the experimental stage. The point which has been definitely proven is that no destructive distillation can be attempted in the same retort that is used for distilling off the spirits of turpentine.

THE FREEZING POINT OF GASOLINE.

BY GODFREY L. CABOT, BOSTON, U.S.A

Received, June 3, 1907.

About 10 c.c. of gasoline, specific gravity 0·698 at 22·8° C., were put in a test tube, this test tube was inserted into the neck of a double wall silvered flask containing liquid air, and the contents stirred with a thermometer containing pentane. At – 110° C., the gasoline was perfectly limpid. At – 122° C., it began to show a slight pastiness. At – 125° C., it looked and felt like soft petrolatum, and rapidly became harder as the thermometer sank further.

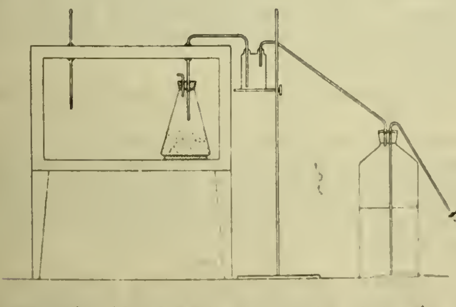
A sample of gasoline the specific gravity of which was 0·713 at 22·8° C., began to show a slight pastiness at about – 120° C.; this pastiness increased, and at – 147° C. the gasoline seemed to be perfectly solid, like horn. There was no sign of any crystallisation, and the frozen gasoline looked like the purest petrolatum or vaseline.

THE DETECTION OF MERCURY IN EXPLOSIVES.

BY W. A. HARGREAVES, M.A., F.I.C., AND W. T. ROWE, PORT ADELAIDE, SOUTH AUSTRALIA.

Received, June 24, 1907.

A very small quantity of mercuric chloride (one part in 200,000) in gelignite, blasting gelatine, or similar explosive will so interfere with the Abel heat test as to increase the time for reaction by many minutes. In an explosive recently examined, the test was raised by this proportion from 23 minutes to 58 minutes. Possibly a smaller proportion of mercuric chloride will also seriously affect the test. Larger quantities of mercuric chloride may extend the time further. In one instance of an explosive in which mercury was found, reactions were not obtained under 90 minutes; duplicate samples, to which was added some silver leaf, reacted in 13 minutes. For those whose duty it is to examine explosives, it becomes, therefore, a matter of very great importance to determine whether a given explosive to be tested for purity or stability by the heat test, contains mercuric chloride or not. An ingenious method has been devised by Dr. Dupré whereby this can be determined by means of spectrum analysis. It is, however, preferable to prove the presence of mercury by direct chemical tests, and even more desirable to actually demonstrate the presence of mercury by extracting it and viewing it in the metallic state. The object of this note is to indicate how this has been done in the Government Laboratory, South Australia. Finding that mercuric chloride may be sublimed from explosives at a fairly low temperature, the following method of extraction was originated. One hundred grms. of blasting gelatine, gelatine dynamite, gelignite, etc., is ground up in a mortar with one hundred grms. of purified French chalk, the grinding being done in small quantities at a time. The mixture is placed in a flask in a water oven, and attached by glass tubing passing out of the oven to a Woulff's flask or other absorption apparatus containing 50 c.c. of water with 0·75 c.c. of strong sulphuric acid, and the whole gently aspirated, while the flask is heated in the bath to the temperature of boiling water. (See figure.) In about two hours, the mercuric chloride will be transferred to the dilute sulphuric acid in the absorption apparatus. The solution is then subjected to electrolysis, a pure gold foil cathode and platinum anode being used. The current required is about 0·5 Ampere or less, at a pressure of two volts. The deposition of the mercury on the gold is complete in a few hours, but the current may be conveniently left running all night. Where the quantity of mercury is large, the gold cathode will be seen coated with mercury, and it may be weighed and the test made quantitative, but in the small quantities usually present, no decided deposit will be visible on the gold. The gold foil is removed from the electrolyte while the current is still running, washed in distilled water and alcohol, dried, rolled into a cornet, and inserted into a small glass sealed tube, 6 m.m. in diameter and about 35 m.m. long, which has its expanded mouth ground flat to fit snugly against a microscope glass slide. The glass tube is fitted in the hole in a stout brass plate, and then very gently heated, after a dry microscope slide has been placed on the top. A sublimate will be obtained on the glass slide, and care must be taken not to raise the temperature sufficiently to re-volatilise this. The slide on being examined under the microscope (about 250 diameters) by transmitted and reflected light will, shew globules of metallic mercury of large or small size according to the skill with which the heating has been conducted. If the globules are very small, they may not be readily recognised as mercury, but under the conditions of the method, any small opaque dots, shewing brilliant specks by reflected light, must be mercury, and a repetition of the test will probably shew larger globules. Mercury was also easily shewn to be present in some gelignite by igniting (by means of a small gas jet) successive small quantities of the explosive under a glass funnel in a porcelain dish, the dish being floated on water to keep it cool. The burning was conducted in the open air to allow of the ready escape of nitrous fumes, and in case of an explosion. The burnt mass was digested in dilute sulphuric acid, and the solution subjected to electrolysis as above described. This method, while shewing any kind of mercury compound present, has the disadvantage of giving an impure solution, and the gold cathode may be coated with salts from the solution. The mercury sublimate can, however, be obtained on the microscopic slide. Another method of solution was experimented with which also resulted in shewing metallic mercury on the slide, but for obvious reasons it is not so satisfactory as the other two. In this case solution was obtained by leaching 100 grms. of explosive, previously ground up with 100 grms. of French chalk with 93 per cent. alcohol, precipitating the nitroglycerin by dilution, filtering, and concentrating the filtrate to a convenient bulk for electrolysis. The first described method is quite satisfactory, and has the advantage of withdrawing the mercuric chloride in the same manner as that in which it acts in masking the reaction with the starch-iodide paper in the heat test. By treating successive portions of an explosive, sufficient mercury may be obtained to render the process capable of yielding quantitative results, the gold cathode being weighed.



Obituary.

F. H. GOSSAGE,

Original Member, and formerly Vice-President of the Society of Chemical Industry.

F. H. Gossage was born in the year 1832, and was the third son of the famous William Gossage, manufacturing chemist. Under his father's supervision F. H. Gossage was initiated into the principles of chemical science and its application to the industries in which the firm was more especially interested. He inherited in a remarkable degree his father's insight and initiative. The business of the firm which had been confined to the smelting of copper, in 1855, was extended to the manufacture of soap, with exceptional success. In the latter industry particularly, F. H. Gossage bore testimony to his inventive capacity in the processes he patented both for the introduction of further economies and the production of new materials. F. H. Gossage always evinced a deep interest in the welfare of Widnes, where the works of the firm are, and when it was incorporated as a township in 1892, he became its first mayor. His public benefactions were on a very liberal scale. He was a governor of Farnworth Grammar School, which was rebuilt chiefly through his activity and generosity, and in 1893, he endowed the school with a scholarship at Liverpool University. Towards the great work of developing in Liverpool those facilities which are now offered by its University for a theoretical and practical training in science, F. H. Gossage has nobly contributed, and in association with T. S. Timmis, he founded the Quantitative Chemical Laboratory as a memorial of his father. It may be mentioned as an instance of F. H. Gossage's interest in this Society in its earliest days, that it was at his suggestion and invitation in 1881, that the late E. Rider Cook accepted the office of Honorary Treasurer. F. H. Gossage was a well-read and cultivated man, apart from his merits as chemist and inventor. He died June 30th, 1907.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

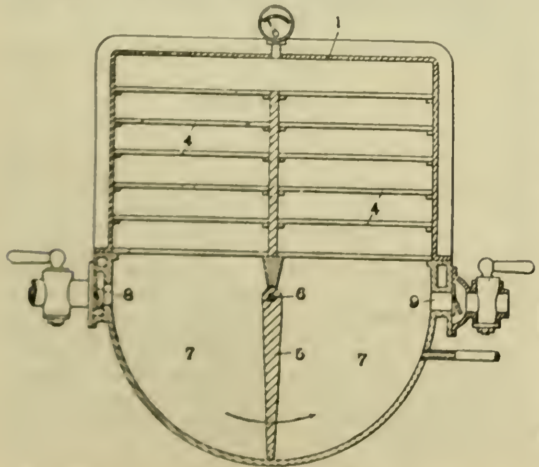
Temperatures; Method and apparatus for determining high ——. F. L. Morse, Trumansburg, U.S.A. Eng. Pat. 16,248, July 18, 1906.

SEE U.S. Pat. 826,594 of 1906; this J., 1906, 839.—T. F. B.

Classifying solid materials by their linear dimensions and their specific gravity; Apparatus for ——. R. E. Trottier, Hussein-Dey, Algeria. Eng. Pat. 17,081, July 28, 1906.

THE materials to be separated are fed intermittingly into a vertical pipe or shoot through which a current of water or air is transmitted. As the particles fall through the ascending current of fluid, they become separated according to their linear dimensions, and the lightest are carried away by the current. The remaining particles then reach a portion of the tube where the speed and direction of the current are altered by an adjustable shoe, and they are separated according to specific gravity. The lighter particles are deflected laterally over an adjustable inclined sorting table, where they are again classified according to their linear dimensions, and finally enter a shoot by which they are withdrawn from the apparatus. The heavier particles collect in a pocket from which they are intermittingly discharged into the next section of the apparatus, where the process is repeated.—W. H. C.

Drying-apparatus. M. Daiber, Lorch, and K. Gammel, Stuttgart, Germany. Eng. Pat. 2795, Feb. 4, 1907.



A DRYING-CHAMBER, 1, provided with shelves, 4, is arranged over a semicircular air-heating chamber, 7. A wing, 5, adapted to be moved to and fro on the pivot, 6, draws in air through the flap-valve, 8, drives it over the material on the shelves, and expels it through the valve, 9. —W. H. C.

Evaporator. F. Kleinschmidt, Doyle, N.Y. U.S. Pat. 856,262, June 11, 1907.

THE evaporator has a horizontal tubular heater arranged in the lower part of the casing. Steam enters a circular perforated distributing box contained in the hollow inlet-head, which forms one end of the heater, and passes through the tubes, the excess of steam and condensed water escaping from an outlet-head at the other end, which is provided with a steam-outlet pipe.—W. H. C.

Evaporating apparatus. S. G. Lewis, St. Louis, Mo., Assignor to Banana Food Products Co., Arizona. U.S. Pat. 856,478, June 11, 1907.

THE apparatus consists of a casing divided by a sloping partition and provided with a heater. The materials are dried on inclined trays on shelves which project from one side of the casing to within an equal distance from the inclined partition. A condenser is formed above the casing, provided with an opening for the circulation of air and with a tray to catch the condensed liquid. —W. H. C.

Evaporator. S. G. Lewis, St. Louis, Mo., Assignor to Banana Food Products Co., Arizona. U.S. Pat. 856,479, June 11, 1907.

A RECTANGULAR chamber is divided into compartments by horizontal partitions. Each compartment has a separate heating coil connected to a common heater situated in the lower part of the chamber. The materials to be dried are spread on the partitions, between which and the wall, on one side, a space is left for the escape of vapour. A water-cooled condenser is arranged over the chamber, and a pan is provided to catch the condensed liquid.—W. H. C.

Dryer; Mechanical ——. W. M. Cummer, Cleveland, Ohio. U.S. Pat. 857,161, June 18, 1907.

A ROTARY drying-cylinder is constructed in sections of progressively larger diameters from the inlet to the outlet. The sections are connected by rings, and the complete apparatus is similar to a drawn-out telescope. Draught-holes are provided in the rings by which the sections are joined together.—W. H. C.

Drying process and apparatus. Gebr. Daiber and K. Gammel. Fr. Pat. 374,712, Jan. 30, 1907.

SEE Eng. Pat. 2795 of 1907; preceding these.—T. F. B.

Filter ; Air —— which is continuously cleaned. J. F. P. Kestner. Fr. Pat. 374,483, Feb. 6, 1907. Under Int. Conv., Feb. 6, 1906.

See Eng. Pat. 2870 of 1906 ; this J., 1907, 246.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Patents.

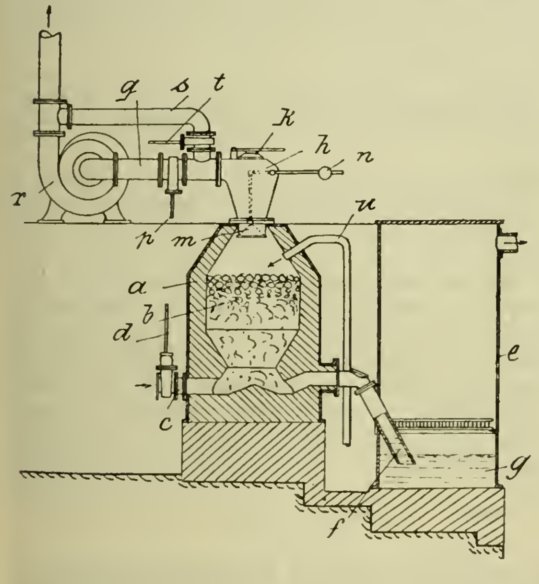
Gas producers. H. Newton, Derby. Eng. Pat. 13,598, June 13, 1906.

The producer, which is designed to operate by either blast or suction, consists of a combustion chamber casing, surrounded by three concentric casings, the whole standing in a water-sealed ash-tray. Upon the exterior surface of the combustion chamber casing is fixed a spiral channel or a series of shallow gutters, on to which the water supply is admitted, the water becoming vaporised and carried downwards to the grate along with the air supply, which is heated by passing up and down between the concentric casings. To provide a supply of steam on first starting the producer, water is admitted to a shallow channel adjacent to, or forming part of, the fire-grate.—H. B.

Methane ; Process for the preparation of pure —— or of a gaseous mixture rich in methane. P. Sabatier, Toulouse, France. Eng. Pat. 13,861, June 16, 1906. Under Int. Conv., June 17, 1905.

See Fr. Pat. 356,471 of 1905 ; this J., 1905, 1294.—T. F. B.

Water-gas producers. W. Clark, London. From Dellwik-Fleischer Wassergas Ges. m.b.H., Frankfort, Germany. Eng. Pat. 18,256, Aug. 14, 1906.



A producer, *a*, charged with fuel, *b*, through the hopper, *h*, *k*, *m*, *n*, has a blast-pipe, *c*, fitted with a side-valve, *d*, and a gas-delivery-pipe, *f*, sealed in the water, *g*, of the scrubber, *e*. The hopper, *h*, has a pipe, *q*, provided with a slide-valve, *p*, connected to the fan, *r*, and also a by-pass pipe and valve, *s*, *t*. When starting, the valve, *t*, is opened, the bell, *m*, lowered, and the blast-valve, *d*, slightly opened. The gases then escape through *s*, to the chimney. When heating up, the valve, *p*, is opened wide, the fan, *r*, is started, the valve, *d*, is opened wide, and *t*, closed. The "blow" then proceeds by suction, so that there is no escape of gas from the joints of the producer, which consequently do not have to be made specially tight. When sufficiently hot, the fan is stopped, *d*, and *m*, are closed, and steam is admitted through the pipe, *u*. The steam passes downwards through the fuel, and the water-gas produced escapes through *f*. As the space above the fuel contains steam only, there is no danger of poisonous carbon monoxide escaping from the top of the generator. The fuel is charged into the hopper through *k*, during the gas-making period. During "slagging," or when the producer is stopped but has to be kept hot, the valve, *p*, is closed, and *t* slightly opened.—W. H. C.

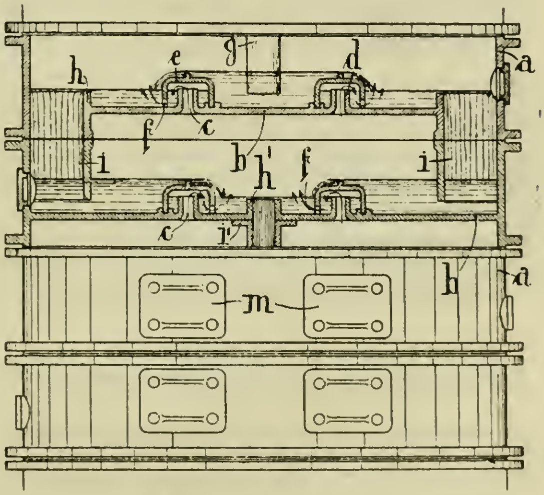
Ascension pipes of gas retorts ; Method of and means for preventing choking of the ——. W. P. Gibbons, Dudley, Staffs., and G. H. Judd, Sheringham, Norfolk. Eng. Pat. 24,418, Nov. 1, 1906.

In order to prevent the choking of the ascension pipes of gas retorts, these pipes, or the retort mouthpieces, are connected together by means of valved pipes, whereby a portion of the gas issuing from one or more of the freshly-charged retorts is passed up those ascension pipes leading from retorts in which the later stages of carbonisation are proceeding.—H. B.

Gases ; Apparatus for purifying blast-furnace and other impure ——. C. Flössel, Munich, Germany. Eng. Pat. 14,496, June 25, 1906.

See Fr. Pat. 373,998 of 1906; this J., 1907, 754.—T. F. B.

Liquids and gases or vapours ; Apparatus for the mutual direct influencing of ——. [Gas-scrubbers, ammonia distilling columns, etc.] H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 25,507, Nov. 12, 1906.



The liquor enters the top cylindrical compartment through the pipe, *g*, sealed in the liquid as shown, and flows outwards over the bubbling hoods or weirs, *e*, to the overflow pipe, *h*, provided with a prolongation, *i*, which dips into and is sealed by the liquor in the next lower compartment. In this compartment the direction of flow is reversed, and the liquid flows from *i*, towards the middle, over the weirs, to the overflow, *h'*. The steam or gas passes up through the slots, *c*, over the flanges, *d*, and bubbles through the serrations, *f*, in the weirs, *e*. These serrations are on the opposite sides of the hoods or weirs, *e*, in alternate compartments.

The hoods, *e*, can be withdrawn through openings closed by the doors, *m*, the joints being made by a piece of wood or similar material. An alternative constructional form is claimed in which each compartment has exactly the same form and can be cast from the same pattern, the alternation of direction of flow being obtained by turning each successive compartment through a horizontal angle of 90° as it is placed in position.—W. H. C.

Gas washing machines. A. Wilson, Stafford. Eng. Pat. 29,471, Dec. 27, 1906.

Two rotating paddle-wheels are arranged, the one above the other, inside a vertical casing, upwards through which the gases to be washed are passed, whilst a stream of water is admitted through the top and falls on to the upper paddle-wheel. The water, which is splashed about by the paddle-wheels during its descent through the casing, is to a large extent caught upon a series of inclined shelves, which direct it back on to the paddles.—H. B.

Electric conductors suitable for incandescent lamp filaments, furnaces, or other apparatus. The British Thomson-Houston Co., London. From the General Electric Co. of Schenectady, U.S.A. Eng. Pat. 18,487, Aug. 17, 1906.

Pure graphite, such as is obtained by graphitising lampblack, is mixed in a fine state of division with an inorganic binding material, and threads or rods made of the mixture are afterwards treated so as to expel the inorganic binder, leaving a conductor of pure refractory graphite. For example, the graphite may be ground up with a warm, plastic amalgam composed of cadmium and mercury, with or without bismuth, and when the amalgam has taken up as much of the graphite as possible, the mixture is squirted into threads, etc., which are then heated in a vacuum or in an inert atmosphere, to expel the metals. —H. B.

Incandescence filaments for electric lamps; Manufacture of —— from metallic thorium containing oxide, with or without admixtures of other difficultly fusible metals. Siemens und Halske A.-G., Berlin. Eng. Pat. 2123, Jan. 28, 1907. Under Int. Conv., Mar. 29, 1906.

Metallic thorium has been found to have so high a ductility, that it can be drawn into filaments even when it contains up to 10 per cent. of oxide. According to this invention, filaments are made from thorium containing oxide, with or without the addition of other metals fusible with difficulty, by drawing or rolling the powder into the desired form, *e.g.* by stamping it into a hollow body of another ductile metal and then subjecting this body with its contents to a drawing process, the shell of the other metal being subsequently removed from the drawn filament either chemically or otherwise.—H. B.

Fuel briquettes; Method of preparing ——. H. W. Jordan, Assignor to Semet-Solvay Co., Syracuse, N.Y. U.S. Pat. 857,287, June 18, 1907.

The binding agent is ground to a fine powder with a portion of the coal or other material to be briquetted, and the mass is then mixed with the remainder of the coal or other material in a coarser state.—W. H. C.

Fuel, artificial; Apparatus for making ——. J. J. Shedlock, London. U.S. Pat. 857,417, June 18, 1907.

See Eng. Pat. 22,677 of 1905; this J., 1906, 1210.—T. F. B.

Hydrocarbons; Emulsioning and solidification of ——. [Briquettes.] W. Van der Heyden, Nanterre, France. U.S. Pat. 857,425, June 18, 1907.

Hydrocarbons, such as naphtha, petroleum, benzene, and the like, are made into an emulsion with a solution of glue. To this are added dust-like fuel, such as coal-dust, together with glycerin, and salts of organic acids (tartrates, citrates, oxalates), and the mass is "subjected to a hardening process."—F. Shdn.

Gas-producer. A. de Gálocsy, L. de Bánó, and J. Terény, Budapest, Austria-Hungary. U.S. Pat. 855,845, June 4, 1907.

This producer consists of a main generator chamber, provided with a rotary stirrer, and a helical grate and a water-seal at the bottom. Above the generator chamber is a distillation chamber with a movable grate, and a door at the bottom, through which the coked fuel is intermittingly fed into the generator chamber. Air inlets are arranged between the door and the grate, and by means of a fan, air is supplied to the generator chamber, and the distillation gases are withdrawn from the distillation chamber and introduced into the generator chamber, below the helical grate, to be converted into permanent gases. The amount of distillation gases introduced, is controlled by means of adjustable inlets to the generator chamber. The suction pipe of the fan is arranged adjacent to the generator chamber, and valved passages, placed in a line, pass through the pipe and allow of the introduction of tools into the generator chamber, without permitting the escape of gas to the outer air. The water-seal is provided with a basin from which the ashes and clinkers are removed by a conveyor.—W. C. H.

Gas-producer. A. de Gálocsy, L. de Bánó, and J. Terény, Budapest, Austria-Hungary. U.S. Pat. 856,137, June 4, 1907.

The gas-producer comprises a generator chamber provided with means for feeding fuel into its upper portion, and mounted upon a ring, which extends downward to form a water-seal. Within this ring, and of substantially the same cross-section as the chamber, is a helical grate which closes the lower portion of the chamber, and is mounted on a vertical shaft so that it can be rotated in either direction. A paddle is also secured to the grate, to force the ashes from the higher portion of the ash-pit into a basin from which they are removed by a conveyor. (See preceding abstract.)—W. C. H.

Gas; Apparatus for washing and cooling ——. H. L. Doherty, Madison, Wis. U.S. Pat. 855,448, June 4, 1907.

The apparatus consists of a casing, provided with a gas inlet and outlet, and divided into a number of vertical communicating chambers, adjoining each other, these chambers being again horizontally divided into compartments one above the other. These compartments are provided with numerous interstices over which the washing and cooling liquor is discharged, and are so arranged that a subdivided distributing space is situated above the vertical chambers, and also a series of baffles beneath them, and below these again, a horizontal collecting-chamber, and means for withdrawing the liquor there deposited. The liquor thus withdrawn is returned to the cooling and distributing pipes at the top of the system of vertical chambers with horizontal compartments.—W. C. H.

Gas-washer. G. Saaler, New York. U.S. Pat. 856,731, June 11, 1907.

A casing has a water-sealed gas-inlet and a water-outlet at its front end and a gas-outlet and water-inlet at its rear end. A drum, provided with a series of inclined wings or blades, is mounted so as to be rotated within the casing and to spray the water centrifugally in a direction opposed to that taken by the gas.—W. H. C.

Purifying gases; Process of ——. G. Saaler, New York. U.S. Pat. 856,732, June 11, 1907.

The claim is for the process of washing gas carried out in the apparatus described in the preceding abstract.

The gas is first cooled by falling streams of cold water, and then passed through a shower of water. It is next caused to alter its direction of flow at a sharp angle, and a mist or spray of water is driven forcibly against it. The gas is finally separated from the moisture.—W. H. C.

Gas producer ; Suction ——. H. N. Bickerton and P. W. Robson. Fr. Pat. 375,232, Feb. 8, 1907. Under Int. Conv., June 14, 1906.

SEE Eng. Pat. 13,703 of 1906 ; this J., 1907, 752.—T. F. B.

Gaseous mixtures ; Apparatus for producing ——, with regulation of the admission of gas and air. Akt.-Ges. f. Selasbeleuchtung. Fr. Pat. 374,508, Feb. 9, 1907. Under Int. Conv., Feb. 22, 1906.

SEE Eng. Pat. 3303 of 1907 ; this J., 1907, 519.—T. F. B.

Gas ; Process and apparatus for mixing and supplying ——, with regulation of its admission. Akt.-Ges. f. Selasbeleuchtung. Fr. Pat. 374,571, Feb. 12, 1907. Under Int. Conv., March 3, 1906.

SEE Eng. Pat. 3533 of 1907 ; this J., 1907, 519.—T. F. B.

Gas washers. G. Wilton. Fr. Pat. 374,849, Feb. 19, 1907. Under Int. Conv., June 15, 1906.

SEE Eng. Pat. 13,787 of 1906 ; this J., 1907, 191.—T. F. B.

Tungsten or molybdenum filaments for electric incandescence lamps ; Process for making ——. J. Lux. Fr. Pat. 374,543, April 19, 1906.

SEE Eng. Pat. 9020 of 1906 ; this J., 1907, 42.—T. F. B.

Filaments of incandescence lamps ; Process of uniting —— to the electric conductors. A. Just, F. Hanaman, Soc. Anon. Réunie d'Electricité, I. Salzmann, and H. Landesberger. Fr. Pat. 374,653, April 23, 1906.

SEE Eng. Pat. 9349 of 1906 ; this J., 1907, 601.—T. F. B.

Fuels ; Process for improving —— by expelling the easily-volatile constituents, under a high gas pressure. O. Hörenz. Ger. Pat. 175,207, Nov. 22, 1903. Addition to Ger. Pat. 161,952 of 1903 (this J., 1905, 1294).

ACCORDING to the present additional patent, the charge of fuel is heated, and the high gas pressure is produced, by means of heating tubes disposed within the retorts. —A. S.

Gas from coal ; Process for the production of —— in vertical retorts. G. Steinicke. Ger. Pat. 174,254, Aug. 27, 1904.

THE patent relates to the process of distilling coal in vertical retorts, wider from above downwards, in which the coal, in small quantities, is charged in at the top towards the sides. It is now proposed to feed in the coal only towards one side of the retort, so that it may form a heap with an inclined side. Under these conditions, distillation proceeds rapidly, and it is stated that the usual time of 6—7 hours is reduced to 4—5 hours.—A. S.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Aromatic hydrocarbons ; Separation of —— by means of fractional precipitation from solutions in alcohol. K. Charitschkow. J. Russ. Phys.-Chem. Ges., 1907, **38**, 1388—1392. Chem.-Zentr., 1907, **1**, 1738.

BY precipitating amyl alcoholic solutions with ethyl alcohol, it is possible to effect the fractionation of crude petroleum and the separation of stearic and palmitic acids. It is unimportant whether the substances to be fractionated are liquid or solid ; the chief point for consideration is the choice of a suitable combination of solvent and precipitant. According to the author, benzene and toluene can also be separated by fractional precipitation. —A. S.

PATENTS.

Distilling and carbonising certain materials [sawdust, wood waste, etc.] to obtain certain by-products therefrom ; Process for ——, and apparatus for carrying out the same. E. B. Robinson, Glasgow, and W. C. Edwards, Rockland, Canada. Eng. Pat. 24,961, Nov. 6, 1906.

THE material to be treated is fed by means of a spiral conveyer, into a slightly inclined, rotating retort, in which it is agitated and distilled : the volatile products of distillation are led off to a condenser, the portion not condensed being brought back to the retort furnace, and burnt. The non-volatile products pass down to a collector at the foot of the retort. (Reference is directed under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pats. 13,830 and 18,825 of 1899, this J., 1900, 724.)—T. F. B.

Liquids and gases or vapours ; Apparatus for the mutual direct influencing of ——. *[Gas scrubbers, ammonia distilling columns, etc.].* H. Koppers. Eng. Pat. 25,507, Nov. 12, 1906. *See* II.

Oils, fats, waxes, and the like ; Process for refining ——. J. K. Field, London. Eng. Pat. 10,960, May 10, 1906.

THE process relates to the treatment of oils, etc., with Florida fuller's-earth, the earth mined at Ellenton being the best for the purpose. The earth is dried, sifted, and then further dried, preferably by heating in an open vessel, before use. A charge of the earth is placed in a conical vat having a perforated bottom, and the oil or melted wax is filtered through it ; in the case of waxes, the vat may be surrounded with a heating jacket. About one part of earth is used for every hundred parts of light mineral oil, but more is used for heavier oils. The earth may be employed a second time after it has been washed with water and calcined at a red heat. (See also this J., 1907, 623.)—W. P. S.

Paraffine candles ; Manufacture of ——. G. Agostini, Chiusdino, Italy. Eng. Pat. 965, Jan. 14, 1907.

IN order to remove the tendency of paraffin candles to bend when warm, a small quantity (about 1 per cent.) of a lead salt is incorporated with them. It is recommended that the lead salt (*e.g.*, lead carbonate) be first incorporated with a fatty substance, such as linseed or cocoanut oil, and added to the molten paraffin, which is then warmed until the whole is homogeneous.—T. F. B.

Creosote ; Process of treating ——, and product thereof. A. G. Meyer, Assignor to H. R. Newbauer, San Francisco. U.S. Pat. 856,975, June 11, 1907.

SEE Eng. Pat. 28,997 of 1904 ; this J., 1905, 290.—T. F. B.

Tar and pitch ; Method of treating —— to render them more suitable for various industrial purposes. W. J. and A. Malden. Fr. Pat. 373,775, Jan. 21, 1907.

THE treatment consists in hardening the tar or pitch by the use of manganese compounds. Manganese dioxide or other suitable manganiferous material, to the extent of 4 per cent. and upwards, is added, together with an equal quantity of sulphuric or other suitable acid, to the tar, which may be either in the natural state or liquefied by heat. The tar is maintained in the liquid condition until the desired hardening effect is obtained. To increase the binding properties of the tar (for briquette making, etc.), resin or resinous compounds may also be added. —O. F. H.

IV.—COLOURING MATTERS AND DYESTUFFS.

Amino- and hydroxy-compounds of the benzene and naphthalene series; Determination of ——. H. T. Bucherer. Z. angew. Chem., 1907, **20**, 877—882.

The well-known method of analysing the components used in the preparation of azo dyestuffs by titration with a diazo-solution, stated by Lunge (*Chem.-tech. Untersuchungsmethoden*, III., 778) to give inaccurate results, furnishes exact figures when diazotised *p*-nitraniline is used in acid solution. For this purpose, Nitrosamine Red paste may be used, but must first be washed free from nitrous acid by means of a saturated salt solution. The paste usually contains 25 per cent. of the compound, $NO_2.C_6H_4.N_2.ONa+H_2O$; 82·8 grms. of it are stirred with 200 c.c. of water and treated with 30—40 c.c. of concentrated hydrochloric acid. The resulting solution is filtered and made up to 1 litre. If the diazo-solution is prepared direct from *p*-nitraniline, 13·8 grms. of the latter are gently warmed with 16 grms. of concentrated hydrochloric acid and 20 c.c. of water. The warm solution is then poured into a mixture of 500 grms. of ice, 8 grms. of concentrated hydrochloric acid, and 50 c.c. of nitrite solution containing 6·9 grms. of sodium nitrite. After stirring for a short time, an almost clear solution is obtained, which is filtered after a further 15 minutes. The filtrate is diluted to 1 litre, protected from light, and standardised by titration with a very dilute solution of β-naphthol in presence of sodium acetate or bicarbonate. Most of the naphthol- and naphthylamine-mono- and disulphonic acids may be accurately analysed by titration with diazotised *p*-nitraniline in presence of sodium acetate or bicarbonate, but those naphthylaminesulphonic acids which combine with difficulty or not at all with diazo-compounds, must be titrated with sodium nitrite according to the usual method. In carrying out the analyses, such an amount of the component is taken as will require about 20—25 c.c. of the diazo-solution; the usual precaution of adding salt to precipitate the azo-dyestuff must also be observed.—J. C. C.

Amino- and hydroxy-compounds of the benzene and naphthalene series; Determination of —— C. G. Schwalbe. Z. angew. Chem., 1907, **20**, 1098—1090.

In freeing Nitrosamine Red paste from nitrous acid (compare preceding abstract), it must be very well drained or, better, pressed out. This operation is repeated, and, finally, the paste should be stirred for 24 hours with salt solution at 20—30° C. In the absence of the commercial product, the paste may be prepared by pouring a solution of *p*-nitrodiazobenzene chloride into caustic soda diluted with salt solution at as low a temperature as possible. The heavy brown-red precipitate so obtained may be converted into the yellow modification by stirring with warm salt solution: this, unlike the former, may be kept as a homogeneous paste for a long time. After adding hydrochloric acid for the purpose of regenerating the diazo-chloride, it is better to wait for one hour instead of 15 minutes as given by Bucherer, before filtering. Those diazo pastes which are prepared in a vacuum (Azophor Red PN, Nitrazol C) are to be preferred as being free from nitrous acid, but Nitrosamine Red paste is much more stable, if kept in well-closed vessels.—J. C. C.

Patents.

Azo colouring matters [dyestuffs]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 17,743, Aug. 7, 1906.

See Fr. Pat. 368,008 of 1906; this J., 1907, 16.—T. F. B.

Triphenylmethane derivatives and azo colouring matters [dyestuffs] therefrom; Production of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 5240, Mar. 8, 1907.

If the leuco compounds obtained by combining an alkylated diaminodiphenylcarbinol with 2·6-dinitrodiphenylamine-4·3′-disulphonic acid, or with 2·4-dinitrodiphenylamine-6·3′-disulphonic acid, or with a derivative of these acids, as in Eng. Pat. 25,977 of 1906 (this J. 1907, 313), be treated with a reducing agent, the corresponding diamino compounds of triphenylmethane derivatives are obtained. These compounds can be combined with diazo compounds, yielding azo dyestuffs which dye unmordanted wool in yellow to brown shades, changing to blue to yellowish-green tints of excellent properties on treatment with bichromate. The diazo compounds used may be either of the benzene or naphthalene series, and may contain a sulphonic acid, carboxylic acid, or hydroxyl group, or be otherwise substituted or not. Example: 500 parts of iron filings and 2000 parts of water are treated, gradually, during a period of two hours, with 671 parts of the leuco compound obtained by condensing tetramethyldiaminodiphenylcarbinol with 2·6-dinitrodiphenylamine-4·3′-disulphonic acid, and having the formula: $(SO_3H)(NO_2)_2.C_6H_2.NH.C_6H_3(SO_3H).CH[C_6H_4N(CH_3)_2]_2$. The temperature rises to about 75° C., and is maintained at that point for 6—10 hours until the reduction is complete. The mass is then boiled with 130 parts of sodium carbonate to precipitate the iron, filtered, and dilute sulphuric acid added to the filtrate until it is just acid to Congo paper, when the diamino compound separates and can be filtered off. 9·3 parts of aniline are diazotised in the usual manner, and the solution is introduced, at the ordinary temperature, into a solution of 61·1 parts of the above-mentioned diamino compound in about 400 parts of water, to which enough sodium carbonate has been added to keep it alkaline. The dyestuff separates as a yellow precipitate. After half an hour the whole is heated to 50° C., filtered, and the dyestuff dried. It is easily soluble in water, and dyes wool in yellow shades which become green on treatment with bichromate.—A. B. S.

Gallocyanine; Leuco-derivative from ——. W. Lommel, Elberfeld, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 856,536, June 11, 1907.

Gallocyanine is treated with alkaline reducing agents until a test portion of the product, after oxidation, is insoluble in sodium carbonate solution, and dissolves in hydrochloric acid (20° B.) with a pure blue colour. The hydrochloride of the leuco-compound is a greenish-black powder, soluble in water with a yellowish-green colour which readily oxidises to blue; it gives a yellow solution with concentrated sulphuric acid.—J. C. C.

Dyestuff; Gallocyanine ——. W. Lommel, Elberfeld, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 856,537, June 11, 1907.

A new dyestuff is obtained from Gallocyanine which, in the form of its hydrochloride, is a dark green powder, soluble in water with a reddish-violet colour. It is distinguished from Gallocyanine by the greater solubility of its hydrochloride and by giving redder and purer shades; it dissolves in hydrochloric acid (20° B.) with a pure blue colour and is insoluble in sodium carbonate solution. —J. C. C.

Indigo; Tribromo-derivatives of ——. G. Engi, Basel, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 856,687, June 11, 1907.

Tribromo-derivatives of indigo of the formula, $C_{16}H_7O_2N_2Br_3$, are obtained by brominating indigo, or mono- or dibromo-indigo in nitrobenzene solution. The compounds are dark blue to brownish-violet powders, insoluble in water, sparingly soluble in cold aniline or nitrobenzene, but more easily soluble in the hot solvents with a blue to bluish-violet colour. They give a blue solution with concentrated sulphuric acid and yield yellowish vats on reduction. The compound obtained from indigo itself is claimed as a new article of manufacture; it dissolves in concentrated sulphuric acid with a greenish-blue, and in fuming sulphuric acid (24 per cent. of sulphur trioxide) with a deep blue colour; it is sparingly soluble in hot aniline with a blue colour and in hot nitrobenzene with a blue-violet colour. On treatment with potassium hydrosulphite (hyposulphite), a greenish-yellow vat is obtained from which unmordanted cotton is dyed in blue shades fast to washing, light, and chlorine.—J. C. C.

Indigo; Tetrabromo-derivatives of ——. G. Engi, Basel, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 856,776, June 11, 1907.

By heating indigo, or mono-, di-, or tri-bromo-indigo with bromine in presence of nitrobenzene, tetrabromo-derivatives, $C_{16}H_6O_2N_2Br_4$, are obtained which are blue to blue-violet powders, insoluble in water, scarcely soluble in chloroform, cold aniline, or cold nitrobenzene, but sparingly so in hot aniline or hot nitrobenzene with a blue to blue-violet colour. They give a deep blue colour with concentrated sulphuric acid, and on alkaline reduction, furnish a light yellow coloured vat from which unmordanted cotton is dyed pure blue shades fast to washing, light, and chlorine.—J. C. C.

Dyestuff of the anthraquinone series, and process of making same. R. H. Scholl, Karlsruhe, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 856,811, June 11, 1907.

See Fr. Pat. 357,239 of 1905; this J., 1906, 66.—T. F. B.

Phenylglycine; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 374,948, April 30. 1906.

See Eng. Pat. 9700 of 1906; this J., 1906, 1214.—T. F. B.

Phenylglycine and its homologues; Process for making ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 375,055, May 2, 1906.

See Eng. Pat. 9774 of 1906; this J., 1907, 15.—T. F. B.

Indigo; Production of easily reducible ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 375,162, Feb. 28, 1907. Under Int. Conv., April 4, 1906.

See Eng. Pat. 6723 of 1907; this J., 1907, 523.—T. F. B.

Sulphide dyestuffs; Process for making and using new compounds of ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 374,642, Feb. 14, 1907. Under Int. Conv., Feb. 26, 1906.

See Eng. Pat. 8066 of 1906; this J., 1907, 16.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Stannic chloride solutions; Tin content and specific gravity of ——. P. Heermann. Chem.-Zeit., 1907, 31, 680.

The author has determined the specific gravity of solutions of the salt, $SnCl_4,8H_2O$, which was prepared from technical anhydrous stannic chloride by three successive crystallisations from its strongly cooled aqueous solution. The following table shows the results obtained at 17·5° C. for technically important concentrations and stated as percentages of tin:

°B.	%Sn.	°B.	%Sn.	°B.	%Sn.	°B.	%Sn.
65·7	29·45	58	25·84	50	22·20	32	14·00
65	29·12	57	25·38	49	21·74	31	13·56
64	28·64	56	24·93	48	21·29	30	13·11
63	28·17	55	24·47	47	20·83	29	12·67
62	27·70	54	24·02	46	20·38	28	12·23
61	27·24	53	23·56			27	11·79
60	26·77	52	23·11	34	14·90	26	11·35
59	26·30	51	22·65	33	14·45	25	10·91

A comparison with Gerlach's figures shows that the two are practically identical.—J. C. C.

Tin mordant employed by the ancient Egyptians. A. Scheurer and E. Gilliéron. Bull. Soc. Ind. Mulhouse, 1907, 77, 148—152.

From the materials then available, namely, metallic tin, sodium carbonate, alkali hydroxide-carbonate (wood ashes), quicklime, acetic acid (vinegar), citric acid (lemon juice), and alum, it would have been possible for the ancient Egyptians to make the following five tin mordanting preparations:—(i), Stannous acetate; (ii), a solution of basic tin citrate in acetic acid; (iii), basic tin citrate dissolved in a solution of alum; (iv), basic tin citrate dissolved by means of a slight excess of sodium carbonate; and (v), basic tin citrate dissolved by caustic soda. The third of these, applied to wool and then dyed with a suitable yellow dyestuff, yields a lake distinguished for purity and intensity of shade. The basic tin citrate in it is produced by acting upon tin in the presence of air, with lemon juice or with a solution of citric acid containing the same proportion, namely 85 grms. per litre, of acid. It consists of a mixture of basic stannous and stannic citrates. The Coptic dyers of the 8th century A.D. probably made and used such a composite alumina-tin preparation as a mordant in dyeing the tapestries discovered in the tombs at Antinoa and found by A. Scheurer and V. Silbermann to contain tin. Concerning the composition of the tin citrate, the fact is recalled that C. Koechlin in 1884 observed that the colouring matter of Persian berries gives its maximum brilliance and fastness when applied upon a mixture of stannous and stannic oxides corresponding with the formula, Sn_2O_3.—E. B.

Diazotisation of p-nitraniline as sulphate; Study of ——. F. Erban and A. Mebus. Chem.-Zeit., 1907, 31, 663—665, 678—679.

The authors have made a large number of experiments on the diazotisation of *p*-nitraniline in presence of sulphuric acid, and have investigated the influence of the agent used to neutralise the free mineral acid, on the shade of the Para-red obtained by combining with β-naphthol on the fibre in the usual way. The most suitable diazo solution was obtained by the use of four equivalents of sulphuric acid to one molecule of *p*-nitraniline. The finest and bluest shade of Para-red was produced by neutralising the free acid with sodium acetate; the dye-bath was clear and greenish-yellow, but after developing, it became darker, brownish, and rather cloudy. After standing for five hours, the dye-bath (after being once used) could still be employed, and after 24 hours the shade produced was a little brighter and yellower than that obtained after five hours' standing. The quantities used are as follows: 2800 grms. of powdered *p*-nitraniline are made into a paste with 2 litres of boiling water, then, after cooling, mixed with a solution of 1560 grms. of 95 per cent. sodium nitrite in 10 litres of cold water, and the resulting paste stirred into a mixture of 20 kilos. of powdered ice or snow and 38 litres of cold water with 8 litres (10·32 kilos.) of sulphuric acid of 32·5° B., or a mixture of 2·175 litres (4 kilos.) of sulphuric acid of 66° B. and 6·32 litres of water. The whole is stirred for $\frac{1}{4}$ to $\frac{1}{2}$ an hour until a clear solution is obtained. For neutralisation there is added a solution of 6 kilos. of sodium acetate in 15·8 litres of water; the volume of the whole is now 100 litres.—J. C. C.

Patents.

Fibrous plants, or portions thereof; Treatment of —— *for the obtainment of fibres therefrom.* M. A. Blachon and J. J. Peretmère, Paris. Eng. Pat. 16,142, July 17, 1906.

100 litres of a solution of sodium hydroxide (7—8 per cent. of soda, Na_2O) are heated to the boiling point, and $2\frac{1}{2}$ kilos. of sodium chloride (containing traces of magnesium chloride), $2\frac{1}{2}$ kilos. of pure potassium chloride, and about $2\frac{1}{2}$ kilos. of sodium hypochlorite of a strength of 20° Gay-Lussac, are added. The fibrous plants are introduced into this bath, the temperature of

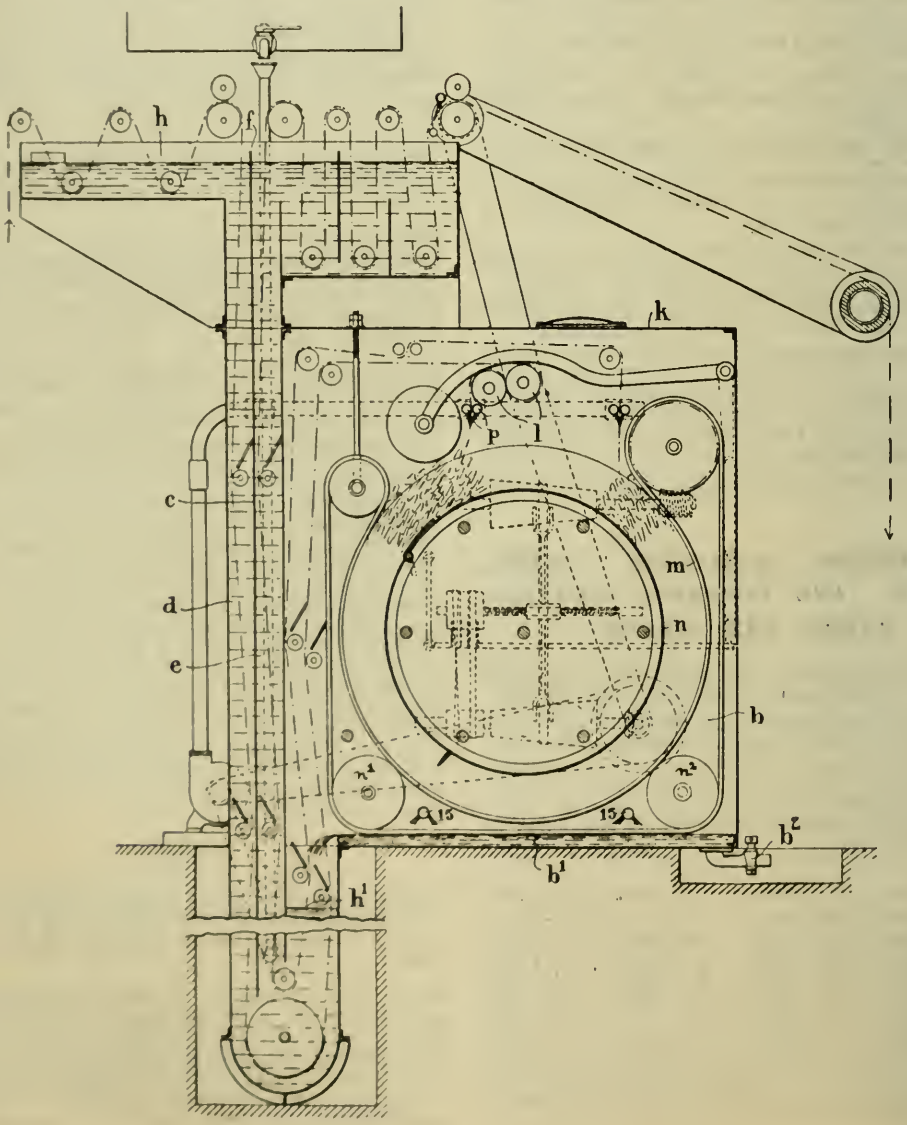
which must not exceed 90° C. The time required for the complete degumming and cleansing of the fibres varies from half-an-hour to three hours, according to the nature of the plants. In the case of some plants, such as ramie, the treatment is advantageously repeated in a similar bath for about twenty minutes, in order to ensure complete removal of the pellicle.—P. F. C.

Scouring machines; Dry ——. E. Ribaucourt and A. M. A. Hannart, Roubaix, France. Eng. Pat. 29,764, Dec. 31, 1906. Under Int. Conv., Sept. 15, 1906.

The machine comprises two scouring vats, through which the fabric passes over a series of rollers. As it leaves the first vat and again as it leaves the second vat, the cloth passes over suction tubes. From the scouring vats, the fabric travels through as many rinsing vats as may be necessary. Suction tubes are also placed between the rinsing vats, and a final tube is arranged at the end of the machine, so that the liquid may be extracted after the last rinsing. Each suction tube consists of a tube having a slot in its upper surface. At one end it is connected to an injector which is fed with steam and controlled by a needle-valve. The other end of the tube is fitted with a manometer. The solvent withdrawn through the tubes, is collected in a receiver and returned to the vats.—P. F. C.

Bleaching kiers. J. Spenle, Salford. Eng. Pat. 14,918, June 30, 1906.

This patent relates to a continuous bleaching kier, shown in sectional front elevation in the figure. The cloth enters and leaves the steaming chamber through a column of liquid which forms a seal. This column is divided by a partition, *c*, into two distinct channels, *d*, *e*, the flow of liquor being so arranged that the entering cloth is exposed to the outgoing liquor. In order to prevent a slight variation of pressure in the steaming chamber, *b*, from causing an inconveniently large rise or fall of the level of the liquor seal, the top of the column is enlarged as shown, the extension *f*, providing a washing tank. The base of the column is also extended to form a sump below the bottom of the steaming chamber. Inside the steaming chamber, *b*, the fabric is led to a pair of delivery rollers, *l*, in the upper part of the casing, *k*. Beneath these rollers is an accumulator, consisting of an endless lattice web, *m*, supported at each side on the rims



of a drum, n. The weight of the drum itself is borne by pulleys, n^1, n^2. The space between the lattice web and the drum, forms the accumulator. The web has a slow motion imparted to it, which also causes the drum to revolve. The cloth falls from the delivery rollers, l, on to the upper surface of the drum. To ensure the even laying of the material on the drum, and also to prevent lapping, the fabric passes between a pair of "spurt-pipes," p, which deliver jets in a downward direction, and thus set up a tension in the material. These pipes, p, are supplied with liquor either by a pump or an injector, and are given an alternating, oscillatory motion so that the jets act as a plaiting device. The liquor discharged by the pipes, p, percolates through the material in the accumulator, and is collected in the shallow receiver, b^1, at the bottom of the steam chamber. This receiver, b^1, acts as a sediment collector, in which the impurities washed out of the material can accumulate, and be periodically blown out through the cock, b^2. The overflow from the receiver, b^1, returns to the sump, and finally flows into the discharge portion, h, of the tank, f. The machine is also fitted with devices for regulating the alkalinity of the liquor in the accumulator and for preventing the material from slipping when the machine is started. Steam is admitted into the steaming chamber by means of pipes, 15.—P. F. C.

Silk; Process of weighting ——. C. Simon, Paterson, N.J., U.S.A. Eng. Pat. 28,982, Dec. 19, 1906.

SEE U.S. Pat. 840,264 of 1907; this J., 1907, 316.—T. F. B.

Mordanting fibrous materials; Method of ——. F. Blumenthal and J. Wolff, jun., Biebrich on Rhine, Germany. Eng. Pat. 1193, Jan. 16, 1907.

SEE Fr. Pat. 373,706 of 1907; this J., 1907, 683.—T. F. B.

Dyeing with sulphurised dyestuffs cotton mixed with wool or silk. Ges. f. Chem. Ind. in Basel, Basel, Switzerland. Eng. Pat. 3500, Feb. 12, 1907. Under Int. Conv., Dec. 24, 1906.

SEE Fr. Pat. 373,871 of 1907; this J., 1907, 759.—T. F. B.

Printing processes in which chemical inks are used. H. T. Wyse, Edinburgh. Eng. Pat. 12,872, June 2, 1906.

THE design is printed with cobalt chloride or some other cobalt salt which, on heating, changes from a pale pink to a blue colour. The cobalt ink may be combined with other coloured inks, for instance with a yellow ink which would become green on heating. In all these cases the original colour is gradually restored on cooling. (Reference is directed to Eng. Pat. 23,657 of 1901.) —A. B. S.

Cellulose; Process for the manufacture of threads, films, or other forms of ——. M. Fremery, E. Bronnert, and J. Urban. U.S. Pat. 856,857, June 11, 1907. *See* XIX.

Cloth; Process of treating ——. S. Hermann, New York. U.S. Pat. 855,708, June 4, 1907.

THE material is subjected to a bath prepared as follows:—5 grms. of gum zapota are added to 95 grms. of amyl acetate, then 10 grms. of this mixture are stirred with 40 grms. of turpentine until clear; 172 grms. of castor oil are added to 10 grms. of oleic acid, and the mixture is added to the turpentine mixture, finally 730 grms. of a concentrated solution of amyl acetate collodion, containing about 16 per cent. of "xylidin" or other nitrocellulose compound are added. After treatment with this solution, the fabric is squeezed, dried, subjected to a steaming process, and finally calendered.—A. B. S.

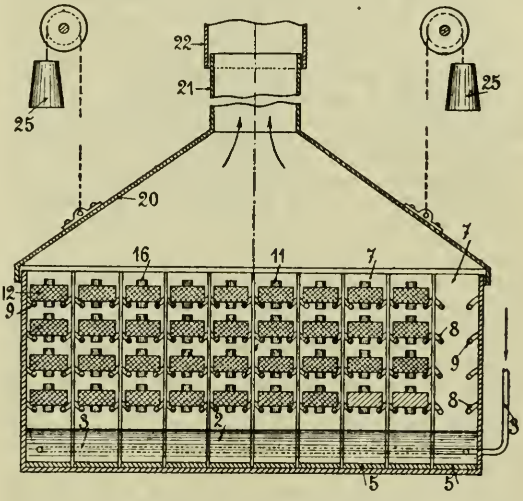
Textile materials; Process of fireproofing ——. W. H. Perkin, jun., Assignor to Whipp Bros. and Todd, Ltd., Manchester. U.S. Pat. 856,906, June 11, 1907.

SEE Fr. Pat. 321,063 of 1902; this J., 1903, 142.—T. F. B.

Cellulose and albuminoid bodies [Artificial silk]; Process for strengthening ——. X. Eschalier. Fr. Pat. 374,724, April 24, 1906.

THE process consists in the action of aldehydes, especially formaldehyde, upon cellulose and albuminoid bodies in the presence of acids or acid salts in conjunction with dehydrating agents. Artificial silk, for example, is placed in a bath of formaldehyde (1—10 parts) and acetic acid, 10—40 per cent. (90—99 parts). The threads after removal from the bath are placed in a dessicator containing calcium chloride or sulphuric acid, until completely dry, and are afterwards heated for 4—5 hours at 40° C. Finally, they are washed in water and again dried. Another method consists in placing the threads in a bath of glacial acetic acid containing formaldehyde for 3—4 hours at 90°—95° C., and afterwards washing with water and drying. The process is particularly adapted for the treatment of artificial silk products for the purpose of strengthening the threads.—G. W. McD.

Dyeing of all kinds of fibres on bobbins. [Froth dyeing.] Soc. Dubar-Delespaul. Fr. Pat. 373,176, Mar. 12, 1906.



THE patent relates to an apparatus for dyeing fibrous material in the froth produced from a dye-liquor by means of steam pipes. The dye-vat consists of a rectangular tank (see Fig.), the lower portion of which contains the dye-liquor (2) and the steam pipes (3). The upper portion of the tank is fitted with a number of frames consisting of two vertical ends (7), of the same height as the tank, and connected at the bottom by a horizontal portion (5). The vertical ends have a number of notches (8) in which are placed parallel horizontal rods (9) arranged in pairs on either side of the vertical portions (7). The material (12) is wound on bobbins (11) having a large central opening (16). The spindle has large openings at right angles to the central one, to allow the dye liquor to penetrate the material. These bobbins are placed in horizontal rows on the rods (9) as shown in the figure. The whole vat is covered with a conical roof (20) connected with a sliding chimney (21, 22), and this roof can be raised by balance weights (25) for the removal of the material.—A. B. S.

Dyeing animal fibres with sulphide dyestuffs; Process for ——. L. Cassella und Co. Fr. Pat. 375,056, May 2, 1906.

SEE Eng. Pat. 10,693 of 1906; this J., 1907, 315.—T. F. B.

Dyeing furs, feathers, and other articles; Process for ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 375,100, May 5, 1906.

SEE Eng. Pat. 10,609 of 1906; this J., 1907, 524.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Lithium monoxide; Preparation of anhydrous ——. De Forcrand. Compt. rend., 1907, **144**. 1321—1323.

LITHIUM hydroxide, or the hydrated hydroxide, LiOH, H_2O, was placed in a platinum boat, and heated electrically in a porcelain tube through which a current of pure dry hydrogen was passed. By heating to 780° C. for one hour (or to 660° C. for 7—8 hours), anhydrous lithium monoxide, Li_2O, was obtained. (See also this J., 1907, 468.)—L. E.

Calcium cyanamide and calcium carbide; Formation of ——. E. Rudolfi. Z. anorg. Chem., 1907, **54**, 170—184.

THOUGH pure calcium carbide will not combine with nitrogen even at 1200° C., it has been shown by Frank and Caro that the ordinary manufactured product is readily acted upon by nitrogen at a considerably lower temperature, with formation of calcium cyanamide (this J., 1905, 441). The reaction is brought about by the presence of lime in the commercial carbide, and a number of calcium salts have the same property of accelerating the combination of calcium carbide with nitrogen. Dry nitrogen was passed over commercial calcium carbide containing 82 per cent. of CaC_2, at temperatures varying from 700° to 1000° C. After two hours at 1000° C., the resulting product contained 21·11 per cent. of calcium cyanamide, $CaCN_2$. When the nitrogen was saturated with aqueous vapour, lower yields of calcium cyanamide were obtained, the percentage after two hours at 1000° C. being only 12·69. This is due to the decomposition of some of the carbide by water vapour, with formation of lime, and to the fact that any excess of the latter, over the amount naturally present in commercial carbide, retards combination with nitrogen. Of the various salts which facilitate the combination of calcium carbide with nitrogen, calcium chloride is the most efficient. Whereas at 800° C., commercial carbide yields only 3·97 per cent. of calcium cyanamide, a mixture of 62 parts of carbide and 18·7 parts of calcium chloride yields 37·29 per cent. Fluoride and iodide of calcium act similarly, and in each case the maximum increase in yield of cyanamide is found to take place at a temperature just above the melting point of the salt added. With regard to the direct production of calcium cyanamide from lime, carbon, and nitrogen, the conditions of calcium carbide formation had first to be made clear, and the author refers to Rothmund's statement (this J., 1902, 761—762) that the reaction, $CaO + 3C \rightleftarrows CaC_2 + CO$ takes place from left to right above 1620° C., and from right to left below that temperature, the partial pressure of the carbon monoxide corresponding to 1/5 atmosphere. According to Moissan, however, lime and carbon do not react at 1775° C. The author, using a Wanner pyrometer for measuring the temperatures, and withdrawing the lime-carbon charges from the influence of carbon monoxide whilst the mixture is still hot, finds that the lowest temperature, at which carbide is formed, lies between 1800° and 1819° C., which agrees fairly well with the figure obtained from thermochemical data, according to Nernst. For the study of the formation of calcium cyanamide, 2 parts of lime and 1 part of pure lampblack were heated in dry nitrogen in the same electric furnace that was used for the calcium carbide experiments. The lowest temperature, at which interaction took place, was found to lie between 1738° and 1753° C., both carbide and cyanamide being formed. The fact, that carbide was produced at a temperature below the minimum mentioned in the previous case, is explained by the decreased partial pressure of carbon monoxide, due to the constant removal of that gas by the stream of nitrogen. Calcium cyanamide was found to be re-converted by carbon monoxide into lime, calcium carbide, carbon, and nitrogen, at temperatures varying from 1650° to 1753° C.—O. R.

Ferric sulphate, anhydrous and hydrated; Different molecular conditions of ——. A. Recoura. Compt. rend., 1907, **144**, 1427—1430.

THE author describes, besides the ordinary anhydrous sulphate and the two hydrated sulphates already described by him (this J., 1905, 844), another form of the anhydrous sulphate and another hydrated salt. The anhydrous salt is obtained by the careful dehydration, first at 100° C., then at 175° C., of the white hydrate, $Fe_2(SO_4)_3,9H_2O$. It is bright brownish-yellow in colour, and dissolves rapidly and completely in water. It also hydrates much more rapidly in moist air than does the ordinary anhydrous salt, and produces a different hydrate, a yellow-brown compound, $Fe_2(SO_4)_3,3H_2O$. This salt is also obtained by dehydrating the white hydrate carefully at a temperature just below 100° C. It dissolves rapidly in 96 per cent. alcohol, whilst the white salt with 9 mols. of water dissolves very slowly, and the yellow one is decomposed by it into acid and basic sulphates. The differences shown by these five varieties of ferric sulphate do not persist in aqueous solution.
—J. T. D.

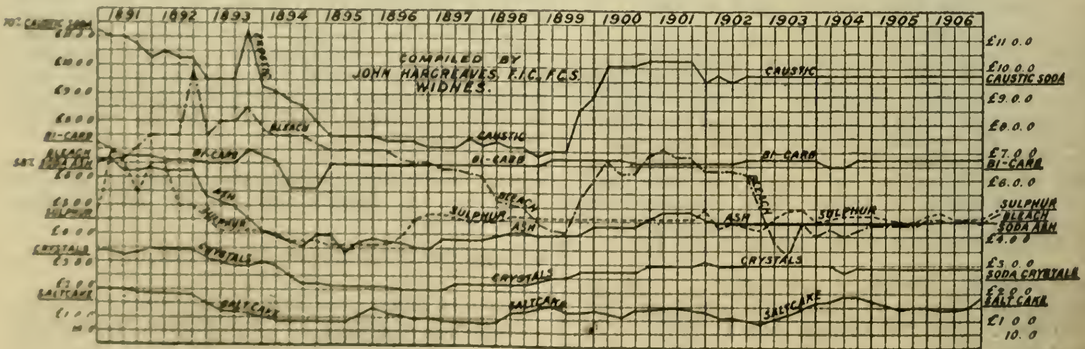
Selenic acid; Preparation for —— *from selenious acid* [*by electrolysis*]. R. T. Glauser. *See* XIA.

Ammonia; New method for determining ——. A. Ronchèse. *See* XXIII.

Nitrogen in nitrates; Volumetric method for the determination of ——. J. G. C. Vriens. *See* XXIII.

Heavy chemicals; Fluctuation in prices of ——, 1891-1906. J. Hargreaves. Chem. Trade J., June 15, 1907.

THE following chart shows the fluctuation in price which various heavy chemicals have undergone during the years 1891 to 1906, inclusive:—



Patents.

Furnaces for burning pyrites and the like. J. Morton and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 17,461, Aug. 2, 1906.

The object of the invention is to remove dust (consisting chiefly of magnetic oxide of iron) from the burner gases of a pyrites furnace, *e.g.*, of the Herreshoff type. For this purpose, a number of plates of magnetic metal are placed side by side in the flue, on either side of which is a pole of an electro-magnet. The dust is attracted to and settles on these plates. From time to time the electric current is interrupted, when the dust falls into a hopper situated below the plates, whence it is removed by opening a sliding door.—A. G. L.

Sulphuric acid; Purification of ——, and the recovery of by-products therefrom. J. Raschen, J. H. Shores, A. W. Wareing, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 23,130, Oct. 18, 1906.

Sulphuric acid is freed from arsenic by bringing it into contact with hydrochloric acid, either as liquid or gas, in presence of charcoal or sulphur, at a temperature preferably of about 100° C. The sulphuric acid may be caused to flow down a tower packed with charcoal (or sulphur) with admission of hydrochloric acid to reduce the quinquevalent arsenic to the arsenious state, when it can be recovered in any well-known manner. Sulphur is only to be used in the purifying process in the absence of selenium; but charcoal may be used whether selenium is absent or present. It is recommended that the charcoal be periodically revivified by washing with an oxidising agent, such as a solution of a hypochlorite. Reference is made to Eng. Pat. 5151 of 1906 (this J., 1907, 318). —E. S.

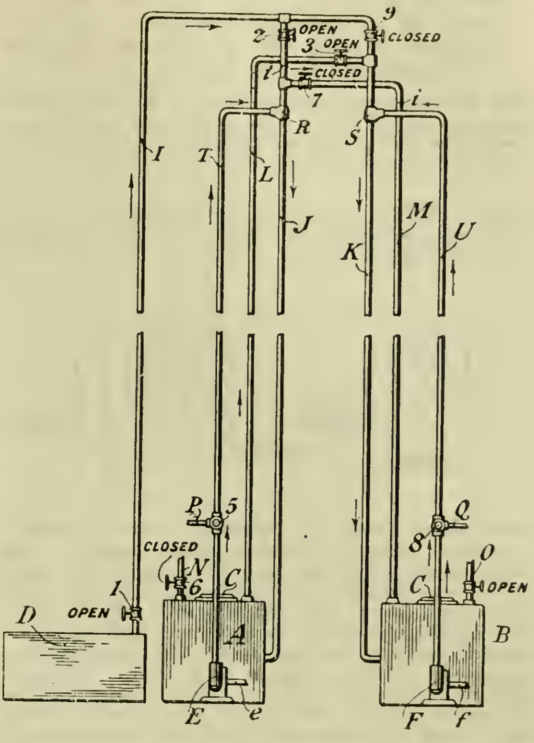
Zinc hydrosulphite [hyposulphite]; Production of stable solid ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 3811, Feb. 15, 1907.

Stable solid zinc hydrosulphite is obtained by passing a current of sulphur dioxide into a mixture of zinc dust and an alcohol, at a temperature exceeding 40° C. For example, 470 parts by weight of sulphur dioxide are caused to react on a mixture of 600 parts of methylated spirit, 250 parts of water, and 270 parts of zinc dust, at a temperature between 60° and 75° C. On stirring, a paste of the hydrosulphite crystals is formed, which is separated, washed with methylated spirit, and dried *in vacuo* at not over 70° C. Other alcohols, such as methyl or amyl alcohol, or glycerol, or other liquids which "wholly or partly prevent the zinc hydrosulphite from going into solution," may be employed.—E. S.

Hydrogen peroxide; Process for the manufacture of ——. R. Wolffenstein, Berlin. Eng. Pat. 13,828, June 16, 1906.

See Fr. Pat. 367,199 of 1906; this J., 1906, 1117. Reference is directed under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pat. 3628 of 1890 (this J., 1891, 482).—T. F. B.

Bisulphite liquor; Apparatus for making ——. N. Heath, Antioch, Cal., Assignor to W. S. Wright and J. W. Stewart, Chicago, Ill., and J. H. Winslow, Glencoe, Ill. U.S. Pat. 856,195, June 4, 1907.



Sulphur dioxide is led through a pipe, I, from a sulphur furnace, D, to two tanks, A and B, provided with vents, N and O. Mixing pipes, J and K, lead into the tanks, and liquid is supplied to these pipes through "risers" or liquor-pipes, T and U, by pumps, E and F, connected with each tank; by the action of these pumps, also, the liquor can be discharged through the pipes, P and Q. The main fume-pipe from the furnace is branched, and the branches lead into the mixing pipes, whilst exhaust fume-pipes, L and M, connect each tank with the mixing pipe of the other tank. Control valves (1—9) are inserted in the main fume-, branch fume-, exhaust fume-, and discharge-pipes, and in the vents. By this arrangement a circulation of fumes and liquid can be established from the furnace through the mixing pipes and tanks, and the liquor can be withdrawn from the circulating system, the rate and course of the circulation being controlled by the valves; also, the liquid in the circulatory system connected with one tank, can be saturated with fumes, while the exhaust fumes are conducted to the circulatory system of the other tank, and so on in succession.—W. C. H.

Calcium hydride; Method of producing ——. P. Askenasy and L. Stockem, Nuremberg, Assignors to Elektrochemische Werke Ges. m. b. H., Berlin. U.S. Pat. 857,146, June 18, 1907.

See Eng. Pat. 11,767 of 1906; this J., 1906, 759.—T. F. B.

Sulphur furnaces; Apparatus for automatically regulating ——. T. A. Clayton. Fr. Pat. 375,031, Feb. 25, 1907. Under Int. Conv., July 19, 1906.

See Eng. Pat. 16,340 of 1906; this J., 1907, 688.—T. F. B.

Zinc hydrosulphite; Production of stable, solid ——. Badische Anilin und Soda Fabrik. Fr. Pat. 374,673 Feb. 15, 1907. Under Int. Conv., Jan. 3, 1907.

See Eng. Pat. 3811 of 1907; preceding these.—T. F. B.

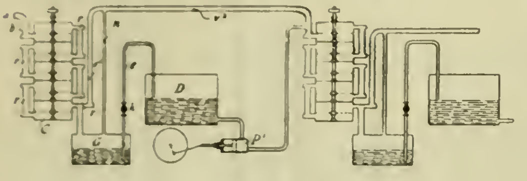
Alkali nitrite; Process for the manufacture of ——. Kuhnheim und Co., Rheinau Chem. Fabr. Ger. Pat. 175,096, May 1, 1904.

Alkali nitrates are reduced to nitrites by means of finely-divided electrolytic copper in presence of caustic alkali.—A. S.

Alkali cyanates; Process for the manufacture of —— by heating the corresponding thiocyanates with oxygen compounds of iron. W. Siepermann. Ger. Pats. 175,583, and 175,584, Aug. 3 and Dec. 17, 1905.

For the production of alkali cyanates, the corresponding thiocyanates are heated with spathic iron ore, zinc carbonate or oxide, calcium carbonate or lime, instead of with ferric oxide as in the usual process.—A. S.

Carbon dioxide; Apparatus for the absorption of —— by potassium carbonate solution. I. Qurin. Ger. Pat. 174,847, May 27, 1905.



The patent relates to apparatus in which potassium carbonate solution (containing soap, saponin, or the like) and the gases containing carbon dioxide are passed, in the same direction, through absorption vessels, divided into compartments, and provided with agitators, which beat the liquid into the form of foam and thus ensure intimate contact with the gases. The arrangement of apparatus claimed, is shown in the figure. The gases and the potassium carbonate solution enter the first absorption vessel, C, through the pipes, *a* and *b*, respectively, and pass downwards from one compartment to another through the connecting pipes, *r*. From the lowest compartment, the foam passes into the closed vessel, G, whilst the unabsorbed gases pass through the pipe, v^1, v^2, to the next absorption vessel. The foam collecting in G is allowed to settle, when the entrained gases separate and pass off through the pipe, *n*, whilst on opening the tap, *k*, the potassium carbonate solution is forced up through the pipe, *e*, into the open tank, D, whence it can be introduced again into the system by means of the pump, P^1.—A. S.

Bromine; Process for the separation of chlorine from crude ——. Dr. Kubierschky. Ger. Pat. 174,848, June 25, 1905.

The mixed vapours of chlorine and bromine, evolved on heating the crude bromine, are passed through a scrubber down which crude bromine is caused to trickle. A kind of fractional distillation of the crude bromine thus takes place, the more volatile chlorine passing off with the vapours. A cooling device may be provided in the upper part of the scrubber or above it, to further assist the separation of the chlorine from the bromine.—A. S.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass: Apparatus for drawing ——. E. Fourcault, Lodelinsart, Belgium. Eng. Pats. 12,603, May 30, 1906, and 12,815, June 1, 1906. Under Int. Conv., June 8, 1905.

See Fr. Pat. 366,383 of 1906; this J., 1906, 985.—T. F. B.

Ceramic masses; Manufacture of substances containing aluminium oxide, and their treatment to form ——. F. Engelhorn, Mannheim, Germany. Eng. Pat. 16,714, July 24, 1906.

Artificial or natural alumina is fused with artificial or natural oxygen compounds of metals, or of metalloids, or of both; the product is ground, mixed with substances such as clay, cement, glass, fluxes, etc., which act as binding materials, and then moulded and cast into the required shapes, which are subsequently burned.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Bricks and the like; Arched kilns for burning ——. J. Hamblet, Sevenoaks. Eng. Pat. 14,030, June 19, 1906.

The kiln possesses a central, internal, longitudinal fireplace, disposed between two longitudinal walls or partitions, and extending along the whole or part of the length of the kiln from end to end; the heat and products of combustion are drawn over the partitions into two longitudinal flues at the sides of the kiln, which communicate with the stack, and may or may not be provided with side flues to convey the waste heat to another kiln. —W. C. H.

Rotary furnaces or kilns; Method of burning or calcining calcareous and argillaceous substances in ——. B. H. Thwaite, London. Eng. Pat. 15,677, July 11, 1906.

Powdered carbonaceous fuel is injected into the combustion chamber of a rotary furnace or kiln, to meet currents of superheated air and of producer gas. The preheating of the air is effected by diverting part of the gaseous fuel for that purpose. The apparatus employed for thus securing a highly intense and lengthened flame, comprises a combustion chamber, connected by a conical flue with the lower end of the kiln. Preheating chambers are arranged on either side of the combustion chamber, into which the heated air passes by a downward vertical flue, while the gas enters by an upward vertical flue from the gas main, and the powdered fuel is introduced at a point in a line with the axis of the combustion chamber. The air is supplied from a main to the preheating chambers, the direction of its flow being controlled by a reversing valve; the direction of flow of the gas is controlled by two valves on the main, which are geared with the air-reversing valve, so that one movement affects all the valves simultaneously. A certain proportion of air is always sent to both chambers to support the combustion of the gaseous fuel diverted into them, and of the combustible dust carried into them by the producer gas, which is burnt off after each reversal. When the gas supply is cut off from either chamber, the major part of the air is directed into such highly heated chamber, and absorbs the heat from it, in flowing to the rotary furnace. —W. C. H.

Refractory materials. H. A. D. Collins, London. Eng. Pat. 15,734, July 11, 1906.

A mixture of powdered quartz, or other silicious material (93 parts by weight), sodium silicate of, say, 175° T. (5 parts) and calcium chloride or lime (2 parts) is heated sufficiently to liquefy the sodium silicate (or else this may be liquefied before the other ingredients are mixed with it), moulded into blocks, retorts, etc., and burnt, without drying, at a temperature of 1500°—2500° C. The invention differs from Eng. Pat. 16,215 of 1902 (this J., 1903, 867) in that sodium silicate solutions too viscous to be worked at ordinary temperatures, are used. —A. G. L.

Wood; Manufacture of a substitute for ——. F. Schnell, Gutenstein, W. Mayer, Wiener Neustadt, and E. Hartwich, Vienna. Eng. Pat. 20,125, Sept. 10, 1906.

See U.S. Pat. 848,133 of 1907; this J., 1907, 529.—T. F. B.

Objects made of soft or porous natural stone, plaster of Paris, magnesite, cement, and the like; Process for hardening and rendering durable coloured or uncoloured ——. E. E. Hippe, Copenhagen. Eng. Pat. 21,576, Sept. 29, 1906.

See Fr. Pat. 370,105 of 1906; this J., 1907, 204.—T. F. B.

Cement mixture for coating or decorating the fronts of buildings and the like. L. Simonsen, Copenhagen. Eng. Pat. 15,808, July 12, 1906.

See Fr. Pat. 371,530 of 1906; this J., 1907, 411.—T. F. B.

Marble; Process for the integral and complete coloration of ——. Marmifera Ligure. Fr. Pat. 374,925, Feb. 21, 1907.

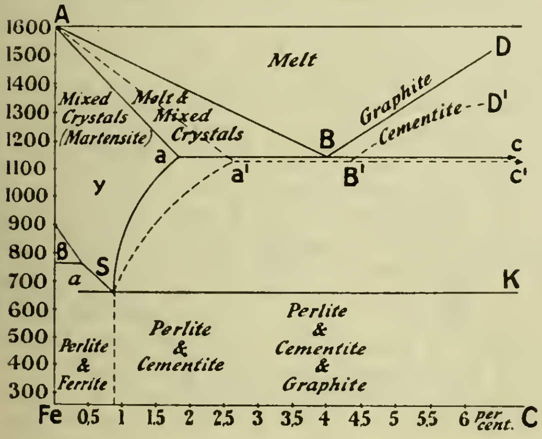
See U.S. Pat. 844,846 of 1907; this J., 1907, 410.—T. F. B.

Cement impermeable to water. S. B. Newberry. Fr. Pat. 374,562, Feb. 12, 1907.

See U.S. Pat. 851,247 of 1907; this J., 1907, 611.—T. F. B.

X.—METALLURGY.

Cast-iron; Chemical and micrographic examination of ——. H. Wedding and F. Cremer. Stahl u. Eisen, 1907, 27, 833—838, 866—870.



The authors' investigations have determined the line, Aa'. in the equilibrium-diagram for cast-iron (see Fig.). This line does not constitute a simple equilibrium-curve like Aa, but it indicates that, for the same content of total carbon, the carbon content of the mixed crystals which first separate on cooling, is greater in the case of white than in that of grey cast-iron. The composition of the mixed crystals indicated by this line, Aa', is dependent on the rapidity with which the melted mass is cooled. In the case of large masses, such as are dealt with in practice, this rate of cooling varies continually, and hence in such cases a number of different series of mixed crystals are obtained. Grey cast-iron is obtained only with slow cooling, or by "inoculation" (introduction of a fragment of grey cast-iron) with rapid cooling. It has a perfectly uniform structure, but the fineness of the graphite veins appears to be determined by the rate of cooling. Grey cast-iron appears from its structure to be formed at a temperature but little below the melting-point, whilst white cast-iron possesses the crystalline structure proper to crystals formed rapidly from a supercooled melt.—A. G. L.

Steel, acid and basic; Relative rates of corrosion of ——. A. G. Fraser. Industr. World, 1907, 41, 434—437.

Pieces of both kinds of steel, 3½ inches square, and of varying thickness were subjected to the influence of corrosion by the atmosphere, by river water, by brine made from rock salt, of sp. gr. 1·022, by a solution of common salt of sp. gr. 1·024, and by dilute sulphuric acid of a sp. gr. of 1·05. Two sets of samples were employed, the first being taken out, washed, and weighed every week, the second being continually subjected to the corroding influence for the whole duration of the test, 12 weeks. The air corroded the basic steel 0·019 per cent. more than the acid steel for the intermittent action and 0·041 per cent. for the continuous corrosion. The river chosen was the Calder, which contained small amounts of dye at various times as well as a considerable amount of sewage. The basic steel lost 0·021 per cent. more than the acid steel for intermittent corrosion and for continuous action 0·014 per cent. In the case of the rock salt solution which was replaced by fresh solution every four weeks, 0·062 per cent. more basic steel was dissolved than acid steel for intermittent action and with continuous corrosion 0·026 per cent. more. With the solution of common salt, also replaced by fresh solution every four weeks, 0·005 per cent. more basic steel was dissolved with the intermittent corrosion and 0·006 per cent. more acid steel for the continuous action. With sulphuric acid 8·34 per cent. more acid steel was dissolved in the intermittent action and 26·24 per cent. in the continuous action. The action of the sulphuric acid tends to show the fibrous nature of the steel, and it was interesting to observe how practically the whole of this action was confined to the cut edges, the "skin" being mostly left intact. The "skin" of the "basic" proved to be tougher than that of the "acid" steel towards the sulphuric acid. The analysis of the two samples taken showed but a slightly higher manganese and carbon, and a lower phosphorus content in the basic steel, but the differences in the analysis were not great enough to account for the marked differences of behaviour of the two steels in the solution of sulphuric acid. The author expresses the opinion that it would have been interesting to have continued these experiments over a longer period than the twelve weeks appropriated for the purpose.

Ozone; Action of —— *on silver and mercury.* W. Manchot and W. Kampschulte. Ber., 1907, 40, 2891—2898.

The action of ozone upon silver is under ordinary circumstances very uncertain and indefinite. On pure metal in the cold, dry oxygen holding ozone, appears to be inactive. On the moderately heated metal, best at 240°, it acts freely, giving a magnificent display of colours, steel-blue bordered with violet, both when the gas is moist and when it is thoroughly dry. Many substances adhering to the silver, even in very minute quantities, cause its immediate blackening in the cold by the most dilute ozone. Such substances are ferric oxide and many other metallic oxides, platinum and other metals, and generally all carriers of oxygen catalytically. Silver already blackened by ozone or corroded by dilute nitric acid or strong sulphuric acid, and then ignited and cooled, is at once attacked by ozone in the cold. The behaviour of mercury with ozone is similar to that of silver.

Lead in ores; Determination of ——. Noaillon. Bull. Soc. Chim. Belg., 1907, 21, 210.

The quantitative separation of lead in minerals is often effected by converting it into sulphate and dissolving the latter in ammoniacal ammonium tartrate in order to free it from gangue. The complete solution of lead sulphate in ammoniacal ammonium tartrate is, however, not easy, and the solution is often difficult to filter. The author proposes to substitute nitric acid as a solvent, and shows that 100 c.c. of dilute nitric acid ranging in concentration from 10 to 50 per cent. (of acid of sp. gr. 1·4) will dissolve from 0·36 to 1·65 grms. of lead sulphate. The lead may be determined in the nitric acid solution, preferably by electrolysis.—L. E.

Lead sulphide and the products of its oxidation; Equilibrium between ——. R. Schenck and W. Rassbach. Ber., 1907, **40**, 2947—2950.

The determination of the melting-point of lead monoxide, recently fixed by Doeltz and Mastowitsch at 906° C., leads the authors to modify and extend the views contained in their recent paper (this J., 1907, 764). They now regard the band in the diagram there referred to, as a field in which labile equilibrium can exist among the members of the system: metal, sulphide, liquid unsaturated oxide-sulphate solutions, and sulphur dioxide, the limits of these solutions being on the one hand, oxide saturated with sulphate, and on the other, sulphate saturated with oxide. They give in this paper a modified diagram indicating generally the regions in which the members of the various possible systems can co-exist, in a stable condition, on the assumption that the system, $PbSO_4$, PbO, would show a normal melting-point diagram.
—J. T. D.

Alloys; The potential and nature of metallic ——. N. Puschin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 13—54. Chem. Zentr., 1907, **1**, 1724—1727.

Fig. 1.

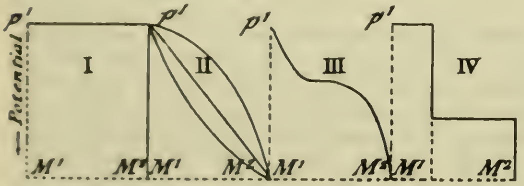
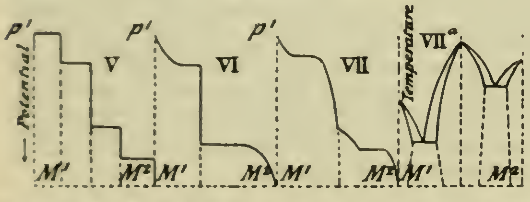


Fig. 2.



The author describes the typical potential-curves of alloys of two metals, M_1 and M_2, having the potentials, p_1 and p_2, respectively, and of which, M_2 is the more noble. The E.M.F. measured is that of a cell composed of the metal, M_1, the alloy, M_1+M_2, and the aqueous solution of a salt of M_1. The potential-curves thus obtained may correspond to any one of seven typical forms:—(1). If the two metals form neither a solid solution nor a chemical compound, the alloy will exhibit towards the electrolyte the potential of the less noble metal, M_1, and the E.M.F. of the cell will be *nil*, so that the curve will have the form marked I. (see Fig.). (2). If the two metals form a continuous series of mixed crystals (solid solutions), the potential, p, of the alloys will fall continuously from p_1 to p_2, and the potential-curve will have one of the three forms shown in II. (3). If the series of mixed crystals is not continuous, that is, if the two metals are only partially miscible in the solid state, the curve will have the form shown in III. (4). When the two metals form a chemical compound, this has its own characteristic potential, and the curve has the shape shown in IV. (5). V. shows the form of curve when several chemical compounds are produced. (6). If the compound of the two metals forms solid solutions with the individual metals, then the potential-curve will have the shape shown in either VI. or VII., according as solutions are formed only of compound in metal, or metal in compound, or of both compound in metal, and metal in compound. The cooling-curve of alloys having the potential-curve represented in VII. is shown in VII*a*. In many cases with a cell composed of the metal, M_1, a solution of a salt of this metal, and the alloy, M_1+M_2, the E.M.F. is too small to be of service. In such cases, a solution of an acid or of an alkali is used as electrolyte. The potential is measured twelve hours after setting up the cell.

From experiments on the lines described, the author finds that silver forms one compound with both selenium and tellurium, of the composition, Ag_2Se and Ag_2Te, respectively. Copper and tellurium yield two compounds, Cu_2Te and CuTe, respectively, which form solid solutions with one another. The mineral, *ricardite*, Cu_4Te_3, is a solid solution of these two compounds. The alloys containing only a small proportion of tellurium are crystalline and brittle, and of a dark gray colour. Alloys containing from 30 to 33 atoms per cent. of tellurium are darker and more brittle; those with from 33 to 50 atoms per cent. are violet; and those with more than 50 atoms per cent. of tellurium are golden yellow. Lead and tellurium form a compound, PbTe, which is capable of holding lead in solid solution. Tin and tellurium form the compound, SnTe.—A. S.

Copper; Alloys of —— *with nickel and gold. Electrical conductivity of solid metal solutions.* N. Kurnakow and S. Shemtschushny. J. Russ. Phys.-Chem. Ges., 1907, **39**, 211—229. Chem. Zentr., 1907, **1**, 1727—1729.

Conflicting statements have been made as to the constitution of copper-nickel alloys. The authors find from the thermal and micrographic examination of the alloys that the two metals form a continuous series of mixed crystals. The electrical conductivity of copper and also the temperature-coefficient of conductivity are strongly diminished by addition of nickel. Feussner (Verh. Physikal. Ges., **10**, 109) found that the electrical conductivity of copper-nickel alloys, which as shown above, consist of a continuous series of mixed crystals, varies progressively with the composition, the curve passing through a minimum. Matthiessen (Pogg. Annalen, **100**, 190) obtained similar curves for alloys of gold with silver and copper, but whereas Heycock and Neville (Phil. Trans., **189a**, 69) have shown that gold and silver form a continuous series of mixed crystals, gold and copper, according to Roberts-Austen and Rose (this J., 1900, 1117), are only partially miscible in the solid state. The authors have re-examined the alloys of gold and copper, and find, contrary to Roberts-Austen and Rose, that the two metals form a continuous series of mixed crystals.
—A. S.

Minerals and metals; Output of certain —— *in the world in* 1905. Board of Trade J., July 4, 1907. [T.R.]

The Colonial and Foreign section of the Mines and Quarries Report for the year 1905 contains a table showing the output of certain minerals and metals (contained in or obtained from ore raised) in the United Kingdom, British Colonies and Possessions, and Foreign Countries during 1905, which may be summarised as follows:—

—		United Kingdom.	British Colonies and Possessions.	Foreign Countries.	Total for the World.
Coal	Metric tons	239,918,239	30,011,140	671,085,628	941,015,007
Copper	,,	727	70,220	667,255	738,202
Fine Gold	Kilos.	169	341,836	238,082	580,087
Iron	Metric tons	4,836,577	512,670	47,216,391	52,565,638
Lead	,,	20,977	207,705	646,015	874,697
Petroleum	,,	—	668,249	26,428,160	27,096,409
Salt	,,	1,920,239	1,524,519	10,806,384	14,251,142
Fine Silver	Kilos.	5,212	665,182	4,877,424	5,547,818
Tin	Metric tons	4,540	59,359	31,269	95,168
Zinc	,,	9,023	31,897	597,670	638,590

The quantities of iron and of the other metals included in the above table are those which are considered obtainable from the ores raised in the countries in question, and must not necessarily be taken as a measure of the metallurgical industries of those countries. The total value of the figures shown in the table represents 700,000,000*l*.

The total amount of coal produced in the world in 1905 amounted to 941 million tons, valued at more than 305,000,000*l*. The following figures show the main sources from which the coal supply of the world is obtained:—

Countries.	1904.		1905.	
	Quantity.	Value.	Quantity.	Value.
	Metric Tons.	£	Metric Tons.	£
United States of America	319,613.000	91,338,000	356,454,000	97,897,000
Great Britain	236,158,000	83,851,000	239,918,000	82,039,000
Germany	169,450,000	57,298,000	173,811,000	58,611,000
Austria-Hungary	40,530,000	10,074,000	42,454,000	10,462,000
France	34,167,000	18,177,000	35,928,000	18,562,000
Belgium	22,761,000	11,465,000	21,775,000	11,007,000

Metal and mineral production of New South Wales. Board of Trade J., July 11, 1907. [T.R.]

The metals and minerals produced in New South Wales during 1906 were valued at 8,169,624*l*., as compared with 7,085,893*l*. in 1905. The chief metals and minerals produced are shown in the following table:—

—		1905.		1906.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Coal	Tons	6,632,138	2,003,461	7,626,362	2.337,227
Coke	,,	162,961	100,306	186,060	110,607
Copper (ingots, matte and ore)*	,,	8,592	527,403	9,755	789,527
Gold	Fine oz.	274,267	1,165,013	253,987	1,078,866
Iron†	Tons	4,447	85,693	8,000	112,848
Portland cement		—	88,100	—	128,487
Silver-lead, ore, concentrates, &c.	Tons	441,447	2,441,856	371,939	2,826,542
Tin (ingots and ore)‡	,,	1,957	226,110	1,671	255,744
Zinc (spelter and concentrates)	,,	103,533	221,155	103,666	292,806

* Exclusive of copper produced from ore from the other States of the Commonwealth.
† Made from scrap, no ore being used.
‡ Exclusive of tin refined from imported ores.

Rhodium and base bullion; U.S. Customs decisions. [T.R.]

Rhodium is dutiable at 10 per cent. *ad val.*, as an "unmanufactured article unenumerated."

Base bullion, in bars, containing gold, silver, lead, and bismuth, is dutiable under the specific provision for "lead or base bullion," at $2\frac{1}{8}$c. per lb.

Patents.

Blast air for metallurgical purposes; A[illegible]us for drying ——. G. Cattaneo and J. Schl[illegible]inger Berlin. Eng. Pat. 13,935, June 18, 1906.

See U.S. Pat. 839,362 of 1906; this J., 190[illegible]9.—T. F. B.

Jigs or apparatus for concentrating and [illegible]shing minerals. A. Taylor, London. Eng. Pat. 17,2[illegible], July 31, 1906.

See Fr. Pat. 373,497 of 1907; this J., 1907, 697.—T. F. B.

Coating sheets with metal; Material for use when ——. J. A. Kyle, Chicago, U.S.A. Eng. Pat. 21,678, Oct. 1, 1906. Under Int. Conv., April 4, 1906.

In order to prevent oxidation of the tin or lead bath and of the surface of the coated metal while cooling, it is proposed to use a mixture of a non-drying glyceride which does not oxidise or solidify at a temperature of 600°—700° F., with a fatty acid and a petroleum product. In practice, one part of castor oil is mixed with four parts of a petroleum product, having a fire test of 400°—725° F., and the resulting mixture is incorporated with a fatty acid, such as stearic acid, in the proportion of three parts of the former to one of the latter.—C. A. W.

Galvanizing wire, wire netting, and similar articles; Process of ——. R. Champ, Sydney, N.S.W. Eng. Pat. 22,766, Oct. 15, 1906.

The articles, after passing through the pickling bath and immediately before immersion in the molten coating metal, are placed in a dilute solution of hydrochloric acid (5 to 10 per cent.) or a metallic chloride (preferably zinc chloride or iron chloride). It is claimed that, although very little more of the galvanizing solution is required, the article takes on a more uniform coating than when a dry flux is employed, and further, that the surface skimmings, being comparatively free from chlorine, are more valuable.
—C. A. W.

Sulphides; Smelting ores containing ——. J. T. Carrick and S. Pattison, Johannesburg, Transvaal. Eng. Pat. 22,166, Oct. 8, 1906.

Copper-nickel pyrites is first smelted so as to produce a matte containing sulphides of copper, nickel, and iron. This is powdered, and treated with dilute sulphuric acid, the hydrogen sulphide produced being utilised as fuel in the production of a further quantity of matte. The flue gases from the cupola, rich in sulphur dioxide, may be utilised for the manufacture of the sulphuric acid needed. The liquor obtained is crystallised to recover the iron and nickel sulphates, whilst the insoluble residue is smelted for copper and nickel.—A. G. L.

Copper; Metallurgical and electrometallurgical process for the production of pure ——. L. Jumau, Paris. Eng. Pat. 414, Jan. 7, 1907. Under Int. Conv., March 20, 1906.

SEE Fr. Pat. 364,430 of 1906; this J., 1906, 892.—T. F. B.

Copper; Process for extracting —— *from its ores.* L. Jumau, Paris. Eng. Pat. 590, Jan. 9, 1907. Under Int. Conv., July 11, 1906.

SEE Addition of July 11, 1906, to Fr. Pat. 359,913 of 1905; this J., 1907, 24.—T. F. B.

Copper; Process of extracting —— *from its ores.* L. Jumau, Paris. Eng. Pat. 591, Jan. 9, 1907. Under Int. Conv., July 11, 1906.

SEE Addition of July 11, 1906, to Fr. Pat. 364,430 of 1906; this J., 1907, 22.—T. F. B.

Steel; High-manganese —— *with low carbon.* R. A. Hadfield, Sheffield. U.S. Pat. 856,250, June 11, 1907.

THE claim is for a steel containing less than 1 per cent. of carbon and from 10 to 14 per cent. of manganese, of relatively strong magnetic character, and capable of being readily heat-treated and toughened without cracking. —O. F. H.

Iron oxides; Process of reducing ——. H. W. Lash, Cleveland. U.S. Pat. 856,351, June 11, 1907.

SEE Eng. Pat. 387 of 1907; this J., 1907, 696.—T. F. B.

Aluminium alloy. A. Chambaud, Paris. U.S. Pat. 856,392, June 11, 1907.

SEE Eng. Pat. 9750 of 1906; this J., 1906, 1153.—T. F. B.

Pickling-bath. C. E. Laverty. U.S. Pat. 856,644, June 11, 1907.

THE pickling bath contains an acid, such as sulphuric, and a hydrocarbon or hydrocarbon oil.—O. F. H.

Detinned iron and residues; Process of treating ——. C. E. Acker, Niagara Falls, N.Y., Assignor to Tin Products Co., New York. U.S. Pat. 856,753, June 11, 1907.

THE de-tinned iron and residues are washed with an anhydrous liquid capable of dissolving stannic chloride, such as carbon tetrachloride. The wash liquors are removed by draining the material and drying it in a current of air.—O. F. H.

Autogenous welding or other methods of soldering; Fluxes or other materials employed in ——. Soc. Anon. L'Oxhydrique Française. Fr. Pat. 373,861, March 28, 1906.

CLAIM is made for the use of tubes, rods, or wires composed of a core of the flux and either a single sheath of a suitable metal, or an outer sheath of the metal used in the soldering and an inner sheath of a more fusible metal or alloy. —O. F. H.

Zinc and lead; Process for treating sulphide ores of ——. A. H. Imbert. Fr. Pat. 374,651, April 23, 1906.

SEE Eng. Pat. 10,303 of 1906; this J., 1906, 933.—T. F. B.

Metals; Paint for ——. P. H. Guérin. Fr. Pat. 374,053, Jan. 29, 1907. *See* XIII*A*.

Aluminium; Process for the autogenous welding of ——. M. U. Schoop. Fr. Pat. 374,089, Jan. 30, 1907. Under Int. Conv., Nov. 9, 1906.

A DEOXIDISING agent is placed in contact with the surfaces to be joined, and melted by the aid of a blowpipe. The reducing agent consists of alkali chlorides including a certain amount of lithium chloride and potassium bisulphate.—O. F. H.

Soldering aluminium; Process for ——. F. F. Payne. Fr. Pat. 374,750, Feb. 16, 1907.

SEE Eng. Pat. 3310 of 1906; this J., 1907, 258.—T. F. B.

[*Mine waters.*] *Waters from iron, lead, zinc, or other mines the ores from which contain iron pyrites; Process for the purification of* ——, *and for the clarification of waters from iron or ochre mines.* C. Lenormand. Fr. Pat. 374,129, Feb. 1, 1907.

THE waters are treated in reservoirs or sumps with the quantity of lime necessary to neutralise free acid, and precipitate the metals as oxides. The water is run off from the precipitate, which is recovered for subsequent treatment.—O. F. H.

Copper, nickel, and their alloys; Process for welding ——. W. Schieber. Fr. Pat. 374,145, Feb. 2, 1907.

THE metals or alloys to be joined are placed in contact, and the junction heated to the softening point in, the flame of a blowpipe using air and hydrogen or gas rich in hydrogen. The air supply to the blowpipe is now cut off, and the flame made strongly reducing in order to remove oxide, the weld being finished by hammering or other suitable means.—O. F. H.

Chromium or manganese free from carbon; Process for increasing the yield and accelerating and intensifying the reaction in the alumino-genetic preparation of ——. Th. Goldschmidt, Offene Handelsges. Ger. Pat. 175,885, July 26, 1905.

THE claim is for the addition of a small proportion of a higher oxide (or one of the corresponding salts) of manganese or chromium to the lower oxides usually employed in the "alumino-genetic" preparation of metals. It is stated that yields of 90 per cent. and more can be obtained. In the preparation of chromium, an addition of 1 per cent. of chromic anhydride to the chromic oxide is sufficient, but still better results are obtained with an addition of 3—4 per cent.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Resistance furnace; Granular carbon ——. S. A. Tucker. Amer. Electrochem. Soc., May, 1907. Electrochem. and Met. Ind., 1907, 5, 227—228.

THE furnace is shown in vertical section and in plan respectively, in the figures; it has a maximum capacity

FIG. 1.

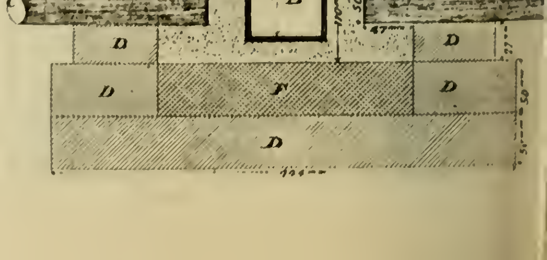
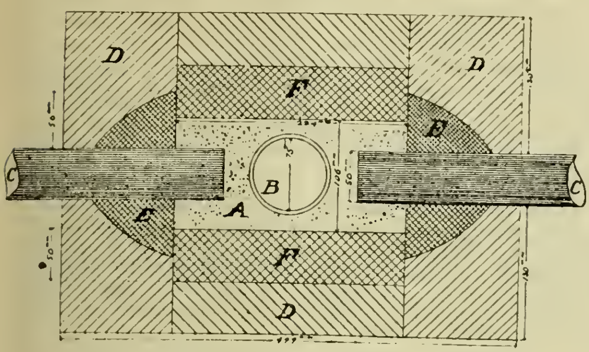


FIG. 2.



of 30—35 kilo-watts. The resistance material, A, consists of crushed gas-coke of about 20-mesh average size, and is held in position by magnesia brick, F, at the sides and bottom. When fresh coke is used, a much higher voltage is needed at first, and great care must be exercised in eliminating the volatile matter from the coke. The electrodes, C, are of Acheson graphite and are luted in at E by a cement composed of equal parts of fire-clay and siloxicon, which cement is also used for fixing the fire-brick setting, D, of the furnace. The crucible, B, is of graphite or magnesia, and may be surmounted by a graphite chimney. The furnace is capable of reducing any oxide which can be reduced in the electric arc. It is worked with alternating current, which is regulated by means of the field of the alternator or an auto-transformer. In order to obtain uniform heating of the crucible from the start, a piece of curved iron is arranged around each side of the crucible opposite the electrodes, and, after the coke has been filled in, the space between the iron and the crucible is packed with charcoal, and the iron then withdrawn. When the furnace is started, as the charcoal is practically a non-conductor, the current is caused to pass around the sides of the crucible instead of being concentrated at the points directly opposite the ends of the electrodes.—A. S.

Molten salts; Electrolytic dissociation of ——. K. Arndt. Ber., 1907, **40**, 2937—2940.

ATTEMPTS have previously been made to apply the theory of electrolytic dissociation to account for the conductivity of molten salts, but only indirect methods were available, since a suitable non-conducting solvent was wanting. The author has found that boron trioxide forms a suitable solvent, its conductivity at 900° C. being only 0·000021. Measurements were made with sodium metaphosphate, and the equivalent conductivity was found to fall off rapidly with decreasing concentration of the salt. In order to establish the relation of the electrical conductivity to the viscosity of the solution, measurements of this latter property were made. The results of the investigation show that the product of the equivalent conductivity and the viscosity is practically constant between the concentrations of 0·5 and 100 per cent. of salt, which clearly indicates that the equivalent conductivity itself is independent of the concentration. This important conclusion is held to prove that molten sodium metaphosphate is completely dissociated, and thus dilution with boric acid does not increase the dissociation. Although only non-volatile salts such as phosphates, borates, and silicates are suitable for investigation by this method, the author believes that sufficient evidence is forthcoming to show that molten monovalent salts are in general completely dissociated.—R. S. H.

Selenic acid; Preparation of —— *from selenious acid* [*by electrolysis*]. R. T. Glauser. Chem.-Zeit., 1907, **31**, 630.

WHEN aqueous solutions of selenious acid are subjected to electrolysis, selenium separates out at the cathode, and selenic acid is formed by the oxygen developed at the anode. The addition of nitric acid to the bath prevents the formation of selenium, and selenic acid alone is then produced. The most favourable conditions for the preparation of selenic acid in this way are: high concentrations both of selenious acid and nitric acid, high temperature, from 50° to 80° C., and a current density at the anode of 4—5 amp. per sq. cm., in quantities of about 100 c.c. of liquid, with a lower current density at the cathode. Under these conditions the conversion of 1 grm. of selenium dioxide was nearly complete with an expenditure of 1·5—2 amp.-hours; and perfectly complete after 4—5 amp.-hours. Care must be taken to ensure that an excess of nitric acid is present during the whole of the experiment.—J. F. B.

PATENTS.

Oxidising [*Ozonising*] *liquids; Process for* —— *with aid of electric discharges.* A. de Hemptinne, Ghent, Belgium. Eng. Pat. 13,023, June 5, 1906.

THE liquid to be oxidised is placed in a revolving horizontal cylinder, filled with oxygen, inside which are disposed vertical plates, alternately composed of a metal and of an insulator such as glass, and separated by a distance of a few mm. from each other. All the odd metal plates are connected with each other and with one pole of a source of electrical energy at high potential, whilst all the even metal plates are similarly connected with the other pole. As the cylinder revolves, the liquid is scooped up in a number of longitudinal gutters, whence it is distributed over the surface of the plates. (Reference is directed to Eng. Pat. 7101, of 1905; this J., 1905, 663.) —A. G. L.

Electric discharges; Processes for producing ——. H. Pauling, Gelsenkirchen, Germany. Eng. Pat. 18,435, Aug. 16, 1906.

SEE Fr Pat. 368,715 of 1906; this J., 1907, 23.—T. F. B.

Electric conductors suitable for incandescent lamp filaments, furnaces, or other apparatus. The British Thomson-Houston Co. From the General Electric Co. Eng. Pat. 18,487, Aug. 17, 1906. *See* II.

Incandescence filaments for electric lamps; Manufacture of —— *from metallic thorium containing oxide, with or without admixture of other difficultly fusible metals.* Siemens und Halske A.-G. Eng. Pat. 2123, Jan. 28, 1907. *See* II.

Accumulators with invariable electrolyte; Alloys for the inactive carriers or for other metallic parts of ——, *and accumulators constructed with such carriers or metallic parts.* Nya Ackumulator Aktiebolaget Jungner, Stockholm. Eng. Pat. 6522, Mar. 18, 1907. Under Int. Conv., Mar. 30, 1906.

THE carriers for the positive plates (anodes) of accumulators with alkaline electrolytes are constructed of alloys of nickel with metals, whose oxides are substantially insoluble in alkalis. Suitable alloys are: Nickel, 30—40, copper, 70—60 per cent.; and nickel, 25—35, iron, 75—65 per cent., with or without the addition of a little copper. Other metallic parts of accumulators may also be constructed of these alloys. In order to increase the facility of working, and the conductivity, and to decrease the specific gravity, small percentages of metals, whose oxides are soluble in alkalis, *e.g.*, tin and zinc, may also be added.—A. G. L.

Electrolytic process of purifying liquids. J. T. Harris, New York. U.S. Pat. 857,277, June 18, 1907.

THE process consists in electrolysing an impure liquid between electrodes spaced apart, the anodes consisting of a magnetised metal (*e.g.*, iron), which will yield a coagulant. Air is simultaneously injected into the liquid, and a reagent assisting the coagulation is added. The coagulum of impurities formed is finally separated from the liquid —A. G. L.

Plastic masses from peat; Process for the manufacture of ——. Rhadoonitwerke G.m.b.H. Ger. Pat. 178,645, Jan. 7, 1906.

Peat is dried, disintegrated, mixed with metallic salts, etc. (*e.g.*, ferric sulphate, magnesium chloride, etc.), warmed, and subjected to high pressure. The solid homogeneous masses thus obtained, are useful as heat non-conductors and electrical insulators. Resins, oils, or the like may also be incorporated in the mixture. —A. S.

(*B.*)—ELECTRO-METALLURGY.

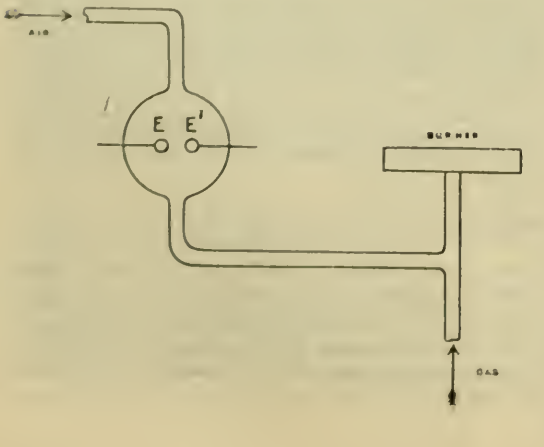
Zinc; Electrodeposition of ——. R. C. Snowdon. Amer. Electrochem. Soc., May, 1907. Electrochem. and Met. Ind., 1907, **5**, 222—223.

The author studied the electrolytic deposition of zinc on a rotating cathode under varying conditions as to concentration and acidity or alkalinity of the electrolyte, presence or absence of a reducing agent, current density, and temperature. Good deposits of zinc were obtained from acid or alkaline solutions, even at such a high current density as 60 ampères per sq. dm. The limiting current density at which good deposits can still be obtained, depends chiefly on the rate of rotation of the cathode. Zinc is deposited readily from strongly alkaline solutions, and the resistance of these solutions, and, consequently, the voltage across the terminals, can be made very low for any current density. A high current efficiency is attainable in alkaline solutions. The deposits from alkaline solutions are more finely crystalline than those from acid solutions. The size of the crystals increases with increasing temperature or concentration, but diminishes with increasing current density, and on addition of formaldehyde.—A. S.

Molybdenum; Compounds of —— *with silicon.* E. Defacqz. Compt. rend., 1907, **144**, 1424—1427.

Copper silicide (free from iron) containing 50 per cent. of silicon, is heated in the electric furnace with one-tenth of its weight of amorphous molybdenum. The product, after treatment successively with nitric acid, solution of sodium hydroxide, hydrochloric acid, and hydrofluoric acid, leaves a gray crystalline molybdenum silicide having the formula, $MoSi_2$. It has a sp. gr. of 6·2, is attacked by chlorine below a red-heat, and dissolved by hydrofluoric acid at the temperature of the water-bath. Other acids do not affect it. When fused with alkali hydroxide or carbonate, with or without addition of nitrate or chlorate, it forms a mixture of silicate and molybdate; but it may be fused with potassium bisulphate without alteration.—J. T. D.

Spectra of metallic substances; New method for producing flame ——. G. A. Hemsalech and C. de Watteville. Compt. rend., 1907, **144**, 1338—1340.



If a condenser be discharged between copper electrodes in an atmosphere of illuminating gas, the latter yields a green flame when ignited. Also, if a condenser be discharged between electrodes fixed above the blue cone of a small Bunsen flame, the latter shows the spectrum of the metal of which the electrodes are made. On the basis of these observations, the authors have constructed an apparatus for the production of metallic spectra (see Fig.) A bulb with the electrodes, E, E^1, of the metal the spectrum of which is required, is placed facing the current of air used in the combustion of the gas in the burner. A discharge is produced between E and E^1 (about 10 sparks per second) from a condenser of high capacity. The method is easily carried out, and a good spectrum obtained. Only a very small quantity of the substance under investigation is required; hence the method is specially useful for the examination of the spectra of rare metals.—L. E.

Patents.

Minerals; Apparatus for treating —— *by electrolysis.* N. H. M. Dekker, Paris. Eng. Pat. 5887, March 11, 1907.

See Addition of Nov. 14, 1906, to Fr. Pat. 367,495 of 1906; this J., 1907, 419.—T. F. B.

Metals; Electrolytically refining ——. A. G. Betts, Troy, N.Y. U.S. Pat. 857,378, June 18, 1907.

Metal anodes, arranged in multiple series, are refined by passing a current from them to suitable cathodes through an electrolyte. The current used at first is of such strength as not to be affected to an appreciable extent by variations in the resistance of the bath; afterwards, as the active surface of the anodes decreases considerably; an increasing proportion of the current is shunted through an external resistance.—A. G. L.

Electric resistance furnaces; Process for agitating the materials under treatment in ——. F. A. Kjellin. Fr. Pat. 375,192, March 2, 1907. Under Int. Conv., March 5, 1906.

See Eng. Pat. 21,416 of 1906; this J., 1907, 475.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Peat; Waxes in ——. R. Zaloziecki and J. Hausmann. Z. angew. Chem., 1907, **20**, 1141—1143.

On treating 1 kilo. of peat with hot alcohol, filtering, and allowing the filtrate to cool, some 10 grms. of a dark yellow wax are obtained. This wax has a melting point of 80°—90° C., and is easily soluble in amyl alcohol. Treatment with ether separates it into two parts. The soluble portion is dark green in colour, the insoluble portion dark brown. The same alcohol, ($C_{20}H_{40}O_4$), is obtained from both the soluble and the insoluble portions. It is yellow in colour and melts at 124°—130° C. The acid ($C_{24}H_{35}O_7$) obtained from the insoluble portion is dark brown in colour, and does not melt at 260° C. A green coloured acid ($C_{16}H_{25}O_5$) is obtained from the portion soluble in ether. It softens at 145° C. and melts at 184° C.—G. W. McD.

Turkey Red oils and soap preparations for dyeing purposes; Production of ——. F. Erban and A. Mebus. *See* V.

Patents.

Oils, fats, waxes, and the like; Process for refining ——. J. K. Field. Eng. Pat. 10,960, May 10, 1906. *See* III.

Butter, oils, lard, and fats ; Apparatus for renovating and refining ——. C. C. Martin and W. D. Jones. U.S. Pat. 856,355, June 11, 1907. *See* XVIII*A*.

Bleaching oils and fats ; Process of ——. H. A. Metz, Brooklyn, and P. S. Clarkson, Beverly, N.J. U.S. Pat. 856,357, June 11, 1907.

See Fr. Pat. 366,630 of 1906 ; this J., 1906, 1056.—T. F. B.

Saponification of fats or oils ; Process and apparatus for the ——. The Karsam Soap Co., Ltd. Fr. Pat. 375,147, Feb. 28, 1907. Under Int. Conv., March 27, 1906.

See Eng. Pat. 7380 of 1906 ; this J., 1907, 476.—T. F. B.

XIII.—PIGMENTS, PAINTS ; RESINS, VARNISHES ; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Carbon ; Manufacture of amorphous ——. J. Machtolf, Dornstetten, Germany. Eng. Pat. 14,601, June 26, 1906.

See Fr. Pat. 364,034 of 1906 ; this J., 1906, 894.—T. F. B.

Lakes [*from azo dyestuffs*] *; Manufacture of colour* ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 22,781, Oct. 15, 1906.

See Fr. Pat. 373,115 of 1906 ; this J., 1907, 701.—T. F. B.

Pigments ; Production of printing-ink ——. P. Fireman, Braddock Heights, Va. U.S. Pat. 857,044, June 18, 1907.

See Eng. Pat. 25,859 of 1905 ; this J., 1907, 57.—T. F. B.

Metals ; Paint for ——. P. H. Guérin. Fr. Pat. 374,053, Jan. 29, 1907.

A paint consisting of potassium or sodium silicate and oxides or carbonates of the alkaline-earth metals, or alumina, is applied to the metals, and then treated with hydrofluosilicic acid.—O. F. H.

Paint removing composition and its manufacture. P. T. Austen and F. J. Maywald. Fr. Pat. 375,171, March 1, 1907.

See U.S. Pat. 846,080 of 1907 ; this J., 1907, 477.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Copaïba balsam ; Sensitive test for colophony in ——. L. E. Walbum. *See* XXIII.

Patent.

Copal ; Method of obtaining ——. R. Groppler, Berlin. Eng. Pat. 12,885, June 2, 1906.

See Fr. Pat. 366,980 of 1906 ; this J., 1906, 1107.—T. F. B.

(*C.*)—INDIA-RUBBER, &c.

Patent.

Cement composition [*adhesive*], *and process of making the same.* A. Thoma, Cambridge, Mass., Assignor to Thoma Corporation, Portland, Me. U.S. Pat. 855,868, June 4, 1907.

The claims are for a non-volatile, non-oxidising, non-inflammable, permanently adhesive cement of low melting point, which forms a thin fluid when heated, and when allowed to cool quickly, is quick setting and permanently cementitious under all conditions. It is prepared by heating a predominating quantity of wax "tailings" with mineral tar and rosin, and a vegetable gum (*e.g.*, gutta-percha), until the gummy mass is disintegrated, and any tendency to oxidation in it is overcome, and permanent stickiness is imparted to the mass.
—W. C. H.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Sumachs and their substitutes. E. Collin. J. Pharm. Chim., 1907, **25**, 603—610. See also this J., 1899, 403 ; 1905, 46.—J. O. B.

Patent.

Leather ; Process for hardening ——. D. Bryan, Liverpool. U.S. Pat. 857,153, June 18, 1907.

See Eng. Pat. 1787 of 1906 ; this J., 1906, 897.—T. F. B.

XV.—MANURES, &c.

Nitrogen in nitrates ; Volumetric method for the determination of ——. J. G. C. Vriens. *See* XXIII.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot ; Cold alcoholic digestion, and the precipitation of the pectin substances of the ——. L. Pellet and P. Métillon. Bul. Assoc. Chim. Sucr. Dist., 1907, **24**, 1528—1530.

The authors show that the pectin substances already existing in the beetroot, or formed during aqueous digestion, are completely precipitated by the addition of sufficient basic lead acetate solution, and that they are also precipitated (but not quite completely) by alcohol. Hence, a smaller quantity of lead solution should be used for clarification in the alcoholic digestion method than in that of aqueous digestion. Excess of the lead solution, in presence of strong alcohol, may precipitate the sugar in the form of an insoluble salt.—L. E.

Dextrose ; Determination of —— *by the Causse-Bonnans method.* [*Indication of final point by ferrocyanide.*] F. Repiton. Monit. Scient., 1907, **21**, 451—453.

According to this method (described in Denigès' "Chimie analytique") the titration is performed in presence of potassium ferrocyanide and is assumed to be finished when the supernatant liquid acquires a red-brown tint due to the formation of copper-caramel compounds. The author states that with this coloration, the final point is not sharp, and the results are not proportional. These objections are surmounted by taking the final point at the stage when the liquor is golden-yellow instead of brown. The author employs the cupric-tartaric solution of Pasteur and adds to it ferrocyanide in the proportions recommended by Denigès, he also adds to each test, 5 c.c. of a concentrated solution of sodium hydroxide to hold the cuprous ferrocyanide in solution. The copper solution in the flask is maintained in constant ebullition during the whole of the titration, and the sugar solution, which must be colourless, is added from a burette. As soon as the liquid becomes pale green, the sugar solution is added in single drops ; the change to a pure golden yellow, indicating the end of the titration, is stated to be extremely sharp. The reducing power of sugars in presence of ferrocyanide is greater than with ordinary Fehling's solution containing the same amount of copper : 82 parts of the ferrocyanide-Fehling's solution are equivalent to 100 parts of the ordinary solution.—J. F. B.

Starch ; Colloidal properties of ——. E. Fouard. Compt. rend., 1907, **144**, 501—503.

A QUANTITY of starch was subjected to five successive extractions with dilute hydrochloric acid. After each extraction, a portion of the starch was washed with distilled water until the electrical conductivity of the wash-water was constant. The ash- and phosphoric acid-contents of each of these five portions, and also of the original starch, were then determined. The results of the analyses showed that the repeated extraction with acid diminished the total ash-content from 0·3310 per cent. in the original starch to 0·1240 per cent. after five extractions, and the phosphoric acid-content from 0·1915 to 0·1117 per cent. (*i.e.*, a smaller decrease in the phosphoric acid than in the ash). Determinations of the acidity of the five portions of starch, both in presence of phenolphthalein and of methyl orange, showed that each sample possessed the two acidities characteristic of phosphoric acid, the difference between these acidities increasing with successive extractions. The phosphorus thus appears to be present in the starch, not in organic combination, but in the form of acid phosphates. The aqueous pseudo-solutions of the extracted portions of starch were not perfectly clear, but became so on filtration ; the acidity of the filtrates was found to be considerably less than that of the original solutions, although the amount of starch removed by filtration was very small. Hence, the acid is absorbed by the insoluble starch granule, and, therefore, coagulation of colloidal starch should be correlated to a fixation of acid, and an excess of free acid should accelerate coagulation. Addition of hydrochloric, sulphuric, or phosphoric acid, does, in fact, accelerate coagulation, which, also, is more rapid at low temperatures than at high ones. Inversely, heat or alkali converts previously coagulated starch into the pseudo-soluble form. Colloidal starch is the first well-defined organic colloid which has been observed to present the phenomenon of reversibility. The action of salts on starch coagulation is in line with that of acids and bases. Salts which undergo hydrolysis in aqueous solution, yielding an acid or alkaline reaction (*i.e.*, liberating an excess of hydrogen- or hydroxyl-ions), act like acids and bases respectively, whereas neutral salts have no action. From these results it is clear that the coagulation of starch by acid substances is due to a fixation of hydrogen ions, the reverse process, effected by alkaline substances, being due to a fixation of hydroxyl ions. In plant life, phosphoric acid, owing to the fact that it can form both acid and alkaline salts, plays a double rôle according to the variations of protoplasmic acidity or alkalinity. An increase of acidity would tend to coagulate the starch and prevent its translocation ; an increase of alkalinity, on the other hand, would tend to dissolve the starch, thus facilitating its translocation (by osmosis) to the organs of reserve.—L. E.

Starch ; Colloidal properties of ——. E. Fouard. Compt. rend., 1907, **144**, 1366—1368. (See preceding abstract.)

AQUEOUS solutions of strong acids (hydrochloric, hydrobromic, nitric, chloric, trichloracetic, sulphuric, monochloracetic, phosphoric, and arsenic acids), so diluted as to possess equal concentrations of hydrogen ions, coagulate starch solutions with the same velocity. Weak acids, however (carbonic and boric acids, organic acids, and some acids of complex structure, such as silicotungstic and phosphotungstic acids), appear to have no coagulating action ; with these acids, an excess of ions or neutral molecules exercises an action antagonistic to coagulation. With the exception of baryta, the alkalis (potash, lime, ammonia), in aqueous solutions so diluted as to possess equal concentrations of hydroxyl ions, retard the coagulation of soluble starch to the same extent ; baryta, which is ionised to a greater degree than lime in aqueous solution, has a less retarding action on coagulation than the latter. The time required for coagulation of starch solutions at 0° C. increases in presence of decreasing quantities of sulphuric acid, and is further prolonged when increasing quantities of potash are added. In the presence of 0·15 grm.-equivalent (*i.e.*, the molecular weight in grms. divided by the valency) of potassium hydroxide per litre, a 5 per cent. starch solution began to coagulate at the end of 20 days ; the presence of larger quantities of potassium hydroxide prevented coagulation altogether. The continuous variation in the time of coagulation in these different media, shows that the transformation of soluble into insoluble starch is one and the same phenomenon in all these cases, the velocity of coagulation being a continuous function of the concentration of active ions. Water contains hydrogen- and hydroxyl ions at a concentration of one ten-millionth grm.-equivalent per litre ; the reversible coagulating action of water on soluble starch must be attributed to these ions. As the reaction remains neutral, there must be, for every hydrogen ion set free, a hydroxyl ion liberated from the intermicellular medium ; hence, there must be, not merely a physical difference between soluble and coagulated starch, but a difference due to hydrolysis or the inverse process of liberation of hydrogen- and hydroxyl ions. According to this conclusion, water should be the essential factor in the solution of starch under the influence of heat. The author shows that such is the case ; insoluble starch, freed from salts and all trace of acid, was rendered soluble by prolonged immersion in water at about 60° C. Since starch coagulation (in a 5 per cent. solution) by the action of hydrogen ions, still occurs in a medium in which the concentration of hydroxyl ions is 0·15 grm.-equivalent per litre, and since, according to the law of mass-action, the product of concentration of hydrogen- and hydroxyl ions in any aqueous solution is equal to Kohlrausch's constant $0{\cdot}1 \times 10^{-13}$, it follows that a fraction of a grm. of hydrogen ions, equal to $0{\cdot}1 \times 10^{-13} \div 0{\cdot}15 = (\frac{1}{15}) \times 10^{-12}$, is sufficient to disturb the equilibrium of one litre of the starch solution. Such a disproportion is far greater than that observed in the actions of enzymes and toxins.

—L. E.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley ; Influence of the protein contents and weight of corn of —— *on the yield of malt and extract.* D. Neumann. Woch. f. Brau., 1907, **24**, 331—336.

As the result of a complete study of a large number of samples of brewing barleys, extending over a period of three years, the author arrives at the following conclusions : The protein contents of a barley are in no way related to the proportions of fat, ash, and husk. Neither favourable nor unfavourable climatic conditions during the vegetative period have any influence on the fat and ash contents ; these are very constant, and are not appreciably altered by artificial fertilisers. Barleys poor in protein ensure the highest yields of extract, provided the corn be plump and heavy as well as poor in nitrogen. In the case of barleys with the same protein contents, those which are plump and heavier in the corn give the higher yields of extract. Barleys which are poor in protein may fail to give malts with high extracts if the corns are narrow, with only moderate 1000-corn weight, and unsatisfactory in grading. A study of the relation which exists between the form of the corn and the proportion of husk, showed that full, plump and heavy corns always contain only a moderate proportion of husk. The ratio of corn-surface or husk, to corn-contents or starch, is more satisfactory the fuller and rounder the corn. In the malting of barleys rich in protein there is a stronger respiratory consumption of the carbohydrates ; in addition to the greater loss of substance by respiration, there is also the loss by migration into the rootlets.—J. F. B.

Dextrins ; Comparison of actions of barley and malt extracts on the most resistant ——. J. Wolff. Compt. rend., 1907, **144**, 1368—1370. (See this J., 1907, 426.)

IT has been previously shown (*loc. cit.*) that the conversion of starch into maltose by means of barley extract at 45° C. does not exceed certain limits, whereas the conversion is nearly quantitative when malt extract is employed. The author has now examined the action of barley and malt extracts on the residual dextrins (formerly called stable dextrins) left at the end of the rapid phase of saccharification, *i.e.*, at the point where the reaction-product no longer gives the starch iodide reaction. Quantities of 50 c.c. each of 1 per cent. starch paste were treated with 5 c.c. of 10 per cent. malt extract at 45° C. for 10 minutes. The flasks containing the conversion products were then placed in boiling water, in order to destroy the diastase, and subsequently cooled to 45° C. The contents of one flask were used for a maltose determination; the other flasks were treated, some with 5 c.c. of 10 per cent. barley extract, and the remainder with 5 c.c. of 10 per cent. malt extract. To each flask was added a few c.c. of toluene and enough sulphuric acid to neutralise $\frac{3}{4}$ of the total alkalinity. The flasks were maintained at 45° C., the amount of maltose formed being determined from time to time. Control experiments were also made. The results showed that the barley extract had only a very slight action at first, and that at the end of 48 hours, it had ceased entirely to act on the residual dextrins, whereas the malt extract converted these substances, by degrees, into maltose. The barley extract increased the yield of maltose by about 3 per cent. beyond that obtained in the preliminary conversion; in the case of the malt extract, the yield of maltose was increased by about 23—25 per cent. The author and A. Fernbach have regarded the considerable difference between the actions of the two extracts to be due to differences in the specific properties of the two diastases present in these extracts; they propose to show shortly, that this explanation only holds for the conditions of temperature which they have hitherto employed.—L. E.

Starch; Saccharification of soluble —— with barley extract. A. Fernbach and J. Wolff. Compt. rend., 1907, **145**, 80—82. (But see preceding abstract.)

STARCH solutions (obtained by heating to 150° C.) were treated, at 30° C., with: (1), freshly-prepared barley extract; (2), barley extract which had been preserved for 25 days (under toluene). The conversions were allowed to run for 332 hours, the amounts of maltose formed being determined at intervals. The results showed: (1), that at a temperature of 30° C., barley extract slowly converts the most resistant dextrins into maltose; (2), that barley extract, like malt extract (see this J., 1906, 707), undergoes an auto-stimulation when preserved. At the end of 332 hours, the starch treated with the barley extract which had been kept for 25 days, was converted almost completely into maltose. With the fresh barley extract, the conversion had not proceeded so far during the same period, but was more advanced than would have been the case if the temperature had been maintained at 45° C. The action of barley extract on starch is much slower than that of malt extract; the authors have shown that this is due to the fact that the diastases present in barley extract are much less active than those present in malt extract *i.e.*, it is not a question of quantity of diastase. (See also Baker, this J., 1902, 1087.) The investigations of Lintner and Eckhardt have shown that the optimum temperature for the rapid phase of the conversion of starch into maltose is not the same for barley and malt diastases; the authors' work shows that this holds also for the slow phase of conversion (*i.e.*, the conversion of the most resistant dextrins into maltose).—L. E.

Yeasts; Origin of ——. A. Guilliermond. Compt. rend. Soc. Biol., 1906, 60; Z. ges. Brauw., 1907, **30**, 354—355.

THE author raises objection to the doubt expressed by Viala and Pacottet (this J., 1906, 277, 329) concerning the ascogenous nature of the sporangium of *Saccharomycetes*, which organisms these authors regard only as stages in the development of other fungi. In support of the author's view, that the sporangium is essentially connected with the *Saccharomycetes*, is cited the work of Hansen, who showed that these organisms hibernate in the soil, and demonstrated the identity of the spores of certain *Saccharomycetes* with the ascospores of some of the *Ascomycetes*. The author finds that the sporangium of *Saccharomycetes* is cytologically identical with the ascus. The fusion of the spores of certain *Saccharomycetes* prior to germination is regarded by Vuillemin as an asexual, anastomotic process, but the author is of opinion that the phenomenon is accompanied by intermingling of the cell-nuclei and must be looked upon as sexual.—T. H. P.

Yeasts; Top-fermentation and bottom-fermentation ——. Studies on variation and heredity. II. E. C. Hansen. Cent. Bakt. (Abth. II.), 1906, **18**; Woch. f. Brau., 1907, **24**, 338—339. (See also this J., 1906, 550.)

THE author has continued his study with the wine yeast, *S. Johannisberg II.*, starting with single cells which yielded descendants of both top and bottom-fermentation type. For instance of 1000 cells derived from a single cell, there were found 987 bottom-fermentation and 16 of mixed type. By cultivating individual cells from these latter, the proportion of top-fermentation type could be raised even up to 75 per cent. In another series one spore of the yeast gave 997 per 1000 of top-fermentation cells, 2 mixed, and only one bottom-fermentation cell. The descendants of this last remained, however, strictly true to their bottom-fermentation type. In the sub-cultures obtained in the analysis of the above mixtures, when the vegetative cells were killed by alcohol, the surviving spores all yielded descendants of the same type as the cells from which they were derived. The cultures described as of mixed type were mixtures of the two forms, and sub-cultures taken from them might be either of top or bottom type. The Johannisberg yeast has the general character of a bottom-fermentation yeast, but any single cell may give rise to either pure top or bottom-fermentation descendants, or to mixtures of the two. The behaviour of the cell is determined by internal forces, the external conditions being maintained constant. *S. turbidans* gave exactly similar results. The Carlsberg bottom-fermentation yeasts I and II, yielded, from single cells, about 5 per cent. of cells of mixed type from which top-fermentation forms could be isolated on sub-cultivation. *S. validus* is a top-fermentation yeast which yields only very few bottom-fermentation cells, and these are not constant in type. Yeasts of strongly pronounced top-fermentation type such as the English and Scotch brewery yeasts only yield bottom-fermentation cells very rarely, and these, being of mixed type, do not give descendants in which the variation is fixed. For instance from over 2600 cells, only one cell of mixed type was obtained, and in the case of spores, only one cell out of 9948 was of mixed type. The author regards the constancy of the top-fermentation yeasts as an indication that this type is the oldest in the scale of evolution and that the bottom-fermentation yeasts are of later development. No information is yet available as to the causes which bring about variations in type.
—J. F. B.

Proteolytic enzymes; Use of optically active dipeptides for the quantitative study of ——. E. Abderhalden and A. H. Koelker. Z. physiol. Chem., 1907, **51**, 294; Woch. f. Brau., 1907, **24**, 338.

SINCE the dipeptides derived from naturally occurring amino-acids are hydrolysed by proteolytic enzymes, they can be conveniently employed for the quantitative study of the activity of these enzymes. By selecting an optically active dipeptide which has a high specific rotatory power, and which, on hydrolysis, yields optically inactive products, the progress of the digestion may be accurately followed by polarimetric readings. A suitable dipeptide is *d*-alanyl-*d*-alanine; the pancreatic ferment attacks this substance very slowly, the intestinal ferment acts more rapidly, but the most active proteolytic enzyme is that present in yeast cell-juice. In one series of observations cited, 0·45 grm. of *d*-alanyl-*d*-alanine was digested with 6 c.c. of yeast cell-juice; the optical rotation at the beginning was $a_D = -1{\cdot}21°$, and it decreased in 55 minutes to $a_D = +0{\cdot}10°$, at which it remained constant. *d*-Alanyl-*l*-leucine can also be employed, but it is less suitable than the other because one of the products, *l*-leucine, is optically active.—J. F. B.

Wort and beer; Action of iron salts on ——. H. Schjerning. Z. ges. Brauw., 1907, **30**, 345—346.

According to the author, the contradictory nature of the statements published concerning the action of iron on beer, is probably due to the fact that, with some beers, ferric salts are formed, and with others, ferrous salts. The actions of these two classes of salts (sulphates) on wort and beer are as follows. The addition of ferric sulphate (0·0016 grm. of iron) to wort (25 c.c.) causes the immediate deposition of a voluminous, flocculent precipitate, which is dark-coloured or almost colourless according as hopped or unhopped wort is used; the action of light and agitation accelerates the deposition. With some unhopped worts, the addition of ferrous sulphate (0·0016 grm. of iron per 25 c.c.) produces a finely-divided precipitate which settles very slowly to form a greyish-white or greyish-black deposit, whilst with others no deposition occurs. With hopped worts, ferrous sulphate gives a reaction very similar to that produced by the ferric salt. With beer, ferric sulphate causes at first considerable turbidity, and, later, the deposition of a rust-coloured precipitate, which settles with difficulty; the rapidity of the precipitation increases with greater speed than the amount of iron added, and is also favoured by the action of light and by agitation. Ferrous sulphate produces a change only in certain beers, in which it gives a flocculent precipitate; in greater dilution and on longer standing, it apparently becomes oxidised and produces a change similar to that observed with the ferric salt. The fact that ferrous sulphate does not cause alteration in all beers seems to depend on the presence or absence of one or more definite, individual proteins.—T. H. P.

Beer; Determination of the "apparent maltose" in ——. C. Bergsten. Woch. f. Brau., 1907, **24**, 321—322.

Assuming that the percentage of solid extract of the beer has been determined, 50 c.c. of Fehling's solution, equal to 0·389 grm. of maltose, are heated to boiling. A quantity of beer, as shown in the accompanying table opposite the numbers for solid extract, is then run into the boiling liquid from a burette. After boiling for four minutes, the liquid is filtered, the first runnings being discarded, and the filtrate is acidified and tested for the presence of copper by ferrocyanide. According to the indication of this test, a second test is made with a slightly greater or less quantity of beer, so that the filtrate contains just the faintest trace of copper. The following table is calculated for dark beers; with pale beers, especially those of the Pilsener type, up to 2 c.c. more of beer may be required.

Solids, grms. per 100 c.c.	c.c. of beer required.	Solids, grms. per 100 c.c.	c.c. of beer required.	Solids, grms. per 100 c.c.	c.c. of beer required.	Solids, grms. per 100 c.c.	c.c. of beer required.
3·0	50	3·9	40	4·8	32	5·7	27.5
3·1	49	4·0	39	4·9	31·5	5·8	27
3·2	48	4·1	38	5·0	31	5·9	26·5
3·3	46·5	4·2	37	5·1	30·5	6·0	26
3·4	45	4·3	36	5·2	30	6·1	25·5
3·5	44	4·4	35	5·3	29·5	6·2	25
3·6	43	4·5	34·5	5·4	29	6·3	24·5
3·7	42	4·6	33·5	5·5	28·5	6·4	24
3·8	41	4·7	33	5·6	28	6·5	23·5

—J. F. B.

Sucrase [invertase] and sucrose in various parts of the vine and in some fruits; Researches on ——. V. Martinand. Compt. rend., 1907, **144**, 1376—1379.

The author employed the Petit Bouschet grape for his investigations. Invertase was found in all parts of the vine (*viz.*, grape must and pulp, leaves, ligneous stalks of the grape bunch, and roots). Sucrose was found in the leaves, in the grape pulp, and, in very small quantity, in the roots; it was not observed in the must obtained by very slight expression of the grape, although it was found in the must obtained by the action of strong pressure on ripe grapes; it was not found in the ligneous stalks of the grape bunch. The author has also detected invertase in cherries, currants, and pomegranates; pears contain a very small quantity of invertase, but none was found in apples (see this J., 1907, 629), oranges or lemons. The author concludes that the hydrolysis of sucrose in the vine is effected by the agency of invertase; quantitative determinations of the hydrolysing power of the invertase in the various parts of the plant examined, with parallel determinations of the amounts of sucrose, indicated that there is a considerable excess of invertase, which, diffused into the must, would be sufficient to hydrolyse all the sucrose added thereto.—L. E.

Red wines; Origin of the deposits of the colouring matter of ——. A. Trillat. Compt. rend., 1907, **144**, 1439—1441.

The author finds that the deposit of the colouring matter of red wines appears whenever an aldehyde is formed in the wine, or the amount of aldehyde already present is increased. This can be caused by oxidation by air, and takes place during the ageing and also in certain diseases of the wine.—F. Shdn.

Distillery mashes; Acidification of —— by mineral acids. E. Bauer. Chem.-Zeit., 1907, **31**, 627—629, 653—654.

The object of the lactic fermentation of distillery seed-yeast mashes is not merely the production of acid; one of the functions of the process is the conversion of albumin into soluble products suitable for yeast nutrition. The process is by no means invariably successful and represents a certain loss of sugar. The use of the nutrient extract, prepared from autolysed yeast as recommended by the author for molasses distilleries (this J., 1902, 1290), in conjunction with sulphuric acid, enables the distiller or manufacturer of pressed yeast working with starchy materials to dispense with the lactic acid fermentation of his mashes. This combination is stated to be a perfect substitute, both physiologically and chemically, for the more expensive and uncertain lactic acid process. The quantity of sulphuric acid to be used, varies with the nature and concentration of the mash. Whereas the object of the author's process is the cultivation of the yeast in a vigorous state under the most favourable conditions, that of Effront's hydrofluoric acid process is to obtain purity of fermentation by the use of a poison which is fatal to bacteria but to which the yeast is acclimatised. Bücheler's process, in which mineral acid is also used, depends on a certain degree of acidity towards "methyl violet," with the object of liberating the organic acids of the mash without the presence of free mineral acid. Actually this object is not attained, but the presence of small quantities of free sulphuric acid is favourable, not harmful as Bücheler believed. The action of sulphurous acid, hydrochloric acid, formic acid, and formaldehyde cannot be compared with that of hydrofluoric acid, so far as successful results are concerned.—J. F. B.

Tartaric acid in tartars and wine lees; Determination of ——. P. Carles. *See* XXIII.

Patents.

Malt kilns and other drying sheds. E. Orval, Brussels. Eng. Pat. 27,417, Dec. 1, 1906.

This invention relates to a heat-distributing chamber, which is shown in sectional elevation (Fig. 1), and sectional plan (Fig. 2). The hot gases from the fire or other source of heat, pass at *d* into the chamber, *c*, and thence proceed through the flues, *f*, which are formed by the spaced pillars, *g*, to the heating chamber, *a*. A portion of the gases passes between the pillars, *g*, whilst the remainder proceeds along the flues, and is discharged below the dispersion domes, *k*. In the heating chamber, *a*, a current is produced in a direction opposite to that of the dis-

Fig. 1

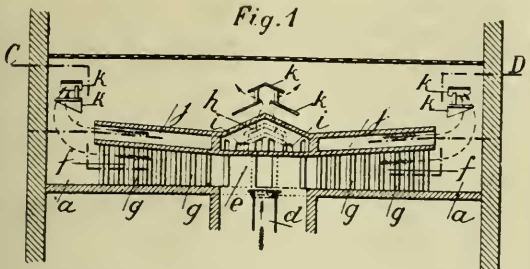
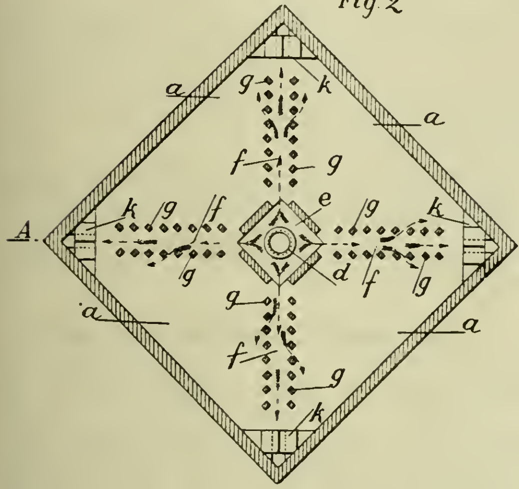


Fig. 2



tribution of the hot gases, and, entering the chamber, *h*, through the openings, *i*, is conducted through the passages, *j*, towards the extremities of the flues, *f*, where it encounters the main current of the hot gases and then mixes with these in the interior of the domes, *k*. This compensating system of circulation produces a uniform heating of the floor of the kiln.—T. H. P.

Alcohol; Production of —— from wood. B. E. R. Newlands, London. Eng. Pat. 16,510, July 21, 1906.

The object of this invention for obtaining alcohol from wood, is the removal of the residual sulphurous acid from the finely-divided wood, after the latter has been treated, and the steam and part of the sulphurous acid have been allowed to escape from the autoclave and passed through the condenser. (See Classen, this J., 1900, 1028; 1901, 734, 1008). The process consists in establishing a vacuum or a partial vacuum in the autoclave by a device arranged so that the vapours containing the residual sulphurous acid are drawn through the condenser on their way from the autoclave.—T. H. P.

Worts; Process of fermenting —— [with addition of hydrogen peroxide]. P. Grosfils, Brussels. Eng. Pat. 18,611, Aug. 20, 1906.

Small quantities of hydrogen peroxide are added to the wort previous to the primary fermentation. Solutions of other substances, such as sodium hypochlorite, calcium hypochlorite, potassium chlorate, and sodium peroxide, may also be used, and the hydrogen peroxide may be prepared by "subjecting hop fruits or cones to the action of hot air saturated with steam, thus producing, by condensation, a liquid charged with hydrogen peroxide."—W. P. S.

Distillery mashes; Process for fermenting —— [with addition of formaldehyde and milk]. G. Fritsche, Strzebowitz, Austria. Eng. Pat. 24,093, Oct. 29, 1906.

A mixture of milk and formaldehyde is added to the yeast and mash in order to increase the yield of alcohol. The mixture is prepared by adding 1 part by volume of formalin to 11 parts of boiled and cooled milk. The quantity of this mixture added depends on the capacity of the mash-tun. For instance, in the case of a tun holding 2750 litres, 1200 c.c. of the mixture were added to the yeast, and 9600 c.c. to the mash. (See also Fr. Pat. 361,643 of 1905; this J., 1906, 1062.)—W. P. S.

Liquids [beer] containing gas; Process and apparatus for pasteurising —— under pressure. T. A. Hearson, London. From F. W. Mönninghoff, Elberfeld, Germany. Eng. Pat. 28,707, Dec. 15, 1906.

The liquid, contained in open receptacles, is placed in a closed vessel and heated therein to a temperature of 70° C. During the heating the pressure is increased by the introduction of compressed gas, such as carbon dioxide, so that the escape of gas from the liquid is prevented. A safety-valve allows the gas to blow-off when the pressure exceeds that required. (See also U.S. Pat. 838,721 of 1906; this J., 1907, 217.)—W. P. S.

Malting; Process of ——. H. Heuser, Chicago, Ill. U.S. Pat. 856,637, June 11, 1907.

The grains are steeped and then conveyed through a suitable closed pipe to the germinating chamber, being, in their transit, subjected to a current of air, and continual stirring, so as to remove all superficial moisture.—W. P. S.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

[Cocoa analysis] Pentoses and pentosans; Determination of ——, and its practical applications. R. Adan. Bull. Soc. Chim. Belg., 1907, 21, 211—221.

The author has examined the methods for the determination of pentoses which depend on the conversion of the pentose into furfural and weighing the latter in the form of (1) phenylhydrazone, or (2) phloroglucide. The results obtained by both methods were fairly accurate. These methods were used for the determination of pentosans in the beans and husks of six samples of cocoa from different sources. The pentosan-content of the beans was found to range between 1·19 and 2·19 per cent., with an average of 1·53 per cent.; that of the husks was found to range between 7·57 and 10·53 per cent. (calculated on dry substance) with an average of 9·96 per cent. Since, in the manufacture of cocoa powder, mixtures of beans from various sources are employed, the amount of pentosans in a cocoa powder, free from husks, should approximate to the above value of 1·53 per cent.; the presence of husks in the sample would, of course, increase the pentosan-content. Hence, a pentosan determination should prove useful for the detection of husks in cocoa powders.—L. E.

Patents.

Casein or albuminous substances; Process of producing a compact mass from ——. G. W. Betz, Berlin. Eng. Pat. 14,319, June 22, 1906.

See Fr. Pat. 367,407 of 1906; this J., 1906, 1162.—T. F. B.

Food from fruit kernels and the like; Preparation or manufacture of human ——. E. H. Miles, Cambridge, and S. J. von Romocki, London. Eng. Pat. 18,292, Aug. 14, 1906.

The kernels, after the outer coverings have been removed by scalding and crushing, are heated in a vessel for half an hour to a temperature of about 105° C., under reduced pressure. The kernels are then treated with purified light petroleum to remove fat, the solvent is expelled by

heating the mass to a temperature of 100° C., or more, and the dried kernels are mixed with other foodstuffs.
—W. P. S.

Butter; Process of renovating and refining ——. C. C. Martin and W. D. Jones, Denver, Colo. U.S. Pat. 856,353, June 11, 1907.

Melted butter-fat, separated from water, curd, etc., is subjected, in the form of a thin layer, to the action of numerous jets of hot air under pressure, until the impurities have been expelled. These impurities are removed by means of an exhaust; the butter-fat is maintained in a melted condition, emulsified with milk, cream, or sour milk, and the mixture is then cooled and worked in the usual manner.—W. P. S.

Butter oils; Pneumatic agitating tank for ——. C. C. Martin and W. D. Jones, Denver, Colo. U.S. Pat. 856,354, June 11, 1907.

The apparatus consists of a closed tank for holding a shallow layer of the butter and surrounded by a hot-water jacket. Hot air is forced into the tank through a main pipe having perforated branch-pipes disposed in the layer of butter. An exhaust pipe is provided and extends to the outside of the tank where it connects with a fan; this exhaust pipe is fitted with a drip pipe in which butter oil is collected apart from the other matters separated from the melted butter.—W. P. S.

Butter, oils, lard, and fats; Apparatus for renovating and refining ——. C. C. Martin and W. D. Jones, Denver, Colo. U.S. Pat. 856,355, June 11, 1907.

The apparatus consists of tank surrounded by a hot-water jacket, and having a heated platform on which the butter is melted. Partitioned compartments are provided for separating the curd from the butter-fat, and a conveyor carries predetermined quantities of the melted fat to a machine where it is subjected to the action of jets of hot air or oxygen (see preceding abstracts). This machine is in connection with apparatus for emulsifying and working the purified butter-fat.—W. P. S.

Baking powder, and process of making the same ——. O. Best, C. S. Ash, and E. Samson, San Francisco, Cal. U.S. Pat. 856,672, June 11. 1907.

Tartaric acid crystals are coated with a solution of albumin, the latter is coagulated by heat, and the acid is then incorporated with the other constituents of the baking powder.—W. P. S.

Baking powder, and process of making the same ——. O. Best, C. S. Ash, and E. Samson, San Francisco, Cal. U.S. Pat. 856,673, June 11, 1907.

Albumin is coagulated by heat, then dissolved in alkali solution, and mixed with the starchy filling material of the baking powder. The acid ingredient of the latter is next added and mixed, so that the acid crystals are coated with a film of starch and albumin. The mixture, after being dried, is incorporated with the other ingredient of the baking powder.—W. P. S.

(B.)—SANITATION; WATER PURIFICATION.

Patents.

Sewage or other liquids; Purification of ——, and apparatus therefor. W. O. Travis, Hampton, Middlesex. Eng. Pat. 13,264, June 8, 1906.

The sewage, after preliminary treatment in tanks such as those described in Eng. Pats. 11,073 of 1903 and 4980 of 1905 (this J., 1904, 676; 1906, 388) is thoroughly aërated, and is then conducted to the bottom of a filter-bed, the liquid being allowed to rise upwards through the filtering material to within a short distance of its surface. After a suitable time, the sewage is withdrawn from this filter, passed through settling chambers, and then over weirs on to a secondary filter which is provided with tray-like layers of fine filtering material interspaced in the body of other coarser material. From the bottom of the secondary filter the liquid is led into further settling tanks before being discharged into a water-course. Suitable valves are provided for regulating the flow of sewage to, and through, the beds, and air is supplied to the bottom of the primary filter.—W. P. S.

Water purifiers [; Electric ——]. F. B. Hinkson, and The Hinkson Electric Liquid Purifying Co., Pittsburg. Eng. Pat. 25,940, Nov. 16, 1906.

See Fr. Pat. 371,055 of 1906; this J., 1907, 338.—T. F. B.

Air; Materials for purifying ——. H. Ryder and L. C. Wilson, Newark-on-Trent. Eng. Pat. 1079, Jan. 15, 1907.

The air to be purified is passed through a chamber in which is placed a number of superposed trays carrying a mixture consisting of glycerol, 95, and potassium metabisulphite, 5 parts.—W. P. S.

Trade effluents; Combined apparatus for the treatment of ——. B. and A. Broadbent. Fr. Pat. 374,974, Feb. 23, 1907. Under Int. Conv., Feb. 24, 1906.

See Eng. Pat. 4537 of 1906; this J., 1907, 164.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Alkali-cellulose. W. Vieweg. Papier-Zeit., 1907, **32**, 130—131, 174—175.

From a study of the amount of alkali taken up by cellulose from solutions of different concentrations, the author concludes that alkali-cellulose is a chemical compound (absorption compound) of the general formula, $(C_6H_{10}O_5)_n$,NaOH. The factor, *n*, varies according to the concentration of the alkali solution employed; it has the value 1 when the most favourable conditions for mercerising are observed, *i.e.*, with an alkali solution of 30°—40° B. The treatment with alkali results in a distinct disaggregation of the cellulose molecule, $(C_6H_{10}O_5)_n$, the value, *n*, in this formula becoming smaller. By boiling with dilute alkali or by heating, gelatinisation takes place, the value of *n* becoming larger. The amount of alkali taken up from solutions of the same by cellulose, decreases with rising temperature. The alkali-cellulose compound is hydrolysed in dilute solutions of alkali. (See also Hübner and Pope, this J., 1904, 404.)—A. S.

Patent.

Cellulose; Process for the manufacture of threads, films, or other forms of ——. M. Fremery, Oberbruck, E. Bronnert, Mülhausen-Niedermorschweiler, Germany, and J. Urban, St.-Polten, Austria-Hungary. U.S. Pat. 856,857, June 11, 1907.

A cuprammonium solution of cellulose prepared at a temperature below 10° C., is injected into a solution of caustic alkali of about 1·3 sp. gr. The thick threads or films so prepared are washed, and dried under tension.
—G. W. McD.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Quinine; Detection of ——. J. Abensour. J. Pharm. Chim., 1907, **26**, 25—26.

The thalleioquin reaction of André is obtained most satisfactorily in the presence of alcohol, with neutral or faintly acid solutions of quinine, under the following conditions:—To 10 c.c. of the solution, saturated aqueous bromine solution is added, drop by drop, until the fluorescence disappears; 10 c.c. of alcohol are then added, followed by 1 or 2 drops of ammonia solution. The characteristic green colour is at once obtained. In very dilute solutions, where the colour is faint, it is rendered more evident by shaking with a small volume of chloroform, in which the coloured body is soluble. Salts of quinine should be dissolved in alcohol, and the solution diluted with an equal volume of water, before applying the test.

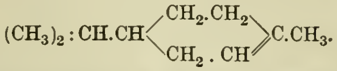
The "erythro-quinine" reaction, obtained as follows, is a very sensitive test for quinine, indicating the base in a dilution of 1 : 1,000,000 of water. Ten c.c. of the faintly acid aqueous solution are treated with 1 drop of a saturated aqueous solution of bromine, previously diluted with an equal volume of water, 1 drop of a ten per cent. solution of potassium ferrocyanide, and 1 drop of a ten per cent. solution of ammonia, and the mixture is shaken with chloroform; on separating, the latter shows a rose colour in the presence of quinine.—J. O. B.

Lupeol. E. Jungfleisch and H. Leroux. Compt. rend., 1907, **144**, 1435—1437.

THE active principles of the gutta-percha of *Palaquium Treubi* (this J., 1906, 646) contain lupeol cinnamate. This substance forms well-defined monoclinic crystals, having the optical rotation, $\alpha_D = +50°$ in chloroform. Lupeol itself crystallises in fine needles, slightly soluble in the usual solvents, and having the rotation, $\alpha_D = + 27{\cdot}24°$ in chloroform. When heated slowly, it melts at 212° C., but when heated rapidly, it melts at 190°—192° C., and then becomes solid, owing to the loss of water and formation of a hydrocarbon, "*lupeylene*," which on further heating, melts at 212° C. This conversion into a hydrocarbon takes place at 130° C. Lupeylene crystallises in fine needles, is soluble in chloroform and bromoform, and slightly soluble in light petroleum; it has the optical rotation, $\alpha_D = +24{\cdot}57°$. Analyses and the molecular weight, 406—412, point to the formula, $C_{30}H_{50}O$ for lupeol. On treatment with bromine in chloroform, lupeol yields the monobromide, m. pt. 185° C., hydrobromic acid being liberated at the same time. With lupeylene, the dibromo-addition compound is obtained, melting at about 160° C. The authors consider that the dibromo-addition product obtained by Sack and Tollens from lupeol (this J. 1904, 1236) is identical with this substance.—F. SHDN.

Essential oils. Dihydroterpinene or carvomenthene. Oil of Pilea. F. W. Semmler. Ber., 1907, **40**, 2959—2963.

BY saturating an ethereal solution of sabinene with dry hydrochloric acid gas, and then fractionating, sabinene monohydrochloride, $C_{10}H_{16}$,HCl, was obtained, boiling at 82°—86° C. at 9 mm.; sp. gr., 0·970 at 20° C.; $n_D = 1{\cdot}482$; and $\alpha_D = -0° \ 15'$. On reduction with sodium in absolute alcohol, dihydroterpinene (carvomenthene), $C_{10}H_{18}$, was produced. This boils at 57°—60° C. at 9 mm., and has sp. gr., 0·8184 at 20° C.; $n_D = 1{\cdot}4566$, and $\alpha_D = + 12° \ 30'$ in a 100 mm. tube. The physical data correspond with those of dihydrolimonene and dihydrophellandrene. On oxidation with ozone, dihydroterpinene yields a ketoaldehyde, $C_{10}H_{18}O_2$, boiling at 119°—125° C. at 9 mm., with sp. gr. at 20° C. of 0·9439; and $n_D = 1{\cdot}44962$. The semicarbazone, $C_{12}H_{24}O_2N_6$, melts at 183° C. When the ketoaldehyde was oxidised with permanganate, a methylketo acid was produced, $CH_3.CO.CH_2.CH_2.CH(C_3H_7).CH_2.COOH$. This boiled at 174°—180° C. at 9 mm., and had sp. gr., 1·019 at 20° C., and $n_D = 1{\cdot}45662$. The phenylhydrazone melted at 102° C. This acid is identical with the methylketo acid obtained by von Baeyer from tetrahydrocarvone. The bisnitrosochloride, $(C_{10}H_{18}NOCl)_2$, of dihydroterpinene melts at 87° C., and the nitrolamine at 107° C. The menthene, $C_{10}H_{18}$, when oxidised with ozone yielded a ketoaldehyde, $CHO.CH_2.CH(CH_3).CH_2.CO.C_3H_7$, boiling at 122°—124° C. at 9 mm., and with sp. gr., 0·959 at 20° C., and $n_D = 1{\cdot}4483$. On oxidation with permanganate, it gave an oxymenthylic acid, $C_{10}H_{18}O_3$, the semicarbazone of which melted at 162° C. There is no doubt that dihydroterpinene is identical with the active carvomenthene obtained by the reduction of limonene monohydrochloride and by the direct reduction of *n*- and *pseudo*-phellandrene. The following formula for dihydroterpinene is given:—



$$(CH_3)_2 : CH.CH\begin{cases} CH_2.CH_2 \\ CH_2 . CH \end{cases}C.CH_3.$$

The monohydrochloride of sabinene is easily converted into the dihydrochloride, m. pt. 54° C., which passes into terpinene on the removal of two molecules of hydrochloric acid. From this it follows that the one ethylenic linking in terpinene must be cyclic and that it has the same position as in dihydroterpinene. A sample of Pilea oil (*Pilea* spec.) was examined, with the following constants: sp. gr., 0·8511 at 20° C., $n_D = 1{\cdot}47053$, $\alpha_D = +59° \ 10'$ (100 mm. tube). Analysis indicated that the oil consisted for the most part of terpenes. A small amount of pinene had been previously found in the oil. On fractionation, the principal part of the oil boiled at 167°—168° C. This fraction had sp. gr., 0·8402 at 20° C., $n_D = 1{\cdot}46954$, $\alpha_D = +61° \ 21'$ (100 mm. tube). A glycol was obtained on oxidation, showing the principal constituent of Pilea oil to be dextro-rotatory sabinene.—F. SHDN.

Chenopodium anthelminticum [*American wormseed*]; *Essential oil of* ——. E. Kremers. Pharm. Review, 1907, **25**, 155—157.

THE characters of three specimens of the oil distilled in 1900—1902 lay between the following limits:—Sp. gr., 0·9621—0·9753; $\alpha_D = -2°5'$ to 2°23′ for 50 mm. at 21·8° C.; saponification value, 3·6—14·5; acetyl value, 246—259. From the behaviour of the oil during acetylation, chemical changes other than mere esterification appear to occur. The behaviour of the oil on heating was remarkable: on attempting distillation, decomposition took place with explosive violence. The same result occurred when the saponified oil, rectified by steam distillation, was heated to near its boiling point. Apparently the oil contains a large percentage of a very unstable alcohol from which water is readily separated on heating, thus generating steam.—J. O. B.

Samoan flowers and drugs; Production of essential oils from ——. O. Thiele. Chem.-Zeit., 1907, **31**, 629.

THE climate of the Samoan Islands is extremely favourable to the production of raw materials for the perfumery industry, but difficulties of transport and the lack of organised cultivation and manufacture hinder the development of the industry. Products such as odorous resins, leaves, fruits, and roots, which preserve their properties for a considerable time, could be collected and exported for treatment. Of such materials Samoa produces: the roots of the mumuta grass, a species of *Andropogon*, the fruits of *Parinarium laurinum* and *Agleia edulis*, the resins of various native trees, the leaves of *Acronychia*, *Sigesbeckia orientalis*, *Nelitris vitiensis*, *Alyxia* species, *Evodia hortensis*, and species of *Citrus*. The problem of exploiting the more perishable blossoms which abound in the islands, is more difficult for the reasons stated above. In this category the ylang-ylang perfume is by far the most important, since the ylang tree (*Cananga odorata*) grows in the islands, and the blossoms have already been worked in a crude and primitive way for the preparation of native perfumes. The introduction of portable apparatus or of *enfleurage* by the cold or hot system by means of cocoanut oil would be the best way of dealing with the transport difficulty; labour, however, is quite unorganised. Other blossoms available are: species of *Gardenia*, *Drymispermum Burnettianum*, species of *Cestrum*, *Melochria odorata* and many others. —J. F. B.

Citral. C. Harries and A. Himmelmann. Ber., 1907, **40**, 2823—2826.

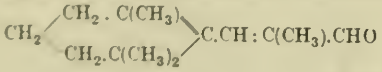
THE authors have studied the products of the action of ozone upon citral. Citral *a* and *b* were treated in the same way, by passing ozonised oxygen through their solution in light petroleum. The clear syrup which separated out, had the properties of an ozonide and the composition, $C_{10}H_{16}O_5$. It is a mixture of the mon-ozonide and the diozonide of citral, for it is not changed by the action of sodium bicarbonate. After warming with water, hydrogen peroxide, lævulinic aldehyde, and acetone superoxide can be detected. The diozonides of citral *a* and *b* can be produced by a similar method if carbon tetrachloride be used in place of light petroleum. The diozonide, $C_{10}H_{16}O_7$, separates as a thick, clear oil, which, after drying in a vacuum, sets to a glassy solid. Unlike the monozonides, the diozonides do not decolorise bromine. When warmed on the water-bath, the diozonide of citral gave a nearly quantitative yield of lævulinic aldehyde, lævulinic acid, and acetone; there was also evidence of the formation of glyoxal.—F. Shdn.

Hydrogenation method of Sabatier and Senderens; New applications of ——. C. J. Enklaar. Chem. Weekblad. 1907, 4, 322—324. Chem. Zentr., 1907, 2, 56.

The author has applied the method of reducing by means of pure hydrogen and finely-divided metals to unsaturated aliphatic compounds, such as ocimene, geraniol, linalool, and citral. The hydrocarbons were readily converted into the corresponding saturated compounds, whilst the alcohols yielded, in part, the corresponding hydrocarbons, and in part, saturated alcohols, the production of the latter proceeding most readily at temperatures between 130° and 140° C. From citral, besides the expected aliphatic compounds, a series of cyclic compounds was obtained, amongst which was an alcohol resembling the menthol from peppermint oil. The author finds that in this method of reduction, copper gives better results than nickel, and he is of the opinion that the hydrogen is absorbed by the finely-divided metal, without forming a compound.
—A. S.

Cyclolemonylidenepropenal: an aldehyde with the odour of violets; Synthesis of ——. P. Barbier. Compt. rend., 1907, **144**, 1442—1443.

A solution of lemonal (citral) and propyl aldehyde in alcohol and water was treated with a dilute solution of sodium carbonate. On fractionation, two isomeric aldehydes were obtained, boiling at 147°—148° C., and 158°—160° C. at 13 mm. The aldehyde boiling at 147°—148° C. is readily oxidised, and has the constitution: $(CH_3)_2C:CH(CH_2)_2C(CH_3):CH.CH:C(CH_3).CHO$. On dissolving in cold 60 per cent. sulphuric acid, and warming to 50° to 60° C., ring-formation takes place. The product, on distilling in a vacuum, yields two fractions boiling at 123°—125° C., and 132°—133° C., and both having the same composition. They are somewhat oily liquids with a slight amber colour. They give semicarbazones, one melting at 174°—175° C., whilst the other could not be crystallised. They have a strong odour of freshly gathered violets, which disappears rapidly owing to oxidation. The following represents the constitution of the products:



—F. Shdn.

Alcohol and ether in their mixtures; Quick method of determination of ——. J. Fleischer and H. Frank. Chem.-Zeit., 1907, **31**, 665.

If benzene and water are added to a mixture of alcohol and ether, the latter is dissolved in the benzene and the former in the water, so that, by reading off the volume of the layers, the proportion of alcohol to ether in the original mixture is quickly estimated. For example: 10 c.c. of an alcohol-ether mixture were mixed with 5 c.c. of benzene and 5 c.c. of water. After standing for a few minutes, the upper layer measured 12 c.c. and the lower, 8 c.c.: hence the proportion of ether to alcohol in the mixture was 7 : 3. When water is present, the sp. gr. of the mixture is taken before the addition of benzene and water, and the sp. gr. of the aqueous alcohol is given by the formula

$$\delta = \frac{10\,d - a \times 0{\cdot}729}{10 - a}$$

where δ is the sp. gr. of the aqueous alcohol, *d* is the sp. gr. of the original mixture, *a* is the number of c.c. of ether present, and 0·729 the sp. gr. of ether. From the figure obtained, the alcohol content can be ascertained from the ordinary tables (Tralles). For example: A mixture of sp. gr. 0·880 was found to contain 20 per cent. of ether. Using the above formula, $\delta = 0{\cdot}917$, which corresponds to an alcohol of 58° Tr. (volume per cent.). The mixture contained, therefore, 46 per cent. of alcohol, 34 per cent. of water, and 20 per cent. of ether (by volume).—J. C. C.

Copaïba balsam; Sensitive test for colophony in ——. L. E. Walbum. *See* XXIII.

Tartaric acid in tartars and wine lees; Determination of ——. P. Carles. *See* XXIII.

Patents.

Aromatic sulphinic acids; Manufacture of ——. C. Dreyfus and the Clayton Aniline Co. Ltd., Manchester. Eng. Pat. 13,054, June 5, 1906.

Aromatic sulphinic acids are produced by acting on a solution of a diazo-derivative of a primary aromatic amine with a reducing agent, in the presence of a dissolved copper salt and sulphur dioxide. Zinc dust, titanous sulphate, stannous salts, dextrose, and glycerol are mentioned as reducing agents, or the reduction may be effected by electrolysis.—F. Shdn.

Sulphonic acids; Process for the manufacture of the sodium salts of aromatic ——. P. W. Uhlmann, Charlottenburg, Germany. Eng. Pat. 24,826, Nov. 5, 1906. Under Int. Conv., Nov. 6, 1905.

See Fr. Pat. 371,089 of 1906; this J., 1907, 279.—T. F. B.

Monoiodobehenic acid; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,648a, Oct. 24, 1906.

See Addition of Oct. 23, 1906, to Fr. Pat. 362,370 of 1906; this J., 1907, 278.—T. F. B.

Isobornyl esters; Manufacture of ——, *and the obtainment of bye products.* C. Weizmann and The Clayton Aniline Co. Ltd., Manchester. Eng. Pat. 23,875a, Oct. 26, 1906.

Isobornyl esters can be obtained by the use of pinene hydrochloride which has been obtained from turpentine purified in accordance with Eng. Pat. 23,875 of 1906. Dipentene and other oils are obtained as by-products.
—F. Shdn.

Camphor from isoborneol; Manufacture of ——. Basler Chemische Fabrik, Basle, Switzerland. Eng. Pat. 9857, April 27, 1907. Under Int. Conv., April 28, 1906.

Isoborneol can be oxidised to camphor by nitric acid at low temperatures, depending on the acid employed; thus, with fuming acid, oxidation is performed at 0° to 5° C., and with 50 per cent. acid, at 25° to 30° C. The presence of "nitrous oxide" is necessary for the oxidation; if the nitric acid is free from it, a small quantity of copper may be added. (See also U.S. Pat. 802,793 of 1905; this J., 1905, 1188, and Fr. Pat. 365,974 of 1906; this J., 1906, 1002.)—T. F. B.

Arbutin derivative [Monobenzoylarbutin]; Method of producing an ——. C. Vilmar, Andernach on the Rhine, Germany. Eng. Pat. 5542, Mar. 7, 1907.

Monobenzoylarbutin can be prepared by the addition of benzoyl chloride to a solution of arbutin, the free acid resulting from the action being neutralised by the addition of alkali. Instead of a solution of arbutin, a clarified extract of drugs containing arbutin may be used, particularly the extract of bear-berry leaves (*Uva ursi*).—F. Shdn.

Dialkylbarbituric acid; Process of manufacturing ——. M. Conrad, Aschaffenburg, Assignor to E. Merck, Darmstadt, Germany. U.S. Pat. 856,622, June 11, 1907.

A dialkylmalonylamide or a dialkylmalonaminic ester is condensed with thiourea in presence of an alkaline condensing agent, and the dialkylmalonylthiourea thus formed is oxidised to dialkylbarbituric acid in the usual manner.—T. F. B.

Formic acid from formates; Process for producing concentrated ——. E. Franke, Assignor to Chem. Fabr. Grünau, Landshoff, und Meyer A.-G., Grünau, Germany. U.S. Pat. 857,046, June 18, 1907.

See Fr. Pat. 367,313 of 1906; this J., 1906, 1173.—T. F. B.

Formaldehyde; Production of gaseous ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated Feb. 15, 1907, to Fr. Pat. 366,605, May 26, 1906. Under Int. Conv., March 28, 1906. (See this J., 1906, 1063.)

Formaldehyde is liberated from its aqueous solutions by the addition of peroxides which have an alkaline reaction, or of the per-acid salts derived therefrom. —T. F. B.

Isoborneol esters; Manufacture of ——. The Clayton Aniline Co., Ltd. Fr. Pat. 375,007, Feb. 19, 1907. Under Int. Conv., April 5, 1906.

See Eng. Pat. 8266 of 1906; this J., 1907, 223.—T. F. B.

Dichlorethoxyethylene; Process for preparing ——. G. Imbert. Fr. Pat. 375,167, March 1, 1907.

Trichlorethylene or acetylene tetrachloride is boiled with the product obtained by heating alcohol (not necessarily absolute) with a caustic alkali and a substance which has an affinity for water, such as lime or calcium carbide; the yield of dichlorethoxyethylene is stated to be good.—T. F. B.

Chloracetic ester and acid; Process for preparing ——. G. Imbert. Fr. Pat. 375,168, March 1, 1907.

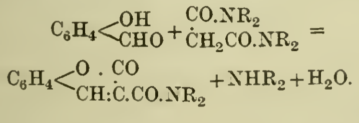
See Eng. Pat. 5013 of 1907; this J., 1907, 637.—T. F. B.

Pseudoionone hydrate and an isomeride of the formula, $C_{13}H_{22}O_2$; *Process for producing* ——. P. Coulin. Ger. Pat. 172,653, May 5, 1904.

Pseudoionone is treated in the cold with moderately concentrated acids, until it is partially converted into ionone, and then fractionated; the part boiling at a higher temperature than ionone is treated with steam, to remove unaltered pseudoionone and β-ionone, and then with an alkali sulphite or bisulphite solution, which dissolves the pseudoionone hydrate, leaving a new compound which, when pure, has the composition, $C_{13}H_{22}O_2$; its spec. grav. is approximately 1; b. pt., 166·8° to 169·8° C. at 10·5 mm.; refractive index, 1·50647 at 21° C. It is not volatilised by steam, and after standing, crystallises to a substance of m. pt. 80° C.—T. F. B.

Coumarincarboxylic acid amides; Process for preparing ——. E. Merck. Ger. Pat. 172,724, April 14, 1905.

Amides of coumarincarboxylic acid are obtained by heating salicylic aldehyde with malonamide or its N-substitution products, thus:—



$$C_6H_4<\begin{matrix}OH\\CHO\end{matrix}+\begin{matrix}CO.NR_2\\CH_2CO.NR_2\end{matrix}=$$

$$C_6H_4<\begin{matrix}O\,.\,CO\\CH{:}C.CO.NR_2\end{matrix}+NHR_2+H_2O.$$

—T. F. B.

Alkaline-earth salts in colloidal or gelatinous form; Process for the manufacture of ——. Chem. Werke vorm. Dr. H. Byk. Ger. Pat. 178,763, Feb. 7, 1905.

Alkaline-earth salts are obtained in a colloidal condition by using alcoholic solutions of one or both of the components from which the salts are prepared. The colloidal salts are stated to be useful in medicine. (See also Neuberg and Neimann, this J., 1906, 926.)—A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Eder's solution (Ammonium oxalate and mercuric chloride) and ferric solutions; Influence of oxygen on the photochemical reactions in ——. A. Jodlbauer. Z. physik. Chem., 1907, **59**, 513—531. (See also this J., 1905, 903.)

The author has investigated the action of light and oxygen on: (1), Eder's solution, consisting of 2 vols. of a 4 per cent. solution of ammonium oxalate and 1 vol. of a 5 per cent. solution of mercuric chloride; (2), a 4 per cent. solution of ferric oxalate; and (3), a 4 per cent. solution of ferric tartrate, parallel experiments being also carried out in which the oxygen was replaced by hydrogen. In absence of oxygen, the amount of the decomposition of Eder's solution by light is about eighty times as great as when the solution is saturated with oxygen, but in both cases, mercurous and ammonium chlorides and carbon dioxide are formed in the proportions required by the equation: $2HgCl_2 + (NH_4)_2C_2O_4 = Hg_2Cl_2 + 2CO_2 + 2NH_4Cl$. The decomposition of ferric oxalate by light is also considerably increased if oxygen is excluded, but, while the amount of ferrous oxalate precipitated is greatly augmented, carbon dioxide is only formed in slightly larger quantity, whence it is concluded that a soluble intermediate product is formed when oxygen is present. Further, the separation of carbon dioxide begins immediately, whilst for the deposition of ferrous oxalate, there appears to be an induction period after the action of the light commences. With ferric tartrate, the separation of ferrous tartrate is accelerated by exclusion of oxygen, whilst the formation of carbon dioxide is hindered. This result, as is shown by the consumption of oxygen during the exposure to light, depends upon the formation of an intermediate oxidation product which remains in solution. Eder's solution is rendered more sensitive by the presence of certain fluorescent compounds, which, however, lose their fluorescence and also their sensitising action when added to solutions of ferric oxalate or tartrate. The variations in the amount of absorbed oxygen present in Eder's solution are probably the cause of the deviations observed in photometric measurements made with this solution. The amount of decomposition occurring in ferric oxalate and tartrate solutions in the dark is negligible.—T. H. P.

Bromide prints toned sepia by the sulphide process; Reagents for reducing ——, H. E. Smith. Phot. J., 1907, **47**, 281—283.

The silver sulphide of sepia-toned bromide prints may be "more or less completely" converted into silver halide (which is subsequently removed by thiosulphate) by the following reagents:—Aqueous solutions of cupric chloride or bromide, or of cupric chloride and sodium chloride; aqueous solutions of chlorine, bromine, or iodine; solutions of iodine in alcohol or potassium iodide solution; acid permanganate solutions. It is stated that iodine in potassium iodide solution is the only one of the above that will completely decolorise the print.—T. F. B.

Patent.

Photographic papers. Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 374,763, April 25, 1906.

The addition of developers to printing papers containing an excess of soluble silver salt to produce papers developed by water alone, is unsatisfactory, the silver salt being reduced after some time. This can be remedied by the addition of sulphurous acid to the emulsion or to the developing solution with which it is treated; for example, 100 c.c. of a 20 per cent. gallic acid solution and 10 c.c. of liquid sulphur dioxide are incorporated, in the dark, with 200 c.c. of a citrate emulsion.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives; Rules respecting importation of —— into British India. Board of Trade J., July 11, 1907.

A notification (No. 4555—4) of 31st May, 1907, lays down Rules for regulating the transport and importation of explosives into India. The Rules provide, *inter alia*, that explosives shall not be imported by sea or land into British India, except in accordance with the conditions of a license to import the same—provided, however, that in accordance with certain rules laid down in the Notification, explosives may be imported by sea previous to the grant of the importation license. Explosives may not be imported by sea except at one of the Ports of Calcutta (including Moyapur and Diamond Harbour), Madras, Bombay, Rangoon, Calicut, Karachi, Aden and (in the case of crackers only) Negapatam and Moulmein. A license to import explosives by sea from Rangoon into the Port of Akyab, Sandoway, Kyouk Phyoo, Tavoy, Mergui, or Victoria Point, as the case may be, may be granted by the Magistrate of the District in which such port is situated. The fee payable for the license to import explosives is 10 rs., but if such explosives are re-imported from one British port to another a fee of 1 r. only will be charged.

The licenses to import may be granted as follows:—

(a) If the importation is by sea, by the Commissioner of Police of Calcutta, Madras, Bombay, or Rangoon, or the District Magistrate of Calicut, Karachi, Aden, Negapatam, or Moulmein, as the case may be, and

(b) If the importation is by land, by the Magistrate of the District to which the explosives are consigned, or if they are consigned to a Presidency town or Rangoon, by the Commissioner of Police.

The present Rules supersede all previous rules issued in accordance with the Indian Explosives Act of 1884.

—[T.R.]

Guncotton; The slow decomposition of wet ——. J. C. A. Simon Thomas. Z. angew. Chem., 1907, **20**, 1143—1145.

The author has examined guncotton which had been stored wet, as torpedo charges, for about 20 years. He has previously placed on record the result of an examination after twelve years storage (this J., 1898, 1179). The guncotton in question had a nitrogen content of 12·98 per cent., and was found to be perfectly stable, as will be seen from the following tests. *Simon Thomas test.* (Heated at 99°—101° C. for 8 hours per day). No brown fumes in 10 days. *Sy test.* (Heated at 115° C. for 8 hours per day and weighed.) Loss in 12 days, 4·48 per cent. Highest daily loss, 0·40 per cent. *Bergmann and Junk test.* (Heated at 130°—132° C.). 2·71—2·82 c.c. of nitric oxide at 0° C. and 760 mm. evolved, per grm. of guncotton in 2 hours.

The guncotton had been mixed with excess of calcium carbonate before storage. During storage a slow decomposition of the cellulose nitrate takes place, the oxides of nitrogen so formed being neutralised by the calcium carbonate. One hundred grms. of the dry guncotton were treated with water, and the calcium salts contained in the filtrate estimated as calcium nitrate; the free calcium carbonate remaining in the guncotton was also determined. The following figures were obtained.

Storage.	CaO. mgrms.	Equivalent N_2O_5, mgrms.	$Ca(NO_3)_2$, mgrms.	N_2O_5 found, mgrms.	$CaCO_3$, per cent.
12 years	45·3	87·4	132·7	153·1	1·53
20 years	348·7	672·5	1021·2	560·0	0·85

The author considers that the fact that the amount of nitrogen pentoxide present after 12 years storage is greater than the calculated amount based on the determination of the calcium present, is probably due to the presence of sodium nitrate, whilst the lower amount of nitrogen pentoxide found after 20 years storage, is due to the presence of calcium bicarbonate in the filtrate. (See also this J., 1898, 1180; 1903, 924; 1904, 953.)

—G. W. McD.

Patents.

Explosives; Manufacture of ——. C. Duttenhofer, Düneberg, Germany. Eng. Pat. 791, Jan. 11, 1907.

Instead of adding indifferent substances and alkali bicarbonates to powders, in order to prevent muzzle flame, claim is made for the use of soaps, such as sodium, potassium, calcium, or magnesium soaps, or so-called soaps such as "colophonic soda, baryta or argillaceous earth." A powder, for example, containing 5 per cent. of sodium soap, prevents muzzle flame as effectively as one containing 5 per cent. of vaseline and 1 per cent. of sodium bicarbonate.—G. W. McD.

Explosives. M. A. G. Himalaya. Fr. Pat. 374,656, Feb. 15, 1907. Under Int. Conv., Feb. 16, 1906.

See U.S. Pat. 853,085 of 1907; this J., 1907, 717.—T. F. B.

Explosives; Manufacture of ——. M. A. G. Himalaya. Fr. Pat. 374,932, Feb. 22, 1907. Under Int. Conv., Feb. 24, 1906.

Finely-powdered potassium chlorate (75—85 parts), is mixed to a paste with linseed oil (6—15 parts). This paste is then incorporated with starch, sugar, charcoal, or resin (8—19 parts). The mass is granulated and exposed to the action of the air, to oxidise the linseed oil and harden the grains. To increase the explosive force, manganese dioxide, barium peroxide, picric acid, etc., may be added.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Drying chambers especially adapted for use in laboratories. E., E., and J. H. Clements and J. E. Wheeler, London. Eng. Pat. 2775, Feb. 4, 1907.

A metal drying chamber is surrounded on all sides, except the front, which is closed by a door, with alternating steam and air passages formed by sheets of corrugated metal, and is also covered with a layer of insulating material protected by an outer metal casing. Air enters an opening in the bottom, passes through the air-passages into the chamber, and leaves by an opening in the top. The steam enters at the top, and passes down through the steam-passages to an exit pipe at the bottom.—W. H. C.

Photometer. T. Torda, London. U.S. Pat. 857,124, June 18, 1907.

See Eng. Pat. 4020 of 1905; this J., 1906, 91.—T. F. B.

INORGANIC—QUANTITATIVE.

Iron in the presence of titanium; Determination of ——. F. A. Gooch and H. D. Newton. Z. anorg. Chem., 1907, **54**, 213—216.

Ferric solutions containing titanium are reduced by means of zinc in the usual manner, and the simultaneously reduced titanous compounds are oxidised back to the titanic condition by means of cupric sulphate, cupric oxide, or bismuthic oxide. The complete oxidation of titanous salts is indicated by the disappearance of the characteristic violet colour. After filtering off the excess of oxidising agent and the reduced cuprous salt, copper, or bismuth, as the case may be, the iron in the filtrate is determined with complete accuracy by titration with permanganate.—O. R.

Ammonia; New method for determining ——. A. Ronchèse. J. Pharm. Chim., 1907. **25**, 611—617.

The method depends on the fact that, in the presence of a large excess of formaldehyde, ammonium salts form hexamethylenetetramine, liberating the acid quantitatively. *Determination of ammonia in a neutral salt.*—The neutral solution is diluted to 100 c.c. with distilled water, free from carbonic acid, and a few drops of phenolphthalein indicator, and a large excess of 20 per cent. formaldehyde solution (previously neutralised) are added. The free acid is then titrated with $N/10$ sodium hydroxide solution. *Determination of ammonia in presence of free acid.*—Before adding the formaldehyde solution, the liquid must be neutralised, but the presence of ammonium salts renders the end-reaction with phenolphthalein wanting in sharpness, and a suitable indicator must therefore be chosen.—J. O. B.

Lead in ores; Determination of ——. Noaillon. *See* X.

ORGANIC—QUALITATIVE.

Copaïba balsam; Sensitive test for colophony in ——. L. E. Walbum. Pharm. Centralh., 1907, **48**, 437—445.

Four c.c. of 1 per cent. solution of ammonia and 1 c.c. of acetone are mixed; to this a solution of 2 grms. of the balsam in 6 grms. of ether are added; the whole is well shaken, and set aside until the lower, aqueous layer is clear. In the presence of colophony, this layer will be darker in colour than a solution of 2 grms. of the balsam in 5 c.c. of absolute alcohol, prepared for the purpose of comparison. The colour reaction with ammonia is produced only by colophony. Canada balsam, mastic, dammar copal, and sandarac mixed with copaïba balsam give no such colour under similar conditions. The test will readily detect the presence of 2 per cent. of colophony; even 0·5 per cent. gives a distinct reaction. The method may be made quantitative by comparing the tint colorimetrically with an arbitrary colour-standard prepared with "vesuvin."—J. O. B.

Quinine; Detection of ——. J. Abensour. *See* XX.

ORGANIC—QUANTITATIVE.

Indole; Separation of —— from skatole by means of sodium β-naphthoquinonesulphonate. C. A. Herter and M. L. Foster. Pharm.-Zeit., 1907, **52**, 435.

A two per cent. aqueous solution of sodium β-naphthoquinonesulphonate precipitates indole quantitatively from alkaline solutions of skatole and indole. After separating the indole precipitate, the filtrate may be distilled, and the skatole determined colorimetrically in the distillate by means of Ehrlich's reagent (dimethylaminobenzaldehyde).—J. O. B.

Tartaric acid in tartars and wine lees; Determination of ——. P. Carles. J. Pharm. Chim., 1907, **25**, 617—619.

The method of Goldenberg and Giromont is modified as follows:—Six grms. of the substance are macerated in water containing 9 c.c. of hydrochloric acid, the mixture is diluted to 100 c.c. with water, and the solution is filtered. Fifty c.c. of the filtrate are poured into an aqueous solution of 2 grms. of potassium carbonate. The liquid should be alkaline. It is heated gradually until the greater part of the effervescence has ceased, and then boiled for 20 mins. to ensure the complete conversion of the calcium tartrate into carbonate, with formation of normal potassium tartrate. The calcium carbonate is filtered off, the filtrate is concentrated, and the tartaric acid precipitated as potassium bitartrate by the addition of excess of acetic acid. The precipitate is collected, washed with strong alcohol, and titrated with alkali, which has been standardised by means of a solution of pure potassium bitartrate.—J. O. B.

Amino- and hydroxy-compounds of the benzene and naphthalene series; Determination of ——. I. H. T. Bucherer. *II.* C. G. Schwalbe. *See* IV.

Beetroot; Cold instantaneous alcoholic digestion and the precipitation of the pectin substances of the ——. L. Pellet and P. Métillon. *See* XVI.

Dextrose; Determination of —— by the Causse-Bonnans method. [Indication of final point by ferrocyanide.] F. Repiton. *See* XVI.

Beer; Determination of the "apparent maltose" in ——. C. Bergsten. *See* XVII.

Alcohol and ether in their mixtures; Quick method of determination of ——. J. Fleischer and H. Frank. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Aluminium; Decomposition of gaseous hydrocarbons by igniting with finely-divided ——. M. Kusnetzow. Ber., 1907, **40**, 2871—2873.

A glass tube containing aluminium dust was connected to two gas burettes, one of which was filled with hydrogen. The hydrogen was passed over the heated aluminium till the volume of the gas was constant, and was then replaced by a gaseous hydrocarbon (methane, ethane, ethylene, or acetylene). After the gas had been passed several times backwards and forwards over the aluminium heated to near its melting point, it was found that the hydrocarbon had been quantitatively reduced to its elements. The hydrogen appeared in the free state, whilst the carbon adhered mechanically to the aluminium or formed a carbide.—F. Shdn.

Albuminoids [Proteids] precipitated by alcohol; Re-solution in alcohol, in presence of electrolytes, of ——. A. Mayer and E. F. Terroine. Soc. biol., 1907, **62**, 307; Woch. f. Brau., 1907, **24**, 322.

Albuminoids which have been precipitated by alcohol, are re-dissolved by that liquid under certain conditions, on the addition of small quantities of electrolytes.—J. F. B.

Prizes.

Prizes for the Solution of Technical Problems offered by the Society of Dyers and Colourists.

The Council of the Society of Dyers and Colourists offers prizes for the solution of the technical problems specified below. The Council request the assistance and co-operation of members and others in developing this scheme, and will be glad to receive additional offers of prizes and problems.

14. The Silver or Bronze Medal of the Society for a full investigation of the mordanting properties of various tannin materials, more especially—(*a*) As to the relative affinity for cotton of the tannins of galls, myrabolams, sumach, divi-divi, &c. (*b*) As to the relative fastness of the colour lakes produced with these tannins and basic colours, in conjunction with antimony, tin, and iron. (*c*) As to the best method of determining by volumetric analysis, or other means, their relative mordanting power.

15. The Silver or Bronze Medal of the Society for the best critical essay (not exceeding 10,000 words) on the treatment of effluents from dyehouses and textile factories.

16. Price of £10 for a reliable method of distinguishing between unmercerised and mercerised cotton of various qualities, and for the estimation of the degree of mercerisation without reference to lustre.

17. Prize of £10 for a determination of the average degree of diminution in strength of cotton yarns of various counts brought about by different bleaching processes.

18. Prize of £20 for a full investigation of the average degree of tendering brought about in cotton yarn of various qualities by (*a*) Cross dyeing with acid colours; and (*b*) Dyeing Aniline Black, with the object of fixing standards for the trade.

19. Prize of £20 for a practical method of causing kemps, when present in yarn or piece goods, to take the dyestuff equally with the accompanying wool.

20. Prize of £10 for a practical method of dyeing full shades of basic colours on cotton, fast to rubbing.

21. Prize of £10 for the most satisfactory method of using formic acid on a practical scale, as a substitute for hydrochloric or other acids, in dyeing cotton piece goods or yarns an aged Aniline Black.

The Imperial College of Science and Technology. Times, July 2, 1907.

The offer of nomination for appointment by the Crown on the governing body of the Imperial College of Science and Technology has been accepted by the Right Hon. the Earl of Crewe, Lord President of the Council, the Right Hon. Gerald W. Balfour, the Right Hon. Sir Francis Mowatt, G.C.B., I.S.O., Sir Julius C. Wernher, Sir William H. White, K.C.B., F.R.S., and Dr. MacAlister, Principal of the University of Glasgow. The other persons nominated as first members of the governing body are:—By the President of the Board of Education, the Right Hon. A. H. D. Acland, Mr. F. G. Ogilvie, C.B., a Principal Assistant Secretary of the Board of Education, Mr. J. C. G. Sykes, an Assistant Secretary of the Board, and Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory; by the University of London, Sir E. H. Busk, Past Vice-Chancellor of the University, Professor D. S. Capper, Professor Farmer, F.R.S., Sir Henry E. Roscoe, F.R.S., and Sir A. W. Rücker, Principal of the University; by the London County Council, Mr. A. A. Allen, M.P., Mr. H. Percy Harris, Chairman of the Council, Sir C. Kinloch-Cooke, Mr. R. A. Robinson, and Mr. J. T. Taylor, I.S.O.; by the City and Guilds of London Institute, the Right Hon. the Earl of Halsbury, F.R.S., chairman of the council of the institute, Sir J. Wolfe Barry, K.C.B., F.R.S., Sir Owen Roberts, clerk to the Clothworkers' Company, Sir Walter S. Prideaux, clerk to the Goldsmiths' Company, and Sir John Watney, hon. secretary of the institute; by the Royal Commissioners for the Exhibition of 1851, Viscount Esher, G.C.V.O., K.C.B., and Lieutenant-Colonel Sir Arthur Bigge, G.C.V.O., K.C.B., K.C.S.I., K.C.M.G., I.S.O.; by the Royal Society, Sir Archibald Geikie, F.R.S.; by the professorial staff, Professor Tilden, F.R.S., Professor Gowland, and Professor Dalby; by the Institution of Civil Engineers, Sir Alex. B. W. Kennedy, F.R.S., president of the institution; by the Institution of Mechanical Engineers, Mr. T. Hurry Riches, president of the institution; by the Institution of Electrical Engineers, Mr. R. Kaye Gray, past president of the institution; by the Iron and Steel Institute, Sir Hugh Bell, president of the institute; by the Institution of Naval Architects, Dr. F. Elgar, F.R.S.; by the Society of Chemical Industry, Dr. E. Divers, F.R.S., past president of the society; by the Institution of Mining Engineers, Mr A. Sopwith, past president of the institution; and by the Institution of Mining and Metallurgy, Mr. W. McDermott, past president of the institution.

The Charter was granted on the 8th July.

Trade Report.

Turkish Customs duties.

From July 12th, the Turkish Customs duties have been increased from 8 to 11 per cent. *ad valorem.*

New Books.

Die Chemische Analyse. Sammlung von Einzeldarstellungen auf dem Gebiete der chemischen, technisch-chemischen und physikalisch-chemischen Analyse. Herausgegeben von Dr. B. M. Margosches, unter Mitwirkung von den Herren Dr. Abderhalden, Ahrens, Autenrieth, H. Biltz, Birckenbach, Börnstein, Böttger, Bredig, Brunck, von Buchka, Classen, Dafert, Dennstedt, Dieterich, Ditmar, Ditz, Donath, Ebler, F. Ephraim, Eschweiler, A. Fischer, Gutbier, Haber, Herbig, Herz, Hönig, Jannasch, Jordis, Kippenberger, de Koninck, F. W. Küster, J. Lewkowitsch, Lottermoser, W. Marckwald, Massot, H. Meyer, R. J. Meyer, W. J. Müller, Neumann, Nissenson, Paessler, Pohl, Proskauer, W. Roth, Ruff, E. Rupp, J. Schmidt, A. Stähler, Staudinger, Stoecker, Ubbelohde, Ulrich, Ulzer, Vortmann, Wegscheider, Will, H. Wislicenus, Wöhler. Die Anwendung der Hydrazine in der analytischen Chemie. I. Band. Von Prof. Dr. Julius Schmidt. Ferdinand Enke's Verlag, Stuttgart. 1907. Price M.3.

8vo volume, containing 81 pages of subject matter, 6 of bibliographic data, and alphabetical indexes of subject matter and names. In the Introduction it is stated that the intention is to issue in single volumes that may be ultimately combined into one entire "Handbuch der analytischen Chemie," resembling Beilstein's, or Dammer's works—treatises on chemical analysis applied to various subjects, and in various directions, the present one referring to the hydrazines, and their use in chemical analysis. The subject is subdivided as follows:—I. Preparation and Properties of the Hydrazines. Volumetric and Gasometric Determination of Hydrazine. II. Employment of Hydrazine and its Salts in Quantitative Analysis. III. Use of Hydrazine and its Salts in Qualitative Analysis. IV. Application of Phenylhydrazine for Analytical Purposes. V. Use of Substitution Products of Phenylhydrazine as Reagents. VI. Use for Similar Purposes of other Substitution Derivatives, especially of the Acid Hydrazides.

Methods of Investigation of Zinc, with Special Reference to the more important Zinc Ores. Von Dipl.-Ing. H. Nissenson. Ferdinand Enke's Verlag, Stuttgart. 1907. Price M.4.

8vo volume, containing 132 pages of subject matter, with alphabetical indexes of subjects and names of authors. The subject matter is classified as follows:—I. General Details. Historical. Production of Crude Zinc, Occurrence of Zinc Ores, and Composition, Manufacture of Crude Zinc, Physical Properties of Zinc. II. Analytical Methods; Qualitative and Quantitative.

Solubilities of Inorganic and Organic Substances. A Handbook of the most reliable Quantitative Solubility Determinations. Recalculated and compiled by Atherton Seidell, Ph.D. D. van Nostrand Company, New York. 1907. Price 12*s*. 6*d*. net. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C.

8vo volume, containing 355 pages of subject matter, followed by an alphabetical index of subjects. This work is intended to be an up-to-date successor of Prof. A. M. Comey's "Dictionary of Chemical Solubilities," which went to press in 1894, since it was felt that the subject since that date had greatly increased. Lists of Abbreviations, of Terms, and of Titles of Journals are given to facilitate reference. The arrangement of subject matter is alphabetical.

Census of Manufactures, 1905: Coke. By Prof. C. E. Munroe, Washington. Bulletin No. 65. Department of Commerce and Labour, Bureau of the Census.

This report contains eleven tables relative to the production of coke in the United States in 1905, two tables relating to the various by-products of American coke ovens, four tables concerning the trade in coke and by-products, and a table giving a detailed summary of coke production by states and territories in 1905. An historical survey of the industry, together with a description of the processes and ovens employed, follows, with notes on the uses of coke and by-products. The report concludes with a bibliography and a digest of United States patents relating to coke. (See this J., 1907, 192.)

Census of Manufactures, 1905: Petroleum Refining. By Prof. C. E. Munroe, Washington. Bulletin No. 70. Department of Commerce and Labour, Bureau of the Census.

The report gives thirteen tables showing the progress of petroleum refining in the United States from 1880 to 1905, a descriptive and historical sketch of the industry, and two appendixes, *viz.*, a bibliography, and a digest of United States patents relating to petroleum refining (See this J., 1907, 311.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

15,150. Buch. Drying peat and other vegetable substances containing much water.* July 1.

15,164. Halket. Evaporators, distillers, and the like. July 1.

15,174. Fichet and Heurtey. Heating continuous furnaces and kilns.* July 1.

15,257. Schmidt. Apparatus for boiling easily foaming or frothing substances, especially rosin size.* July 2.

15,350. Durant. Separation of solids from liquids. July 3.

15,406. Petersen. Filling for reaction chambers. [Ger. Appl., Aug. 4, 1906.]* July 4.

15,533. Lébédeff and Pomeranzoff. Regenerative furnaces. July 5.

15,589. Bradford Dyers' Assocn., and Worsley. Vacuum evaporators. July 6.

15,597. Arduino. Apparatus for heating liquids.* July 6.

15,894. Allen. Furnaces. July 10.

16,150. Heim. Rendering barrels and like wooden receptacles impermeable. [Fr. Appl., July 19, 1906.]* July 13.

Complete Specifications Accepted.

14,710 (1906). Koch. Melting process and furnace. July 10.

15,304 (1906). Kiefer. Filters. July 10.

20,918 (1906). Jury. Apparatus for producing extracts by diffusion and concentration. July 17.

26,875 (1906). Warren. Rotary kilns. July 17.

2111 (1907). Wiart. Production of a vacuum. July 10.

2242 (1907). Wiart. Producing vacuum by condensation of steam. July 10.

7453 (1907). Schlieper. Filtrating machine. July 10.

7776 (1907). Acheson. Disintegration and subsequent treatment of amorphous bodies. July 17.

10,024 (1907). Meister, Lucius, und Brüning. Separating and extracting water from mineral, vegetable, and animal substances. July 17.

11,060 (1907). Seger. Centrifugal liquid separators. July 17.

II.—FUEL, GAS, AND LIGHT.

Applications.

15,065. Stevenson and Hunter. Apparatus for manufacturing gas for heating purposes. July 1.

15,172. Black and Lennox. Apparatus for washing smoke or gases. July 1.

15,510. Deutsche Gasglühlicht A.-G. Manufacture of illuminating bodies for electric incandescence lamps. [Ger. Appl., July 11, 1906.]* July 5.

15,536. Thompson (Eisenmann). Immersion baths for incandescent mantles.* July 5.

15,554. Scott-Moncrieff. Smokeless fuel. July 6.

15,593. Claussen and Corbett. Combustible liquids. July 6.

15,871. Parker. Production of gas from volatile hydrocarbons. July 10.

15,872. Parker. Manufacture of fuel. July 10.

Complete Specifications Accepted.

24,666 (1906). Armstrong. Gas producers. July 17.

28,148 (1906). Bachman. Apparatus for washing gases. July 10.

1446 (1907). Robert. Manufacture of artificial fuel by using waste or refuse. July 10.

6183 (1907). Keith and Keith. Apparatus for making air gas. July 10.

7405 (1907). Kunzler and Schneider. Suction gas plant. July 10.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

15,349. Pagès, Camus, et Cie. Directly obtaining pyroligneous substances. [Fr. Appl., April 3, 1907.]* July 3.

15,519. Spink. Treatment of mineral and other volatile oils for use with explosion engines. July 5.

15,809. Samuel. *See under* XII.

Complete Specifications Accepted.

22,395 (1906). Noad and Townsend. Refining mineral oil by fractional distillation. July 17.

23,381 (1906). Wildenhayn. Production of tar-oil emulsions. July 17.

11,185 (1907). Ryan and Burke. Process for obtaining lubricating oil from crude oil. July 10.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

15,138. Durand, Huguenin, et Cie. Manufacture of condensation products of gallocyanines with amines. [Ger. Appl., Nov. 19, 1906.]* July 1.

15,204. Shillito (Geigy). Manufacture of blue colouring matters of the triphenylmethane series. July 2.

15,228. Oakes. Production of a dyestuff.* July 2.

15,420. Newton (Bayer und Co.). Preparation of azoxy- and azo-compounds of the benzene series. July 4.

15,607. Meister, Lucius, und Brüning. Manufacture of brown vat dyestuffs. [Ger. Appl., Feb. 23, 1907.]* July 6.

15,664. Imray (Soc. Chem. Ind. in Basle). Manufacture of dyestuffs of the thiazine class. July 8.

Complete Specifications Accepted.

17,558 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. July 17.

22,021 (1906). Ransford (Cassella und Co.). Manufacture of monoazo dyestuffs. July 17.

22,202 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of a product from anthrachrysone and of nitrogenous derivatives of the anthraquinone series therefrom. July 10.

28,578 (1906). Badische Anilin und Soda Fabrik. Manufacture of vat colouring matters containing sulphur. July 10.

9548 (1907). Meister, Lucius, und Brüning. Manufacture of substantive red dyestuffs. July 10.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

15,095. Hunt and Moscrop. Apparatus for bleaching, scouring, dyeing, and otherwise treating fabrics in the open condition. July 1.

15,137. Bloxam (Kirchhoff und Neirath). Bleaching fibres, fabrics, or the like. July 1.

15,341. Silberrad. Dyeing. July 3.

15,352. Venter. Removing soda-lye from fabrics saturated therewith. [Ger. Appl., March 1, 1907.]* July 3.

15,574. Péronne and Humbert. Apparatus for drying or carbonising materials. [Fr. Appl., Aug. 29, 1906.]* July 6.

15,829. Rothwell-Jackson. Kiers for bleaching. July 10.

15,837. Ashworth and Hall. Mercerising cloth and apparatus therefor. July 10.

15,886. Haddan (Ratignier, and Pervilhac et Cie.). Apparatus for finishing sized fabrics.* July 10.

16,149. Lake (Chem. Fabr. vorm. Weiler-ter-Meer). Printing with sulphurised dyestuffs. July 13.

Complete Specifications Accepted.

17,487 (1906). Giehler. Production of transparent patterns and the like on tissues. July 10.

23,594 (1906). Fielden. Machinery for drying fibrous materials. July 10.

27,072 (1906). Fulton and Hardcastle. Extraction of grease or oleaginous gum or resinous matter from wool, fabrics, sawdust, wood shavings, etc. July 17.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

Application.

15,997. Lamb and Rennie. Leather dyeing or printing. July 11.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

22,327A (1906). McTear. Manufacture of salt. July 10.

15,087. Calico Printers' Assocn., and Warr. Utilising spent nitric acid used by engravers, and recovery of copper.* July 1.

15,140. Whitehouse. Chlorine and hydrochloric acid process. July 1.

16,047. Tassopoulos. Manufacture of cream of tartar. July 12.

16,067. Ramsay. Manufacture of nitric acid. July 12.

16,068. Ramsay. Manufacture of oxides of nitrogen. July 12.

Complete Specifications Accepted.

15,590 (1906). Rinman. Manufacture of alumina compounds. July 10.

22,038 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of ammonia and formic acid from cyanides. July 17.

24,101 (1906). Johnson (Chem. Fabr. Griesheim Elektron). Manufacture of a dry chlorinated compound of lime. July 17.

26,755 (1906). Boult (Raithel). Gypsum burning kilns. July 10.

29,383 (1906). Johnson (Chem. Fabr. Schlempe). Manufacture of cyanides in a condition fit for transport or storing. July 17.

7775 (1907). Acheson. Manufacture of graphite. July 10.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

15,981. Woolley. Kilns or ovens for firing pottery. July 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

15,434. Barnhurst and Fuller. Production of cement clinker in the manufacture of cement.* July 4.

15,667. Thom. Artificially produced marble and stone blocks and slabs. July 8.

15,688. Le Marchant. Manufacture of cement. July 8.

15,722. Hailwood. Mixing cementing materials to be used in place of fireclay for firebrick furnaces. July 9.

15,761. Siegmann. Wood substitute.* July 9.

15,764 and 15,765. Collos Portland Cement Co. (Colloseus). Manufacture of cement or cementitious material from slag.* July 9.

15,964. Thom. Manufacture of lithographic stone artificially. July 11.

16,111. Wyatt. Sulphur-salt brick. July 13.

Complete Specifications Accepted.

15,735 (1906). Collins. Refractory materials. July 17.

16,164 (1906). Boult (Neuburger). Manufacture of sorel cement. July 17.

28,199A (1906). Kilburn (Isolatoren-Fabr. Pulvolit). Manufacture of artificial stone or the like. July 17.

628 (1907). Gery. Drying and burning bricks and the like. July 10.

X.—METALLURGY.

Applications.

15,192. Cameron. Manufacture of compound ingots. July 2.

15,419. Wilfley. Ore roasting process.* July 4.

15,480. MacCowan and McIvor. Treatment of complex ores containing gold. July 5.

15,498. Churchward. Steel alloys.* July 5.

15,941. Petersen. Furnace for roasting sulphide ores. July 10.

15,943. Willey. Aluminium solders.* July 10.

15,962. Lloyd. Converting metals. [U.S. Appl., Aug. 4, 1906.]* July 11.

15,963. Lloyd. Apparatus for converting metals. [U.S. Appl., Aug. 4, 1906.]* July 11.

Complete Specifications Accepted.

9981 (1906). Sulman and Sulman. Ore concentration. July 10.

17,915 (1906). Smith, Harden, and Amalgaline, Ltd. Jointing sheet lead, tin, zinc, &c., and a flux therefor. July 10.

28,936 (1906). Cooper and Morgan. Open-hearth, melting, or other furnaces. July 17.

210 (1907). Metallurgiska Patentaktiebolaget. Apparatus for magnetic separation of ore. July 10.

2377 (1907). Hadfield. Improving the magnetic qualities of a magnetic body. July 10.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

15,692. Baker. Manufacture of sodium by electrolysis. July 8.

15,693. Baker and Haworth. Manufacture of sodium by electrolysis. July 8.

16,098. Cowper-Coles. Apparatus for electroplating.* July 12.

Complete Specifications Accepted.

8039 (1906). Rambaldini. Continuous electrolysis. July 10.

14,922 (1906). Roberts. Electrolytic diaphragms. July 10.

23,413 (1906). Leitner. Active material for accumulators. July 10.

26,981 (1906). Reynolds. Electric furnaces. July 17.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

15,231. Carmichael. Manufacture of soap. July 2.

15,264. Baker. Apparatus for cooling and drying soap and similar materials. July 2.

15,809. Samuel. Manufacture of soaps containing mineral oils. July 9.

15,900. Verein. Chem. Werke A.-G. Manufacture of bleached soap. [Ger. Appl., Aug. 11, 1906.]* July 10.

Complete Specifications Accepted.

26,077 (1906). Johnson (Kalle und Co.). Manufacture of a fatty substance from micro-organisms. July 10.

27,072 (1906). Fulton and Hardcastle. *See under* V.

3301 (1907). Szigeti and Szilard. Preparations of cod-liver oil. July 10.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, ETC.

(*A.*)—Pigments, Paints.

Applications.

15,263. Kallab. *See under* XXIII.

15,339. Den Ouden. Manufacture of an antifouling paint. [Ger. Appl., Sept. 14, 1906.]* July 3.

Complete Specification Accepted.

23,687 (1906). Allendorff. Rendering lithopone insensitive to the action of light. July 10.

(*B.*)—Resins, Varnishes.

Complete Specification Accepted.

27,072 (1906). Fulton and Hardcastle. *See under* V.

(*C.*)—India-Rubber.

Applications.

15,542. Ohm. Production of a caoutchouc-like elastic substance.* July 5.

16,033. Campbell. Rubber substitute. July 12.

XIV.—TANNING, LEATHER, GLUE, SIZE, ETC.

Applications.

15,253. Weeber. Leather substitutes.* July 2.

15,257. Schmidt. *See under* I.

15,792. Howorth (Oesterr. Pluviusin A.-G.). Imitation of chamois leather. July 9.

15,794. Pollak. Manufacture of leather substitute or artificial leather.* July 9.

15,997. Lamb and Rennie. *See under* VI.

Complete Specifications Accepted.

15,418 (1906). Bocciardo, Odera, and Spinola. Tanning of hides. July 17.

15,648 (1906). Dufour. Treatment of tannic extracts. July 10.

XV.—MANURES, ETC.

Complete Specification Accepted.

15,949 (1906). Earp-Thomas. Preparing and distributing organisms which fix atmospheric nitrogen. July 10.

XVI.—SUGAR, STARCH, GUM, ETC.

Complete Specifications Accepted.

24,035 (1906). Steffen. Obtaining starch and a foodstuff from potatoes. July 10.

4620 (1907). Altolaguirre and Zubillaga. Apparatus for defecating cane juice. July 10.

XVII.—BREWING, WINES, SPIRITS, ETC.

Application.

15,259. Bonnard. Treatment of preserved musts or fruit juices. [Fr. Appl., July 3, 1906.]* July 2.

Complete Specifications Accepted.

25,595 (1906). Braunbeck. Saccharification of starch in the distilling industry and in the production of yeast. July 10.

816 (1907). Sauer. Production of vinaceous beverages from pure hæmoglobin free from serum. July 17.

4174 (1907). Hellwig. Preparing and filtering beer wort. July 17.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

15,259. Bonnard. *See under* XVII.

15,340. Ramsay. Bleaching flour. July 3.

15,395. Goldberg. Preparation of non-alcoholic beverages. [Ger. Appl., July 10, 1906.]* July 4.

15,455. Hooker and Thew. Manufacture of baking powder. July 4.

15,700. Nussbaum. Production of acid-albuminate from albumen and albuminous substances. July 8.

16,152. Hoering. Ferro-albumin compounds.* July 13.

Complete Specifications Accepted.

24,035 (1906). Steffen. *See under* XVI.

3035 (1907). Craig. Rendering materials for making baking powder impervious to moisture at ordinary temperatures. July 10.

(*B.*)—Sanitation; Water Purification.

Application.

15,305. Bell and Bell. Filtration of water, sewage, and other liquids. July 3.

Complete Specification Accepted.

17,948 (1906). Ellis and Slade. Forming and filling bacteria or other tanks or beds. July 10.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

15,155. Bolton and Rand. Composition for making trays, boxes, etc.* July 1.

16,055. Roth. Machine for preparing wood pulp from sawdust for use in paper manufacture.* July 12.

Complete Specifications Accepted.

15,241 (1906). Mitchell. Treatment of paper and other surfaces. July 10.

3103 (1907). Lederer. Manufacture of cellulose esters. July 10.

10,165 (1907). Hanauer Kunstseidefabr. Manufacture of cellulose products. July 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

15,546. Haller. Bacteriological preparations. July 5.

15,987. Wellcome and Barger. Manufacture of chlorine derivatives of methylene ethers of pyrocatechol derivatives. July 11.

Complete Specifications Accepted.

18,280 (1906). Weizmann, and Clayton Aniline Co. Manufacture of isobornyl esters. July 10.

25,718 (1906). Newton (Bayer und Co.). Manufacture of aminoacetopyrocatechin. July 17.

25,747 (1906). Twitchell. Combination of selected members of the alcohols and fatty acids. July 17.

3665 (1907). Hildebrandt. Condensation products from formaldehyde, tannin, and aromatic mono-hydroxyl compounds. July 10.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specifications Accepted.

18,741 (1906). Davies. Colour photography. July 17.

25,906 (1906). Pfenninger. Three-colour photography and plates therefor. July 10.

XXII.—EXPLOSIVES, MATCHES, Etc.

Application.

16,157. Cocking, and Kynoch, Ltd. Gelatinous and other explosive compounds.* July 13.

Complete Specification Accepted.

2286 (1907). Wessel. Manufacture of explosives. July 10.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

15,263. Kallab. Apparatus for comparing and determining colours and tints and ascertaining the components thereof. July 2.

Journal of the Society of Chemical Industry.

No. 15, Vol. XXVI. AUGUST 15, 1907. No. 15, Vol. XXVI.

Canadian Section.

Meeting held at Toronto on February 7, 1907.

DR. HODGSON ELLIS IN THE CHAIR.

EXAMINATION OF TURPENTINE.

BY ANTHONY MC GILL, B.A.SC., F.R.S.C.

R. A. Worstall (this J , 1904, 302) has given a concise account of the methods of work that have, from time to time, been recommended for the assay of turpentine. He believes that the determination of specific gravity (0·865); the flash point (92° to 94° Fah.) and distillation (90 per cent. between 150° and 165° C.) are sufficient to detect admixture with petroleum products or rosin spirits. But so-called "wood turpentine," distilled from yellow pine, is more difficult of detection. Worstall has found the iodine number, obtained by use of Hübl's method, to give best and quickest results. He found 55 samples, known to be pure, to give an average iodine absorption of 384 per cent. He argues that, since the equation $C_{10}H_{16}+2I_2=C_{10}H_{16}I_4$ requires 373 per cent. of iodine, this is the correct number. Worstall's experiments show that the absorption depends upon the length of time given and the excess of iodine.

The apparent advantage offered by this method seemed to justify its further investigation, because the use of Hübl's solution has been practically superseded by the Hanus' solution in most American laboratories. The latter solution acts more energetically than Hübl's, and time is saved thereby. An exhaustive study of the methods, by L. M. Tolman, may be found in Bulletin 81 (1904) of the Bureau of Chemistry, Washington.

Turpentine of guaranteed purity being unobtainable, ordinary commercial samples were bought, and the following reference numbers given to them:—

1 and 2, (Canada Paint Co.); 3, 6, 7 and 8, (Queen City Oil Co.); 5, (Ramsay Paint Co.); 4, 9, 10, (Source unknown); 11, (French turpentine); 12, (Coal oil or kerosene); and 13, (Rectified oil of turpentine).

No. 2 and No. 10 were treated with Hanus' solution in excess, and allowed to stand for 30 minutes. Using quantities of from 0·131 to 0·208 grammes, the average iodine absorption in the two samples was found to be 120·7 and 172·3 per cent. respectively, whilst determinations on the same sample varied between 151·6 and 185·4.

Standing for 3½ hours, instead of 30 minutes, the percentage absorption of iodine on five different samples varied between 151·4 and 240·5, whilst duplicate determinations on the same sample in one case differed by as much as 24·6 per cent. where the difference in the weight taken was 0·044 gramme. Thus, a very marked irregularity is still observable; and although the percentage of iodine absorbed is notably increased, it is very much lower than the numbers obtained by Worstall, with Hübl's solution.

The work was repeated, giving one hour for absorption, in the hope that, even should the absorption continue to be lower than with Hübl's solution, it might be found constant, and possess a relative value as among a series of samples, similarly treated.

While, in some cases, the duplicates agreed, there were very large differences in other cases. All that could be said for this method of working is that it served to point out some samples as decidedly different from the others, while others were markedly lower than the majority, and indicated an average absorption of about 200 per cent. of iodine.

It remained to be seen whether this low iodine number was due to the inherent nature of the samples, or to the substitution of the Hanus' solution for the Hübl's solution of iodine.

The following work was done with Hübl's solution, acting for 23 hours:—

Sample.	Per cent.	Means.
No. 2	375·8	380·9
"	385·9	
No. 4	210·2	214·8
"	219·3	
No. 8	368·6	374·4
"	382·2	
No. 10	235·0	236·9
"	238·8	
No. 12	17·6	17·6

The duplicates, in this case, agree better; and the absorption per cent. is evidently in accordance with that found by Worstall. Clearly then, the Hanus' solution cannot take the place of Hübl's solution in the determination of iodine absorption in turpentines.

Both solutions give a certain amount of iodine absorbed by the sample of kerosene (No. 12); but this number is larger with the Hanus' than with Hübl's solution. It would appear that some internal change in the Hanus' solution itself takes place; while its efficiency in causing addition products with terpenes is much less than that of Hübl's solution.

The specific refraction of these samples gives valuable corroborative indications. Refraction was observed at 20° C., both on the samples themselves and on fractions of 25 c.c. distilled from 100 c.c., the range of temperature in the latter case being noted.

Sample.	Refractive index at 20° C.		Temperature 25 c.c. from 100 c.c.	
	Sample.	Fraction.	Initial.	Final.
1	1·4708	1·4678	155°	to 158°
2	1·4705			
3	1·4707			
4	1·4428	1·4154	110°	to 129°
5	1·4704			
6	1·4693			
7	1·4703			
8	1·4705	1·4673	155°	
9	1·4703			
10	1·4461	1·4219	110°	to 132°
11	1·4790	1·4680	—	to 158°
12	1·4480	1·4238	129°	to 189°
13	1·4725			

The fractions above referred to were treated for absorption of iodine with Hanus' solution for one hour and gave the following numbers:—

Sample.	Per cent.
No. 1	194·4
" 4	78·9
" 8	191·0
" 10	83·1
" 11	184·6
" 12	27·0

Conclusions.

1. The Hübl method is preferable to the Hanus method when working with oil of turpentine.
2. The Worstall number (370 per cent.) is correct for turpentine, when Hübl solution is used, as specified.
3. With the Hanus method and solution, the number 200 may be accepted as indicating genuine turpentine.
4. Turpentines containing ordinary adulterants give numbers lower than 370 (Hübl) or 200 (Hanus).
5. The specific refraction for genuine turpentine, at 20° C., is nearly 1·47.
6. Ordinary adulterants reduce the specific refraction.
7. Decidedly more characteristic numbers, both in refraction, and in iodine absorption, are obtained by work on fractions of 25 per cent. volume.

8. The iodine number, specific refraction, and temperature of distillation for fraction of 25 per cent. volume suffice to distinguish between genuine turpentine and the adulterated article as now found on the market.

London Section.

Meeting held at Burlington House on Monday, June 3rd, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

ANALYSIS OF WHITE LEAD.

BY W. A. DAVIS AND C. A. KLEIN.

Owing to the fact that a standard method has not yet been adopted by the trade, disputes frequently arise in cases in which white lead is prepared to specification and analysis is made use of as a check on the quality of the material supplied; the percentage of carbon dioxide in the same sample returned by different analysts has differed by as much as 1 or 2 per cent. It therefore appeared desirable to make a comparative study of the degree of accuracy obtainable by the different methods now actually in use in the trade, to ascertain the sources of error to which these methods are subject, and to devise or decide upon a method of analysis worthy of general adoption. The inquiry was undertaken on behalf of the Brimsdown Lead Co., Ltd.; we are indebted to the Company for consenting to the publication of the results.

The experiments show that whereas the analysis of the material untreated with oil presents no serious difficulty so long as proper care is used, wide variations may occur in the case of white lead ground in oil for reasons which it will be convenient to consider separately under the two heads: I. Differences due to the method of analysis adopted; II. Changes occurring in the composition of white lead owing to its being acted on by the oil or substances present in the oil.

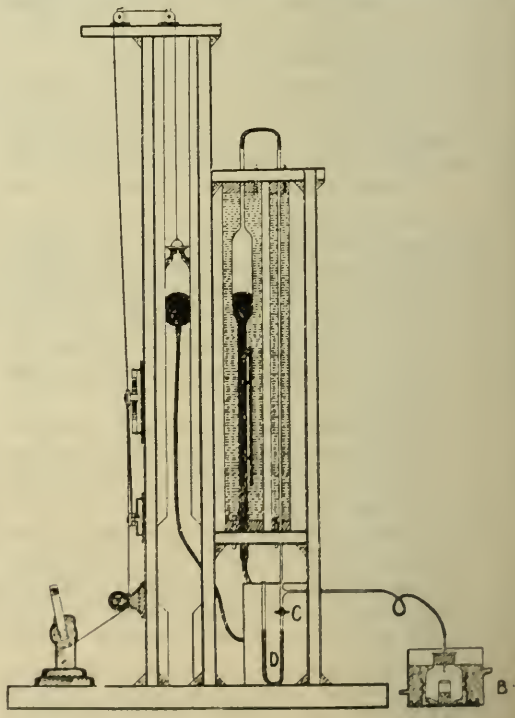
I. Three constituents may be determined, namely, lead oxide, carbon dioxide, and water. The first is easily and accurately estimated: if the white lead is pure one need only ignite about 1½ grms. in a porcelain crucible until the weight is constant. If the lead oxide thus formed be heated until it partly melts, there is no danger of red lead being produced. If it be required to determine carbon dioxide and water directly, it is essential that the error be minimised as far as possible, because in calculating the values, the carbon dioxide is multiplied by 6·07 and the water by 13·37 in order to find the corresponding amounts of lead carbonate and hydroxide.

The principal difficulty in the analysis arises from the impossibility of removing the last traces of oil or fatty material from the sample by extraction with any solvent. Part of the oil is easily extracted by the use of solvents such as ether and acetone, but we have found (see p. 849) that a point is soon reached beyond which repeated extraction fails to remove any further quantity.* Although the actual amount is small, probably not exceeding 0·3 per cent., this oily matter may give rise to wide variations in the values found for carbon dioxide and water.

The method of estimating carbon dioxide ultimately adopted as giving accurate results consists in decomposing 3 grms. of white lead with a slight excess of dilute nitric acid, and absorbing the carbon dioxide in a weighed potash bulb of the Wetzel type; the procedure followed is substantially that described in a previous paper (Davis, this J., 1906, p. 792), but the use of aluminium there recommended is not possible in this case, owing to nitric acid being used instead of hydrochloric acid. The method gives results which are probably correct within 0·03 per cent.; thus duplicate experiments with one sample gave identical results (11·27 per cent.) whilst with another sample the values were 12·92, 12·90, and 12·98 per cent. Special experiments showed that there is no danger of nitric acid being volatilised and thus causing the result to be high.

The "combustion" method, which has been widely used in analysing white lead, owing to its rapidity and to the fact that it gives the percentage of all three constituents (lead oxide, carbon dioxide, and water) in a single operation, has been found to give fairly accurate results (usually the carbon dioxide found is 0·1—0·2 per cent. high) in the case of pure dry white leads (free from acetic acid and organic matter), but to be valueless in the case of white lead ground in oil. In this method the white lead is heated in a stream of dry air free from carbon dioxide, the carbon dioxide and water formed being absorbed in weighed potash and calcium chloride tubes respectively; the fact that a small quantity of "oil" always remains in a white lead after its extraction causes the values for carbon dioxide found by combustion to be from 0·8 to 1 per cent. too high. The percentage of water found is also correspondingly high. As, however, the water is completely expelled from white lead at temperatures above 200° C., accurate results can be obtained for this constituent by gently heating the substance over a small flame in a stream of dry air, taking care that the temperature is kept low enough to prevent the formation of yellow oxide of lead. Thus, in three determinations the percentage of water found was 2·42, 2·48, and 2·45; the sum of the percentages of lead oxide, carbon dioxide, and water as directly determined in this way was 100·03.

For works purposes, the gravimetric method of determining carbon dioxide is impracticable, as it requires too much time; the volumetric method, which consists in measuring the carbon dioxide evolved from a known weight of white lead, is the only sufficiently precise method by which a dozen analyses may be made during the course of two or three hours. Unless special precautions are taken, however, very different results may be obtained. A large number of experiments have been made with the object of determining the conditions under which the method is trustworthy. The apparatus shown in the figure is that which was ultimately adopted: it has been used this year for more than 3,000 analyses, and has not required any attention other than cleaning once.



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* The presence of "oil" can be demonstrated by dissolving about a gram of the extracted white lead in dilute nitric acid; a small quantity of an oily scum forms on the surface of the acid. The oil is retained probably in the form of the lead salt of an oxidation product of linoleic acid.

Exactly 1 grm. of white lead having been introduced into the decomposition flask, A, and 5 c.c. of 1 in 5 nitric acid run into the inner tube, the flask is closed by the rubber stopper and immersed in the water in the vessel, B, where it is held in position by clips fastened to the bottom of the vessel. The mercury is brought to zero in the measuring tube by raising the reservoir and opening the three-way tap, C, to the air; after closing the tap, it is adjusted so as to stand at about 65—70 c.c. on the graduation. The flask is then removed and shaken violently until the white lead is completely dissolved; it is next replaced in the water, and the mercury approximately levelled; after 5 minutes the three-way tap is opened, so as to connect with the water-manometer, D, and, by means of a fine adjustment, the mercury in the tubes is exactly levelled. The volume of gas is then measured and the temperature of the water circulation and the barometric pressure are registered; the volume is then reduced to normal temperature and pressure, allowance being made for the vapour pressure; the percentage of carbon dioxide is then read off from a table.

The best results are obtained by liberating the gas under diminished pressure; the use of a water manometer renders the adjustments very accurate. Error is likely to arise principally owing to the solubility of carbon dioxide in the dilute acid used to dissolve the white lead; it has been found possible, however, to introduce an accurate correction for this by working under exactly standardised conditions. The actual error is diminished by using a comparatively large apparatus and measuring about 50 to 70 c.c. of gas. At first the correction fot solubility was made by measuring in two successive experiments the gas evolved from 1 grm. of white lead when dissolved in 5 c.c. and 10 c.c. respectively of dilute nitric acid (1 acid. d. 1·42,: 4 water), the difference being taken to represent the amount of gas dissolved in 5 c.c. of acid. After correcting for temperature and pressure, the percentages of carbon dioxide thus found are always a trifle low, but not more than 0·2 per cent. in error (for example. four experiments gave results ranging from 12·70 to 12·80 in the case of a sample of white lead containing 12·93 per cent. of carbon dioxide. In another case results varying between 12·10 to 12·25 per cent. were obtained, instead of the true value 12·28 per cent.). It was subsequently found that a more nearly accurate correction could be introduced by actually determining the amount of gas held back under the standard conditions adopted by making the measurements with a sample of white lead in which the amount of carbon dioxide was accurately known.* The difference between the volume actually measured and that which should be obtained theoretically represented the volume of gas retained by the acid. It is recommended that, in using this method in works, the solubility correction be determined each day, as it varies with alterations in the atmospheric temperature and pressure. In illustration of the degree of accuracy obtainable, it may be stated that three successive experiments gave results varying from 12·39 to 12·45, with an average of 12·43, instead of the correct value 12·42 per cent. The average of four closely concordant experiments made with another sample was 11·28, instead of the true value 11·27.

Owing to the rapidity with which it can be used, the Schrötter apparatus is often adopted by analysts in determining carbon dioxide; the results it affords are, however, only approximate, and its use is to be deprecated.

II. The removal of the oil from white lead is most expeditiously effected by repeatedly shaking the sample (on a shaking machine) with successive quantities of ether in a tall stoppered cylinder.† The ordinary Soxhlet extractor, with a paper "thimble" to contain the white lead, cannot be used conveniently at first, owing to the finely divided material passing through the thimble; but it can be used with advantage after most of the oil has been removed by a preliminary treatment in the cylinder.

A series of experiments made to ascertain the influence of repeated extractions on the values obtained in the analysis of the same sample showed that the bulk of the oil is easily removed from the white lead, but that a point is soon reached beyond which further prolonged extraction with ether or boiling acetone does not appreciably change the composition of the material. (Thus, the values obtained after the first series of extractions were: PbO, 86·06; CO_2, 11·27. Re-extracted during a fortnight with ether and finally during several hours with boiling acetone the values were—PbO, 86·11; CO_2, 11·31.)

But even after this prolonged treatment the white lead is not completely free from oil, as shown by its giving a scum when dissolved in acid. The high proportions of carbon dioxide and water found in such material by the combustion method correspond with the presence of about 0·3 per cent. of "oil" (assuming the latter to have the composition of linoleic acid, $C_{18}H_{32}O_2$). The actual amount of oil retained after using different extracting solvents was determined in a number of cases in the following way. Twenty grms. of white lead (of soft consistency) was shaken during 5 hours with 200 c.c. of solvent; after allowing the lead to settle, another 200 c.c. of solvent was added, and the shaking repeated during another 5 hours, and so on, the solvent being changed every 5 hours. After 20, 30, 40, and 50 hours' shaking respectively the residual fat was determined in a sample of 5 grms. in the following manner: the dry white lead was weighed on the asbestos of a Gooch crucible and decomposed with nitric acid (care being taken to avoid loss by effervescence), using at first acid of strength 1 : 20, then 1 : 10, and finally acid of 1 : 5 to ensure complete decomposition. After washing with cold water until the liquid passing through was free from lead (tested by a solution of sodium sulphide), the crucible was dried *in vacuo* over sulphuric acid until constant in weight.

Hannay and Leighton have stated (Proc. Chem. Soc., **124**, p. 122; Chem. News, **78**, p. 268) that the oil can be completely extracted from white lead by means of ether providing that sufficient of the latter be used (100 c.c. for each grm. of white lead), no insoluble lead compound clinging to the lead after the oil is extracted; Harland, on the other hand, maintains that ether does not completely remove the oil. Our results show that Harland's contention is correct: instead of using merely 100 c.c. for each grm. of white lead in the course of the 50 hours' extraction, we used so much as 2000 c.c. per grm.

Solvent.	Hours extracting.			
	20.	30.	40.	50.
Methylated ether	0·234	0·229	—	—
Petroleum ether	0·406	0·348	0·332	0·307
Acetone.................	0·342	0·317	0·292	0·247
Ratio of solvent used to White Lead	200 : 1	400 : 1	800 : 1	2000 : 1

Changes occurring in white lead when dried above 100° C.—A series of experiments was made to ascertain the temperature at which marked decomposition of the white lead began. It was found that no decomposition occurs during prolonged heating at 110° C., but that it sets in above 120°. Thus, on heating 2 grms. of dry white lead during 2 hours at 135° C., 0·53 per cent. of water was lost, another 0·18 per cent. being expelled after heating during another 1½ hours; at 171° both water and carbon dioxide were given off, a sample losing 1·6 per cent. water (out of 2·5 per cent.) and 0·37 per cent. carbon dioxide after 4½ hours. At 212° (naphthalene jacket) the loss of water from 2 grms. of white lead was complete in 2 hours, but only about 2·5—3 per cent. (out of 11·2 per cent.) of carbon dioxide was expelled.

Although the loss of water during drying greatly affects the percentage of lead oxide, it hardly changes that of carbon dioxide; thus $2PbCO_3.Pb(OH)_2$ requires PbO = 86·34, CO_2 = 11·36, and $2PbCO_3,PbO$ requires PbO = 88·4, CO_2 = 11·63.

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* The following is an actual example. The standard sample contained 11·23 per cent. of carbon dioxide. By the volumetric method this gave with 5 c.c. of acid a quantity of gas corresponding with 10·60 per cent. of carbon dioxide; with 10 c.c. of acid the volume corresponded with 10·20 per cent. Correction using 5 c.c. of acid = 0·63 per cent.; using 10 c.c. of acid the correction is 1·03 per cent.

† About 25 grms. of the sample is used, and quantities of 200 c.c. of ether are successively added. The ether must be freed from traces of acid by previously distilling it over lime; commercial methylated ether often contains small quantities of sulphuric acid.

Changes in composition of white lead caused by age.—The fact that white lead ground in oil gradually undergoes a change in composition is probably the principal cause of the differences existing between the results obtained by different analysts using the same sample of material. The following example of such change may be taken as typical. A sample of white lead ground in oil which, when extracted as completely as possible, contained $PbO = 86·06$ and $CO_2 = 11·27\%$ (ratio $PbO : CO_2 = 7·64$) was left in a wide-mouthed bottle closed with a cap during 3 weeks. It was then again extracted and, after removing the small pieces of skin (formed by the oxidation of the oil and insoluble in all solvents, including acetone, ethyl acetate, chloroform, benzene, and xylene) the residual powder was found to contain $PbO = 85·76$ $CO_2 = 11·89$ (ratio $PbO : CO_2 = 7·21$). Thus a change has occurred which has diminished the percentage of lead oxide by 0·3, and increased that of carbon dioxide by 0·6 per cent. No further change took place in the same sample during another 2 months, so that a limit of the action appears soon to be reached.* The foregoing facts show that an analysis of white lead ground in oil cannot be adduced as a sure index of the composition of the white lead originally mixed with the oil. Analyses made by different analysts can, moreover, only be expected to agree in the case of such material when the samples have by chance undergone approximately the same amount of change or when the analyses are made with samples in which change has ceased. As the actual amount of change is very variable (depending, for instance, on the amount of free acid in the oil, the possibility of air coming into contact with a larger or smaller proportion of oil, the nature of the oil itself) it must be concluded that the results of the analysis of white lead ground in oil are only very approximate. The amount of change occurring may easily give rise to differences exceeding 0·5 per cent. of carbon dioxide, or expressed as lead carbonate, 3 per cent. of the latter.

In conclusion we wish to thank Messrs. H. O. Otto and R. G. Covington for the assistance they have given us in carrying out several of the analyses.

Discussion.

Mr. E. **Grant Hooper** agreed with the authors as to the almost invariable retention of a small amount of oil in extracted white lead which had been previously ground, and suggested that this was largely due to oxidation of the oil. In view of that fact, a combustion process was inapplicable. He would have been glad to hear a little more on the practical point of the range in proportion of carbon dioxide in what was recognised by makers and dealers as good white lead. He had before him a few results from a large number of carbon dioxide determinations, both in unground and extracted white leads. In a batch of the former, the carbon dioxide varied from 11·76 up to 13·4 per cent., with an average for 10 samples of 12·31, against the theoretical 11·36 per cent. In some cases where the carbon dioxide had been found to be well over 12 per cent. the white lead had been reported by practical men to be satisfactory in covering power. Was there any general agreement in the trade as to the highest proportion of carbon dioxide allowable? Again, on the question of the best solvent of the oil in a mixed white lead, he asked if the authors agreed that petroleum spirit was a better solvent than either of the others mentioned. White lead separated from petroleum ether better than from methylated ether, and after decanting off the petroleum spirit and so removing most of the oil, the residual extraction was easily accomplished, so that where there was no appreciable oxidation of the oil, it was frequently possible to reduce the residual oil to as low as 0·1 per cent.

Mr. A. C. **Chapman** thought that if analysts would resort to methods of acknowledged repute and of established accuracy in analysing products of this character, instead of adopting what are known as "works methods," a good deal less would be heard about the necessity for analytical standardisation, and discrepancies between analysts would be rarer. Some analysts were in the habit of estimating the carbon dioxide in extracted paint residues by combustion, but such a method was reprehensible, and was liable, as the authors had pointed out, to be the cause of serious errors. With regard to the use of volatile solvents in paint analysis, he had found a mixture containing a good deal of acetone a very useful one for the purposes of extraction. The mineral substances tended as a rule to separate more readily, and in a more granular form, from such a solvent than from ether or light petroleum.

Mr. H. W. **Rowell** said that analysis by the combustion method gave high results for carbon dioxide and water in proportion to the acetic acid and tan which dry white lead, made by the stack process, contained. The only method which he found gave accurate results was that mentioned by the authors of dissolving in acid and weighing the carbon dioxide evolved. The accuracy and convenience of the method greatly depended on the form of apparatus employed. He had never been able to extract all the oil from white lead paints, always having 0·2 to 0·4 per cent. remaining. With three washes of methylated ether in a centrifugal machine he could get out all the oil possible and estimate it in about fifteen minutes, and successive washes of ether, acetone, high and low boiling-point petroleum ether, carbon tetrachloride, and mixtures of these solvents removed no more oil, nor did heating under pressure. He was of opinion that the substance left on dissolving in nitric acid was an oxy-linoleate of lead, but that, except in old paints, the oil did not exist in this state when in the paint.

Mr. **Davis** said the results obtained on using different solvents for the extraction of the "oil" were discussed in detail in the paper. Methylated ether appeared to be the best, but there was little to choose between them. The amount of "oil" left unextracted would depend on the age of the sample; it doubtless was some oxidation product of lead linoleate. It was quite true that dry white leads obtained by some processes contained considerable quantities of acetic acid and other organic substances which gave high results for carbon dioxide by the combustion method.

Mr. **Klein** said it was impossible to lay down any definite ruling as to what was the most desirable percentage of carbon dioxide in white lead. The chemical composition did not necessarily indicate the physical condition, and consequently it was unsafe to condemn any white lead containing between 11 and 13 per cent. of carbon dioxide on chemical grounds only. The physical condition of the pigment was to his mind a more important factor than the chemical composition, although public bodies often assumed that the desirable limits of the percentage of hydrate were between 25 and 30 per cent. He did not think that manufacturers or the painting trade cared whether it was below 25 or above 30 per cent., provided the paint was a good one. He himself preferred a white lead containing fully 12 per cent. of carbon dioxide. It was possible to have a white lead with a low percentage which was perfectly crystalline, and as a pigment was useless. In view of the fact that analyses often did not agree within 2 or 3 per cent. of hydrate, he thought it would be very unfair to condemn a lead wholly on account of a chemical analysis.

New England Section.

Meeting held at Boston, Mass., U.S.A., on Friday, Feb. 1, 1907.

MR. HENRY HOWARD IN THE CHAIR.

ELECTRO-METALLURGY OF ZINC.

BY WOOLSEY MCA. JOHNSON.

(ABSTRACT.)

The electro-metallurgical treatment of zinc ores, in ore-dressing, and in the application of electrolytic and of electric furnace methods, has had a valuable effect in stimulating the metallurgy of complex sulphide ores.

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* Special experiments showed that white lead in the form of fine powder does not absorb carbon dioxide either when moistened and exposed in the air of the laboratory during a fortnight or when heated at 110° in a drying oven with a hole in the bottom admitting the products of combustion from a Bunsen burner. The increase in the proportion of carbon dioxide cannot therefore be attributed to such an absorption.

A variety of electro-magnetic separators are used in the treatment of zinc-ores. At the mine of the New Jersey Zinc Company at Franklin Furnace, the ore, after a preliminary water concentration, is dried and passed over Wetherill separators, whereby a separation of magnetic franklinite and of willemite is effected; the former is worked up to zinc oxide and the latter to metallic zinc. In the Western States, electro-magnetic separators are used for separating the oxysulphide of iron formed by roasting the ore at a low temperature and also for the separation of marmatite—the magnetic sulphide of zinc and iron. At the works of the Colorado Zinc Company at Denver, where Leadville ore is used, the product, after being crushed and sized, is separated into silicious tailings, zinc-iron middlings, and lead concentrates. The magnetic sulphide of zinc is separated from the second product by a Wetherill electro-magnetic machine and the non-magnetic tailings concentrated by means of a Blake-Morscher electrostatic machine.

As the results of experiments with a small scale plant, (treating 400 ore to charge) for the treatment of zinc ores in an electric furnace of the resistance type, the author concludes that this method of treatment possesses the following advantages:—(1) A purer and more uniform product is obtained. (2) The proportion of zinc obtained from the ore is increased. (3) A wider range of ores can be treated. (4) The labour charge is decreased owing to the larger units of plant that can be employed. (5) The thermal efficiency of the plant is increased. (6) The capital outlay is decreased if the treatment is combined with a "preheater" in which the first part of the reduction is effected in retorts heated by a regenerative gas furnace, or if water-power is available for the supply of electricity. (7) The recovery of lead, silver, copper, and gold is more effective. The greatest difficulty is the condensation of the zinc to the metallic state is one operation.

The treatment of zinc ores by the Swinburne-Ashcroft electrolytic process, by a similar process devised by Baker and Burwell, of Cleveland, Ohio, by the Brown and Oersterle and by the Laval electric furnace methods is described in the paper and the limitations and possible developments of the old retort discussed.

Sydney Section.

Meeting held at Sydney on 12th June 1907.

MR. J. A. SCHOFIELD IN THE CHAIR.

RECENT WORK ON THE EUCALYPTS.

BY HENRY G. SMITH, F.C.S.

"The Eucalypts are destined to play a prominent part for all time to come in the sylvan culture of vast tracks of the globe; and for hard wood supplies, for sanitary measures and for beneficient climatic changes, all countries within the warmer zones will with appreciative extensiveness have to rely on our eucalypts during an as yet unaccountable period."

So wrote the late Baron von Mueller on completing that admirable work the Eucalyptographia, and in the comparatively short time which has elapsed since that work was published, we have seen the truth of that prophecy.

In certain districts in America considerable activity prevails at the present time in the planting of Eucalyptus trees, the idea being, primarily, to supply hardwood for railways and for other works of construction. This too is the case in South Africa, where extensive planting of eucalyptus trees has also taken place. In India, Algeria, Italy and other places the eucalypts have been cultivated, and with very great advantage to those countries in many directions. When the results of these plantations become better known, and the advantages appreciated, it may be assumed that increased activity will prevail in the establishment of eucalyptus forests in other countries.

The distillation of essential oils for medicinal purposes, for perfumery, and other economic requirements for which the several oils may be found suitable, will of a surety be extended. It may also be expected that the possibilities of certain species for producing a bark of excellent quality for tanning purposes will not be overlooked, so that we may soon expect to see the cultivation of special species for special products greatly extended.

The scientific knowledge concerning the products of the several species of Eucalypts, which has been obtained during the last few years, has placed the question on a much more satisfactory footing than was previously possible, and it is now generally known from which species the most satisfactory results can be obtained in the direction required.

The great chemical fact underlying this question, is that of the comparative constancy of the products of any particular species, so that the study of the possible economics of the several members of this great genus is provided with a sure basis.

There are certainly not less than 200 well defined species of eucalyptus in Australia, the greater number of which have been chemically investigated, and it is the main points, in the results of these investigations, which I now purpose submitting.

At the present time, beyond a few of the more common species, but little is known by the general public of the economic possibilities of the members of this group of trees, and it is largely for this reason that *Eucalyptus globulus* has obtained such wide prominence in different parts of the world. It has been stated that even to-day many of the seedsmen in America know no other species. In California, this species has, in years gone by, been planted in large quantities.

Recent investigations, however, have given *Eucalyptus globulus* its proper place in the sequence of species. One cultivator in America has at the present time 900,000 eucalyptus trees in his forests, and not a single tree of *E. globulus*. He considers that his trees will soon be worth 10/– each or even more. We in Australia might well take a lesson from such an enterprise, and profit from its results.

I shall refer as briefly as possible to botanical questions, restricting myself more fully to the chemical side, but it will be seen that the chemical and botanical studies of these trees are inseparable, and it is to the phytochemical researches which have recently been undertaken that the discovery of several important facts is due.

The name Eucalyptus was given to the genus by L'Héritier in 1788 in allusion to the presence of the lid or operculum of the bud stage. The numerous species, into which it has been considered advisable by botanists to divide the genus, have suggested to some workers the idea that hybridism has played an important part in the formation of these numerous species. There is much to be said in support of this theory, but the weight of chemical evidence is dead against it, if we admit the peculiarities of the parent being passed on to the offspring. From the results obtained during recent researches by R. T. Baker and myself, it was evident that the theory of evolution accounted for the formation of the numerous species better than any other, and it has been possible from our results to formulate a genealogical table to illustrate this process of evolution, and to show how the genus has developed through past ages. Hæckel says that the careful construction of these genealogical trees is not an amusement, but the chief task of modern classification.

In a theory of this character the question of time is an important factor, and there is no doubt but that the Eucalypts do go back to a remote age. In Wallace's Island Life a map of Australia is depicted illustrating the distribution of land during later cretaceous or early tertiary times. It will be seen from this that Tasmania was, at that time, part of a long narrow island, and had not been separated from the mainland. There appears every reason to suppose that several species of eucalyptus which are growing to-day in Tasmania, as well as in Australia, were well established species before Tasmania was separated from the mainland. In the Technological

Museum there is a splendid specimen of a Tertiary fossil leaf, which, from the shape and venation, is undoubtedly a eucalyptus, and the venation is that of a species like *E. globulus*, which group is shown to be well down in the series of evolution. There are also very few species of eucalyptus growing to-day in Tasmania which have not yet been found growing on the mainland. How different this must have been if hybridism played an important part in the formation of new species!

In Australia gigantic eucalyptus trees occur, and one growing at Marysville in Victoria has a circumference of 70 feet, and is about 150 feet to the first branch. This particular tree is probably some 2,000 years old, yet the venation of the leaf is that of the phellandrene group, the most recent of all the eucalypts; so that this tree, (probably *E. regnans*) belongs only to a species of to-day. When we consider the length of time necessary for any species to distribute itself over a large extent of territory, after it has become well established, we can begin to understand the constancy in the members of this genus, and to feel that time has been the chief factor in their establishment.

The eucalypts are essentially oil yielding plants, and if the known constituents of the several oils are tabulated it will be seen how very diverse they are. The following list of known constituents will show this:—eucalyptol, eudesmol, geraniol, methyl alcohol, ethyl alcohol, isobutyl alcohol, amyl alcohol, aromadendral, citral, citronellal, butaldehyde, valeraldehyde, piperitone, geranyl acetate, amyl eudesmate, valeric-acid ester, acetic-acid ester, formic acid, acetic acid, eudesmic acid, valeric acid, aromadendrene, pinene (both dextro and lævo-rotatory), phellandrene (the lævo form), limonene (the lævo form), and cymene. Although the known constituents are so numerous, yet, they do not all occur in the product of any one species. There is, however, a remarkable regularity in their distribution, and the commencement and increment of at any rate the principal constituents are well marked and most clearly indicated by the remarkable and characteristic feature of alteration in the venation of the lanceolate leaves. It is now clearly understood that the venation of the leaves of most species is indicative of certain oil constituents, and this changing of leaf venation has been contemporaneous with the alteration in the character of the oil. It has been possible to show this venation by photography directly from the natural leaves themselves, using the leaf as a negative. This very well demonstrates the evolutionary processes which have taken place and suggests that there is a natural arrangement governing the peculiarities and properties of eucalyptus trees, which will be better defined when better understood.

In what may be considered the earliest members of the genus the oil consists largely of the terpene pinene, with an entire absence of eucalyptol and phellandrene; the leaf venation illustrating this resembles the markings in a feather, the midrib is thick, and the marginal vein close to the edge of the leaf. As eucalyptol makes its appearance in the oil the midrib becomes less stout, the marginal vein recedes from the edge, and the structure of the leaf has a cellular appearance, thus allowing more room for the oil glands. In the leaves of those species giving an oil with a maximum amount of eucalyptol these characters are intensified. In the groups from which phellandrene oils are obtained, the venation is again different, the midrib is very thin, there is an entire absence of the feather-like venation, the veins are quite acute and lace-like, and the marginal vein has become so far removed from the edge of the leaf, that often a secondary one has formed. The genus thus divides itself roughly into three main groups, governed by the venation of the leaf, and this venation is characteristic of the chief constituents in the oils.

It is evident, therefore, that all eucalyptus oil cannot have the same medicinal value, because it is not to be expected that all the constituents are equally efficaceous. At present, one of the chief uses for eucalyptus oils is for pharmaceutical purposes, and it thus becomes necessary to know from which species the chief constituents can be obtained most satisfactorily, and in greatest abundance. The bactericidal value of the several constituents found in eucalyptus oils has been investigated by Dr. Hall of Parramatta, whose work represents a considerable addition to our knowledge in this respect. The new constituents recently discovered were also included in that investigation.

Although recognising the importance to Australia in the preparation of oils for pharmaceutical purposes, which industry at the present time has a money value of from £40,000 to £50,000 annually, yet, it is to the manufacturing industries that Australia must look for the development and utilisation of the enormous supplies of raw material at present going to waste. It is possible that by systematic effort Australia could, from her eucalypts, largely supply the demands of the world for oils useful for many solvent purposes, as well as for other uses in the arts and manufactures, and supply oils also for perfumery, for scenting soaps, and for flavouring purposes, but to be successful the industry must be systematised and governed by the results of scientific investigation. A very large proportion of eucalyptus species being useless for economic purposes, these might be eradicated and their places taken by useful species.

Two economic facts of great importance stand out prominently, these are, (1) that the young growth of any species yields an oil corresponding in constituents to that of the mature trees and often having a larger yield of oil, and, (2) that most eucalypts are very tenacious of life and when cut down soon throw out fresh growth. If then large tracts of country were devoted to the growth of any particular species yielding the required oil, and when sufficiently grown cut down by machinery, and distilled in correspondingly large stills, the cost of production would be merely nominal. With the old methods of distillation, using the 400 gallon ship tanks, the oil from some species of eucalyptus has been distilled for 4d. or 5d. per pound, or from 3s. to 3s. 8d. per gallon. This is the case with several species giving terpene oils. The possibility of success in this direction, therefore, when treated on a sufficiently large scale, seems to be considerable. One of the principal factors, in this connection, is that of yield of oil obtainable from any species. The variation in yield is very great, this ranging from 4 pounds from 100 pounds of leaves with terminal branchlets to practically nothing, but the yield from most species is now known and is practically constant. With the perfumery oils this factor has perhaps less commercial importance.

Geraniol.—The oil from *Eucalyptus Macarthuri* contains a large amount of the alcohol geraniol, principally as an acetic-acid ester, and it thus has commercial value for perfumery purposes. From a very large number of determinations the ester has been found to range from 60 to 75 per cent. in oil from mature trees, when distilled at various times of the year, so that a minimum of 60 per cent. of ester might very well be made the standard for the oil of this species. Experiment has shown that when the larger amount of ester is present, the free geraniol has considerably diminished, only 6 per cent. of free alcohol being present when the ester reached 75 per cent. whereas 10 per cent. was shown to be present when the amount of ester was only 60 per cent.

The eucalyptus from which geranyl-acetate is obtainable in such large amount, is known vernacularly as "Paddy's River Box," and occurs plentifully in the neighbourhood of Paddy's River, New South Wales. When found growing along the river flats it forms a fine umbrageous tree, and seems to prefer moist situations. The percentage of oil under these conditions also appears to be larger than from trees grown on the highlands. The oil from *E. Macarthuri* never contains eucalyptol, nor has phellandrene ever been detected, so that if a minimum of 60 per cent. of ester is insisted upon, sophistication of the oil is hardly possible. The whole of the ester in this oil is saponified in the cold, by two hours' contact, using alcoholic potash, and the quantitative results are certain. Schimmel & Co. obtained the following results from two consignments of the oil of this species:—

(1) Ester before acetylating 63·7 per cent.; after acetylating, 85·2 per cent.

(2) Ester before acetylating 71·68 per cent.; after acetylating, 80·5 per cent.

which figures entirely confirm my own results. After distilling *in vacuo* No. 2 gave 73·95 per cent. of ester, and after acetylating 82·2 per cent.

The well ascertained fact that the oil obtainable from the young growth of all eucalyptus species is the same in character as that obtained from mature trees is also borne out with the "suckers"* from this tree, and fortunately the yield of oil is greater also, 0·23 per cent. of oil being obtainable from "suckers" collected at Wingello, in New South Wales, at the end of the Australian summer. The ester content was 77·5 per cent. obtained both by the hot and cold methods. This is over 2 per cent. more ester than has ever been obtained from the oil of mature trees, and illustrates the great economic possibilities of this tree when systematically cultivated. The oil from the young growth should be easily obtained, and in any quantity. There seems no reason, therefore, why this plant should not be cultivated for its oil, and when sufficiently grown it might be cut down by machinery. If sufficiently large stills were utilised the oil should be obtainable at a comparatively low price. The value of the oil of this species, containing 80 per cent. ester, has been considered by Schimmel & Co. to be twenty-four shillings per pound, but it should be possible to produce it at a considerably cheaper rate. As it has been shown that the eucalyptus are very tenacious of life, destruction of the plants should not take place if the material were collected as suggested, and at the proper time of the year. Experiments should also be carried out to determine the most suitable time for collecting the material, so that a maximum yield of oil might also be obtained. There is abundance of land in Australia which could be used for the systematic cultivation of such eucalypts.

Lævo-limonene and citral.—Another eucalyptus which may eventually be of considerable economic value as an oil yielding plant, is *E. Staigeriana*. This is a Queensland species, and is locally known as the "Lemon Scented Ironbark." The material from which my results were obtained was forwarded from the Palmer River, Queensland. Although it has not been possible, as yet, to carry out conclusive experiments with this tree, there is no reason to suppose but that this species will follow the rules always found to be constant with the members of this genus. The yield of oil from mature leaves is large, 2·5 per cent., and would be greater from the young growth. The oil of this species may eventually be used as a flavouring agent, and take the place of lemon oil for many purposes. The principal difference between this oil and lemon oil is that the predominant terpene of the oil of *E. Staigeriana* is lævo-limonene, while that of lemon oil is dextro-limonene. The following roughly comparative statement will illustrate the characteristic differences in the oils of these two plants, as well as their resemblances :—

Lemon Oil (Messina Oil).	E. *Staigeriana* Crude Oil, unrectified.
Rotatory Power $[\alpha]_D + 59$ to 61°	Rotatory Power .. $[\alpha]_D - 43{\cdot}1°$
Specific Gravity.......... 0·86	Specific Gravity........ 0·87
Citral.............. 5 to 9%	Citral 16%
Geranyl Acetate.......... 1%	Esters as Geranyl Acetate 8·3%
? Geraniol .... Small amount	Alcohol as ? Geraniol.. 12·7%

From the results of my analysis not less than 60 per cent. of limonene (tetrabromide m.p. 104—105° C.) is present, of which the lævo form predominates. Less than 3 per cent. of undetermined substances are present, and pinene and phellandrene appear to be quite absent.

The odour of the oil is very aromatic, reminding much of lemon oil, and has no resemblance to ordinary eucalyptus oil. The greater yield of citral over that of lemon oil is also worthy of notice, particularly if the manufacture of "terpeneless oils" is undertaken.

One wonders, perhaps, why we in Australia do not take advantage of the possibilities of these unique species of eucalyptus, by utilising some of the waste places of this continent for their cultivation, and by modern commercial methods build up an industry with their products, and so utilise some of the natural resources of this continent in new directions. One thing seems certain, that if we do not utilise this knowledge to our own advantage we shall awake to find our opportunities gone.

Citronellal.—The oil from *Eucalyptus citriodora* consists principally of the aldehyde citronellal, and if the production of the oil is cheapened, it should have considerable value for scenting soap and other manufacturing purposes. The cost of collecting leaves from mature trees militates at present against cheap distillation, and as the yield of oil is not large (·58 per cent.) it is to the production from cultivated material that we must look for the successful exploitation of this species as an oil producing tree. The amount of aldehydes present in the oil—mostly citronellal, —averages about 90 per cent.

Constancy of composition.—This tree is a very good illustration of the comparative constancy of the products obtainable from particular species of eucalyptus, because no matter where the tree is grown its oil is practically constant in composition and character. Numerous illustrations of this fact have been accumulated from different species, as it was felt that this factor was of the greatest importance commercially. It is found that the constituents vary only slightly among themselves, so that when the results from any particular species have been accurately determined from undoubted material, it is known what material is obtainable from that particular species. One will not obtain a phellandrene oil from such species as *E. Smithii* or *E. globulus*, nor eucalyptol in quantity from such species as *E. dives* or *E. radiata*, nor eucalyptol or phellandrene from *E. Staigeriana*, nor the ketone piperitone from such species as *E. goniocalyx* or *E. Maidenii*, nor the aldehyde aromadendral from such species as *E. citriodora* or *E. Macarthuri*. Each has its own peculiarities, and if any particular constituent is required, then the species which contains that constituent in greatest abundance must be exploited.

Eucalyptol oils.—The eucalyptol bearing species are the most numerous, as this constituent occurs, in either small or large amounts, in the oils from most eucalypts. It is even found in small quantity in the oil from *E. dives*, it occurs in the pinene oils, and also in the phellandrene oils, as in *E. risdoni* and in *E. amygdalina*, &c. Provided a sufficient amount of eucalyptol is present,—I think the minimum might well be fixed at 55 per cent.,—the presence of a small amount of phellandrene in oils for pharmaceutical purposes should not be condemned any more than pinene. Dr. Hall considers from his experiments that the objection to phellandrene is not warranted, and that it is no more objectionable than pinene. It is true that the oils richest in eucalyptol are not obtained from the phellandrene bearing plants, but it must not be forgotten that we do not even now know which is the most efficaceous medicinal constituent in eucalyptus oils. In the preparation of eucalyptol oils for pharmaceutical purposes commercial requirements will settle the matter of species, and the price of the article will eventually find its natural level. The two factors to be considered are percentage of eucalyptol and yield of oil. The increased cost of collecting leaves from large trees, over that of the shrubby forms or Mallees, practically puts the large trees out of the running; so that if it is desired to utilise these species, they will have to be cultivated, to place them on an equal footing with the shrubby forms.

Taking two species which grow as large trees, *viz.*, *E. globulus* and *E. Smithii*, it is found that the yield of oil from the latter species is 1·5 to 2 per cent., that from *E. globulus* about ¾ per cent., and as *E. Smithii* is undoubtedly the best eucalyptol bearing plant yet investigated, it appears that *E. globulus* can hardly compete for cultivation for oil distillation.

Other species whose oil is rich in eucalyptol also give a large yield of oil, as for instance *E. cordata* 2½ per cent., *E. pulverulenta* 2¼ per cent., *E. Morrisii* 1¾ per cent., *E. polybractea* 1½ per cent., *E. Maideni* 1¼ per cent., and *E. cinerea* 1¼ per cent. *E. Morrisii* and *E. polybractea* are "Mallees" or shrubby forms of eucalypts, and with *E. Dumosa* and *E. oleosa*, cover large tracts of country, and practically form natural plantations. There are other species, however, which grow as "Mallees" and which are useless, at present, as oil bearing plants, such as *E. viridis*.

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* Eucalyptus species do not sucker in the strict sense of the term, and the word is here used with that understanding to denote adventitious shoots.

A consideration worthy of notice when dealing with the distillation of the eucalyptol oils for pharmaceutical purposes, is the duration of time necessary to distil the leaves, so that the best results may be obtained, both in amount of oil distilled and in the quality of the product. An investigation was undertaken to decide this point, and it was found that with *E. amygdalina* 89 per cent. of the total oil distilling came over during the first 2 hours, 7 per cent. during the third hour, and 4 per cent. during the fourth hour. Practically the whole of the eucalyptol came over during the first two hours, the less volatile constituents as the sesquiterpene, aromadendral, &c., distilled far more slowly. It is thus possible to leave the greater portion of these products in the still, securing a superior eucalyptol oil by so doing. Practically the same results are obtainable with other eucalyptol bearing species.

These high boiling constituents have some value, however, in raising the specific gravity of the oil, but it is doubtful whether economy of fuel, time and labour, is not better served by stopping the distillation after 2 or 2½ hours. Of course this method is not applicable to the perfumery oils, as with these it is necessary to obtain all the available oil from the leaves.

It may be well here to refer to the method of eucalyptol determination. The phosphoric acid method for the determination of eucalyptol in eucalyptus oils was discovered by L. R. Scammell of Adelaide, South Australia, in 1892, and the method was utilised by Faulding & Co. of that town for the commercial manufacture of eucalyptol. In 1894 the method was patented in England, France, Germany, and America, as well as in the Australian Colonies, as a commercial process for the production of eucalyptol. It has now been supplanted by the freezing process, but it still remains the most useful method for the quantitative determination of eucalyptol in essential oils, though it is not a perfect method for general practice, as so much depends on the mode of manipulation and on the analyst. If a method could be devised which would minimise these errors of manipulation, it would be a most welcome acquisition.

When the cake formed by the combination of eucalyptol with phosphoric acid has been prepared in a perfectly dry condition it can be weighed for the determination of the percentage amount of eucalyptol, or if preferred decomposed by hot water and the eucalyptol measured, or it may be prepared in petroleum ether as recommended in the American Pharmacopœia, although I prefer the dry method. The gravimetric method is fairly satisfactory if the percentage of eucalyptol is taken as 59·5 in the calculation; this is more correct than the old percentage 61·1. It was thought that the eucalyptol entered into combination with the phosphoric acid in molecular proportions, and as $C_{10}H_{18}O,H_3PO_4$ contains 61·1 per cent. eucalyptol, this was considered to be the amount present. But in a series of experiments which I undertook to prove this, it was shown that the phosphoric acid combined with the eucalyptol in its diluted state. The results obtained gave very concordant results; oils from three different species were used.

Taking varying amounts of the solid cake prepared with the greatest care and decomposing with hot water, the mean of six determinations gave weights of eucalyptol corresponding to a mean value of 59·47 per cent. (59·34 to 59·57) and the weights of the phosphoric acid which had entered into combination, determined by titration and other methods, represented an acid containing 89·25 per cent. H_3PO_4. The phosphoric acid used in the determination contained 89·4 per cent. H_3PO_4. One might expect, too, that the water separating from the H_3PO_4 in the formation of the eucalyptol phosphate, if such separation took place, would prevent satisfactory quantitative results being obtained. Experiments were made with more dilute phosphoric acid, but the results were not at all satisfactory.

Although several organic acids have been determined in eucalyptus oils, yet, they all appear to be in a state of combination as esters, with the exception of a portion of the acetic acid. When crude eucalyptus oils are redistilled, the water in solution which is always present comes over first, this naturally brings over with it the free volatile acids, and determination of these acids was made in this way with three oils which may be considered to be types of groups, *viz.*:—*E. amygdalina*, *E. cinerea*, and *E. Smithii*. The material worked upon was derived in each case from not less than 500 pounds of oil. The free acids in the water thus distilled were determined as follows:—*E. Smithii* 0·435 per cent., *E. cinerea* 2·1 per cent., and *E. amygdalina* 0·744 per cent. The molecular weight determination was made with the aid of barium sulphate, and theory requires for acetic acid 91·37 per cent. $BaSO_4$. With the acids from *E. Smithii* 91·32 per cent. $BaSO_4$ was obtained; from *E. cinerea* 91·27 per cent., and from *E. amygdalina* 91·25 per cent., proving the presence in all three cases of acetic acid alone. It has not yet been definitely proved that other volatile acids are absent from the oils of all eucalyptus species, but the above results indicate that no others are present.

Efforts were made to determine whether the lower members of the aliphatic monohydric alcohols were present in any particular eucalyptus oil, and if so which of them. The investigation was made on two litres of the water which first distilled when the oil of *E. amygdalina* was rectified. The results showed that methyl, ethyl, isobutyl, and amyl alcohols were present, and in somewhat considerable amount. It was thus possible to chemically prove the presence of all of them in the oil of this species. It is not to be supposed, however, that they all occur together in the oils of all the species, although they may be present even in traces.

Both ethyl and amyl alcohols had previously been detected in a eucalyptus oil by Bourchardat and Oliviero, and formic acid by M. Voiry. It seems thus conclusive that the presence of the known aldehydes and acids in these oils is traceable to the prior presence of the corresponding alcohols. Amyl alcohol seems to occur mostly as an ester in combination with eudesmic acid; this ester has been found in large amount (about 57 per cent.) in the oil of *E. aggregata*, and is probably present in all the class of oils of which *E. saligna* is a representative. Unfortunately the oil from *E. aggregata* is very small (·04 per cent.) and it has not been possible, so far, to obtain sufficient material to decide with certainty the constitution of eudesmic acid. Its formula seems to be $C_{14}H_{18}O_2$, it is monobasic, and 1355 parts of water at 20° C. are required to dissolve one part of the acid. It is an unsaturated acid, crystallises well, melts at 160° C., and crystallises again on cooling, it forms a dibromide, and is probably homologous with cinnamic acid, but further material is required to prove that point. I hope to obtain sufficient oil of this species eventually, to enable me to determine the correct constitution of eudesmic acid.

The presence of esters in eucalyptus oils, as has been shown, is often large, and one or other of these appear to be present in all eucalyptus oils, from traces up to 77 per cent. Besides the species above mentioned, an acetic acid ester occurs in some quantity in the oil of *E. umbra*. In the oils of *E. saligna*, *E. cinerea*, *E. Maideni*, *E. goniocalyx*, *E. botryoides*, as well as in other species, esters have been found in considerable quantity. In some of these oils a valeric acid ester occurs; the oil of *E. saligna* was found to be the best in which to determine its presence. The amyl ester of eudesmic acid occurs in small amount in the oil of this species, but valeric acid is also found existing as an ester, and was separated in sufficient quantity to chemically determine its identity. No other alcohol than amyl alcohol could be detected in the oil of this species. It may be mentioned that those oils in which this valeric acid ester occurs contain most markedly the corresponding aldehyde.

Other constituents.—Other constituents worthy of mention which are found occurring in eucalyptus oils are, —eudesmol, the stearoptene; aromadendral, the aromatic aldehyde; piperitone, the aromatic ketone; and the sesquiterpene. Eudesmol has been found in a considerable number of eucalyptus oils, and one species, previously undescribed, was named by R. T. Baker, *E. camphora*, from the presence of this stearoptene in the oil. This is not the only eucalyptus that has been so honoured. The "Sydney Peppermint," *E. piperita*, derives both its vernacular name and its scientific name from the presence of piperitone in its oil, although this constituent was not known until recently. It is the presence of this ketone that causes the name "Peppermint" to be applied to a large group of these trees. It is not perhaps generally known that eucalyptus oil was one of the first Australian products exported to England, but a quart of the oil distilled from the leaves of the "Sydney Peppermint" was sent to a Mr. Wilson in 1788, soon after the first settlement in New South Wales was formed. Dr. White mentions that he found this oil most efficaceous in dealing with some of the ailments of the convicts at that time.

Aromadendral is the aldehyde which has previously been considered to be cuminaldehyde, but it has a considerable lævo-rotation, the specific rotation of the aldehyde from *E. salubris* being $[a]_D - 90{\cdot}43^\circ$. The formula is $C_9H_{12}O$, the specific gravity at 16° C. $= 0{\cdot}9576$, the refractive index at the same temperature 1·5141. It readily forms an acid which when heated to 110° C. melts at 137—138° C. The oxime melts at 86° C., and the hydrazone at 104—105° C. Aromadendral is a frequent constituent in eucalyptus oils, being found in all the members of the large group of trees known as "boxes," as well as in allied species; and is found mostly in those species in which phellandrene is absent. It is to the presence of aromadendral, therefore, that the lævo-rotation of the "box" oils is due.

The sesquiterpene is found in considerable quantity in the oils of many species, as *E. Dawsoni, E. eximia, E. nova-anglica, E. affinis* and in *E. hœmastoma*. In the oil from the latter species over 50 per cent. distilled above 255° C.

In some species dextro-rotatory, and in others lævo-rotatory, pinene occurs in such abundance that the oils are practically turpentine oils, so that it is hardly possible to detect sophistication with ordinary turpentine. It is thus necessary to insist on standards which will ensure the quality of the product required, but, as I have previously shown, any general standard cannot meet all requirements, nor determine the value of eucalyptus oils for all purposes. For pharmaceutical oils the specific gravity should be ·91 at 15° C. or ·905 at 22° C. but the figure can be readily calculated from any ordinary temperature to that of 15° C., because it has been determined that these oils alter their specific gravity ·00075 for every ordinary degree of temperature.

I have dealt somewhat fully with the characteristics of the oils of the eucalypts, because it is a matter to which I have devoted many years of study and investigation. I think also that the eucalyptus oil industry is in its infancy, and that the time is not far distant when, to supply the demands for the oil products which Australia has to offer, will mean the establishment of a considerable industry in the country.

Kinos.—There is no more interesting chemical group of substances in the eucalypts than the astringent exudations, or kinos. Many of the species exude kino freely, but these differ very greatly in chemical constitution. Whatever is eventually done with eucalyptus exudations commercially, it must be recognised that it is just as imperative for the product of a particular species or groups to be kept distinct, as it is in the preparation of the various oils. The two main uses to which these exudations may eventually be put, is in the tanning industry and for pharmaceutical purposes, principally for the preparation of tinctures.

The following are the main points in the evolution of these kinos as shown by the chemical products of the several species. It can be demonstrated that the alterations which have taken place have been contemporaneous with those in the oil constituents, and also in the venation of the leaves. Two well-defined crystallised products are found in these kinos,—aromadendrin and eudesmin. In the exudations of what appear to be the earlier members of the genus, aromadendrin occurs alone, eudesmin being quite absent. I have also isolated aromadendrin from the kinos of *Angophoras*, where it occurs alone without eudesmin, so that in this direction these trees are shown to be allied to the older members of the genus eucalyptus. This is also true of the venations, and the venation of the leaves of *Angophora lanceolata* and *E. corymbosa* have a striking resemblance to each other. The principal difference between the two trees is the absence in Angophora of the operculum in the bud stage.

As the several eucalypts descend towards the more recent species, the second body—eudesmin—makes its appearance. It then commences to displace the aromadendrin, until at the end of the group known as the "boxes," eudesmin is the principal crystallised substance present.

I have not yet examined a eudesmin-bearing kino in which aromadendrin does not also occur, so that commencing alone in the kinos of the earliest members of the genus, it runs through the whole group of species whose kinos contain crystallised bodies, although at the more recent end it is present in very small amount. I have succeeded in separating these two bodies in a pure condition when they occur together in any kino, and hope soon to investigate them more fully. They show a remarkable difference when treated with strong sulphuric acid and with nitric acid, as they give the reverse coloration with these acids, so that it is easy to detect even slight traces of each with the other. The tannins in all the kinos containing these bodies give a greenish or a blue coloration with ferric chloride.

Another group of these trees, which branches off in a different direction to the "Boxes" and the "Gums," includes the "Stringybarks," and the "Peppermints." The exudations of this group do not contain crystallised bodies, and the tannins give a violet coloration with ferric chloride. They are very astringent, relatively the most astringent of all eucalyptus kinos, but the tannins act very indifferently with raw hide substance. They are, when fresh, entirely soluble in alcohol and in water.

Another group of eucalypts known as "Ironbarks," exudes a handsome looking kino, clear, bright and transparent when fresh, but this soon changes, the kino ultimately becoming almost black. Although readily soluble in water, yet the kinos of this group are almost insoluble in alcohol. This peculiarity was long thought to be due to the presence of a gum, but I recently showed that this was not the case, but that this insoluble substance was a tannin glucoside. It has been named "Emphloin." It is a remarkable substance, the sugar group being particularly interesting. These kinos give a brownish-grey coloration with ferric chloride, but a violet with ferric acetate. The tannin seems to be identical with that of the "Stringybark" and "Peppermint" groups. The distribution of the kinos in the plants themselves is also often dissimilar. In the "Stringybarks" and allied species the astringent substance is often distributed through the wood, and in many other species this is the case also, causing the timber to be of indifferent quality owing to the rings of kino. In the "Ironbarks" the kino is often largely distributed throughout the bark itself; this is particularly the case with *E. crebra* and *E. sideroxylon*, and is the cause of their astringency. The barks of these trees are often very thick and rugged, and contain a large amount of kino. There are enormous quantities of this bark in Australia, and if some method of utilising it satisfactorily for tanning purposes could be discovered, the result would be of considerable advantage. It has already been used to some extent, and much effort has been expended in the endeavour to utilise it, but it is very sluggish in its action on hide, and forms a dark reddish-coloured leather. The glucoside itself seems to have little affinity for hide, and when it is hydrolysed the colouring substance which separates resembles a "kino-red," and has considerable dyeing properties. The matter is one of considerable importance to Australia, and the whole question is worthy of extensive research.

The eudesmin-bearing kinos appear to be the best for tanning purposes if found in quantity, and the barks of those species exuding this class of kino are often rich in tannin as the "Mallet," *E. occidentalis*, for instance. The oils from species containing eudesmin in their kinos do not appear to contain phellandrene, and those species, which exude kinos in which eudesmin is found in quantity, contain the largest amount of the aldehyde aromadendral in their oils. The kinos of the species, which yield oils rich in eucalyptol, all resemble each other, and all appear to contain eudesmin in small amount. This substance has been isolated from the kino of *E. Smithii*, perhaps the richest of all the eucalyptol bearing species.

In certain species belonging to this class of trees, the kinos of which contain eudesmin, a sugary substance often exudes in some quantity, this is known as "Eucalyptus Manna." It is obtained in some quantity from *E. viminalis*, and in smaller amount from *E. punctata* and other allied species. The principal sugar is raffinose. I am not aware of any record of sugary exudations having even been obtained from any eucalypt the kino of which contains the glucoside emphloin, nor in any species containing an identical tannin. This is suggestive of the possibility of raffinose itself being allied to the glucosides, and it behaves similarly to the synthetically prepared disaccharides of Fischer and Armstrong which also resemble glucosides.

The "kino red" of the glucoside obtained from all the "Ironbarks" as *E. crebra*, *E. paniculata*, &c., as well as from the kinos of the "Stringybarks," as *E. macrorhyncha*, &c., and the "Peppermints" as *E. piperita*, &c., when boiled with acid all give protocatechuic acid, and catechol when fused with potash. They all give identical colours with mordanted cloth, similar reactions with reagents which act on the tannin alone, and the tinctures gelatinise with equal rapidity. From the products of decomposition two of the hydroxyls in the tannin molecule are in the ortho position relatively to each other, and the sugar group in emphloin is probably attached through one of these hydroxyls.

Although the tannins are similar the kinos of the "Stringybarks" do not contain the glucoside emphloin, but in the leaves of some of them, *E. macrorhyncha* particularly, a glucoside, myrticolorin, occurs. It is a glucoside of quercetin and the sugar is glucose. It occurs in considerable amount in some species, and 8½ pounds in a dry condition was obtained from 100 pounds of leaves when these were treated by commercial methods. Myrticolorin ($C_{27}H_{28}O_{16}+3H_2O=C_{15}H_{10}O_7+2C_6H_{12}O_6$) is a true dye material giving to mordanted cloth the usual colours of the quercetin glucosides, and could be obtained in any quantity if required. If raffinose be considered as allied to the glucosides, we find a similar substance in each of the large groups of eucalypts: raffinose from the group whose kinos contain eudesmin, and whose oils are rich in eucalyptol; emphloin from the "Ironbarks" and allied species; and myrticolorin, from species whose kinos consist of a tannin alone and whose oils contain phellandrene.

The comparative astringency value of the kinos of the "Ironbarks," when determined with potassium permanganate, is only about half that of the "Stringybarks" and allied species, although the tannins are similar. This is accounted for by the presence of the glucoside in the "Ironbark" kinos. Taking gallotannic acid, with 14·43 per cent. water, as the standard 1000, the results are as follows:—

E. pilularis	containing	18·32%	water	838
E. macrorhyncha	,,	18·06%	,,	835
E. eugenioides	,,	18·01%	,,	811
E. paniculata	,,	22·78%	,,	412
E. siderophloia	,,	20·28%	,,	459
E. crebra	,,	18·77%	,,	470
E. sideroxylon	,,	19·46%	,,	459
The glucoside (emphloin)	,,	11·75%	,,	423

The amount of "Kino Red" obtained from the glucoside (prepared as pure as possible by repeated precipitations by alcohol from aqueous solution) was 47·33 per cent. The sugar was inactive to light, was fermented by yeast, and gave an osazone soluble in hot water, and which melted at 176—178° C. The sugar portion in the glucoside emphloin appears to protect the tannin molecule from that alteration common to the kinos of the "Stringybarks" and "Peppermints," because no matter how long the "Ironbark" kinos are kept, they retain almost unimpaired their ready solubility in water. When the tannin is free from sugar, as in the kinos of the "stringybarks," &c., change commences at once after exudation, and although but little coloured when freshly exuded, yet, they soon become darker and less and less soluble in both water and alcohol, until after a few years they become almost black and practically insoluble.

The causes of this insolubility under natural conditions act more energetically when the kinos are dissolved in alcohol, because the tinctures gelatinise rapidly, so that the exudations of the "Stringybarks," the "peppermints," and allied species, although readily soluble in alcohol when fresh, cannot be used for the purposes of the pharmacist. The "ironbark" kinos, being practically insoluble in alcohol, cannot, of course, be used; besides they also gelatinise rapidly. It is, therefore, to the kinos containing eudesmin and aromadendrin, obtained from the members of the remaining groups of eucalypts and allied species, that we must look for material which may be useful for pharmaceutical purposes.

By the systematic investigation of numerous kinos from undoubted species, it has been determined that eucalyptus exudations, obtained from certain species, are more satisfactory for the pharmacist than perhaps any other astringent exudation. The best of these kinos do not gelatinise in tinctures under ordinary conditions, no matter how long they may be kept, and they require no corrigent; they are markedly astringent, readily soluble in alcohol, are not precipitated on dilution with water, and may be stored in a dry condition for an unlimited time without alteration. The kinos of *E. microcorys* and *E. calophylla* answer the above conditions; the former species, however, only yields kino in small amount and is thus difficult to collect, but *E. calophylla* exudes abundance of kino. This species is the "Red Gum" of West Australia, and its kino contains aromadendrin but not eudesmin. Two other kinos which do not gelatinise in tinctures are obtained from *E. eximia* and *E. maculata*, but these give precipitates when diluted with water and are thus somewhat objectionable.

The kino of the "Red Gum" of Victoria and New South Wales, *E. rostrata*, is not so good for tinctures, although of fair quality. It is less astringent than that of *E. calophylla*, in the proportion of 576 to 753 (gallotannic acid 1000) and, owing to the presence of more of the tannins which gelatinise, is not so resistent in that respect.

Although it has been considered convenient to roughly classify the eucalypts into groups, yet, the chemical constituents slowly graduate from one species to another. This is well illustrated with the tannins in the kinos. There appear to be three tannins in eucalyptus exudations, and these give distinctive differences with very dilute ferric chloride. Those kinos giving green and violet colorations gelatinise in tinctures, while those giving a blue coloration do not gelatinise. It is the predominance or absence of any one of these tannins in any particular kino that governs its rate of gelatinisation. This rate may very well be determined by the aid of formaldehyde, a few drops of commercial formalin solidifying, in 24 hours, an alcoholic solution of those kinos giving most markedly a violet coloration with ferric chloride, but acting less quickly on kinos containing the other tannins in larger amount. The kinos of 22 species belonging to all groups were tested. Five drops of formalin in 5 c.c. of tincture (1 in 10) gave a solid jelly in 24 hours with the kinos of *E. Siberiana*, *E. dives*, and *E. pilularis*; and no change occurred with the others, to which 5 drops more of formalin were added till the next day, when the tinctures from *E. corymbosa* and *E. oleosa* solidified. Five drops more of formalin were again added, and observations taken for five months. The tinctures of *E. trachyphloia*, and two specimens of *E. rostrata* (collected at different dates from different localities) solidified after four days; *E. goniocalyx*, *E. Dawsoni*, and *E. populifolia* after seven days; *E. Bridgesiana*, and *E. Smithii* after eight days; *E. melliodora*, *E. pendula*, *E. hemiphloia* and *E. intertexta* after eleven days; *E. Woollsiana* after twenty-five days; and after five months, no change had taken place with *E. calophylla*, (two specimens collected 1895 and 1897), *E. microcorys*, *E. eximia*, and *E. maculata*. Those which gelatinised slowly became much thicker prior to forming a jelly. Similar results were obtained with tinctures tested by age alone, and a tincture of *E. calophylla*, put up ten years ago without any corrigent, is now as fluid as when first made.

The formalin test seems to be a reliable one for determining the gelatinising properties of kinos, and it may be assumed that tinctures which do not form a jelly in four days under like conditions will not readily gelatinise. That the gelatinisation is due to the particular tannin present is shown by the following determinations.

A tincture of two kinos were made up in varying proportions and five drops of formalin added to each, they gelatinised as follows:—

E. pilularis.		*E. calophylla.*	Gelatinised.
4·5 c.c.	added to	0·5 c.c.	2 days.
4·0 c.c.	,, ,,	1·0 c.c.	2 days.
3·0 c.c.	,, ,,	2·0 c.c.	4 days.
2·0 c.c.	,, ,,	3·0 c.c.	7 days.
1·0 c.c.	,, ,,	4·0 c.c.	75 days.

That the gelatinisation of eucalyptus kinos is due to the particular tannin, and not to an enzyme as suggested by E. White, is shown by the fact that the tincture made from the kino of *E. pilularis*, which had been boiled for one hour, formed a jelly in exactly the same length of time as the unboiled portion, but it is a remarkable fact that in the readily gelatinisable kinos a fungus readily forms at the bottom of a dilute aqueous solutions, if allowed to stand in a bottle for a few days. This fungoid growth appears to start from the particles of undissolved kino.

Calcium oxalate in the bark.—A very interesting fact in regard to eucalyptus trees is that in the bark of several of them a large amount of calcium oxalate occurs. This salt does not appear to have been found in quantity in the bark of other plants belonging to genera which often occur as large trees, so that in this respect the eucalypts are peculiar. The crystals have not been found as raphides, but in well developed microscopic monoclinic crystals, containing one molecule of water, a marked feature being the frequent occurrence of geniculate twins, with the twinning plane parallel to the basal plane of the crystal. These microscopic prisms are a constant feature of this salt in all the barks tested. The average length of the crystals of the general type was 0·01746 mm., the breadth 0·00776 mm. The crystalline form and composition show a strong resemblance to the mineral *Whewellite.* The percentage occurring in the barks of the undermentioned species was as follows:—*E. gracilis* 16·66, *E. Behriana* 16·5, *E. salubis* 16·0, *E. oleosa* 10·64, *E. dumosa* 9·8, *E. salmonophloia* 8·34, *E. occidentalis* 6·82, *E. viridis* 5·01. Scientifically the occurrence of such large amounts is most interesting, as it enables a probable theory to be advanced to account for the formation of the shrubby forms of eucalypts, or "Mallees." Of the species determined containing over 8 per cent., only, *E. salubris*, and *E. salmonophloia* have any pretensions to be considered as forest trees; the rest are "Mallees," and mostly have a thin smooth back, which usually ranges in thickness from 2 to 5 millimetres. The botanical and chemical resemblances between *E. salmonophloia* of West Australia, and *E. oleosa* of Western New South Wales are most marked, and it seems probable that the latter tree is only the degenerate form of *E. salmonophloia.* It may be assumed, therefore, that these degenerate forms of "Mallee" growth, have been brought about by the poisonous effect of the excess of the oxalic acid in the plant, and that the "Mallee" form is but a stage in the extinction of the species. The presence of the oxalic acid in these barks is usually associated with the tannins of economic value, and this result, taken with the presence of such large quantities of oxalate of lime, gives these barks considerable economic importance. The value of the "Mallet," *E. occidentalis*, for tanning purposes is well known, but the tannin of the "Gimlet," *E. salubris*, seems to be even better, although it is not present in such large quantity. An analysis of the bark of *E. salubris* gave 18·6 per cent. of tannin; this makes an excellent tanning extract, which was found to be but slightly decomposed when evaporated to dryness on the water bath, so that a slight reduction in pressure would serve for perfect evaporation with this extract. The tannin is light in colour, astringent, and acts on hide similar to the tannin of the "Mallet." The large amount of oxalate of lime in the bark residue after extraction, makes it worth while to consider whether it could not be profitably extracted for the oxalic acid it contains. The value of the tannin extract should cover all expenses of collection, grinding, extraction, &c. Eucalyptus barks containing a large percentage of calcium oxalate are readily powdered when dry as they are very brittle.

Under ordinary conditions the Eucalypts appear to assimilate the calcium oxalate first formed, but when the deposition increases faster than it can be absorbed, then the plant seems to lose this power of assimilation, and it becomes stunted in growth, and perhaps eventually disappears as a species. That this is so I have been able to show from the investigation of the bark of an individual forest tree, *E. oreades.* The living bark contained 1·37 per cent. calcium oxalate, the thin ribbon-like bark shed from the outer portion of the same tree only contained ·025 per cent., while in the thicker persistent bark at the base of the trunk none could be detected.

In the course of this paper I have endeavoured to illustrate the chemical peculiarities of this interesting group of trees, and also to suggest a few scientific conclusions in certain directions, which, both from botanical and chemical results, appear to be the most conclusive. The botanical evidence accumulated by my colleague R. T. Baker, F.L.S., when taken in conjunction with the chemical results, has enabled us to formulate many new ideas in reference to the eucalypts.

The chief interest to chemists, however, lies in the remarkable variety of oil constituents of the various species; in the peculiarities and wide range of the kinos or astringent exudations, in the varying tannins from the barks and sugary products, in the large quantities of calcium oxalate in the barks of certain species, and in the presence of the glucosides. Such an abundance of chemical products existing in the several members of one group of trees points unmistakably to the fact that the genus is not of recent origin, and the knowledge that perhaps three-fourths of the vegetation of Australia consists of eucalyptus trees in one form or another, suggest the possibility of successful commercial exploitation in new directions. It is true that many of these chemical products have only been discovered in very recent years, and the knowledge of their existence has hardly reached beyond the outskirts of local conditions, where the spirit of enterprise mostly restricts itself to the few main productions of the continent. Australia is so vast in extent that the territory of the whole of Europe, (excluding Russia), is not so large by 1,000,000 square miles. It may be accepted, therefore, that there is abundance of land in Australia, of all sorts and conditions, waiting to be utilised in various ways in profitable production.

The amount of chemical work still waiting to be done in connection with the eucalypts is considerable, and many problems yet remain to be solved. It is, too, to the furtherance of scientific effort and investigation into the unknown properties of this unique vegetation of Australia, that real progress in the development of these resources can best be brought about. Every successful effort will ultimately react in increased commercial activity, with profit to Australia, and possible benefit to the world.

Discussion.

Mr. T. U. Walton drew attention to the somewhat precise relation between the botany and the chemistry of the eucalypts that had been established by the work of Messrs. Baker and Smith, so that it was possible, from a knowledge of the venation of the leaf of a species, to tell the chemical characteristics of the oil obtainable by distillation. In the same way a chemical examination of the oil could be used to differentiate between species that are botanically to be separated. Other countries had been quick to take advantage of the knowledge gained, and were planting the suitable varieties of eucalypt to yield the medicinal oil desired; yet in Australia, while the existing trees were being cleared, no serious move was made for replanting.

Obituary.

WILLIAM HENRY PERKIN.

President, Society of Chemical Industry, 1884—1885.

Sir W. H. Perkin, LL.D., D.C.L., F.R.S., died at his residence, after a very brief illness, on July 14th. He was the youngest son of the late G. F. Perkin, and was born on March 12th, 1838.

Educated at the City of London School, he was sent from there, under the advice of Thomas Hall, the famous teacher of chemistry and natural philosophy at that school, to the Royal College of Chemistry, to study under Hofmann, whose research assistant he became.

In an endeavour to prepare quinine synthetically from aniline, carried out in his home laboratory, Perkin produced the first of the artificial colouring matters. This was in 1856. Young though he was, he fully and at once recognised the importance of his discovery to the arts, patented the process, and in partnership with his father and brother, quickly began the manufacture of this colouring matter and of the nitrobenzene and aniline, needed for it. He thus laid the foundations of the coal-tar products industry, which is remarkable as being probably the most comprehensive and elaborate application of scientific research to the arts that has ever been made. A year ago, the Jubilee was held throughout the chemical world, in celebration of his discovery of the first aniline dyestuff, mauve, and its technological developments (this Journal, 1906, 783, 1207, 1208).

The first commercially successful process for the manufacture of alizarin from anthracene was carried out by Perkin in 1869, Graebe and Liebermann having shortly before synthesised it in the laboratory, and patented their method. The volume of this Journal for 1885 contains Perkin's own account of the work he had done upon mauve, alizarin, and other coal-tar products. In 1873 he retired from the work of the industrial production of these colouring matters.

In 1865, Perkin synthesised coumarin, the lactone of *o*-hydroxycinnamic acid, the first natural perfume to be prepared artificially, by heating sodium salicylaldehyde with acetic anhydride. In 1875 he gave this reaction an entirely different aspect by allowing sodium acetate and acetic anhydride to act upon salicylaldehyde, this reaction thus acquiring wider and more general application. The "Perkin reaction" ultimately became one of the most fruitful of synthetic methods.

From 1873 up to the end of his life, he devoted himself to the prosecution of researches in chemistry and physics. Of these there can only be mentioned here the great series of investigations upon magnetic rotary polarisation in relation to chemical constitution, begun in 1884. For these he received the Chemical Society's Longstaff Medal in 1888. In 1879 he had received a Royal Medal on the award of the Royal Society, of which he had been a Fellow since 1866. He received moreover the Albert Medal of the Society of Arts in 1890, and the Birmingham Medal of the Gas Institute in 1892. In 1893–4 he was a Vice-President of the Royal Society.

The Society of Chemical Industry, of which he was one of the founders and one of its early presidents, gave him its Medal in 1898, and in that year's volume of the Journal a portrait of Perkin will be found. His specially valuable address as president will be found in the volume of the Journal for 1885. For the years 1883-5 he was President of the Chemical Society. He was also one of the first Fellows of the Institute of Chemistry.

Perkin was knighted last year, and only last month received the D.C.L. of Oxford. Last year's jubilee, already referred to, was made the occasion for presenting him with his portrait in oil by A. S. Cope, A.R.A., which, by his death has become the property of the nation and will go to the National Portrait Gallery. His bust, by F. W. Pomeroy, A.R.A., was at the same time presented to the Chemical Society, and a Research Fund, to bear his name, was instituted and placed with that Society for administration.

AUGUST DUPRÉ.

August Dupré, Ph.D., F.R.S., who was of Huguenot descent, was born at Mainz on September 6th, 1835. After attending the Polytechnic Schools of Giessen and Darmstadt, he studied chemistry in the University of Giessen and under Bunsen in that of Heidelberg. Having taken his Ph.D. degree at the latter University in 1855, he came to London, and from that time made England his home, becoming a naturalised British subject in 1866. From 1864 until 1897 he was the lecturer on chemistry at Westminster Hospital Medical School. In 1871 he was appointed chemical referee to the medical department of the Local Government Board, and in 1873, public analyst for Westminster. In that year also he was made chemical adviser to the Explosives Department of the Home Office. Dupré was associated with Sir Frederick Abel and Sir James Dewar on the Explosives Committee. He was joint author of a work on the "Nature, Origin, and Use of Wine," of a "Manual of Inorganic Chemistry," and in 1872, conjointly with Dr. Thudichum, of a treatise on the "Origin, Nature, and Varieties of Wines," and with Dr. H. N. Hake of a "Manual of Inorganic Chemistry."

Dupré was elected a Fellow of the Royal Society in 1875, and published a number of original papers, chiefly dealing with problems of analysis of water and foodstuffs. He was a Fellow of the Institute of Chemistry, and acted as President of the Society of Public Analysts in 1877-8. He was an original member of the Society of Chemical Industry. August Dupré died July 15th, at his residence, Mount Edgcumbe, Sutton, Surrey.

JOHN CLARK.

John Clark, Ph.D., was born in Glasgow in the year 1844, and was educated at the High School, and passed through the Arts Classes in the University, where he gained distinction in science. He afterwards studied for four years in Germany, *viz.*, in Göttingen, where he took the Ph.D. degree, and subsequently under Bunsen, in Heidelberg. He further pursued his studies for two years in Paris, at the end of which period he returned to Glasgow and became assistant to Dr. Penny, in Anderson's College. On the death of Penny, Clark joined the firm of Tatlock and Wallace. He was formerly Chairman of the Scottish Section of the Society of Chemical Industry, a Vice-President of the Society, and a member of the Council of the Institute of Chemistry, and at the time of his death was President of the Society of Public Analysts. Clark carried out many investigations connected with analytical processes. He died July 9th, 1907.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Furnaces ; Regenerative ——. R. M. Brooke, Elland. Eng. Pat. 14,637, June 27, 1906.

THE stay-walls of the retort-setting are prolonged downwards through the regenerator, forming a number of separate flues for the waste gases. Each of these flues communicates by a separate aperture with the main flue, so that by adjusting the dampers, the draught in any part of the setting can be easily regulated. To further control the heat in different parts of the setting, the secondary air is admitted by a number of separate flues, each of which can be regulated by a damper.—W. H. C.

Furnace. C. Többelmann, Berlin. Eng. Pat. 15,297, July 5, 1906. Under Int. Conv., Jan. 11, 1906.

THE furnace is cylindrical in form and has a rotatable grate, above which, on the same side as the charging door, is a hood or curtain arch, which projects downwards so that only a narrow opening is left for the passage of the gases. When fresh fuel is charged in, the products of distillation are deflected downwards by the hood and are forced through the narrow opening and through the incandescent bed of fuel on the opposite side of the grate, and so become completely burned. The supply of air beneath the bars on the charging side, may be shut off by a damper, and air may be supplied, by a special flue, to the distillation products as they pass to the hot bed of fuel through the narrow space.—W. H. C.

Hydro-extractors ; Impts. in —— to facilitate the simultaneous rapid discharge of material from and scraping clean the inside of the revolving basket, as the material is being discharged from it. G. W. Sutton, Stevenage, Herts. Eng. Pat. 15,744, July 12, 1906.

THE bottom of the basket is formed of a number of trap-doors hinged to narrow radial arms by which the drum is attached to the spindle. The trap-doors are attached by rods to a ring on the spindle, which can be raised or lowered by a lever, so that the doors are simultaneously opened or closed. When the doors are opened, the same movement of the lever causes a circular spring scraper to move downwards over the interior surface of the perforated drum and to completely scrape out the contents. The basket may have a frusto-conical, instead of a cylindrical form, and the scraper may be dispensed with. —W. H. C.

Filter-press-plates for Anglo-American presses. R. and G. Koeber, Harburg, Germany. Eng. Pat. 16,827, July 25, 1906. Under Int. Conv., March 19, 1906.

THE press-plates are formed with a raised edge all round, so as to completely enclose the material being pressed. It is stated that there is less strain on the cloths used to enclose the material and consequently less danger of bursting. The edges of the cakes, owing to the sloping inner side of the raised edge, are as completely pressed as the centre.—W. H. C.

Towers and other apparatus used for the absorption or elimination of chemical vapours ; Construction of ——. The Mayor, Aldermen, and Citizens of the City of Bradford, W. Wild, Bradford, and S. W. Shepherd, Shipley. Eng. Pat. 19,001, Aug. 25, 1906.

THE tower is packed with a series of crossed layers of vertical or inclined glass strips. The ends of the strips fit into the grooves of, and are supported by, special grooved bricks which are built into the lining of the tower. The depth of the glass strips is slightly less than that of the bricks, in order to allow a space between each layer. —W. H. C.

Separators ; Centrifugal ——. I. P. B. Knudsen, Copenhagen, Denmark. Eng. Pat. 25,327, Nov. 9, 1906.

THE vertical shaft from which the drum is suspended, so that it is free to oscillate, is supported by a movable guide-pivot around which the drum revolves. The pivot works in a fixed bearing with a ball-guide, and is enclosed outside the latter by a spring, or between fixed and tightened cords which take up the vibrations transmitted to the pivot.—W. H. C.

Mixing, attemperating, condensing or effecting reactions between liquids and gases ; Apparatus for ——. O. Guttmann, London. Eng. Pat. 4407, Feb. 22, 1907.

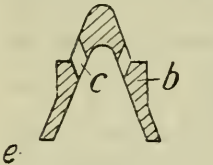


FIG.1

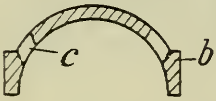


FIG.2.

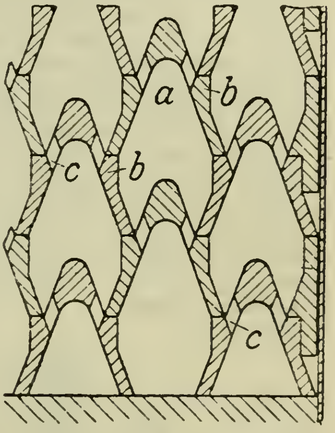


FIG.3

CHANNEL-SHAPED pieces of suitable material, having a cross-section of the forms shown in Figs. 1, or 2, and provided with gas passages and draining holes, *c*, and projections or shoulders, *b*, are built up into a honeycombed structure as shown in Fig. 3. It is stated that a larger surface of liquid is exposed, less resistance is offered to the passage of the gas, and greater contact between liquid and gas is obtained than with previously described forms of apparatus.—W. H. C.

Drying-furnace. J. Caygill, Wheeling, W. Va. U.S. Pat. 858,260, June 25, 1907.

SEVERAL heating pockets, open above but closed below, project through the flat roof of a furnace into the space above the fire. The products of combustion escape from the furnace through a flue in the side, just below the roof, into a downtake flue. The latter is also connected to a chamber formed by a cap or hood over the roof of the furnace, which encloses the upper ends of the pockets. Air is conveyed to within a short distance of the bottom of the latter by pipes connected to an air main, and, after becoming heated, escapes from the open ends of the pockets into the chamber above the roof of the furnace, and thence to the downtake flue.—W. H. C.

Filter. A. Lindemann, New York. U.S. Pat. 858,610, July 2, 1907.

A NUMBER of filter-bags, kept distended by enclosed frames, is suspended in a closed casing, into which the liquid to be filtered is delivered. The frames are rectangular, and are formed of laths kept apart by cords stretched between them, and provided with openings to allow the filtrate passing through the bags to reach the interior of the frames. The filtrate is discharged through pipes which pass through the bags. The latter are slightly wider and considerably longer than the frames, so that when they are in position, the bag presents a corrugated or folded surface. When the deposit on the exterior of the bags becomes too thick to allow the filtration to continue, the supply of liquid is cut off, and a fluid under pressure is admitted to the interior of the frames to give the bags a vibratory motion, which causes the deposit to fall off.—W. H. C.

Pressure-filter. A. E. Davis, Johannesburg, Transvaal. U.S. Pat. 859,749, July 9, 1907.

A SERIES of grooved filter-frames covered with cloth is suspended in a closed tank provided with a hinged bottom which acts as a discharge door. The liquid to be filtered is fed into the tank, the bottom door being closed, and the clear portion passes through the cloths to the grooves, which are connected by suitable passages with a common discharge main at the top. The solids collect on the exterior of the cloths, and are prevented from adhering to the top and sides of the tank by forming the upper part and sides of the filter-frames without grooves. When sufficient solid matter has collected, the supply of liquid is cut off, and that which remains in the tank is drained off through a pipe in the bottom. Wash water is then admitted to the tank and passes through the cakes, washing out the solution. The bottom discharge door is next opened, and the solids washed off the cloths by water forced in the reverse direction through them from the filtrate-discharge pipe.—W. H. C.

Compressing air or other elastic fluid for the production of motive power; Apparatus for ——. J. Gill, Edinburgh. U.S. Pat. 859,213, July 9, 1907.

SEE Eng. Pat. 8753 of 1905; this J., 1906, 523.—T. F. B.

Distilling and evaporating; Means or apparatus for ——. O. Unglaub, Salford. U.S. Pat. 859,352, July 9, 1907.

SEE Eng. Pat. 18,172 of 1905; this J., 1906, 1032.—T. F. B.

Centrifugal machine; Suspended —— with periodical automatic discharge. J. Kostalek. Fr. Pat. 374,601, Feb. 13, 1906.

FIG 1

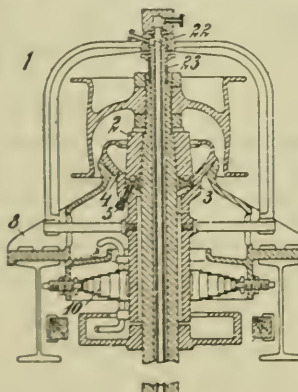
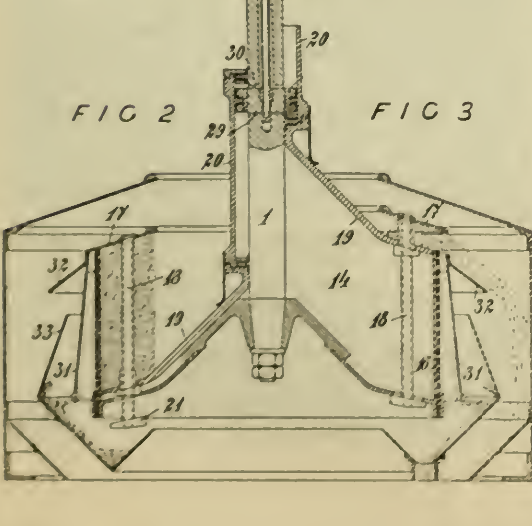


FIG 2 FIG 3



THE basket, 14, is attached to the spindle, 1, and the latter is suspended by the ring, 2, supported, when the machine is at rest, on the ring, 3, and the cup, 4, which are carried by the casting, 8. When the machine is in motion, the whole of the weight is carried by oil injected under pressure through the passages, 5, so that there are no solid parts in contact to cause friction. Excessive oscillation is prevented by the conical springs, 10. The basket, 14, has a movable top, 17, attached by the rods, 18, to a false bottom, 19, carried by the hydraulic cylinder, 20, concentrically surrounding the spindle, 1. During the time that the machine is being filled, and whilst the liquid is being expelled, the false bottom is lowered as shown in Fig. 2, the liquid passing through the perforations in the drum, 16, into the collecting trough, 33. The screen, 31, fastened to the basket, prevents splashing. As soon as the material is dry, a liquid under pressure admitted through the channels, 23, 30, to the cylinder, 20, causes the false bottom, 19, and the cover, 17, to rise into the position shown in Fig. 3. The solids are discharged over the upper edge of the drum and are guided by the inclined plate, 32, fastened to the basket. When the latter is empty, a liquid under pressure injected through the channels, 22, 29, forces the false bottom back into the position shown in Fig. 2, and the machine is filled again. —W. H. C.

Filtration of liquids; Process and apparatus for the ——. C. H. Perrin. Fr. Pat. 375,098, May 4, 1906.

THE liquid is filtered through a felted layer of suitable fibres, which is formed on a perforated metal plate serving as a support. The fibres are introduced into the apparatus in suspension in water, and are caused to pack and felt on the supporting plate by the application of pressure, *e.g.*, by centrifugal force or by producing a vacuum on the opposite side of the plate. One form of construction is similar to a centrifugal machine, the outer case and cover of which may be hollow, to allow of the introduction of steam when desired, and the outlet of which is trapped to prevent the drum acting as a fan and drawing air through the filtering layer. In another form, the apparatus is similar to a filter-press mounted so that it can be turned into a vertical position during the formation of the felted layer. When the latter becomes choked with impurities, it is removed from the apparatus and washed in running water until the fibres are separated and the dirt is washed out. The clean fibres remain suspended in the last wash-water and are ready for use again.—W. H. C.

Desiccator for air or gas, specially applicable to apparatus for the production of sulphur dioxide. P. Marin. Fr. Pat. 374,519, Feb. 11, 1907.

THE air or gas, which may be under atmospheric or increased pressure, is passed upwards through a vertical cylinder in which a number of trays of metallic gauze are placed. These trays support calcium chloride or other suitable dehydrating agent and are spaced apart, so that the gas comes into intimate and repeated contact with the drying agent.—W. H. C.

Measuring apparatus for liquefied gases. P. V. Pacottet. Fr. Pat. 374,743, Feb. 13, 1907.

A MEASURING tube provided with inlet and outlet valves at the bottom, is screwed on to the reservoir of liquefied gas, and the outlet valve closed. The valve leading from the reservoir is opened, and the liquefied gas rises into the measuring tube, expelling the air or gas therein through a valve at the top. As soon as the liquid reaches this valve, the height of which may be adjusted to vary the quantity measured, it closes automatically. The inlet valve is then closed, the outlet opened, and the measured quantity of liquefied gas allowed to escape.—W. H. C.

Drying-drum. Maschinenbauanstalt, Eisengiesserei und Dampfkesselfabrik H. Paucksch, Act.-Ges. Fr. Pat. 375,063, Feb. 26, 1907.

AGITATOR blades, fixed to a frame between and above two rotating heated drying drums, have a to-and-fro movement communicated to them by suitable gearing, in order to agitate and ventilate the material which is being dried on the surfaces of the drums. The blades are bent and are curved to the shape of the drums, and fixed blades are interposed between the agitators to prevent the material from being carried forward by the latter. —W. H. C.

II.—FUEL, GAS, AND LIGHT.

Motor Fuels. Chem. Trade Journal, July 27, 1907. [T.R.]

THE Fuels Committee of the Motor Union of Great Britain and Ireland, under the chairmanship of Dr. H. S. Hele-Shaw, F.R.S., which was appointed in September, 1906, "to inquire into the recent alarming rise in the price of petrol, and to report what steps, if any, can be taken to protect the interests of the private consumer," has now completed its labours. The Union hope shortly to issue the report in its complete form, when it will include various appendices, among which will be found a bibliography of fuels for internal-combustion engines, and a brief description of the fuels mentioned in the report.

The following are the recommendations of the committee:—

(1.) That, being of opinion that the introduction of alcohol as a fuel in the future is by far the most promising substitute for petrol, they recommend:—

- (*a*) That steps be taken to remove the restrictions on alcohol.
- (*b*) That a prize be offered for the best essay on alcohol as a fuel.
- (*c*) That trials be held to test the comparative merits of alcohol and petrol.

(2.) That the use of heavier spirit be encouraged.

(3.) That efforts be made to modify the present restrictions on the use and distribution of petrol.

(4.) That competitions for paraffin carburetters and vaporisers be organised.

(5.) That benzol, being a home production and more economical in use than petrol at the present time, be encouraged for use in motor cars

(6.) That a standing Fuels Committee of the Motor Union should be appointed for the purpose of giving effect to these recommendations.

Heats of combustion of organic substances, especially sugar and benzene; Adiabatic determination of the ——. T. W. Richards, L. J. Henderson, and H. L. Frevert. See XXIV.

PATENTS.

Coke ovens; Horizontal regenerative ——. F. J. Collin, Dortmund, Germany. Eng. Pat. 7650, March 30, 1907. Under Int. Conv., April 4, 1906.

HEATING gases are caused to pass alternately upwards and downwards in each heating flue of a regenerative coke-oven, the change of direction occurring at each reversal of the draught. No flue is traversed merely by products of combustion, and each flue receives continuously a direct supply of gas.—H. B.

Producer gas generators. J. B. Wilkie, St. Michaels, and T. W. S. Hutchins, Manchester. Eng. Pat. 12,467, May 29, 1906.

A GAS producer, in which the "blow" is upwards and the "make" downwards, is provided at its base with air conduits so arranged that, when worn out by the intense heat, they can be removed without interference with the main refractory lining. The producer is surmounted by a tubular boiler, opening into the chimney, and a steam pipe is directed upwards into the latter; during the "blow" period, air is drawn up through the fuel by natural draught, aided by the injector action of the steam jet in the chimney, the hot products of combustion passing through the tubular boiler on their way to the chimney.—H. B.

Coal- and water-gas; Production of ——. W. Thomas, Vancouver, British Columbia, and P. Thomas, Wellington, Somerset. Eng. Pat. 16,498, July 21, 1906.

THE coal is carbonised by stages in a retort formed of an inclined or horizontal portion opening into a vertical portion, the gas generated being led off at the top of the vertical portion and the coke withdrawn from time to time at the bottom. The coal is first introduced into the inclined or horizontal branch, and after being carbonised therein for two hours or so, it is pushed forward into the vertical portion, where the distillation is completed. A pipe for the admission of steam is provided near the lower end of the vertical retort, and at its upper end is an inlet for carburetting liquid.—H. B.

Gases; Apparatus for washing ——. F. E. Bachman, Port Henry, N.Y., U.S.A. Eng. Pat. 28,148, Dec. 10, 1906.

SEE U.S. Pats. 844,312 and 844,313 of 1907; this J., 1907, 399.—T. F. B.

Incandescence bodies for electric glow lamps; Method of producing metallic ——. Deutsche Gasglühlicht A.-G. (Auerges.), Berlin. Eng. Pat. 14,816, June 28, 1906. Under Int. Conv., Oct. 28, 1905.

IN the manufacture of metallic filaments, especially filaments of tungsten, the process of sintering is effected by passing through them a continuous or direct current, instead of an alternating current.—H. B.

Glow-bodies for electrical apparatus; Metallic ——. A. Lederer, Vienna. Eng. Pat. 20,209, Sept. 11, 1906.

FOR the purpose of determining whether inequalities in cross-section exist, in metallic filaments for use in incandescence lamps, the filament under examination is subjected momentarily to the action of an electric current in a gaseous atmosphere capable of reacting upon the filament when heated. For example, a tungsten filament may be heated in air or other oxidising gas. The reaction will take place most rapidly at any thin parts of the filament, and the changes of colour produced, enable such thin parts to be detected readily on subsequent examination.—H. B.

Fuel; Method of burning finely-divided ——. G. S. Welles, Chicago, Ill. U.S. Pat. 858,640, July 2, 1907.

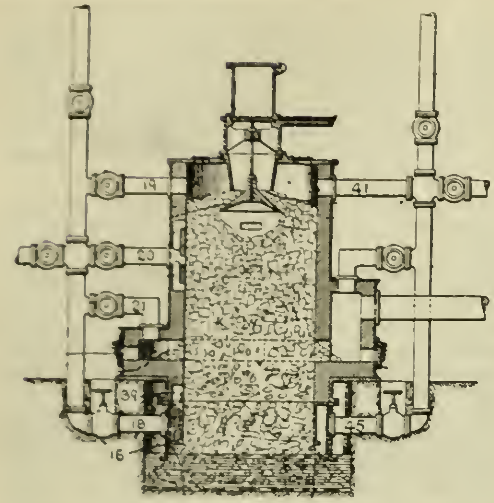
AIR which has been previously heated, is introduced into a combustion chamber, in lateral, rotating currents, which follow the peripheral walls of the chamber, and a mixture of finely-divided fuel and a heated "fluid vehicle" therefor, is also projected into the chamber and directed relatively radially into the air currents.—W. C. H.

Gas-producer. T. Curry, Pittsburg, Pa. U.S. Pat. 858,580, July 2, 1907.

THE gas-producing furnace described comprises a closed inner chamber, which is practically entirely surrounded by a hot-air space. The lower end of the furnace is surrounded by a circular pipe, provided with a number of branch pipes, by which steam or air may be forced into the hot-air space, and into the grate in the furnace. There is a substantially horizontal escape flue leading from the hot-air chamber, and a tubular escape flue from the heating chamber, which extends across the hot-air chamber, and is in telescopic communication with the former flue, its outer end being open and substantially surrounded by the outer flue. By this arrangement the flame from the inner chamber is surrounded by and fed with hot air from the outer chamber in order to completely burn the gases.—W. C. H.

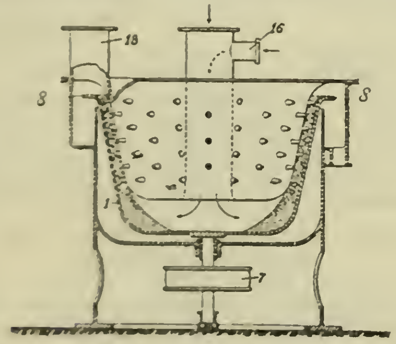
Gas-producer. P. Eyermann, Beloit, Wis., Assignor to Fairbanks-Morse Manufacturing Co., Beloit, Wis. U.S. Pat. 858,589, July 2, 1907.

THE producer, which is of the combined up- and down-draught type, consists of a casing to contain the fuel, and a gas-chamber situated at approximately the centre of the casing, and provided with a gas-outlet pipe. A main pipe is provided for supplying air or steam through the branches, 18 and 19, to the lower and upper portions of the casing; through the branch, 20, to a point in the casing above the gas-chamber; and through the branch, 21, to the gas-chamber. Pipes, 41 and 45, communicate with the upper and lower portions of the casing respectively, to convey away the waste gas. A casing, 16,



is suspended from the lower end of the fuel chamber, and is sealed in water as shown. Air and steam are supplied to the space between the casing, 16, and the annular member, 17, by the pipe, 18, and the pipe, 45, also communicates with the space, and a port, 39, extends from it to the interior of the fuel chamber. The producer is also provided with a chimney connected with the outside water-seal casing.—W. C. H.

Gas; Process of purifying ——. F. Brandenburg, Lendersdorf, Germany. U.S. Pat. 859,427, July 9, 1907.



The gas enters the apparatus by the pipe, 16, as indicated by the arrows, and passes through the ring, 1, of purifying liquid, maintained in position by the centrifugal-force developed by rotating the drum, 8, by means of the pulley, 7. The impurities are absorbed by the liquid, and the gas passes through the perforations of the drum to the outlet pipe, 18.—W. H. C.

Arc-light electrode. R. H. Read, Schenectady, Assignor to General Electric Co., New York. U.S. Pats. 859,579, 859,889, 859,890, and 859,891, July 9, 1907.

See Eng. Pat. 17,194 of 1901; this J., 1902, 334.—T. F. B.

Electric-light illuminant. R. H. Read, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 859,540, July 9, 1907.

The claim is for an electrode formed of a moulded pencil consisting chiefly of magnesium carbide mixed with a conducting diluent.—W. H. C.

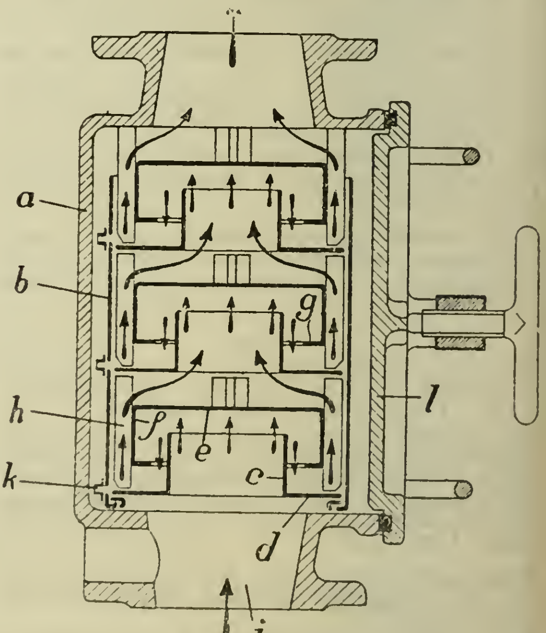
Combustible or other agglomerates; Apparatus for the drying of ——. H. Poulet. Fr. Pat. 375,163, Mar. 1, 1907.

The briquettes, etc., to be dried, are placed by means of a conveyor on the uppermost one of a series of horizontal moving endless bands of metal gauze, placed in a chamber through which hot air passes. The briquettes fall from one to the other of the moving bands, which are also given an oscillating motion, and repeatedly traverse the chamber from side to side in so doing, finally falling into one of a number of hoppers placed outside the chamber, in pits, through which the air passes on its way to the heater. After being thus quickly cooled, the briquettes fall into trucks. The hot air rises into the chamber through inclined gratings which retain any fragments of the briquettes.—A. G. L.

Coal; Apparatus for the distillation of —— *in the manufacture of coal-gas.* O. Guillet. Fr. Pat. 374,503, April 18, 1906.

A vertical retort is surmounted by a closed hopper, capable of holding sufficient coal for 12 or 24 hours' work, the top of the hopper being in communication with the hydraulic main. The gas generated in the retort is thus caused to pass through the body of raw coal in the hopper. Within the retort, below the heating zone, is arranged a pair of horizontal fluted rollers, or the like, which prevent the coke from descending, excepting when the rollers are rotated. The rollers are caused to turn from time to time, thus allowing the coke to drop into the lower portion of the retort, a fresh charge of coal descending automatically into the upper end of the retort. A jet of "pulverised" water is directed on to the hot coke beneath the rollers, whereby water-gas is generated.—H. B.

Gases containing particles of tar or other liquids; Apparatus for drying ——. Gasmotoren-Fabrik Deutz. Fr. Pat. 374,492, Feb. 9, 1907. Under Int. Conv., Feb. 12, 1906.



The apparatus consists of an external casing, *a*, containing a cylinder, *b*, in which is arranged a series of compartments, one above the other, each compartment being constructed of a short pipe, *c*, resting on an annular plate, *d*, and surmounted by a box, *f*, between the under edge of which and the pipe, *c*, is an annular opening, *g*. The gas, containing particles of tar and water in suspension, enters the apparatus at *i*, passes up through the pipe, *c*, impinges against the top, *e*, of the box, *f*, and is directed downwards through the space, *g*. It then passes upwards over the exterior of the box, and so in succession through each of the compartments. The distance pieces, *h*, maintain the box, *f*, in its correct position. The deposited tar, etc., are run off through the pipes, *k*. The side of the casing, *l*, can be removed to facilitate cleaning of the apparatus.
—H. B.

Combustible gases; Process of improving —— [by removing carbon monoxide]. Cie. du Gaz de Lyon. Fr. Pat. 375,164, Mar. 1, 1907.

Industrial gases, such as water-gas and coal-gas, are mixed with steam and passed at a suitable temperature (exceeding 400° C.) through a catalyser consisting of metals, oxides (preferably oxide of iron), or metallic salts. The carbon monoxide and steam react, with production of hydrogen and carbon dioxide. The carbon dioxide is then removed from the resulting gas by pumping the latter under pressure into a column of water or other suitable solvent. An arrangement of plant for carrying out the process economically is described.—H. B.

Mantles; Manufacture of incandescence ——. G. Buhlmann. Fr. Pat. 374,796, Feb. 18, 1907. Under Int. Conv., June 28, 1906.

To prevent the tendering of the fabric of, and absorption of moisture by, mantles which are to be stored and sold in the unburned state, the acidity of the solution of nitrates used for the impregnation is reduced, to a point short of precipitation of thorium hydroxide, by adding to it ammonia or other volatile alkali, or organic salts of the same, or oxides or hydroxides of thorium, cerium, glucinum, etc., or organic salts of these metals.—H. B.

Incandescence lamp filaments of tungsten; Manufacture of ——. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 374,659, Feb. 15, 1907.

Filaments of tungsten, when incandescent, can be bent to any desired shape. The filament to be treated is first covered with a protective coating, and is then heated either electrically or in a flame until it becomes incandescent, whereupon it is given the required form.—H. B.

Filaments for electric incandescence lamps; Manufacture of metallic [tungsten] ——. Deutsche Gasglühlicht A.-G. (Auerges.). Fr. Pat. 375,133, Feb. 27, 1907. Under Int. Conv., Aug. 30, 1906.

In order to prevent the irregular contraction which tends to occur during the concretion of tungsten filaments, the latter are put under slight tension by attaching a small weight to them during the process of concretion. —H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Toluene; Direct catalytic oxidation of ——. P. Woog. Compt. rend., 1907, **145**, 124—126.

When air charged with toluene vapour is passed over finely-divided platinum, the temperature gradually rises until the metal becomes incandescent, and the toluene is completely oxidised to water and carbon dioxide. Experiments were made with other catalytic agents deposited on pumice stone. The following results were obtained. Toluene is converted completely into benzaldehyde by iron oxide at 175°—300° C. or nickel oxide at 150° C., and partially by copper oxide at 180°—260° C. Manganese dioxide oxidises toluene completely, whilst carbon at 370° C. converts it into benzoic acid. In the case of nickel oxide small quantities of phenolic compounds are also produced. Incandescence is set up in the case of all the metallic oxides between 250° and 300° C. (See also this J., 1906, 717.)—G. W. McD.

Patents.

Petroleum oils; Process for purifying ——. E. W. Wynne, Seacombe, Cheshire. Eng. Pat. 2314, Jan. 30, 1907.

To 100 galls. of oil, 15 or 20 lb. each of borax, alum, and salt, dissolved in 12 galls. of boiling water are added. The mixture is allowed to stand for 15—30 minutes, and then from 5 to 15 pints of sulphuric acid are added, and the mixture is again allowed to stand for a similar period. It is then heated to 73°—100° F., and, finally, a gentle stream of air is blown through the mixture. The treatment causes the expulsion of explosive volatile vapours and the precipitation of "wax and tarry matters." The oil drawn off is stated to have a much higher flashing point and to be suitable for use as a lamp oil, etc.—W. H. C.

Lubricating oil from crude oil; Process for obtaining ——. W. J. Ryan, Chester, Del., and C. R. Burke, Cynwyd, Pa., U.S.A. Eng. Pat. 11,185, May 13, 1907.

See U.S. Pat. 854,057 of 1907; this J., 1907, 678.—T. F. B.

Mineral oils, lignite tar, and mineral oil residues; Process for purifying raw and distilled —— by means of sulphuric acid. F. Schwarz. Ger. Pat. 175,453, March 12, 1904.

Loss of oil is avoided in purifying mineral oils, etc., with sulphuric acid, by the addition of a sulphate or a compound of an alkali, alkaline-earth, or earth metal which forms a sulphate with sulphuric acid; no distillation or oxidising agent is required.—T. F. B.

Mineral oils and mineral oil residues; Process for removing the resinous and asphaltic compounds from ——. B. Diamand. Ger. Pat. 176,468, July 12, 1904.

The separation of the resinous or asphaltic constituents from mineral oils is effected by only a small quantity of fusel oil, but a much larger addition of the reagent is needed to cause the separated matter to settle. According to the present patent, only a small quantity of the reagent is used, and the separated asphaltic substances are removed by centrifugalising. (See also this J., 1907, 87.) —T. F. B.

Petroleum; Process for improving the odour of the distillates of crude ——. J. Dehnst. Ger. Pat. 178,771, Sept. 26, 1905.

When crude petroleum is distilled over sulphur, the distillates are stated to be less odorous than those produced in the usual manner.—T. F. B.

Mineral oils and tar oils; Process for separating the resinous impurities from the pure oil obtained by treating —— with sulphuric acid. J. Kusch. Ger. Pat. 181,255, Nov. 17, 1905.

The resinous mass at the bottom of the vessel in which the purification has been performed, is warmed to bring it to the consistence of a thin fluid, whilst the supernatant oily layer is cooled to a viscous condition by means of a worm, in order to prevent the two layers mixing when the contents are removed from the base of the vessel. —T. F. B.

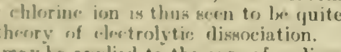
IV.—COLOURING MATTERS AND DYESTUFFS.

Triphenylcarbinol; Researches on the derivatives of ——. I. A. Baeyer. Annalen, 1907, **354**, 152—204.

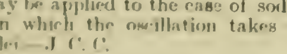
A large number of derivatives of triphenylcarbinol and diphenylphthalide has been prepared and examined with the view of throwing more light on the connection between colour and chemical constitution in the triphenylcarbinol series. The derivatives dealt with in this paper are those containing not more than one substituent in each benzene nucleus and are therefore termed "unitary" compounds. The following conclusions are drawn:—The lactone group in the phthaleins has no influence on the colour, and therefore only the hydroxy- and amino-derivatives of triphenylcarbinol are considered; these possess the following properties: (1) All carbinols are colourless; colour only results in consequence of the elimination of water from the molecule. (2) In the case of the mono-substituted derivatives, only the para compounds can split off water; thus from *p*-hydroxytriphenylcarbinol there is formed the orange fuchsone, and from the hydrochloride of *p*-aminotriphenylcarbinol the orange fuchsonimonium chloride. (3) The unitary disubstituted derivatives behave differently according as they belong to the oxygen or nitrogen series. (3*a*) Only those oxygen derivatives lose one molecule of water which contain at least one hydroxyl group in the para position. In this way para-, ortho-, or meta-hydroxyfuchsones are formed which are quite similar to fuchsone. All three dissolve in alkalis with an intense violet, blue-red, and blood-red colour respectively, but it is only the violet colour of the *p-p*-form which is stable. Further, the alkali solution of the latter alone shows a characteristic spectrum, namely, that of Benzaurin. (3*b*) The hydrochlorides of the unitary diaminotriphenylcarbinols correspond with the alkali solutions of the hydroxyfuchsones in that only the *p-p′*-form (Doebner's Violet) gives a characteristic spectrum, which is also identical with that of Benzaurin. The *p-m′*-compound behaves like the mono-*p*-amino-derivative, and in the *p-o′*-form, the tinctorial effect of the *p*-amino-group is actually weakened. Those derivatives which contain no amino-group in the para position do not give the slightest colour in acid solution. (4) Of the unitary trisubstituted derivatives in the oxygen series, only Aurin is known, which, in alkaline solution, shows a characteristic spectrum similar to that of Benzaurin. In the nitrogen series, *p*-Magenta corresponds with Aurin and it gives the same spectrum as does an alkaline solution of Aurin. Only those carbinols which contain at least two amino-groups in the para position, yield dyestuffs, as, for example, the *o*-amino-derivative of Malachite Green. The various triamino-derivatives which do not conform to this rule, give either colourless or only orange-yellow solutions in acids. (5) It is seen from the above that at least two hydroxy- or amino-groups in the para position must be present in order that a sharply-defined, characteristic spectrum containing a narrow band may result. The typical substances are: sodium-benzaurin and Doebner's Violet on the one hand, and sodium-aurin and *p*-Magenta on the other. In attempting to explain the origin of colour in "aniline- and Aurin-dyestuffs," the author agrees with Hartley's view that a retardation of the oscillation previously existing in the hydrocarbons may take place, so that the oscillations may be thrown back from the ultraviolet (where they occur in the case of benzene and triphenylmethane) to the visible portion of the spectrum. It is however, also possible that in the coloured molecule of the aniline dyestuffs, a rhythmic movement exists which induces ether-oscillations of definite wave-length and so produces a characteristic spectrum. Applying the rule that at least two amino-groups must be in the para position, and calling the benzene nuclei containing the amino-groups in diaminotriphenylcarbinol *a* and *b*, either may exist in the quinonoid form, and the quinonoid form *a* may pass into the quinonoid form *b* without the nature of the substance being changed. Possibly a continuous oscillation goes on which gives rise to the above-mentioned rhythmic oscillation of the ether. The same argument may be applied to the sodium salt of Benzaurin. The formulæ given show how this process may take place; the fourth valency of the central carbon atom being indicated, and it is seen that the movement can be traced to a simple oscillation of this carbon atom; the movement of the sodium or chlorine ion is thus seen to be quite in accord with the theory of electrolytic dissociation. The same reasoning may be applied to the case of sodium-aurin and *p*-Magenta in which the oscillation takes place in three benzene nuclei.—J. C. C.

Dibenzalacetone and triphenylmethane. A. Baeyer. Ber., 1907, **40**, 3083—3090.

Gomberg's recently expressed view (Ber., 1907, **40**, 1847) that the colour of the derivatives of triphenylcarbinol is due to a quinonoid transformation, is shown to be incorrect. According to this theory the quinonoid part of the double salts formed with ferric chloride by the bromide of tri-*p*-chlorotriphenylcarbinol and the chloride of tri-*p*-bromotriphenylcarbinol:



$$(C_6H_4Cl)_2C:C_6H_4<\begin{smallmatrix}Cl\\Br\end{smallmatrix} + FeCl_3 \text{ and}$$

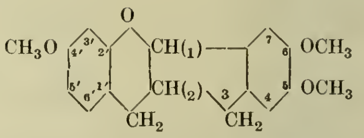


$$(C_6H_4Br)_2C:C_6H_4<\begin{smallmatrix}Cl\\Br\end{smallmatrix} + FeCl_3$$

is the same in each case, but the author's experiments show that, on treatment with water, the former salt loses bromine, and the latter, chlorine, so that they cannot have the quinonoid structure attributed to them by Gomberg. The results obtained from a study of a number of double salts of the above type, show that the colour of the double salts of *p*-halogen-substituted triphenylcarbinol chlorides is not due to a quinonoid transformation but to halochromism. This must also hold good for the unsubstituted triphenylcarbinol chlorides as well as for the sulphate and its halogen derivatives. As the colour of the compounds of the Aurin group and the corresponding members of the Magenta group is due to a quinonoid transformation, there are, therefore, two different origins of colour in the triphenylcarbinol series, namely, halochromism and quinonoid transformation.
—J. C. C.

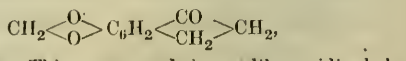
Brazilin and hæmatoxylin. VII. Synthesis of derivatives of hydrindene closely allied to brazilin and hæmatoxylin. W. H. Perkin, jun., and R. Robinson. Chem. Soc. Trans., 1907, **91**, 1073—1103.

Veratraldehyde, $(CH_3O)_2C_6H_3.CHO$, was converted, by condensation with ethyl acetate, in presence of sodium, into 3.4-dimethoxycinnamic acid (dimethylcaffeic acid), and this, by reduction, into 3.4-dimethoxyphenylpropionic acid. The latter, on treatment with phosphorus pentoxide, yields 5.6-dimethoxy-1-hydrindone, which when condensed with *p*-methoxysalicylaldehyde, in the presence of a trace of potassium hydroxide, is converted into 2′-hydroxy-4′.5.6-trimethoxy-2-benzylidene-1-hydrindone. This latter substance can be reduced to 1.2′-dihydroxy-4′.5.6-trimethoxy-2-benzylhydrindene, which, on boiling with glacial acetic acid, is decomposed, with elimination of water and formation of 4′.5.6-trimethoxy-1.2-hydrindochromane,



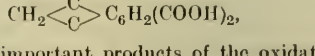
The synthesis of this compound is interesting in that it differs from trimethylbrazilin (this J., 1902, 110) only by one atom of oxygen, the CH_2 group connecting the hydrindene nucleus with the additional benzene ring, being replaced by a CH(OH) group.

By a similar series of reactions, but starting from piperonal instead of veratraldehyde, 5.6-methylenedioxy-1-hydrindone,



$$CH_2<\begin{smallmatrix}O\\O\end{smallmatrix}>C_6H_2<\begin{smallmatrix}CO\\CH_2\end{smallmatrix}>CH_2,$$

was obtained. This compound is readily oxidised by nitric acid with formation of hydrastic acid,



$$CH_2<\begin{smallmatrix}C\\C\end{smallmatrix}>C_6H_2(COOH)_2,$$

one of the most important products of the oxidation of hydrastine and berberine.—A. S.

Patents.

Isatine; Manufacture of reduction products of o-nitrophenylglycollic acid and of ——. G. W. Johnson, London. From Kalle und Co., Biebrich-on-Rhine, Germany. Eng. Pat. 17,164, July 30, 1906.

If a salt of *o*-nitrophenylglycollic acid, or the free acid itself, be reduced by zinc dust, in the presence of ammonium chloride, *o*-hydroxylaminephenylglycollic acid is obtained, which, by the action of a dehydrating agent, such as a mineral acid, is converted into anhydrohydroxylaminephenylglycollic acid.

Example I.—5 kilos. of *o*-nitrophenylglycollic acid are dissolved in 50 litres of water and 20 litres of a 10 per cent. sodium carbonate solution, or the corresponding amount of ammonia. To this solution, 2 kilos. of ammonium chloride and 12 kilos. of zinc dust are added, and the mixture is briskly stirred, the temperature gradually rising to 30—35° C. As soon as the reaction has ceased, the mass is cooled, filtered, and well washed. The filtrate is mixed with 5 kilos. of hydrochloric acid of 20° B., when anhydrohydroxylaminephenylglycollic acid separates in compact yellowish-white needles, which melt at about

162° C., and are easily soluble in hot water and cold dilute sodium carbonate solution, but less so in cold water. By using a smaller amount of zinc dust, nitrosophenylglycollic acid is obtained, which, on treatment with aqueous alkali, is converted into anthroxanic acid. The nitrosophenylglycollic acid by further treatment with a reducing agent, in the presence of ammonium chloride or acid, can be converted into hydroxylaminephenylglycollic acid.

Isatine is obtained if the anhydrohydroxylaminephenylglycollic acid be treated either with a dehydrating agent, or with an agent which produces intramolecular change, *e.g.*, acetic anhydride, or aqueous alkalis.

Example II.—10 kilos. of the anhydrohydroxylaminephenylglycollic acid are dissolved in 30 litres of water with an excess of sodium carbonate solution. On heating the deep violet solution thus obtained, it becomes almost colourless. It is then acidified, whereupon the isatin separates in the form of crystals, or a thick pulp.—P. F. C.

Azo dyestuff ; Black ——. O. Dressel, Elberfeld, and R. Kothe, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 858,444, July 2, 1907.

SEE Fr. Pat. 368,608 of 1906 ; this J., 1907, 16.—T. F. B.

Sulphide dyestuffs ; Preparation of blue and black ——. E. Vidal. Fr. Pat. 374,800, April 26, 1906.

WHEN aminohydroxytolylphenylamine, aminohydroxyditolylamine, aminohydroxytolylxylylamine, or the corresponding indophenols are heated with sulphur alone to 170—200° C., or with sulphur and sodium sulphide either to 110—140° C. or, with the addition of water, to the boiling point, dyestuffs are obtained which produce blue or black shades directly on cotton.—J. C. C.

Induline series ; Process for the preparation of substances [dyestuffs] of the ——. A. Ostrogowich and T. Silbermann. Fr. Pat. 374,715, Jan. 31, 1907.

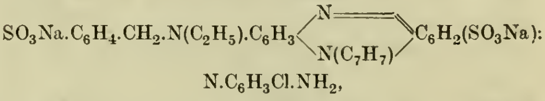
DYESTUFFS of the induline series are obtained by heating aromatic amines with the halogens or such substances which readily disengage halogens, to 180° C. The process may be modified by treating an amine hydrohalide (hydrochloride, hydrobromide, etc.) or a mixture of this and an amine with air or other oxidising agents in presence of water. (See this J., 1907, 604.)—J. C. C.

Dyestuffs ; Production of sulphurised vat —— *and of their sulphonic acids.* Badische Anilin und Soda Fabrik. First Addition, dated Feb. 16, 1907 (Under Int. Conv., Dec. 22, 1906), to Fr. Pat. 373,513, Dec. 31, 1906.

β-HYDROXYTHIONAPHTHENE and similar compounds when treated with sulphuric acid, form new red products, containing sulphur, which can also be obtained from the leuco-compounds previously described (this J., 1906, 1143 ; 1907, 89). These products are transformed into the Thioindigo Red dyestuffs described in the chief patent (this J., 1907, 680) on treatment with alkalis or acids, or on heating alone, or in the presence of indifferent solvents. The dyestuffs are also formed if the β-hydroxythionaphthene (10 parts) is left in contact with sulphuric acid (100 parts) sufficiently long (24 hours) to ensure the production of the intermediate product ; the reaction may be hastened by raising the temperature. The mixture is poured into ice-water, and the precipitate converted into the sodium salt.—J. C. C.

Sulphonic acids of the safranine series ; Process of preparation of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 374,832, Feb. 19, 1907.

WHEN monoacyl - *p* - diaminoarylphenylaminosulphonic acids of the general formula, $C_2H_3O.NH.R.NH.C_6H_3(NH_2)SO_3H$, and benzylalkylanilinesulphonic acids are oxidised together, indamines are formed, which, when oxidised in presence of primary aromatic amines, furnish dyestuffs, soluble in water, dyeing wool blue from an acid bath. *Example* 1 : 16 kilos. of acetyl-*p*-diaminodiphenylaminesulphonic acid and 15 kilos. of ethylbenzylanilinesulphonic acid are dissolved together in 500 litres of cold water with the addition of two molecular proportions of caustic soda. There is then added 16 kilos. of a solution of sodium bichromate containing 42 per cent. of chromic anhydride, and the mixture is poured into 33 litres of 30 per cent. acetic acid, the whole being stirred and kept at 0° C. In half an hour, 5 kilos. of aniline are added, and then, drop by drop, 8 kilos. of bichromate solution, which gradually produces a blue colour. The dyestuff is converted into the sodium salt, filtered from chromium oxide, and precipitated with salt. It forms a bronzy powder which gives a blue solution and dyes wool blue from an acid bath. When caustic soda is added to the aqueous solution, the colour changes to orange, and the powder gives, with concentrated sulphuric acid, the green colour characteristic of the Safranines. When the substance is heated with dilute sulphuric acid, the acetyl group is split off, and the resulting dyestuff produces blue shades on wool, which are considerably greener than those obtained by the use of the unsaponified dyestuff. *Example* 2 : When acetyl-*p*-diamino-*m*-chlorodiphenylamine-*o*-sulphonic acid is used in the first oxidation, and *p*-toluidine in the last, a brown-red powder is finally obtained, which dyes wool blue from an acid bath in rather greener blue shades than the acetyl compound described in the preceding example. On eliminating the acetyl group, the resulting dyestuff,

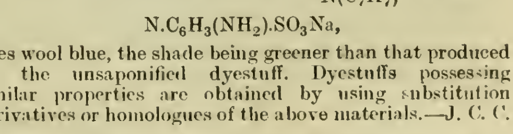


$$SO_3Na.C_6H_4.CH_2.N(C_2H_5).C_6H_3\begin{matrix}\diagup N = \diagdown \\ \diagdown N(C_7H_7) \diagup\end{matrix}C_6H_2(SO_3Na):$$
$$N.C_6H_3Cl.NH_2,$$

dyes wool blue from an acid bath, the shade being greener than that produced by the dyestuff just described. Similar dyestuffs are obtained by using homologues of the compounds mentioned in the first example.—J. C. C.

Safranine dyestuffs for wool ; Process for the preparation of blue ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 374,833, Feb. 19, 1907.

BLUE dyestuffs of the Safranine series, which dye wool blue, are obtained by oxidising monoacyl-*p*-monoaminoarylphenylaminosulphonic acids of the general formula, $R.NH.C_6H_3(SO_3H).NH.C_2H_3O$, in which the para position is free, together with alkylbenzyl-*p*-phenylenediaminesulphonic acids ; indamines are produced which are, in turn, oxidised together with aromatic primary amines. The method is similar to that described in the preceding abstract. The dyestuff furnished by oxidising *p*-toluidine with the indamine from monoacetyl-*p*-aminodiphenylaminesulphonic acid and benzylethyl-*p*-phenylenediaminesulphonic acid, dyes wool from an acetic acid bath, a slightly reddish, deep blue shade. Its properties resemble those of the dyestuff described in the first example of the preceding abstract. On heating with dilute acids, the acetyl group is split off, and the resulting dyestuff,



$$SO_3Na.C_6H_4.CH_2.N(C_2H_5).C_6H_3\begin{matrix}\diagup N = \diagdown \\ \diagdown N(C_7H_7) \diagup\end{matrix}C_6H_3:$$
$$N.C_6H_3(NH_2).SO_3Na,$$

dyes wool blue, the shade being greener than that produced by the unsaponified dyestuff. Dyestuffs possessing similar properties are obtained by using substitution derivatives or homologues of the above materials.—J. C. C.

Dyestuffs ; Preparation of orthohydroxyazo —— *and of intermediate products.* Act.-Ges. f. Anilinfabr. Fr. Pat. 374,834, Feb. 19, 1907.

AZO dyestuffs derived from diazotised 1 : 2- and 2 : 1-aminonaphtholsulphonic acids are obtained by first preparing the arylsulphonic ethers of the latter, by which means the amino group may be readily diazotised ; the diazo compound is then combined with the usual components. The arylsulphonic group is finally eliminated by treatment with dilute aqueous caustic alkalis, and orthohydroxyazo dyestuffs result which give blue-black or violet-black shades on chromed wool. For example, the dyestuff obtained from 1 : 2 : 4-aminonaphtholsulphonic acid (through the *p*-toluenesulphonic chloride derivative) and β-naphthol, dyes wool a bright Bordeaux, which, on chroming, becomes a very bright blue-black, fast to fulling and cold water (compare Fr. Pat. 373,409 of 1906; this J., 1907, 680). When *m*-hydroxydiphenylamine is used instead of β-naphthol in the above example, a dyestuff is obtained which dyes wool a dull violet, and this, on chroming, gives a black shade fast to fulling and cold water. The combination of the same diazo compound with resorcinol furnishes a dyestuff giving a Bordeaux red shade on wool, which, on chroming, changes to blackish-violet.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Dyeing; Experimental investigations into the process of ——. J. Hübner. Chem. Soc. Trans., 1907, **91**, 1057—1073.

THE author has carried out a large number of experiments on the absorption of dyestuffs, etc., by textile fibres and various inert substances, under different conditions, and also the behaviour of the dyed materials when submitted to diverse treatments. In some preliminary experiments, cotton and wool in varying stages of disintegration (*i.e.*, in the ordinary condition and after treatment for different periods in a beating engine) were dyed in solutions of Night Blue at the ordinary temperature. In the case of cotton, the absorption of the dyestuff by the unbeaten material increased continuously during the 72 hours of immersion, whilst with the most highly disintegrated material, the colour was absorbed very rapidly during the first hour, but afterwards only very slightly. In accordance with practical experience in the dyeing of paper pulp with basic dyestuffs, it was found that the most highly disintegrated cotton, although it absorbed more than twice as much dyestuff as the unbeaten material, was dyed only to about the same shade. In the case of wool, the total amount of dye absorbed and the tint of the dyed material is independent of the state of disintegration of the fibres, but as with cotton, the speed with which equilibrium is established between fibre and dye-liquor is greater, the more highly disintegrated is the material. Comparative test with artificial silk of two kinds, of which the average diameter of the fibres was 0·0299 mm. and 0·184 mm. respectively, but which were otherwise identical, showed that the absorption of Night Blue was roughly proportional to the surface exposed. Similar results were also obtained in experiments on the absorption of Night Blue by coarse and fine emery powder. The results of comparative tests on the dyeing of cotton, wool, silk, China clay, graphite, and charcoal with the basic dyestuff, Night Blue, are shown in the following table. In each case, 10 grms. of the dry material were dyed in 750 c.c. of liquor containing 0·25 grm. (3·5 grms. in the case of charcoal) of the dyestuff. The figures in the second column of the table give the weight of dyestuff absorbed during 72 hours' immersion in the cold liquor; column 3 gives the amount absorbed in 72 hours in the cold, followed by heating for 1 hour to 95° C.; and col. 4 gives results obtained in the same way as those of col. 3, except that after heating for one hour at 95° C., the liquor was allowed to cool and remain in contact with the material for another period of 72 hours before examination.

Material	Weight of dyestuff absorbed in grms.		
	Cold.	Hot.	Cooled.
Cotton	0·036 (0·144)	0·04 (0·16)	0·04 (0·16)
China clay	0·1693 (0·6772)	0·17 (0·68)	0·172 (0·688)
Graphite	0·2449 (0·9796)	0·2474 (0·9896)	0·249 (0·996)
Wool	0·05 (0·2)	0·23 (0·92)	0·2486 (0·994)
Silk	0·236 (0·944)	0·246 (0·984)	0·249 (0·996)
Charcoal	3·123 (0·8923)	3·495 (0·9987)	3·5 (1·0)

Note.—The numbers enclosed in brackets represent the amount of colouring matter absorbed as a fraction of the weight taken.

With all the materials mentioned, after a few washings, the dye did not "bleed" into water, but "bled" freely in a hot solution of Marseilles soap.

Similar comparative experiments with the acid dyestuffs, Naphthol Yellow S, Ponceau RR, and Acid-magenta, both with and without the addition of sulphuric acid to the dye-bath, showed that the analogy between the absorption of basic dyestuffs by fibrous and by inert absorbents is also apparent in the case of acid dyestuffs. With these latter, however, there is a striking difference between the behaviour of some of the inert materials and that of others, just as there is between vegetable and animal fibres. Graphite and China clay absorb acid dyestuffs in exactly the same kind of way as do vegetable fibres, such as cotton, whilst charcoal behaves like animal fibres, such as wool and silk. The analogy between cotton and graphite on the one hand, and wool and charcoal, on the other, was also observed in comparative tests with direct-dyeing cotton dyestuffs such as Diamine Sky Blue FF and Congo-rubine, and this analogy extends to the behaviour of the dyed materials with various reagents—water, soap solution, etc. In further experiments, wool and charcoal were dyed with the acid dyestuff, Scarlet RR, then "topped" with Night Blue, and the dyed materials treated with alcohol, hot and cold water, etc. It was found that the charcoal dyeings behaved exactly like the wool dyeings, *i.e.* the Night Blue was extracted by alcohol, and the Scarlet RR by hot water, whilst the dye or colour-lake was practically fast to cold water. Similar experiments showed that cotton, charcoal, and graphite also behave alike when dyed with the direct-dyeing cotton dyestuff, Benzopurpurin 4 B and then "topped" with Night Blue. In view of the results obtained, the author considers it may be safely concluded that all of the dyeing processes described, are due to purely physical or mechanical absorption.

A few experiments were also carried out on the absorption of iodine from its solution in potassium iodide. Cotton and China clay absorb a small amount, whilst graphite absorbs rather more; wool and charcoal absorb very large quantities of iodine. The absorbed iodine is removed quickly and completely from cotton, China clay and graphite by washing with water. From wool and charcoal, on the other hand, the iodine can only be removed completely by such solvents as alcohol or potassium iodide. (See also this J., 1905, 223, 1907, 682.)—A. S.

Dyeing; Desolution effects in ——. W. P. Dreaper. J. Soc. Dyers and Col., 1907, **23**, 188—189. (See also this J., 1905, 223.)

THE author criticises the paper of Hübner (see preceding abstract) and gives the results of experiments indicating that there is no essential difference in the behaviour of inert materials, *e.g.*, silica, towards basic, acid, and direct dyestuffs. He makes use of a device termed an "aggratometer," consisting of a glass tube, 3 ins. long and ½ in. diam., covered at one end with a cap of fine copper wire gauze. At two inches from the end, the tube is marked, giving a definite volume. The tube is filled with fine white sand up to this mark, and the solution is introduced from a burette and allowed to percolate through the sand at the rate of not more than 5 c.c. per minute. The following results were obtained:—*Basic dyestuff.* With a 0·1 per cent. solution of Night Blue, the sand absorbed 2 c.c. before liquid began to pass through. Six c.c. of solution then passed through practically colourless, but at 6·1 c.c., the solution was again highly coloured, indicating that the saturation point had been passed. *Acid dyestuff.* From a 0·1 per cent. solution of Crocein M, 2·1 c.c. were absorbed by the sand, and then 1·5 c.c. of colourless liquid passed through; from the 5 c.c. of solution passed through in all, 38 per cent. of the dyestuff was retained by the sand. *Direct dyestuff.* On passing through 5 c.c. of a 0·1 per cent. solution of Cotton Red R, 85 per cent. of the colour was retained whilst 97 per cent. was held back from a similar solution containing 2 per cent. of sodium chloride. —A. S.

Diazotisation of p-nitraniline as sulphate; Study of the ——. *III.* F. Erban and A. Mebus. Chem.-Zeit., 1907, **31**, 687—688. (See this J., 1907, 819.)

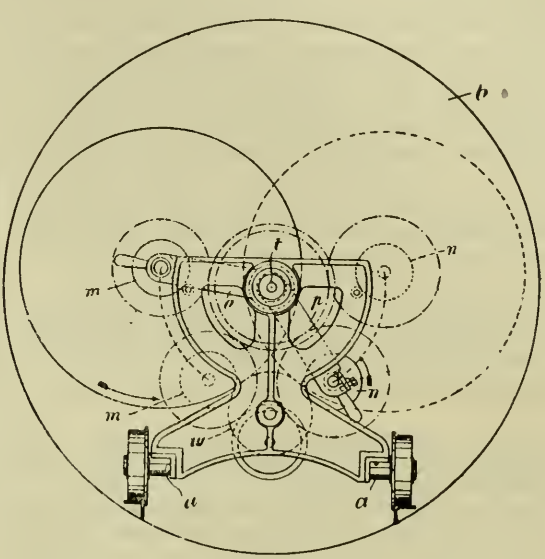
WHEN only 2½ equivalents of sulphuric acid are used, *p*-nitraniline cannot be properly diazotised, titration experiments having shown that in this case no free mineral acid remains at the end of the experiment. Similar experiments with hydrochloric acid showed that when four equivalents were used, two equivalents remained in the free state after diazotising. This difference in behaviour of diazotised *p*-nitraniline sulphate and chloride is not found in the case of aniline, for when four equivalents of sulphuric acid were used, two equivalents were found in the free state, after diazotisation, by titration with sodium carbonate using methyl orange as indicator. The diazo-solution of *p*-nitraniline was also prepared by acidifying Nitrosamine paste with hydrochloric and sulphuric acids respectively, with a calculated excess, in each case, of 1·95 equivalents of free acid. The diazo chloride became cloudy only when 1·7 equivalents of the free acid had been neutralised, whilst the diazo sulphate began to be cloudy when 1 equivalent of acid had been neutralised, and showed an alkaline reaction when only 1·25 equivalents had been neutralised. When caustic alkali was used instead of sodium carbonate, the alkaline reaction was only reached when 1·7—1·8 equivalents had been neutralised.—J. C. C.

PATENTS.

Bleaching, scouring, dyeing or otherwise treating fabrics in the open condition. E. W. Hunt and W. Moscrop, Middleton, Lancs. Eng. Pat. 20,494, Sept. 15, 1906.

THE tissue to be bleached, etc., is wound in the open state upon one of the two batching rollers *m*, *n* (see figures), and thus placed upon the carriage, *a*, which is then conveyed into the kier, *b*. The batching rollers are supported upon radial arms, *o*, *p*, which, as the tissue is drawn from one roller to the other, move in the direction of the arc of a circle round the axes of the studs, *t*, carrying them. The tissue passes partly round (usually below) the loosely-journalled roller, *w*, on its way to the batching roller upon which it is being wound. When almost the whole has passed from one roller to the other, a clutch, *d*, on the main shaft, *c*, is moved, for the purpose of bringing into operation either the counter-shaft, *j*, or the sleeve, *l*, loosely mounted upon this, *i.e.*, in order to drive the gearing which so far has been disconnected, and thus to reverse the direction of motion of the tissue, the nearly empty batching roller being now driven, and the other roller running freely. The alternate filling and emptying of each of the batching rollers is continued until the tissue has been sufficiently acted upon by the liquors with which it has been saturated or which are present in the kier, under the influence of the steam, etc., present in the latter. Means may be provided for automatically reversing the motion of the batching rollers or for giving a signal to enable the attendant to effect the reversal by hand.—E. B.

FIG 1



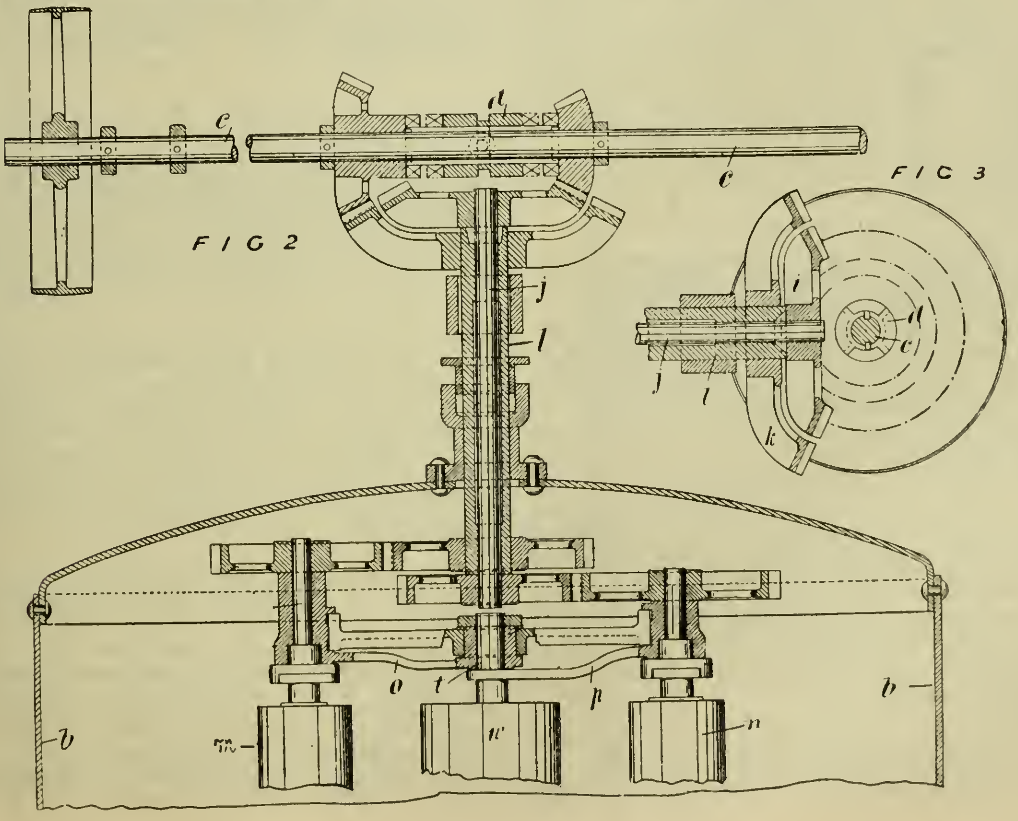


FIG 2

FIG 3

Mercerising and sizing fibrous material; Apparatus for ——. I. Sagar, Eccleston, Lancs. Eng. Pat. 27,438, Dec. 3, 1906.

The warp threads to be treated, travel over guiding rollers into a beck containing boiling water. Here they first travel over a small guiding roller, down to and underneath a larger roller, which is partially immersed in the water, and finally between squeezing rollers. This group of rollers forms a unit, and the beck may contain as many such units as desired. The warps next pass through another beck containing the mercerising solution, and furnished with rollers similarly arranged to those in the washing tank, and then through a second washing beck similar to the first, but provided also with spurt-pipes, which discharge water on to the yarn just before it enters the nip of the squeezing rollers. After a thorough washing, the warps travel through a sizing machine, and then over drying cylinders and through a separating device of the usual type. Throughout the whole machine, the small guiding rollers, which lead the yarn to the immersion rollers, are so arranged that the yarn bears on the immersion roller before it comes in contact with the liquid in the beck. The squeezing rollers are also so set that the warps do not leave the immersion roller until they have emerged from the liquid. Moreover, instead of allowing the passing yarn to rotate the immersion rollers, these, and also one of each pair of squeezing rollers, are positively driven by side shafts.—P. F. C.

Patterns and the like on tissues; Process for the production of transparent ——. A. Giehler, Chemnitz, Saxony. Eng. Pat. 17,487, Aug. 3, 1906.

See Fr. Pat. 368,662 of 1906; this J., 1907, 17.—T. F. B.

Cylinders for printing textile fabrics and paper; Production of ——. S. O. Cowper-Coles, London. Eng. Pat. 6963, Mar. 22, 1907.

A very thin layer of copper is electrolytically deposited on an iron or steel cylinder from an alkaline solution, and the cylinder is then transferred to an acid copper-depositing bath, where the deposition can be carried on more expeditiously. When the desired thickness of copper has been obtained, the roller is removed, and those portions which are to be in intaglio are coated with an insulating material or varnish, after which, copper is electrolytically deposited on those portions of the cylinder which it is desired to have in cameo. Before depositing the second thickness of copper, the surface of the cylinder may be engraved or etched, so that the pattern ultimately appears in different degrees on the copper, both in cameo and in intaglio.—P. F. C.

Singeing threads and yarns; Method of ——. G. Gin, Paris, and V. Courtecuisse, Lille, France. Eng. Pat. 4550, Feb. 25, 1907.

The thread is passed axially through a long metallic split tube, which is raised to the necessary temperature by an electric current. The tubes can be made of platinum, rhodium, iridium, or nickel covered with platinum, and have a lug at each end for the electrical connections. The threads can be passed successively through several tubes or through several grooves in a single piece of heated metal. When the singeing is effected in a single tube with a narrow groove, the natural supply of air may not be sufficient for the combustion of the fibres projecting from the thread. In such cases an air-blower is employed, which directs a very thin stream of air into the tube, and in order to prevent excessive cooling, the section of the tube is reduced at the point where it receives the jet of air. It is essential that the split tubes should be perfectly straight; they are, therefore, fixed only at one end, in order to permit free expansion. The tubes are arranged in groups which are connected in series, the members of each group being arranged in parallel.—P. F. C.

Silk-like threads; Manufacture of ——. R. Linkmeyer, Brussels. U.S. Pat. 857,640, June 25, 1907.

See Fr. Pat. 361,061 of 1905; this J., 1906, 692.—T. F. B.

Cotton-seed; Treatment of ——. I. Kitsee, Philadelphia, Pa. U.S. Pat. 858,075, June 25, 1907.

The hulls of the seeds are first broken by subjecting them to a bruising treatment, the kernels are removed, and the broken hulls, together with the adhering fibres, are treated with a hot solution of zinc chloride. The fibres are thus dissolved, and the hulls may be removed from the solution. —P. F. C.

Cotton-plant; Recovery of the fibre of the ——. T. W. McFarland, Chicago, Ill. U.S. Pat. 858,411, June 25, 1907.

The cotton-plants are first crushed and then treated with hot water until the gums and acids are removed from the finer fibres, and the coarser fibres are softened. The gums and lignin are then removed from the coarser parts of the plants by treating the mass, under pressure, with an alkaline solution of such strength that the finer fibres are not destroyed. An alternative process consists in subjecting the plants to the action of an alkaline "cooking" liquor and cotton-seed oil. The fine and coarse fibres are separated by flooding the mass with water, the fine fibres rising to the surface and being skimmed off. These processes can also be applied to the unblown "pods" of the cotton-plant.—P. F. C.

Dyeing machine. J. R. Greenwood, Boothwyn, Pa. U.S. Pat. 854,417, May 21, 1907.

The apparatus claimed is composed of: (i), a vat, containing, (ii), a framework, supporting (*a*), a pair of rollers, driven by means of gearing and serving to draw the materials to be dyed, into the vat; (*b*), a series of rollers, mounted in the same horizontal plane and driven in a direction opposite to that of the two entering rollers; (*c*), "auxiliary" rollers, adjacent to the two endmost rollers of the series (*b*), and rotated in the same direction as these; (*d*), a series of loosely-mounted rollers placed below the rollers of series (*b*), and driven by contact with the tissue, &c., which is being dyed; (*e*), a pair of squeezing rollers between which the tissue passes as it leaves the vat. The tissue is drawn across the vat to the entering rollers (*a*). It then passes over the system of rollers (*b*), (*c*), and (*d*) backwards to the squeezing rollers (*e*). —E. B.

Steaming cloth; Apparatus for ——. E. Senkbeil, Pankow, Germany. U.S. Pat. 858,032, June 25, 1907.

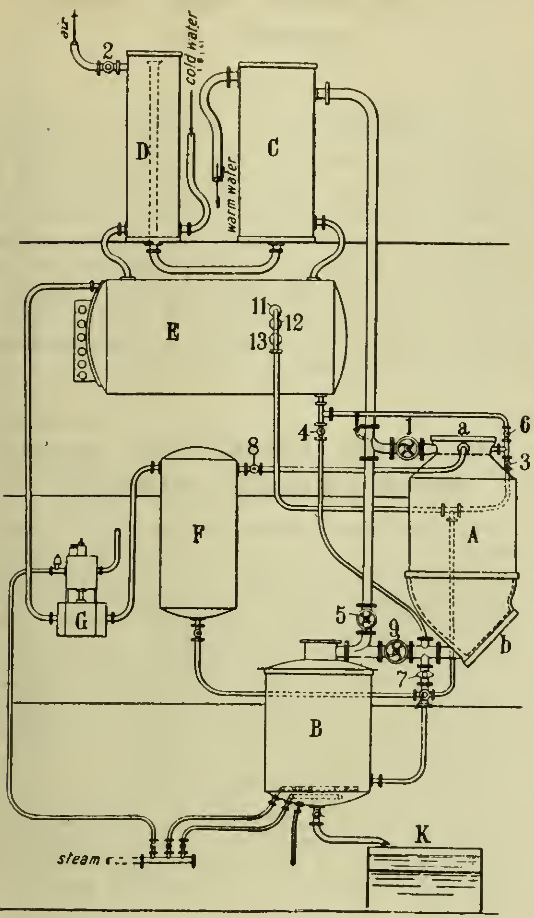
This machine consists of a steaming press which is combined with one or more tables for folding the cloth. Means are provided for moving the tops of the tables into and out of the press. The machine is also fitted with carriers for transferring the cloth from the press on to the table and *vice versa*. The carriers have perforated top plates. —P. F. C.

Fibres, artificial; Manufacture of ——. Gocher Oelmühle Gebr. van den Bosch. Fr. Pat. 374,790, Feb. 18, 1907.

The filaments immediately after their formation, are wound crosswise on bobbins which have an undulating surface, such that an end elevation of a bobbin would have a circumference like that of a cog-wheel. It is claimed that the use of such a bobbin protects the wound filaments from excessive tension and also allows an easy access of liquid to the filaments during subsequent operations.—P. F. C.

Wool washing by means of carbon tetrachloride; Apparatus for ——. P. Bernard. Fr. Pat. 374,544, April 19, 1906.

This apparatus comprises a closed vessel, A, (see fig.), fitted with two doors, *a* and *b*, for charging and emptying. The material, between perforated plates, is placed inside this vessel which is connected by means of pipes, fitted with valves, with a tank, B, which can be heated by a steam coil, and also with two condensers, C and D. A tank, E, for the carbon tetrachloride, an air-pump, G, and air reservoir, F, complete the apparatus, which is



operated as follows: The raw wool having been placed in A, and the doors closed, the valves 1, 2, 3, and 4, are opened, allowing the solvent from the tank, E, to enter the vessel, A, at the bottom, fill it, and overflow through 3, into the tank, B. The displaced air escapes through 1, into the condenser, C, the reservoir, E, and the refrigerator, D, before escaping by the valve, 2. As soon as A is full, the valve, 4, is closed. When all the air has been driven out, the valve, 1, is closed, and 4 is re-opened, and the tank, B, is heated by means of the steam-coil. The solvent from E, after passing upwards through the wool, flows over into B, where it is distilled, its vapours being condensed in C and D, and returning to E, whilst the fatty matter remains in B, and can be run off into a receptacle, K. A small quantity of water is placed in B, at the commencement of the operation, to prevent the fatty matter coming in contact with the steam coils. The direction of the solvent through the wool can be reversed by opening the valves, 6 and 7, instead of 3 and 4. As soon as all grease has been removed from the wool, the valves, 3, 4, and 6, are closed, and 7 and 8 are opened, thus allowing compressed air and gases from F, to pass through the wool, forcing the solvent before them into B, and also partially drying the wool. To remove final traces of solvent, the valves, 2, 7, 8, and 5, are closed, and 1 and 9 are opened, and the pump, G, set in action, thus causing a vacuum in E, C, A, and B. When the desired vacuum is attained, the tank, B, is heated, the solvent it contains being driven through the wool from bottom to top, and then into the condenser. The steam from B, follows the same path and removes the last traces of solvent from A. The pump, G, forces all the air, etc., into the reservoir, F, where it is ready for use in the next cycle of operations. The condensed water which collects in E, is run off into B, by means of the valves, 11, 12, and 13.—A. B. S.

Mineral and organic matters of the waste liquors from sugar factories or from the degreasing of wool, or of distillery vinasses; Separation and recovery of the ——. A. E. Vasseux. Fr. Pat. 374,564, Feb. 12, 1907. See XVI.

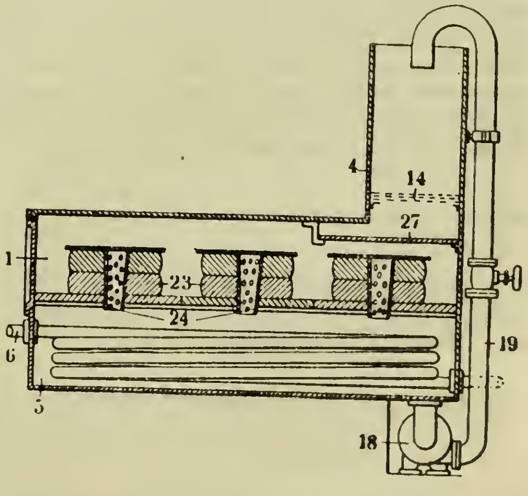
Linen, hemp and other analogous textiles; Bleaching of —— *without exposure on the grass.* L. C. P. Jardin. Fr. Pat. 374,580, April 20, 1906.

After undergoing the ordinary treatment for the removal of the most soluble impurities, the material is treated with a dilute solution of *aqua regia* at the ordinary temperature, and in diffused light, the strength of the solution used depending on the nature of the textile material. The treatment with *aqua regia* is repeated a number of times, according to the degree of bleaching necessary. Between each course of treatment the material is further treated with an alkaline liquid, either alone, or followed by "chloring." The material is finally soured and rinsed.—A. B. S.

Mercerising vegetable textile fibres, particularly in the form of flocks; Process for ——. Heberlein and Co. Fr. Pat. 375,068, Feb. 26, 1907.

The material is placed in a horizontal or vertical turbine centrifugal machine, which is set in motion before the fibres are impregnated with the concentrated solution of caustic alkali. This movement of the fibres is also maintained during the subsequent washing of the material. —P. F. C.

Wool, half-wool, threads and other textile material; Apparatus for the treatment of —— *by means of a liquid passing through the material under pressure, and running freely.* H. Giesler. Fr. Pat. 374,606, Feb. 13, 1907. Under Int. Conv., Feb. 14, 1906.



In this apparatus the pressure of the liquid varies automatically with the resistance which the material offers to its passage. The machine can be arranged for material in various stages of manufacture, the one shown in the figure being suitable for "top" dyeing. In this arrangement, 1 is the dye-vat containing the tops, 23, which are placed on perforated spindles, 24, projecting into a lower vessel, 5, containing a heating coil, 6, for heating the dye-liquor. At one end, is a raised "chimney," 4, fitted with perforated plates, 14 and 27. A centrifugal pump, 18, forces the liquid from 5, through the pipe, 19, into the "chimney," 4, whence it passes by its own pressure through the bobbins and back again into the lower vat, 5.—A. B. S.

Sulphide dyestuffs; Production of bi- and multicolour effects on cotton and wool union fabrics by means of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 374,677, Feb. 15, 1907. Under Int. Conv., Jan. 25, 1907.

Chromed wool has practically no affinity for sulphide dyestuffs. Colour effects are therefore produced by dyeing the chromed wool in a union fabric, either before or after treatment with sulphide dyestuffs. Reserve effects are produced by simply dyeing with a sulphide dyestuff, a union fabric containing chromed wool. Example:—10 kilos. of wool are treated for 1½ hours with 50 grms. of potassium bichromate, 50 grms. of lactic acid, and 50 grms. of sulphuric acid, and then washed and dried. The chromed wool is next woven with cotton, and the fabric dyed in a bath which contains in each 200 litres of liquor:— 800—1200 grms. of Katigen Black T W extra., 1600—2400 grms. of crystallised sodium sulphide, 2000 grms. of anhydrous sodium carbonate, 4000 grms. of common salt, and 7200—8800 grms. of acid sodium lactate. The goods are steeped in this bath at a temperature of 20—25° C. for 1¼ hours, then washed with water and finally with dilute acetic acid.—P. F. C.

Dyeing and bleaching of threads on bobbins by means of the "bundle" method; Arrangement for regularly distributing the dye-liquors and the gas in the ——. B. Spiegler und Söhne. Fr. Pat. 374,817, Feb. 19, 1907.

In a machine for treating bobbins in layers, the spaces between the bobbins are filled with perforated blocks or plates, which oppose an equal resistance to the flow of the liquids or gases, as the material to be treated does, and so prevent unequal dyeing or bleaching.—A. B. S.

"Rainbow" and silky effects on fabrics; Production of ——. Soc. de la Manuf. E. Zundel. Fr. Pat. 375,072, Feb. 26, 1907.

A fine uniform layer of colour is applied to the surface of the fabric by means of an engraved roller, which is fixed in an ordinary printing machine. The colour is only applied at the ends of the fibres, and thus the material exhibits different colours when viewed parallel to the surface and at right angles to it. To ensure that the colour shall be evenly applied, the fabric, as it passes over the surface of the roller, is kept at a constant tension by means of a series of guiding rollers, rotating at exactly the same rate. These guiding rollers have specially prepared surfaces to enable them to grip the fabric. The best results are obtained with woollen fabrics.

—P. F. C.

Indanthrene dyeings fast to chlorine and bleaching; Process for producing ——. F. Erban. Ger. Pat. 182,441, March 5, 1904.

Indanthrene is dyed or printed on fabrics, either alone, or with other dyestuffs, such as the iron lake of alizarin, and then steamed at a pressure of 4 to 5 atmospheres or at a corresponding temperature.—T. F. B.

Condensation products of β-methylanthraquinone or its side-chain halogenated derivatives; Process of fixing —— on the fibre. Badische Anilin und Soda Fabrik. Ger. Pat. 179,893, March 26, 1905.

The condensation products are made into a "vat" with alkaline agents, and the fibres dyed in this, or they are mixed with alkalis, with or without reducing agents, printed on the fibre, and steamed, or again they may be mixed with a reducing agent alone and printed on the fibre, and then passed through an alkali bath.—T. F. B.

Sulphide dyestuffs; Process of shading ——. Anilinfarben- und Extraktfabr. vorm. J. R. Geigy. Ger. Pat. 175,077, Aug. 26, 1905.

Shaded effects are obtained on dyeings with sulphide dyestuffs by treatment, after chroming, with a basic or substantive dyestuff which is susceptible to chroming.

—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Furs, feathers and other articles; Dyeing of ——. Act.-Ges. für Anilinfabr. Fr. Pat. 375,085, Feb. 26, 1907.

Claim is made for the use of *o*-amino-*p*-nitraniline for the dyeing of furs, feathers, etc. The shades obtained range from yellow to deep brownish-orange. The best results are obtained by adding a suitable oxidising agent to the bath. Example:—2 parts of the base are dissolved in 1000 parts of water, with enough hydrochloric acid to make the solution feebly acid, and then 20 parts of a 3 per cent. solution of hydrogen peroxide are added. The skin or other article to be dyed, is worked in this bath for about three hours and then washed and dried. The shade thus obtained is a deep brownish-orange.

—P. F. C.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Nitrate of soda output. Mining World, July 6, 1907. [T.R.]

For the fiscal year ending March 31, 1907, the nitrate of soda combination in Chile reported a production of 40,141,490 quintals (1,824,613 long tons), against 37,817,583 qtls. (1,718,981 tons) for 1905–1906; an increase of 2,323,907 qtls. (105,632 tons).

Exports by allotment were 43,500,000 qtls. (1,977,273 tons), against 39,000,000 qtls. (1,722,727 tons) for 1905–6; actual exports, 29,734,110 qtls. (1,351,550 tons), against 27,507,735 qtls. (1,250,351 tons) for 1905–6; exports to the United States, 7,218,262 qtls. (328,103 tons), against 7,917,206 qtls. (359,873 tons), for 1905–6.

Deliveries in Europe were 1,216,290 tons, against 1,230,880 tons for 1905–6; in the United States, 330,000 tons, against 337,000 tons for 1905–6, and in other parts of the world, 37,870 tons, against 36,060 tons in 1905–6. The total deliveries for the last fiscal year were 1,584,160 tons, against 1,603,940 tons in 1905–6; a decrease of 19,780 tons.

Monazite production in 1906. Eng. and Min. J., July 20, 1907. [T.R.]

According to the U.S. Geological Survey, the monazite produced in the United States in 1906 all came from North and South Carolina. The output of crude sand amounted to approximately 2,000,000 lb., averaging about 30 per cent. of monazite. The grade of this sand was so variable, and the prices realized on different lots were so irregular that cleaned sand has been used as an estimate of the quantity of monazite produced, an additional reason for so doing being furnished by the fact that the greater part of the crude material is cleaned by local mills before shipment, and the grade brought up to 80 per cent. or more of monazite. On a basis of 80 per cent. production, North Carolina produced 607,275 lb. of the mineral, valued at $125,510; and South Carolina, 148,900 lb., valued at $26,802; the total for the United States amounted to 846,175 lb., valued at $152,312. The production for 1905 amounted to 1,352,418 lb., valued at $163,408. This amount represented in part crude and in part cleaned sand—a fact that explains the increase in quantity without corresponding increase in value.

The condition of the monazite market in the United States in 1906 was fairly strong, despite the fact that the price of thorium nitrate was reduced nearly one-half early in the year by the German thorium combine.

Chamber process [Sulphuric acid]; Rational arrangement of the ——. H. Petersen. Z. angew. Chem., 1907, **20**, 1101—1105.

The essential for rapid, and hence "intensive" working of the chamber process is a sufficient supply of nitrous gases in the atmosphere; but the Glover tower may be overworked if the quantity of nitrous vitriol to be dealt with is large, and the denitration must then be incomplete, unless, on the other hand, the acid be diluted so far that the Glover tower cannot concentrate it to the requisite extent. To avoid this difficulty, the author uses a "double ring" arrangement. There are two pairs of Glover and Gay-Lussac towers, an outer and an inner. The first or inner Gay-Lussac tower is fed with acid of sp. gr. 1·6 to 1·65; this acid absorbs the greater part of the nitrous gases, is next completely denitrated in the second or inner Glover tower, and is then returned to the inner Gay-Lussac tower. The second or outer Gay-Lussac tower, fed with stronger acid (sp. gr. 1·7) completes the absorption of the nitrous gases, and the nitrous vitriol from this is denitrated and concentrated as usual in the first or outer Glover tower. This double system not only has the advantage of dealing completely with the nitrous gases, but also causes a considerable amount of reaction to take place in the two Glover towers, and hence relieves the chambers, and lessens the amount of corrosion occurring there. Between the last chamber and the first Gay-Lussac tower, the author introduces a "chamber regulator," *i.e.*, a tower through which cold nitrous vitriol of sp. gr. 1·6 is circulated continuously. This acid absorbs any sulphur dioxide or steam which may reach it through disturbance of the normal working of the chambers, or cools the gases if they leave the chambers unduly hot, and thus prevents the transmission of any such disturbance to the Gay-Lussac towers. When sulphur dioxide is absorbed, nitrogen oxides are set free; these are absorbed in the Gay-Lussac tower, and being set free again in the Glover tower, make good the deficiency in the chambers which allowed the escape of sulphur dioxide at the far end. On the other hand, if through deficiency of sulphur dioxide there be a temporary excess of nitrous gases at the end of the chambers, this is absorbed in the regulator, in part at least, and stored for future use. With the regulator, the chambers can be worked so as to allow sulphur dioxide much nearer the end than without it, and thus lessen the excess of nitrous gases near the end and consequently their action on the lead, lessening also, at the same time, the tendency to form those higher oxides of nitrogen which are difficult of absorption. Figures are given of the results of actual work with the "double ring" and the chamber regulator installed in systems which previously worked without them; these figures show great economy in the nitre consumption, with simultaneous increases in the yield of acid.—J. T. D.

Sodium carbonate; Causticising of ——. H. Walter. Monatsh. f. Chem., 1907, 28, 543—553.

THE author carried out a series of experiments on the equilibrium attained in the causticising of sodium carbonate, using (1), sodium carbonate, calcium hydroxide, and water, and (2), sodium hydroxide, calcium carbonate, and water, at temperatures of 106—110° C., 80°, and 62° C. respectively. At 62° C. equilibrium was not attained even after 40 hours. At 80° C. equilibrium was attained after about 32 hours, and at 106—110° C., after about 3—5 hours. At this last-mentioned temperature the reaction proceeded very rapidly at first, 57·5 per cent. of the sodium carbonate being already causticised after 2 minutes. The results may be expressed, for solutions not stronger than 4·7*N*, by the following formulæ, where $v=\frac{(\mathrm{NaOH})^2}{(\mathrm{Na_2CO_3})}$, and T = the total alkalinity of the solution; in both cases, the concentrations are expressed in 0·1 grm.-equivalents per litre.

$$\text{At } 106°—110° \text{ C.}: \quad v = 584{\cdot}4—8{\cdot}624 \text{ T.}$$
$$\text{At } 80° \text{ C.}: \quad v = 1337{\cdot}4—26{\cdot}55 \text{ T.}$$

It was found that the causticising proceeds somewhat further at 80° C. than at 106°—110° C., but, on the other hand, cooling the mixture to the lower temperature would increase the danger of loss of soda. (See this J., 1907, 253.)—A. S.

Sodium carbonate; Causticising of ——. R. Wegscheider. Monatsh. Chem., 1907, 28, 555—558.

THE author has compared Walter's results (see preceding abstract) with those previously obtained by Lunge and Schmid (this J., 1886, 240), and by Le Blanc and Novotny (this J., 1906, 1145), and finds that there is good concordance at 80° C., but that at the higher temperatures (100° C. and 108° C.), Walter's results are lower than those of the other investigators. This he considers probably due to a displacement of the equilibrium, owing to cooling, in the experiments of the latter, Walter having shown that the reaction velocity is very great above 100° C. From the two formulæ given by Walter, the author has calculated the formula: $v\delta = 348{\cdot}88—2{\cdot}6893\delta—(77{\cdot}767—0{\cdot}640214\delta)$ T, where δ = the temperature in Centigrade degrees. This formula gives results in accord with those obtained experimentally for temperatures not higher than about 108° C.—A. S.

Calcium-sodium carbonates; Conditions of formation of ——. R. Wegscheider and H. Walter. Monatsh. Chem., 1907, **28**, 633—672.

A DETAILED account of experiments as to the conditions under which double carbonates of calcium and sodium are formed, especially with reference to the loss of soda in the causticising of sodium carbonate. For the results of the experiments, see this J., 1907, 253.—A. S.

Aluminium nitride. F. Fichter. Z. anorg. Chem., 1907, **54**, 322—327.

PURE aluminium nitride is best prepared by heating finely-divided aluminium ("aluminium-bronze"), dry and free from grease, in a stream of nitrogen, a nickel tube being used. At 720°—740° C. a vigorous exothermic reaction commences, and further heating is not required. The operation occupies only a few minutes, but to obtain the nitride free from admixed metal, it is necessary to powder the product and renew the treatment with nitrogen. The compound is a bluish-grey, non-crystalline powder. It reacts slowly with damp air and readily with alkalis, ammonia being formed. Crude aluminium nitride is found to be directly applicable as a nitrogenous manure.—F. SODN.

PATENTS.

Hydrate of potash; Process for making crystalline ——. Salzbergwerk Neustassfurt und Theilnehmer, Zschherndorf, Germany. Eng. Pat. 6405, March 16, 1907. Under Int. Conv., July 16, 1906.

THE process is based on the following facts:—On cooling caustic potash solutions to a low temperature, anhydrous potassium hydroxide separates from those of over 85 per cent. strength; the monohydrate, $\mathrm{KOH,H_2O}$, crystallises from those of 59—85 per cent. strength; and the dihydrate, $\mathrm{KOH,2H_2O}$, from solutions of less than 58 per cent. strength. It is thus possible to obtain crystalline potassium hydroxide of from 61 to nearly 100 per cent. purity as desired, by choosing a solution of a certain strength, and removing the crystals when the concentration has attained a predetermined point. It is stated that potassium hydroxide monohydrate is relatively resistant to the action of moisture, and that it may be kept and transported, even in wooden casks.—A. S.

Alumina compounds; Manufacture of ——. E. L. Rinman, Upsala, Sweden. Eng. Pat. 15,590, July 10, 1906

SEE Fr. Pat. 367,756 of 1906; this J., 1906, 1147.—T. F. B.

Sulphuretted hydrogen, or gases containing sulphuretted hydrogen; Treatment of —— *for the obtainment of sulphur therefrom.* C. E. Tyers, J. Hedley, and The United Alkali Co., Ltd., Liverpool. Eng. Pat. 25,976, Nov. 16, 1906.

A SALT, or ore of titanium, or other titaniferous substance is used as the contact substance or catalytic agent in the recovery of sulphur from sulphuretted hydrogen, or gases containing it.—W. C. H.

Gypsum burning kilns. A. J. Boult, London. From F. Raithel, Windsheim, Germany. Eng. Pat. 26,755, Nov. 24, 1906.

SEE Fr. Pat. 371,989 of 1906; this J., 1907, 411.—T. F. B.

Borax; Utilisation of by-products obtained in the manufacture of ——. The Liverpool Borax Co., Ltd., and A. Fry, Liverpool. Eng. Pat. 4193, Feb. 20, 1907.

Borax-mud, obtained as a by-product in the manufacture of borax, is intimately mixed with soluble alginates, prepared from seaweed, with or without the addition of fibrous substances, to produce a new article of manufacture, that may be employed as a heat non-conducting material.—W. C. H.

Graphite [deflocculated]; Manufacture of ——, *and method of producing same.* E. G. Acheson, Stamford, Canada. Eng. Pat. 7775, April 3, 1907. Under Int. Conv., Dec. 10, 1906.

See U.S. Pat. 844,989 of 1907; this J., 1907, 417.—T. F. B.

Acids; Receptacle for ——. G. P. Adamson, Easton, Pa., Assignor to General Chemical Co., New York. U.S. Pat. 846,541, March 12, 1907.

A bottle, formed of glass, ceresin, or other suitable material, has the sides and bottom strengthened by a cylinder and plate of wire-gauze which are embedded in the material of the bottle. The lower edge of the gauze cylinder has a head formed on it which projects below the edge of the gauze plate embedded in the bottom of the bottle.—W. H. C.

Nitric acid; Process of manufacturing ——. W. Ostwald, Leipzig, Germany. U.S. Pat. 858,904, July 2, 1907.

See Addition of April 9, 1902, to Fr. Pat. 317,544; this J., 1903, 93.—T. F. B.

Sulphuric acid; Apparatus for concentrating ——. A. Gaillard, Barcelona, Spain. U.S. Pat 859,757, July 9, 1907.

See Fr. Pat. 367,376 of 1906; this J., 1906, 1146.—T. F. B.

Lime-kiln. J. H. Campbell, Strasburg Junction, Va. U.S. Pat. 858,951, July 2, 1907.

The lime-kiln comprises a stack, and one or more external furnaces, each having a discharge opening, at its inner (or stack) end, the full size of the maximum cross-section of the fire-chamber, and having hollow grate-bars arranged on a level with the bottom of the opening. Air-passages with discharge outlets extend around the openings at points between the stack and furnaces. Means are provided for forcing heated air through the grate-bars and air-passages, so as to produce a secondary combustion. —A. G. L.

Sulphate crystals; Method of recovering ——. F. H. Daniels, A. F. Backlin, and H. K. Swinscoe, Assignors to American Steel and Wire Co., Worcester, Mass. U.S. Pat. 857,793, June 25, 1907.

The acid solution of the metallic sulphate is partially or completely neutralised by means of the same metal as that forming the base of the sulphate, and is then passed continuously first through a settling vessel, where the impurities separate, then through a vacuum evaporating apparatus, and finally into crystallising tanks.—A. S.

Phosphorus; Process of making ——. G. C. Landis, York, Pa., Assignor to American Phosphorus Co., Camden, N.J. U.S. Pat. 859,086, July 2, 1907.

The ores or compounds containing phosphorus are crushed, calcined at a red heat, and then ground to pass through an 80-mesh screen; sand or silicates, and coke are also similarly crushed, heated, and ground to the same degree of fineness. The ingredients thus prepared are formed into briquettes with a suitable binding agent, and these are dried and fed into an electric furnace "so that the electric current will act to uniformly reduce the material, forming phosphorus."—E. S.

Nitric acid; Manufacture of ——. Valentiner und Schwarz. Fr. Pat. 374,902, Feb. 21, 1907.

In the manufacture of nitric acid by distilling a mixture of sodium nitrate and sulphuric acid, in a vacuum or under diminished pressure, it is proposed to restrict the passage of the outlet from the retort where it connects to the condensing coil, so that it may have a diameter not exceeding one-half of that of the coil. A higher pressure is thus maintained in the retort than in the condenser, and the uprush of the sodium nitrate through the superincumbent layer of sulphuric acid is prevented, whereby, it is stated, the distillation progresses more vigorously and rapidly. The condensing coil extends to the bottom of the first of a series of receptacles, so that the condensed acid forms a liquid seal, and gases, such as lower oxides of nitrogen and hydrochloric acid pass on, carrying with them gaseous impurities, and leaving behind pure nitric acid.—E. S.

Lead chambers for the manufacture of sulphuric acid. L. G. Fromont. Fr. Pat. 375,117, Feb. 27, 1907. Under Int. Conv, Feb. 28, 1906.

In order to facilitate radiation and convection of heat from lead chambers, the usual plain walls of the latter are replaced by corrugated ones. The chambers are preferably built in the form of segments of a circle or ellipse around a common open centre, from which a number of hollow partitions radiate into the chambers. The roof of each chamber is arched, and the usual heavy wooden framework is replaced by leaden supports made rigid by iron bars; these supports, as well as the roof, are hung by means of chains from iron brackets on the framework surrounding the chamber, this framework being preferably of reinforced concrete.—A. G. L.

Desiccator for air or gas, specially applicable to apparatus for the production of sulphur dioxide. P. Marin. Fr. Pat. 374,519, Feb. 11, 1907. *See* I.

Aluminium silicates, or artificial crystalline zeolites; Manufacture of hydrated ——. J. D. Riedel Akt.-ges. Fr. Pat. 374,525, Feb. 11, 1907. Under Int. Conv., Jan. 23 and July 5, 1906.

Alumina or an aluminium silicate, or an aluminate, is fused with an alkali silicate or carbonate, or an alkali, quartz or its equivalent being added in such proportion that all the alkali may be bound to the silica and alumina, so that the fused product may be treated with water without becoming gelatinous. Silica may be replaced in the process by other inorganic acids, such as boric, phosphoric, nitric, or sulphuric acids, or their salts. (See also Ger. Pat. 174,097 of 1905; this J., 1907, 771.)—E. S.

Alumina; Calcination of ——. L. Prost. Fr. Pat. 374,557, Feb. 13, 1907.

The claim is for the calcination of alumina in retorts disposed in a regenerative gas-furnace. The retorts are arranged horizontally in three tiers of three retorts each. Each retort has end-pieces, which can be closed gas-tight, at both front and back, whilst from the front end, a vertical pipe rises for the escape of steam. The alumina is charged into the retort through one of the ends or through the vertical pipe.—E. S.

Crystals; Method of producing large —— *in solutions saturated whilst hot.* J. Bock. Fr. Pat. 374,968, Feb. 23, 1907. Under Int. Conv., Sept. 8, 1906.

Instead of inducing crystallisation in solutions saturated whilst hot, by the introduction of entire crystals, or of powdered crystals, splinters of crystals are used for this purpose. It is claimed that large crystals are obtained much more rapidly than usual.—A. G. L.

Permanganates of the alkali and alkaline-earth metals; Electrolytic manufacture of ——. E. Favier and A. Giraudet. Fr. Pat. 375,076, Feb. 26, 1907. See XIA.

Ozonising gases containing oxygen; Process for ——. Allgem. Elektricitäts Ges. Fr. Pat. 374,643, Feb. 14, 1907. Under Int. Conv., Feb. 16, 1906.

Oxygen, or a gaseous mixture containing it, is caused to pass over the surface of incandescent non-metallic bodies at a velocity exceeding one metre per second. This can be accomplished either by projecting the gases through a slit over the surface of the incandescent body or by causing the incandescent body to travel in the gas at corresponding speed.—R. S. H.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Regenerative gas furnaces for glass and other purposes. C. Deselle, Colombes, France. Eng. Pat. 20,955, Sept. 21, 1906.

See Fr. Pat. 369,384 of 1906; this J., 1907, 95.—T. F. B.

Kilns; Glazing and enamelling ——. F. W. Jones, King's Heath, Worcester. Eng. Pat. 9,281, April 19, 1906.

The kilns are of the tunnel type, and contain longitudinal rails, on which trolleys carrying the articles to be glazed or enamelled are mounted. The tops of the trolleys are formed of firebrick slabs adapted to fit together end to end to form a continuous platform through the kiln. The side edges of the trolleys are bent over to dip into sand troughs along the sides of the tunnel, so that the platform of the trolleys, and the sides and arch of the tunnel form a practically closed heating chamber. Heat is supplied from an exterior furnace and exterior heating flues to a space in the arch of the kiln, above the arch of the tunnel, so that no smoke or gases can come in contact with the articles to be glazed. The heating space in the arch of the kiln is provided with a number of baffle-walls, so that the kiln becomes gradually hotter from the entrance at one end of the kiln, up to the point where the furnace is situated, and gradually cooler from this point to the other or outlet end. Sprocket wheels and an endless chain, provided with arms engaging the trolleys, are arranged below the latter, for the purpose of moving them along the kiln as required.—W. C. H.

Ceramic products; Process of manufacture of light (weight) ——. M. J. Silvestre, sen. Second Addition, dated Jan. 5, 1907, to Fr. Pat. 369,417, Sept. 5, 1906 (this J., 1907, 96 and 690).

This addition covers the use of all sorts of waste materials, such as mineral waste, shells, slag, furnace refuse, etc., together with solid vegetable materials to produce ceramic bodies that are light in weight, as described in the original patent.—W. C. H.

Ceramic body; Process of forming a new ——, *and of making pottery objects of all kinds therefrom.* Risler and Co. Fr. Pat. 375,155, Feb. 28, 1907.

This new ceramic body consists of a mixture of a vitreous composition having a high content of silicic acid, with a non-plastic clay or quartz, of suitable grain, together with a plastic clay as a binding material. The vitreous composition is made by fusing together quartz, alkalis, alkaline earths, and the clayey substance so that the resulting product may contain at least 75 per cent. of silicic acid and 10 per cent. of clay.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Cement production in Canada. J. J. Ball. Eng. and Min. J., July 20, 1907. [T.R.]

That the use of Portland cement in Canada is increasing at a remarkable rate, and that the market is not likely to be glutted by overproduction as was at one time feared, is shown by the figures for 1906, which have been compiled by the statistician of the mines branch of the Geological Survey.

Fifteen plants were in operation in 1906, with a total daily capacity of about 10,500 bls. Of these, eleven were in Ontario, two in Quebec, one in Nova Scotia and one in British Columbia. At least four plants are under construction, with an initial capacity of 4700 barrels.

The quantity made in Canada during the year was 2,152,562 bls., an increase of 39·6 per cent. over 1905. The total sales were 2,119,764 bls., an increase of 57·4 per cent. over 1905. The average price per barrel at the works in 1906 was $1·49 as compared with $1·42 in 1905. The total value of cement sold was; 1906, $3,164,807; 1905, $1,913,740.

The imports of Portland cement into Canada in 1906 were 2,430,760 cwt., equivalent to 694,503 bls. of 350 lb. each. The value was $778,706, being an average of $1·12 per barrel. The duty is 12½c. per hundred pounds. The import in 1905 was equivalent to 917,558 bls., at an average price of $1·24 per barrel.

Little cement is exported from Canada. The consumption is therefore practically represented by the production plus the imports. The accompanying table shows the increase in the consumption of Portland cement during the past six years.

Consumption of Cement in Canada.

Year.	Canadian, bls.	Imported, bls.	Total bls.
1901	317,066	555,900	872,966
1902	594,594	544,954	1,139.548
1903	627,741	773,678	1,401,419
1904	910,358	784,630	1,694,988
1905	1,346,548	917,558	2,264,106
1906	2,119,764	694,503	2,814,267

Patents.

Plastic material [Clay, etc.]; Methods of treating ——. A. A. Scott, Knoxville, Tenn., U.S.A. Eng. Pat. 22,421, Oct. 10, 1906. Under Int. Conv., Oct. 12, 1905.

See U.S. Pat. 816,385 of 1906; this J., 1906, 427.—T. F. B.

Bricks and the like; Drying and burning ——. A. A. Gery, Reading, Pa., U.S.A. Eng. Pat. 628, Jan. 9, 1907.

See Fr. Pat. 373,118 of 1906; this J., 1907, 692.—T. F. B.

Blast-furnace slags and other silicate mixtures; Process for the treatment of —— *for the production of cementitious material therefrom.* B. Bruhn, Hamburg, Germany, Assignor to H. Edmunds, London. U.S. Pat. 859,166, July 2, 1907.

See Fr. Pat. 354,790 of 1905; this J., 1905, 1110.—T. F. B.

Impregnating pasteboard and other coverings for roofs; Process of manufacture of a special resistant material for ——. O. Schreiber. Fr. Pat. 374,830, Feb. 19, 1907.

This impregnating material, which resembles caoutchouc, is made from pitch obtained in the distillation of coal-tar, petroleum, certain animal products (*e.g.*, stearine pitch or pitch furnished by wool grease) or mineral material (as ozokerite, fossil wax), or from a mixture of these residues. The process consists in subjecting the pitch residue to a preliminary heating, and then forcing cold air through it, with the simultaneous addition of an oxidising body, such as "manganese or sulphuric acid and the ultimate addition of formaldehyde."—W. C. H.

X.—METALLURGY.

Mineral exports of Brazil. Eng. and Min. J., July 13, 1907. [T.R.]

According to official statistics the mineral exports from Brazil in 1905 and 1906 were as follows:—

	1905.	1906.
Gold (bar and scrap)	3,881(*a*)	4,568(*a*)
Diamonds	$449.172	$1,055,444
Carbons....................	356,784	992,164
Precious stones	278,925	438,750
Crystal	57,363	32,978
Monazite	4,437(*b*)	4,352(*b*)
Graphite	3,395(*a*)	2,563(*a*)
Manganese	224,377(*b*)	121,331(*b*)
Mica	1,358(*a*)	6,123(*a*)
Copper ore	658(*b*)	1,484(*b*)
Platinum	72(*a*)	...

(*a*) Kilograms. (*b*) Metric tons,

New production of cadmium. Eng. and Min. J., July 20, 1907. [T.R.]

The production of metallic cadmium has been undertaken by the Grasselli Chemical Company at Cleveland, Ohio. Heretofore cadmium has been produced only in Belgium and Silesia. The production of the former country was never large, and recently the world's supply has been furnished by Silesia alone. The ore of the Joplin district is, on the whole, immensely richer in cadmium than the ore of Silesia, but under the general conditions of zinc smelting, it has not been considered worth while to attempt to save cadmium as a by-product, which would have involved the separate treatment of the first blue powder and oxides, with other complications. Moreover, the production of so much cadmium as would be possible from the Joplin ore would cause a heavy fall in price. The production of the metal was not started until after an attempt to market the cadmium-bearing by-product in Europe had failed.

Borides of iron; Preparation and properties of ——. Binet du Jassonneix. Compt. rend., 1907. **145**. 121—123.

Ferrous oxalate is calcined, and the oxide so produced is reduced to metal in a current of hydrogen. This finely-divided iron is then mixed with boron, compressed into blocks, and the mixture heated in a magnesia boat, in a porcelain tube, in a current of hydrogen, and afterwards in a magnesia crucible in an electric furnace. The compound, Fe_2B, has a crystalline structure and a steel-grey colour. It has a sp. gr. of 7·37 at 18° C. It is rapidly oxidised by moist air, even in the cold, but by dry air only at a low-red heat. It is only slightly attacked by hot sulphuric acid or hydrochloric acid. Strong cold nitric acid dissolves it very readily. Another compound, FeB_2, was also obtained; it has a sp. gr. of 4·3, is somewhat friable, and is but slightly oxidised in moist air. Hot strong hydrochloric acid attacks it but slightly, whilst nitric acid dissolves it readily.—G. W. McD.

Patents.

Melting process and furnace therefor. A. Koch, Hannover-List, Germany. Eng. Pat. 14,710, June 27, 1906. Under Int. Conv., June 27, 1905.

See Fr. Pat. 367,470 of 1906; this J., 1906, 1154.—T. F. B.

Brass; Manufacture of ——. Centralstelle für Wissenschaftlich-technische Untersuchungen, G.m.b.H., Neubabelsberg, Germany. Eng. Pat. 17,758, Aug. 7, 1906. Under Int. Conv., Aug. 21, 1905.

In order to prevent brass from becoming brittle when heated to temperatures of from 300° to 500° C., an amount of phosphorus is added, during the process of manufacture, such that the alloy will contain from 0·03 to 0·10 per cent. of phosphorus.—G. W. McD.

Magnetic body; Process of improving the magnetic qualities of a ——. R. A. Hadfield, Sheffield. Eng. Pat. 2377, Jan. 30, 1907. Under Int. Conv., July 5, 1906.

See U.S. Pat. 836,755 of 1906; this J., 1907, 155.—T. F. B.

Flux for iron. J. Davies, Birmingham. U.S. Pat. 858,582, July 2, 1907.

See Eng. Pat. 23,783 of 1905; this J., 1906, 1153.—T. F. B.

Metallurgical reduction and melting processes; Method of carrying out ——. A. J. Petersson, Alby, Sweden. U.S. Pat. 858,622, July 2, 1907.

See Fr. Pat. 370,910 of 1906; this J., 1907, 327.—T. F. B.

Ores; Art of treating ——. R. McKnight, Pittsburg, Pa. U.S. Pat. 858,667, July 2, 1907.

A refractory ore is mixed with sufficient sodium chloride to convert the refractory elements into "oxysalts of sodium," and the mixture is roasted by agitating it whilst a current of gas containing oxygen, previously heated to 500° C., is directed on to it, but without subjecting it to any further source of heat. Any metallic chlorides volatilised, are condensed, and the residual ore is treated by amalgamation, the solution of the non-volatile chlorides obtained being treated by a wet method. —A. G. L.

Blast-furnace. G. D. Bulmer, Duquesne, Pa., Assignor to J. Johnston, Homestead, Pa. U.S. Pat. 858,949, July 2, 1907.

The blast-furnace consists of a suitable foundation carrying universal bearings, comprising "trunnioned rings" and roller bearings, which support an inclined tapering rotating shell. This shell has a lining of non-fusible material; at its larger end is mounted a "feed head," consisting of a shoot and fuel-supply pipes, whilst a cinder- and dust-collector is constructed on the foundation at the smaller and lower end of the shell. This collector communicates by means of a flue with the interior of the shell, whilst a second flue leads from the collector to a stack, the lower end of this flue being normally closed by a gate. A tilting ladle is mounted beneath the smaller end of the shell and is furnished with a tap-hole near its upper edge; adjacent to this tap-hole, a trough is suspended from the collector. Means are provided whereby easy access can be had to the second flue, as well as means for revolving the shell. —A. G. L.

Tin from tin ores; Process of extracting ——. H. Brandenburg, Kempen on Rhine, Germany. U.S. Pat. 859,184, July 2, 1907.

See Fr. Pat. 370,355 of 1906; this J., 1907, 260.—T. F. B.

Tin from tin products containing iron; Process for extracting ——. H. Brandenburg, Kempen on Rhine, Germany. U.S. Pat. 859,594, July 9, 1907.

See Fr. Pat. 370,355 of 1906; this J., 1907, 260.—T. F. B.

Aluminium alloys; Method of and means for casting ——. W. A. McAdams, Bay Shore, N.Y. U.S. Pats. 859,612 and 859,888, July 9, 1907.

See Eng. Pat. 16,168 of 1906; this J., 1907, 98.—T. F. B.

Ores containing nickel; Treatment of ——. R. W. E. MacIvor, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 859,776, July 9, 1907.

See Eng. Pat. 6255 of 1905; this J., 1906, 541.—T. F. B.

Iron and steel; Process for plating —— *with alloys of aluminium.* Deutsche Wachwitzmetall-Akt.-ges. Fr. Pat. 374,814, Feb. 19, 1907.

The aluminium alloy, in the form of thin sheet or foil, is applied to the surface of the plate of iron or steel, and the whole subjected to pressure at a moderate temperature. The plate is then rolled at a temperature near the melting point of the alloy.—O. F. H.

Steel containing a high percentage of manganese; Manufacture of ——. C. H. Kelsall. Fr. Pat. 375,148, Feb. 28, 1907. Under Int. Conv., Sept. 14, 1906.

Soft and "spongy" or "porous" steel obtained from the Bessemer converter is added to rich ferromanganese in the molten condition.—O. F. H.

Metals; Process of heating —— *without oxidation.* F. J. C. Jones. Fr. Pat. 374,891, Feb. 20, 1907.

The furnace comprises one or more gas-producers, a combustion chamber, and a muffle in which the metals are heated. Part of the gas from the producer, previously heated to a temperature at least as high as that to which the metal is to be heated, is first used to provide a non-oxidising atmosphere inside the muffle, and is afterwards burned in the combustion chamber of the furnace. When metals are to be heated which readily combine with sulphur, the gas used in the interior of the muffle is obtained from a separate producer using charcoal as fuel.

The apparatus may be modified by placing a trough filled with fine-dust or other light material in front of the mouth of the muffle.—O. F. H.

Metals in a finely-divided state ; Process for the agglomeration, by pressure, of all ——, and their applications. Société anon. Le Carbone. Fr. Pat. 375,180, March 1, 1907.

THE powdered metals or alloys are heated in a reducing atmosphere, moulded under pressure, and reheated. The process may be used for the manufacture of decorative ornaments, brushes for electrical machines, bearings, etc. —O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Iron-nickel accumulator ; Processes in the ——. I. Nickel peroxide electrodes. F. Foerster. Z. Elektrochem., 1907, **13**, 414—434.

CONTRARY to the conclusions of Zedner (this J., 1905, 1239 ; 1906, 765) the author finds that the lower oxide (hydroxide) of nickel, $Ni(OH)_2$, upon anodic oxidation, takes up more oxygen than corresponds to the sesquioxide ; the oxidation-product probably contains some peroxide, NiO_2. In the freshly charged electrode some of this peroxide is present, but, upon standing, oxygen is evolved, and the potential falls to the value characteristic of the sesquioxide ; a similar fall rapidly occurs when current is taken out of the cell. Thus the main portion of the discharge is provided for by the sesquioxide. During the charge, however, the potential rapidly attains a value higher than that of the sesquioxide, and it appears that the peroxide is the first product of oxidation of the lower oxide. With a sufficiently low current density, the process of charging can be carried to a high point with very little loss ; beyond this, a still further charge can be introduced, but with a much lower current efficiency. —R. S. H.

Electrolytic analysis ; New apparatus for rapid ——. F. C. Frary. Z. Elektrochem., 1907, **13**, 308—309.

RAPIDITY in electrolytic analysis has been secured by powerful stirring of the electrolyte, which has generally been effected by causing one or other of the electrodes to rotate. In order to obviate the necessity for an electric motor, the author has employed two arrangements which enable the electrolyte to be stirred rapidly by effecting the electrolysis in a magnetic field ; as is well known a conductor suitably disposed in a magnetic field tends to rotate. Two methods of arranging the apparatus are shown in the figures. In both cases, S represents the field coil. In the second case (Fig. 2), an annular glass vessel, E, with a mercury cathode, is employed, and a central iron core, B, serves to strengthen the field and ensure a rapid rotatory motion in the electrolyte. Preliminary experiments on the rapid deposition of copper and iron have already been successfully carried out, and it is intended later to communicate further results. —R. S. H.

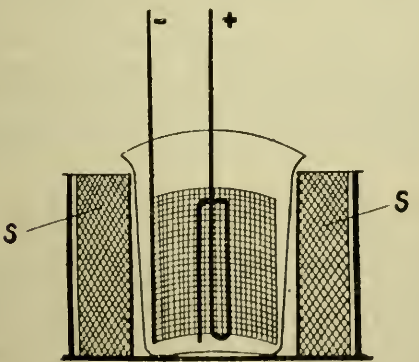


FIG. 1.

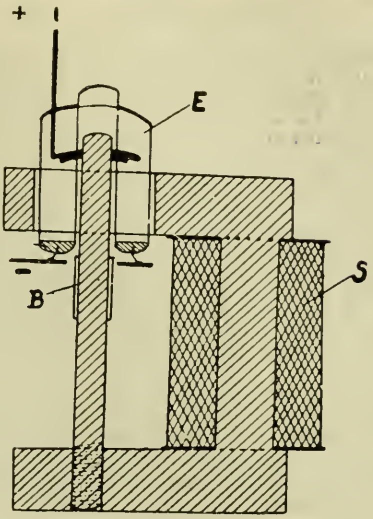


FIG. 2.

Deposition of metals, using a mercury cathode and rotating anode ; Effect of sulphuric acid on the ——. L. G. Kollock and E. F. Smith. J. Amer. Chem. Soc., 1907, **29**, 797—806.

THE volume of solution taken (including the acid added in all cases except that of zinc) was 10 c.c., containing 0·25 grm. of metal, the current was maintained at 2 ampères, and the E.M.F. varied between 2 and 4·5 volts. Concentrated sulphuric acid was added in amounts varying between 1 and 5 c.c. The results obtained were as follows :—*Zinc.*—Using 1 c.c. of acid, 0·25 grm. of metal was deposited in 10 mins. ; with 5 c.c. of acid, precipitation was only complete in 15 mins. *Copper.*—In the presence of 1 c.c. of acid and with an E.M.F. of 3—3·5 volts, 0·2485 grm. was precipitated in 10 mins. Using 5 c.c. of acid, precipitation was complete in 25 mins. *Cadmium.*—The results were very similar to those obtained with copper. *Iron.*—The effect here was most marked. In the presence of 1 c.c. of acid, a trace of iron was left in solution after 40 mins., but even with 4 c.c. of acid, the metal was not completely held in solution. The same effect was observed with solutions of the sulphates of nickel and cobalt. Thus, with 2 c.c. of acid in a solution containing 0·25 grm. of nickel, the liquid after 35 mins. still showed traces of the metal.—C. A. W.

Stannates and borates ; Electrolysis of ——. I. A. Coppadoro. Ann. Soc. Chim. di Milano, 1906 ; Chem.-Zeit., 1907, **31**, Rep., 336.

WHEN a cold concentrated solution of sodium or potassium stannate is electrolysed in a divided cell, using two platinum electrodes, a steady evolution of hydrogen occurs at the cathode, and metallic tin is deposited on the electrode. At the anode, although a current of 30—200 ampères may be employed, the theoretical quantity of oxygen is liberated, and stannic acid, H_4SnO_4 is precipitated. After the electrolysis is complete, no trace of oxidising agent can be detected. If, however, about 1 per cent. of an alkali fluoride be added to the solution, less than the theoretical amount of oxygen is evolved at the anode, and the solution contains a per salt, the active oxygen of which corresponds to the missing amount of oxygen. The electrolysis of alkali borates under the same conditions, either with or without the addition of fluoride, does not lead to the formation of peroxide.—J. C. C.

Platinum ; Electrolytic oxidation of ——. C. Marie. Compt. rend., 1907, **145**, 117—118.

KOHLRAUSCH, in using platinum electrodes for the electrolysis of a solution of platinic chloride, has noted the appearance of a brown coloration on the anode. The same phenomenon has been observed by the author in electrolysing $N/1$ solutions of sulphuric acid, nitric acid, hydrochloric acid, and sodium hydroxide. On treating the anode with a dilute solution of potassium iodide and hydrochloric acid, a red coloration is obtained, similar to that observed when potassium iodide is added to a dilute solution of platinic chloride. At the same time free iodine is liberated and can be detected with chloroform. After the above treatment, an anode with an area of 100 sq. cm. which had been used for a period of 12 hours with a current of 2 ampères had lost weight to the extent of 0·8 mgrm. The brown deposit is considered to be platinum peroxide.—G. W. McD.

Combustion of nitrogen in the high-tension arc flame ; Validity of the law of mass action in the ——. W. Nüranen and M. Le Blanc. Z. Elektrochem., 1907, **13**, 297—305.

THE authors have made an extensive experimental investigation of the concentration of nitric oxide formed in the high-tension arc flame, with mixtures of oxygen and nitrogen of widely varying composition. With mixtures containing up to about 75 per cent. of oxygen, fairly close agreement is found with the theoretical values for a simple equilibrium, but in the case of mixtures containing higher percentages, a marked discrepancy is observed; this seems to the authors to be due largely to the change in the character of the arc flame, which was smaller and very unsteady under these conditions. Evidence is put forward in view of the belief that the reaction is monomolecular and can be expressed as: $NO \rightleftarrows N + O$. By rapidly cooling the gases by drawing them direct from the arc through a cooled quartz tube, a marked increase in the percentage of nitric oxide is observed. The rapidity of the reaction is clearly indicated by the fact that in some experiments with a velocity of the air of 72 to 76 litres per hour, the concentration of nitric oxide is only reduced to half that obtained with 0 to 3 litres per hour. In some experiments with "flame" carbon arcs, using 120 volts and 5 to 9 ampères, only negligible quantities of nitric oxide were produced. —R. S. H.

p-Toluene sulphonic chloride ; Electrolytic reduction of ——. F. Fichter and W. Bernoulli. Z. Elektrochem., 1907, **13**, 310—312.

p-TOLUENE SULPHONIC CHLORIDE can be electrolytically reduced, with a fairly good yield of *p*-tolylmercaptan (which passes into the disulphide on standing), in aqueous alcoholic solutions of hydrochloric acid, if titanous chloride be employed as a catalyst. By the use of a rotating lead cathode and a current density of 0·13 ampère per sq. cm., good yields are also obtainable in alcoholic sulphuric acid solution. *p*-Toluenesulphinic acid forms a direct intermediate product, and under ill-defined experimental conditions, other products are obtained with a corresponding diminution in the yield.—R. S. H.

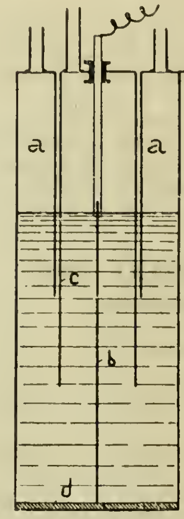
PATENTS.

Electrolysis ; Continuous ——. G. B. Rambaldini, Milan, Italy. Eng. Pat. 8039, April 3, 1906. Under Int. Conv., April 3, 1905.

SEE Fr. Pat 364,826 of 1906; this J., 1906, 992.—T. F. B.

Chemical reactions ; Electric plant for producing ——. I. Moscicki, Freiburg, Switzerland. Eng. Pat. 14,259, June 21, 1906. Under Int. Conv., Jan. 17, 1906.

THE terminals of the secondary winding of an induction coil are connected with separated electrodes in a generator circuit, and a spark gap is arranged in parallel with the gap between the electrodes and the coils of low resistance. Each gap is connected in series with condensers, and cores between the electrodes and the conductors, of lower tension than the electrodes, are unnecessary. Both the conductors leading to the low-resistance coils are connected with a condenser, in order to effect short-circuiting of the high-frequency alternating current passing through the low-resistance coils. —B. N.



Gases ; Electrolytic production and separate collection of ——. J. Wetter, London. From Elektrizitäts A.-G. vorm. Schuckert und Co., Nürnberg, Bavaria. Eng. Pat. 17,981, Aug. 10, 1906.

THE outer vessel, *a*, acts as one electrode, the second electrode, *b*, being supported in a bell, *c*, of insulating material. The latter dips down to such a depth in the electrolyte, that the lines of current flow are from *b* to the outer vertical walls of *a*, the base, *d*, being covered with insulating material; consequently, no gas is liberated in the space between the two bells, *a* and *c*.—B. N.

Incandescence bodies for electric glow lamps ; Method of producing metallic ——. Deutsche Gasglühlicht A.-G. (Auerges.). Eng. Pat. 14,816, June 28, 1906. *See* II.

Glow-bodies for electrical apparatus ; Metallic ——. A. Lederer. Eng. Pat. 20,209, Sept. 11, 1906. *See* II.

Electrolytic diaphragms. I. L. Roberts, New York. Eng. Pat. 14,922, June 30, 1906.

SEE Fr. Pat. 367,835 of 1906; this J., 1906, 1156. Reference is directed, under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pat. 13,358 of 1894.—T. F. B.

Accumulators ; Electric ——. C. Haunz, London, and The A.B.P. Accumulator Co., Ltd., Stockton-on-Tees. Eng. Pat. 17,539, Aug. 3, 1906.

WOODEN separators, for electric accumulators, are prepared by treating wood for 6 to 8 hours, at a raised temperature, with a solution of potassium hydroxide, the pressure in the vessel during the treatment being maintained about 20 lb. above that of the atmosphere. —B. N.

Heating molten or semi-molten materials by electricity ; Method of ——. F. Wynne, London. Eng. Pat. 18,835, Aug. 22, 1906.

SEE U.S. Pat. 848,422 of 1907; this J., 1907, 622.—T. F. B.

Electric transformer furnaces. O. Frick, Stockholm. Eng. Pat. 29,271, Dec. 22, 1906. Under Int. Conv., Dec. 27, 1905.

SEE Fr. Pat. 372,801 of 1906; this J., 1907, 534.—T. F. B.

Electric furnaces ; Crowns or covers of ——. R. B. Ransford, Upper Norwood. From Soc. Anon. Electrométallurgique (proc. P. Girod), Ugine, France. Eng. Pat. 3276, Feb. 9, 1907.

SEE Addition of Dec. 7, 1906, to Fr. Pat. 350,524; this J., 1907, 535.—T. F. B.

Lining tanks for electrolytic work ; Method of ——. J. F. Miller, Trail, British Columbia. U.S. Pat. 857,886, June 25, 1907.

MELTED asphaltum is run into grooves, cut in the interior surface of the walls of an electrolytic tank composed of sections, so as to form a layer, and a flame is passed over it in order to expel bubbles or other imperfections. These operations are repeated until the coating in the grooves is sufficiently thick, and the entire inner surface of the tank is then treated in a similar manner.—B. N.

[*Electrodes for*] *Electrolytic cell.* A. O. Tate, New York. U.S. Pat. 857,909, June 25, 1907.

The electrode comprises a series of positive and a series of negative plates, of relatively good conductivity, each series being provided with holes or openings, so that the plates may be threaded on to two conducting bolts with conducting washers between. The two series are nested together, with insulating strips between the pairs of plates. By means of end plates of an insulating material, binding plates of metal, and nuts, the parts of the electrodes are bound together in such a manner that only the lateral edges or faces of both sets of plates are exposed to the electrolyte.—B. N.

Apparatus [*Electrodes*] *for treating liquids electrolytically* A. O. Tate, New York. U.S. Pat. 857,910, June 25, 1907.

The electrode comprises an insulating supporting frame, which is provided with ridges on its opposite faces, and with sets of conductors alternately secured between the ridges. The anodes and cathodes are arranged alternately, and slipped between the ridges. One set of conductors thus connects the anodes at one side of the frame to a terminal of an electric generator, whilst the second set of conductors connects the cathodes to the other terminal. Any one of the electrodes may be readily removed or replaced.—B. N.

Storage battery electrode. T. A. Edison, Llewellyn Park, Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 857,929, June 25, 1907.

See Eng. Pat. 1927 of 1906; this J., 1906, 432.—T. F. B.

Carbide from lime and carbon; Process of continuously producing ——. A. J. Petersson, Alby, Sweden. U.S. Pat. 858,623, July 2, 1907.

See Fr. Pat. 370,912 of 1906; this J., 1907, 327.—T. F. B.

Battery; Primary and secondary ——. T. A. Edison, Orange, N.J., Assignor to Edison Manufacturing Co., West Orange, N.J. U.S. Pat. 858,862, July 2, 1907.

In batteries where an alkaline electrolyte is employed, the addition of an alkali silicate is found to be advantageous. With metallic zinc as one electrode and a depolarising mass, *e.g.*, nickel hydroxide as the other, an alkaline electrolyte containing potassium silicate is employed. Similarly, metallic magnesium and nickel hydroxide electrodes can be used in conjunction with an alkaline electrolyte containing zincate and silicate.—R. S. H.

Liquors; Process of treating —— *by electricity.* C. H. C. Koch, Assignor to Chicago Distributing and Trading Co., Chicago, Ill. U.S. Pat. 859,178, July 2, 1907.

The liquor is confined in a wooden receptacle, so that only the wood comes into contact with the liquid, and metallic electrodes are applied externally to the ends of the cask, sheets of "moisture-holding material" being placed between the metal and the wood. The current is thus transmitted to the liquor directly from the wood.—B. N.

Electric light illuminant. R. H. Read, Assignor to General Electric Co. U.S. Pat. 859,840, July 9, 1907. *See* II.

Mastics; Electrolytic process of manufacture of —— *by the aid of hydroxides of iron and nickel, for the formation of electrodes and accumulator plates.* Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 374,597, Feb. 13, 1907. Under Int. Conv., Feb. 16, 1906.

Iron or nickel, in the form of shavings or powder, is first covered with finely-divided metals, such as copper and mercury, which are more electro-negative than the shavings, and the latter are then moistened with an appropriate electrolyte, such as a solution of an ammonium salt. On exposure to the atmosphere, a progressive continuous oxidation occurs, producing a substance analogous to mastic. In the case of the mastic composed of iron rust, the oxide is soaked in an adhesive liquid. such as a solution of caoutchouc in carbon bisulphide, after which the mastic is reduced electrolytically in an alkaline solution, and finally compressed. The mastic, as prepared in this manner is used as an electrode in an accumulator with alkaline electrolyte, the second electrode consisting of a hydroxide of nickel. A molecular adherence of the active mass to the metallic support is obtained by a previous oxidation of the metal of the latter.—B. N.

Electrodes for accumulators; Process of formation of —— *by electrolytic oxidation of magnetic metals.* Nya Ackumulator Aktiebolaget Jungner. Fr. Pat. 374,598, Feb. 13, 1907. Under Int. Conv., Feb. 16, 1906.

Magnetic metals are converted into active masses, for use in accumulators, by immersing them, in the form of plates, network, etc., as anodes in a suitable electrolyte, such as an alkali solution, with or without the addition of small quantities of substances which facilitate oxidation, or which otherwise favourably affect the result of the operation, as, for example, ammonia, and certain organic substances. The electrolyte is "absorbed or gelatinised by a porous substance," for example, by making it into a paste with an alkaline hydroxide, only slightly soluble in water, such as calcium hydroxide. Several such plates may be united, and used as positive electrodes in an accumulator with an alkaline electrolyte, the negative electrodes consisting of iron, cadmium, or their active oxygen compounds.—B. N.

Incandescence lamp filaments of tungsten; Manufacture of ——. Consortium für Elektrochem. Ind. G.m.b.H. Fr. Pat. 374,659, Feb. 15, 1907. *See* II.

Filaments for electric incandescence lamps; Manufacture of metallic [*tungsten*] ——. Deutsche Gasglühlicht A.-G. (Auerges.) Fr. Pat. 375,133, Feb. 27, 1907. *See* II.

Permanganates of the alkali and alkaline-earth metals; Electrolytic manufacture of ——. E. Favier and A. Giraudet. Fr. Pat. 375,076, Feb. 26, 1907. Under Int. Conv., Feb. 26, 1906.

A solution of an alkali manganate is treated with ozonised air or oxygen, and an electric current is simultaneously passed through the liquid. The products are separated in a suitable manner, and the alkali hydroxide is recovered in the form of a concentrated solution, and used again for the preparation of the manganate.—B. N.

Insulating composition for metallic and other pieces. Soc. D'Exploitation des Brevets Dolter. Fr. Pat. 375,092, Feb. 26, 1907.

The material to be covered is cleaned, scoured, dried, and then sprayed, brushed over, or steeped in a solution of tetra-acetate, butyrate, benzoate, or acetate of cellulose, dissolved in acetone, chloroform. nitrobenzene, ethyl acetate or amyl acetate, or mixtures of these. The thickness of the coating is regulated by the concentration of the solution, or by the number of immersions, each layer being allowed to dry before the succeeding one is applied.—B. N.

(*B.*)—ELECTRO-METALLURGY.

Anodic disturbances in the electrolysis of fused substances. K. Arndt and K. Willner. Ber., 1907, **40**, 3025—3029.

The authors electrolysed fused barium chloride and strontium chloride in a large porcelain crucible and in an iron crucible lined with fireclay, a thick iron wire being used as cathode and a carbon rod as anode. A few minutes after starting, the resistance of the bath rose abruptly, so that an E.M.F. of 30—60 volts was required to obtain a moderate current, whereas previously, a current of 20—40 ampères was obtained with an E.M.F. of 6—10 volts. The increase in the resistance of the bath was accompanied by the appearance of a narrow, bluish halo around the anode; the electrolyte became violently agitated, and the evolution of chlorine ceased. The authors find that these phenomena are due to silica, which is dissolved from the crucible or its lining and separates on the anode in the form of a thin skin. between which and the carbon rod is a layer of gas, in which the current produces numerous small arcs. By rapid movement of the anode, the film of silica can be destroyed, and the electrolysis then proceeds satisfactorily. Fused barium and strontium chlorides can be electrolysed with good results in an iron vessel without any lining, the anode being replaced by a fresh one after electrolysis begins; with a current of 35 ampères at 13 volts, compact deposits of metal are obtained.—A. S.

Patents.

Furnace; Electric ——. S. Z. de Ferranti, London. Eng. Pat. 13,949, June 18, 1906.

An induction furnace is operated by a one or more phase current, and is provided with energising or primary coils, constructed in tubular form, through which a cooling fluid is circulated. The coils are thus cooled, and the iron of the magnetic circuit is prevented from rising above the temperature at which the maximum permeability is obtained. The secondary circuit consists of a tube or channel containing the molten metal. This channel may be provided with appropriate windings for producing a rotary or shifting magnetic field, which will thus cause a circulation in the molten metal.—B. N.

Furnace; Electric ——. S. Z. de Ferranti, London. Eng. Pat. 13,949a, June 18, 1906.

A two- or poly-phase electric induction furnace is provided with two or more cores passing through the crucible, the cores being grouped in such a manner as to reduce the magnetic losses to a minimum. Thus, each core is provided with its appropriate energising coil, and each forms part of a magnetic circuit energised by coils other than its own. The ends of the cores may be connected together by suitable laminated members. The constructions are similar to those adopted in polyphase transformers.—B. N.

Electric induction furnaces. Soc. des Procédés Gin pour la Metallurgie Electrique, Paris. Eng. Pat. 1080, Jan. 15, 1907. Under Int. Conv., March 7, 1906.

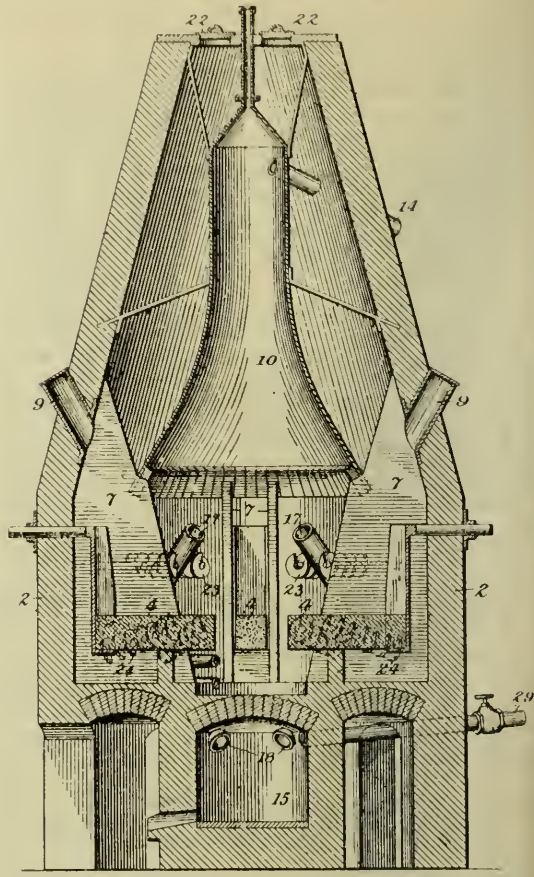
See Fr. Pat. 363,937 of 1906; this J., 1906, 892.—T. F. B.

Furnaces; Electric transformer ——. E. A. A. Grönwall, A. R. Lindblad, and O. Stalhane, Ludvika, Sweden. Eng. Pat. 6193, March 14, 1907.

The furnace is similar to that described in Eng. Pat. 1658 of 1907 (this J., 1907, 622), but the primary coil is placed around the leg of the transformer core which is enclosed by a portion of the channel, and immediately under the latter.—B. N.

Furnace; Electric ——, *and metallurgical process.* E. R. Taylor Penn Yan, N.Y. U.S. Pats. 843,776 and 843,777, Feb. 12, 1907.

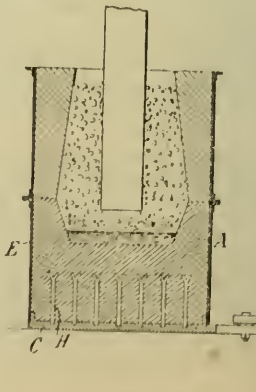
The reducing chamber, 2, of the furnace is provided with several carbon electrodes, 4, which are fixed between vertical walls, 7. Between each pair of walls is a charging aperture, 9, through which conductive material is fed, so that it surrounds the electrodes, and fills the space between the walls, 7. The charge to be reduced is fed through the openings, 22, and passes downward around the bell or hood, 10, to the reducing chamber. The heat, which is produced by the passage of the current, reduces the charge, and the vapours pass upwards into the lower part of the hood, 10. The heavier constituents, such as vapours of metals, pass downward into condensing tubes 17, the latter being connected with similar tubes, 18, fixed at right angles to the former, and leading to the collecting chamber, 15, whilst the fixed gases escape from the upper portion of the hood through the outlet, 14. The material, gravitating downwards near to the periphery of the furnace, receives heat from the escaping gases, and also the heat produced by the condensation of the vapours in the tubes, 17 and 18. Two rows of screws, 23 and 24, the latter being slightly inclined, are arranged to feed the charge continuously from the periphery of the furnace along radial lines through a surrounding body of the charge to the reaction zone between the electrodes. A pipe, 29, conveys away any uncondensed vapour from the collecting chamber, 15.—B. N.



Electric furnace process. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. U.S. Pat. 858,400, July 2, 1907.

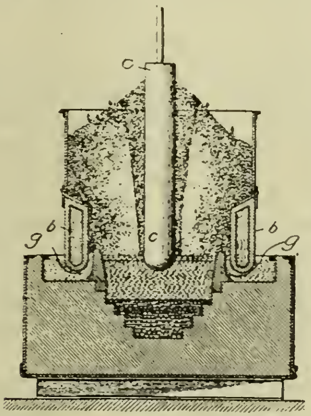
In either electro-thermal or electrolytic processes a current is passed through the molten charge from one or more electrodes, which are suitably cooled in order to maintain a protective but conducting coating of the charge upon them. In both cases the conducting coating becomes the working electrode, and the electrode itself is protected from fusion and attack.—R. S. H.

Electric furnace. P. L. T. Héroult, La Praz, France, Assignor to Soc. Electro-Metallurgique Française, Froges, France. U.S. Pat. 858,718, July 2, 1907.



The hearth of the furnace is formed of a mass of carbon, A, to which the current is led from a cast-iron base-plate, C, having a number of wrought-iron rods, H, projecting into the carbon. The iron jacket, E, is divided, and its ends are joined by copper, so as to break the magnetic circuit and reduce losses by self induction.—R. S. H.

Smelting process and furnace. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pats. 859,132 and 859,133, July 2, 1907.



The patents relate to a process of, and furnace for, smelting ores containing a compound of a metal which is volatile at the temperature of reduction, especially roasted sulphide ores of zinc, or zinc and lead. The ore is mixed with coke and with lime or other fluxes in such proportions as to yield a slag containing 50 per cent. or more of silica, and is then fed into the upper part of a furnace containing a vertical electrode, C (see fig.), and, in its lower part, a crucible or receptacle for slag. In introducing the charge, the coarser particles are fed towards the outside of the mass. The charge passes progressively downwards, meeting a gradually increasing degree of heat, and when in contact with the slag-bath, is heated electrically, under a pressure greater than that of the atmosphere, to a temperature above the boiling point of zinc. The walls of the furnace, just above the slag-bath, are water-cooled, as shown at *b*, and the condensed zinc collects in the receptacle, *g*, forming a seal which prevents escape of gas. The gases (chiefly carbon monoxide) pass up through the ore-charge, assisting in the reduction of the same, and escape at the top, any zinc vapour present, being condensed and returned to the slag-bath, where it is re-volatilised. The slag is withdrawn, from time to time, through a slag-tap. The furnace and the supply of heat are so arranged that the slag outlet is maintained at a temperature above the boiling point of zinc, and the gas-outlet, at the top of the charge, at a temperature below the solidifying point of zinc.—A. S.

Smelting process. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pat. 859,134, July 2, 1907.

The process is intended for the treatment of ores of metals which are volatile at the temperature of reduction. It consists in smelting successive separate charges of the ore, together with carbon and fluxes, upon a slag bath in a closed furnace. The furnace is heated by passing an electric current through the slag, so that each charge from the slag upwards is heated, first to a degree sufficient to reduce the ore, with evolution of "carbonic gases," and afterwards to the melting point of the charge. The "carbonic gases" escape from the upper surface of the charge, which is maintained sufficiently cool to cause any metal vapour to condense within the body of the charge. In the second stage of the heating, the charge is fused, the volatile metal expelled (and subsequently condensed), and the residue converted into slag. The operations are repeated with each succeeding charge.
—A. S.

Metallurgical process, and electric furnace. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pats. 859,135 and 859,136, July 2, 1907.

The furnace comprises a base or crucible of refractory material, surrounded by a metal "curb," with hollow metal walls, through which a flow of water is maintained, extending upwards from the top of the base, and enclosing a smaller area than the latter, to form a furnace chamber. These walls support a dome-shaped roof, having a central opening for feeding in the ore charge, and two other openings, through which hollow carbon electrodes project into the furnace chamber. Directly below one of the electrodes, at the lower part of the hollow wall, is a tap-hole leading to a spout which extends over the base of the furnace. Electrical connection between metallic leading-in wires and the hollow carbon electrodes is effected by causing the wires to dip into an easily fusible metal contained in cups hollowed out of the electrodes. The ore, *e.g.*, zinc-lead sulphide ore, is partially roasted, leaving a substantial proportion of sulphur in it, and is then mixed with limestone, a gas-forming coal, and iron carbonate, and fed into the furnace on to the surface of a bath of molten slag contained in the crucible. Granular carbon is also continuously fed in, through the hollow carbon electrodes, on to different parts of the bath of slag, so as to form floating electrodes, and a current is passed between these floating electrodes in two paths, *viz.*, directly and horizontally across the slag, and also vertically through the slag, so as to include, in series, the molten metal which collects beneath the slag; the relative flow of current along the two paths is regulated by tapping off the slag. In this way there is produced a layer of metallic lead, a layer of matte above the lead, and an upper layer of slag. The temperature is maintained sufficiently high to also produce metallic iron, which collects between the slag and the matte, and sets free from the latter the zinc and lead. The layer of matte is kept at such a thickness as to maintain the surface of the molten metal considerably below the smelting temperature. The zinc is volatilised, and passes, together with the gaseous reaction products, through inclined flues adjacent to the furnace, wherein it is condensed in the form of dust. These flues converge below to a closed conduit, leading to the feed opening of a second furnace, below the first, wherein the zinc dust is smelted to spelter. In starting the furnace, the interior is heated by burning fuel therein, then an easily fusible metal is added, and allowed to accumulate below the fuel, the embers of which are collected in separate piles on the surface of the molten metal. Electrodes are now brought into contact with the piles of embers, and an electric current is passed between the electrodes, through the embers and the underlying metal, thereby avoiding the formation of an arc at the surface of the metal.—A. S.

Furnace; Electric ——. F. T. Snyder, Oak Park, Ill., Assignor to Electric Metals Co., Chicago, Ill. U.S. Pat. 859,137, July 2, 1907.

The electric smelting furnace described. is divided by a transverse partition into two compartments, one of which serves as the smelting chamber. The upper part of the other compartment serves as a condensing chamber, and the lower part as a refining chamber. There is also a horizontal partition so as to form a preheating chamber above the smelting and condensing chambers. Passages are provided leading from the preheating chamber to the smelting chamber, and from the smelting chamber to the condensing chamber. The smelting chamber is H-shaped in plan, the two arms of the H communicating with the exterior of the furnace and forming receptacles for the molten metal. The cross passage is shallower and contains molten resistance material floating on the surface of the molten metal. The electrodes dip into the molten metal at the ends of the cross passage. A flue is provided for the escape of uncondensed gases from the condensing chamber.—A. S.

Light metals [alkali metals, etc.] by electrolysis; Process for producing ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. U.S. Pat. 850,376, April 16, 1907.

The cell, which contains the molten halogenide or other salt of the metal, is arranged with an anode consisting of a fused heavy metal capable of uniting with the halogen or other anion liberated by electrolysis. The cathode is placed in the upper part of the cell. The salt of the heavy metal which is formed by the solution of the anode, is prevented, as far as possible, from diffusing to the cathode; for this purpose, convection currents are avoided, and a diaphragm of iron gauze or other material is inserted between the anode and cathode. The electrolysis is discontinued from time to time to allow the salt of the heavy metal to settle, and this salt is withdrawn periodically. The production of metallic sodium with a fused lead anode is described.—R. S. H.

Steel dies; Process of producing ——. G. F. Diez, New York. U.S. Pat. 857,926, June 25, 1907.

An iron matrix with conducting surface is obtained by depositing iron electrolytically from an electrolyte consisting of eight parts of a saturated solution of iron sulphate and one part of a saturated solution of sodium bicarbonate, an iron anode being employed.—A. G. L.

Nickel contained in basic nickel precipitates; Process of recovering the ——. H. H. Dow and W. S. Gates, Midland, Mich., and A. E. Schaeffer, Cleveland, Ohio, Assignors to The Ontario Nickel Co., Ltd., Worthington, Canada. U.S. Pat. 857,927, June 25, 1907.

Nickel is recovered from basic nickel precipitates by treating them with a free halogen (bromine) and finely-divided sulphur or a sulphur compound (sulphur chloride) in the presence of a substance (calcium hydroxide or a soluble calcium salt) capable of precipitating sulphates. The solution obtained, is decanted from the precipitate, evaporated to a consistency sufficient to precipitate the last traces of sulphate, and electrolysed so as to obtain metallic nickel and free halogen, the latter being used over again.—A. G. L.

Electroplating apparatus. D. F. Broderick, New Britain, Conn., Assignor to L. Sperry, South Windsor, Conn. U.S. Pat. 858,059, June 25, 1907.

An endless carrier moves over two series of tanks placed one above the other, and supports the material to be plated. The carrier rises and descends in a manner requisite for dipping the material in the tanks of the upper series while travelling in one direction, and in those of the lower series while returning in the opposite direction.—R. S. H.

Metals; Apparatus for electrolytic deposition of ——. H. C. Harrison, London, and J. Day, Weston-super-Mare. U.S. Pat. 858,341, June 25, 1907.

See Eng. Pat. 23,647 of 1900; this J., 1902, 354.—T. F. B.

Ores; Process of electrically reducing oxide ——. A. J. Petersson, Alby, Sweden. U.S. Pat. 858,621, July 2, 1907.

See Fr. Pat. 370,910 of 1906; this J., 1907, 327.—T. F. B.

Low-carbon metals or alloys; Electric furnace process of making ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co. U.S. Pat. 858,780, July 2, 1907.

A charge of ore mixed with a reducing agent and, if required, with an auxiliary source of iron, is smelted by an electric current of high density. The carbon electrodes are relatively of small sectional area, and in order to protect the upper portion of the electrode from oxidation, it is surrounded by a cooling jacket.—R. S. H.

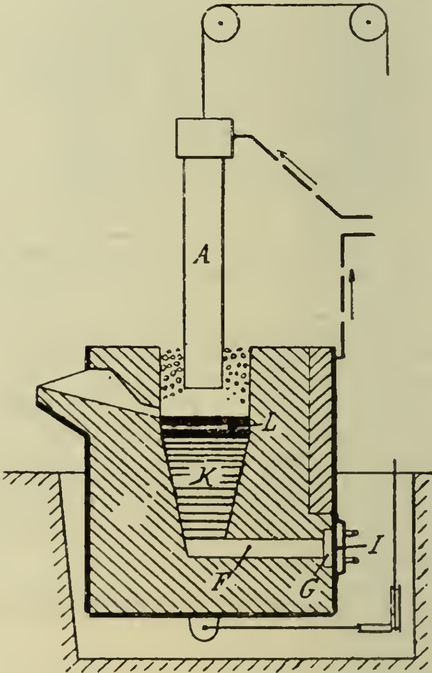
Electrolytic separation of metals; Process for the ——. Patent Actien-Ges. (Hongrie). Fr. Pat. 375,212, Jan. 12, 1907.

The process has for its object the rapid removal from the anode chambers of an electrolytic cell, of the gases evolved at the anode; such gases being soluble in the electrolyte, and capable, if allowed to diffuse into the cathode compartments, of redissolving some of the precipitated metal. The object is accomplished by directing a powerful current of the electrolyte from the cathode chambers, either through the diaphragms separating the cathodes from the anodes, or through special channels disposed near the bottom of the anode chamber, and thus ensuring a rapid stream of electrolyte upwards past the anodes. —R. S. H.

Zinc in compact form; Electrolytic deposition of metallic —— *from solutions of zinc sulphate without the use of a diaphragm.* Siemens und Halske A.-G. Fr. Pat. 375,140, Feb. 28, 1907. Under Int. Conv., Aug. 29, 1906.

Under ordinary conditions it is found that zinc electrolytically deposited from sulphate solutions redissolves so soon as the electrolyte contains any considerable amount of free acid. This is specially disadvantageous, since the metal obtained from acid solutions is well crystallised and free from oxide. The inventors have found that the solubility is caused by the presence of metallic impurities, which dissolve in minute quantity from the platinum, lead, or carbon anodes previously employed, and become deposited on the cathode. The present invention consists in using anodes of lead peroxide, either in the form of compact pieces without metallic support, or with a support of some insulating material, which is not attacked by the acid solution, and which serves to augment the mechanical compactness of the peroxide.—R. S. H.

Electric furnace with a metal hearth. G. A. Massip. Fr. Pat. 374,664, Feb. 15, 1907.



The furnace is designed with the object of minimising the losses due to self-induction, and, by the use of a hearth of metal of similar composition to the product to be manufactured, of enabling ferro- and other alloys of low carbon content to be obtained. The figure shows a transverse vertical section. The furnace chamber can be tilted on supports which are not shown. The upper movable electrode, A, consists of a graphite block; the lower metal electrode, F, is mounted in a water-cooled terminal, G, and connected at I, to the posterior wall of the furnace. This wall consists preferably of a sheet of copper, and serves for the return of the current, thus reducing to a minimum the formation of a circuit of self-induction. Above the lower electrode is placed a mass of metal, K, of similar constitution to the alloy to be manufactured, the reduced metal, L, thus collecting upon a hearth of metal, from which it is removed, from time to time, by tilting the furnace.—R. S. H.

Metals or metalloids; Process and apparatus for the reduction of —— from their compounds. A. D. Kjellin. Fr. Pat. 375,191, March 2, 1907.

THE process is carried out in an electric arc or other furnace consisting of a chamber divided into compartments by one or more partitions, which end just below the surface of the bath of molten metal. The oxide or other compound to be reduced is melted in one of the compartments, and the reducing agent, such as carbon, added to the metal in the adjoining compartment. Thus, the reducing agent does not come into direct contact with the material to be reduced, but acts through the bath of molten metal in the furnace.—O. F. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Cocoanut oil; Determination of the fatty acids of ——. E. Paulmyer. La Savonnerie Marseillaise, 1907, [78]; Chem.-Zeit., 1907, 31, Rep., 333.

THE fatty acids obtained by saponification of cocoanut oil with caustic soda and subsequent treatment with sulphuric acid, were fractionally distilled in steam, and the acid values of the resulting ten equal fractions determined. From these figures the composition of the fatty acids was calculated to be in percentages: caproic acid, 0·25; caprylic acid, 0·25; capric acid, 19·5; lauric acid, 40; myristic acid, 24; palmitic acid, 10·6; and oleic acid, 5·4. It is to be noted that, in the decomposition and washing, large quantities of caproic and caprylic acids are lost, so that the amounts of these acids are considerably greater.—J. C. C.

Corn [Maize] oil as an adulterant in lard; Possible use of ——, and its detection. W. McPherson and W. A. Ruth. *See* XVIII*A*.

PATENTS.

Palm oil from the chaff of palm nuts; Machine for extracting ——. S. C. Phillips, Lagos, W. Africa. Eng. Pat. 9733, Apr. 26, 1907.

THE machine consists of an outer casing furnished internally with angular projections. A rotating shaft or drum is fitted through the centre of the casing and is provided with "tines" or beaters which reach to within a short distance of the casing. The fresh palm nuts as gathered, are introduced through an opening at the top of the machine, and this opening is then closed by a water-tank mounted on a hinge. A quantity of water is allowed to enter the machine by opening a valve-plate, and the shaft is rotated. The "chaff," or fleshy covering, is rapidly removed from the nuts, and the oil is extracted and drains off with the water through a sieve fitted at the bottom of the machine; the cleansed nuts together with the exhausted "chaff" are removed through an opening in the side of the outer casing. —W. P. S.

Soap; Manufacture of —— [from cocoanut oil]. J. C. A. Henderson, London. Eng. Pat. 14,784, June 28, 1906.

COCOANUT oil is melted and subjected to the action of fine jets of ozonised air, until it loses its characteristic odour and yields a reaction with potassium iodide. The treated oil is then saponified in the usual manner. —W. P. S.

Soap; Manufacture of ——. P. Krebitz, Munich, Germany. U.S. Pat. 858,295, June 25, 1907.

SEE Eng. Pat. 4092 of 1905; this J., 1906, 188.—T. F. B.

Fats; Method of decolorising ——. A. Marcellin. Fr. Pat. 374,532, Feb. 11, 1907.

THE fats are partially saponified to a slight extent by means of weak caustic lye, the emulsion heated to boiling, and treated with a bleaching agent, such as chlorine, and the boiling continued until the bulk of the water has evaporated.—C. A. M.

Soaps of every kind; Apparatus and process for making ——. L. Rivière. Addition, dated Jan. 14, 1907, to Fr. Pat. 374,179, Jan. 12, 1907. (This J., 1907, 769.)

INSOLUBLE soaps obtained as described in the original patent, or in apparatus modified by the omission of the collecting vessels, may be converted into potassium or sodium soaps, by heating them not only with alkali carbonates, but also, in certain cases, with alkali sulphates.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—PIGMENTS, PAINTS.

PATENTS.

Lithopone insensitive to the action of light; Method of rendering ——. H. Allendorff, Leipzig, Germany. Eng. Pat. 23,687, Oct. 24, 1906.

SEE Addition to Fr. Pat. 370,500 of 1906; this J., 1907, 421.—T. F. B.

Antimony colours; Manufacture of ——. L. Brunet, Brioude, France. U.S. Pat. 857,978, June 25, 1907.

SEE Eng. Pat. 16,490 of 1905; this J., 1906, 768.—T. F. B.

Paint; Waterproof ——. R. Plönnis, Berlin. U.S. Pat. 858,536, July 2, 1907.

THE paint consists of water-glass solution and an alkaline lye, each of a density of about 40° B., together with a pigment and cement.—E. S.

White pigment; Manufacture of a —— from lead ores. W. Mills. Fr. Pat. 374,495, Feb. 9, 1907.

THE finely pulverised ore is treated with gaseous hydrochloric acid, and the resulting lead chloride converted into sulphate by treatment with sulphuric acid. To obtain a non-crystalline pigment which will mix more readily than the ordinary sulphate with oils, the sulphate obtained from the chloride may be converted into a hydrated basic sulphate by treatment with not more than three times its weight of water and with ammonia in gaseous form or in aqueous solution of not less than 25 per cent. strength; or the sulphate may be directly treated with an aqueous solution of ammonia containing not less than 1·75 per cent. of the gas. This basic sulphate will mix well with oil, forming a brilliant white paint of great covering-power.—C. A. M.

Paints; Manufacture of ——. P. A. Tirribillot. Fr. Pat. 374,609, Feb. 13, 1907.

ANY required degree of brilliancy may be imparted to a paint by adding more or less of a mixture of certain resins, castor oil, essential oils, and mineral salts, incorporated with a suitable drying oil. Suitable proportions mentioned are:—Soft resins distilling at low temperatures (*i.e.* about 30° C.) 500 to 1200; medium hard resins (distilling between 150° and 200° C.), 20 to 100; castor oil, 50 to 200; walnut oil, 5 to 15; essential oil or distillate of hard resins (distilling between 300° and 500° C.) 5 to 10; petroleum spirit (benzine) 500 to 1100; essential oil, 100 to 500; manganese borate, 5 to 10; and calcium carbonate, 25 to 75 parts.—C. A. M.

(*B*.)—RESINS, VARNISHES.

Tolu balsam New method of testing ——. T. Delphin. *See* XX.

(C.)—INDIA-RUBBER, &c.

Rubber cultivation in Fed. Malay States. Bd. of Tr. J., July 18, 1907. [T.R.]

The Director of Agriculture of the Fed. Malay States reports that whereas in December, 1905, the total acreage of rubber planted in the Malaya Peninsula was probably less than 50,000 acres; in December, 1906, it was 99,230, so that during the year the acreage was practically doubled. The number of trees, which was probably under 7,000,000 in 1905, is now 12,980,756. The output of dry rubber, which was about 150 tons in 1905, increased in 1906 to 412 tons.

The following table gives statistics relating to rubber in Malaya up to Dec. 31, 1906:—

—	Federated Malay States.	Straits Settlements.	Johore.	Total.
No. of Estates	242	5	7	254
Total acreage	85,579	11,341	2,310	99,230
Opened during 1906, Acres	42,154	4,098	1,355	47,607
No. of trees planted up to 31st December, 1906.............	10,745,002	1,987,954	147,800	12,980,756
No. of trees tapped	441,488	27,076	48,350	516,914
Dry rubber extracted, lb.	861,732	13,560	47,724	923,016

India-rubber; Influence of pressure on the rate of vulcanisation, strength, and oxidation of different kinds of ——. R. Ditmar. Chem.-Zeit., 1907, **31**, 638—639.

Experiments were made with nine varieties of rubber, *viz.*, Para, Kinsembo, Upper Congo, Bassam, "Lumps," Congo thimbles, Uelle, Guayule, and Dead Borneo. Samples were vulcanised with 4 per cent. of sulphur at 4 atmospheres and at 15 atmospheres pressure. The following conclusions are arrived at. The rate of vulcanisation is greatly increased at the higher pressure. With one exception (Kinsembo), the rubbers shewed much the same strength whether cured at 4 or at 15 atmospheres pressure, but a decidedly greater extensibility was attained at the higher pressure. Vulcanisation at 4 atmospheres pressure, on the other hand, distinctly favoured resistance to oxidation; this is attributed to the lower degree of depolymerisation. At 4 atmospheres pressure, after 40—50 minutes treatment, none of the specimens contained more than 1·67 per cent. of combined sulphur, whereas at 15 atmospheres pressure, almost the whole of the sulphur (4 per cent.) was found in combination after 10—20 minutes' treatment.

—W. A. C.

Patents.

Caoutchouc, gutta-percha, and balata; Process for the direct utilisation of the lactiferous juices of ——. L. Morisse, Paris. U.S. Pat. 859,611, July 9, 1907.

See Fr. Pat. 360,325 of 1905; this J., 1906, 487.—T. F. B.

Caoutchouc; Extraction of raw ——. Raffineries Réunies de Caoutchouc. Fr. Pat. 375,118, Feb. 27, 1907.

The caoutchouc is drawn out into laminæ, and is kept in this condition during the process of extracting resin, oil, etc., by means of volatile solvents.—S. R. T.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin; Suggestion and basis for a new method for the determination of ——. A. W. Hoppenstedt. J. Amer. Leather Chem. Assoc., 1907, 2, 175—179.

Believing that it is impossible to found a satisfactory method of tannin determination on the direct weighing of its compounds, the author proposes one depending on the optical activity of certain salts, which precipitate it. Cinchonine sulphate was used, since it is soluble in water, is optically very active, and precipitates tannin completely, but not non-tannins. The amount of tannin corresponding to a reduction in optical rotation of 1 degree was first found for pure tannic acid, and this factor was applied to solutions of natural tannins. The method of working was as follows:—50 c.c. of the cinchonine sulphate solution were added to an equal volume of the tannin solution, with stirring, and after thoroughly mixing, the precipitate was filtered off, and the optical rotation of the filtrate determined. The optical rotation of a mixture of 50 c.c. of the cinchonine sulphate solution and 50 c.c. of distilled water, was also measured, and from these readings the factor for pure tannic acid was calculated. The results obtained agreed closely with those of the official method of tannin determination except with tannins containing "reds," and the analysis may be carried out with solutions of the same strength as used in the tannery, thus minimising errors of analysis.—S. R. T.

Catechol-tannins in sumac; Determination of ——. M. Nierenstein and T. A. Webster. Collegium, 1907, 244—247.

The authors have applied their process (this J., 1907, 423) to the examination of sumac, which is frequently adulterated with bodies containing catechol-tannins. Five grms. of powdered sumac are extracted with 100 c.c. of water for six hours on the steam bath and filtered. 50 c.c. of the filtrate are treated with 10 c.c. of a two per cent. solution of diazobenzene chloride in a narrow beaker, the precipitate is filtered off, and washed first with dilute hydrochloric acid and then with distilled water, after which the nitrogen content is determined. A blank experiment may be made at the same time with 50 c.c. of a 1 per cent. solution of tannic acid. Preliminary experiments made with quebracho-tannic acid and pure tannic acid, gave a mean nitrogen content of 14 per cent. for the azo compound from quebracho-tannic acid. Some specimens of sumac were found to give a slight precipitate with the diazo solution, and the authors allow for this by subtracting 0·0014 grm. from the nitrogen found.

—S. R. T.

Hides and skins intended for tanning; Chemical control of the soaking of ——. F. K. Kopecky. Collegium, 1907, 241—243.

The author states that nitrogen determinations, besides being tedious, give results of doubtful value in the chemical control of "soak-waters." Well-washed skins, in the absence of bacterial action, do not contain any appreciable amount of soluble nitrogen, and the term "soluble hide-substance" is therefore incorrect. Besides "soluble hide-substance," the wash water contains variable quantities of ammonium salts, the largest amounts being found when skins from male animals are being washed. Since the presence of "soluble hide-substance" is due to bacterial action, the amount of nitrogen in solution can be controlled by careful regulation of the process and selection of a suitable water supply. Experiments were made with the object of finding a quicker method of testing "soak-waters" than by means of a determination of nitrogen. The author has proved that the products of bacterial action, formed during soaking, are alkaline to methyl orange, and can therefore be titrated, the results having a direct relation to the nitrogen content. Assuming that "the temporary hardness" of the water used, remains constant during the process, it is suggested that by determining the alkalinity (expressed in terms of "temporary hardness" or calcium carbonate) of the "soak-water" at all stages of the process, and also the amount of salt by titration with silver nitrate, the soaking can readily be controlled. An increase of "temporary hardness" of 1 part of calcium carbonate per 100,000 is stated to indicate the presence of from 0·85 to 1·15 part of "soluble nitrogen" per 100,000 according to the kind of hides under treatment. Under ordinary circumstances it is impossible to wash out all the salt used in preserving, without unduly prolonging the process. From the results of his work, the author draws the following practical conclusions:—

Receptacles used for soaking must be well cleansed after the withdrawal of a pack of hides, and if old wooden pits are employed, the use of a powerful antiseptic at intervals of about a week is desirable. Washing in a drum before soaking is advantageous, especially in hot weather. The soaking process should be regulated so that the goods remain for the shortest time in the first water and the longest in the last. Where it is impracticable to use separate vessels for the first and subsequent "soaks," an antiseptic should be used to retard the rapid growth of organisms.—S. R. T.

Patents.

Tannic extracts ; Treatment of ——. L. Dufour, Genoa, Italy. Eng. Pat. 15,648, July 10, 1906.

See Fr. Pat. 367,917 of 1906 ; this J., 1906, 1227.—T.F.B.

Leather ; Substitute for ——, *and process for producing the same.* G. Harrison, London. From A. Ferraguti, Milan, Italy. Eng. Pat. 3433, Feb. 11, 1907.

See Fr. Pat. 374,805 of 1907 ; following these.—T. F. B.

Leather substitute ; Manufacture of a ——. A. Ferraguti. Fr. Pat. 374,805, Feb. 18, 1907.

The following solutions are prepared :—(A.), Skin glue, 100 ; beetroot molasses, 50 ; and Venice turpentine, 2 parts. (B.), Bone glue, 100, and glycerin, 50 parts. (C.). Palm oil, 100, and colophony, 50 parts. (D.), Potassium carbonate solution of 25° B., 500 ; oleic acid, 200 ; palm oil, 50 ; tanyard grease, 50, and "essence de cuir," 15 parts. (E.), Yellow vaseline, 100, and paraffin, 10 parts. (F.), Formalin, 100 ; water, 50, and alcohol, 50 parts. (G.), Boiled linseed oil, 100 ; oil of turpentine, 50, and "essence de cuir," 10 parts. For a thin soft material, 100 parts of B, 25 of A, 20 of D, and 5 of E, or for a thick rigid material, 100 of A, 25 of B, 15 of C, and 3 of D, are mixed with 7 parts of a saturated aqueous solution of potassium bichromate, and the whole heated. The resulting mass is cut or rolled into laminæ, which are pressed by plates first hot and then cold, between sheets of a cotton or other textile fabric. Talc is dusted on both surfaces, the material is dried at a low temperature, and then treated in succession with solutions, F and G, drying after each dressing.—S. R. T.

Leather ; Manufacture of —— *from outer skin of intestines.* Zephyrleder-Fabrik G.m.b.H. vorm. Trenckmann und Co. Fr. Pat. 375,185, Mar. 1, 1907.

The skins are cleansed and treated with dilute acid, after which they are placed in a bath containing a soluble salt of an alkaline-earth, or of lead, tin, zinc, copper, etc. The goods are then introduced into a second acid bath containing a body capable of producing an insoluble compound with the salt used in the first bath. In this way, carbonates, phosphates, silicates, etc., are precipitated in the skin. Instead of the second bath, gases, such as carbon dioxide, ammonia, etc., may be employed, or a soap solution may be added in order to produce a high degree of suppleness.—S. R. T.

XV.—MANURES, &c.

Phosphate industry of Tunis. Bd. of Tr. J., July 25, 1907. [T.R.]

H.M. Consul-General at Tunis (Mr. E. J. L. Berkeley, C.B.) reports that some twenty years ago a mine of calamine was opened out, but, although large profits were made, the attention of prospectors was scarcely attracted to the country. Since then, however, large deposits of phosphates have been discovered near Gafsa, Kalaat Djerda, Kalaat-es-Senam, 'Ain Moulares and Metlaoui, to the west of Gafsa, as well as iron mines in the north-west of the Regency. The largest enterprise in phosphates is that of the Gafsa Company. In 1905 this company put out 400,000 tons ; in 1906, 500,000 tons. Mr. Berkeley adds that the world's total consumption of phosphates during 1906 was said to be 4,500,000 tons, of which 800,000 tons is reported to have come from Tunisia, 400,000 tons from Algeria, 1,300,000 tons, 600,000 tons of hard rock, and 700,000 tons of land pebble from Florida, 450,000 tons from Tennessee, 500,000 tons from France, and 350,000 tons from Belgium.

Ammonia ; Can calcium carbonate cause loss of —— *by evaporation from the soil ?* T. Takeuchi. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, **7**, 433—436.

Direct experiments showed that whilst calcium sulphate and ammonium carbonate interact readily, at the ordinary temperature, with the production of ammonium sulphate and calcium carbonate, the reverse reaction takes place only to an insignificant extent at the average summer temperature (up to 24° C.), and hence there is no danger of an appreciable loss of ammonia on manuring a soil with ammonium sulphate when calcium carbonate is present.—A. S.

Magnesia ; Physiological effects of an excess of —— *upon barley.* S. Kumakiri. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, **7**, 441—442.

Barley was grown in pots in a soil containing 0·5 per cent. of lime and 0·4 per cent. of magnesia soluble in 10 per cent. hydrochloric acid, and pots containing equal numbers of the young plants were : (1), used for control purposes ; (2), treated each with 10 grms. of crystallised magnesium sulphate in the form of a very dilute solution ; (3), treated each with 50 grms. of magnesium sulphate. The results showed that the growth and ripening of the plants are retarded by an excess of magnesia over lime. The number of shoots per plant is not appreciably affected by a moderate excess of magnesia, but is diminished by a larger excess. Excess of magnesia also diminishes the strength of the leaf-sheathes and of the stalks.—A. S.

Aluminium nitride. F. Fichter. *See* VII.

Patent.

Superphosphate pits ; Discharging apparatus for ——. H. R. Neech, Lincoln. Eng. Pat. 17,512, Aug. 3, 1906.

An endless chain or belt, having a series of projecting prongs or forks, passes over wheels or drums, the lower of which is mounted on a shaft between two brackets, the latter being attached to a carriage, provided with wheels by which the apparatus can be moved into any required position. The upper drum is mounted on a shaft at the upper and forward end of a frame. This frame is pivoted to the carriage, so that its forward, upper end can be raised or lowered, to cause the prongs to engage the material in the pit. The endless chain is driven so that the prongs move from the upper towards the under side of the stretched belt, and carry the material from the pit down, either on to the ground, or into a shoot arranged below the chain.—W. C. H.

XVI.—SUGAR, STARCH, GUM, &c.

Patents.

Potatoes ; Process of treating —— *for obtaining starch and a nutritive foodstuff.* C. Steffen, Vienna. Eng. Pat. 24,035, Oct. 29, 1906.

See Fr. Pat. 368,002 of 1906 ; this J., 1906, 1230.—T. F. B.

Lactose from glucose [*dextrose*] *; Process of making* ——. J. A. Just, New York. U.S. Pat. 851,673, April 30, 1907.

The process consists in treating dextrose solution with an extract of mammary glands. A suitable temperature for the conversion is from 80° to 105° F., and the lactose may be separated from the solution by the addition of alcohol. As the conversion proceeds in the presence of alcoholic fermentation, excess of dextrose may be employed and allowed to ferment, so that the lactose is precipitated as fast as it is formed.—W. P. S.

Mineral and organic matters of the waste liquors from sugar factories or from the degreasing of wool, or of distillery vinasses ; Separation and recovery of the ——. A. E. Vasseux. Fr. Pat. 374,564, Feb. 12, 1907.

The process is based on the fact that the organic matters contained in these waste products are acid in character. Treatment with an appropriate base brings about their coagulation and the formation of organic compounds, or "organates," containing the base employed. The liquors are evaporated and to the residue is added, gradually, a suitable amount of a base or basic salt. The mass is then dried, in order to render the organic matter insoluble, and extracted with water, either with or without suction or pressure, whereby the soluble salts and bases are removed, leaving a residue of insoluble nitrogenous matter.—T. H. P.

Drying of materials in the form of thin pastes or liquids, especially molasses; Apparatus for the continuous ——. E. Nussbaum. Ger. Pat. 183,137, Oct. 31, 1905.

The apparatus is of the type in which the material to be dried, is fed on to two drying cylinders, rotating in opposite directions, from two troughs disposed above. Each trough has slits or perforations in the bottom, and is provided also with a shaft extending its whole length. On this shaft is mounted either a series of wheels or a cylinder, provided in their periphery with slits or holes. As the shaft rotates, the rims of the wheels or the cylinder close the holes in the bottom of the trough except when these holes register with those in the wheels or cylinder. The material is thus fed intermittingly on to the drying drums, whereby, it is claimed, the drying is expedited.—A. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Extract of barley; Determination of the ——. K. Krapf. Z. ges. Brauw., 1907, **30**, 379—380.

25 grms. of the finely-ground barley (containing at least 20—25 per cent. of meal) and 25 grms. of finely-ground Pilsener malt (saccharification period, 10—15 minutes) are mashed with 300 c.c. of cold distilled water and allowed to stand for about 12—15 hours. The mash is kept as usual at 45° C., and is then saccharified at 70° C., the time required being 25—30 minutes if the stirring is efficient. After the mash has been allowed to stand for 5 minutes without stirring, 40—50 c.c. of the liquid are withdrawn, and the remainder is stirred and heated to boiling for 15 minutes. The walls of the beaker are washed, the mash is cooled to about 60° C., the portion which was removed is returned, and the whole is heated at about 75° C. to produce a second saccharification, which is completed in 10—15 minutes. The mash is then cooled, made up to 450 grms. and filtered, the specific gravity of the filtrate being determined and calculated to degrees Balling. The extract of the malt employed must also be determined by the above method, but in this case the after-saccharification proceeds very rapidly and only requires about 20 c.c. of the clear mash; the value thus obtained is, with a well modified malt, about 1 per cent. higher than that obtained with fine grist, and agrees exactly with the absolute, theoretical yield of extract. A malt of known extract may be kept for almost any length of time without change, provided it is stored in air-tight vessels.—T. H. P.

Malts; Coloured ——. L. Briant. J. Inst. Brewing, 1907, **13**, 486—497.

The coloured malts on the market are classed as black, brown, amber, and crystal. Black malt is used for colour and crystal malt for flavour; very successful results are obtained with suitable blends of all four types. For black malt the grain is kept 5—8 days on the floor, but it is essential that the growth should be uniform. The correct degree of roasting can only be determined by empirical methods. The tinctorial value of a 10 per cent. extract of black malt generally lies between 1000° and 1500° in a 1-inch cell with Lovibond's 52 series glasses; a minimum colour value of 1250° would be a fair standard for commercial purposes. With normal samples the use of a diastatic pale malt in preparing the wort has no influence on the colour but increases the yield of extract. Black malt is utilised in various ways, sometimes mixed with the whole grist, sometimes mashed with a little pale malt in a separate vessel, and sometimes finely ground and added to the copper, but this last method, if considerable proportions of black malt are so used, is apt to impart roughness or bitterness of flavour. Black malt is generally sold by measure; its weight varies from 215 to 290 lb. per quarter. On the basis of an average weight of 270 lb., it gives a yield of 50—60 lb. of extract. Of late years roasted barley has been largely used in place of roasted malt. Its lower price is somewhat discounted by its lighter weight, which rarely exceeds 250 lb. per quarter; the colour and extract are also slightly lower than those of black malt. The author finds, contrary to a general impression, that the colour imparted by roasted barley is not less permanent than that produced by black malt, under ordinary circumstances. It does, however, appear to be less resistant towards certain wild yeasts, such as those which infect beers stored for many months in vats. In both cases the component colours, as analysed by Lovibond's glasses, change in relative proportions during storage. In flavour, roasted malt is superior to roasted barley. Crystal malt is used not only in black beers but in mild ales, to which it imparts a rich "nutty" flavour. Its weight ranges from 250 to 280 lb. per quarter; on its own weight, the yield of extract in the brewery is about 50 lb. On a weight of 336 lb., it yields about 50 lb. when extracted alone, and about 80 lb. when mashed with malt as is always the case in practice. The colour of a 10 per cent. solution is 100°—250°, a fair minimum standard being 125°. With all coloured malts, there is a distinct advantage in using only freshly-roasted material, since it readily becomes slack and loses aroma.—J. F. B.

Brewing; The nitrogen question in ——. H. T. Brown. J. Inst. Brewing, 1907, **13**, 394—446.

The author gives a summary of the work published in the Guiness Research Lab. Trans. (see this J., 1905, 135, 137, 275 and 1906, 1110) on the systematic analysis of complex mixtures of protein derivatives and on the nature of the non-coagulable nitrogenous constituents of malt extracts. He has now extended his studies to the relations of these constituents towards yeast, dealing particularly with the residual nitrogenous constituents of beer and their effect on its stability. A. J. Brown has shown that the main factor which limits the reproductive functions of yeast in a fermenting wort is the exhaustion of the dissolved oxygen. In order, therefore, to stimulate the yeast to exert its maximum reproductive capacity and to determine the maximum assimilation of nitrogen under given conditions of nutrition, fermentations were conducted in liquids through which a slow current of air was passed. Under these conditions, 51 per cent. of the nitrogen contained in a boiled cold-water extract of malt, to which sugar had been added, was removed in a single fermentation. In a second and a third fermentation, after driving off the alcohol and adding fresh sugar each time, a further 7·5 and 1·7 per cent. respectively were removed. Thus not more than 62—63 per cent. of the total non-coagulable nitrogenous constituents of such an extract are available for the nutrition of yeast. It is suggested that the remaining 38 per cent. of these constituents, which are non-assimilable, correspond with the "unclassified nitrogen" mentioned in the previous papers (*loc. cit.*). Turning next to brewery worts, the percentage assimilation of nitrogen was found to be distinctly lower, *viz.*, first fermentation, 40·7 per cent.; second fermentation, 8·6; third, 5·3; total, 54·6 per cent. This difference is due to proteolytic changes which take place at the temperatures employed in mashing. These changes are manifested in an increased extraction of permanently soluble forms of nitrogenous constituents, owing to the increased action of the enzyme on the insoluble proteins. The influence of elevated temperatures on this action and on the degree of assimilability of the products is shown in the following table:

Temperature of mashing, °F.	60°	113°	150°	160°
Non-coagulable nitrogen in wort (extraction at 60° F. expressed as 100)	100·0	151·8	159·9	147·6
Percentage of non-coagulable nitrogen removed in the first fermentation	50·7	51·5	46·0	40·8
Ditto in the second fermentation	9·8	9·8	9·4	6·4
Total assimilation.......	60·5	61·3	55·4	47·2

Thus, when the mashing temperature is increased beyond certain optimum points (different in the two cases) the solvent power of the proteolytic enzyme is crippled, and the degree of assimilability of the products is reduced. The normal degree of assimilability can, however, be restored in the case of these high-temperature mashes, by adding to the previously boiled clear wort, before fermentation, a cold-water extract of malt-culms, the proteolytic enzyme in which breaks down the less readily assimilable matters of the wort into simpler and more available products. In this sense an active proteolytic extract of malt-culms acts as a "yeast-food." When ordinary brewery worts, which, with complete aeration, lose 42 per cent. of their nitrogen in a single fermentation, are fermented under industrial conditions, the proportion of nitrogen removed may vary between 20 and 36 per cent. The difference between these latter numbers and 42, therefore represents the percentage of "readily" assimilable nitrogen remaining in the beer. But the effect of the residual readily assimilable nitrogen on the stability depends not on its ratio to the total nitrogen of the wort, but on its actual concentration in the beer. This is best determined directly by a special fermentation of the de-alcoholised beer extract with the addition of sugar and with complete aeration. In a series of beers of various qualities from the same brewery, the residue of readily assimilable nitrogen ranged from 0·0052 to 0·0231 grm. per 100 c.c. The amount of this readily assimilable nitrogen in a beer is a very important factor in determining its liability to "yeast frets," turbidities, and the development of infecting bacilli. But there are several other factors which also control organic activity in the finished beer. Such factors, for instance, are: the degree of oxygenation to which the beer is subjected, and the amount of readily fermentable carbohydrates left in the beer or added as priming. The alcoholic strength of the beer is also a powerful limiting factor when it exceeds 4·0—4·5 per cent. Without taking all these into consideration, it is impossible to fix a safe limit for the amount of readily assimilable nitrogen in beer. As regards the nature of the readily assimilable nitrogenous bodies, the author is inclined, with reservation, to regard the malt peptones and albumoses as being more readily assimilable than the amides and amino-acids. Comparing the assimilating power of the "wild" or secondary yeasts with that of the primary beer yeast, it was found that *S. Pastorianus III*, and *S. ellipsoideus I* and *II* were practically equivalent to the primary yeast, whereas *S. Pastorianus I* and *S. exiguus* were feebler and failed to assimilate certain forms of nitrogenous constituents which were readily removed by the other yeasts.

—J. F. B.

Amygdalase; Enzymes of yeast: ——. R. J. Caldwell and S. L. Courtauld. Roy. Soc. Proc., 1907, **B79**, 350—359.

The action of an extract of dried yeast on amygdalin and also on methyl-α-glucoside persists after heating the solutions to such a temperature that the action on maltose is at an end. At higher temperatures the enzyme which hydrolyses amygdalin can be destroyed without depriving the solution of its power of hydrolysing sucrose. The new enzyme which is distinct from maltase and invertase is termed *amygdalase*; it is uncertain whether it also attacks methyl-α-glucoside. Maltose, galactose and lactose are without effect on the hydrolysis of amygdalin by amygdalase, whilst dextrose has a marked inhibitory effect. Amygdalase is contained in invertase prepared by O'Sullivan and Thompson's method, which involves the autolysis of the yeast and precipitation of the enzyme by alcohol—a process which entirely destroys maltase. Bottom-fermentation yeast though equally rich in maltase, appears to contain a far smaller proportion of both invertase and amygdalase than top-fermentation yeast.

—E. F. A.

Enzymes; Nature of ——. H. E. Armstrong and E. F. Armstrong. Roy. Soc. Proc., 1907, **B79**, 360—365.

Additional evidence is adduced that the action of enzymes is specific, and that it is limited to compounds of a particular type to a greater extent, indeed, than previously recognised. It is shown that maltase hydrolyses α-glucosides alone, whilst emulsin hydrolyses β-glucosides. Additional experiments made with specially purified materials confirm the conclusion that enzyme and hydrolyte must be in complete correlation, and the evidence on this point appears to be little short of absolute in the case of the sucroclasts. Dextrose and lævulose alone retard the action of invertase on sucrose, galactose, mannose, dulcitol, and mannitol being without effect. Invertase is extraordinarily active, and minute quantities of impurity exercise an important influence on it; the activity is much increased by amino-acids. Sucrose is a derivative of α-glucose but not a simple α-glucoside; it is also not a simple fructoside. There is little room for doubt that during hydrolysis, the enzyme extends its influence over the whole of the sucrose molecule, being intimately correlated in all its parts with the carbohydrate. This is probably true of other biases. The enzymes themselves are subject to hydrolysis and simplification, and there is evidence that a biase may give rise to a monase. The sucroclastic enzymes are products of hydrolytic change conditioned mainly by proteoclasts, and it is to be supposed that several enzymes may arise in this manner, all of one type, yet all capable of hydrolysing a particular hydrolyte and differing only in activity.

—E. F. A.

Wines; Disease organisms of ——, *with special reference to Coccus anomalus and the "blue" disease of Champagne wines.* P. Mazé and P. Pacottet. Compt. rend., 1907, **145**, 141—143. (See also this J., 1904, 200.)

The organisms, which are the cause of "turned" and bitter wines, were cultivated in grape must concurrently with yeast. Sour and mannitol-containing wines were thus obtained, similar to those frequently obtained under practical conditions. The authors have also investigated the coccus of Champagne wines which they have named *Coccus anomalus*. This organism does not form fermentation products in appreciable quantities; its injurious action consists chiefly in the turbidity and sediment which it produces. A large number of Champagne wines affected with the "blue" disease were examined; it was invariably found that the disease was due to the development of *C. anomalus*. This disease has been confounded with the "*graisse*" disease which also renders the wine opalescent, but the authors have not observed a single case of "blue" disease caused by the "*graisse*" disease organism. The "blue" disease develops in relatively new wines. *C. anomalus* was also found in other wines from various sources, and in a sample of cider. Wine infected with this organism, cannot be freed from it by filtration. The development of *C. anomalus* is not prevented by a high alcohol- or tannin-content. With regard to the production of bitterness, the organism has very little action.—L. E.

Wine stored in metal vessels; Alterations in ——. J. Trummer. Mitt. aus dem chem. Versuchs- und Hefereinzucht-Lab. der k. k. höheren Lehranstalt für Wein- und Obstbau in Klosterneuburg.

After storing for five weeks in a tinned iron vessel, a sample of deep-red, clear wine became dirty red and very turbid, and assumed a marked unpleasant metallic flavour. On standing, the turbid wine deposited a flocculent precipitate, but still retained a certain amount of turbidity, which could only be removed by filtration through asbestos. The filtrate was nearly as dark in colour as the original wine, but the metallic taste and unpleasant smell persisted, though in diminished degree. Analysis of the wine after storing in: (I.), a glass vessel, and (II.), a tinned iron vessel, gave the following results:

	Alcohol, by vol.	Grms. per litre.					
		Extract	Total acid.	Volatile acid.	Tartar.	Tannin.	Ash.
I	10·00	27·40	5·55	0·720	1·82	1·22	2·320
II	10·10	26·60	4·90	0·577	1·66	1·10	2·294

A further experiment, with wine containing salicylic acid, showed that the changes described above were due to the action of the tin and not to bacterial development. Similar changes are produced in white wine when stored in a tinned iron vessel. In both cases hydrogen sulphide is produced. Aluminium, on the other hand, exerts only a negligible influence on wine, so that measuring and cooling vessels of this metal are safer than the tinned iron ones usually employed. Although must has a higher acid content than wine, it is not influenced to the same extent as the latter by contact with tin. Thus, with a Riesling must, exposed to the action of tin, a slight evolution of hydrogen sulphide occurred after the completion of the fermentation, but the new wine had not the unpleasant odour and flavour observed in wine after storing in contact with tin.—T. H. P.

Wines; Distillation of —— in vacuo. C. Girard and Truchon. Monit. Scient., 1907, **21**, 441—444.

The process of distillation *in vacuo* has recently been applied to the distillation of brandy from wines. The distillation is carried out at a temperature not exceeding 30° C., and the quality of the brandy is said to be superior to that of spirit distilled by the usual methods. The residual vinasse possesses all the characters of the original wine, and its composition is unchanged. On dilution with water to the original volume, a de-alcoholised wine is obtained which remains perfectly clear; the colour is slightly more yellow than that of the original, and resembles that of an aged wine. These vinasses are capable of many applications. They can be sold as non-alcoholic wines, either "still" or aërated. On the addition of sugar, and re-fermentation, a new wine of full quality is obtained. On the addition of the requisite proportion of clean commercial spirit, a marketable wine of slightly poorer quality is produced. The vinasses may be used for reducing wines of excessive alcoholic strength. When judiciously mixed with water, they can, it is stated, be employed for diluting wines in such a manner that the dilution cannot be detected by analysis. When mixed with commercial acetic acid they can, according to the authors, be sold as wine-vinegar, or else they may be mixed with alcohol and converted into vinegar by fermentation. A "small" wine can be converted into a strong wine by distilling off the alcohol, concentrating the vinasse, and returning the alcohol to the concentrated product. The authors give tables showing the composition of vinasses obtained from typical wines and of blended wines prepared with them.—J. F. B.

Patents.

Cattle or like food from yeast. J. Schmidt. Eng. Pat. 20,832, Sept. 19, 1906. *See* XVIII*A*.

Yeast; Process of preparing and utilising ——. M. Wallerstein, New York. U.S. Pat. 858,691, July 2, 1907.

Yeast is propagated in successive worts containing regularly increasing proportions of alkaline-earth sulphates and chlorides, and potassium chloride. A suitable proportion of these salts is also added to the wort to be fermented before introducing the yeast. The yeast so prepared is said to be "distinguished by its flocculent character, by its rapid and complete clarification or settling in beer in the absence of chips, and by its relatively high proportion of associated mineral salts of alkali earth metals."—W. P. S.

Brewers' wort or the like; Apparatus for heating or boiling ——. H. J. Worssam, Assignor to H. Hunt and H. S. Fox, London. U.S. Pat. 857,779, June 25, 1907.

See Eng. Pat. 10,198 of 1905; this J., 1905, 1079.—T.F.B.

Distilling apparatus. M. Llodra, Manila, Philippine Islands. U.S. Pat 858,346, June 25, 1907.

Two stills or "caldrons" are disposed the one behind the other. The front one is heated directly by a furnace, whilst the rear one is surrounded by a spiral flue, through which the hot gases from the furnace pass, on their way to the stack. A distilling column is arranged over the second still, and its vapour outlet is connected to the coils of a condenser, a cooler, an auxiliary cooler, and a receiver, arranged in series. The vapours generated pass from the top of the first still to the bottom of the second, up the column and then through the coils of the train of apparatus in the order given above. The liquid to be distilled, or "wash," flows in the opposite direction around the coils, and after serving as the cooling and condensing medium and becoming heated, is delivered into the distilling column.—W. H. C.

Brewers' pitch; Preparation of absolutely neutral ——. L. Schmied. Fr. Pat. 374,611, Feb. 13, 1907.

Colophony is subjected to destructive distillation at 230—300° C., in order to remove the non-condensable gaseous constituents which might exert a harmful influence on the beer. The neutral residue is melted with a quantity of neutral paraffin or similar hydrocarbon sufficient to give a mixture having the consistency of pitch.—T. H. P.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

Egg-yolk; Direct analysis of ——. N. A. Barbieri. Compt. rend., 1907, **145**, 133—135.

Egg-yolk was extracted with pure carbon bisulphide and alcohol successively. The alcoholic extract was evaporated, the residue extracted with ether, and the ethereal solution evaporated. The residue was again extracted with carbon bisulphide, the solution added to the first carbon bisulphide extract, and the whole evaporated. On dissolving the residual oily liquid in the least possible quantity of ether and adding alcohol, a precipitate was thrown down, containing tristearin and triolein. The filtrate from this precipitate was evaporated, and the residue dissolved in a small quantity of ether and treated with acetone. The precipitate thus obtained contained a white crystalline substance (m. pt. 18° C.; composition, C., 64·80; H, 11·30; N, 3·66; P, 1·35; S, 0·40; and O, 18·49 per cent.) which the author names *ovine*; it had been previously obtained, in an impure state, by Gobley, who named it cerebrine. The filtrate from the acetone precipitation was evaporated, and the warm residue treated with acetic acid. On cooling, ovocholesterol (cholesterol) separated. The acetic acid mother-liquor was neutralised and extracted with ether; on evaporation, the ethereal extract yielded an intensely yellow oil, from which, on treatment with ether or chloroform, small octahedral crystals (m. pt. 115° C.) of nearly pure sulphur were obtained.—L. E.

Tomato; Complete analysis of the fruit of Lycopersicum esculentum or ——. J. M. Albahary. Compt. rend., 1907, **145**, 131—133.

Fresh tomatoes were found to contain: water, 93·5; nitrogenous matter, 0·95; non-nitrogenous matter, 0·50; fat, 0·20; carbohydrates, (dextrose, lævulose, and sucrose), 3·60; insoluble organic matter, 1·69; insoluble inorganic matter, 0·11; and total ash, 0·74 per cent. (of which, 0·12 was calcium phosphate). The percentages of free acids were as follows:—malic, 0·48; citric, 0·09; oxalic 0·001; only traces of tartaric and succinic acids were found. In addition to these acids, there were others (representing about 77 per cent. of the total acidity) which were not precipitable by lead acetate; the author considers that the non-precipitable acid or acids may be glycollic acid or its analogues. Small quantities of organic salts were also found. The ash of tomatoes contains a determinable quantity of iron, part of which is present in the tomato in a soluble form.—L. E.

Corn [Maize] oil as an adulterant in lard; Possible use of ——, and its detection. W. McPherson and W. A. Ruth. J. Amer. Chem. Soc., 1907, **29**, 921—926.

Whether maize oil is actually used as an adulterant in lard the authors have not been able to ascertain by enquiry; but that it can be so used is proved from the fact that mixtures containing as much as 15 per cent. of oil were employed in making the pastry for a number of establishments without any adverse comments or complaints being made. As regards the chemical detection of maize oil in lard, results of the examination of various mixtures show that the iodine values and refractometer readings of samples containing 10, and even 15, per cent. of the oil were within the limits exhibited by pure lards. Maize oil may, however, be detected readily by means of the phytosteryl acetate test (this J., 1902, 192). Whilst the m. pt. of the acetyl derivative obtained from lard is 113° C., samples containing 4 per cent. of maize oil give acetyl compounds having a m.pt. of about 125° C.—W. P. S.

Patents.

Cattle-, or like food from yeast. J. Schmidt, Burton-on-Trent. Eng. Pat. 20,832, Sept. 19, 1906.

To prevent the development of a bitter taste, the yeast is heated rapidly to a temperature of from 58° to 75° C., and then boiled and evaporated to drynes. For instance, 1 cwt. of yeast is introduced into a pan heated previously to a temperature of 60° to 70° C., and the mass is stirred until it becomes fluid; successive smaller portions of yeast are then added until the whole of the quantity which it is desired to treat has been introduced, the temperature never being allowed to fall below 58° C.—W. P. S.

Malted whole dough or whole meal; Process and apparatus for the production of ——. E. and J. Keller, Colmar, Germany. Eng. Pat. 5,226, Mar. 4, 1907.

The washed grain, such as all kinds of undecorticated cereals, seeds, and pulse, is introduced, with the quantity of water necessary for germination, into a revolving malting drum. The latter is provided with a heating jacket and two sets of internal perforated tubes; one set serves for the admission of air to the drum, whilst the other set is connected with an exhaust pump. When germination has taken place, the air supply is cut off, and the grain is dried by heating the drum, a low pressure being produced in the drum by means of the exhaust pump. The dry grain may be ground into flakes, groats, or meal.—W. P. S.

Butter; Manufacture of ——. A. H. Borgstrom, Hango, Finland. Eng. Pat. 6,394, Mar. 16, 1907.

Milk, or cream, is churned at a temperature as near the freezing point as possible, without, however, allowing the liquid to freeze. The liquid becomes thick, but no formation of butter is visible. The temperature is then raised, when the butter separates almost instantaneously, and is collected directly, or after a further slight churning. The cream may be "soured" just before or during the churning operation.—W. P. S.

Butter; Apparatus for determining water in ——. C. E. Gray. U.S. Pat. 858,868, July 2, 1907. *See* XXIII.

Waterproof, acid-proof, and odour-proof material [cardboard] particularly applicable for lining butter boxes and for packing purposes generally; Manufacture of inert ——. J. Bishop, J. H. Stanley, and A. A. Sage. Eng. Pat. 18,136, Aug. 13, 1906. *See* XIX.

Albumin product [from casein] useful as a substitute for ordinary albumin. L. J. Pansiot. Fr. Pat. 374,594, Feb. 13, 1907.

Casein is dissolved in an excess of alkali, and the solution is treated with 5—10 per cent. (on the weight of casein) of sodium peroxide. The mixture is gradually heated to a temperature of 65°—70° C. with constant stirring, and is then cooled. Dilute hydrochloric acid is now added, avoiding an excess, until the casein is precipitated. The latter is pressed, washed cautiously so that solution does not take place, and the mass is spread over glass plates and dried at a low temperature.—W. P. S.

Albumin compound from fish; Process of making a soluble ——. K. Schwickerath. Fr. Pat. 375,028, Feb. 25, 1907.

The fleshy part of fish is finely divided and subjected to the action of superheated steam in an autoclave. The liquid portion is then separated, cooled, and treated with potassium permanganate solution, about 250 grms. of the salt being used for 50 kilos. of flesh. The mixture is heated to a temperature of from 70° to 80° C., then filtered, and the filtrate evaporated to dryness. An alternative process consists in adding milk of lime, or other alkaline-earth, to the aqueous extract of the fish until no further precipitate forms, and then treating the mass with permanganate as described above, but preferably after removing the calcium precipitate by filtration. The dry albuminous product obtained, is stated to be free from taste or smell.—W. P. S.

Butter; Process and apparatus for purifying [renovating] ——. J. Bredenkamp. Fr. Pat. 375,075, Feb. 26, 1907

The butter is placed in a cylindrical vessel provided with a stirrer and surrounded by a hot-water jacket, the horizontal shaft bearing the stirring blades being hollow, so that the hot water may pass through it. When the butter is melted, the water, curd, etc., are drawn off, the fat is heated to a suitable temperature, and an alkali solution is introduced and well mixed with the fat. A little milk may be added, finally, and the butter re-worked —W. P. S.

Coffee extract; Process for making a concentrated ——. P. Albertolli. Fr. Pat. 375,120, Feb. 27, 1907.

Ground roasted coffee is extracted with boiling water, and the solution is evaporated to dryness. The volatile matters given off during the evaporation, are reunited with the extracted residue, and the latter is then treated with suitable solvents to obtain the flavouring constituents of the coffee. The dry residue from the first operation is mixed with sugar, the flavouring extract is added to the mixture, and the whole is compressed into tablets.—W. P. S.

Milk, skimmed, and milk-serum; Process of treating [preserving] ——. Soc. di Esportazione Polenghi-Lombardo and E. Soncini. Fr. Pat. 375,123, Feb. 27, 1907. Under Int. Conv., Mar. 2, 1906.

Skimmed milk is treated with sulphur dioxide, either in the form of gas or as an aqueous solution, in order to separate the casein; the treatment preserves the casein and also the serum separated from it. The proportion of sulphur dioxide added is from 300 to 400 grms. per 100 litres of milk.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Water storage and pathogenic microbes. Times, July 20, 1907. [T.R.]

At a meeting of the Metropolitan Water Board held on July 19th the Water Examination Committee presented an exhaustive report, which had been prepared by the director of water examinations, respecting the work carried out at the Board's laboratory during the 12 months ended March 31st last. The report gave, in considerable detail, the results obtained in the testing of 11,993 samples of London waters, and also dealt at length with the important question of the value of storage. Dr. Houston stated in regard to this question that there was a consensus of opinion among bacteriologists that pathogenic microbes did not multiply in storage reservoirs, but gradually lost their vitality. The time required to effect the destruction of these bacteria was matter for controversy, and although the American authorities considered a few days might suffice, most British bacteriologists placed the limit at a much longer period. The essential point was that each day's storage made for safety, and that a time arrived eventually when all the pathogenic bacteria had perished, and in such a case subsequent filtration alone was required to improve the chemical and physical qualities of a water already incapable of giving rise to epidemic disease. There was indeed an intrinsic biological difference between storage and mere filtration which should not be overlooked. The fact that there were almost insuperable difficulties in directly and practically proving the absolute benefit, as regards the elimination of pathogenic bacteria, resulting from adequate storage, did not destroy the value of the indirect and inferential proofs which had led both epidemiologists and bacteriologists to regard storage as of paramount importance. Until the safety limit had been determined, and it doubtless varied according to the quality of the water and the season of the year, it was obviously desirable to store water for as long a time as was economically possible. In this connection it might be asked whether storage, if too prolonged, might not actually lead to deterioration in the quality of a water. The fact, however, remained that in relation to danger to health, over-storage was believed to be impossible. Undoubtedly from the epidemiological point of view, apart from questions of cost of pumping, the storage reservoirs should be so worked as to give each drop of river water abstracted for waterworks purposes the maximum number of days' detention in store. Dr. Houston also drew attention to the difference between "active and passive storage" and the great importance of active storage from the epidemiological point of view.

Putrescibility [*in sewage effluents*]; *Hamburg test for* ——. Korn and Kammann. Gesundheits-Ing., 1907, 30, 165.

After describing previous methods of determining putrescibility, which are all indirect methods, the authors base a direct method on the fact that what is generally termed putrefaction only occurs in effluents containing sulphur in combination with organic matter. For the detection of this organic sulphur they have devised the following test:—To about 100 c.c. of the liquid to be tested are added about 30 c.c. of baryta water (of 1·5 per cent. strength) and 5 c.c. of barium chloride solution (1 : 9), and the mixture warmed at about 50° C. until a flocculent precipitate forms. To the clear liquid a drop of the barium chloride solution is added and if a further precipitate forms, more of the reagents are added and the warming repeated until precipitation is complete. The liquid is then filtered and evaporated to dryness. The residue is dissolved in a little hot water, filtered if necessary, and again evaporated and completely dried in an air-oven. The residue is now completely transferred to a small test-tube, and heated with a pellet of potassium washed in ether. Heating is continued to redness and the tube then immersed in about 20 c.c. of water in a porcelain basin, when the glass breaks and the contents dissolve in the water. This solution now contains potassium sulphide, if there was any organic sulphur in the original sample, and this is tested for by Caro's reaction with *p*-aminodimethylaniline (formation of "methylene blue"). Tables are given showing the agreement between the results obtained by this test and those obtained by the incubation of the sample. The authors point out that the test is only applicable to domestic sewage, and cannot be applied to liquid containing trade effluents without further investigation.—J. H. J.

Patents.

Filtering and deodorising material; Process for the manufacture and treatment of ——. G. H. Ellis and R. K. Slade, Reading. Eng. Pat. 16,558, July 23, 1906.

The material consists of lignite as obtained from Bovey Tracey, Devonshire. The raw material is picked over, disintegrated, and the particles and powder obtained are sifted into different grades of fineness. After being washed and dried, these graded products are ready for use. The lignite may be also partially carbonised by heating it in closed retorts, then ground to powder, mixed with sawdust and coal tar, again baked, and ground.—W. P. S.

Gases; Apparatus for treating noxious ——. A. C. Day, Saugus, Mass., Assignor to United States Garbage Reduction Co., Boston, Mass. U.S. Pat. 858,062, June 25, 1907.

The gases are collected in a chamber which is provided with a jacket connected with a steam and water supply, so that it can be alternately cooled and heated. When the chamber is cooled, the gases are drawn into it, whilst on heating, the gases are forced out and conducted through a pipe to below the bars of a furnace situated beneath a tall chimney.—W. P. S.

Water; Process for the purification of ——. G. Lambert. Second Addition, dated Apr. 21, 1906, to Fr. Pat. 361,435, May 3, 1905 (this J., 1906, 862).

The composition of the purifying agents is slightly altered from that given in the original specification. The water is first treated with a mixture of potassium permanganate and anhydrous sodium carbonate, and afterwards with a mixture of anhydrous manganese sulphate and aluminium sulphate. The second mixture may consist of manganese sulphate and calcium carbonate, in which case a small quantity of a 60 per cent. solution of ferric chloride is also added to the water. Various forms of precipitating vessels, floating filters, and siphons are described, for purifying large quantities of water and also for portable use.—W. P. S.

Sewage; Purification of ——. J. Mougin. Fr. Pat. 374,700, Jan. 19, 1907.

The sewage is led into a large tank having the shape of a quarter-cylinder, the inlet pipe being between the two straight sides of the tank. The cylinder is divided into three principal parts. The sewage is separated from solid matters, etc., in the first compartment, and then passes into the second compartment, which is sub-divided into a number of chambers, filled with pieces of limestone. In this second compartment, the sewage is acted on by anaërobic bacteria. The third compartment of the apparatus contains a number of gravel beds, over which the sewage is passed for the purpose of oxidation. A filter is placed at the side of this compartment, through which the effluent may be passed, if required.—W. P. S.

Sewage; Purification of ——. J. Mougin. First Addition, dated Feb. 9, 1907, to Fr. Pat. 374,700, Jan. 19, 1907 (see preceding abstract).

A passage provided with a sieve may be substituted for the pipe forming the means of communication between the first and second compartments of the apparatus described in the original patent. The partitions in the second compartment reach to below the surface of the liquid, and the second and third compartments are separated by means of a perforated plate. Small openings in the partitions permit excess of gas to pass into the third compartment, whence it escapes through an outlet-pipe.—W. P. S.

Mineral and organic matters of the waste liquors from sugar factories or from the degreasing of wool, or of distillery vinasses; Separation and recovery of the ——. A. E. Vasseux. Fr. Pat. 374,564, Feb. 12, 1907. *See* XVI.

Colloidal substances; Process for the separation of —— *from aqueous solutions.* K. Winkelblech. Ger. Pat. 180,493, Nov. 2, 1905.

The aqueous liquid is treated with hydrocarbons or other substances, which are insoluble or only slightly soluble in water, and which do not dissolve the colloidal substances; the mixture is violently agitated in presence of air, and then allowed to settle. Special claim is made for the application of the process to the clarification and purification of effluents.—A. S.

(*C.*)—DISINFECTANTS.

Patents.

Composition for dipping sheep, goats, dogs and other animals. J. G. Hume, Duns, N.B. Eng. Pat. 20,651, Sept. 18, 1906.

One lb. of mercuric chloride is dissolved in hot water and mixed with 8 oz. of sodium hydroxide also dissolved in water. The mixture is made up to a volume of 1 gallon, and a further quantity of sodium hydroxide or other alkali, or soap, fats, and oils, may be added. Any soluble mercuric salt may be employed in place of the chloride. (See also Eng. Pat. 14,818 of 1906; this J., 1907, 111).—W. P. S.

Disinfectants soluble in water; Preparation of ——. J. Laboschin. Fr. Pat. 374,563, Feb. 12, 1907.

Disinfecting agents are prepared by mixing potassium hydroxide solution, alcohol, and a thick oil or its equivalent, and adding to the mixture, which becomes hot owing to the saponification of the oil, essential oils or balsams. By this means the latter are rendered soluble in water.—T. H. P.

XIX.—PAPER, PASTEBOARD, &c.

Patents.

Paper and other surfaces; Treatment of ——. H. C. Mitchell, London. Eng. Pat. 15,241, July 4, 1906.

See Fr. Pat. 369,301 of 1906; this J., 1907, 93.—T. F. B.

Waterproof, acid-proof, and odour-proof material [cardboard] particularly applicable for lining butter boxes and for packing purposes generally; Manufacture of inert ——. J. Bishop, South Melbourne, J. H. Stanley. North Brunswick, and A. A. Sage, North Carlton, Australia. Eng. Pat. 18,136, Aug. 13, 1906.

Cardboard is first steeped for about a quarter of an hour in a bath consisting of a molten mixture of 90 per cent. of inodorous paraffin and 10 per cent. of stearine at a temperature of about 280° F., then passed between heated rollers kept at the same temperature, and finally placed in an oven, also at 280° F., in order to complete the absorption.—A. S.

Paper, paper-board, and moulded products [from peat]; Manufacture of ——. O. P. Beck, New York. Eng. Pat. 26,962, Nov. 27, 1906.

Peat, in its natural wet condition, is converted into "half-stuff" by treating it mechanically by stamping, crushing, rubbing, or other means, in such a manner that the individual fibres are separated, without removing the gelatinous matter normally present in the peat. The pulp thus produced, is diluted with water, and may then be pumped directly to the stuff-chest, or mixed with other paper-making stock. Paper-board or the like containing, in its finished state, peat fibres intimately associated or smeared with, and bound together by, the gelatinous substance naturally contained in the peat, is also claimed as an article of manufacture.—A. S.

[Paper] Half-stuff from peat turf; Apparatus for making ——. O. P. Beck, New York. Eng. Pat. 27,125, Nov. 28, 1906.

The patent relates particularly to the type of machine described in Eng. Pat. 9589 of 1901 (this J., 1901, 830). The stamping mechanism consists of upper and lower rocking-levers mounted on supports and extending from opposite sides of a rotating shaft. The levers have separate stampers mounted on them, and the rotation of the shaft in one direction, causes, by means of rods and cams, the stampers at opposite sides of the shaft to be raised and let fall alternately. The stampers may be loaded with auxiliary weights and have convex bearing faces.—W. P. S.

[Paper] Half-stuff from peat; Method and apparatus for the production of ——. O. P. Beck, New York. Eng. Pat. 27,126, Nov. 28, 1906.

The peat is placed on a rotating, annular, trough-shaped carrier and is subjected to the action of stampers. The latter have bevelled working surfaces, the bevel being placed in an opposite direction to the motion of the material, so that the latter is subjected simultaneously to a breaking and drawing action. Means are provided for actuating the stampers and for allowing them to remain in contact with the material for a time after each blow.—W. P. S.

Linen finish on paper; Calendering machine for producing a ——. A. Kirfel, Ahrweiler, Germany. Eng. Pat. 28,697, Dec. 15, 1906. Under Int. Conv., Dec. 15, 1905.

The machine comprises two smooth calender rollers, between which are fed two bands of linen fabric with the band or sheet of paper between them. Each band of linen is unwound from a roller on one side of the calender rollers and wound on to another roller on the other side, and means are provided for simultaneously reversing the direction of rotation of all the rollers.—A. S.

Cellulose esters; Manufacture of ——. L. Lederer, Sulzbach, Germany. Eng. Pat. 3103, Feb. 7, 1907.

See Fr. Pat. 374,370 of 1907; this J., 1907, 776.—T. F. B.

Cellulose products; Manufacture of —— Hanauer Kunstseidefabrik G.m.b.H., Gross-Auheim, Germany. Eng. Pat. 10,165, May 1, 1907. Under Int. Conv., May 2, 1906.

See U.S. Pat. 839,825 of 1907; this J., 1907, 340.—T. F. B.

Paper; Machine for coating ——. M. Cantine, Saugerties, N.Y. U.S. Pat. 858,149, June 25, 1907.

See Eng. Pat. 2770 of 1907; this J., 1907, 712.—T. F. B.

Acetylated nitrocelluloses; Process for the preparation of ——. L. Lederer. Ger. Pat. 179,947, June 24, 1905.

Acetylated nitrocelluloses are prepared by acting on nitrocellulose, at a temperature below 60° C., with acetyl chloride or acetic anhydride, with or without the addition of a condensing agent. The products burn much more quietly than the nitro-compounds; they can be partially or completely denitrated by treatment with suitable agents.—A. S.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Camphor cultivation in Fed. Malay States. Bd. of Tr. J., July 18, 1907. [T.R.]

The Director of Agriculture of the Fed. Malay States reports that experiments have been made with the propagation of camphor by means of cuttings. The first trial of some thousands of these was not successful owing to lack of supervision, but more have been struck, and it is hoped to be able to produce a stock of young plants. While not recommending that the cultivation of camphor should be taken up over large areas, the report points out that the growth of the trees at the experiment station is most encouraging, and compares very favourably with trees of the same age in Ceylon, even at higher elevations, which are supposed to be more suitable for camphor cultivation. Some 300 trees at the Experimental Plantations at Batu Tiga, growing only a few feet above sea level, have in two years attained a height of from 12 to 14 feet.

Digitoxin. H. Kiliani. Ber., 1907, **40**, 2996—2998.

A specimen of digitoxin, which remained white and solid when heated to 200° C. in a capillary tube, was dissolved in alcohol, re-precipitated by pouring the solution into water, and the amorphous precipitate dried in a vacuum. The molecular weight, determined by the boiling-point method, was found to be from 501 to 507. Crystallised digitoxin had a molecular weight of 582 to 682. The amorphous variety began to sinter at 150° C. Its lower molecular weight is due to partial hydrolysis, and is not caused, as Cloetta has recently stated (Münch. med. Wochenschr., 1906, **53**, 2282, and 1907, **54**, 886, and 987), by the halving of the molecule.—F. Shdn.

Lichens and their characteristic constituents. O. Hesse. J. prakt. Chem., 1907, **76**, 1—57. (See this J., 1906, 281.)

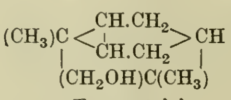
The following varieties of lichens have been examined by the author. *Usnea articulata var. intestiniformis*, Nyl. ; *Ramalina armorica*, Nyl. ; *Evernia furfuracea* (L.) *Parmelia physodes* (L.) Ach., *var. vulgaris* Kbr. ; *Menegazzia pertusa* (Mass.) = *Parmelia pertusa* (Schrank.) ; *Cladina destricta*, Nyl. ; *Cladonia rangiferina var. silvatica* (L.) Hoffm. = *Cladina A silvatica*, Nyl. ; *Cetraria islandica* (L.), of which the varieties from the Stubaital (Tyrol), and Oesterdalen (Norway) were examined separately ; *Tornabenia chrysophthalma* (L.) Mass. ; *T. flavicans var. crocea*, Ach. ; *T. flavicans var. acromela*, Pers. = *Physica acromela*, Nyl. ; *T. flavicans var. cinerascens*, Ach. Pers. ; *T. flavicans* (Ach., Mass.) = *Teloschistes flavicans* (Siv.) ; *Physica leucomelas* (L.), Schaerer ; *Urceolaria scruposa var. vulgaris* (L.) Körber ; *Hämatomma coccineum var. abortivum*, Hepp. : *Hämatomma coccineum var.* ? ; *Biatora lucida*, Ach. ; *Rhizocarpon geographicum* (L.) DC. f. *geronticum* Ach. ; *Lepraria candelaris*, Schaerer. —F. Shdn.

Tolu balsam ; New method of testing ——. T. Delphin. Svensk. Farm. Tidskr., 1907, 3, 415. Pharm. J., 1907, **79**, 71.

Two grms. of tolu balsam are placed in a separator and treated with 5 c.c. of ether, the separator being laid on its side until the balsam has dissolved as completely as possible. 20 c.c. of ether, and $N/_1$ solution of potassium hydroxide are then added, and the whole carefully shaken. When the liquids have separated, the under layer is run into a flask of about 75 c.c. capacity ; to the ethereal contents of the separator 2 c.c. of water are added, shaken, and, after separation of the two liquids, the aqueous layer is run into the above-mentioned flask. The ethereal solution is evaporated in a weighed Erlenmeyer flask on a water-bath, the residue kept on the water-bath for half an hour, and then from twelve to eighteen hours in a desiccator, and weighed (cinnameïn). The alkaline solution in the flask is treated with 2 grms. of sodium bicarbonate until an abundant yellowish-white precipitate is obtained. Afterwards a stream of carbon dioxide is driven slowly through the liquid for an hour, the solution is filtered, and the precipitate washed carefully with warm water until the filtrate is no longer alkaline, the filtrate and wash-water being collected in a flask of 300 c.c. capacity. For the determination of resin esters, the precipitate is collected on a weighed filter, and dried until of constant weight. The filtrate from the resin esters is supersaturated carefully with 6 or 7 c.c. of 25 per cent. hydrochloric acid. When the evolution of gas ceases, the precipitate is collected on a dried and weighed filter, and the latter washed with boiling water until the filtrate is no longer acid. After drying, the resin acid is weighed. The cooled filtrate and crystallised acid are placed in a separator and shaken, first with 40 and then with 20 c.c. of ether. The ether liquids are mixed, and the mixture, after addition of phenolphthalein, is titrated with $N/_{10}$ solution of potassium hydroxide. The number of c.c. of potash solution used, multiplied by 0·0148 gives the quantity of aromatic acids present (calculated as cinnamic acid) in 2 grms. of the balsam. A good balsam should not contain less than 8 per cent. of cinnameïn and 25 per cent. of cinnamic acid, and not more than 1 per cent. of resin acid. The presence of colophony may be detected by the resin acid content. In some cases the presence of 2 per cent. of colophony may thus be detected.

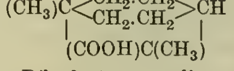
Essential oils ; Constituents of ——. (*Teresantalic acid.*) F. W. Semmler and K. Bartelt. Ber., 1907, **40**, 3101—3107.

Teresantalic acid and its ester occur to the extent of about 0·5 per cent. in East Indian sandal-wood oil, and appear in the first fractions on distilling the oil. The methyl ester of teresantalic acid, $C_{11}H_{16}O_2$, boils at 85°—86° C. at 11 mm., and has the sp. gr., 1·032 at 20° C., $n_D = 1·47053$, and $a_D = -63° 45'$ in a 100 mm. tube. These constants show that teresantalic acid is tricyclic and saturated. The free acid has the optical rotation, $[a]_D = -70° 24'$, and melts at 157° C. When the methyl ester is reduced with sodium, teresantalol, $C_{10}H_{16}O$, is produced ; it boils at 95°—98° C. at 9 mm., melts at 113° C., and has the optical rotation, $[a]_D = +11° 58'$. It readily sublimes, forming fine hair-like needles, with a strong smell resembling that of camphor. The acetate boils at 102°—103° C. at 9—10 mm., has the sp. gr., 1·019 at 20° C., $n_D = 1·470$, and $a_D = +21°$. When the alcohol dissolved in ether is treated with phosphorus pentachloride, teresantalyl chloride is obtained, boiling at 78°—85° C. at 9 mm., and with the sp. gr., 1·0656 at 20° C. On reducing this with sodium, teresantalane, $C_{10}H_{16}$, is produced, boiling at 165°—168° C., and having the sp. gr. 0·892 at 20° C., and $n_D = 1·48033$. Teresantalic acid dissolved in methyl alcohol was saturated with hydrochloric acid gas, and allowed to stand, when the hydrochloric acid addition product, m. pt. 199° C., separated. On reduction, dihydroteresantalic acid, $C_{10}H_{16}O_2$, was obtained, melting at 226° C. The methyl ester of this acid boils at 88° C. at 9 mm., has the sp. gr., 1·0034 at 20° C., $n_D = 1·46757$, and $a_D = -13°$ in a 100 mm. tube. Dihydroteresantalol, $C_{10}H_{18}O$, can be obtained by the reduction of this methyl ester, or of the hydrochloric acid addition product of teresantalol. It melts at 171° C., whilst its chloride boils at 70—75° C. at 9 mm., and dihydroteresantalane, $C_{10}H_{18}$, boils at 48°—58° C. at 9 mm. The following formulæ are suggested :—



$$\begin{array}{l}(CH_3)C<\begin{array}{l}CH.CH_2\\ CH.CH_2\end{array}>CH\\ \quad | \qquad\qquad\qquad |\\ \quad (CH_2OH)C(CH_3)\end{array}$$

Teresantalol.



$$\begin{array}{l}(CH_3)C<\begin{array}{l}CH_2.CH_2\\ CH_2.CH_2\end{array}>CH\\ \quad | \qquad\qquad\qquad |\\ \quad (COOH)C(CH_3)\end{array}$$

Dihydroteresantalic acid.

(See this J., 1907, 431.)—F. Shdn.

Ketones ; Synthesis of unsaturated a-β-acyclic —— *by means of mixed zinc-alkyl compounds.* E. E. Blaise and M. Maire. Compt. rend., 1907, **145**, 73—75.

The process starts from the hydroxy-fatty acids. These are converted (when the alcohol group they contain is primary or secondary) into acetates, then, by treatment with thionyl chloride, into the corresponding acid chlorides. The latter, when treated with the mixed zinc-alkyl compound, are converted into acetylated ketones, which by saponification, yield quantitatively the unsaturated ketone required :—

$$R.CHOH.CH(R')CO_2H \rightarrow R.CHO(COCH_3).CH(R')COCl \rightarrow$$
$$R.CHO(COCH_3).CH(R')COR'' \rightarrow R.CH:C(R')COR''.$$

When the alcohol group of the original acid is tertiary, the attempt to produce the acetate results only in forming the corresponding unsaturated acid by dehydration—$CH_2:C(R).CO_2H$. In some cases, the chlorides of such acids react directly with the zinc-alkyl to form the ketones, but in others, the chloride group is converted into a tertiary alcohol group, and the compound thus produced, reacts with a further quantity of the chloride to form an ester. These reactions are of very general application ; but others attempted, *viz.*, the reaction of the magnesium-alkyls upon the semiorthoxalic or β-ethoxycrotonic esters are of theoretic interest only.—J. T. D.

Fatty acid anhydrides ; Direct hydrogenation of ——. P. Sabatier and A. Mailhe. Compt. rend., 1907, **145**, 18—21.

The vapour of acetic anhydride, passed with excess of hydrogen over metallic nickel at 180° C., yields a mixture of ethyl alcohol, acetic acid, and ethyl acetate together with a small proportion of acetaldehyde. The authors conclude that the reaction consists in the formation in the first place of aldehyde and acetic acid—$(CH_3CO)_2O + H_2 = CH_3.CHO + CH_3.CO_2H$—and the subsequent hydrogenation of the aldehyde to alcohol. This latter partly reacts with the acetic acid, and the water liberated forms, with unattacked anhydride, a further portion of acetic acid. Similar results have been obtained with propionic, butyric, isobutyric, and isovaleric anhydrides ; but as the molecular weight rises, the amounts of alcohol and free acid in the products become greater, and those of aldehyde and ester less. Copper acts similarly to nickel, but much less intensely, and the products are chiefly aldehyde and acid ; moreover, copper is rapidly changed and loses its activity, whilst nickel remains unaffected.—J. T. D.

Patents.

Dichlorethoxyethylene ; Process of producing ——. G. Imbert, Nuremberg, Bavaria. Eng. Pat. 5014, March 1, 1907.

See Fr. Pat. 375,167 of 1907 ; this J., 1907, 839.—T. F. B.

Organic iodine preparation. [*Substituted higher fatty acid ester*]. E. Fischer, Berlin. Assignor to Farbenfabr vorm F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 858,446, July 2, 1907.

See Fr. Pat. 374,231 of 1907 ; this J., 1907, 778.—T. F. B

Thorium, cerium, etc., and rare earths in general ; Process of separating ——. Soc. Anon. des Etablissements Poulenc Fréres. Fr. Pat. 374,540, April 19, 1906.

A solution of oxides of the rare earth metals in nitric acid is exactly neutralised, and crystallised sodium bichromate is added (500 to 1000 grms. per 1 kilo. of oxides dissolved in 10 litres of solution). The solution is heated to 60—80° C., or, preferably, to boiling, and a 10 per cent. solution of sodium carbonate (or other alkali) is gradually added with vigorous stirring, the precipitate obtained being removed from time to time. The earths are precipitated in the order: Thorium, cerite earths, terbium and gadolinium, yttrium. If sulphate solutions be used, the above concentrations may require modification. The precipitates obtained may be treated again in the same way after dissolving in nitric acid ; or, the oxalates may be obtained by dissolving in acid and adding oxalic acid or alkali oxalates in the cold, so as to avoid reduction of the chromic acid ; or, the difficultly soluble sulphates may be obtained by treatment with sulphuric acid.—A. G. L.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver gelatino-bromide plates ; Action of water and developing solutions on the sensitiveness to light of ——. A. and L. Lumière and A. Seyewetz. Bull. Soc. Franç. Phot., 1907, **23**, 264—270.

The decrease of sensitiveness of plates moistened with water or with a developing solution is practically the same when they are exposed to the light of electric incandescence lamps ; the decrease varies with different plates, being most marked with highly sensitive plates, when the sensitiveness may become four or five times less than that of unbathed plates. With a plate initially containing 0·128 grm. of water, a decrease of sensitiveness first became apparent when the water content had increased to 0·1334 grm., reaching a maximum at 0·288 grm. By drying in air after immersion in water or a developer, the original degree of sensitiveness is regained, but no further increase is produced by complete drying (*e.g.*, at 100° C.). The fall of sensitiveness appears not to differ greatly in different regions of the spectrum, but it appears to be most pronounced in the yellow and the green.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives ; Thirty first Annual Report of His Majesty's Inspectors of —— 1906. (See also "New Books.")

Modifications of the law :—There have been two modifications of the law during the course of the year taking the form of Orders in Council. The one extends the quantities, which may be kept on registered premises, of the more harmless fireworks, and amplifies the definition of the substantial receptacle prescribed for the keeping of explosives. The other exempts certain scheduled mixtures of picric acid with other substances from being deemed to be explosives.

Accidents :—The number of accidents which occurred during the year in factories for explosives was 42, causing 6 deaths and injuring 12 persons. The number of deaths (6) from accidents by fire or explosion was below the average for the decade (7·2).

Factories :—The total number of factories under continuing certificate or licence is 147.

Importation :—

	1906. lb.	1905. lb.
Nitroglycerin blasting explosives	3,558,662	3,234,485
Non-nitroglycerin ,, ,,	41,714	278,736
Detonators (numbers)	23,932,225	28,897,300

Of the above quantity of nitroglycerin explosives imported during 1906, 2,741,050 lb. were transhipped for other countries.

New memorandum on the Heat Test :—A new memorandum came into force during the year, but has not altered the test to any material degree. The alterations which have been made are more with a view to making clear several points, on which the old memorandum has been found by experience to be liable to misconstruction.

Dr. Dupré's Report :—Out of 404 samples examined, 53 were rejected. Attention is directed to the presence of mercuric chloride in explosives, which has the effect of prolonging or "masking" the heat test. The effect is not due directly to the mercuric chloride but to the metallic mercury derived from it by reducing agents practically always present in guncotton, notably metallic iron derived from the machinery during manufacture. The metallic mercury volatilises at the temperature of the heat test, and combines with the iodine liberated by the nitrous fumes, thus preventing the formation of iodide of starch on the heat test paper. The test generally recommended for detecting mercury, *i.e.*, placing a small particle of gold leaf in the vapour evolved from the explosive at 70°—80° C., and testing the gold leaf for mercury, was not found to give very satisfactory results. A spectroscopic method was finally adopted, and by it mercuric chloride as well as metallic mercury can be detected. Confidence in the value of the heat test has been still further strengthened by recent experience on a large scale in actual practice. The addition of mercuric chloride raises the heat test without increasing the stability of the explosive, and an insufficiently purified explosive may therefore pass the heat test, which, without such addition, would have been rejected. On this account the addition of mercuric chloride or any other material which has the effect of masking the heat test, has always been prohibited by the Home Office.

Woolwich Testing Station :—Captain Desborough reports that during the year 16 explosives were submitted to the official test, and in thirteen cases the tests were successful. The total number of permitted explosives now on the list is 58 and are divided as follows. Nitroglycerin :—(A), Carbonites (13). (B) Strong carbonites (3), (C) Gelatines (12). Ammonium nitrate (22). Nitroglycerin and ammonium nitrate (5). Miscellaneous (3). The results of coal-getting experiments, carried out by the Bobbinite committee, have accorded very closely with the relative strengths as determined by the ballistic pendulum test at Woolwich. The following figures show this.

Explosive.	Coal-getting experiments.	Ballistic pendulum.
Bobbinite	100	100
Ammonite	272·9	261
Carbonite	177	159
Saxonite	256·9	248

When determining the relative strength of explosives at Woolwich, care is taken that the cartridges completely fill the bore of the cannon, in other words, that the air-spacing is reduced to a minimum, and it has been proved experimentally that if this is not done, a heavier charge is required to produce the same swing of the pendulum ; it is probable, therefore, that if in actual practice the charges are allowed a certain amount of air-spacing, the relative charges as determined by the ballistic pendulum will give rather exaggerated values, and that in order to obtain the best results, it will be necessary to increase the weight of the charges in order to allow for the effect of air-spacing.

Petroleum :—A disastrous explosion took place on the S.S. Haverford at Liverpool, owing to the presence in the hold of a consignment of Fels-naptha soap. Sir Boverton Redwood established the following points: (1) A sample of the soap which had been kept for some time lost over 25 per cent. of its naphtha. (2) The escape of not more than 3 per cent. of the naphtha contained in the consignment in question would suffice to render the atmosphere of the hold explosive. (3) Neither the cases nor the wrappers enclosing the soap were airtight. As an immediate consequence of this disaster, an Order in Council has been issued under the Petroleum Act specifying and legalising a method of testing solid and viscous materials which are suspected to contain petroleum.

Foreign Explosions and Accidents :—A detailed account is given of explosions occurring in German factories during 1906, including smokeless powder, caps, nitroglycerin and the roburite explosion at Witten.—G. W. McD.

Nitration of cellulose; Composition of mixed acids used for the ——, and the stability of the nitrocellulose obtained. Kismiemsky. Mém. des Poudres, Saltpêtres, **13**, 247—59.

The author makes use of facts given by W. Will (this J., 1901, 609, 932; 1902, 1490, 1554) regarding the stability of nitrocelluloses prepared from different acid mixtures and with varying amounts of purification. Will's method for determining stability consists in noting the loss of nitrogen from 2·5 grms. of nitrocellulose at a temperature of 135° C. Results are expressed as curves, using as coordinates the time of heating and the loss of nitrogen in mgrms. The composition of any mixed acid is represented by the formula, $2HNO_3 + aH_2SO_4 + bH_2O$. Thus, in the notation used, (4–1/1) represents the following acid mixture: $2HNO_3 + 1.3H_2SO_4 + 0.6H_2O$; that is, H_2O 4 per cent., H_2SO_4 48 per cent., HNO_3 48 per cent. The "strength" of a mixed acid is expressed by the value (a—b). From curves showing the loss of nitrogen on 2·5 grms. of nitrocellulose at 135° C., it is found that the stability increases as the strength of (a—b) of the acid mixture decreases. (1st law). It is shown that nitrocelluloses prepared from acids, for which (a—b)$>$0 do not reach their "limit state" of stability after even 100 hours boiling, while those prepared from weaker acids attain their "limit state" after 30 hours; that is, the value of N_{135} is constant after 30 hours boiling. For all nitrocelluloses in the "limit state" it was found that the loss of nitrogen is directly proportional to the time of heating at 135° C. (2nd law). The value N_{135} expresses the loss of nitrogen in mgrms. from a 2·5 grm. sample during 15 min. heating at 135° C. From a series of determinations on nitrocelluloses prepared from acid mixtures with varying values of (a—b), a value for N_{135} is found as follows: $N_{135} = 0.41 + 0.1(a—b)$. (1) The 1st law given above is verified by the following values for the nitrocelluloses investigated:

Designation of acid mixture	(a—b)	N_{135} Calculated	N_{135} Experimental
4—3/1	+2·7	0·68	0·62
9—[illegible]/1	+1·1	0·52	0·54
14—3/1	−0·7	0·34	0·35
14—1/1	−1·0	0·31	0·29
19—1/1	−2·0	0·21	0·16
19—3/1	−2·7	0·14	0·13

For temperatures other than 135° C. the same relation holds true, as the following table of tests of a nitrocellulose shows:

Values of N_t for varying temperatures.

t°	N_t Calculated	N_t Experimental	t°	N_t Calculated	N_t Experimental
[illegible]	0·2	[illegible]	147·	2·5	2·70
[illegible]	0·3	0·25	149·	3·4	4·10
[illegible]	0·4	[illegible]	151·	4·5	5·10
137·	0·7	0·67	153·	5·9	5·46
[illegible]	[illegible]	0·87	155·	7·7	6·70
141·	1·3	1·52	157·	10·0	10·05
[illegible]	1·5	1·65			

The author derives a value for N_t as follows: $D_1 = D_t\,q^{t-t_1}$, (formula of Guttmann), where t and t_1 = temperature of heating, D_t and D_{t_1} = time of heating at given temperature to produce a given loss, q = index of progression of the stability of the sample. Also $4N_t\,D_t$ = loss of nitrogen in D_t hours, and $\frac{N_t}{N_{135}} = \frac{D_{135}}{D_t}$, but $\frac{D_{135}}{D_t} = q^{t135}$. $\therefore N = N_{t_{135}}\,q^{t-135}$. From an average of the results in the table, the value for q is found to be 1.144, and substituting the value of N_{135} (1), then $N_t = [0{\cdot}41 + 0{\cdot}1(a—b)]\,(1{\cdot}144)^{t-135}$ (2). A series of values for N_t obtained experimentally by Will at temperatures from 135—160° C. on two different samples of nitrocellulose, are calculated from the formula (2) by the author and agree closely with the experimentally obtained values.

Pyroxylin; The optical analysis of ——. H. de Chardonnet. Compt. rend., 1907, **145**, 115—117.

Accepting Vieille's views as to the formula of cellulose, $C_{24}H_{40}O_{10}$, the author deals with the appearance under the polariscope of the compounds from the pentanitrate (8·32 per cent. of nitrogen) to the decanitrate (12·75 per cent. of nitrogen). The following conclusions have been drawn. It is stated that each nitro-compound is characterised by a different appearance in polarised light, the polariscope even being capable of differentiating the definite nitrates contained in a mixture. The relation between chemical composition and the appearance of the cellulose nitrate in polarised light remains constant, even though variations exist in the materials employed, method of preparation, diameter of fibre, and solubility in ether-alcohol. Cellulose nitrate, recovered from solution in ether-alcohol or other solvent, still retains its characteristic appearance in polarised light, and if partial denitration has been carried out, the lower nitrate retains the appearance characteristic of that particular step in nitration. Nitration is uniform throughout the entire thickness of the walls of the fibre. Pyroxylin, under certain circumstances, contains water of constitution, and in these conditions the ether-alcohol solutions are less viscous and much clearer. The fibres, whatever be the degree of nitration, always appear brilliantly yellow or white in polarised light. (See this J., 1907, 443.)—G. W. McD.

Explosives; Action of detonants on ——. L. Wöhler and O. Matter. Z. ges. Schiess- und Sprengstoffwesen, 1907, 2, 265—269.

In order to classify substances which may act as initial detonants for larger quantities of other explosives, the authors make use of a test, which consists in detonating 1 grm. of the substance contained in a copper cylinder on a lead plate 3 mm. in thickness. From the extent to which the lead plate is perforated, fractured and marked, detonants are placed in the following order. Silver hydrazoate, mercury fulminate, trimercuryaldehyde and a perchlorate, trimercuryaldehyde and a chlorate, diazobenzene nitrate, nitrogen sulphide, sodium fulminate, and mercurynitromethane. A series of experiments were also carried out in the same manner, with, in general, 1 grm. of such explosives as guncotton, picric acid, and the trinitro-compounds of benzene, toluene, xylene, cresol, etc., primed with varying quantities of the detonants mentioned above. Comparative lead block tests are also recorded. The following conclusions are drawn. Quite different results are obtained with the lead plate and lead block tests in determining the order of efficiency of initial detonants. The loading limit is independent of the quantity of explosive to be fired, but is dependent on its nature and state of aggregation. Diazobenzenenitrate, nitrogen sulphide, sodium fulminate, and mercurynitromethane do not act as initial detonants for larger quantities of explosive. Abel's hypothesis of a wave synchronism between explosive and detonator was found to be untenable.—G. W. McD.

Phosphorus sesquisulphide; Action of iodine on ——, and detection of the same in match compositions. L. Wolter. Chem.-Zeit., 1907, **31**, 640.

In carbon bisulphide solution phosphorus sesquisulphide absorbs iodine with formation of a compound, $P_4S_3I_2$, which separates in orange-yellow silky needles having a melting-point of 119·5° C. No other sulphide of phosphorus yields a well-defined iodide. To detect phosphorus sesquisulphide in match compositions by means of this body, 200—300 match-heads are freed from wood and extracted with carbon bisulphide. The filtered liquid is treated with successive portions of a solution of iodine in the same solvent, being meanwhile vigorously shaken and cooled to 0° C.; if phosphorus sesquisulphide is present, the di-iodide will crystallise out.—W. A. C.

Patents.

Explosives; Manufacture of ——. O. F. von Schrœtter, Kruppamühle, Germany. Eng. Pat. 8156, April 8, 1907. Under Int. Conv., April 11, 1906.

Hexanitrodiphenylamine or its salts are used as an explosive with or without addition of other substances suitable for adjusting the sensitiveness and melting point, such as a nitrohydrocarbon of lower melting point. The explosive is stable and is not sensitive to shock or percussion.—G. W. McD.

Guncotton; A method of detonating wet ——. O. F. von Schrœtter, Kruppamühle, Germany. Eng. Pat. 8157, April 8, 1907. Under Int. Conv., April 11, 1906.

The detonation of the cap is transferred to the charge of wet guncotton by means of nitro-compounds of the aromatic series, such as trinitrophenol, trinitrobenzene, or trinitroaniline. These compounds are said to possess advantages over dry guncotton for this purpose, especially where the charges must remain long under water before they are fired.—G. W. McD.

Dinitroglycerin, and process of making same. A. Mikolajczak, Castrop, Germany. Reissue No. 12,669, dated July 2, 1907, of U.S. Pat. 798,436, Aug. 29, 1905.

See Fr. Pat. 341,911 of 1904; this J., 1904, 911.—T. F. B.

Explosive. F. E. W. Bowen, London. U.S. Pat. 857,580, June 25, 1907.

See Eng. Pat. 21,481 of 1903; this J., 1904, 1238.—T. F. B.

Explosive. P. A. Kline, Bloomsbury, Pa. U.S. Pat. 858,894, July 2, 1907.

The composition consists of:—molasses (20 parts), glucose (23), milk sugar (7), tannic acid (10), oxalic acid (5), turpentine (1), powdered oak bark (2), alcoholic solution of shellac (2), and potassium chlorate (30 parts).
—G. W. McD.

Phosphorus; Process of making ——. G. C. Landis, York, Pa., Assignor to American Phosphorus Co. Camden, N.J. U.S. Pat. 859,086, July 2, 1907. *See* VII.

Powder yielding little smoke; Process for the preparation of a ——. H. Schöneweg. Ger. Pat. 180,724, Dec. 2, 1904.

A powder yielding little smoke, and possessing the advantage over other similar powders, that neither it nor its combustion products have a corrosive action on metals with which they are likely to come into contact, is prepared by dissolving trinitrotoluene and picric acid in hot alcohol, benzene, or other suitable solvent, mixing the solution with nitrocellulose, and drying the product. Trinitrocresol may be substituted for part of the picric acid.—A. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Steam-calorimeter. L. M. Ellison, Chicago, Assignor to American Steam Gauge and Valve Manuf. Co., Boston, Mass. U.S. Pat. 857,984, June 25, 1907.

The apparatus consists of a jacketed vessel provided with means for the insertion of a thermometer, and also, inside, with a deflector. The portion of the inlet-pipe passing through the jacket, is of smaller diameter than the portion outside the vessel. A pressure-gauge, extending at right-angles to the inlet-pipe, is connected to the vessel by means of a swivel-joint.—W. P. S.

Butter; Apparatus for determining water in ——. C. E. Gray, Washington, D.C. U.S. Pat. 858,868, July 2, 1907.

The apparatus consists of a graduated tube closed at its upper end by a stopper, and provided at its lower end with an enlargement or bulb. A tube is sealed into this bulb, the upper portion of the tube inside the bulb being bent at a right-angle, whilst the other end passes through a cork into a flask. The graduated tube is surrounded by a condenser.—W. P. S.

INORGANIC—QUALITATIVE.

Phosphorus sesquisulphide; Action of iodine on —— and detection of the same in match compositions. L. Wolter. *See* XXII.

INORGANIC—QUANTITATIVE.

Phosphorous acid; Determination of ——. C. Marie and A. Lucas. Compt. rend., 1907, **145**, 60—62.

The authors have modified the method of Amat (this J., 1891, 68) by working in an alkaline solution, under which conditions the stability of the permanganate solution is increased. Ignited potassium carbonate (in quantity enough to have an excess of about 3 grms.) is introduced into a flask, followed by 50 c.c. of *N*/25 permanganate solution. The whole is heated on the water-bath to 80° C., and the solution of phosphorous acid or phosphite (0·2—0·3 grm.) added. After 15 minutes at 80° C., 50 c.c. of ferrous-ammonium sulphate solution ("*M*/5," containing 10 per cent. of sulphuric acid) are added, and the excess is titrated by permanganate. The authors prefer to standardise the permanganate by means of calcium formate, proceeding exactly as in the phosphite determination.—J. T. D.

Electrolytic analysis; New apparatus for rapid ——. F. C. Frary. *See* XI*A*.

Deposition of metals, using a mercury cathode and rotating anode; Effect of sulphuric acid on the ——. L. G. Kollock and E. F. Smith. *See* XI*A*.

ORGANIC—QUALITATIVE.

Corn [Maize] oil as an adulterant in lard; Possible use of ——, and its detection. W. McPherson and W. A. Ruth. *See* XVIII*A*.

ORGANIC—QUANTITATIVE.

Tannin; Suggestion and basis for a new method for the determination of ——. A. W. Hoppenstedt. *See* XIV.

Catechol-tannins in sumac; Determination of ——. M. Nierenstein and T. A. Webster. *See* XIV.

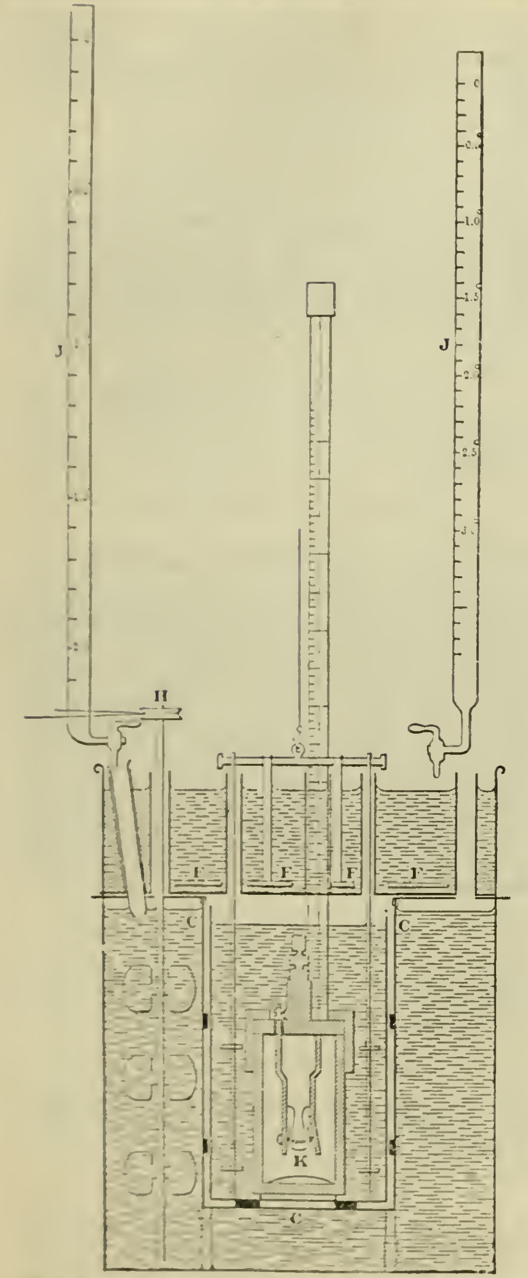
Extract of barley; Determination of the —— K. Krapf. *See* XVII.

Tolu balsam; New method of testing ——. T. Delphin. *See* XX.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Heats of combustion of organic substances, especially sugar and benzene; Adiabatic determination of the ——. T. W. Richards, L. J. Henderson, and H. L. Frevert. Proc. Amer. Acad., 1907, **42**, 573-593.

The adiabatic method adopted, consists in preventing heat exchange with the surroundings, by causing the



temperature in the outer vessels enveloping the calorimeter to change in the same direction and at the same rate as that of the water in the calorimeter itself. This object was achieved, in the apparatus shown in the figure, by causing a chemical reaction, *e.g.*, the neutralisation of an alkali by an acid, to occur in the outer annular vessel, C, and in the vessel, F, forming the cover. Provision is made for a rapid stirring by means of the rotary stirrer, H, and thus the temperature of the whole mass of liquid in the outer vessel is quickly adjusted. The burettes, J, which contain the acid, are calibrated in tenth degrees of temperature centigrade, according to the quantity of acid necessary for raising the temperature of the particular reaction vessel by this amount. "In other words, the amount of acid necessary to raise each of the outer systems 1/10° C. was determined by trial, and the burettes were marked accordingly." The combustion was effected in a bomb calorimeter, with slight modifications to improve the accuracy. Closely concordant results were obtained with cane sugar. For the determinations with benzene, thin glass bulbs of 0·7 to 0·8 c.c. capacity were filled with the liquid and sealed off close to the bulb at a capillary stem. For the combustion, one of these bulbs was placed in the crucible upon the top of a small charge of sugar, which was ignited in the usual way. Very rapid and complete combustion is thus effected, and the inaccuracy with volatile liquids, due to the material being partly in the liquid and partly in the vaporised condition, is avoided. The effect of an inert gas, nitrogen, in lowering the heat of combustion was noticed for the first time with benzene, and although no explanation is forthcoming, the result is clearly established.—R. S. H.

Benzoic acid in Pinguicula vulgaris. O. Loew and K. Aso. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, 7, 411—412.

The plants, *Pinguicula vulgaris*, were dried in the sun and extracted with water, and the acid liquid thus obtained shaken with ether. The ether solution, on evaporation, left behind a crystalline mass mixed with a yellow, amorphous substance, and some tannin. The crystalline substance was obtained in a pure condition by two recrystallisations from hot water, and was identified as benzoic acid.—A. S.

Japanese tobacco from Satsuma [*Japan*]*; Note on* ——. K. Baba. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, 7, 471—473.

Japanese tobacco is used chiefly for the manufacture of cigarettes, and also, to some extent, for wrapper purposes. The author has examined a tobacco (*Nicotiana rustica*) from Satsuma, the chief object being to ascertain its fitness for the manufacture of cigars. The results are shown in the following table, figures for other kinds of Japanese tobacco being given for the purpose of comparison. In the table, A refers to the lowest or sand leaves ("doha"); B, to the lower middle leaves ("chuha"); C, to the upper middle leaves ("honpa"); and D, to the uppermost leaves ("tenpa"); in all cases, the middle vein of the leaves was discarded. The figures express percentages on the dried leaves.

	Ibusuki tobacco produced in Kagoshima, Satsuma.				Daruma tobacco produced in Ibaraki.			Takeda tobacco, produced in Oita.		Shiroume tobacco.
	A	B	C	D	B	C	D	B	C	
Crude fat	6·302	*11·549	*14·004	*12·616	9·235	11·671	11·102	8·135	8·821	7·821
Resin, soluble in petroleum ether	3·001	5·839	6·666	6·003	—	—	—	—	—	—
Resin, ,, ,, ether	0·365	0·432	0·824	0·799	—	—	—	—	—	—
Resin, ,, ,, alcohol	0·498	0·858	1·133	1·021	—	—	—	—	—	—
Total nitrogen	0·893	1·381	1·525	1·594	1·299	1·589	1·712	1·632	2·072	1·122
Protein nitrogen	0·549	0·775	0·808	0·875	—	—	—	—	—	—
Amido nitrogen	0·163	0·272	0·300	0·372	—	—	—	—	—	—
Nicotine	0·820	1·443	1·811	1·410	1·187	1·273	1·002	0·679	0·807	1·371
Ammonia	0·033	0·102	0·126	0·125	—	—	—	—	—	—
Nitric acid	0·118	0·172	0·169	0·201	0·180	0·183	0·188	0·200	0·353	0·40
Ash	22·271	14·811	14·042	12·654	18·465	16·121	13·111	16·000	14·123	14·582
Potassium carbonate in ash	2·043	2·406	2·132	1·693	2·201	2·356	2·016	2·204	2·052	1·990

* These figures are rather too high for a good cigar leaf.

—A. S.

Patent

Tobacco; Process for de-nicotinising —— Soc. des Tabacs Désintoxiqués (Procédés du Docteur Parant), Geneva. Eng. Pat. 1184, Jan. 16, 1907. Under Int. Conv., Jan. 25, 1906.

The tobacco is immersed in a solution previously saturated with the soluble constituents of tobacco but free from nicotine. The vessel containing this solution is in connection with another vessel also filled with the solution, the two vessels being separated by a dialysing membrane. The solution dissolves the nicotine from the tobacco, but extracts no other constituent, and the alkaloid passes through the membrane. By replacing the solution in the second vessel from time to time, the whole of the nicotine is removed.—W. P. S.

New Books.

Second Report of the Departmental Committee appointed to enquire into the Ventilation of Factories and Workshops. Part II., Appendix. Cd. 3553. Wyman and Sons, Fetter Lane, London, E.C. Price 4s. 5d.

This volume, which forms the Appendix to the Second Report of the Committee, was prepared by the Secretary. It contains 51 plates and diagrams illustrating the results of experiments carried out by the Committee, with their recommendations. These include experiments on the construction of main ducts and the arrangement of throats or branches; experiments on equalisation of current; blast and exhaust currents; experiments with propeller fans. A number of illustrations are given of methods of local ventilation and removal of dust, such as in grinding-machinery, textile factories, removal of steam and acid fumes, removal of benzol fumes in French cleaning, removal of phosphorus fumes, and extracting white lead dust from cask filling and packing shops and from white lead grinding pans.

Explosives Act, 1875. Thirty-first Annual Report of His Majesty's Inspectors of Explosives; being their Annual Report for the Year 1906. (Cd. 3593.) Price 1s. 8d. (See also XXII., page 891.)

This report comprises sections dealing with the manufacture, storage, packing and conveyance, and importation of explosives, Government inspection of explosives factories, report of chemical adviser, working of the Explosives Act by the Local Authorities, accidents, experiments, use of explosives in coal mines, petroleum, carbide of calcium and acetylene. There are a number of appendixes relative to explosives at present authorised for manufacture or importation, Orders in Council, model codes of bye-laws for railways, canals, harbours, &c., prosecutions and convictions during 1906, accidents by fire or explosion during 1906, &c., &c.

Thirty-Seventh Annual Report of the Deputy Master and Comptroller of the Mint, 1906. (Cd. 3598.) Price 11d.

The following table shows a summary of the Imperial currency issues during recent years:—

Metal.	1905.	1906.	Mean of 10 years, 1896–1905.
	£	£	£
Gold	6,500,000	12,165,000	7,167,554
Silver..............	510,491	1,705,070	1,068,403
Bronze	100,325	184,520	118,290
Totals	7,110,816	14,054,590	8,354,247

Attention is drawn to the increase in the loss per million sterling on the gold coinage. This loss was almost entirely due to the inferior quality of much of the gold bullion received. It remains, says the report. to be seen whether the process generally used in London can be so improved as to cope efficiently with the impurities left by the cyanide process. If not. it may become necessary to submit for the consideration of the Treasury a revision of the regulations governing the receipt of gold bullion for coinage, and to examine the present limitations of the Department in respect of refining and purifying gold.

Annual Report of the Chief Inspector of Factories and Workshops for 1906. Report and Statistics. (Cd. 3586.) Price 3s. 2d.

This publication contains the general report of the Chief Inspector upon the work of the Factory Department in 1906, as well as the statistical tables which formerly were separately published at a later date. Reports are included by the divisional Superintending Inspectors, and the Superintending Inspector for dangerous trades. The latter reports that the removal or mitigation of dust created in cement works has received attention, and that a memorandum on the precautions necessary for the safety of those employed in dry cleaning has been issued. He also gives statistics of the number of earthenware and china works under the special rules of Nov., 1903, and the certificates in force at the close of 1906. Copies of memoranda on the use of water-gas in factories, on anthrax, regulations for the manufacture of paints and colours, nitro- and amido-derivatives of benzene, and statistics of the number of persons employed are included.

Sewage and the Bacterial Purification of Sewage. By Samuel Rideal, D.Sc. (Lond.). Third Edition. The Sanitary Publishing Co., Ltd., London. John Wiley & Sons, New York. 1906. Price 14s.

8vo volume, containing 348 pages of subject matter, with 58 illustrations, and an alphabetical index. The subject matter is subdivided according to the following classification:—I. Introduction. II. and III. Chemical analysis of sewage and effluents. IV. Bacteria and other organisms in sewage. V. Chemical changes produced by bacteria. VI. Irrigation and Sewage farms. VII. Subsidence and chemical precipitation. VIII. Sterilization by heat, chemicals and electricity. IX., X., and XI. Bacterial purification. XII. Distribution and distributors. XIII. Sewage outfalls and discharge. XIV. Agricultural value of bacterial effluents. Trade effluents.

The Principles and Practice of Brewing. By Walter J. Sykes, M.D., D.P.H., F.I.C. Third Edition, thoroughly revised by the Author and Arthur R. Ling, F.I.C., Lecturer on Brewing at the Sir John Cass Institute. Chas. Griffin & Company, Limited, Exeter Street, Strand, London. 1907. Price 21s. net.

8vo volume, containing 578 pages of subject matter, with 95 illustrations, and an alphabetical index. The subject-matter is classified and arranged according to the following scheme:—Part I.—(i.), Physical Principles involved in the process of Brewing. (ii.), Chemistry, with special reference to the Materials used in Brewing. Part II.—(iii.), The Microscope. (iv.), Vegetable Biology. (v.), Fermentation. Part III.—(vi.), Water. (vii.), Barley and Malting. (viii.), Arrangement of the plant in a Brewery. (ix.), Estimation of the quantities of Materials for the Brew. (x.), Beer, its Characteristics and its Diseases. Appendix.—Researches on Starch (Maquenne and Roux). Auto-excitation of Malt Extract. Soluble Non-coagulable constituents of Malt. "Bios" and Yeast Development. Fermenting power of yeast determined by the constitution of its nitrogenous food. Toxic action of cereals on low-fermentation Yeast, etc.

Traite Complet d'Analyse Chimique Appliquee aux Essais Industriels. par J. Post et B. Neumann, Avec la collaboration de nombreux Chimistes et Spécialistes. Deuxième édition française entièrement refondue. Traduite d'après la troisième édition allemande et augmentée de nombreuses additions. Par le Dr. L. Gautier. Tome Premier. Premier Fascicule. Libraire Scientifique A. Hermann, Libraire de S. M. le roi de Suède, 6, rue de la Sorbonne, 6, Paris. 1907. Price 5s. 6d.

8vo volume, containing 217 pages of subject matter, with 104 illustrations, and a table of contents. It forms

Part i. of Vol. I. and treats of the following subjects, written by the authors named:—I. Sewage effluents, (J. H. Vogel). II. Fuels (H. Langbein). III. Pyrometry (B. Neumann). IV. Mine gases, fuel gases, motor gases, and mine gases (B. Neumann).

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

16,206. Kayser. Utilisation of exhaust steam, especially in drying and evaporating processes. July 15.

16,237. Simoneton. Filter. [Fr. Appl., July 19, 1906.]* July 15.

16,344. Lake (Stöhr und Co.). Concentration of liquids.* July 16.

16,963. Hampson. Diffusion processes for separating gases of different densities. July 24.

17,056. Ilges. Apparatus for rectifying mixtures of liquids.* July 25.

Complete Specifications Accepted.

16,330 (1906). Pfeiffer. Apparatus for separating granular and pulverised material by air. July 24.

17,999 (1906). Meyer and Hastert. Apparatus for cooling and purifying gases. July 31.

26,146 (1906). Collet. Apparatus for mixing liquids in definite proportions. July 24.

5295 (1907). Bock. Manufacture of large crystals. July 24.

7522 (1907). Heinz. Filtration system. July 24.

7754 (1907). Ostertag. Drying stove or kiln. July 24.

II.—FUEL, GAS, AND LIGHT.

Applications.

16,303. Franks. Manufacture of coal gas. July 16.

16,342. Tangyes, Ltd., and Robson. Gas producers. July 16.

16,489. Siemens und Halske A.-G. *See under* VII.

16,616 and 16,617. British Thomson-Houston Co. (General Electric Co.). Filaments for electric lamps. July 19.

16,786. Lloyd Wise (Solvay et Cie.). Coke ovens.* July 22.

16,867. Süssman. Manufacture of incandescent mantles.* July 23.

16,890. Monseur. Escape of gas through working openings of gas furnaces, gas producers, etc.* July 23.

16,937. Boult (A.-G. Gorlitzer Maschinenbau Anstalt u. Eisengiesserei). Gas generators.* July 24.

17,020. Jones. Production of power gas. July 25.

17,137. Jones. Coke ovens. July 26.

17,154. Blanc and Caton. Manufacture of illuminating gas. [Fr. Appl., July 30, 1906.]* July 26.

Complete Specifications Accepted.

16,901 (1906). Rosenberg. Gas generating apparatus. July 24.

17,176 (1906). Dunn and Berriman. Liquid for controlling evolution of gas from calcium carbide. July 31.

18,738 (1906). Lederer. Manufacture of filaments of tungsten or molybdenum for electric incandescent lamps. July 24.

20,670 (1906). Shaw. Apparatus for washing coal. July 24.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

16,432. Martini. Refining crude petroleum to obtain increased distillates and reduce the residuum. July 17.

16,446. Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of pure α-naphthylamine. [Ger. Appl., Aug. 1, 1906.]* July 17.

16,969. Common, and The Hull Oil Manufacturing Co. Method of rendering paraffin emulsifiable. July 24.

Complete Specifications Accepted.

13,840 (1906). Martini. Treatment of crude petroleum or its distillates. July 24.

28,147 (1906). Bloxam (A.-G. für Anilin Fabrikation). Manufacture of tertiary butyl-xylene or tertiary butyl-toluene. July 31.

13,508 (1907). Pages, Camus, and Duchemin. Manufacture of acetone. July 24.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

16,246. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. July 15.

16,505. Badische Anilin und Soda Fabrik. Manufacture of vat colouring matters of the anthracene series. [Ger. Appl., Oct. 15, 1906.]* July 18.

16,580 Lesser. Manufacture of arylthioglycollic-*o*-carboxylic acid, its esters, and substitution products. [Ger. Appl., July 19, 1906.]* July 19.

16,584. Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. July 19.

16,775. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. July 22.

16,962. Newton (F. Bayer und Co.). New dyestuffs of the anthracene series. July 24.

Complete Specifications Accepted.

16,086 (1906). Pantin and Tolputt, Executors of Abel (Act.-Ges. f. Anilinfabr.). Manufacture of derivatives of 5-oxy-1.2-naphthimidazole-7-sulphonic acid. July 24.

24,091 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *p*-nitrodiphenylamine or its homologues or derivatives. July 24.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

16,189. Green. Production of aniline black on textile fibres and fabrics. July 15.

16,361. Sharp. Printing fabrics, paper, etc. July 16.

16,495. Verein. Glanzstoff-Fabr. Manufacture of artificial fibres. [Ger. Appl., Aug. 3, 1906.]* July 18.

16,512. Bouillier. Production of artificial silk. [Fr. Appl., July 19, 1906.]* July 18.

16,520. Ebizuka. Manufacture of waterproof fabrics.* July 18.

16,655. Albert. Dyeing or printing warps and yarns.* July 20.

16,715. Evans, Ltd., and Evans. Wood rollers for use in dyeing, finishing, and printing.* July 22.

16,757. Dillberg and Gadd. Protecting from decomposition vegetable fibres and articles made therefrom.* [Swedish Appl., Dec. 14, 1906.]* July 22.

16,927. Hall and Brandt. Machines for scouring, bleaching, and dyeing spun or manufactured fibres. July 24.

17,108. Layland and Whitehead. Drying wool after washing. July 26.

Complete Specifications Accepted.

23,083 (1906). Newton (F. Bayer und Co.). Dyeing with sulphur dyestuffs. July 31.

780 (1907). Destrée and Wiescher. Dyeing, bleaching, or washing apparatus. July 24.

3536 (1907). Barrillot. Weighting silk in skein or in piece. July 24.

5020 (1907). Diamanti and Lambert. Recovery of volatile solvents used in making artificial silk. July 24.

8245 (1907). Schmitz. *See under* XII.

11,903 (1907). Schmitz. *See under* XII.

12,219 (1907). Johnson (Badische Anilin und Soda Fabrik). Dyeing with sulphur colouring matters and preparations therefor. July 24.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc

Complete Specification Accepted.

4590 (1907). Newton (Dresdner Chromo und Kunstdruck Papierfabrik Krause and Baumann). Process for coating paper in continuous lengths with heavy colours. July 31.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

16,200. Staley. Manufacture of graphite. July 15.

16,489. Siemens und Halske A.-G. Manufacture of a plastic mass from tungsten compounds. [Ger. Appl., July 21, 1906.]* July 18.

16,850. Swayzi. Treating feldspar.* July 23rd.

16,853. Finlay. Manufacture of bicarbonate of soda. July 23.

16,885. Det Norske Aktieselskab for Electrokemisk Industri and Halvorsen. Absorbing dilute nitrous gases. [Norwegian Appl., July 26, 1906.]* July 23.

16,999. Pawlikowski. Producing chemical compounds.* July 24.

17,052. James and Richardson. Producing liquid air and other liquid gases. July 25.

17,080. Crowther Leach and Gidden. Purifying sulphuric acid from arsenic and selenium. July 25.

17,125. Evans. Utilising products of chemical treatment of mixed ores. July 26.

Complete Specifications Accepted.

16,442 (1906). Lecoeur. Preparation of ammoniacal copper solutions. July 24.

23,967 (1906). Rohleder. Process for extraction of sulphur. July 31.

5295 (1907). Bock. *See under* I.

11,187 (1907). Boult (Günther and Franke). Extraction of sulphur from gangue. July 31.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

16,583. Humphrey. Firing pottery kilns, ovens, or furnaces by gas. July 19.

16,690. Humphrey. Firing pottery ovens, kilns, or furnaces. July 20.

17,736. Bastian, Calvert, and Sanders. Melting or fusing glass around electric conductors.* July 22.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

16,249. Cowper-Coles. Manufacture of cement. July 15.

16,530. British Thomson-Houston Co. (General Electric Co.). Preparation of refractory materials. July 18.

16,865. Brookes (Asbestos Wood Co.). Insulating materials. July 23.

17,171. Zeiller. Imparting increased resisting power, cohesion, and hardness to cement, concrete, and asphalt.* July 26.

Complete Specifications Accepted.

17,006 (1906). Timofeeff. Manufacture of cement for building purposes. July 31.

2442 (1907). Laeuffer. Substitute for wood or stone. July 31.

X.—METALLURGY.

Applications.

16,217. Heskett. Continuous extraction of zinc from its sulphide. July 15.

16,238. Miller. Treatment of metals.* July 15.

16,351 and 16,352. Juppont and Teil. Metallic alloys. [Fr. Appls., July 16, 1906.]* July 16.

16,504. Becker and Lamb. Metallic alloys. July 18.

16,643. Hatton, Purcell, and Arrowsmith. Removing sulphur from steel in open-hearth furnaces and Bessemer converters. July 20.

16,726. Krupp Act.-Ges. Aluminium alloy.* [German Appl., Nov. 28, 1906.]* July 22.

16,773. Kirstein. Agglomeration of pulverulent ores. July 22.

16,834. Imbert. Treating ores by the precipitation process.* July 23.

16,884. Masson. Wet process for recovery of pure antimony from ores, concentrates, tailings, and slimes. July 23.

16,936. Ehrmann. Treatment of ores. July 24.

17,038. Debuch. Preventing oxidation of iron and steel wire, etc., through cooling immediately after rolling. July 25.

Complete Specifications Accepted.

16,364 (1906). Isherwood. Treatment of refractory zinc-lead ores. July 24.

16,912 (1906). MacIvor and Fradd. Treatment of sulphide ores containing zinc. July 31.

17,001 (1906). MacIvor and Fradd. Treatment of zinc residues. July 31.

17,002 (1906) MacIvor and Fradd. Extraction of tin from ore. July 31.

17,672 (1906). Cowper-Coles. Continuous process for removing scale and oxide from metal and drying and galvanising it. July 31.

17,932 (1906). Marks (Soc. Anon. Italiana Gio Ansaldo Armstrong and Co.). Process for manufacturing armour plates for protecting ships and other steel objects or objects made from an alloy of steel. July 31.

18,910 (1906). Cowper-Coles. Coating wire with zinc, etc. July 31.

19,944 (1906). Sulman. Ore concentration. July 24.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

1197A. British Thomson-Houston Co. (General Electric Co.). Treatment or refractory materials by electricity. July 17.

16,735. Harrison. Electrolytic or chemical deposition of metals. July 22.

16,736. Bastian, Calvert, and Sanders. *See under* VIII.

16,780. Metallurgiska Patentaktiebolaget. Apparatus for magnetic separation of ore. [Swedish Appl., July 28, 1906.]* July 22.

17,193. Hatfield. Electrolytic cell. July 27.

Complete Specifications Accepted.

18,600 (1906). Pauling. Electrodes for use in the treatment of gases by arc discharges. July 31.

19,411 (1906). Cowper-Coles. Electrodeposition of alloys. July 24.

20,716 (1906). Roberts, Roberts, and Jaffray. Apparatus for the electrodeposition of metals and alloys. July 24.

21,583 (1906). Cowper-Coles. Electrolytic manufacture of metallic wire, strip, or the like. July 24.

4051 (1907). Cowper-Coles. Production of electrotypes. July 24.

4927 (1907). Chaplet, and La Néo-Métallurgie. Electric furnaces. July 24.

6502 (1907). Thirot and Mage (*alias* Nouguier). Process for regenerating electrolyte employed in extracting copper from old bronze. July 31.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

16,783. Wegner. Cakes of soap. July 22.

16,886. Schow and Schou. Producing fatty substances.* July 23.

Complete Specifications Accepted.

1771 (1907). Savary. Antiseptic soaps. July 31.

2519 (1907). Soc. Française "La Cremouline." Super-alkalinated dry soap in compressed cakes and method of manufacture. July 31.

8245 (1907). Schmitz. Manufacture of oils and soaps suitable for turkey-red dyeing. July 24.

11,903 (1907). Schmitz. Manufacture of fatty compounds suitable for turkey-red dyeing. July 24.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(*A.*)—Pigments, Paints.

Complete Specification Accepted.

6722 (1907). Meister, Lucius, und Brüning. Manufacture of body colours. July 24.

(*B.*)—Resins, Varnishes.

Application.

16,245. Badische Anilin und Soda Fabrik. Manufacture of products resembling resin. July 15.

(*C.*)—India-Rubber.

Applications.

16,325. Gammeter. Vulcanising rubber.* July 16.

16,761. Dawson. Liquid cement for affixing rubber tyres without heat. July 22.

17,018. Coppin. Rubber composition for making tyres, etc. July 25.

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Applications.

16,887. Inouye and Dogura. Manufacture of leather.* July 23.

16,994. Baum. Substitute for leather. July 24.

Complete Specification Accepted.

19,577 (1906). Bernstein. Manufacture of an adhesive material from casein. July 24.

XVI.—SUGAR, STARCH, GUM, Etc.

Complete Specifications Accepted.

20,488 (1906). Fielding. Manufacture of soluble starch and dextrine. July 24.

21,973 (1906). Thomson and Morrice. Manufacture of modified soluble starch. July 31.

25,340 (1906). Eastick. Process for making and purifying invert sugar. July 31.

9031 (1907). Thorl. Treatment of starch. July 24.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

16,254. Goldsmith, and British Xylonite Co. Purification of alcoholic and other substances. July 15.

16,291. Smith. Treatment of water for whisky distillation and analogous purposes. July 16.

16,895. Epstein. Production of fermented and other products from vegetables, etc. July 23.

16,995. Heymann. Preparing malt.* July 24.

Complete Specification Accepted.

4009 (1907). Davidson and Burra. Extracts of hops. July 31.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Application.

16,664. Caverhill. Preparation of a beverage.* July 20.

Complete Specification Accepted.

29,425 (1906). Process for improving sterilised milk. July 31.

(*B.*)—Sanitation; Water Purification.

Applications.

16,239. Linden. Tanks for purifying and clarifying water or effluents. July 15.

16,291. Smith. *See under* XVII.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

16,361. Sharp. *See under* V.

16,590. Davidson. Manufacture of paper. July 19.

16,653. Wallace and Wallace. Means for applying a linen finish to paper.* July 20.

16,777. Fiorillo. Transparent material as substitute for tracing paper and cloth. July 22.

Complete Specifications Accepted.

16,271 (1906). Lake (Chem. Fab. vorm. Weiler-ter-Meer). Manufacture of celluloid. July 31.

21,469 (1906). Jackson. Paper and manufacture thereof. July 31.

24,308 (1906). Pering. Manufacture of waterproof and fat-proof paper, cardboard, etc. July 24.

28,382 (1906). Sefton-Jones (Berti). Manufacture of paper and apparatus therefor. July 24.

89 (1907). Haddan (A. Lumière et ses fils). Manufacture of collodion filaments, artificial silk, horsehair, and the like. July 31.

1820 (1907). Lamort. Paper-making machines. July 2.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

16,532. Zeitschel. Manufacture of acid esters of cyclic terpene alcohols.* July 19.

16,605. Weizmann, and Clayton Aniline Co. Manufacture of isobornyl esters. July 19.

Complete Specification Accepted.

20,526 (1906). Shukoff. Process of manufacturing esters of alcohols of terpenes. July 31.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

16,509. Farmer. Sensitised papers for photographic purposes. July 18.

XXII.—EXPLOSIVES, MATCHES, Etc.

Application.

16,492. Wadsworth. Treatment of gelatinised nitrocellulose explosives. July 18.

Complete Specifications Accepted.

19,215 (1906). Bichel. Increasing the density of fusible explosive nitro-substances. July 24.

24,240 (1906). Claessen. Explosives. July 24.

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Birmingham and Midland Section.

Meeting held at Birmingham on March 14th, 1907.

PROF. THOMAS TURNER, A.R.S.M., F.I.C., IN THE CHAIR.

THE PASSIVIFYING, PASSIVITY, AND ACTIVIFYING OF IRON.

The Influence of Local Electric Currents on the behaviour of Iron in Electrolytes.

HENRY L. HEATHCOTE, B.SC.

Introduction.

Most of the experiments to be described in this paper were made six years ago in the Physical Chemistry Institute of the University of Leipzig, whilst holding an 1851 Exhibition Research Scholarship. They were begun at the suggestion of Prof. Ostwald, whose help and guidance I most gratefully acknowledge. The experiments in which dry passive iron—obtained by washing with a series of reagents—was used, have been performed during the last six months, and I am greatly indebted to the firm I serve, Messrs. Rudge-Whitworth Ltd., and to the University of Birmingham for the facilities they have granted me for carrying out the work.

An attempt will be made to give a synoptical review of the experimental results and opinions of the many workers who have approached the phenomena of the passivity of iron. No apology is offered for this marshalling of historical data: it is a necessary part of any attempt to realise the complex and manifold nature of the processes which go on even while iron is in the so-called passive state. As will be seen later on, the appellation "passive" is only true so far as the sense of sight is concerned; passive iron is really the seat of a multitude of changes, which changes give rise to the many phenomena observed and recorded in the literature. By classifying and comparing these data we may hope to realise the full value of the wealth they contain.

The matter will be divided up under the following headings:—

1. Material and method of experimenting.
2. Passivifying.
3. Activifying.
4. Experiments with blued iron.
5. Passivity.
6. Transmission of activity and passivity.
7. Pulsations.
8. Current oscillations.

The numbers in brackets indicate the papers (see Bibliography) to which reference is made.

1.—Material and Method of Testing for Passivity.

Silver Nitrate.—Active iron behaves in the usual way and precipitates silver, passive iron produces no precipitate—*vide* 58, 174, 175, 32. (See Bibliography, at end.)

Some (193) used copper nitrate and others (202) copper sulphate: absence of precipitate showed passivity.

Again others (196, 53, 92) used a galvanometer the deflection of which was interpreted to indicate activity. Even at such an early date this method led to statements totally at variance with those made by users of chemical tests. For example, one (94) describes a number of experiments which show how easily a passive rod is activified, *e.g.*, by scratching, whereas another (196) states that a steel wire could be polished with a leather and even lightly scratched with a file without measurably affecting its "negativity."

Schönbein (160) employed 1·35 nitric acid in most cases as a test for passivity which was shown by the absence of action. Faraday (50) showed and Schönbein confirmed that 1·35 nitric acid can passivify iron, and although it was shown (132) that iron passivified in strong nitric acid remains passive in 1·204 nitric acid, which vigorously attacks an ordinary piece of iron, the 1·35 acid test continued to be used by many experimenters (110—115, 149). Schönbein (160) regarded the evolution of oxygen at iron anodes as a characteristic of passivity. Beetz (16) sometimes used the combination, "iron/liquid to be investigated/sulphuric acid/copper," and determined its electromotive force. For other users of nitric acid as a test for passivity, which was judged by the absence of visible action, see:—150, 149, 33, 16, 82—84, 5, 121, 184, 185, 67 129, 130, 18, 94.

For subsequent users of e.m.f. measurements as a test of passivity see:—114, 87, 116, 57, 126, 40, 65.

It should be noted that normal potassium chloride solution employed by Muthmann and Frauenberger (126) activifies passive iron rapidly, a fact which probably accounts for some of the differences between the results they obtained and those obtained by other experimenters.

Both methods of testing, the e.m.f. method and the nitric acid method, have their pitfalls. The nitric acid test has led to contradiction because the acid used passivified the rod being tested, and the e.m.f. test not only measures the e.m.f. between passive (or active) iron and the liquid in question, but it generally indicates also conditions intermediate between activity and passivity, and failure to recognise that a low, or negative potential difference is not always associated with passivity, has led to even more contradictions than the nitric acid test. Corsepius has recognised this and differentiates clearly between polarisation and passivity.

It appears therefore as if the best method would be to employ either 1·2 nitric acid in which passivity vanishes very slowly (in about 12 to 24 hours), and which, alone, is incapable of passivifying iron, and attacks it at once, or an e.m.f. test in which the solution employed was of such a nature that passive and active states persisted but all states intermediate between passivity and activity were of very short duration.

1·2 nitric acid is a liquid approaching this description and has been employed in some of our tests, in conjunction with a mirror galvanometer and 1,000,000 ohms in series.

In most cases, however, we have employed 1·2 nitric acid without galvanometer, and the rod was regarded as passive when, after plunging in 1·2 nitric acid and shaking for a moment in the acid and then holding motionless, no chemical action could be detected at the surface by the unaided eye, the temperature of the acid being about 15—17° C.

Material.—Most of the early experimenters used iron rods either completely or partially immersed. The completely immersed rods touched the bottom or sides of vessel and were therefore not in contact with the liquid at these points.

In the case of partially immersed rods the part projecting out of the acid is a source of disturbance. As it is pointed out (199*a*), this is liable to become partially immersed by lowering the rod, or by the acid creeping up. Either of these processes would bring active iron into immediate proximity with passive iron and both into contact with electrically conducting liquid. If the rod be raised so that the part just above the liquid be passive, this part is prone to become active, owing to the activifying influence of the air (58).

One (150) suggested covering the end of rod which touched the bottom of the vessel with wax, and another (149) eliminated the activifying action of air by covering the rod above and below the surface of liquid with varnish.

We have made a welded hollow steel vessel to float below the surface in nitric acid of a certain density, but the uprising bubbles interfered with the experiment, and when it was desired to eliminate contact as far as possible this was done by supporting a rod under the liquid on the points of three or four glass rods drawn out to the finest possible thread.

In most of our experiments paraffin wax was applied to all parts except that to be experimented upon. This is not a perfectly satisfactory expedient, for the evolution of gas tends to raise the wax at its edges and to expose a little ordinary iron. When the evolution of gas was likely to be considerable we used sealing wax, *e.g.* in experiments with iron as anode in sulphuric acid. Sealing wax could not be used in nitric acid experiments. Furthermore, when the surface of metal becomes rough owing to the action of reagents, little tunnels are formed under the wax, the ends of which very possibly never become passive during passivification. When a rod of this kind is cleaned and put into concentrated aqueous solution of potassium ferricyanide, a dark blue precipitate is formed where iron and wax unite showing the presence of active places.

For the most part the material used was drawn wrought iron wire; some experiments have been made with 2 kinds of drawn steel wire. The analysis and physical constants of the steels are as follows:—

	Mild Steel.	Steel.
Carbon (colour)	0·102%	0·625
Sulphur	0·043	0·053
Phosphorus	0·074	0·119
Silicon	0·025	0·094
Manganese	0·483%	0·686%
Tensile strength lbs. per sq. in.	61270	161600
,, ,, tons per sq. in.	27·35	71·73
Elongation of 1″	0·36″	0·07″
Contraction	73·68%	44·63%
Diameter 4·5 mm.		

All rods were highly polished and etched before using with 1·2 nitric acid.

The iron rods were not free from longitudinal crevices and even when the surface was ground off the under layers showed, after etching, crevices sometimes quite deep. These crevices appeared to contain some ingredient or area which refused to become passive and caused a blue precipitate on iron around them in potassium ferricyanide solution. Such rods always behaved abnormally, the passivity proving very unstable and of much less duration than usual. Sometimes it appeared impossible to produce passivity on them which lasted more than a few seconds. In such cases the surface was either removed and repolished or another portion of the same rod tried.

The steel rods were much more homogeneous, and active crevices could rarely be observed.

2.—PASSIVIFYING OF IRON.

1. In liquids without aid of external current.
   (*a*) which passivified rapidly.
   (*b*) which passivified slowly.
2. In liquids with aid of external current.

The following list contains solutions etc. which have been said to passivify iron without the aid of external current.

Aqueous solutions of salts.—Silver nitrate (32, 174, 175) (94) lead nitrate (99) mercury nitrate (159*a*) (28) ammonium nitrate, ferrous nitrate, ferric nitrate, aluminium nitrate, nickel nitrate, cobalt nitrate, (147) potassium permanganate, potassium bichromate, (28) copper nitrate, (193) cupric nitrate + silver nitrate (sat. soln.) (94), (193), copper tartrate + potassium tartrate (194).

Solutions, not aqueous.—Alcoholic cupric nitrate (193), cupric oxide in ammonium hydrate (194).

Acids or solutions containing acids.—Chloric acid (28) (145*a*), arsenic acid (28), chromic acid (15, 16), nitric acid (94 etc.), iodic acid (145*a*), sulphuric acid + nitrous acid + potassium chlorate, sulphuric acid + nitrous acid + potassium iodate (141*a*), cupric nitrate + sat. silver nitrate + nitric acid (94), equal vols. conc. aq. copper sulphate + fuming nitric acid (172), sulphuric acid + nitrous acid (164), sulphuric acid + nitric acid (28) (42), nitric acid + chromic acid, nitric acid + permanganic acid (28), silver nitrate + nitric acid (94) (13), sulphuric acid + chloric acid, sulphuric acid + bromic acid, sulphuric acid + iodic acid, (14).

Gases, vapours, &c.—Compressed nitric oxide (185), absorption of oxygen from air (28) (126), vapour of strong nitric acid (150).

There are some other liquids which have been said to passivify iron (*e.g.* alcohol, acetic acid) but the statements have been disproved.

In some cases passivity is induced very quickly indeed, but in others there is a longer or shorter period during which the liquid acts appreciably on the iron and then ceases to act when passivity ensues. The following list contains instances of this latter mode of action, no external current being used:—Nitric acid 1·38—1·26 (150), silver nitrate added to active iron in nitric acid (94), concentrated nitric acid (10), nitric acid (184, 185) (160*a*, 82—84) (45*a*) (199*a*) (121, 122), nitric acid + mercuric nitrate (159*a*).

Results of Passivifying Experiments.

In view of the many contradicting results obtained not only by different early experimenters but by the same experimenter (who found that different rods of iron behaved differently and even the same rod did not always behave in the same way), it is all the more important to note the few indications there are as to the causes of variation. Some of these have already been mentioned.

There are however some regularities to be noticed in the accounts of these experimenters. Keir (94) describes how iron being attacked by nitric acid became passive on adding concentrated silver nitrate solution, *after* producing a precipitate of silver.

Iron not being attacked by nitric acid became passive without producing a precipitate of silver.

In other words Keir found differences in the passivification of dry iron and iron which is being attacked by nitric acid. One (194) observed the same difference with iron in aqueous cupric nitrate solution. Another (132) observed similar differences when wet and dry iron were placed in nitric acid of medium strength. The observations of Schönbein I shall refer to later.

It is not to be inferred from this however that the dry iron became passive without *any* action. It has been shown (10) that when iron and bismuth are connected to a galvanometer and the metals then plunged into concentrated nitric acid, there is a deflection first in one direction and then in the opposite direction. In dilute nitric acid this reversal does not occur and the initial direction when iron is in conc. nitric acid is the same as when in dilute nitric acid. This shows that iron becomes passive after some chemical action has taken place. Varenne (185) was of the opinion that in nitric acid a momentary action always occurred, and our experiments with highly polished iron rods which were kept cool during polishing, show that there is always a visible dulling of the surface, though not always all over, even in the strongest nitric acid.

Rate of passivifying retarded.—The early experimenters found several ways in which the time the metal was acted upon before becoming passive could be lengthened. For example, by presence of nitrous acid in nitric acid (94) (14); by adding excess of nitric acid in silver nitrate + nitric acid (94); by diluting strong nitric acid (82); by saturating nitric acid with nitrous fumes (82).

One notices that retardation of passivification is brought about in every case by making the liquid in question less oxidizing—*i.e.* of a lower oxidation potential,—either by diluting or adding a reducing agent, and a multitude of instances exist to support the statements (121) that the establishment of passivity is always accompanied by an oxidation, and (149) that oxidizing agents have no action on passive iron, but deoxidizing agents destroy passivity. This does not mean that a small amount of a deoxidizing agent will destroy passivity. If the addition is continued the passive iron will become active and active iron will not be passivified in the mixture (132).

But while this is true there are also abundant experiments which show that the oxidation potential of the solution in question is not the only condition.

Oxidizing potential of a liquid and passivifying.—In nitric acid of about 1·3 sp. gr., iron has been observed to dissolve up slowly and sometimes show no sign of becoming passive as long as the rod is motionless (82, 83, 45*a*, 160*a*, 159*a*,) (199*a*); on moving the rod in and out of the acid, or dropping it to the bottom with a shock, or sometimes by removing it from the acid it will become passive. Sometimes quick shaking has the same effect. It has been suggested (14—17) that moving the rod about has the result of bringing fresh acid up to the surface wherewith the passivification is accelerated. This may be one reason, but is not the only one, for we have often confirmed the observation (150) that the rod may become passive whilst out of the acid after the film of acid has continued its action. From this it might appear as if the products of the action facilitated the passivifying, but we have found that rods covered with the brown products resulting from the action of nitric acid on iron, behave just like rods without this addition when immersed in 1·3 nitric acid. It has been shown recently (126) that air may produce a semi-passive condition in iron. Another class of results show that the oxidation potential of the liquid is not the only factor in passivifying. Drops of a strong solution of copper nitrate in water placed upon polished iron rods sometimes passivify the part wetted and sometimes do not (193). In some drops the iron would be active, and in others passive on the same piece of iron. It is recorded (193) that a rod polished almost as brightly as a mirror decomposed the spots wherever they were placed, while on another rod which had a rough surface, almost every drop remained undecomposed. There are differences and contradictions observed (160*a*) by so many that one feels inclined to attribute this difference to the character of the surfaces. Fawsitt (52) has proved that highly polished steel has a greater solution-pressure than etched steel (*ceteris paribus*), and gives results which explain the differences (193) just referred to.

Electric currents in passivifying iron.—Facts of this kind led several of the early experimenters to suspect that electric currents play some part in the passivification of iron. Faraday (50) showed that charcoal and plumbago when brought into contact with active iron in 1·35 nitric acid, induced passivity, and he put forward the suggestion that the spontaneous passivifying of steel in nitric acid is due to the action of the carbon contained in the steel. The wording of his statements however would not lead one to suppose that he ascribed the passivifying of iron in nitric acid to an electrolytic effect, nor did Schönbein (162) understand Faraday to mean that. Another (121) expresses the view that the establishment of passivity is always accompanied by an oxidation and a corresponding electric current, and another (149) was of the opinion that the passivifying of steel and cast iron was to be ascribed to the action of the carbon liberated.

Passivity may spread.—Schönbein (160) has shown that a passive rod (in nitric acid) may be made to passivify another by bringing them into contact and lowering the active one slowly into nitric acid. Others (149) (185) showed that one passive part of a rod may passivify adjacent parts of the same rod, if it is lowered gradually into nitric acid. These experiments show that passivity could spread from one part to another under certain conditions, but it does not follow that passivity induced at one point of a rod which is totally immersed could spread, for others (193) found that when active and passive iron are brought into contact both become active, and if the rod in the experiment (149) were lowered rapidly the whole became active. Furthermore, since electrolytically deposited iron from many solutions becomes passive in nitric acid (40) it is evident that the use of carbon as one pole of local cells is not essential to passivifying, though it may facilitate it as Belck showed (18). This had the effect of throwing doubt on the electrolytic theory.

Electrolytic passivifying.—Leaving for the present the question of whether an electric current does or does not play some part in passivifying let us consider the results of employing an electric current to passivify iron. Schönbein (160) discovered that when a piece of gold or platinum or lead oxide was attached to the end of an iron rod, it became passive at once when immersed in nitric acid, and contact with noble metals always facilitated passivifying. He also discovered that when an electric circuit is completed by dipping an iron anode into nitric acid (probably 1·35) the iron became passive. If the nitric acid is replaced by mercury (167), *ceteris paribus*, the iron does not become passive, hence the passivifying in this case is an electrolytic (anolytic) process and not a current effect.

Later he (166) observed that when the circuit is completed after immersing, the iron may become passive, but not readily. This has been confirmed by others (65) and it should be noted that the difference in the behaviour is precisely analogous to that already mentioned which obtains when wet or dry iron is passivified by a liquid without external current:—when the circuit is closed by iron it is dry and when closed after immersion it is wet and is more difficult to passivify. Schönbein made extensive experiments and concluded that iron can be passivified electrolytically in every aqueous solution of an oxy-compound. On the other hand iron could not be passivified electrolytically in aqueous solutions of compounds whose anions attacked iron (*e.g.* sulphides, halides, etc.).

The similarity between these two generalisations and the previous statements regarding passivification induced by liquids without electric current will be noticed.

Later some apparent exceptions were found. The cell "iron/potassium sulphide/sulphuric acid/copper" was found to give a current in the same direction as "passive iron/nitric acid/sulphuric acid/copper" so the iron was apparently passive; but it was shown (16) that the iron from the former cell was always acted upon by more dilute nitric acid, whereas the iron from the latter was always passive, and (133) that the iron in the former cell was covered with a film of iron sulphide. The fact is that potassium sulphide, like potassium hydrate, will convert iron into the semi-passive state analogous to the slow dissolving state in 1·3 nitric acid, and after being in the first two solutions there is less action before iron becomes passive in nitric acid (110).

Another supposed exception is the alleged passivification of iron electrolytically in potassium cyanide solution (65). Ruer (155*a*) points out that Fredenhagen's conception of the behaviour of iron in potassium cyanide solution is incorrect, and it is probable that if the low potential is due to passivity and not to an intermediate or semi-passive state, it is to be ascribed to the electrolysis of potassium hydrate in the solution.

I have repeatedly tried to passivify iron and steel in concentrated and dilute solutions of potassium cyanide, both with and without external current, but whenever immersed direct or after drying by washing etc. (see later) in 1·2 nitric acid it was invariably active. Some (57) e.m.f. measurements appear to show that iron dipped in potassium cyanide and then in potassium ferrocyanide or ferricyanide is really passive, but it is most probable that the rod was passivified by the latter solutions and not by the potassium cyanide.

Returning to the electrolytic passivification of iron (92) some measurements of the current show that the drop in current when iron becomes passive is probably due to an opposing electromotive force and not to the establishment of a resistance at the surface of the iron anode. Another (57) came to the same conclusion by measuring polarisation capacity by Nernst's method, but other (71) results on polarisation capacity lead to the opposite conclusion. The contradiction is possibly due to the solutions employed, for when concentrated nitric acid was used and the iron was certainly passive their results agreed.

Some e.m.f. measurements of "iron anode/sulphuric acid/ordinary iron" (40) show the process of passivifying to be accompanied by a previous polarisation and that there is a sudden fall in potential when passivification takes place. Passivifying *began* when the e.m.f. reached about —·55 V.

The values found by others (57, 65) tabulated under "Passivity, Historical" show the e.m.f.'s corresponding to different stages in passivification.

PASSIVIFYING WITHOUT EXTERNAL CURRENT—EXPERIMENTAL.

Nitric acid.—The acid used had a specific gravity of 1·405 to 1·416, and was the ordinary "pure" nitric acid (B.P.) of commerce. This when diluted with water to 1·36, 1·345, 1·320, 1·295, 1·285, 1·275, 1·260, 1·245 sp. gr. proved itself capable of passivifying the iron rods used.

In the weaker acids rods showed considerable differences in the rapidity of passivifying, and the actual limit of dilution when acid ceases to passivify varies from rod to rod as observed by another (18), and averages about 1·245. (One (18) found 1·25 and another 1·26 (150).) Electrolytic iron deposited by the method of Hicks and

O'Shea became passive in 1·4 nitric acid and remained so in 1·2 nitric acid, generally about 1 minute.

Passivifying is a complex process.—The passivifying of iron in nitric acid of, specific gravity ranging between 1·36 and 1·245 presents many points worth noting. When first immersed the rod is usually vigorously attacked, then the action slows down, smaller bubbles are evolved, and the slowly dissolving condition is reached.

Rods in this condition may be passivified as already described by shaking, moving in and out of the acid, or by shock, or by contact with platinum or making rod anode of an electric current in another way. On the one hand activifying and on the other passivifying influences appeared to have the same effect. This suggested touching a rod in the slowly dissolving condition in 1·32 nitric acid with a zinc rod: in four cases the rod became passive immediately on removing the zinc. It appears therefore as if one condition necessary for passivifying to occur when iron is in the slowly dissolving condition is the establishment of differences in the rate of solution at different parts of the surface. The result of this would be a difference of potential between adjacent parts and for a moment an electric current would flow and possibly be sufficient to induce passivity. That an electric current plays *some* part when a rod becomes passive spontaneously in nitric acid is rendered likely by the fact that at the moment of passivifying, the evolution of gas is suddenly much increased. The same effect can be produced when a passive rod is brought into contact with another in the slowly dissolving condition, every time the latter is touched the rate of evolution of gas is momentarily accelerated.

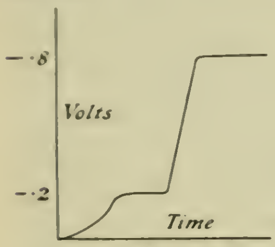

FIG 1

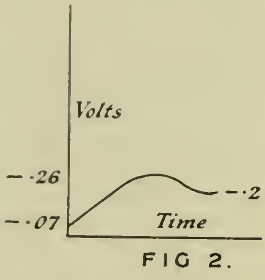

FIG 2.

In order to follow the changes which take place during passivifying we connected two rods to the poles of a voltmeter having a resistance of 1000 ohms, and dipped both rods in 1·245 nitric acid. One became gradually passive till action ceased entirely: the other remained throughout in the semi-passive condition. The motion of the needle every time the experiment was tried is indicated in Fig. 1. The sudden rise was always associated with the sudden evolution of gas referred to before.

Another experiment made in the same way but using 1·2 nitric acid and 0·1 carbon steel and a galvanometer with 1 megohm in series to measure the e.m.f. "iron/1·2 nitric acid" gave the curve in Fig. 2 several times.

Since all the solutions enumerated above that passivify iron contain an oxy-anion, experiments were made with an oxidising solution which contained no oxygen in combination. Potassium ferricyanide was found to passivify iron and steel very rapidly when a freshly prepared concentrated solution is used. When plunged direct into 1·2 nitric acid, or if washed for a moment with potassium hydrate and then with water, or if dried by the method to be described and then plunged into 1·2 nitric acid the rods remained passive. N/100 potass. permanganate solution passivified iron. Saturated potassium ferrocyanide has also been found to passivify iron and steel.

PASSIVIFYING ELECTROLYTICALLY.

When two iron electrodes each having an area of about ·5 sq. cm. are immersed in sulphuric acid (16%) and connected in series with an amperemeter of low resistance (1·8 ohms) and a thermopile (the e.m.f. of which can be increased to 2·5 V. by increments of ·05 V. and whose resistance is low, about ½ ohm) the process of passivification can be deduced from the amperemeter readings.

Applying ·5 V. Fig. 3 is obtained.

Applying ·65 V. Fig. 4 is obtained.

The iron anode dissolves rapidly at first then almost ceases to evolve gas, then when the needle is on the rising part of the curve it dissolves slowly, reminding one very strongly of the slowly dissolving condition in nitric acid. By comparing Figs. 3 and 4 with Fig. 2 it will be seen that the changes of potential of the iron are precisely similar in all cases. In our experiments it has never been possible to passivify iron electrolytically in 16 per cent. sulphuric acid with an applied e.m.f. of less than ·65 volts. The current density must be above a certain value for passivity to ensue, which possibly accounts for Schönbein's (163) observation that smooth rods became passive more easily than rough ones. A rod that was being violently attacked by 1·2 nitric acid became passive when the applied e.m.f. was 10 volts and current density ·75 amp. per sq. cm.

Applying 1 volt, Fig. 5 is obtained and the point marked P. corresponds to the sudden fall in e.m.f. observed when iron just becomes passive in nitric acid (Fig. 3).

If the circuit be now opened by a key and closed again Fig. 6 is obtained.

And if again opened and closed the time till passivity ensues is again less, Fig. 7.

When the applied e.m.f. is insufficient to passivify the anode, by opening and closing the circuit by a key the results indicated in Fig. 8 may be obtained.

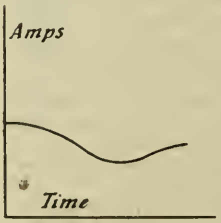

FIG 3

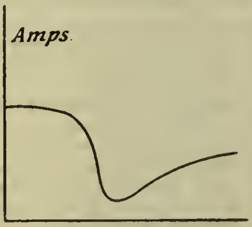

FIG. 4

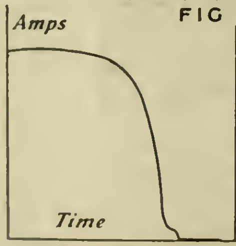

FIG. 5

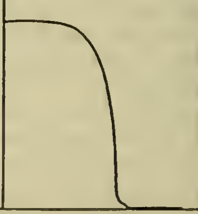

FIG 6.

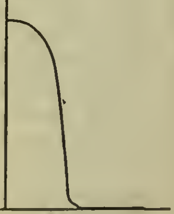

FIG 7.

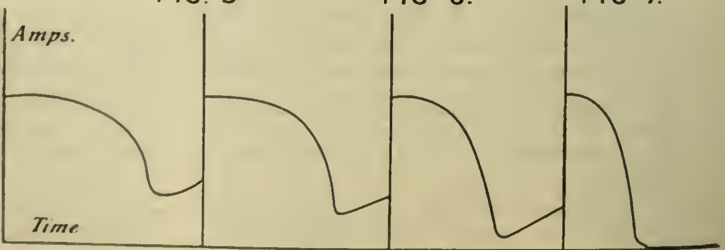

FIG 8

In both cases the iron behaves as if one could teach it to become passive: repeated trials end in success and once passivity has been produced, its reproduction is facilitated. Another observation I have made seems associated with this same phenomenon. In some instances a certain current density was insufficient to passivify iron even after long waiting, but after applying a higher current density and producing passivity, the original current sufficed to induce passivity. As to whether the phenomena are due to an after effect persisting in the anode or in the liquid surrounding the anode (anolyte), it is probable that the latter was altered, for shaking considerably modified the results. If the acid were stirred a much higher current density was required to induce passivity than when motionless. This is of course due to acceleration of the rate of solution of the iron, passivity of which is incompatible with the presence of nascent hydrogen. When saturated potassium bichromate solution rendered alkaline by adding potassium hydroxide (which we have found to have very little action on iron) is used and vigorously stirred, the passivification by electrolysis is induced, so far as the eye can tell from the rate of amperemeter needle, just as rapidly as when the solution is motionless. The first effect of the electrolysis is to inhibit the processes going on at the surface of the anode or to polarize it (40), the next effect is to passivify it. The polarizing effect (Figs. 3 and 4) can be observed when hydrochloric acid is the electrolyte, but the drop of current to a few thousandths of an ampere indicating passivity does not occur in hydrochloric acid. That the iron is really passive in sulphuric acid (126) and that the passivity is as permanent as that produced by other agencies is shown by the fact that if the anode be sprayed with alkaline potassium bichromate solution as it is withdrawn from the sulphuric acid, it can be dried and kept 15 hours in a laboratory atmosphere without becoming active to 1·2 nitric acid.

3.—ACTIVIFYING.

Historical.—The number of observations and experiments relating to the activifying of passive iron are much fewer than those relating to passivifying. One or two experimenters (126) however have admitted the desirability of studying the phenomena which accompany activifying.

The methods of activifying discovered by early experimenters can be classified under the following heads:—By solutions, by gases, by metallic contact, by scratching, by stirring, by heating, and by electrolytic (catholytic) action. By heating in hydrogen (28, 47) iron was activified. Contact with air induces activity at edge of passivifying solution (58, 184, 193, 194,) (133). Contact with chlorine or bromine vapour activified iron (160*a*). Corresponding to the list of solutions that passivify iron is a list which activify passive iron. Passive iron is activified by water (94) (33), dilute nitric acid (132), hydrochloric acid (160*a*), sulphuric acid (166). Potassium nitrate solution activifies iron after the lapse of a few seconds (159). Varenne has measured the rate of activifying by motionless nitric acid of the following specific gravities, 1·31, 1·285, 1·265, 1·240, 1·210, 1·160. The duration of passivity varied from 11 days to 12 hrs.

Rate of activifying accelerated.—By moving the solution (164) (150) (18) activifying is sometimes accelerated. The mere proximity of an active piece of iron without contact can induce activity of a passive piece in nitric acid (94, 184). Bubbles of carbon dioxide or air, or rotating the rod produced the same effect, due doubtless to the stirring of the liquid (184). Stirring may accelerate activifying just as it may accelerate passivifying.

The rate of action of the solution on the surface of passive iron may also be increased by heating. Warm cupric nitrate solution (193, 194) activified iron, also nitric acid when heated (129, 83, 46, 5). As active iron in nitric acid may be passivified by contact with noble metals, so passive iron is activified by touching with active iron, zinc, or lead (193); ignoble metals produce activity (52—84) (166) (50). The activifying here is due to electrolytic effects and it has been stated (166) that passive iron is always activified when placed as cathode (111).

Just as the passivifying of an iron anode proceeds differently according to the process already going on at its surface, so the activifying of a passive cathode depends on the liquid surrounding it. For instance, in concentrated nitric acid a considerable current density is required to induce activity at the cathode. In addition to the foregoing, iron may be activified by scratching with glass (82—84) (94), which we may regard as equivalent to exposing a little ordinary iron. Scratching in 1·4 nitric acid has no effect and activifying is produced more quickly the diluter the nitric acid which adheres to the passive rod.

In all the activifying experiments referred to above, a liquid of some kind (generally nitric acid) is present adhering to or surrounding the rod. None of the results obtained can be regarded as due to the action of the activifying agent (*e.g.* ignoble metal) on pure passive iron.

The early experimenters used active iron in the wet and dry condition and obtained different results as has already been pointed out. It is therefore to be expected that dry passive iron may behave differently to wet passive iron. Beetz tried to obtain dry passive iron by washing with ether and appears to have succeeded in a few instances.

Another activifying agent is a magnetic field (129, 4), which probably develops electric currents between the ends and middle of the passive iron when it becomes a magnet. When placed *in vacuo* passive iron is said to become active (184, 18); this does occur under certain conditions but not always.

Corsepius has studied the process of activifying which goes on when the passivifying current through sulphuric acid is interrupted. The e.m.f. "passive iron/N. sulphuric acid/ordinary iron," rises rapidly from say —1·3 to —·84 or —·90 V. then remains almost stationary for a moment then rises rapidly.

EXPERIMENTAL.

Activifying, Conditions affecting rate of.—Iron rods passivified in 1·4 nitric acid remained from 12 to 48 hours in motionless 1·2 nitric acid before becoming active, Many dozens of rods have been tried and all became active sooner or later. By spraying the 1·2 nitric acid from a reservoir on to the surface of the passive rod, (which was kept totally submerged to exclude air) it became active very quickly; in four experiments the periods of activifying were 120 secs. 60 secs. 60 secs. 50 secs. That the action of the spray was not purely mechanical was proved by spraying the passive rod with a saturated solution of potassium bichromate in water in just the same way. After 10 to 15 minutes the rods were still passive when tested with 1·2 nitric acid. Rods of ordinary iron were not passive when sprayed and tested in the same way.

Thinking it possible that the acceleration of activifying which occurs when the activifying liquid is heated, might be due to convection currents brushing past the passive surface, a piece of iron was immersed in 1·4 nitric acid and the whole sealed up in a thick walled glass tube. The tube was wrapped round and round with a cloth and the bundle heated in water very gradually. After 1½ hours at 70° C. the iron became active, showing that the acceleration is a temperature effect.

The results of stirring and heating experiments seem to show that the activifying process in nitric acid is closely akin to a dissolving of the passive iron by the acid.

The passive state may persist for seconds or days—. Schönbein makes the statement (162) corrected later (167) which has often been quoted and his opinion upheld:—*viz.*, that an iron wire is only passive in dilute nitric acid so long as it is the anode and the current is flowing. On repeating his experiment we also found that when removed and plunged into 1·2 nitric acid the rod was active. By carefully pouring a layer of 1·2 nitric acid under the more dilute acid it was found that when the current was broken and then the rod lowered it remained quite passive. When sulphuric acid is the electrolyte the persistence of passivity after breaking the current can be proved in several ways, *e.g.*, by closing the circuit, when no deflection of the amperemeter is produced. Activification is not instantaneous, as Corsepius (40) proved. We have repeated his experiment and measured the e.m.f. of the combination "Iron anode/16% sulphuric acid/ordinary iron" after interrupting the current. The e.m.f. falls rapidly to a value which for different area electrodes gave the values —·90, —·90, —·86, —·87, —·88, —·90. See Fig. 9.

The determination of the e.m.f. Iron anode/16% sulphuric acid by means of the Lippmann electrometer and normal calomel electrode is difficult on account of the rapidity with which it changes, but by waiting for the momentary steady value the reading —·85 was obtained. Using a mirror galvanometer with one megohm, and the normal calomel electrode in series, the value —·813 was obtained for a "(·6 carbon) steel anode/2N. sulphuric acid."

Experiment showed the e.m.f. ordinary iron/16% sulphuric acid to be +·06. Deducting this from the average of above 6 values we obtain —·825 for the e.m.f. "iron anode/16% sulphuric acid," just before rapid activifying commences, when no current is flowing. That this gradual activifying is not limited to iron which has been passivified electrolytically is shown by the fact that (·6 carbon) steel rods, passivified in 1·4 nitric acid or saturated potassium ferricyanide, gave the average values (in 2N. sulphuric acid) —·792 and —·73 respectively. 0·1 carbon steel was also employed and in every case the existence of a sudden rise in potential could be observed, but it happened before the needle (which in this instance was not well damped) had quite come to rest and no readings could be obtained. By calculating the nearly steady deflection from the values at the end of each swing it was apparent that the stop was at about the same potential as in the case of 0·6 carbon steel.

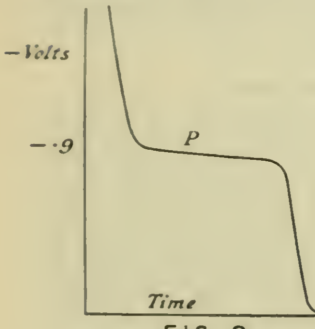

FIG. 9.

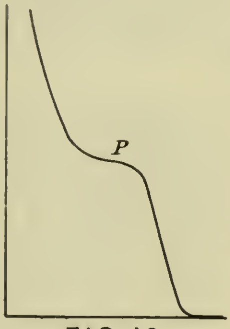

FIG. 10.

Fig. 9 shows the change of e.m.f. with time; the above measurements apply to the part P. which was generally reached a few seconds after immersion in the 2N. sulphuric acid. A curve of a similar kind was obtained when iron passivified by 1·4 nitric acid was placed in saturated potassium nitrate solution, see Fig. 10. Every time the iron rod was removed before the part P. was reached it proved passive in 1·2 nitric acid. If this part had been passed it was always active. Activifying in this solution took from 1 to 2 minutes.

In 2N. potassium hydrate activifying required several minutes.

Steel and iron passivified by nitric acid or potassium ferricyanide or electrolytically &c do not become active in a saturated solution of potassium bichromate for many hours (*e.g.* 20 hrs.) provided this has no acid reaction to litmus and is employed at ordinary temperatures. Exceptions to this rule have frequently occurred, but the discrepancies are traceable to causes other than the bichromate, which tend to activify the iron. Ordinary iron is not passivified in saturated potassium bichromate although its potential fell (*e.g.* 87) in our experiments to about —·34 V. measured against the solution. On testing this rod it proved active in 1·2 nitric acid. The e.m.f. between a passive rod and alkaline potassium bichromate increased slowly to —·36. On removing and testing in 1·2 nitric acid the rod proved passive. The alkaline bichromate used in these experiments contained 34 grms. potassium hydrate in 1200 c.c. saturated bichromate solution, and the e.m.f. of the normal electrode is taken as Mercury/N. potass. chloride = —·56.

Dry passive iron.—All these experiments go to prove that activifying is a process which takes a measurable time, and that the rate depends in part on the difference of potential between active and passive iron in the solution in question. This suggests that activifying may, at any rate sometimes or in part, be due to local currents between active specks and passive areas whereby the latter are electrolytically activified, and certainly the sudden rise in potential at the moment of activifying may be ascribed to the effect of local currents, as when an active rod just becomes passive. In support of this may be mentioned the observation of Martens (115), that passive iron, when immersed in a solution of a copper salt that activifies it, becomes covered with a bright, strongly adherent deposit of copper, such as would be produced by electrodeposition and quite different from that obtained when ordinary iron is put in a copper salt solution. By trying a great number of solutions we have found it possible to select certain ones which can be used to wash passive iron, and to wash one another off, leaving ultimately a clean dry surface of passive iron. They are sprayed on from a wash bottle as quickly as possible one after the other and the rod then shaken in the air to evaporate the last. The solutions are:—

1. Saturated aqueous solution of potassium bichromate + 2·8 grms. potassium hydrate per 100 c.c. solution of bichromate.
2. Water 100 c.c., pure methylated spirits 10 c.c., potassium hydrate (by alcohol) 2·5 grms.
3. Absolute alcohol.

Previous to spraying with the last we sometimes rubbed the rod with a wad of cotton wool soaked in absolute alcohol.

When dry the iron and steel rods, passivified electrolytically or otherwise, are not activified by standing sometimes for days in a laboratory atmosphere. Rubbing well with dry cotton wool did not activify them. Contact with zinc and scratching with glass did not activify parts of the rods not touched. The same applies to iron rods passivified in 1·4 nitric acid and dried by placing in high vacua, and makes it impossible to believe, as Fredenhagen (65) suggests, that the nitric acid was not all removed. When a film does remain, contact with zinc or scratching always activifies the surface gradually all over.

We shall refer again to the duration of passivity later on, when dealing with the question of different degrees of passivity.

Activifying the reciprocal of passivifying.—Before leaving this part of the subject I would again refer to the connection between passivifying and activifying. The one is the reverse of the other. Solutions passivify, solutions activify; contact passivifies, contact activifies; laying bare active iron may activify the rest, contact of a passive rod may passivify an active one; stirring may passivify, stirring may activify; anolytic changes may passivify, catholytic changes may induce activity; some phenomena on passivifying are attributable to local electric currents, the same holds when iron becomes active; oxidizing solutions passivify, reducing solutions activify. In many respects the one process is the reverse of the other.

4.—Blued Iron.

Historical.

Blued iron not passive.—Schönbein (160) discovered that iron blued by heating in the air became passive when immersed in 1·44 and 1·35 nitric acid.

Rods heated in hydrogen behaved like ordinary iron, so the heating was not the cause of the change. In another place (167) he restates his opinion that the iron oxide formed on heating induces passivity in the same manner as lead peroxide, or carbon, gold, platinum, etc. It is impossible therefore that the belief that blueing renders iron passive (126) (57), can have arisen from Schönbein's statements.

The view probably arose partly from the inaccurate experiments and statements of Martens, and because Faraday had put forward a theory that passivity was due to a film of oxide, and himself believed that blued iron was passive *per se*. The confusion this introduced was bewildering: experimenters (28, 110—115, 50) regarded passive iron and blued iron as identical, and it is often next to impossible to find which they really meant.

Belck (18) appears to be the first to discover that 1·2 nitric acid attacks blued iron vigorously. Others observed the same (87), but even before that, some (14, 15) recognized clearly the difference between blued iron and passive iron.

Further, confusion appears to have existed regarding the composition of the blue layer. Some (87) experimenters on passive iron regard it as represented by the formula Fe_3O_4, but it has been shown that the composition is by no means so simple, and that layers near the steel approximate to the formula $6FeO.Fe_2O_3$. (Mosander, Pogg. Ann. 6, 35.) and only the outside layers of thick coats obtained at high temperatures are nearly pure Fe_3O_4. It is therefore interesting to note that some (114) (18) experimenting with blued iron found that the darker the blue the more rapidly were the rods passivified, and a rod covered with a thick layer of oxide by heating for 15 minutes in the blow pipe was quite passive to 1·2 nitric acid, and copper sulphate solution. We have found that 1·2 nitric acid acts quite differently on pieces of oxide scale and on pure Fe_3O_4. The former often dissolves readily, whereas the latter dissolves very slowly indeed.

It is stated (147) that ($FeO.Fe_2O_3$) (which was supposed present as a protecting film causing passivity) is almost insoluble in concentrated but readily soluble in dilute nitric acid. This is not confirmed by our experiments.

Experimental.

Solubility of magnetic oxide and ferric oxide in nitric acid.—To compare the solubility of magnetic oxide in nitric acid of different strengths we triturated 1 grm. oxide in a mortar for 5 mins. with 10 c.c. of acid, allowed to settle for 1 min. then poured off into a test tube and by means of a magnet accelerated the settling of undissolved oxide. After standing 40 mins. 5 c.c. of the clear solution were pipetted off, diluted to 55 c.c., and 5 c.c. taken for colour test. In each case an equal vol. of ammonium thiocyanate solution was added and compared with a solution containing ·0001 grm. iron per 1 c.c.

The results obtained, after allowing for traces of iron in the reagents determined by blank experiments, were :—

10 c.c. 1·4 nitric acid dissolved ·04004 grm. Fe_3O_4.
,, 1·3 ,, ,, ,, ·02291 ,, ,,
,, 1·15 ,, ,, ,, ·01709 ,, ,,

Since passive iron is attacked in a few seconds by 1·15 nitric acid, it was to be expected from Ramann's statement that the solubility in this acid would be greater and not less than in the two stronger acids. Thinking it possible that the black oxide employed might contain traces of iron that masked the effect Ramann describes, the oxide was treated with copper potassium chloride and hydrochloric acid (the solutions generally employed to dissolve iron in carbon by the combustion method), well agitated and heated, filtered, and then washed repeatedly with water and finally with alcohol. The results then were ·02332, ·01752 and ·01124 grms. respectively.

It will be noted that these results do not support the statement (118) that iron oxide obtained by burning iron in oxygen is not attacked in nitric acid of all concentrations. We found too that oxide obtained in the latter way gave a blue colour in 1·2 nitric acid containing a little potassium ferrocyanide.

We have also compared the solubility of purest ferric oxide in the same way. The results were :—

10 c.c. 1·4 nitric acid .. ·00374 grm. Fe_2O_3.
,, 1·3 ,, .. ·00335 ,, ,,
,, 1·15 ,, .. ·00242 ,, ,,

Passivifying blued iron.—Experiments made with dozens of blued and strongly heated iron rods confirmed the statements that the deeper the blue (or more accurately, the longer it was heated, for there is a stage beyond which further oxidation produces a lighter blue) the more dilute the nitric acid required to passivify iron ; and iron strongly heated (for 5—15 mins. in blow pipe) remains for several days in 1·2 nitric acid without becoming active.

That magnetic oxide is passive is further supported by the result :—E.m.f. iron covered with magnetic oxide by long heating/1·2 nitric acid/iron passivified in 1·4 nitric acid = —·06.

It should be stated that our experiments did not reveal degrees of oxidation which would just produce passivity in acids between 1·245 and 1·2 sp. gr. Heating the polished rods in an air bath to protect them from the products of combustion of the flame introduced no variation in the results save a more beautiful and uniform colour of the surface, and a better agreement in the behaviour of similarly heated rods.

The most marked characteristic in the passivifying of blued iron by nitric acid is that passivity in acids of 1·26—1·35 sp. gr. is produced without any visible action on the surface. This fact no doubt underlay the belief that blued iron was passive *per se*. This absence of visible action is quite in accordance with Schönbein's view: a very little of the oxide layer probably dissolves and generates an electric current which passivifies the layers just under and around those that have been dissolved. Since the rate of solution of the oxide is much less than that of iron, a less current density will be required to inhibit the action and induce passivity, and the attack will be proportionately less.

It has been shown (18, 87) that a blued iron rod is not passive. Viewed by means of a microscope it becomes obvious that although the shade of colour is different for different crystal grains the iron is all oxidised. Probably, impurities such as sulphide or phosphide areas are not oxidised, and it may be that these exert an activifying action, so it is not certain from the 1·2 nitric acid experiment that blued iron particles are not passive. A blued iron rod is not passive.

Passive blued iron.—The most marked characteristic of the passivity of blued iron is the vanishing of the colour (*e.g.* in 1·2 nitric acid). This happens also when the blued iron is passivified anolytically in 1·2 nitric acid, or by simple immersion in 1·4 nitric acid. When passivified (without apparent action) in 1·36—1·26 nitric acids and allowed to remain in the acid in question the colour slowly vanishes. The same happens when active blued iron is placed in saturated potassium bichromate or saturated potassium nitrate solution. That it vanishes in sulphuric acid is of course well known.

Comparison of Fe_3O_4 and passive iron.—We have made a number of e.m.f. determinations with a 0·6 carbon steel rod oxidised by melting and keeping it melted for several minutes in the tip of the oxy-acetylene flame. This most probably produces a film of fairly pure magnetic oxide on the surface of the drop.

	E.m.f. Fused magnetic oxide/acid.	E.m.f. Passive iron/acid.
1·2 Nitric acid	– 0·81	– 0·91
1·3 Nitric acid	– 1·21	– 1·185
1·4 Nitric acid	– 1·16	– 1·185

These results do not of course prove identity, but they show that magnetic oxide behaves in some respects quite similarly to passive iron. The similarity in the solubility of the magnetic oxide and passive iron in nitric acid is worth noting.

Activifying passive blued iron.—With regard to the activifying of passive blued iron : as already stated this is generally much slower than in the case of ordinary passive iron. An exception to this is its behaviour in saturated potassium bichromate solution ; in several instances the former became active after being immersed for a short time. A number of blued iron rods passivified in 1·4 nitric acid and dried *in vacuo* for 120 hours were quite passive to 1·2 nitric acid.

5.—PASSIVITY.

Historical.

The theory that the passivity of iron is due to a protecting film of oxide has already been mentioned. The following list contains the various theories which from time to time have been put forward to account for passivity.

Protecting film of oxide.—Faraday (50) had a strong impression that passive iron was oxidised, or that the superficial particles of the metal were in such a relation to the electrolyte as to be equivalent to an oxidation (*cf.* also 16, 147, 28, 68, 1, 136, 80, 116, 155*a*, 199*a*, 137 and 77).

Oxygen as a film, or occluded or dissolved in the iron has been suggested to explain passivity (*cf.* 136, 149, 18, 57, 65, 126).

Physical alteration of iron.—That passivity is due to mechanical alteration or a strain of the iron is postulated by several (*cf.* 161, 166, 167, 87, 41*a*). A molecular or allotropic change is assumed by some, *e.g.* 57, 134, 32, 174, 175, and an altered electrical condition as the cause of passivity by others (*cf.* 82, 196, 110, 22, 162).

Iron nitrate was supposed to form a protecting coat round passive iron in nitric acid preserving it from attack by some (*cf.* 28, 29, 80).

Nitric oxide in the form of a protecting film has also been assumed (*cf.* 184, 65). Others believed in a layer of nitrous acid (121).

Gases other than oxygen and nitric oxide.—One (47) believed that nitrogen in iron was the cause of passivity, another (65) postulates cyanogen as one cause.

Cleanness of surface.—Some (1, 2, 183*a*) regarded passivity as due to the extreme cleanness of the surface.

Other theories.—Peretti (143) supposed passivity in nitric acid to be due to the absence of a hypothetical deutoxide of hydrogen and Dumas ascribed it to some peculiarity in the nitric acid. Schönbein held various theories at different times, one being that passivity was due to a sort of capillary action (159*a*) and another was that the iron atoms may be capable of assuming different polarity towards oxygen, at one time attracting, at another repelling it. This theory appears to have much in common with the view of Le Blanc (26) that some elements may be capable of forming both positive and negative ions. He (26) has associated passivity with ionisation, which is a process having a certain velocity, and suggests that metals are passive when the rate of ionisation is very small. Sakur (156) has associated passivity with catalytic power to accelerate the combination of oxygen in electrolyte with hydrogen at cathode.

Worthy of note is the opinion (4) that passivity is not a static state. Many have believed that passive iron was covered with a film, but could not believe it was oxidised because it looked so white (53). The number of partisans of the oxide and physical change theories is greater than of any other, and in point of numbers these two appear to be equally supported. The point to decide however is how far the support is justified in each case, and as the validity of many of the theories appears to be affected by some of the results of our experiments yet to be described we will postpone discussion of the merits of the theories.

Different Degrees of Passivity.—Keir proved for iron passivified by nitric acid and silver nitrate that it is the iron which is altered and not the solution. Quite early some of the experimenters believed that passive iron could be obtained with various degrees of passivity.

We have already mentioned the semi-passive state that iron may assume in 1·3 nitric acid or solutions like potassium hydrate or sulphide, or in air, all of which lower its potential without passivifying it.

There is much evidence to show that this semi-passivity may and does occur in a great variety of grades. Some experimenters have failed to recognise that these states are semi-passive and not passive (85, 57, 65) and the reason is not far to seek: their test and method of experiment did not reveal any but gradual changes. Thus Hittorf states that there is an infinite number of merging states between activity and passivity, but the e.m.f. test proves neither continuity nor discontinuity in the conversion of passive to active particles. Figs. 9 and 10 could be obtained if the activification were continuous or discontinuous, for it is most probable that it would not take place at precisely the same rate all over, and when one particle became active, local currents would activify the rest.

The e.m.f. test gives the average of the processes going on at the surface and close to the surface tested, and as there may be an infinite variation in the proportion of active parts to passive parts while the rod is semi-passive, there may consequently be an infinite number of semi-passive states of the whole surface, shown by the electrometer. Other grades of passivity appear to have been observed by earlier experimenters in which even semi-activity would have become apparent at once.

In some of these instances it is obvious that the more stable passive iron was throughout the test subject to obvious passivifying agencies, such as contact with lead peroxide, oxide of iron (160, 160*a*, 110, &c.), or carbon liberated when steel was used (6) (46) (41). These we may leave out of account and consider instances where obvious passivifying influences were not at work. Another class may be excluded, namely, where the difference in duration of passivity is due to contact with different solutions which activify at different rates (184).

Excluding these, the remaining references (160*a*, 80, 14—17, 185, 145*a*, 40, 58, 193—198) go to show that the surface condition and purity of the iron influence the duration of passivity, also that iron passivified in nitric acid has a more stable passivity than that induced by an external electric current.

Solubility of Passive Iron.—The earlier experimenters concluded that passive iron was insoluble in nitric acid but several of later date proved the contrary. Faraday (50) showed that a passive iron anode dissolves appreciably when a current is passed, and others have confirmed this and (18) shown that the rate of solution is less in more dilute nitric acid. A passive iron anode dissolves slowly in sulphuric acid (33, 149). Not only during the passing of an external current does passive iron dissolve. After standing a long time in fuming nitric acid, green crystals of iron nitrate appear (28), and passive blued iron slowly loses its colour in nitric acid (112). Some give figures relating to the relative solubility of passive iron in nitric acid of different concentrations (67) and state that the slow dissolving of passive iron is accompanied by the formation of iron nitrate, and traces of ammonia and nitrogen peroxide. Others describe the solution of passive iron in nitric acid with evolution of gas (129).

These facts all show that passive iron is rarely if ever in a static condition, and it is small wonder that measurements frequently give varying results (57). For the sake of completeness, however, we give some of the electromotive force observations below, which may prove useful.

Active iron (ordinary iron)—

(49—51)	Active iron/1·35 Nitric acid/Platinum E.m.f. →
(85—88)	Iron/Sodium nitrate/Chromic acid/Platinum 1·8.
	Iron/Sodium sulphate/Chromic acid/Platinum 1·95.
	Iron/Sodium acetate/Chromic acid/Platinum 1·49.
(57)	Iron/N. Ferrous sulphate ·26.
(65)	Iron/Sulphuric acid ·625.
(126)	Iron/10 % or 16 % Sulphuric acid ·03.

Semi-passive iron (or probably semi-passive)—

(43, 45)	Iron/Alkaline solutions/Copper E.m.f. ←.
(43, 45)	Iron/Solutions of hydrosulphides/Copper E.m.f. ←.
(85, 88)	Iron/Potassium bichromate sol./Chromic acid/Platinum ·95 → ·17.
(15)	Activified iron/Electrolyte/Ordinary iron E.m.f. →.
(85, 88)	Iron / Potassium cyanide / Chromic acid / Platinum 1·62.
(57)	Iron/Normal potassium cyanide –·20.
	Iron/Ammonium hydrate ·23.
	Iron/Ammonium sulphide ·25.
	Iron/Potassium ferricyanide ·09.
	Iron/Potassium ferrocyanide ·10.
(65)	Iron/Normal potassium hydrate ·248.
(126)	Iron/1 : 3 Potassium hydrate –·2.
(85, 88)	Iron/Sodium hydrate/Chromic acid/Platinum 1·59.

(15) Iron/Potassium sulphide/Sulphuric acid/Copper E.m.f. ←.
(126) Iron anode/Hydrochloric acid –1·25.

The following appear to refer to the condition immediately preceding the sudden establishment of passivity.

(40) Iron anode/Sulphuric acid/Ordinary iron –·55.
Iron anode/·2 N. Sulphuric acid –·56.
Iron anode/·2 N. Sulphuric acid –·55.
Iron anode/·2 N. Potassium sulphate –·56.
(57) Iron anode/·2 N. Sulphuric acid + ·2 N. Ferric sulphate –·586.
Iron anode/·2 N. Sulphuric acid + N. Ferric sulphate –·601.
(65) Iron anode/Sulphuric acid –·28.

Passive iron, &c. (or probably passive)—

(144, 145) Passive steel/Conc. Nitric acid/Platinum E.m.f. ←.
(50, 51) Passive iron/1·35 Nitric acid/Platinum E.m.f. = 0.
(107) Passive iron/Commercial Nitric acid/Platinum E.m.f. →.
(85, 88) Passive iron/Conc. Nitric acid/Platinum ·28 V.
(126) Passive iron/34% Nitric acid –·61.
Pass. iron/1·397 Nitric acid/N. Sulphuric acid/Ord. iron –1·324.
Pass. steel/1·397 Nitric acid/N. Sulphuric acid/Ord. iron –1·273.
(40) Pass. iron/1·397 Nitric acid/N. Sulphuric acid/Zinc –1·898 to –2·055.
Pass. electrolytic iron/1·397 Nitric acid/N. Sulphuric acid/Zinc –1·73 to –1·977.
Pass. iron/1·42 Nitric acid/1·50 Nitric acid/Pass. iron E.m.f. ←.
(5) Pass. iron/Hot 1·42 Nitric acid/Cold 1·42 Nitric acid/Pass. iron E.m.f. ←.
(4) Pass. iron magnetized/1·42 Nitric acid/Pass. iron not magnetized E.m.f. ←.
(49, 51) Iron/1·35 Nitric acid/Silver E.m.f.: first → then ←.
(126) Iron/Chromic acid 30% –1·45.
Iron anode/N. Potassium hydrate –·58 when bubbles evolved.
(65) Iron anode/Sulphuric acid/Ordinary iron –·905 (deduced).

Blued iron—

(85, 88) Bl. iron/Sodium nitrate/Chromic acid/Platinum 1·764.
Bl. iron/Sea water or Potassium nitrate/Chromic acid/Ord. iron E.m.f. →.
(114) Iron after heating to red heat/1 : 6 Sulphuric acid/Ord. iron E.m.f. ←.
(40) Pass. bl. iron/1·397 Nitric acid/N. Sulphuric/Ord. iron –1·326 to –1·255.
(40) Pass. bl. iron/1·397 Nitric acid/N. Sulphuric acid/Zinc –1·852 to –1·96.

Experimental.

Duration of passivity.—Rods passivified in 1·4 nitric acid often showed great variations. In some cases we have traced this to crevices which probably never became passive in 1·4 nitric acid. Experiments with 1·2 nitric acid heated to near boiling showed that the longer the rods were left in 1·4 nitric acid the longer the duration of passivity in the hot acid.

Rods passivified in 1·4 nitric acid and exposed to the air became active after varying times (*e.g.*, 22 mins. 6 mins. 25 mins. &c.). After carrying out a large number of tests the average showed that iron passivified in nitric acid ranging from 1·36 to 1·275 specific gravity remained passive in 1·2 nitric acid just as long as iron passivified with 1·4 nitric acid. Passive blued iron rods remain passive in 1·2 nitric acid much longer than ordinary passive iron; the blue colour gradually disappears and the layer is no doubt used up in maintaining passivity. Similarly iron which has been blackened by placing as anode in 1·4 nitric acid remained passive for weeks in 1·2 nitric acid. Iron immersed in a solution of silver nitrate for 30 minutes was found to remain passive for hours in 1·2 nitric acid. After 15 mins. in the silver nitrate passivity lasted for only 5 secs., and after 2 mins. in silver nitrate, for only 2 or 3 secs. Also in a mixture of silver nitrate and nitric acid iron appeared to assume different degrees of passivity. After 3 mins. immersion it remained passive for 30 secs. in 1·2 nitric acid. After being 5 mins. in the acid silver nitrate it remained passive for hours (once 20 hours).

Solubility of passive iron.—We have also observed that iron completely immersed in fuming nitric acid in a stoppered bottle at ordinary temperatures dissolves and produces a greenish precipitate of small shining crystals. In 1·4 nitric acid the production of crystals was not observed. A piece of mild steel (·1 carbon) completely immersed in 1·4 nitric acid and heated showed evolution of minute bubbles (*cf.* 129). Careful observation showed that the bubbles were generally evolved from the bottoms of crevices in the surface, or at the bottom of the thread if the rod was a screwed one. On raising the temperature similar bubbles were evolved from other crevices, and often these would all be in one row and parallel to the direction in which the rod had been drawn. A similar evolution of small bubbles from a few places has been observed also in boiling fuming nitric acid.

If the temperature was raised still further, action commenced with explosive violence as described by Andrews, and Nichols and Franklin, and so suddenly that it was impossible to state with certainty that it always began at these same crevices. In the case of a threaded rod, vigorous action would sometimes commence and continue on the thread while the smooth part remained passive. That the action is due to the increased rate of action of the nitric acid and not to the effect of temperature on the passive iron as such, was shown by heating dry passive rods, prepared by washing &c., to the melting point of wax and even to 100° C. in air. This did not render them active, and after cooling down they were still passive to 1·2 nitric acid.

We have also confirmed the observation that passive iron as an anode in nitric acid and sulphuric acid, dissolves. In the former case comparison of the amount dissolved, made by diluting and adding potassium thiocyanate and comparing with a standard ferric iron solution, showed that at the anode in 1·4 nitric acid much more dissolves than when dilute acid (1 of 1·2 acid to 25 water) is used (*cf.* 18). On the other hand a passive iron cathode in 1·4 nitric acid only loses traces of iron, in dilute acid, large quantities of iron.

In all cases ·34 amp. was passed and the area exposed was about ½ sq. cm. The apparatus was H-shaped to keep anolyte and catholyte separate.

In another experiment the anode was rotated to obviate concentration of the anolyte, and a current of ·085 amp. was employed in every case and for the same time (18 mins.).

1·4	Nitric acid	·0141	grm. iron dissolved from the anode.
1·3	„	·0108	„ „ „
1·15	„	·0079	„ „ „

That passive iron does dissolve in 1·2 nitric acid was shown also by immersing a small area ·1 carbon steel anode and platinum cathode in 1·2 nitric acid containing a little potassium ferrocyanide. On applying 2·0, 1·8, 1·42, 1·23, 1·04 and ·85 volts, a blue coloration of decreasing intensity was produced round the anode; ·65 volt produced discernible but very faint blue colour. When the anode was immersed without applying e.m.f. (*i.e.* active) an immediate and copious blue precipitate resulted.

The solubility of rotating passive iron in 1·4 and 1·3 nitric acid, no current being employed, proved variable, but the results indicated less solubility in the diluter acid. In 1·15 nitric acid passive iron becomes rapidly active.

In sulphuric acid (6 N) the dissolving of a passive iron anode was shown by adding a small crystal of potassium thiocyanate. A very small iron area was used and a platinum cathode.

Applying 1·8 V., streams of red descended from the anode, showing that a solution containing ferric iron resulted.

Applying	1·05 V.	Still streams of red.
„	·94 V.	Very faint streams of red.
„	·85 V.	No streams of red.
„	·65 V.	„ „

Employing sulphuric acid (6 N) containing a crystal of potassium ferricyanide.

Applying	1·35 V.	No blue precipitate at anode.
,,	·84 V.	,, ,, ,,
,,	·82	,, ,, ,,
,,	·80	And shaking, copious blue ppt.

An active piece of iron also produced a copious blue precipitate.

From this it seems probable that no ferrous ions are produced or if produced they are at once oxidised. That oxidation of ferrous ions is possible under these conditions was shown by the fact that when a platinum point was used as anode in sulphuric acid (6 N) containing a little ferrous sulphate when ·94 volts were applied, very distinct streams of red were visible. When ·85 V. was applied a stream of red was visible, and with ·66 V. a little red was visible at the anode.

The results of a similar experiment using an iron anode, a platinum cathode and 6 N. hydrochloric acid are of interest.

Applied	2·5 V.	Red streaks.
,,	1·35 V.	,,
,,	·92 V.	Faint red streaks.
,,	·88 V.	Very faint red streaks permanent.
,,	·85 V.	Very faint red streaks not permanent.
,,	·66 V.	No streaks after 1 minute.

One cannot fail to note that the e.m.f. at which discharge of hydroxyl ions just commences appears to approximate to that required for the establishment of passivity in sulphuric acid.

Vacuum experiments.—Several experimenters have stated that passive iron becomes active *in vacuo*. One (184) found that passive iron loses its passivity at 15 mm. pressure. Another (18) says that passive iron in 1·2 nitric acid becomes active *in vacuo*. We have observed that bubbles of gas form at its surface and at the surface of the paraffin wax and rise to the surface of liquid, also that the mechanical action of these sometimes activifies the iron but more often than not the gas soon ceases to escape and the iron remains for hours quite passive at a pressure of about 15 mm.

Sudden admission of air will sometimes produce activity, an effect we ascribe to the nitric acid being driven suddenly into some of the active crevices before referred to.

Iron passivified in 1·4 nitric acid, shaken and transferred to a small vessel that could be evacuated very rapidly to 1 to 5 mm. mercury, soon lost all the adhering nitric acid. Some rods became active, others did not before they were dry, the activity in this case being judged by their brown appearance. Once dry, the rods remained passive as long as they remained *in vacuo* (60 min., 100 min., 14 hrs., and sometimes 90 hrs.) and when removed and tested in 1·2 nitric acid would remain passive for hours. Not only iron passivified by immersing in 1·4 nitric acid, but iron passivified anolytically in 1·2 nitric acid can be dried *in vacuo* without becoming active to 1·2 nitric acid. Iron that has been passivified in 1·4 nitric acid and then washed well in 1·2 nitric acid has been obtained and preserved dry *in vacuo* for 21 hrs. by evacuating rapidly, without it becoming active. Some of the rods were passive in places and active in spots, which makes it unlikely that a film of acid persisted in these experiments. We regard this inequality as supporting our supposition that there are spots on some rods which never become passive.

Thanks to the kindness of Mr. F. W. Aston we have been able to expose some passive ·1 carbon steel dried by washing as described before, to extremely high vacua. His apparatus is described in Phil. Mag. (1907) and when adapted to this test consisted of a tube in which the passive steel was placed, connected on one hand to an evacuated vessel full of cocoa-nut charcoal and surrounded outside by liquid air, and on the other to an exceedingly delicate manometer giving readings accurately to 0·02 mm. of mercury. Connected to the same tube was a Plücker tube whereby an electric discharge could be sent (when vacuum not too high) and the gases examined spectroscopically.

After introducing the dried passive steel rod and a tube containing phosphorus pentoxide, the apparatus was sealed and evacuated in less than 1 minute by opening the tap connecting it to the vessel containing charcoal. The rods in this case were passivified in potassium ferricyanide solution. Readings

Pressure in mm. Hg	·026	·082	·132	·18	·208	·268
Time	12.24	12.26	12.29	12.35	12.40	1.37

In another precisely similar experiment using the same rod the readings were

Pressure in mm.	·03	·108	·15	·176	·24
Time	2.32	2.34½	2.38	2.41	2.49

at the last point the tube was again evacuated.

Pressure in mm.	·02	·02
Time	2·52	3·1

The Plücker tube showed the air spectrum as pressure increased. Both rods were passive in 1·2 nitric acid and remained so during the test (a few minutes).

The same rod when activified and dried in the same way gave the following readings:—

Pressure in mm.	·054	·082	·104	·118	·14	·14
Time	11.40	11.45	11.49	11.53	11.57	11.60

A similar appearance was obtained with the spectrometer. Testing after removing showed the rod to be active.

It is obvious therefore that passive iron contains some gas, and the volume can be calculated from the above figures, but its nature could not be decided from these tests. If the gas is oxygen a larger volume than that obtained would be necessary before its spectrum could be obtained. The important point is that this gas is not essential to passivity. That passive iron should contain gas is to be expected if the passivifying is an electrolytic process, or if local currents exist after passivifying. That hydrogen is absorbed during the pickling of iron in acid is acknowledged, and it (201) has been shown that hydrogen evolved electrolytically penetrates to the inside of a hollow iron cathode and has a great pressure outside. It appears quite possible that oxygen may be absorbed in the same way. On the other hand there are some reasons for thinking that (OH) may be absorbed. An experiment with hydrogen peroxide of a high degree of purity showed that iron did not become passive in this when immersed for a minute or two.

The fact that passivity persists under extremely high vacua in this way renders it very unlikely that this state is due to adsorbed or dissolved gas.

6.—TRANSMISSION OF ACTIVITY AND PASSIVITY.

We have discussed the conversion of active into passive iron, the behaviour of passive iron whilst it remains passive, and the agencies which induce activity. We will now consider one process by which the active or passive condition generated at one spot on a rod may spread until it covers the whole surface.

This part of the subject is not directly concerned with the way the first particle becomes active or passive, but as in the case of the spread of a conflagration, like the firing of gunpowder or the gradual burning of some gases inside a gas engine cylinder, we are concerned now with the action of a small portion in one condition on the large remainder in quite a different condition. The analogy is not a close one, because in the case of gunpowder the reaction proceeds chemically in one direction, whereas in the case of passive iron becoming active, for instance, the conditions are possibly such that passivity *may* be regenerated.

Historical.—That one state does sometimes spread and wipe out the previously existing one has been observed by several experimenters. Wetzlar (193) was the first to observe the spread of *activity*. When drops of copper acetate solution were placed on iron, copper deposition began at the margin of drop and progressed towards the centre; see also 55, 160*a*, 121, 115, 202, 82, 83, 129.

Herschel (82, 83) observed that passivity was transmitted when iron dissolved with pulsations in nitric acid of intermediate concentration, and that it always began at the end.

Schönbein's results may also be recalled here, although the conditions were very different from the above. He found that by connecting an active iron rod to a passive one which was immersed in 1·35 nitric acid and then lowering the active one into the acid it became passive. This rod could then be used to passivify another active one, and so on.

Local electric currents—theoretical considerations.—As to the reason for these phenomena:—Mousson (121) and Beetz suggested electric currents, and evidence has already been mentioned which supports this idea.

Let us consider for a moment what will happen in the following case. A long thin flat strip A P of passive iron is surrounded by a thin layer of say 1·2 nitric acid, and a small area A B is rendered active near A. (Fig. 11.)

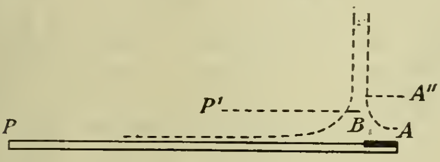

FIG. 11.

When just activified the e.m.f. B A/1·2 nitric acid will be about —·075 V. and e.m.f. B P/1·2 nitric acid about —·9 V. At first the e.m.f. over both surfaces P B and A B will be uniform, and since the resistance between B and any small area on B P is approximately proportional to the distance (d) and since E = c R ∴ E = (c d) (constant) and ∴ c d = E, constant, will hold for all such equal areas along B P, which shows that the curve connecting initial current density with distance along the rod is an equilateral hyperbola, the density being greatest at B.

The actual value of the current density will vary inversely as the total resistance to this current element along its path through the acid and the iron, and directly as the initial e.m.f.

The same applies to the part B A. The total initial current from B A to B P will be represented by the area enclosed between the curve and P B and B A. If B A is a mathematical point the resistance will be infinite and the current zero. Since both anolyte and catholyte will exert some depolarising action, the activifying and passivifying effect of the current will be represented by the ordinates above the lines P′ B′ and B″ A.″ The actual position of these two lines will depend on the liquid, character of the surface &c.

If B A is very small it is quite possible that the current density anywhere on B P will be insufficient to overcome the depolarising action of the acid upon the hydrogen liberated and the surface may continue passive for a time. This case was realized experimentally by protecting all but the very point of a needle with paraffin wax and inserting it in 1·2 nitric acid. When, by means of a lens, bubbles could be seen arising from it, it was brought into contact with a passive rod (in 1·2 nitric acid). After about 30 seconds the needle point became passive. Increasing the active area ever so little caused immediate activity of the larger passive surface. The experiment was repeated with the same result several times. That the point really did touch the passive rod was shown also by the increased action at the needle point at first.

If the area B A is large enough, P B will become active at B if the depolarising action of the liquid and products surrounding the part A B is more powerful than the depolarising action of the liquid and products about B P. If the reverse is the case A B will become passive; in both cases, at B first because the current density is greatest near this place.

Transmission of state—Experimental.—In our experiments bearing on these points, long spirals of iron wire and long rods (75 cm.) insulated by wax in the usual way were used, which greatly facilitated observation since the transmission is sometimes exceedingly rapid. After passivifying the rod anolytically in 1·245 nitric acid and scratching it with a glass rod or a zinc rod under the acid, the transmission of activity could readily be followed. When the rod was in 1·4 nitric acid, contact with zinc only produced activity at and a little below the point of contact; on removing the zinc this active part at once became passive.

After passivifying in 1·4 nitric acid and immersing in 1·28 acid and touching with zinc, the part touched became active and activity spread for about 30 cm., then it ran back again (*i.e.* passivity was transmitted) then down again and continued to oscillate in this way as long as the zinc was held in contact. On removing the zinc, passivity was transmitted and the active part closed up from below till the whole rod became and remained passive.

The influence of the thickness of film of nitric acid on the current density is readily shown by removing the passive rod from say 1·25 nitric acid. On rendering it active the motion is seen to be much slower. When the long rod was passivified and immersed in 1·2 nitric acid and then activified the rate of transmission of the active state was much greater than in the stronger acids referred to. This effect we ascribe to the lower depolarising power of the 1·2 nitric acid around passive parts. This, in the diagram, would be represented by drawing B′ P′ nearer B P. Possibly the rate of action on active parts was also greater so this would also increase the depolarising agencies round the active part and both causes would facilitate and accelerate activification.

The behaviour of the 75 cm. rod in 1·315 nitric acid was different from any described above, possibly on account of the greater passivifying power of this acid. On touching this with a zinc rod under the liquid and removing the rod, an active zone about 10 cm. long was formed which moved down the rod gradually growing smaller till it vanished just before the end was reached, the whole rod becoming and remaining passive.

This is an instance of what is, so far as we know, an exceedingly rare phenomenon. The transmission of chemical action in gunpowder presents nothing analagous to this observation. Why should the active zone not spread up as well as down? There are one or two facts which throw some light on this. Andrews describes some experiments which indicate that the e.m.f. "passive iron/1·4 nitric acid" is numerically less than that of "passive iron/1·4 nitric acid containing iron nitrate" (5). In conducting experiments on the activifying of passive iron in nitric acid catholytically, we found that in 1·285 nitric acid the application of 4·5 V. effected activifying. If the current were now interrupted the iron became passive and on attempting to activify it in the same way it was found that even 6 V. would not induce activity. On opening the circuit and shaking the passive rod not only 6 V. but also 4·5 V. activified it at once. The experiment was repeated several times with the same result. Applying this to the case of the travelling active zone it will be seen that the part behind the zone is surrounded by acid containing iron nitrate and it is quite possible that in spite of the high current density the e.m.f. between this part and the active part would not be sufficient to activify it. On the other hand, the current density at the hinder margin of active zone would be greater, and so the iron would be passivified behind faster than it activified the passive part in front, and the result obtained experimentally is fully accounted for.

Transmission along a nerve.—In 1900, then, Professor Ostwald called our attention to the possibility of nerve transmission being a process akin to the transmission of activity. It appeared but necessary to postulate a passivifying envelope to render the nerve passive again to establish a plausible hypothesis. Such a hypothesis is very attractive and suggestive. For instance, it has been established that practice lowers the time required for nerve transmission and the phenomenon is characterized by the term "facilitation." Now it would be quite in accord with other physiological changes if the passivifying layer of nerve increased in thickness when repeatedly used, and this change as we have seen would cause increase in the velocity of transmission. Further the velocity in the case of the iron rod is of the same order as that along a nerve (20—30 metres per sec.) the latter varies from person to person and the former can vary between limits quite as wide (80*a*). Again it is to be expected from other experiments and their bearing on the current at the margin of active and passive parts, that transmission of activity would be slower immediately after the first transmission owing to products of reaction around the iron. This has been confirmed by direct experiments in the case of iron in nitric acid. An effect of this kind in a nerve would explain the nature of "fatigue" so far as it concerns nerves.

One of the most marked peculiarities of nerve structure is the synapse. The microscope shows that two adjacent nerve cells approximate but do not fuse. It appears as if the function of the synapse were to aid in preventing a return or spreading back of the stimulus. This peculiarity presents no difficulties to the suggested mode of action because activity, as Keir first showed, may spread from piece to piece of iron without actual contact.

So far as we are aware there appear to be three important facts relating to nerve transmission:—

(1) The very small amount of energy consumed in the transmission.

(2) All substances and causes which depress and tend to destroy the functions of the nervous system begin by acting as excitants (122*a*); and

(3) The impulse or whatever it be that induces the muscular contraction or expansion passes along the nerve and not by any other path into the muscle in question.

All these can be represented by this theory of transmission without forcing it. (1) The layer concerned in passivity is certainly extremely thin, and the amount dissolved when active, even by nitric acid is not great. (2) We have pointed out how the products of action may reduce the rate of transmission, but this happens when the products are oxidized by the acid and effect depolarisation round the passive part. Before this oxidation the products would be less oxidized and would act as depolarizers round the active part and thereby accelerate the rate of transmission. (3) If mechanical changes were the cause and accompaniment of transmission, like, as some have suggested, the transmission of sound, it is not so obvious why muscle tissue could not transmit the stresses. Furthermore so far as we are able to judge there is nothing in the structure of nerve which renders it impossible to regard transmission as occurring in a way which is analogous to the transmission of activity along passive iron. It is not necessary to postulate a solid core that becomes passive, it might be tubular, and the passivifying layer might sometimes or always be inside the tube.

It appears possible too that the network in protoplasm may be a layer capable of transmitting changes in a similar way and which manifest themselves as an essential part of the mechanism of irritability.

Nitric acid is not a very suitable medium for studying this phenomenon owing to the great velocity of the reaction between iron and nitric acid. A better solution to employ would probably be potassium ferricyanide containing a little sulphuric acid, in which we have also observed transmission.

Periodic solution of iron.—One is so accustomed to chemical action proceeding continuously from beginning to end, or from beginning till equilibrium is attained, that the mention of a chemical action which proceeds and then stops then begins again, stops, begins again and so on, at once rivets attention. So long as reactions like this proceed as the result of external interference or some external process happening at the same time, the phenomenon is not remarkable. In connection with passive iron both kinds of variation have been observed and we shall classify them accordingly into pulsations proper when no external electric current is employed, and current oscillations when an external electric current is used.

7.—PULSATIONS.

Historical.—Herschel was the first to observe this remarkable phenomenon (82, 83) with iron in nitric acid of intermediate concentration. Schönbein (160*a*) observed intermittent solution in nitric acid, the only difference being that contact with copper was required to start the pulsations. The periods were different for different rods, but if they were brought into contact the pulsations and passivifying occurred on every one at the same moment, a fact which is (121) ascribed to a current effect. It will be seen from some experiments described below that if the resistance be considerable between two rods they will not pulsate together.

The actual period between different pulsations, *i.e.* the passive period, was decreased by diluting the acid or warming it, doubtless owing to the fact that the diluter and warmer nitric acid would activify the rods more quickly. Sometimes the period decreased of itself, an effect Beetz ascribes to the formation of activifying nitrous acid round the rod. Another (68) points out the effect of dissolved iron on the periods. The pulsating continued for a time and then terminated either in permanent activity or permanent passivity. Another (121) also observed pulsations, and noticed that activifying occurred transmissively when pulsations were in progress. He mentions too that a pulsating rod gives off gas more violently than a not pulsating rod and sometimes the evolution is almost explosive, a fact which recalls the observation we have made that contact with a passive rod momentarily increases the rate of gas evolution when iron is in the slowly dissolving condition. Others also observed pulsations (185).

The explanation of these phenomena has always presented considerable difficulties. One (147) supposed that they were due to one part of the iron becoming active and causing currents to the passive part. Another (199*a*) suggests that pulsations are purely a current effect. A certain area is rendered active (*e.g.*, by contact with copper wire), currents then flow from active to passive parts, passivifying former and activifying latter, then the reverse occurs.

Experimental.—It appeared possible that these pulsations might be due to an electric current being generated at the surface where active iron projected out of the acid, so pieces of iron rod were totally immersed in the acid. Under these conditions pulsations were also to be observed. To eliminate contact as far as possible a submerged ·1 carbon steel rod with no wax on it was supported on four minute points of glass rod. Pulsations were also observed under these conditions. Pulsating solution was never obtained at ordinary temperatures in nitric acid having sp. gr. greater than 1·32. It is stated (68) that pulsations occur in 1·5 nitric acid if it is heated. In our experiments the general behaviour in acids of less than 1·32 sp. gr. was as follows:—after remaining in the slowly dissolving condition for a few seconds a momentary rapid evolution of gas is observed and the rod will become white nearly all along, then the slowly dissolving state begins at once, to be followed by another brisk evolution of gas and so on. The intervals between pulsations varied from two to thirty seconds.

Pulsations due to local currents.—On examining rods which have behaved in this way one notices two characteristics. (1) The middle of the rod is smooth and has a silky appearance and none of the sharp crevices which characterize a rod which has dissolved in dilute nitric acid or sulphuric acid. (2) The two ends of the rod, *i.e.* where the wax ends, are attacked much more deeply than elsewhere, and the surface is full of shallow hollows like little craters. This second appearance is found also on rods which have been used in experiments on current oscillations and which dissolve intermittently. This suggested the likelihood that only the ends of the rod really pulsate and that the above effect over the whole surface is perhaps the result of passivity spreading every now and then over the surface joining the ends, just as one part of the rod in 1·28 nitric acid in transmission experiments dissolved continuously, while lower down the solution was intermittent.

To obtain a better insight into what was happening we, at the risk of introducing some external current effects, connected two active rods to the terminals of a voltmeter having the highest resistance we could obtain (1000 ohms) and immersed both in 1·245 nitric acid. Soon pulsating began at one rod the other remaining active. The volt-meter needle oscillated between 0 and ·75 V., the passive periods were but momentary and the active 30″, 38″, 45″, 36″, etc. See Fig. 12.

Then oscillations ceased. The experiment was then repeated using fresh 1·245 nitric acid but making no other change. The results are shown in Fig. 13.

The volt-meter needle oscillated between ·80 and ·75 irregularly and quickly. On closely observing the passive rod a brown film appeared to move up and down over the upper tenth part of the length and it was obvious that the frequency of this movement was about the same as that of the volt-meter needle movement. The appearance was just like that described in connection with the rod in transmission experiments just referred to but on a much smaller scale. The one end was dissolving intermittently. On again repeating the experiment using fresh acid Fig. 14 was obtained.

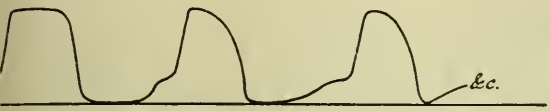

FIG. 12.

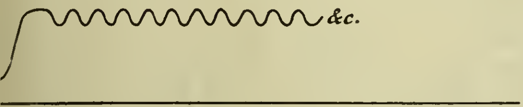

FIG. 13.

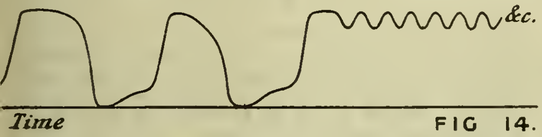

FIG 14.

We regard these results as confirming the supposition that, owing to inequality of the action of nitric acid, electric currents are generated so that the ends of a rod dissolve intermittently and induce the pulsations referred to. Since intermittent solution in nitric acid of this concentration is induced at the cathode and not at the anode (see later) it appears probable that the middle part sends current to the ends. Why it should do this will probably be more evident after the subject of current oscillations has been dealt with.

This suggests also that the slow dissolving state in nitric acid is in part at any rate due to electric currents from these more active parts to the ends. Indirect evidence pointing to the same conclusion is the fact that iron as anode in sulphuric or hydrochloric acid may be induced to assume a slowly dissolving semi-passive condition that is closely similar to that assumed by iron in nitric acid of intermediate concentration without external electric current.

8.—Current Oscillations.

Historical.—Observations of intermittent solution of iron when an external electric current was used are more frequent than observations of pulsations. Fechner (53) was the first to observe this phenomenon when using the system, Iron/Nitric acid and Silver nitrate/Silver/Galvanometer/Iron.

The galvanometer needle was deflected first in one direction and then in the opposite according to whether the iron was passive or not. About 4 or 6 oscillations were observed which were sometimes very rapid. It is worth while pausing a moment to consider some of the consequences of this experiment. The fact that the current fell not only to zero but went in the opposite direction shows that the opposing e.m.f. generated is greater than the initial e.m.f., a phenomenon which would contradict the second law of thermodynamics if the e.m.f. generated were entirely the result of the current. One must conclude therefore that some other currents participated in the passivifying of the iron.

Current oscillations under other conditions have also been observed *cf.* 55, 166, 50, 139, 33.

Joule obtained intermittent solution with the system "Iron (anode)/1 : 6 Sulphuric acid/Amalgamated zinc/3 Daniells cells/Iron."

The current did not fall to zero in his experiments, and both active and passive states lasted about 30 secs. According to his view the current passivifies the iron, and when the former decreases, the sulphuric acid activifies the iron, thereby removing the opposing e.m.f., and the series of changes begins over again.

Ostwald questions the sufficiency of the explanation, but if one adds transmission of activity, everything required for a full explanation is given.

Recently another (65) has obtained intermittent solution of an iron anode in sulphuric acid by adding hydrochloric acid. If the iron anode was moved about the oscillations vanished. He made no quantitative measurements but enumerates a number of conditions affecting the oscillations. He also describes evanescent oscillations in $N/10$ nitric acid using an applied e.m.f. of ·93 to ·95 V. and ·0054 to ·0049 amps. Another (155*a*) has observed periodic action on iron when alternating currents were transmitted through sulphuric acid. One of the samples of electrolytic iron (40) dissolved with a pulsating appearance.

Experimental.

Nitric acid.—In some of the above experiments in which nitric acid was used, it is not clear whether the iron was anode during passivifying or cathode. For instance with the system "Iron/1·275 Nitric acid/Copper/Iron" intermittent solution of the iron was observed. Thinking it probable that the current went from iron to copper we attempted to produce oscillations in the same acid by making iron the anode of a variable electric current. No oscillations of any kind could be obtained. On reversing the current however oscillations were readily produced. The amperemeter in series showed variations between 0 and ·2 amp. The passive periods were of short duration and the active ones 18″, 20″, 23″, 14″, 13″, 12″, 15″, 11″, 12″, 11″, 11″, 10″, 10″, 10″, 8″, 10″, etc.

A similar experiment has been performed with 1·4 nitric acid. On applying 10 volts with a variable resistance in series, an iron cathode was activified, and both from its appearance and from the amperemeter in series it was obvious that the solution was intermittent. The amperemeter oscillated between ·56 and ·54 amp. in one case and between ·81 and ·75 amp. in another. In each case the lower current was always associated with vigorous gas evolution (active period). These oscillations were slower than the above ones. Larger surfaces required a much greater current to induce oscillations. In the second experiment it was observed that the amperemeter needle shook irregularly in the neighbourhood of ·81 amps. (rod passive), and careful observation of the cathode revealed brown films darting from the ends to the middle of the rod, up and down in just the same manner as described for Fig. 13.

The intermittent phenomenon observed by Schönbein and others at an iron anode in sulphuric acid are therefore "reversible" and are obtainable when the current is employed to activify instead of passivify, and the passivifying is done or initiated by a liquid. We have already called attention to the fact that passivifying is but the reversal of activifying, and this is another instance of the same kind. We regard these facts as strongly indicative of passivity generated anolytically being identical with that generated by contact with liquids, and are inclined to believe that passivifying in a liquid is also an anolytic effect induced by local currents.

We have made many attempts to obtain oscillations with an iron anode in nitric acid varying from 1·276 sp. gr. to acid containing 1 vol. 1·2 nitric acid to 25 vols. water, but in all cases without success. The anode could readily be passivified and the current would fall to zero, but the rod would not become active until the applied e.m.f. was much reduced. Fredenhagen's measurements throw light on this (65). When an iron anode had just become passive in nitric acid the e.m.f. "anode/nitric acid" was —1·08, but just before it became active the e.m.f. was —·196. Now compare these figures with those we have obtained for iron in sulphuric acid. Corresponding to the first value we could have about —·85 V., and the e.m.f. "anode/sulphuric acid" just before becoming active is about —·80. In a case like this there will be no need to reduce the applied e.m.f. before activifying will take place :

oscillations will be possible but in the former case impossible.

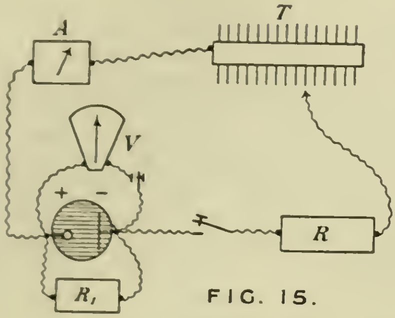

FIG. 15.

Sulphuric acid.—Let us now turn to the phenomena to be observed when sulphuric acid is used, which does not appear to have any noticeable passivifying action but which activifies passive iron after a measurable interval. The apparatus employed is indicated in Fig. 15. The sulphuric acid was 1 : 6 by weight.

R and R_1 are variable resistances, and except when otherwise stated, were 0 and infinity respectively. The resistance of the whole circuit was about 6·2 ohms, the electrolytic cell being about 4 ohms and the amperemeter 2·0 ohms. Both electrodes were of iron, the anode being much the smaller, about ·5 sq. cm., and the temperature was that of the air. The mode of procedure was to gradually increase the applied e.m.f. by moving the clip from plate to plate of the thermopile T. At a certain plate the current would fall to very nearly zero, then rise again and again fall, and so on.

If the e.m.f. was increased the oscillations would cease and the iron remain passive.

The following table gives readings when current oscillations occurred, Ca and Cp being the amperemeter readings when anode in active and passive conditions respectively; Va and Vp the like values of the e.m.f. between the electrodes.

Remarks.	Ca.	Cp.	Va.	Vp.
Anode area of pinhead size	0·094	0·001	0·45	0·74
Anode area a little larger	0·10	0·002	0·47	0·78
.. larger still ..	0·14	0·002	0·47	0·81
.. .. ..	0·15	0·002	0·50	0·91
.. .. ..	0·16	0·002	0·45	0·87
Sulphuric acid heated to 55° C.	—	—	0·85	1·85
Sulphuric acid heated to 55° C.	—	—	2·3	3·3
Hydrochloric acid added to the cold sulph. acid ...	—	—	1·8	2·0

When oscillations occurred the usual movement of the amperemeter needle, which was well damped, was as shown in Figs. 16 and 17, the passive period being generally the greater. Sometimes the change from passivity to activity was quite sudden, as in Fig. 18.

In most cases the oscillations persisted as long as we cared to watch them, but there have been occasions when the oscillations became rapidly shorter and degenerated into shaking and then ceased altogether, the iron remaining in the active slowly-dissolving condition. Fig. 19.

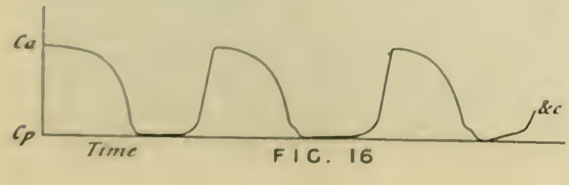

FIG. 16

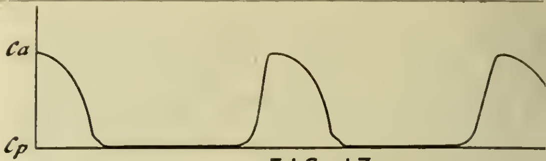

FIG. 17

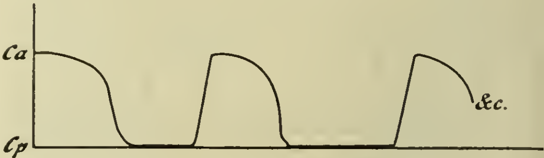

FIG 18.

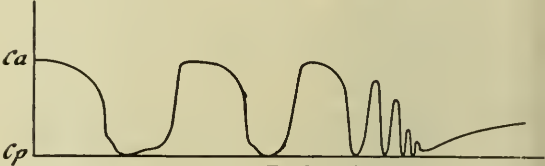

FIG. 19.

In cases when the oscillations persisted, for the same two electrodes the amplitude (Ca—Cp) remained constant, both the active (Pa) and the passive (Pp) periods varied, for instance: Values observed for Pa + Pp were:—

Seconds. 210, 93, 70, 63, 56, 59, 93, 64, 55, 81, 105, etc.

Five minutes later the values were:—

Seconds. 20, 25, 27, 27, 24, 25, 31, 31, 28, 28, 48, 42, 36, 45, 42, 42, 62, 65, 42, 47, etc.

In two other experiments the values for Pa + Pp were:—

(1) Seconds. 50, 50, 48, 72, 70, 160, 80, 60, 60, 62, 68, 68, 67, 85, 66, 69, 92, 95, 59, 107, 56, 70, 77, 70, 82, 75. (2) Seconds. 21, 27, 20, 15, 11, 10, 8, 8, 10, 10, 12, 19, 24, 23, 22, 18, 20, 25, 22, 18, 17, 17, 14, 15, 16, 15, 12, 10, 10, 8, 10, 8, 9, 10, 17, 13, 8, 9, 10, 10, 45, 130, 33, 17, 9, 5, 6, 5, 7, 9, 9, 7, 8, 7, 8, 195, 36, 20, 11, 7, 4, 6, 6, 6, 7, 8, 7, 8, 7, 9, 6, 9, 8, 10, 10, 10, 9, 12, 13, 9, 9, 9, 11, 13, 7, 8, 9. Some time later, 9, 9, 10, 108, 107, 40, 20, 11, 6, 5, 5, 5, 5, 6, 7, 6, 8, etc.

As a rule the passive periods were the more irregular. In another experiment using a smaller anode area the values were:—

Pp, seconds, 40, 56, 47, 52, 48, 43, 50, 44, 43, 35, 39, 37, 30, 22, 15, 11, 32, 28, 23, 25, 11, 26, 23, 20, 24, 22, 21, 19, 20, 18, 19, 6, 14, 16, 12, 12.

Pa, seconds, 13, 14, 13, 13, 13, 12, 12, 12, 11, 11, 11, 11, 12, 12, 11, 10, 6, 12, 11, 12, 10, 10, 10, 10, 10, 10, 10, 10, 9, 10, 10, 9, 8, 11, 8, 8, 8, etc.

Increasing the applied e.m.f. induced permanent passivity or greater value for Pp.

Decreasing the e.m.f. shortened the intervals. Opening and closing the circuit without other alteration affected the periods considerably. Raising the temperature of acid reduced the periods and increased the amplitude to ·32, ·35 or ·36 amps. In view of what has been said already regarding the velocity of activifying etc. there is no need to discuss the mode of production of these effects, they are all explained by what has gone before. Once, using iron electrodes as before, in fact, so far as we could judge, under just the same conditions, the oscillations in Fig. 20 were obtained.

The small oscillations could just be counted and lasted in every case almost exactly 15 secs. On another occasion the oscillations observed in Fig. 21 were obtained. The time between one crest and the next was 3 secs. at first and 5 secs. later on. With the same electrode and acid, oscillations indicated in Fig. 22 were obtained.

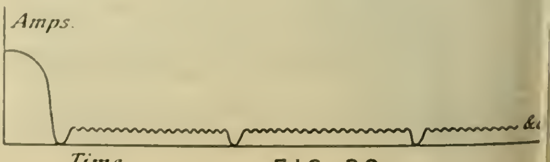

FIG 20.

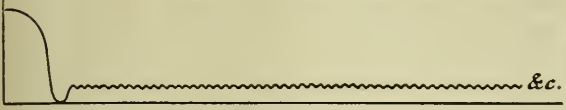

FIG. 21.

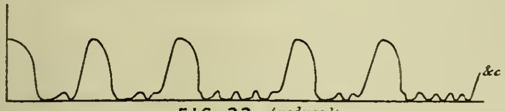

FIG 22 (*reduced*)

We ascribe these small oscillations to activity spreading over a fraction of the length from the ends of the anode, as observed at the cathode in nitric acid experiments when the change of colour facilitates observation of the processes going on at the surface.

The average potential of the anode in such a condition would be greater than when passive, hence the position of the wavy line in Figs. 21 and 20. If this is the explanation Fig. 21 would correspond to the anode surface being mostly active (*i.e.* "slowly dissolving" in this case), only a small portion of it becoming passive.

The same probably accounts for Fig. 20 save that the whole surface would become passive for a moment just as suspected in the case of pulsations in nitric acid. Fig. 22 shows that the anode can oscillate between passive and semi-passive conditions; and all these cases point to the possibility of some part of the anode remaining active in these experiments. (*c.f.* remarks under passivity.) Pure steel wire, and electrolytic iron gave results similar to those depicted in Figs. 16 to 22 and just as irregular periods.

Investigation of the factors influencing passive and active periods.—In the hope of arriving at suggestions for rendering the periods more regular we have attempted to express the actual conditions more accurately.

Influence of current density.—As the anode dissolves, the surface at first probably increases and then diminishes, hence the current density will alter.

Consider first current density during active stage. If E is total e.m.f., r the resistance of the electrolytic cell and R the remaining resistance of the circuit, and A the area of anode and Sa the active-period current density at the anode,

then $Ca = A \times Sa = \frac{E}{R + r}$.

Now what is wanted is a cell such that, when any change of A occurs, $\frac{E}{R + r}$ changes in the same proportion.

Assume that E and R are constant and that any change in r is by the alteration in A and such that r A is constant (=K) which is equivalent to assuming the cathode area to be very great.

Then substituting for A we have $Sa = \frac{Er}{K(R+r)}$.

Differentiating this with respect to r we have:—

$$\frac{d\,Sa}{d\,r} = \frac{K(R+r)E - Er\,K}{K^2(R+r)^2} = \frac{RE}{K(R+r)^2}$$

Introducing the condition we require *i.e.* that there shall be no change in Sa when r changes, then $\frac{RE}{K(R+r)^2} = 0$;

or $\frac{(R+r)^2}{R} =$ infinity; *i.e.*, $R + 2r + \frac{r^2}{R} =$ infinity.

The value of this function is dominated by the relation of r to R. The smaller R is than r the nearer the approach to infinity, which shows that the anode should have the smallest possible area and the external resistance be as small as possible.

When in the passive condition E is very nearly zero, which is one of the conditions that the current density may, *ceteris paribus*, be independent of the area of a small anode. So we might have expected that the current density Sp in our experiments was nearly constant during the progress of the oscillations, and that constant passive periods would be obtained.

The current Cp may be expressed thus:

$$Cp = \frac{\text{Total e.m.f.}}{\text{Resistance to reaction}}$$

and it is therefore directly proportional to the difference between the applied e.m.f. and opposing e.m.f.'s which exist mainly at the passive anode and inversely proportional to a function which is itself indirectly proportional to the rate of discharge of the state at the anode.

Now if the state can be anolytically re-developed by Cp, we may expect that increase of Cp will prolong that state and that the greater the applied e.m.f. the longer the passive period will be. This we have already seen is what happens. When the rate of discharge of state, *e.g.* rate of solution of passive iron (or rate of activifying) is increased for example by heating the sulphuric acid or adding hydrochloric acid, Cp is much greater. To obtain more constant passive periods therefore it would be necessary to ensure a constant e.m.f. between passive anode and solution and to render the activifying process more constant as regards time. Two methods of doing this were tried, *viz.*, adding hydrochloric acid to the sulphuric acid, and stirring the electrolyte, with the object in both cases of rendering the differences in the rate of activifying owing to unequal diffusion etc. less. The latter method proved a failure, the stirring accelerated the depolarising action on the anions, and a higher e.m.f. was required before the current density was sufficient to induce passivity, consequently when passive, Cp was greater and the surface remained passive. The alteration employed must obviously avoid any appreciable acceleration of the action in the active state.

Hydrochloric acid appears to do this, but before going on to these results we would like to call attention to the bearing of the above anolysis on pulsations. Suppose an iron rod is in 1·3 nitric acid and in the slowly dissolving condition, and suppose a very small area becomes passive (say at one end), electric currents will flow from the remaining area and tend to make the passive spot active, and many of the conditions are just favourable to pulsating or intermittent solution of the small passive part.

There is a relatively huge anode and a minute cathode, the "external" resistance is but that opposed by the iron and is certainly much less than that opposed by the liquid.

Current oscillations when the anolyte activifies rapidly.—On adding a few drops of hydrochloric acid to the electrolytic cell oscillations were obtained which differed very much from those described for sulphuric acid. On adding resistance at W (Fig. 15) the oscillations did not vanish but altered in period and form. If W was 10 ohms oscillations occurred between ·16 amp. and ·05 amp. as figured in Fig. 23.

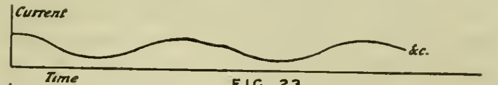

FIG. 23.

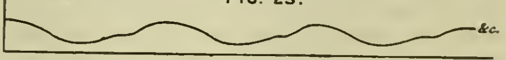

FIG. 24.

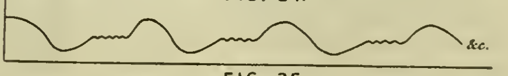

FIG. 25.

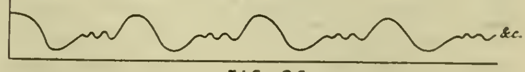

FIG. 26

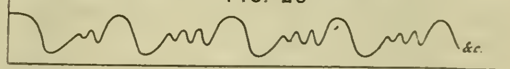

FIG. 27.

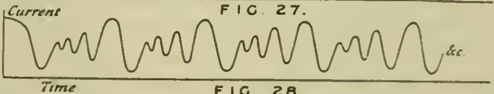

FIG 28

When W was 5 ohms the current oscillated between ·17 A and ·07 A and paused during activifying at ·12 A every time. Fig. 24.

When W was 4 ohms motion was similar but the pause was more definite. Ca was ·21 A, Cp ·06 A and pause at ·11 A. Consecutive values for Pa + Pp in secs. were 42, 37, 39, 42, 36, 45, 56, 42, 41, 35, etc. Forty minutes later the oscillations were still in full swing with about the same period, *viz.* 38, 46, 42, 34, 45, 43. When W was 3 ohms, Ca was ·23 A Cp ·06 A. During activifying the needle paused at ·11 amp. and began to oscillate through a small angle, then jumped quickly to ·23 as indicated in Fig. 25. Every period showed just the same effect.

Pa + Pp in secs. was 35, 27, 25, 25, 31, 25, 27, 24, etc.

When W was 2 ohms Fig. 26 was obtained.

Pa + Pp was 24, 24, 32, 25, 38, 24, 26, 32, etc.

When the resistance was 1 ohm the period was 20, 19, 18, 23, 20, 22, 23, 20, 21, 21, 21, 22, 30, 23, etc. etc. and the form as in Fig. 27.

Pa was ·29 A. and Cp ·06 A. with pause at ·11 A. When finally it was reduced to zero see Fig. 28, Ca was ·32 A. Cp ·065 A. pause at ·11 A. and the periods 17, 16, 17, 17, 16, 17, 17, 16, 17, 19, 16, 17, an hour later 14, 23, 18, 19, 19, 16, 19, 19, 18, 18, 17, 17, 16, 19, 19, 17, 18, 19, etc. These last curves are what might result if curves 20 and 16 and their corresponding conditions were added together. The oscillations of smaller amplitude probably correspond to transmission of activity and passivity, up and down the surface, moving further each time till the whole is active and then the whole passive and so on. It will be noticed that the periods are shorter the greater the current density at the anode, *i.e.*, large amplitude is associated here with short period. The appearance of the anode after dissolving intermittently has already been described under pulsations.

In spite therefore of the use of a stronger activifying solution and small anode area the periods are not perfectly constant. Possibly variations in temperature may have had something to do with this, and also the diffusion of the products near the anode during the active period. Possibly too the influence of surface condition measured by Fawsitt (52) may come in and possibly too may the variations in the rest of the circuit set up as a secondary effect. For not only will the e.m.f. vary between the iron electrodes, but the current strength and hence the potential differences between any two parts of the circuit will vary periodically. The temperature of the cell and its heat radiation will vary with the same periods. Further the temperature of the hot junctions of the thermopile and their heat radiation will vary and consequently the temperature of all objects in the room will vary with corresponding periodicity. These results will introduce super-posed effects and may alter the period at the cell.

We should like to follow some of these effects to their issue and compare them with other periodic phenomena to be observed in our daily life but they bear too remotely on the question. Mention however may be made, for thinking purposes, of the similarity these current oscillations present to the discharge of a Leyden jar when connected to the conductors of an electrifying machine which is rotated at a steady rate. The flow of electricity into the jar corresponds with the establishing of polarisation and passivity at the iron anode which opposes the flow of current. Then discharge occurs which corresponds to activifying and the process begins again. Now the electrostatic discharge may be oscillatory or continuous, and it has recently been stated that electrolytic potential differences may be discharged in the same way (101). These oscillations had a period of only $\frac{1}{600000}$ second, (in N. hydrochloric acid and 30 per cent. sulphuric acid) so they have probably nothing to do with those observed in our experiments, which correspond to the quantity of electric induction at any section of either conductor supplying the jar.

The passive period is much longer in the case of passive iron which permits of a better investigation of the stages in which the phenomenon occurs.

If the electric machine be turned very fast and the rate of discharging lessened, the discharge may become continuous, which corresponds to permanent passivity, and if other conditions be altered it would be possible for the Leyden jar to cease sparking and to discharge itself continuously in the "brush" form. This condition would correspond to the semi-passive slowly dissolving state. In both cases the condition for intermittent discharges when energy or matter is supplied at a uniform rate, is that the velocity of passing away of the energy or matter in question is at some point (in time) greater than the rate of storage. Thus passive iron might exist in all sorts of grades, but if the rate of activifying be at any time greater than that of passivifying it would be still possible to obtain oscillations, granted of course that other conditions obtain, such as appropriate e.m.f., current density, etc.

We have made many attempts to obtain current oscillations in solutions such as sodium carbonate, potassium nitrate, but have only succeeded in the case of sodium persulphate. The periods were irregular *viz.* secs. 58, 3, 8, 6, 23, 30, 33, 39, 42, 45, 47, 50, 55, 59, 63, 6, 10, 14, 18, 2, etc. The periodic variations in the period are perhaps worth recording.

CONCLUSION.

Finally, what are the main conclusions to be drawn from these experiments? The main fact established is the intimate connection between the phenomena obtained when liquids are used to passivify or activify on the one hand and those manifested when a current is employed on the other hand. Taken all together we regard them as showing that the process of passivifying is always electrolytic, and that when no external current is employed, current is generated from one part of the surface to another.

In accordance with this view we regard the process of passivifying as occurring in the following manner. When iron is immersed in a solution some of the metal passes into solution forming ferrous ions, or the ferrous ions in the metal pass into the solution, from all parts of the surface. The solution pressure of the iron will not be the same at all parts of the surface, *e.g.* the average round a convex apex will probably be greater than that round a concave hollow. Consequently local electric currents will arise, and if the solution will act as a depolarizer at the cathode of the local current, the current may persist until it effects passivification of the iron at the local anode. In this way a number of very small local cathode areas might be associated in the passivification of a much larger local anode area, and the rest of the surface might become passive nearly at the same moment all over. If the solution however is not a very vigorous hydrogen depolariser, or if its action on active iron is vigorous, passivifying may require quite a considerable time; various stages of semi-passivity will succeed one another until in some spots the passivification may become complete. When one particle becomes passive it may at once be activified, but it follows from the hyperbola diagram that the current density on a small passive or semi-passive area at the ends of a rod is half what it would be if the area in question were at the middle. Hence passivity may be expected to be established at the ends first. If the rate of action of the solution on the passive particle is small and if the solution can depolarise it, currents between the passive part and adjacent active iron will not activify the passive area but may passivify the active part. In this way, we believe, passivity is established over the surface. But what of the last particle of active iron? The resistance to an electric current from or to a point is infinite, so this point will probably never become really passive. Moreover, if there are crevices and *culs de sac*, on the surface, the bottom of each will be a terminus for the spreading passivity and consequently there will be an active area there. These points or spots may be many or few but it is certain that they will be the origin of small currents which will persist as long as the rod remains passive. Passive iron is soluble, but these active particles will generate current sufficient to maintain it in the passive condition so long as the liquid will continue to combine with the electrolytic products and prevent activifying of the passive part. If the depolarization fails, the rod will become active and the activity will spread from these active particles and principally from the ends of the rod. We regard the active spots referred to in vacuum experiments and the blue spots which sometimes appear when a rod is passivified in potassium ferricyanide solution, as confirmation of the above mode of passivifying. Other evidence will be found in the experimental part *e.g.* the fact that the pulsations nearly always start from one of the ends of a rod.

As to the cause of passivity itself, there is no theory which will explain these results and the results of others so well as that which postulates a layer of magnetic oxide. The ions (H) and (OH) can be liberated even from aqueous solutions of salts which contain no oxygenated anions, and our results go to show that it is the ion OH which effects passivity, and it is certain that this state is due to the establishment of a solid phase.

We have not laboured, however, to establish any theory as to the nature of the new phase which covers the surface of iron when it is passive. Our object throughout has been to find explanations of the manifold discrepancies in the statements of others and the hosts of conflicting experimental results obtained in course of this research. We believe that the mechanism of passivifying, passivity, and activifying portrayed above is sufficient to explain the difference observed, and the help and insight this affords has prompted us to produce this paper in spite of the incompleteness of the work and its many shortcomings. This much however seems certain. Local currents play a most important part in nearly all the phenomena. It appears that they produce passivity, they cause passivity to spread, and are probably intimately concerned in its maintenance in some liquids (not, of course, when dry). They cause activifying and the spreading of activity; they account for the slowly dissolving state, for pulsating solution and for the fact that active spots are present on passive specimens causing great variation in the resulting phenomena. It seems probably that somewhat similar phenomena may arise in all cases where the e.m.f. between the metal in question and the anolyte of a local electric current is very different from that between the metal and the catholyte. Under these conditions the current density between adjacent local electrodes will be exceedingly great (*e.g.* chromium).

Much as we should like to remedy the defects and pursue the work, there appears to be no chance of doing so at present, owing to the whole of our time being devoted to technical research and experiment. In many of the above experiments the quantitative results were so variable that none have been reproduced in the text, and only the general trend is described. Some of the historical matter has been left out. On this account we shall be careful to reply to any inquiries on the subject that reach us from other workers.

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DISCUSSION.

Professor **THOS. TURNER** stated that he was certainly under the impression that the magnetic oxide theory was the more generally accepted one, but Mr. Heathcote had given so many reasons to show that reasonable support could be adduced in favour of other explanations, that he should look forward to reading the paper with a great deal of pleasure.

Dr. **ALEX. FINDLAY** said that he also was under the impression that the most generally accepted theory to account for passivity was the oxide or hydroxide theory. He did not know that it was necessarily, the ferric oxide, the Fe_3O_4, but there was a formation of oxide on the electrode which explained the phenomena which were observed. He believed that the theory was put forward chiefly on account of the electrode potentials. He would like to ask whether in the experimental work done by others, on the electrode potential measurements, the gas polarisation had been taken account of, and had been distinguished from the potential which one got from ordinary passive iron. He did not know whether the experiments of Drs. Inglis and Taylor on the passivity or quasi-passivity of aluminium would also come in with a view of explaining these passive phenomena. They put forward the view that the ability of aluminium to rectify an electric current was due to the formation of a film of hydroxide which was permeable to certain ions, but was impermeable to the sulphate ions. Consequently in a solution of a sulphate, aluminium could be rendered passive, whereas in the solutions of halogen salts, aluminium could not be rendered passive. He thought that such an explanation might be put forward to explain the passivity of iron.

Mr. **J. C. SHELDON** asked if Mr. Heathcote had observed that nickel behaved apparently in a similar way to iron with regard to passivity?

Mr. **H. L. HEATHCOTE**, in reply, said he believed himself that up to about six or seven years ago, the Fe_3O_4 film was the generally accepted theory although not unanimously. But since then several papers had been published in which opposition was apparent, and in which the authors, for the most part, favoured the oxygen theory. They pointed out that the potential of a passive piece of iron was exactly that of platinum, and behaved as if covered with a film of oxygen. It took the potential of any solution in which it was placed unless the solution activified it. Dr. Findlay asked whether the ordinary gas polarisation played any part, or whether it was eliminated. He thought this was answered by his previous remarks. It took the potential of solution, but the passive condition could exist quite apart from any gas. Reference had been made to the semi-permeable membrane. That theory had already been put forward, *viz.*, that passive iron was covered with a sort of network through which active iron might pass and exercise an influence.

Dr. Morrell suggested that there might be some combination between the iron and the anion of the electrolyte and that this preliminary process caused passivity. That was rendered unlikely by the fact that iron passivified in potassium ferricyanide was perfectly colourless. Sometimes it was blue in places, but it was only where it was active and not passive. Mr. Lewis had inquired whether he had made any experiments on iron in different states—in particular on hard-drawn wire and annealed wire. Professor Senderens, and de Brenneville had studied the matter, and had experimented with silver solutions, finding very little difference between annealed and hard-drawn metal when exposed to the action of silver-nitrate. De Brenneville studied it from the point of view of allotropic theory but found nothing to associate passive iron with any of the known forms of allotropic iron. Nickel had been referred to. The passivification of that metal had been studied by others who had proved that for nickel at any rate passivity was due to the layer of oxide.

His conclusions on the whole matter were that the facts brought forward in the paper, and those discovered by other workers, supported the Fe_3O_4 theory more strongly than any other. The authors who supported the oxygen theory, and who had been referred to, mentioned a great number of objections to the Fe_3O_4 theory, but he had found that many of the statements were not borne out by facts. Certain of their results were explained by different reasons than those they mentioned.

With regard to the question of the rusting of iron he had not found either of the theories mentioned by Dr. Davidson of much help in the practical prevention of rusting. Passive iron rusted less rapidly than ordinary iron.

Obituary.

THOMAS B. EVANS.

Thomas B. Evans, Ph.D., was born in Cincinnati in 1863, where he received his early education. He next proceeded to the Columbia School of Mines, New York. After graduating there, he went to Erlangen in Germany, where he took his Ph.D. degree in 1886. Returning to America, Evans commenced practice as a public analyst in Atlanta, Ga., and later, accepted the engagement of chief chemist of the Procter and Gamble Company. He next accepted the post of lecturer in the Massachusetts Institute of Technology, Boston, which he filled from 1892 to 1895. At the close of this period, Dr. Evans became chief chemist to the American Cotton Oil Company, which position he occupied for four years. But his heart was fixed on the work of education, and in 1901 he accepted an appointment as assistant professor of organic and technical chemistry in Cincinnati, his home-city, eventually succeeding to the professorial chair. In 1905, Professor Evans was made Dean of the College of Engineering, and he only resigned this post when health failed him. Since the year 1896, he has been a member of this Society. He was also a member of the Council of the American Chemical Society. He wrote and published a "Laboratory Manual of General Chemistry," and in addition contributed considerably both to scientific and technological research. He was specially gifted as a speaker and lecturer. He died in July, 1907.

Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Vacuum; Process and means for producing a ——, *applicable for raising liquids and for other purposes.* E. Wiart, Ferté-Bernard, France. Eng. Pat. 2111, Jan. 28, 1907. Under Int. Conv., Jan. 29, 1906.

Steam at a minimum pressure of 100 lb. per sq. in. and at 170° C., is admitted to a vessel, and drives out the contained air through a flap-valve. When the air has been expelled, the steam supply is automatically shut off, and a small quantity of water is injected into the vessel in an atomised condition. This causes an immediate condensation of the steam and the production of a vacuum, which is utilised to raise liquid into the vessel. When the liquid reaches the top, it lifts a float which opens an air-valve, and the liquid then flows out through the delivery pipe. The various steps of the process are arranged to be automatically repeated.—W. H. C.

Vacuum; Process and means for producing —— *by condensation of steam.* E. Wiart, Ferté-Bernard, France. Eng. Pat. 2242, Jan. 29, 1907.

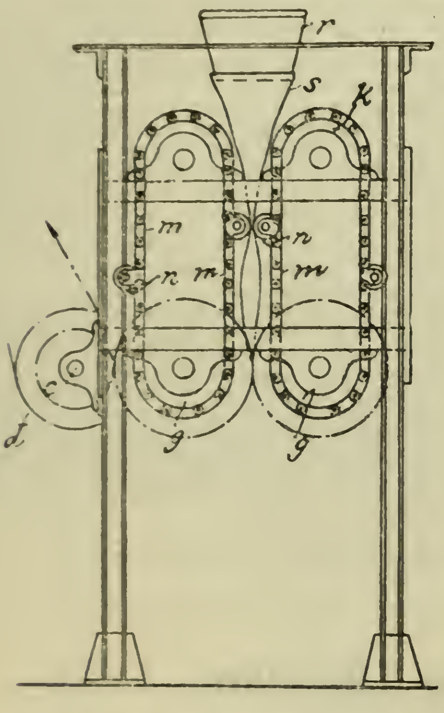
The claim is for an improvement in the process described in the preceding abstract, and consists in employing a doubly conical vessel and in breaking up the steam previous to its entry, by passing it through metal shavings contained in the steam-pipe, and delivering it through a perforated nozzle. The condensation of the steam may also take place spontaneously, or may be brought about by "an electric spark."—W. H. C.

Filters. K. Kiefer, Cincinnati, Ohio. U.S.A. Eng. Pat. 15,304, July 5, 1906.

A number of discs of compressed pulp are superposed in a drum or casing, each disc being separated from the adjacent ones by circular grids or "liquid conductors." The discs have a central perforation and are more strongly compressed at the periphery and at the centre than elsewhere.

The grids have rims on both sides at the periphery and the centre to correspond with the more compressed parts of the discs, and the rims of alternate grids are perforated at the centre and at the periphery respectively. The liquid to be filtered is fed into the drum and passes down a narrow annular space between the edges of the discs and the drum. It enters the peripheral perforations of the grids, passes through the pulp discs, and escapes through the central perforations to a central discharge channel.—W. H. C.

Filtrating machines. A. Schlieper, Elberfeld, Germany. Eng. Pat. 7453, March 28, 1907.



The liquid to be filtered is fed from the hopper, *r*, into the filter-bag, *s*, and is compressed between the rollers, *n*, *n*, carried on the endless chains, *m*, *m*, which travel over the sprocket-wheels, *g*, *g*, *k*, *k*. The latter are rotated by gearing from the pulley, *d*.—W. H. C.

Separators; Centrifugal liquid ——. E. Seger, Stockholm, Sweden. Eng. Pat. 11,060, May 11, 1907.

The central feed tube which carries the partition plates, has a flange at each end, between which the plates are displaceable for cleaning, but which prevents the plates from being removed from the drum without the tube. The plates consequently always retain the same relative order of position. In a modification, the tube is made in two pieces one of which slides within the other.

—W. H. C.

Regenerative furnace. F. Brocke. Fr. Pat. 375,361, March 4, 1907.

The furnace is heated with gaseous fuel, previously mixed with steam and an atomised liquid fuel in order to attain a very high temperature. The air necessary for combustion is preheated by passing it alternately through one of two regenerators. The lower parts of the gas producers are enclosed in boxes provided with dampers to regulate the admission of air.—W. H. C.

Classifying solid materials according to their size and density; Apparatus for ——. R. E. Trottier. Fr. Pat. 375,246, May 9, 1906.

See Eng. Pat. 17,081 of 1906; this J., 1907, 814.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Coal in Borneo. Eng. and Min. J., July 29. [T.R.]

An article in the "Australian Mining Standard" gives an account of the discovery of coal in the island of Borneo. Extensive coal measures have been found on the Brunai river in north-east Borneo, where facilities for working are such as to permit of coal being marketed at a very low cost. The river, which is a deep broad stream, runs past the outcrop, and sea-going vessels can anchor very near the mouth of the tunnel. In the early part of 1906 a shipment of 1500 tons was made to Hong-kong, where investors have secured concessions which include 10 seams of bituminous coal of various thicknesses, the work now being carried on in a seam 18½ ft. thick.

Patents.

Fuel; Manufacture of an artificial —— *by utilising waste or refuse.* L. A. Robert, Paris. Eng. Pat. 1446, Jan. 19, 1907.

About 800 kilos. of finely pulverised waste or refuse, after being passed between rollers to remove the greater portion of the moisture, are completely sterilised, without removing the whole of the remaining moisture, by being passed rapidly over a series of shaking screens set in a furnace and heated to from 150° to 250° C. The mass is then kneaded with about 10 kilos. of calcium oxide and about 3 kilos. of sulphur, when it is said to form a good agglutinant. The resulting material is mixed with a paste formed of 20 litres of mineral, shale or other similar oil, 8 kilos. of resin, 50 kilos. of pitch, 50 kilos. of charcoal, and 100 kilos. of coal or coke. After being thoroughly mixed and kneaded, the mass is formed into briquettes.—W. H. C.

Air gas; Apparatus for making ——. J. and G. Keith, London. Eng. Pat. 6183, March 14, 1907.

In apparatus for making air-gas, the gasoline or other carburetting liquid is usually measured out in definite quantities, in proportion to the air passed, by means of a measuring device actuated by a mechanical connection between it and the ram of the motor. According to the present invention the measuring device is operated without any such mechanical connection, but by means of a small separate hydraulic cylinder, which is so connected to the main motor cylinder that for every stroke of the main piston, the auxiliary piston also makes a stroke.

—H. B.

Suction gas plant; Impt. in [starting] ——. A. Künzler and F. Schneider, Baden, Germany. Eng. Pat. 7405, March 27, 1907.

The starting of the producer is effected by means of a fan or blower driven by a water-motor, the water supply for which is obtained through a valved branch-pipe leading from the water inlet to the scrubber and the water outlet of which is connected to the waste pipe of the scrubber.—H. B.

Generator for gas, with recovery of by-products. B. Junquera. Fr. Pat. 375,650, March 13, 1907.

The producer, which is designed for use with pulverised coal, comprises a conical combustion chamber, open at the bottom and resting in a water-sealed ash-pit; a burner at the top of the chamber, through which pulverised fuel and air saturated with steam are admitted in regulated quantities; and apparatus for cooling and scrubbing the gases. The gases, on leaving the producer proper, pass, on their way to the scrubber, through a tubular heat-interchanger, which is situated above an extension of the water-sealed ash-pit, and through which a counter current of moist air flows on its way to the producer. An annular series of gas flames is arranged at the base of the combustion chamber within its hollow walls, and the whole is enclosed in an outer casing, through which the air and steam circulate.—H. B.

Suction gas producer. J. B. Catteau. Fr. Pat. 375,656, March 13, 1907.

The gas-outlet pipe of the producer is surrounded by a concentric jacket serving as a vaporiser, into which the water supply is dropped, the air drawn down through the jacket mingling with the steam and passing through an annular metallic superheating chamber, at the base of the producer, which communicates with both faces of the fire-grate. A second annular metallic chamber, concentric with, and of smaller diameter than, the first, receives a separate supply of water, and the steam generated therefrom issues through a series of orifices into the fuel.—H. B.

Gas producer. J. A. J. M. Dobbé du Plessis. Fr. Pat. 375,896, March 19, 1907.

The producer is surrounded by a series of superposed annular chambers, through which the air supply passes; in the uppermost chamber the air is heated, in the next (which serves as a boiler and is fed with water) it mixes with steam, and in the lowest chamber it is superheated, before entering the enclosed ash-pit beneath the fire-grate.—H. B.

Gases; Process of purifying [dehydrating] ——. J. Babin, et Soc. L'Air Liquide (Soc. Anon. p. l'Etude et l'Exploit. d. Procédés G. Claude). Fr. Pat. 375,887, May 26, 1906.

The air or other gas to be treated, after purification by ordinary methods, is first submitted to a primary dehydration at the atmospheric temperature (by means of calcium chloride, for example); it is then cooled to a temperature somewhat above the saturation point of the residual moisture and is again dehydrated; and is further dehydrated in this manner at progressively and systematically decreasing temperatures. By keeping the temperature rather above the dew-point at each stage, the deposition of dew or rime upon the cooling surfaces is prevented. A preliminary purifier is described, in which the air or other gas is mixed with a spray of milk-of-lime or the like, the spray being produced by the injector action of the inrushing air, as in an ordinary scent spray.—H. B.

Glow bodies for incandescence electric lamps; Manufacture of ——. H. Kuzel. Fourth Addition, dated Feb. 27, 1907, to Fr. Pat. 359,025, Jan. 9, 1905 (this J., 1906, 308, 976, 1084 and 1085). Under Int. Conv., June 2, 1906.

For the purpose of increasing the available concentration and stability of the colloidal "solutions" of the metals and oxides mentioned in the principal patent and previous additions thereto, there are added small quantities of organic "protective colloids," such as gum arabic, gelatin, etc. The plastic mass is then formed into filaments, which are dried and then heated gradually to a white heat *in vacuo*, or in an indifferent atmosphere, or in an atmosphere containing hydrogen.—H. B.

Gases; Process for absorbing, condensing, or purifying ——. F. Brandenburg. Fr. Pat. 375,962, March 21, 1907. Under Int. Conv., April 4, 1906.

See U.S. Pat 859,427 of 1907; this J., 1907, 862.—T. F. B.

Incandescence mantles; Manufacture of ——. T. Terrell. Fr. Pat. 375,927, March 20, 1907. Under Int. Conv., March 21, 1906.

See Eng. Pat. 6814 of 1906; this J., 1907, 398.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Naphthalene; Mechanism of the oxidation of ——. I. Oxidation of naphthalene to phthalonic acid by alkaline permanganate solution. R. A. Daly. J. of Physical Chem., 1907, **11**, 93—106. Chem. Zentr., 1907, **2**, 67.

The author determined the rates of oxidation of naphthalene to phthalonic acid, and also of several possible intermediate products, by alkaline permanganate solution at 40° C. It was found that homophthalic acid and *o*-carboxymandelic acid are oxidised much more slowly than naphthalene, and it is inferred, therefore, cannot be intermediate products in the oxidation of the latter. β-Naphthoquinone is also excluded, since it does not yield phthalonic acid as its chief oxidation product. On the other hand, *o*-carboxybenzoylacetic acid and α-naphthoquinone are oxidised very rapidly by alkaline permanganate solution, and are probable intermediate products in the oxidation of naphthalene to phthalonic acid.—A. S.

Naphthalene; Mechanism of the oxidation of ——. II. Course of the oxidation of β-naphthoquinone to phthalic acid. M. C. Boswell. J. of Physical Chem., 1907, **11**, 119—131. J. Chem. Soc., 1907, **92**, [i], 407—408. (Compare preceding abstract).

Information in regard to the intermediate products formed in the oxidation of β-naphthoquinone to phthalic acid by acid bichromate solutions was sought by a comparative study of the rates of oxidation of the quinone and several possible intermediate substances. The experiments were carried out at 100° C. The results indicate that neither *o*-carboxycinnamic, *o*-carboxyphenylglyceric, phthalylacetic, homophthalic, nor phthalidecarboxylic acid can be formed as essential intermediate products in the oxidation of β-naphthoquinone, for the last-mentioned substance is more rapidly attacked than any of the preceding acids. Phthalonic acid is formed in the oxidation of all the acids mentioned, as well as by the oxidation of naphthoquinone. It is also considered that homophthalic acid cannot be an intermediate product in the oxidation of either *o*-carboxycinnamic, *o*-carboxyphenylglyceric, or phthalylacetic acid to phthalonic acid. From similar comparative experiments with α-naphthoquinone and α-naphthol, the author further considers that neither homophthalic, *o*-carboxycinnamic, nor phthalylacetic acid is an intermediate stage in the oxidation of α-naphthoquinone, and that homophthalic acid is not formed when α-naphthol is the original substance acted upon. Experiments made to ascertain the course of the oxidation of naphthalene by nitric acid permit of no definite conclusions, on account of the formation of very considerable quantities of nitrated products. The yields of phthalic acid obtained in six hours at 100° C. with nitric acid of sp. gr. 1·15 from naphthalene, α- and β-naphthoquinones, and homophthalic and phthalidecarboxylic acids are compared.

Petroleum; Chemical composition of —— from Borneo. H. O. Jones and H. A. Wootton. Chem. Soc. Trans., 1907, **91**, 1146—1149.

On distilling crude Borneo oil, the distillates obtained have generally a higher specific gravity than the corresponding fractions of American and Russian oils. There is present a considerable amount (25 to 40 per cent.)

of aromatic hydrocarbons including benzene, *m*-xylene, and mesitylene. There are about 6—7 per cent. of naphthalene hydrocarbons present, including naphthalene, α- and β-methylnaphthalene, and one of the dimethylnaphthalenes. Some samples leave a residue of paraffin wax after distillation, some leave a residue of asphaltum. The less volatile portions of the oil are optically active, the fraction boiling at 260°—340° C. having the optical rotation, $\alpha_D = -0{\cdot}18°$ in a 2 dem. tube.—C. E. F.

PATENT.

Wood distillation products; Process for obtaining —— directly. Soc. Pages, Camus et Cie. Fr. Pat. 375,314, May 10, 1906.

THE process of distillation, and separation of the distillates into marketable products is conducted in the ordinary apparatus, but the several operations are carried out at predetermined temperatures, which are kept constant. The apparatus is surrounded by a bath of boiling liquid or other suitable arrangement, by which heat is conveyed to the apparatus, or absorbed from it as required.—W. H. C.

IV.—COLOURING MATTERS AND DYESTUFFS.

Morinda citrifolia, L.; A constituent of the wood of ——. O. A. Oesterle. Arch. Pharm., 1907, **245**, 287—290.

THE author examined the wood of *Morinda citrifolia, L.*, a plant used in India for dyeing purposes. By a tedious process of extraction and repeated crystallisation from different media, brownish-yellow, glistening crystals (from glacial acetic acid), melting at 216° C., were isolated. From acetone and dilute acetic acid, lighter coloured crystals of the same melting point are obtained. By means of a methoxyl determination and the preparation and analysis of its acetyl derivative, the substance was identified as the monomethyl ether of a trihydroxymethylanthraquinone, $C_{15}H_7O_2(OH)_2OCH_3$. It is easily soluble in chloroform, benzene, and glacial acetic acid, less readily in alcohol and acetone, and almost insoluble in ether and petroleum ether. It differs from the substances of similar composition found by Perkin and Hummel in chay root (this J., 1894, 244, 346; 1895, 746) and in the bark of *Morinda umbellata* (this J., 1894, 352, 940, 1054), but is considered to exhibit some identity with the compound isolated by those authors with considerable difficulty, as they acknowledged, from the bark of *Ventilago madraspatana* (this J., 1894, 353; 1895, 27), more especially as regards the melting point of the diacetyl derivative. The lower melting point (200° C.) found by A. G. Perkin and Hummel was thought to be probably caused by the presence of impurities. Author alleges that the fact of the ether dissolving in alkalis with a red colour, as stated by Perkin and Hummel, does not militate against the possible identity of the two substances, for he found that in presence of traces of impurities the ether dissolves in the cold with a red colour instead of a yellow. The compound isolated is thus regarded as probably not the dyeing principle of the wood, as it scarcely colours mordanted tissues. The author suggests that the case may resemble that of *Ventilago*, where the true dyestuff (Ventilagin) is a non-crystallisable resinoid. —A. S.

Toluidine hydrochloride. Oil, Paint and Drug Rep., Aug. 5, 1907. U.S. Customs Decision. [T.R.]

MERCHANDISE imported and invoiced as "chlorhydrate of toluidine" was assessed for duty at 25 per cent. ad valorem under paragraph 3 of the tariff as a chemical salt. It was claimed to be dutiable under paragraph 15 at 20 per cent. ad valorem as a coal tar preparation, not a colour or dye. In sustaining the protest the General Appraiser writes:—"It appears that the appraiser returned this merchandise as a chemical salt in accordance with Abstract 10,989 (T. D. 27,309) where merchandise identical was held to be a coal tar preparation dutiable at 20 per cent. ad valorem, but owing to some error the merchandise was reported in the Treasury decisions to have been classified as a chemical salt. We therefore find the merchandise to be a coal tar preparation, not a colour or dye and not medicinal, and hold it dutiable at 20 per cent. ad valorem.

PATENTS.

Quinoline dyestuff, and process of making the same; Blue ——. B. Homolka, Frankfort, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 844,804, Feb. 19, 1907.

WHEN quinolinium salts or quinaldinium salts are treated with alkaline substances (alkali or alkaline-earth hydroxides) and formaldehyde, with or without a solvent, blue dyestuffs are obtained, which possess valuable colour sensitising properties for photographic emulsions; in this respect they are said to be superior to the other dyestuffs derived from quinoline.—T. F. B.

Monoazo dyestuff for lakes, and process of making same. O. Ernst and G. Gullbransson, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on the Maine, Germany. U.S. Pat. 858,065, June 25, 1907.

A MONOAZO dyestuff specially suitable for use in preparing bluish-red lakes, is obtained by combining 2-diazonaphthalene-1-sulphonic acid with 2.3-hydroxynaphthoic acid, of m.pt. 216° C.—T. F. B.

Indigo; Production of halogenated derivatives of ——. Ges. f. Chem. Ind. in Basel. Fr. Pat. 375,514, Feb. 25, 1907. Under Int. Conv., Jan. 26, 1907.

SEE U.S. Pats. 856,687 and 856,776 of 1907; this J., 1907, 818, 819.—T. F. B.

Dyestuff derived from salicylthioacetic acid; Process for preparing a red, vat-dyeing ——. [*Thioindigo Red.*] Soc. pour l'Industrie Chimique à Bâle. Addition, dated May 2, 1906, to Fr. Pat. 362,876, Jan. 31, 1906.

SEE Eng. Pat. 10,405 of 1906; this J., 1906, 751.—T. F. B.

Nitroaminophenolsulphonic acid and [azo] dyestuffs derived therefrom; Process for making a new ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 375,460, May 14, 1906.

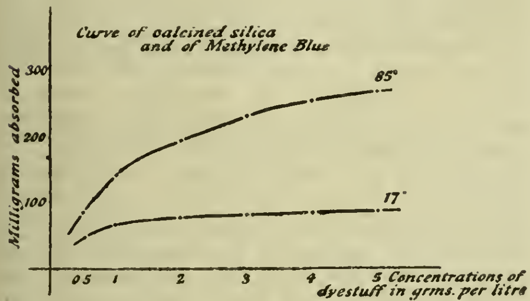
SEE Eng. Pat. 11,196 of 1906; this J., 1907, 679.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Dyestuffs; Fixation of some —— by inorganic substances. Pelet and L. Grand. Rev. Gen. Mat. Col., 1907, 11, 225.

THE authors refer to the work done on this subject by Georgevics (see this J., 1894, 807, 945), Gnehm and Röthel (this J., 1898, 660, 756), W. Suida (this J., 1904, 1144), and Freundlich and Losev (this J., 1907, 682). They used

Methylene Blue and Crystal Ponceau in their experiments, as being representative basic and acid colours, which were easily obtained pure. Qualitative trials were made upon some 80 inorganic substances, about 1 grm. of each being taken and shaken up with 1 c.c. (or more) of a 0·1 per cent. solution of the dyestuff, and only such as decolorised the first cubic centimetre of solution were looked upon as absorbents. In the quantitative trials, a weighed quantity of the substance or fibre, was placed in a measured volume of the dyestuff solution of known strength and left therein, with frequent agitation, for 5 days. At the end of this period the amount of colour remaining in solution was estimated, various methods being employed, to eliminate all possibility of error. Among the substances used, were precipitated silica, calcined silica, pure sand, infusorial earth, kaolin (hydrated and calcined), aluminium, iron and chromium oxides (hydrated and calcined), bone charcoal, graphite, lampblack and wool. It was noted that the greatest amount of absorption occurred with the derivatives of elements of high valency, and such as show a tendency to give colloidal solutions, and that with compounds of divalent elements, (calcium, magnesium, etc.) the amount of absorption was very small. Basic colours are absorbed much more readily and by a much larger number of substances than is the case with acid colours. The results obtained may be represented graphically, the curve being of the same form in all cases; thus, for calcined silica and Methylene Blue :—



Such a curve is well known and can be plotted from the equation: $\frac{x}{m} = \beta C^{\frac{1}{p}}$ where x = amount absorbed, m = the weight of substratum, C = concentration of bath at the end of the experiment, and β and p are constants. It is in agreement with those obtained by Freundlich and Losev (this J., 1907, 682), and by W. Biltz (this J., 1905, 920) and the authors support these investigators in their opinion that the fixation of dyestuff by the class of substances taken, is a purely physical phenomenon. They confirm the view of Freundlich and Losev that the absorption of colouring matters by charcoal is analogous to the dyeing of textile fibres. Basic colours are fixed by sand, silicates, and the hydrated oxides of iron, aluminium and chromium according to the same laws as hold in the cases of animal charcoal and the textile fibres, but acid colours (in neutral solutions) are not fixed by inorganic substances.

Turning to the influence exerted by salts in the dyebath, the authors find confirmation from their experiments, of the theory that the dyestuff solutions are colloidal and that dyeing is due to the precipitation of colloids upon the fibre.—F. M.

Discharge-resists on indigo, which act as reserves on cover-printing. A. Romann. Sealed note, 863, March 27, 1896. Bull. Soc. Ind. Mulhouse, 1907, **77**, 244—245.

Zinc sulphate and kaolin are added to the chromate discharge paste, a white thus being reserved under the cover-print. For coloured discharges, the necessary lakes are also incorporated, and, previous to cover-printing, the cloth is prepared with an albumin solution of a certain strength ("$\frac{1}{16}$ l. albumin 500/1 per litre of water.")—F. M.

Leather dyeing; Acid in ——, its absorption and effect. M. C. Lamb and J. W. Lamb. J. Soc. Dyers and Col., 1907, **23**, 209.

The critical temperature in leather dyeing is about 50° C., a rise of a few degrees being very detrimental to the product. The acids usually employed are sulphuric, hydrochloric, oxalic and formic, and trials with various strengths of these were made at different temperatures. The inorganic acids are absorbed by the leather in approximately equivalent amounts, but much smaller quantities of the organic acids are taken up. At low temperatures the appearance of the final product was best when sulphuric or hydrochloric acid was used, and there was no apparent deterioration in quality, but at 60° C. the leather dyed with hydrochloric acid was disintegrated. At 65° C. the samples dyed with an addition of sulphuric acid suffered as well, and in fact only those dyed with the assistance of formic acid, remained unaffected. At 70° C. the presence of any acid in the dye bath appeared to be detrimental.

The conclusions arrived at are :—(1) There is little liability of injury to well tanned leather by immersion in water at 60° C. (2) The amount of acid absorbed is practically independent of the concentration. (3) Any excess of acid, over that absorbed, conduces to rapid disintegration of the leather, at temperatures much lower than would otherwise be the case. (4) There is much less liability to damage goods when formic acid is used, than when other acids are employed.—F. M.

Patents.

Webs of fabric and the like; Method of sealing chambers in which —— are continuously treated. W. E. Heys, Manchester. From the Liesinger Druckfabrik Popper und Ornstein, and F. Werthecker, Liesing, Austria. Eng. Pat. 16,752, July 25, 1906.

The apparatus comprises a partly cylindrical trough having a slit or longitudinal opening, through which the fabric passes into the chamber in which it is to be treated. A roller, preferably covered with an elastic or flexible material, fits closely in the trough, and the fabric on its way to the opening mentioned, passes between the roller and the side of the trough.—P. F. C.

Machine; Centrifugal [dyeing] ——. H. Stebler, Assignor to the Färberei- und Appretur-Ges., (vorm. A. Clavel und F. Lindenmeyer), Basel, Switzerland. U.S. Pat. 859,346, July 9, 1907.

The material to be dyed is packed inside a centrifugal drum, which rotates upon a vertical axis inside a stationary vat. The floor of the drum is provided with a number of slots, along each of which a paddle is fitted; when the machine is in operation, these paddles force the dye-liquor from the vat, through the slots, into the drum. Above the slots, are hollow perforated distributing devices, extending nearly the whole height of the drum. The cross-sectional area of each distributor diminishes progressively from the base to the top. The dye-liquor which is forced through the slots, enters the distributors, which disperse it evenly through the material in the drum. In order to further facilitate the distribution of the dye-liquor, the drum has a hollow nave provided with openings. Part of the liquor which is drawn along by the paddles, enters this nave, and is forced through the openings into the material contained in the drum.—P. F. C.

Textile fibres; Method of bleaching ——. Badische Anilin und Soda Fabrik. Addition, dated Feb. 22, 1907 (under Int. Conv., Aug. 23, 1906), to Fr. Pat. 366,701, May 30, 1906. (See Eng. Pat. 12,517 of 1906; this J., 1906, 807.)

Solutions of gelatinous substances, glue, etc., may be bleached by treatment with the basic zinc salt of formaldehyde-sulphoxylic acid in the presence or absence of organic or inorganic acids.—C. A. M.

Bobbins of hanks [" *mèches* "] *or of threads round a supple core; Preparation of* [*dyeing*] ——. Soc., Anon. de Teint. et d'Impress. G. G. Pneu. (Anciens Etablis. Gaydet, Grulois, Pneumatique). Fr. Pat. 375,291, Feb. 28, 1907.

Bobbins made of wood or cardboard have several defects. When brought in contact with a liquid, they expand and press tightly against the threads wound on them, thus rendering the interior of the wound bobbin much more resistant to the penetration of the dye-liquor. According to this patent, these rigid bobbins are replaced by supple cores made of some textile material. In order to replace a wooden bobbin by such a core, the rigid bobbin is first displaced by a thin-walled metallic tube of slightly less diameter, and this tube is used as a guide for the introduction of the flexible core. The metallic tube is then withdrawn.—P. F. C.

Drying sized fabrics; Machine for ——. A. Holle and Co. Fr. Pat. 375,660, Mar. 13, 1907.

Inside the casing of an ordinary drying machine are arranged two or more drums, each of which can rotate about a hollow steam pipe serving as axis. This steam pipe is surrounded by a second pipe through which air is forced under pressure, and the end of this pipe is provided with openings communicating with a third pipe, surrounding the second and concentric with it. The third pipe is perforated in all directions. Each drum is also provided with a number of steam pipes which branch out of the central steam pipe and are arranged parallel with it. When the machine is working, the compressed air, which is forced through the second pipe, is heated by the central steam pipe, is next forced into the third pipe and then expelled in all directions through the perforations. It is then still further heated by the branch steam pipes. The hot air thus obtained is forced against the sized fabric which is carried by the rotating drums.—P. F. C.

Artificial silk, artificial hair and plastic cellulose products; Washing of, and the rapid and complete removal of copper from ——. E. Crumière. Fr. Pat. 375,827, Mar. 16, 1907.

In the preparation of cellulose products by the cuprammonium process, it is necessary to remove all traces of copper from the coagulated cellulose. According to this patent, the material is placed in a vat which contains a liquid capable of dissolving copper, such as, for example, dilute sulphuric or acetic acid. An electric current is then passed between two suitable metallic electrodes which are immersed in this liquid. The vat itself can be used as the cathode. The copper contained in the cellulose is dissolved and then deposited on the cathode. For the purpose of this treatment the coagulated cellulose may be either wound on bobbins or arranged in the form of hanks.—P. F. C.

Silk, artificial; Machine for forming —— *and similar substances.* M. Waddell. Fr. Pat. 375,633, March 12, 1907.

See U.S. Pat. 846,879 of 1907; this J., 1907, 467.—T. F. B.

Singeing fabrics; Electrical process and apparatus for ——. G. H. Gin. Fr. Pat. 375,683, March 14, 1907.

See Eng. Pat. 4550 of 1907; this J., 1907, 868.—T. F. B.

Dyeing; Centrifugal turbine for ——. Färberei- und Appretur-ges. vorm. A. Clavel und F. Lindenmeyer. Fr. Pat. 375,939, March 20, 1906. Under Int. Conv., April 3, 1906, and Jan. 10, 1907.

See U.S. Pat. 859,346 of 1907; preceding these.—T. F. B.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Dyeing furs, feathers, and other articles; Process for ——. Act.-Ges. f. Anilinfabr. Addition, dated May 15, 1906, to Fr. Pat. 375,100, May 5, 1906.

See Eng. Pat. 10,609 of 1906; this J., 1907, 524.—T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Sulphur; On the density and allotropic condition of certain varieties of ——. *Notes on the determination of the density of bodies in a fine powder.* W. Spring. Bull. Soc. Chim. Belgique, 1907, 21, 243—257.

The author has already shown that the amorphous yellow precipitate, insoluble in carbon bisulphide, which is formed by the reaction of sulphuretted hydrogen and sulphurous acid in water, is not a special variety of sulphur, but a definite hydrate of sulphur, which has the power of easily forming a colloidal solution with water. He has now investigated the precipitates formed in water (1), by the action of acids upon alkali polysulphides, and (2), by the action of ferric chloride upon sulphuretted hydrogen (the precipitates which form " milk of sulphur "). The formation of " milk of sulphur," and its relative stability must be a consequence only of the extreme tenuity of its particles. The sulphur extracted from alkali polysulphides or from sulphuretted hydrogen is not hydrated. The densities of these two kinds can be regarded as equal, and do not differ appreciably from the density of the most stable form of sulphur, namely the rhombic. The sulphur obtained from potassium sulphide is completely soluble in carbon bisulphide, whereas that from sulphuretted hydrogen contains 3·2 per cent. of a variety, with a slightly lower density, which is insoluble in that liquid, and its specific volume is nearly one-tenth greater than that of rhombic sulphur. The sulphur obtained from alkali polysulphides is identical with that from sulphuretted hydrogen, not only in respect to density but also to specific heat. Although the density of sulphur from polysulphides is practically the same as that of rhombic sulphur, and although both are soluble in carbon bisulphide, nevertheless the specific heat of the latter is rather less than that of the former. Above a temperature of 95° C. the specific heat of sulphur from polysulphides (including sulphuretted hydrogen) although not very different from that of rhombic sulphur, is quite different from that of amorphous sulphur. The sulphur from polysulphides is unstable, and in the cold passes slowly into rhombic sulphur. During the investigation it was found when taking the weight of fine powders of sulphur in water, for the determination of the specific gravity, that the weight increased daily for several days, even after the sedimentation of the powder appeared to be complete. The increase in weight amounted to nearly 8 in 1000 of the total weight. It was found that at first this increase of weight proceeds at a rate which does not follow any law, but it soon changes to a rate which at each instant is proportional to the weight of sulphur that still remains in suspension in the water. It was found that the rate of sedimentation $\frac{\Delta p}{\Delta t}$ could be expressed by an equation of the form $y = b(a - x)$; in other words it is subject to a law of the same form as that which governs the rate of chemical change in a mono-molecular reaction.
—W. C. H.

Phosphorus; Allotropic modifications of ——. J. Böeseken. Chem. Weekblad, 1907, **4**, 200—209. Chem. Zentr., 1907, **1**, 1772.

Only two allotropic modifications of phosphorus are known with certainty: *viz.*, (1), white phosphorus, sp. gr. 1·831 at 18° C., m.p., 44·77° C.; (2), the violet, anisotropic phosphorus, sp. gr. 2·31—2·34. White phosphorus was purified by drying at 80° C. in a vacuum, and then distilling. Violet phosphorus is obtained by treating commercial red phosphorus with a powerful current of water which carries off the lighter and finer particles. The residue is boiled for some time, first with concentrated sodium hydroxide solution and then with dilute nitric acid; it is next washed with cold water, and dried *in vacuo*. It is not affected by water nor by dilute acids, with the exception of nitric acid. It is oxidised to orthophosphoric and hypophosphoric acids by boiling nitric acid of sp. gr. 1·25. Scarlet or orange-red phosphorus is a kind of colloidal solution holding the elements of water in a firmly adherent condition. It can be prepared by dissolving 5 grms. of white phosphorus in 100 grms. of boiling, freshly-distilled phosphorus trichloride, and adding 15 grms. of finely-powdered aluminium chloride in three equal portions. The phosphorus trichloride is then removed by distillation in a current of dry carbon dioxide, and the cooled residue is extracted for several days with dry carbon bisulphide to remove white phosphorus. The aluminium chloride can be removed only by treatment with ice water, during which treatment, the phosphorus takes up water. Commercial red phosphorus is a mixture of the violet modification with a small proportion of colloidal phosphorus.—A. S.

Phosphorus; Direct oxidation of ——. E. Jungfleisch. Compt. rend., 1907, **145**, 325—327.

Oxygen acts on phosphorus at the ordinary pressure to form phosphorus pentoxide; but at pressures of 18—20 mm., whether alone, as air, or mixed with other inert gases, it produces the trioxide and a yellow substance, less volatile than the trioxide, which the author is now investigating. The trioxide thus formed is spontaneously inflammable in air or oxygen, and phosphorus which, through oxidation at low pressures, has become coated with a film of the trioxide, will on exposure to air or oxygen at the ordinary pressure, take fire, being ignited through the spontaneous combustion of the trioxide. —J. T. D.

Alkali-metal monoxides; Heats of formation of ——. E. Rengade. Compt. rend., 1907, **145**, 236—238.

The author has determined with pure monoxides the heat of the reaction $M_2O,aq.$ as shown in the second column of the table below. Adding to the figures for the reaction, $M_2,aq.$, in the third column (determined by Joannis and by Beketoff) 69, the heat absorbed in dissociating 1 molecule of water, the figures for the reaction, $M_2,O,H_2O,aq.$, are obtained (fourth column); and subtracting from these the figures in the second column, those in the fifth are left, representing the heats of formation of the monoxides (M_2,O).

Metal.	$M_2O,aq.$	$M_2,aq.$	$M_2,O,H_2O,aq.$	$M_2,O.$
	cals.	cals.	cals.	cals.
Sodium	56·5	85·2(J.)	154·2	97·7
Potassium..	75·0	90·8(J.)	159·8	84·8
Rubidium .	83·0	96·4(B.)	165·4	82·4
Cæsium ...	80·6	103·1(B.)	172·1	91·5

It is seen from these figures that the heat of hydration and dilution of the monoxides rises from sodium to rubidium and then drops. The heat of formation of the monoxides is highest for sodium, and is for cæsium intermediate between the figures for sodium and those for potassium and rubidium, which are almost identical. The monoxides thus differ from most of the binary compounds of sodium and potassium, in which the potassium compound is formed with greater evolution of heat than the sodium compound.—J. T. D.

Sulphuric and nitric anhydrides; Mixed ——. A. Pictet and G. Karl. Compt. rend., 1907, **145**, 238—240.

By dissolving nitric anhydride in melted sulphuric anhydride, or by mixing solutions in carbon tetrachloride of the two anhydrides, a white crystalline substance is obtained, melting at 124°—125° C. and boiling at 218°—220° C. This substance is very hygroscopic and reacts violently with water, yielding sulphuric and nitric acids. It has the formula, $(SO_3)_4N_2O_5$. It reacts powerfully with many organic substances, in some cases yielding nitro-compounds (often accompanied by sulphonic derivatives), but in many others forming very complex products. —J. T. D.

Metallic bromides; Method of preparing ——, *from the corresponding oxides.* F. Bourion. Compt. rend., 1907, **145**, 243—246.

By passing over the heated oxide a mixture of bromine vapour with a little of the vapour of sulphur monochloride, the anhydrous metallic bromide is in many cases obtainable. The author has thus prepared the bromides of thorium, chromium, nickel, cobalt, neodymium, cerium, already known; and a thorium oxybromide, $ThOBr_2$, bromides of lanthanum, samarium, praseodymium, gadolinium, dysprosium, ytterbium, and terbium, not hitherto described.—J. T. D.

Lead sulphate; Solubility of —— *in concentrated solutions of ammonium acetate* (*Preliminary note*). J. J. Fox. Chem. Soc. Proc., 1907, **23**, 199—200.

Solubility experiments were carried out with the view of determining the course of the reaction occurring between ammonium acetate and lead sulphate. The solid phases were examined to ascertain whether they changed during the solution. The following are some of the results obtained from the analysis of the solutions saturated at 24·9° C., the concentration of the ammonium acetate varying from about $N/_1$ upwards:

Sp. gr. of solution.	Molecules of salt per 1000 molecules of water.		
	Ammonium acetate.	Ammonium sulphate.	Lead acetate.
1·0197	20·0	0·54	0·52
1·0320	31·2	0·93	0·92
1·0457	44·5	1·49	1·46
1·0578	55·6	2·11	2·08
1·0694	68·5	2·77	2·74
1·1094	94·1	2·77	6·31
1·1281	133·3	2·80	8·10

The curve obtained does not agree with the formula developed by Noyes (J. Amer. Chem. Soc., 1905, **27**, 747), the solubility being greater than that given by the formula. The solid phase consisted of lead sulphate and was unaltered with concentrations of ammonium acetate up to rather more than 3*N*, but with more concentrated ammonium acetate, well-defined crystals of lead ammonium sulphate, $Pb(NH_4)_2(SO_4)_2$, were obtained. The solubility of the lead sulphate increased considerably with ammonium acetate of greater concentrations than above, and the solid phases consisted of mixtures of lead sulphate and lead ammonium sulphate. The lead is probably present in solution as lead acetate, since the amount of sulphate in solution gradually became less than the equivalent of the lead present as the concentration of the ammonium acetate was increased beyond 3*N*.

Chrome alum. U.S. Customs Decision. Oil, Paint and Drug Rep., July 22, 1907. [T.R.]

The board of general appraisers has decided that chrome alum, must pay duty at 25 per cent. ad valorem. The board bases its ruling on the provision of paragraph 3 of the tariff for "all chemical compounds and salts not specially provided for."

Nitrogen and oxygen ; Action of the electric spark on —— at low temperatures. E. Briner and E. Durand. *See* XIA.

Peroxide of copper, and the catalysis of alkali hypochlorites and hypobromites. E. Müller. *See* XXIV.

Uranium. U.S. Customs Decision. Oil, Paint and Drug Rep., July 29, 1907. [T.R.]

Merchandise imported and described on the invoice as uranium and sodium acetate was assessed for duty at the rate of 25 per cent. ad valorem under paragraph 3 of the Tariff Act of 1897 as a chemical compound. It was claimed to be free under paragraph 691. The board found the merchandise to be a double salt of uranium and held it free of duty as claimed.

Patents.

Peroxides ; Preparation and purification of ——. Les Etablissements Poulenc Frères. First Addition, dated May 18, 1906, to Fr. Pat. 359,523, Jan. 24, 1905 (this J., 1906, 374).

A solution of hydrogen peroxide is prepared by the process described in the original patent, and then, instead of concentrating and distilling in a vacuum, the dissolved barium salt is precipitated by means of a suitable sodium salt, and separated by filtration. The sodium salt left in solution does not affect the stability of the product, and has not the poisonous effect of barium nitrate. Such a solution of hydrogen peroxide can be obtained of ordinary strengths, and is suitable for commercial purposes. —W. C. H.

Nitrous gases ; Concentration [absorption] of dilute ——. A. Sinding-Larsen and Det Norske Aktieselskab for Elektro-kemisk Industri. Fr. Pat. 375,342, March 4, 1907.

Dilute nitrous gases, produced in electric furnaces or otherwise, are passed, for absorption, through an alkaline liquid to which soap has been added ; the consequent frothing greatly increases the surface of contact between the gases and the liquid. The gases are preferably introduced through a series of contracted passages, so as to produce as much spray as possible, with formation of bubbles. The froth thus produced may be swept off from time to time into a large reservoir, the liquid which forms therein on standing, being returned to the absorption vessel, with further addition of alkali if necessary.—E. S.

Nitric acid and other compound ; Electro-chemical process and apparatus for manufacturing —— by means of gases. G. J. J. Br[illegible]et and A. M. Muguet. Fr. Pat. 375,349, May 11, 1906. *See* XIA.

Hydrofluosilicic acid and alkali fluosilicates ; Manufacture of —— in superphosphate factories. L. Rivière. Fr. Pat. 375,989, May 28, 1906. *See* XV.

Hydrogen and carbon dioxide ; Process for the separation of ——. Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude). Fr. Pat. 375,991, May 28, 1906.

The mixture of hydrogen and carbon dioxide is subjected to a pressure of, say, 30 atmospheres, and is then passed through heat-exchangers wherein it meets cold gas passing in an opposite direction. The temperature of the gaseous mixture falls progressively, and the carbon dioxide gradually liquefies. The temperature should not be low enough for the production of solid carbon dioxide. The counter-current of cold gas may be either : (1), The non-liquefied portion of the compressed gaseous mixture, the cold end of the heat-exchanger being cooled externally by suitable means, in order to compensate for the heat developed by the liquefaction of the carbon dioxide ; or (2), the non-liquefied portion of the gas, after previous expansion, with external work, in a suitable engine, the power produced being utilised in maintaining the necessary refrigeration. In either case, the liquefied carbon dioxide is drawn off at atmospheric pressure ; a portion volatilises and is passed through the heat-exchanger, whilst the remainder solidifies and may be utilised as a refrigerating agent, etc.—A. S.

Chlorates and perchlorates ; Process for the decomposition of —— by combustion and ignition. G. F. Jaubert. Fr. Pat. 375,816, May 23, 1906.

The object of the invention is to obtain, from chlorates or perchlorates, without danger of explosion and in a regular manner, a supply of oxygen or other gas, under pressure, for power purposes or the like. The chlorate or perchlorate is mixed with catalytic or combustible substances and with an incombustible, non-heat-conducting, light substance (infusorial earth, or light oxides of manganese or iron obtained by calcination of the carbonate or oxalate), which will absorb the fused chlorate or chloride. The mixture is enclosed in receptacles made of an incombustible material porous to gases, such as asbestos cloth, whilst in order to facilitate the ignition of the mass, a small cup or hollow is formed in it, in which is placed a powder which can be ignited by means of a flame, *e.g.*, a mixture of potassium permanganate and finely-divided iron. It is stated that up to 100 kilos. of such a mixture can be burned smoothly in a closed vessel for the production of compressed oxygen, etc.—A. S.

Sulphides of alkali metals from their sulphates ; Process of preparation of ——. Soc. Ind. Elettro-Chim. di Pont St. Martin and A. Piccini. Fr. Pat. 375,529, 1907. *See* XIA.

Barium oxide and cyanides ; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 375,357, March 4, 1907. Under Int. Conv., April 18, 1906.

This process is for the production of barium oxide by calcining a mixture of barium carbonate and carbon, and for the production of cyanides by heating a mixture of oxides, hydroxides, or carbonates, etc., of alkaline-earths, and carbon in an atmosphere of nitrogen. The essential feature of the invention is that the substance to be calcined is placed in saggers piled one on another, or in retorts, which are gradually heated from the ordinary temperature to that necessary for the reaction, and then allowed to cool, the principal direction of the heating gases being always parallel to the axis of the saggers or retorts. —W. C. H.

Barium oxide ; Process of manufacture of anhydrous ——, especially for the production of spongy barium dioxide, with total recovery of the nitrous acids. C. Limb and F. Louis. Fr. Pat. 375,386, May 12, 1907.

This process is applicable to the recovery of gaseous nitrogen compounds produced in any reactions in which nitric (or nitrous) acid is decomposed, and especially to the case of the production of spongy barium oxide by calcination of barium nitrate or nitrite. The nitrous gases, with or without the addition of air, are passed into pure water, or water containing barium hydroxide in solution or barium carbonate in suspension, contained in a vessel into which a rapid succession of electric sparks can be passed.—W. C. H.

Ammonia; Transformation of the nitrogen of peat into ——. M. L. Gaillot and P. Brisset. Fr. Pat. 375,792, March 15, 1907.

THE peat is burned in stoves, or in kilns resembling lime-kilns, to which access of air is limited, so as to render the combustion slow, and with or without injection of steam. The effluent gases are brought into contact with suitable acid or other solutions, or of solids, especially such as superphosphates, for absorption of the contained ammonia.—E. S.

Ammonia; Process for the manufacture of —— [*from cyanamides, etc.*] Ges. f. Stickstoffdünger G.m.b.H. Fr. Pat. 375,979, March 22, 1907.

THE decomposition of cyanides and cyanamides, with liberation of ammonia, on heating in presence of water, is accelerated and promoted by the addition of calcium chloride. For example, powdered calcium cyanamide is mixed to a paste with about an equal weight of a concentrated solution of calcium chloride. This paste solidifies on standing, and is then broken into pieces and heated in a retort, the ammonia evolved being collected.—E. S.

Sodium hydrosulphite containing water of crystallisation; Process for dehydrating ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 375,711, May 21, 1906.

SEE Eng. Pat. 11,565 of 1906; this J., 1907, 527.—T. F. B.

Lithium salts and by-products; Process for treating ores containing lithium for the production of ——. W. E. Wadman. Fr. Pat. 375,873, March 19, 1907.

SEE U.S. Pat. 847,856 of 1907; this J., 1907, 469.—T. F. B.

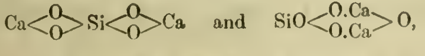
Plaster; Treatment of —— *for the extraction of sulphur.* A. Müntz and P. Nottin. Fr. Pat. 375,469, March 8, 1907.

CALCIUM sulphate, especially plaster or old plaster work, is heated to a temperature below that corresponding to a cherry red, and reduced to calcium sulphide by the action of reducing gases, obtained from any cheap carbonaceous material. The calcium sulphide and carbon dioxide produced react upon one another in the presence of water to form calcium carbonate and sulphuretted hydrogen, from the latter of which the sulphur can be obtained.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Blast-furnace slag and cement; Physico-chemical relations of highly basic ——. K. Zulkowski. Stahl u. Eisen, 1907, **27**, 1062—1066, 1098—1102.

THE author defends his previously published views that tricalcium silicate does not exist; that the excess of lime over that necessary to form disilicate exists in Portland cement in the form of solid solution; and that both in Portland and slag cements, the calcium silicates and calcium aluminates are present as double compounds. Moreover, he believes that dicalcium silicate exists in two modifications expressed by the formulæ:



$$\mathrm{Ca}\langle{}^{\mathrm{O}}_{\mathrm{O}}\rangle\mathrm{Si}\langle{}^{\mathrm{O}}_{\mathrm{O}}\rangle\mathrm{Ca} \quad \text{and} \quad \mathrm{SiO}\langle{}^{\mathrm{O.Ca}}_{\mathrm{O.Ca}}\rangle\mathrm{O},$$

the first of which is a neutral orthosilicate, whilst the second is a basic metasilicate. The ortho- passes more and more completely into the meta-silicate as the temperature rises, and, conversely is regenerated by heating the meta-silicate at lower temperatures; the meta-silicate is obtained by rapid cooling of the highly heated mass. The meta-silicate is stable on cooling and possesses hydraulic properties, whilst the ortho-silicate falls to powder and does not set with water. The author calculates the quantity of water necessary for the hydration of a typical cement from the equation:

$$(SiO_2,2CaO) + \frac{1}{x}(Al_2O_3,2CaO) + \left(\frac{3+x}{x}\right)H_2O =$$
$$CaSiO_3 + \frac{1}{x}(Al_2O_3,H_2O) + \left(\frac{2+x}{x}\right)CaO_2H_2.$$

To determine this water, 2 grms. of the powdered cement are mixed with water, allowed to stand for 30 days in a stoppered vessel, and then dried *in vacuo* over sulphuric acid until of constant weight. The results obtained are generally close to the theoretical, but are lowered by increasing the quantity of water used. Slag cements take up much less water than Portland cement, owing to their low content of lime; mono-calcium silicate takes up no water at all, and mono-calcium aluminate only 18·5 per cent. as against 25·1 for the dicalcium aluminate.—A. G. L.

PATENTS.

Refractory materials. H. A. D. Collins, London. Eng. Pat. 15,735, July 11, 1906.

THE claim is for the use of powdered "water-glass" instead of liquid sodium silicate in the process described in Eng. Pat. 15,734 of 1906; this J., 1907, 824.—W. H. C.

Artificial stone or the like; Manufacture of ——. B. E. D. Kilburn, London. From Isolatoren-Fabrik "Pulvolit," Ges.m.b.H., Frankfort. Eng. Pat. 28,199A, Dec. 11, 1906.

THE claim is for an improvement upon the process described in Eng. Pat. 26,516 of 1904 (see Fr. Pat. 348,601 of 1904, this J., 1905, 499) and consists in adding to the mixture, resin or other resinous products, which have the property of absorbing oxygen from the air. These bodies act catalytically, and hasten the oxidation and solidification of the binding material. —W. H. C.

Agglomerating materials; Process of ——. W. Schumacher, Osnabrück, Germany, Assignor to E. Thalmann, New York. U.S. Pat. 859,411, July 9, 1907.

QUANTITIES of silicious material and of lime, containing approximately equal proportions of silica and calcium oxide respectively, are ground together very finely, so as to split up the silicious material into particles of irregular shape coated with lime dust; the mixture is incorporated with the material to be agglomerated and with moisture, and the resulting mass is treated with steam under pressure.—A. S.

Refractory materials and method of making same. Asbestos Wood Co. Fr. Pat. 374,489, Feb. 9, 1907. Under Int. Conv., June 7, 1906.

ASBESTOS fibre (80 per cent. by weight) is mixed with magnesium oxide (20 per cent.), obtained by calcining at a low temperature, finely-divided, *e.g.*, precipitated, magnesium carbonate. Water is added, and the mass is submitted in a filter-press to a pressure of 105—175 kilos. per sq. cm. until hydration is complete. The mass may then be pressed in moulds at a pressure of 1·4—2 kilos. per sq. cm.—A. G. L.

Impregnating porous materials such as railway sleepers; Process of ——, and products obtained. J. Chateau and J. Merklen. Fr. Pat. 375,859, Mar. 18, 1907.

The invention aims at treating wood very thoroughly with a small quantity only of a disinfecting liquid. For this purpose, the impregnation is stopped when only a small quantity of disinfectant has entered the wood, and an "auxiliary liquid" (*e.g.*, water, when the disinfectant used is creosote) is forced into the wood, carrying with it and distributing throughout the interior of the wood the small quantity of disinfectant which originally entered the latter.—A. G. L.

X.—METALLURGY.

U.S. production of copper, zinc, and lead in 1906. Bd. of Trade J., Aug. 8, 1907. [T.R.]

The "Iron Age" (New York) publishes the following (preliminary) statistics, issued by the United States Geological Survey, showing the production of copper, zinc and lead in the United States in 1906. The production of copper amounted to 906,591,947 lb., an increase of about 18,000,000 lb., or 2 per cent., over the production of 1905. Of the total production in 1906, 816,386 lb. in blister was produced in foreign smelters from materials exported from the United States. In addition to the total given, 54,543,116 lb. was produced as blister in domestic smelters from foreign ore, concentrates and matte, while blister imported from foreign sources containing 136,826,906 lb. of fine copper was electrolytically refined in the United States.

The production of electrolytic copper in the United States in 1906, based on actual returns from all refineries, amounted to 839,984,614 lb. The production of domestic nonelectrolytic copper refined by the furnace process and known as casting copper amounted in 1906 to 28,345,263 lb. This does not include Lake copper. The total production of refined copper of domestic origin was 882,568,237 lb.

The production of zinc in 1906 amounted to 224,770 tons (of 2,000 lbs.), an increase over 1905 of 20,921 tons, or 10·3 per cent.

The total production of refined lead in 1906 amounted to 404,669 tons, comprising 313,886 tons of desilverised lead and 90,783 tons of soft lead. This total embraces all desilverised lead produced at works in the United States and the pig lead recovered from the Mississippi Valley lead ores, but is exclusive of a product of 10,546 tons of antimonial lead reported by refineries. About 25,000 tons of pig lead derived from Mississippi Valley ores was desilverised, and is therefore included under desilverised lead and not under soft lead.

Nickel discovery in Ontario.

A Reuter's telegram, dated Ottawa, August 8, states that what is believed to be the richest nickel deposit in Canada has been discovered near Worthington, in Northern Ontario. The vein is reported to be 100 ft. wide, and to contain almost pure ore. The Standard Oil capitalists, who control the nickel field in Canada, are endeavouring to purchase the new ground.

Metals; The hard and soft states in ductile ——. G. T. Beilby. Proc. Roy. Soc., 1907, Ser. A, **79**, 463—480.

Further experiments on the two states of ductile metals (this J., 1904, 788), more especially of copper, silver and gold, are described. So far, a homogeneous specimen of metal entirely in the hard state has not yet been obtained. The rigidity and tenacity of metal hardened by working, appears to depend as much on the type of structure (size and shape of crystals, &c.) developed, as on the actual proportions of the two phases. A true change of state, consisting in the passage of the non-crystalline into the crystalline state, occurs at a well defined temperature, between 220° and 300° C. for the above three metals, as shown by recrystallisation, loss of mechanical stability, development of thermal E.M.F. between wires in the hard and soft states, and complete restoration of elasticity in the hardened metal. The mechanical stability decreases with increasing size of crystals, and the true stability of the crystalline phase, in single crystals, is probably less than that of any aggregate of crystals. The thermal E.M.F. is found to be a delicate indicator of the existence of strains in hardened wires; these strains are partly of a temporary character, which can be partially removed by annealing at a temperature of 100°, and wholly by heating to 180°—200° C.; partly the strains are due to a fundamental physical change of state. The two kinds of strain in hardened metal differ from each other in that one, in which possibly the molecules themselves are strained, is unstable even at the ordinary temperature, and slowly disappears; whilst the other is stable up to the recrystallisation temperature, at which a change in the microstructure takes place; in this second state the molecules appear to be restrained by mutual cohesion from turning into a uniformly oriented condition. The acoustical investigation of minute changes of elasticity in the metal tongue of a reed vibrator gave elasticity curves showing these changes even more plainly than did the E.M.F. curves.

The author believes that the hardening produced by chilling metals, and that produced by hammering, are both due to the same kind of molecular change of structure, which is the result of contraction strains. Their low recrystallisation temperatures are the reason why the ductile metals cannot be hardened by chilling, the strains produced by rapid cooling from 220° C. to the ordinary temperature being too small to have a hardening effect. High crystallising temperature and high coefficient of expansion are necessary for hardening by chilling.

In the ductile metals, the crystalline phase is more plastic but much less stable (mechanically) than the amorphous phase. Repeated alterations of stress, which only temporarily deform the latter, may permanently alter the former, and render evident its inferiority in a mixture of the two phases which at first appears to be (mechanically) stable.—A. G. L.

Chrome-tungsten steels. L. Guillet. Rev. métal., 1907, **4**, 5.

The properties of chrome-tungsten steels, and the results of tests made to determine the composition and treatment best adapted for high-speed tool steels are here given. The constituents of these steels in the normal state are perlite, martensite, and a triple carbide of iron, chromium and tungsten, accompanied by martensite, sorbite (or troostite) or γ-iron. Perlitic steels show a tensile strength and elastic limit higher than the ordinary carbon steels; the elongation is lower. Steels containing martensite have very high tensile strength and elastic limit, but low elongation. Hardening changes the perlite to martensite, raising the tensile strength and elastic limit, and lowering the elongation. With carbide steels the higher the temperature employed above 850° C., or the longer the heating, the less carbide is left. The presence of carbide being undesirable, the hardening conditions are so regulated as to cause its disappearance. Steels containing martensite are softened slightly by quenching in water, while the sorbite steels are hardened. Steels containing γ-iron are also softened. Perlitic chrome-tungsten steels have no future in mechanical construction, nickel-chrome steels being equally good, and cheaper. The only practical use is for high-speed tool steels, which should not contain perlite, martensite (too difficult to forge), martensite and carbide, or γ-iron (too soft). They should contain sorbite (or troosite) and carbide. The treatment should be such as to dissolve all the carbide.

Tantalum steels. L. Guillet. Compt. rend., 1907, **145**, 327—329.

Tantalum steels containing 0·12—0·18 per cent. of carbon and 0·09—1·05 per cent. of tantalum were prepared and examined micrographically and mechanically. They were all perlitic, and showed no peculiarity of structure due to the tantalum. The mechanical tests showed that the breaking stress and the resistance to shock were slightly increased by the presence of the tantalum, especially in the case of the quenched steels, but to an extent not greater than would have been produced by an equal proportion of many other elements, especially nickel. The author concludes that tantalum steels present no characters meriting attention from an industrial point of view. —J. T. D.

Iron; Behaviour of —— with lead, bismuth, thallium, and cadmium. E. Isaac and G. Tammann. Z. anorg. Chem., 1907, **55**, 58—62.

IRON does not dissolve in lead or bismuth, and forms no compound with either. It does not dissolve in the solid state in thallium, and as it melts above the boiling point of thallium, its solubility in the liquid state can only be ascertained by experiments under pressure.—J. T. D.

Alloys of antimony with manganese, chromium, silicon and tin; of bismuth with chromium and silicon, and of manganese with tin and lead. R. S. Williams. Z. anorg. Chem., 1907, **55**, 1—33.

Antimony-manganese: The fused metals mix in all proportions. They form two compounds, Sb_2Mn_3 and $SbMn_2$, both grey alloys, less brittle and softer than their components. Both of these are magnetic; $SbMn_2$ has the higher permeability, but becomes non-magnetic at 250°—260° C., whilst Sb_2Mn_3 retains its magnetic character up to 320°—330° C. Antimony and Sb_2Mn_3 form mixed crystals containing 50—60 atoms per cent. of manganese, and antimony and $SbMn_2$ form a second series, containing 65—69 atoms per cent. of manganese.

Antimony-chromium: The metals mix in all proportions, and form two compounds, Sb_2Cr, silver-white and extremely brittle, and SbCr, dark grey, so slightly coherent that it can be crushed between the fingers. There are two series of mixed crystals, chromium and antimony, containing 94—100 atoms per cent., and chromium and SbCr, containing 50—52·5 atoms per cent. of chromium.

Antimony-tin: The metals mix in all proportions, and yield three series of mixed crystals, containing 0—8, 49·8—52·8, and 90—100 atoms per cent. respectively, of antimony. Possibly the 50 per cent. mixed crystal is really a compound, SnSb.

Antimony-silicon: From alloys containing 0·5—99·0 atoms per cent. of silicon there separate mixed crystals rich in silicon, in a matrix of antimony; when the silicon content is below 0·5 atom per cent. these crystals are no longer visible—the silicon apparently remaining dissolved in the antimony.

Bismuth-silicon: The mixture separates into two layers, the upper, pure silicon, the lower, bismuth, in which it is doubtful whether or not a very small proportion of silicon is dissolved.

Bismuth-chromium: These two metals are practically immiscible, and form no compounds.

Manganese-tin: The metals mix in all proportions, and form three compounds, $SnMn_4$, steel-grey, less brittle than manganese; $SnMn_2$, very similar to the former, and SnMn (this is a doubtful compound). The compound, $SnMn_2$, shows a slight magnetic permeability, and $SnMn_4$ not only has a much higher permeability, but shows weak permanent magnetism. Besides the compounds, a series of mixed crystals exists, containing 96—100 atoms per cent. of manganese.

Manganese-lead: Melted manganese dissolves 10 per cent. of lead; from alloys containing less lead than this, manganese crystallises out, and when the lead content rises above 10 per cent., separation into two layers occurs, an upper, the limiting alloy, and a lower, of lead. —J. T. D.

Iron-platinum alloys. E. Isaac and G. Tammann. Z. anorg. Chem., 1907, **55**, 63—71.

IRON and platinum form at high temperatures a continuous series of mixed crystals, which on cooling are converted into two series, one containing 0—50, the other 60—100 per cent. of platinum. The melting-point diagram shows considerable analogy between these and the nickel-iron alloys. This analogy is stronger in the case of the alloys rich in iron than in the case of those rich in nickel or platinum; the differences in these latter alloys no doubt arise from the fact that nickel exhibits a transformation-point while platinum does not.

The micrographic examination of a specimen of native platinum containing 9·4 per cent. of iron showed it to be very similar in structure to the artificial alloy with a similar composition.—J. T. D.

Platinum; Alloys of —— with copper, gold, silver, tin, and lead. F. Doerinckel. Z. anorg. Chem., 1907, **54**, 333—366.

BY a study of the cooling curves of some alloys of platinum, and by microscopical examination, the author arrives at the following results:—Platinum alloys with gold or copper in all proportions forming a series of mixed crystals. With silver the series is only continuous up to a platinum content of 48 per cent. But platinum shows a greater affinity for metals of the lead group than for those more decidedly electro-positive, lead and tin forming a number of definite compounds with platinum. The only lead compound of which the composition has been established, has the formula, PtPb. Tin forms the compounds, Pt_3Sn, PtSn, and probably also, Pt_3Sn_8, and Pt_2Sn_3, the latter one existing in two modifications. The substance, PtSn, melts to a homogeneous liquid, but the other compounds are not fusible without decomposition. The platinum-lead alloy containing 2·5 per cent. of platinum is more readily oxidised than lead itself, and all are attacked by nitric acid. Platinum-tin alloys containing not more than 30 per cent. of platinum are readily attacked by dilute mineral acids, those containing about 40 per cent. of platinum are but slowly attacked by concentrated acids, and those with 90 per cent. of platinum are scarcely at all acted on by *aqua regia*.—F. SODN.

Platinum; Silicide of ——. P. Lebeau and A. Novitzky. Compt. rend., 1907, **145**, 241—243.

BY direct combination of the elements, a platinum silicide is obtainable, having the formula, SiPt. Its general chemical characters are similar to those of platinum, but it is more readily attacked by oxidising agents. —J. T. D.

Tin-nickel alloys. E. Vigouroux. Compt. rend., 1907, **145**, 246—248. (See also this J., 1907, 413 and 472.)

ALLOYS containing from 40 to 55 per cent. of tin yield, on continued treatment with hydrochloric acid, an insoluble residue of a composition corresponding to the formula, Ni_3Sn_2.—J. T. D.

Aluminium; Autogenous soldering of ——. M. U. Schoop. Chem.-Zeit., 1907, **31**, 749—750.

THE surfaces to be joined are cleaned, placed in contact with each other, and covered with a mixture of alkali (potassium, sodium, lithium) chlorides applied either in the form of an aqueous paste, or, for thicker pieces, as a dry powder. The soldering is then carried out by means of an oxygen-blowpipe flame. The mechanical strength of aluminium welds made in this way is claimed to be very great. (See Fr. Pat. 374,089; this J., 1907, 828.) —A. G. L.

Manganese borides; Preparation and properties of ——. A. B. du Jassonneix. Ber., 1907, **40**, 3193—3199.

THE author recapitulates his work (this J., 1905, 94) on the preparation and properties of manganese boride, MnB, and points out that its ready decomposition by hydrochloric acid affords a means of separating it from the compound, MnB_2, first prepared and described by Troost and Hautefeuille. Though the hydrogen evolved during the solution of the monoboride in acid burns with a green flame, it contains only unweighable traces of boron compounds. Manganese-boron mixtures containing from 1·4 to 28·6 per cent. of boron were investigated as to their magnetic properties. The magnetic susceptibility rose from zero to a maximum at a boron content of 13—15 per cent. (corresponding to MnB), and fell again to zero when the composition corresponded to the compound, MnB_2.—J. T. D.

Platinum in New South Wales. Mining World, July 20. [T.R.]

Advices state that a prospecting party has discovered a platinum-bearing vein of ferruginous material, about six miles from Stephen's creek, in the Broken Hill district. The property is being opened up, and samples sent to Sydney assayed from 1 to 4½ ozs. of platinum per ton.

Discovery of manganese in Borneo. Bd. of Trade J., Aug. 1, 1907. [T.R.]

The Commercial Intelligence Branch are informed that considerable deposits of manganese were recently discovered at Taritipan in Marudu Bay. The first cargo was shipped from North Borneo early this year, but, owing to an exceptionally rainy season which devastated the works, no further shipments have been made.

Production of manganese ore. Ch. of Com. J., Aug. [T.R.]

The "Iron Age" says that out of the world's production of 1,100,000 tons of manganese ore, Russia produced 426,813 gross tons in 1905; Brazil, 233,950 tons; India, 150,297 tons; Germany, in the previous year, 52,866 tons; Turkey, 49,100 tons; Spain, 26,895 tons; Chile, 17,110 tons in 1903; Austria, 13,788 tons; Hungary, 11,527 tons in 1904; with France, Japan, Greece, and Cuba following with lesser supplies.

Laurium mines. [*Lead and Silver.*] Eng. and Mining J., 1907, **84**, 217. [T.R.]

The smelters at Laurium, Greece, in 1906 treated 180,102 metric tons of ore, which yielded 12,127 tons of lead, containing an average of 1504 to 1793 grms. of silver per ton. The result of the year is considered satisfactory, but there are signs of the exhaustion of several of the ore-producing strata belonging to the French Sunium Company's concession, and it is expected that work will very shortly be reduced to a great extent.

Carnotite in Colorado. Mining World, July 20, 1907. [T.R.]

The name carnotite was applied in 1899 by Cumenge and Friedel to a canary-yellow ochreous pigment that was found impregnating a silicious sandstone in Montrose county, Colorado.

This mineral is a source of uranium and vanadium, and tests have also shown that it contains radium.

Carnotite has been discovered at a number of places in Colorado and adjacent parts of Utah. Particularly interesting deposits are found near the valley of Coal creek, about 14 miles north-east of Meeker, in Rio Blanco county, in the north-western part of Colorado. Hoyt S. Gale, of the United States Geological Survey, has written a brief account of the deposits.

Blast-furnace slag and cement; Physico-chemical relations of highly basic ——. K. Zulkowski. *See* IX.

Patents.

Stirring arms for roasting-furnaces. C. Lean, London. Eng. Pat. 27,061, Nov. 28, 1906.

Each arm is kept in position by a pivot, either on the upper side or underneath, which slides in a bayonet groove in the shaft, so that it can be disengaged when the shaft is stationary by giving it a slight movement in a plane at right-angles to the shaft in the direction of rotation. The stirring arm is thus a two-armed lever of which the longer is the raking arm, and the shorter extends into the shaft and serves to secure the lever. When two stirring arms are attached to one shaft, they are placed diametrically opposite, and dovetail into one another in the centre of the shaft.—O. F. H.

Furnaces; Open-hearth, melting or other ——. A. H. Cooper and E. D. Morgan, Linthorpe, Yorks. Eng. Pat. 28,936, Dec. 19, 1906.

Each air- and gas-port of the furnace is provided with its own separate communication in the form of a suitable curved tube let into a distributing plate, between which and the furnace itself there is formed a recess, serving to mix the gases before their entry into the furnace. Each tube is provided with a water-seal arrangement which allows of free expansion and contraction.—A. G. L.

Ore concentration, and apparatus therefor. H. L. and E. A. Sulman, London. Eng. Pat. 9981, April 28, 1906.

The powdered ore and a thin layer of liquid (*e.g.*, water) are fed on to a surface over which movable members or squeegees, provided with flexible (india-rubber) lower edges, sweep periodically, so as to expose the ore alternately to the action of the air and of the liquid. The surface should preferably be inclined, but not sufficiently so to cause the ore to flow off of its own accord. At the lower end of the surface, the ore particles which have not been floated, sink through the liquid to the bottom of a spitzkasten, whence they may be removed for re-treatment to a second surface, whilst the floated particles pass over a partition into a second spitzkasten.—A. G. L.

Iron; Production of ——. H. T. Simpson, Bilbao, Spain, and A. E. Bourcoud, Clapham Park, Surrey. Eng. Pat. 21,770, Oct. 2, 1906.

The ore is reduced in a blast-furnace by means of a hot blast of carbon monoxide or of carbon monoxide and hydrogen. The waste gases from the furnace are then heated in a stove and passed through a producer or "regenerator" charged with coke, where the carbon dioxide present is reconverted into carbon monoxide. The gas from the regenerator passes through a second stove and thence to the reduction furnace. Means are provided for allowing a part only of the gases to enter the furnace, the remainder circulating through the first stove and regenerator.—O. F. H.

[*Iron*] *Scale and oxide from metallic surfaces; Removal of* ——. S. O. Cowper-Coles, London. Eng. Pat. 23,664, Oct. 24, 1906.

The articles to be treated are heated in a closed vessel through which is passed a stream of pure hydrogen produced electrolytically, and dried by passing through sulphuric acid and thence over calcium chloride.—O. F. H.

Silver; Process for rendering —— *non-tarnishable.* S. O. Cowper-Coles, London. Eng. Pat. 25,966, Nov. 16, 1906.

The silver article is coated by electro-deposition or other means with a metal such as zinc, which will alloy with silver and is not blackened by sulphur. The coated silver articles are then subjected to pressure by placing them in a closed cylinder into which a liquid, such as petroleum or petrol, or a solution of a salt of the coating metal, is pumped.—O. F. H.

Wire of copper and any other metal ; Process for the manufacture of bimetallic ——, in predetermined proportions. J. B. Clamens, Paris. Eng. Pat. 135, Jan. 2, 1907. Under Int. Conv., Jan. 3, 1906.

Composite wire of steel and copper is prepared, containing comparatively little copper. For this purpose, discs of "Martin extra mild steel," 30—60 cm. in diameter and 15—50 mm. thick, are cleaned, polished, and electrolytically coated with a film of copper, tin, or zinc to prevent oxidation. Electrolytic cast copper rolled into sheets 0·5—2 mm. in thickness, is punched into discs 8 mm. larger than the steel discs, on which they are then fastened by turning up the edge so as to form a flange ; the copper on one face of the steel amounts to 4 to 10 per cent., on the other to 1 or 2 per cent. The discs are then piled on one another, with plates of steel between them to prevent welding from taking place, and after connecting by means of heavy bottom and top plates, the discs are heated to 800—900° C. and pressed. After cooling, the individual discs are cleaned and pressed hydraulically so as to form a socket 100—150 mm. in diameter, 200—250 mm. high, and with a bore 80—90 mm., the 4—10 per cent. of copper being on the outside, and the 1—2 per cent. on the inside of the socket. Bars of extra mild steel of the same diameter and somewhat greater length than the bore of the socket are then introduced. The whole is then re-heated and rolled hot until a diameter of 45 mm. is obtained, when welding is complete. These bars are again heated and rolled hot to wire of any desired diameter. —A. G. L.

Cyaniding ; Process of ——, and apparatus therefor. W. A. Merralls, San Francisco, Cal. Eng. Pat. 1344, Jan. 18, 1907.

The gold-bearing material and cyanide solution are introduced into a tank or vat having a filter at the bottom, and provided with a propeller-shaped agitator rotating horizontally. The filtration can be assisted by air pressure, and agitation is continued during filtration, means being provided for adjusting the agitator to the level of the pulp in the tank.—O. F. H.

Iron and steel ; Method of treating ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 858,326, June 25, 1907.

An alloy of titanium and calcium is added to the molten iron or steel. In addition to titanium and calcium, any or all of the elements aluminium, silicon, carbon, and iron may be present in the added alloy.—O. F. H.

Alloy and method of producing it. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 858,327, June 25, 1907.

An alloy of titanium and calcium is produced by reducing by carbon in an electric furnace or by other means, a charge containing the oxides or oxygen compounds of titanium and calcium. The process may be made continuous by adding fresh portions of the charge and withdrawing the product as desired. In a similar manner, an alloy may be made containing any or all of the elements silicon, aluminium, carbon, and iron in addition to titanium and calcium.—O. F. H.

Vanadium sulphide ; Process of reducing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 858,328, June 25, 1907.

The process consists in reducing vanadium sulphide with the calculated quantity of silicon or a silicon alloy, such as ferrosilicon. The process may be made continuous by adding fresh portions of the charge, and withdrawing the product as desired.—O. F. H.

Cyanide briquette [for gold extraction], and process of making same. J. Bueb, Dessau, Germany, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 859,482, July 9, 1907.

A solution of free caustic alkali is added to a cyanide solution, and the mixture is allowed to crystallise, whereby particles of cyanide mixed with, and inclosed by, a layer of free caustic alkali, are obtained. These are dried, and formed into briquettes by compression.—A. S.

Pyritic smelting ; Process of ——. H. Arden, San Diego, Cal. U.S. Pat. 860,512, July 16, 1907.

Air heated to a high temperature by electricity, is mixed with a hydrocarbon vapour, and brought into contact with a sulphide ore.—A. G. L.

[" *Aluminium* "] *Solders.* W. R. Mitchell and J. B. Vigo. Fr. Pat. 375,756, Feb. 12, 1907.

In making these solders, three substances are first prepared, by mixing and melting together 5 kilos. of zinc, lead, or tin with 28, 28, and 21 grms. respectively of potassium chlorate. A hard solder suitable for general use is obtained by melting 200 grms. of this " prepared " zinc with 56—57 grms. of zinc chloride and 56—57 grms. of tin chloride, adding the melted mixture to 56—57 grms. of aluminium heated to a white heat, stirring, allowing the mass to cool, and again melting it at a dark red heat after the addition of a further 56—57 grms. of zinc chloride and 56—57 grms. of tin chloride. A softer and more fusible solder is obtained by melting 200 grms. of the above solder with 28 grms. of zinc chloride and 28 grms. of tin chloride, and adding the mass to a fused mixture of 28 grms. of " prepared " lead, 56—57 grms. of " prepared " tin, 28 grms. of zinc chloride and 28 grms. of tin chloride. A still softer solder is obtained by substituting 56—57 grms. of cadmium for 28 grms. of the " prepared " tin in the last mixture.—A. G. L.

Lead ; Obtaining metallic —— from lead sulphide. Soc. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude). Fr. Pat. 375,780, May 22, 1906.

Oxygen, or air enriched in oxygen, is blown into melted lead sulphide (galena), metallic lead, sulphur dioxide and a certain amount of lead sulphide dust being formed. This last is collected and submitted to a second similar operation. The gas used may preferably be heated. —A. G. L.

Copper ; Process for the extraction of —— from copper residues. D. Crispo. Fr. Pat. 375,899, Mar. 20, 1907.

Copper is recovered from residues by treating them with dilute sulphuric acid and manganese dioxide. The solution of copper sulphate obtained is treated in any usual way.—A. G. L.

Metallic pieces ; Process and apparatus for making composite ——. J. F. Monnot. Fr. Pat. 373,972, Jan. 14, 1907.

See Eng. Pat. 8913a of 1906 ; this J., 1907, 696.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Nitrogen and oxygen ; Action of the electric spark on —— at low temperatures. E. Briner and E. Durand. Compt. rend., 1907, **145**, 248—250.

Electric sparks were passed through dry air at atmospheric pressure at the ordinary temperature, at the temperature of solid carbon dioxide and ether (– 80° C.), and at that of liquid air (–190° C.); and the amount of nitrogen peroxide formed was estimated from the diminution of pressure. The limiting concentrations reached were respectively 5—6, 10—15, and 20 per cent., the last corresponding to the complete fixation of the oxygen. Experiments with the vessel immersed in liquid air, and containing in different series mixtures of 4 vols. of nitrogen to 1 of oxygen (air), equal volumes of the two, and 1 vol. of nitrogen to 2 of oxygen, shewed that in all cases the ultimate product is nitrogen peroxide; but the existence in one case of a minute quantity of a blue substance (nitrogen trioxide), lends support to the view that the substance directly formed by the spark is nitric oxide, which is then oxidised in the first place to the trioxide, and ultimately, after a longer period, to peroxide. The yields of peroxide in grms. per kilowatt-hour were respectively 0·55, 0·77 and 0·50. Another series of experiments was made on the mixture of 1 vol. of nitrogen and 2 vols. of oxygen (still in liquid air) at different pressures. The yields, at pressures of 460—217 mm., were 0·8—0·6, and at pressures of 145—4 mm., 1·43 grms. per kw.-hour. It thus appears that the fixation of nitrogen as oxide gives better yields than its fixation as ammonia. (See this J., 1907, 416.)—J. T. D.

PATENTS.

Active materials for electric accumulators. H. Leitner, Woking, Surrey. Eng. Pat. 23,413, Oct. 22, 1906.

A SMALL percentage of gum tragacanth is added to the usual substances employed as active materials for electrodes in accumulators.—B. N.

Electrolytic production of chemical compounds; Apparatus for the ——. C. F. Carrier, jun., Assignor to Elmira Electro-Chemical Co., Elmira, N.Y. U.S. Pat. 859,431, July 9, 1907.

THE apparatus comprises a pan, adapted to contain a molten metal, and anode and cathode compartments, with their lower ends open and supported above the bottom of the pan in such a position that the compartments are sealed by the liquid metal. A channel is formed on the under side of the pan, leading from a point beyond the cathode compartment to a point below the electrode in the anode compartment. In the channel, immediately beyond the cathode compartment, is mounted a screw propeller, and by the rotation of this, a circulation of the metal of the bath is produced through the channel from the cathode to the anode compartment. The circulation of the metal thus causes an upheaval immediately below the anode. Means are provided for charging the compartments, and for drawing off the product from the cathode compartment.—B. N.

Arcs of high tension with a high tension circuit; Process for connecting in series ——. Salpetersäure Ind-Ges.m.b.H. Fr. Pat. 375,268, Feb. 21, 1907. Under Int. Conv., July 6, 1906.

THE arc gaps are connected in series, and each, with the exception of one gap, is bridged by a shunt of high resistance. These resistances may be connected in parallel or in series, or in two portions, each portion being connected in series or in parallel.—B. N.

Electrodes; Manufacture of —— from fused oxide of iron. Chem. Fabrik Griesheim-Elektron. Fr. Pat. 375,595, March 11, 1907.

MAGNETIC oxide of iron is fused, and a quantity of ferric oxide is added, sufficient to convert all the excess of ferrous oxide present into the tetroxide. Instead of ferric oxide, any oxide, such as oxide of manganese or chromium, capable of combining with the ferrous oxide, may be employed. The fused mixture is then poured into tubular moulds, closed at the bottom, and as soon as a sufficiently thick layer has solidified upon the walls of the mould, the remainder of the fused substance is poured back into the crucible; the cylindrical electrode thus produced is then furnished with a metallic core. Alternatively, a metallic rod (of copper, nickel, or other non-reacting metal) is pushed into the fused mixture in the mould and allowed to become fixed therein upon solidification occurring.—H. B.

Black diamond; Obtaining amorphous fused or ——. L. Bonnet. Fr. Pat. 375,669, May 19, 1906.

THE process claimed consists in fusing carbon by means of a high-tension electric current in a gaseous or liquid medium under high pressure, and having no action on the carbon. The apparatus described consists of a thick-walled vessel of bronze or other suitable metal in which are two thick carbon electrodes, having between them a rod of pure carbon. Below this rod is a capsule containing carbon bisulphide or other liquid which will produce a high pressure when vaporised, and which has no action on carbon. A current is first passed sufficient to produce a high pressure in the vessel by means of the carbon bisulphide vapour, and then a high-tension current is passed for a few moments, whereby the carbon is fused. Instead of producing the pressure by vaporising a liquid, an inert gas under pressure may be forced into the vessel, and the pressure increased as before by the passage of an electric current.—A. S.

Calcium carbide; Manufacture of ——. S. Mizgier. Fr. Pat. 375,666, May 17, 1906.

A MIXTURE of lime with anthracite, preferably in the proportion of 60 parts of the former to 34 of the latter, is used as a resistance medium between two electrodes in a covered crucible. Considerable economies as to the consumption of electrodes and otherwise are stated to be effected by thus substituting an electric resistance process for that of the arc.—E. S.

Nitric acid and other compounds; Electro-chemical process and apparatus for manufacturing ——, by means of gases. G. J. J. Brisset and A. M. Muguet. Fr. Pat. 375,349, May 11, 1906.

THIS invention relates to the production of oxygen compounds of nitrogen from air by means of an electric arc, spread out in a magnetic field so as to obtain a long luminous flame drawn out in front of the magnet. For this purpose two horns provided with arms are attached to the poles of the magnet to extend the lines of magnetic force. The electrodes are supplied with an alternating movement for the rapid production of a series of arcs, drawn out by the magnetic force; or a high-tension alternating current may be employed instead. The electrodes are provided with an "amplifying conductor" for the arc, to bring it in a regular way within the sphere of influence of the magnet. The reactions are carried out in a tall narrow tower, provided with interior ribs to bring the gases over the arc and thus ensure regular working. The tower is composed of refractory insulating material, and is pierced at the bottom by two electrodes arranged between the poles of an electro-magnet placed on each side of the narrowest part of the tower. Air is supplied to the bottom part of the tower, and on to the sides to cool the electrodes and the amplifier. The electrodes may be hollow to form an electric condenser, and to allow the air to pass into the amplifier in order to cool it. The walls of the tower may be provided with radiators. Several arcs may be arranged in one tower, and by a suitable arrangement of inlet and outlet, the gases may pass over two successive arcs or over one arc only. Several towers may be connected together, and a condenser joined to the electrodes of one series of towers. Coils are inserted in the main wires as a protection for the transformer or generator against discharge of the condensers. When two towers are in communication, the poles of the magnets are connected by a transverse bar so that only one coil is used for each pole. For the manufacture of nitric acid, the use of an alternating current is recommended as more economical than a continuous current.—W. C. H.

Sulphides of alkali metals from their sulphates; Process of preparation of ——. Soc. Ind. Elettro Chimica di Pont Saint-Martin and A. Piccinini, Italy. Fr. Pat. 375.529, Feb. 28, 1907. Under Int. Conv., March 1, 1906.

Sulphides of alkali metals are prepared by the reduction of their sulphates by means of carbon, which is also a good conductor of electricity, the carbon being heated by means of a continuous or alternating current, the intensity of which is proportioned to the section of the reducing mass. Any suitable closed electric furnace may be employed, which comprises a chamber with orifices, which may be closed, for charging and discharging the material to be treated, and which is provided with fixed and adjustable electrodes, the mass of carbon, acting as the reducing agent, closing the circuit between the electrodes. Or, an electric furnace, in which a triphase circuit is employed, may be used, the mass, acting as reducing and heating agent, being distributed in three distinct chambers of reaction, thus serving for the manufacture of other sulphides, or the mass may be contained in one chamber of reaction formed by joining three similar chambers into a single crucible.—B. N.

Ozone; Apparatus for the production of ——. E. Applegarth and J. R. Quain. Fr. Pat. 375,507, Feb. 15, 1907. Under Int. Conv., Feb. 16, 1906.

See Eng. Pat. 3905 of 1906; this J., 1906, 992.—T. F. B.

Electrolytic cells; Batteries of ——. R. H. F. Finlay. Fr. Pat. 375,416, March 6, 1907.

See Eng. Pat. 1716 of 1906; this J., 1907, 620.—T. F. B.

Glow bodies for incandescence electric lamps; Manufacture of ——. H. Kuzel. Fourth Addition, dated Feb. 27, 1907, to Fr. Pat. 359,025, Jan. 9, 1905. *See* II.

Artificial silk, artificial hair, and plastic cellulose products; Washing of, and the rapid and complete removal of copper from ——. E. Crumière. Fr. Pat. 375,827, March 16, 1907. *See* V.

(*B.*)—ELECTRO-METALLURGY.

Steel hardening- and tempering-oven with electrically-heated melting-bath. L. M. Cohn. Elektrotech. Zeits., Aug. 2, 1906, 721—5.

The oven consists of a cast-iron casing lined with firebrick, within which is placed a crucible separated from the firebrick by a layer of asbestos. Alternating current (to minimise electrolytic action) is passed between two plates of soft iron, acting as electrodes in the crucible, which contains a suitable fusible salt, the composition of which depends on the temperature required. For temperatures over 1000° C. pure barium chloride (melting-point about 950° C.), and for lower temperatures a mixture of two parts of barium chloride to one part of potassium chloride, melting at about 670° C., is used. The salts in question being practically non-conductors when cold, but good conductors when molten, an auxiliary carbon electrode is required to start the fusion and form a strip of molten salt between the two iron electrodes, whereupon the rest of the salt in the crucible gradually melts.

The temperature of the oven being dependent on the current passing through the molten salts, an oil-insulated auto-transformer giving a number of different voltages is employed in connection with an auxiliary resistance, or, in cases where direct current only is available, a rotary converter may be installed. The temperature of the oven can be most accurately recorded by means of a pyrometer and a d'Arsonval galvanometer suitably calibrated, and, with the exception of a layer 10 millimetres ($\frac{3}{8}$ inch) thick at the top, is found to be practically uniform throughout the molten mass and absolutely uniform in any given horizontal section. Between temperatures of 880° C. and 1300° C. the power required to work the oven varies between 5·4 and 12·25 kilowatts, while about half an hour suffices for starting.

Tungsten; Melting-point of pure ——. H. von Wartenberg. Ber., 1907, **40**, 3287—3291.

By using in a vacuum tube an anode of pure tungsten and a Wehnelt cathode, the fall of potential at the cathode is reduced to 1—2 volts, and it becomes possible to send through the tube very considerable currents—say 20 ampères—at moderate voltages—100 to 110. When this is done, the fall at the anode is about 40 volts, and the whole energy of this—$40 \times 20 = 800$ watts—is spent in heating the cathode. It was possible in this way (details of the experimental appliances are given in the paper) to melt the tungsten, and observe the temperature of melting by means of a Wanner pyrometer. The melting-point thus obtained lies between 2800° and 2850° C.
—J. T. D.

Boron; Compounds of nickel and cobalt with ——. B. du Jassonneix. Compt. rend., 1907, **145**, 240—241.

From fusions in the electric furnace of mixtures of boron with nickel and cobalt, there can be separated by appropriate treatment, besides the compounds, NiB and CoB, already described by Moissan, compounds having the formulæ, Ni_2B and Co_2B, and NiB_2 and CoB_2.—J. T. D.

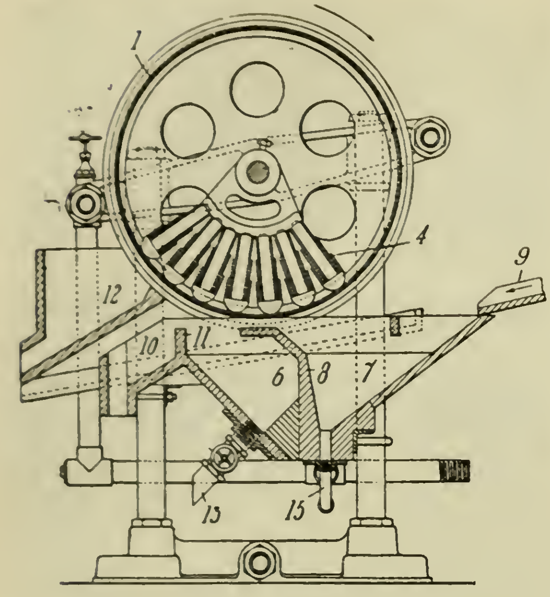
Patents.

Electrotypes; Process for the rapid production of ——. S. O. Cowper-Coles, London. Eng. Pat. 17,617, Aug. 4, 1906.

The anodes and moulds or cases, suspended from rods in the electrotyping vat, are subjected to a spraying of the electrolyte, and the latter is afterwards pumped up and discharged as a fine spray, in contact with the atmosphere, on to a filter composed of sand and blankets. From the filter, the electrolyte is delivered to spraying pipes located in the vat beneath the anodes or cathodes, the liquid being thus caused to rapidly circulate over the faces of the cathodes or anodes. Instead of electrolyte, air may be delivered from an air compressor through the spraying pipes, in order to bring about a circulation of the electrolyte.—B. N.

Ore; Magnetic separation of ——. Metallurgiska Patentaktiebolaget, Stockholm, Sweden. Eng. Pat. 210, Jan. 3, 1907. Under Int. Conv., Jan. 9, 1906.

The powdered ore, mixed with water, is fed from the pipe, 9, to the top of one compartment, 7, of a funnel-shaped tub, which is divided by the partitions, 8 and 11. The ore is met by a current of water flowing upwards through the pipe, 15, and is thus carried close to a rotating drum, 1, of diamagnetic material (*e.g.*, zinc or brass) inside which are stationary electro-magnets, 4. The non-magnetic ore particles sink to the bottom of the second compartment, 6, of the tub, whence they are removed by the pipe, 13; the feebly magnetic particles move with the drum, but are retained by the liquid owing to surface tension, and only float over the partition, 11, into the compartment, 10; whilst the strongly magnetic



particles adhere to the drum until they are past the electro-magnets, when they fall into the collector, 12.
—A. G. L.

Vanadium and its alloys; Process of producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 858,325, June 25, 1907.

The process consists in passing an electric current through a molten bath of vanadium oxide and the calculated quantity of silicide of carbon required for its reduction, a basic flux being used. The process may be made continuous by adding fresh portions of the charge and withdrawing the product as desired. Vanadium alloys, such as ferro-vanadium, may be produced by reducing the vanadium compound in the presence of iron or other alloying metal.—O. F. H.

Metals and alloys; Process of effecting chemical reduction and producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., West Virginia. U.S. Pat. 858,329, June 25, 1907.

Partial reduction is effected by means of a non-metallic reducing agent such as carbon, and the reduction completed by silicon carbide. As applied to the reduction of vanadic oxide the process consists in electrically smelting first with carbon to yield vanadous oxide, and then with silicon carbide to complete the reduction to vanadium.—O. F. H.

Furnace; Electric ——. E. A. Colby, Newark, N.J., Assignor to American Electric Furnace Co., New York. U.S. Pat. 859,641, July 9, 1907.

The electric induction furnace described is provided with an annular crucible, in which the charge forms a secondary circuit, a core of magnetic material being disposed in the circular space enclosed by the crucible. Between the core and the crucible, and separated from the latter by an air space, is a removable inducing coil, this being so constructed that a free circulation of air is obtained "through, outside of, and between the turns of the coil," thus preventing variations of resistance due to heat radiated from the crucible. A rectangular frame of magnetic material surrounds and supports the crucible and the coil on its lower member, detachable upper and middle members of the frame being arranged to support the coil and core, and clamp these down on to the lower member. The coil consists of a number of turns with separated bodies of refractory insulating material, these being disposed between the turns, and provided with recesses to receive the coil. A ring of insulating material surrounds the coil. The insulating bodies are superposed to form a vertical column, and, by clamping down the coil, the bodies are held in contact with each other. The primary coil may also be made tubular, with means for establishing a circulation of refrigerating liquid within it. The core is constructed of laminated magnetic material, the laminations being of different width, so as to form symmetrically-disposed longitudinal recesses, and tubes of insulating material are arranged in the recesses between the coil and the core. A terminal of conducting material is provided with a duct, with means for connecting a liquid-conduit to the duct, and a conductor is attached to the terminal, the latter and the duct being electrically connected to the tubular coil.—B. N.

Electrolytic cask. J. Lafond. Fr. Pat. 375,589, March 11, 1907.

This invention relates to apparatus designed for the deposition of metals on light objects, the latter being contained in a cask immersed in an electrolyte. The cask consists of two lateral discs of insulating material, with the cylindrical portion constructed in the manner of "Venetian shutters," so that the electrolyte may easily penetrate to the interior. On the shaft on which the cask is mounted, is a fixed box, prismatic in form, of insulating material, with the exception of the lower wall which constitutes the anode, and to which the current is brought by means of a cable passing through the hollow shaft. By means of an arrangement of levers and connecting rods, the cask may be rotated if necessary, and the speed may be varied by means of a sliding attachment in a groove for the connecting rod.—B. N.

Furnace; Electric ——. Allmänna Svenska Elektriska Aktiebolaget. Fr. Pat. 375,382, March 5, 1907. Under Int. Conv., March 7, 1906.

See Eng. Pat. 5345 of 1907; this J., 1907, 535.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Oils; New constants of ——. E. Louïse and E. Sauvage. Compt. rend., 1907, **145**, 183—185.

If acetone be mixed with a fatty oil at a definite temperature, the composition of the two layers into which the mixture separates on standing, remains practically constant whatever the amounts of the respective liquids used. Thus with colza oil the following results were obtained, the letters *a* and *b* representing the quantities of oil in one grm. of the liquid from the upper and lower layers respectively.

Temperature.	Oil, grms.	Acetone, c.c.	*a*.	*b*.
°C.			grm.	grm.
13	50	80	0·220	0·499
—	50	120	0·21	0·513
12·5	40	80	0·193	0·52
—	40	120	0·18	0·52

In the authors' opinion these results show that the oil and acetone may be regarded as forming *double mixtures.* The value of *a* increases constantly with the rise in temperature, whilst the value of *b* decreases, until at a certain point *a* becomes equal to *b*, and the two layers blend, forming a limpid fluid of homogeneous composition.

Thus 40 grms. of purified colza oil mixed with 80 c.c. of acetone gave the following results:—

Temperature. °C.	a. grm.	b. grm.
0	0·095	0·6425
7·5	0·128	0·572
12·5	0·185	0·520
15·4	0·384	

The temperature 15·4° C., may be called the *critical temperature* of this oil, and similar values may be obtained with other oils. For practical purposes it is easier to determine the curve of miscibility as follows:—A given weight of oil is mixed with 20 c.c. of acetone (measured at 12° C.), and the tube immediately closed by means of a stopper through which passes a thermometer graduated in fifths of a degree. The tube is then heated (or in some cases cooled), until all turbidity disappears, and the *temperature of miscibility* is read upon the thermometer. The error of reading should not exceed $\frac{1}{5}$° C. The almost sudden disappearance of turbidity is very marked in the case of quantities of oil between 15 and 30 grms. With quantities less than 15 grms. the test is less sensitive, whilst with quantities exceeding 30 grms. the liquid may become too viscous for the temperature to rise uniformly throughout the whole liquid. It is stated that each oil has a characteristic temperature of miscibility, and that this affords a more accurate and rapid means of differentiating oils than most of the ordinary tests.

—C. A. M.

Dumoria Heckeli; Fat from the seeds of ——. A. Chevalier. *See* XVIII*A*.

Cottonseed oil and its competitors. U.S. Cons. Reps., June, 1907, through Oil, Paint and Drug Reporter, July 29, 1907. [T.R.].

Belgium.

Cottonseed oil of good quality competes with peanut and sesame oils in the manufacture of margarine, and is employed in mixing with olive oil. "Prime summer yellow," previously exclusively used in the manufacture of margarine, is frequently replaced by peanut oil and sesame oil, also imported from the United States. The market value of these last two oils is respectively from $14.47 to $19.30 per 100 kilos (220 lb.) and $12.54 to $17.37 per 100 kilos. "Prime summer yellow" of extra quality is also used in mixing with olive oil and occasionally used in its pure state as a table oil. "Off summer yellow" could be sold in large quantities in Belgium if offered at reasonable prices.

Maize oil, imported from the United States and used in soap making, comes into competition with cottonseed oil, but of late this importation has decreased to almost nothing.

The following table shows the amount of importations of the olive, cottonseed and maize oils and the countries from which each was imported during the year 1906:—

Country of origin.	Olive oil.	Cottonseed oil.	Maize oil.
	Pounds.	Pounds.	Pounds.
United States	—	6,487,884	20,024,972
England	35,682	9,806,221	251,911
France.............	3,214,658	6,241	—
Germany...........	27,958	—	—
Hamburg	42,594	28,050	43,663
Holland............	59,814	4,190,014	164,465
Italy	332,350	—	—
Spain	17,415	—	—
Other countries	174,724	207,913	132,442
Totals	3,905,195	20,726,323	20,617,453

Of other oils that compete with cottonseed oil the imports were: Poppy oil, 2,348,017 pounds, nearly all from France; peanut oil, 1,111,356 pounds; cocoanut oil, 3,487,314 pounds; lard, 30,240,014 pounds, of which 26,903,807 pounds are credited to the United States; butter, 11,101,393 pounds, the bulk of it from Holland.

France.

Cottonseed oil competes chiefly with the following oils and greases: Olive, arachis, gingelly seed, poppy seed, copra butter, tallow, butter, lard and other edible oils and greases. The prices of these articles are as follows: Olive oil, 125 to 145 francs per 100 kilos.; arachis oil, 90 to 92 francs; gingelly seed oil, 80 to 95 francs; poppy seed oil, 92 to 95 francs; tallow, 90 to 95 francs; lard. 132 to 140 francs, and butter, 250 to 350 francs.

Great Britain.

Cottonseed oil has free entry into English ports. It cannot be used as an adulterant of olive oil, as the latter must be labelled in bottles and tins as pure olive oil. Those oils sold as "salad oil," or other name, may be adulterated with cottonseed oil. From the number of such appearing in the retail markets a considerable quantity of the oil must be annually used.

Germany.

The coarser grades of cottonseed oil are consumed in the manufacture of soap. The soap factories of Saxony and Thuringia are eighty in number.

Practically no cottonseed oil is now sold as such in Saxony for table purposes. Some years ago the oil was imported for adulterating animal fats. The food laws of Germany have, however, put a stop to it. There is a somewhat limited permissible use of cottonseed oil in the manufacture of oleomargarine. Ten per cent. of the oil is added to the animal fats customarily employed. An oleomargarine factory in Chemnitz uses for this purpose about 20 tons annually.

The edible fats in Germany with which purified cottonseed oil would compete, are the following:—

Olive oil.—Saxony consumes about 250 long tons annually of edible oil. The consumption of the whole Empire is about 1,800 tons. In addition there is a consumption of about 4,500 tons of cheaper grades, denatured for industrial purposes by the addition of walrus oil, or by oil of cloves. Italy supplies over one-half of the total import. Three-eighths come from Turkey, and the remainder from France. The price of the different grades range from 110 to 150 marks per 100 kilos. The chemists of the Chemnitz municipal laboratory, where there is a very careful control over all food products, say that they never detect an adulteration with cottonseed oil.

Poppyseed oil is widely used for table purposes, especially among the poorer classes. The annual consumption in Saxony is estimated at 150 tons. The current prices are 76 to 78 marks per 100 kilos. This oil is manufactured chiefly in the region about Magdeburg.

Peanut oil is also used, and the consumption is about the same as that of poppyseed oil. When of French origin, it is frequently sold under the name of "Florida oil." The prices for various grades are 70 to 100 marks per 100 kilos.

Sesame oil.—The consumption is about equal to that of the two preceding oils combined. The prices range from 70 to 90 marks per 100 kilos.

A syndicate of German oil mills, five in number, with headquarters at Mannheim, is engaged in the expression of these three oils, producing about 100 tons per day. They furnish the major portion of the vegetable seed oils required for the German table, although there is an importation of peanut oil from Marseilles, where the extraction is carried out on an enormous scale, yielding about 80,000 long tons annually. The crude material comes chiefly from the French colonies in equatorial Africa.

Cocoanut oil.—A comparatively small amount is used in Saxony as a food product—about 5 tons annually. Large quantities are imported for use in soap manufacture.

Linseed oil.—This is extensively used as a food by the poor in Hungary, Poland, Russia and other parts of Eastern Europe. The demand for table purposes is limited in Germany, though the use is slowly extending.

Oleomargarine.—The consumption is steadily growing and the manufacture is now an important German industry. There are two large factories in Saxony and several in other parts of the Empire. Chemnitz receives daily from 10 to 15 tons to cover the demand in the city and in the tributary region. The current quotations are very variable, depending on the quality. They vary from $7.55 to $12.95 per 220 pounds.

Germany imports annually oils and oil-cake to the value of about $16,000,000 and exports about one-third of this amount. No discrimination is shown on the part of the Government against the use of cottonseed oil, other than the watchfulness against use for falsification and the somewhat elevated tariff rates.

The only mill in Germany for crushing cotton seed is at Gross Gerau, near Bremen, and its oil is said to be of fair quality. Several other factories have tried it, but with discouraging results, for the oil, cake and meal had a bitter, rancid taste and unpleasant smell, which has been attributed to a decomposition or oxidation of the seed shells while crossing the sea. The oil sent by England is inferior to the American, which is always rated from 4 to 5 marks higher per 100 kilos.

In Magdeburg, in the manufacture of soap, large quantities of oleine, an American product, were used until the present tariff law went into effect, which has advanced the duty by new classifications from 3 marks to 10 marks per 100 kilos. In the manufacture of soap cottonseed oil comes into competition with palm kernel oil.

With regard to introducing cottonseed oil no better method could be adopted than that organized by the representatives of such food products as maize, meal, oatmeal, and the like.

The time is propitious now for pushing the use of cotton by-products. Germany is intensely interested in the establishment and development of cotton culture in her own African colonies. While it will be many years before she can hope to cover her own demand for the fibre from the plantations of her colonial possessions, she is in an exceedingly receptive frame of mind for all suggestions connected with the industrial and economic utilization of every product of the cotton plant as bearing directly upon the problem to which she is now devoting not only careful planning, but considerable money outlay.

There is a good field for cottonseed oil among the peoples of Western Asia and Eastern Europe. The peculiar adaptation of this oil to the needs of the Moslem and Jewish populations, owing to their aversion to all swine fats, has frequently been noted, as well as the natural predisposition on the part of the Hindoo to vegetable oils. The adherents of the various Oriental Christian churches, dispense with fats of animal origin during their Lenten and other fasts. At that time sesame oil, linseed oil, and poppy-seed oil completely supersede butter, lard, suet, tallow, margarine, etc. As the adherents of these Oriental churches number over 100,000,000 and their fasts are much more frequent than in the Roman Catholic Church, the economic desirability of studying the needs of this large fraction of the human race assumes a very distinct importance.

PATENTS.

Fatty substance; Production of a —— from micro-organisms. G. W. Johnson, London. From Kalle and Co. Biebrich-on-the-Rhine, Germany. Eng. Pat. 26,077, Nov. 17, 1906.

PURE cultures of *Streptothrix leproides* or of other micro-organisms capable of resisting the action of acids, are washed, ground up with ammonia solution, treated with Adam's solution (100 parts by vol. each of ether and of a mixture of 30 grms. of ammonia solution of sp. gr. 0·92, 834 grms. of 90 per cent. alcohol, and 136 grms. of water), again washed, dried *in vacuo*, and extracted with a suitable solvent for fats, such as ether or chloroform. The filtered extract is evaporated, and the residue taken up with hot alcohol or acetone, from which there separates, on cooling, a white mass consisting of the glyceride of a fatty acid. It is stated that this fat, administered as an injection, has a curative or immunising action against leprosy or tuberculosis.—C. A. M.

Distillery by-products; Apparatus and process for treating —— in the wet way. L. Rivière. First Addition, dated May 12, 1906, to Fr. Pat. 362,654, Jan. 23, 1906. *See* XVII.

Essential oil; Extraction of —— from oils or fats, and notably from cocoanut oil. Soc. Rocca, Tassy et de Roux. Fr. Pat. 375,364, March 4, 1907. *See* XX.

Insecticide; Manufacture of soap to be used as ——. E. Fichtenau. Fr. Pat. 375,877. *See* XVIII*C*.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—PIGMENTS, PAINTS.

PATENT.

Monoazo dyestuff for lakes, and process of making same. O. Ernst and G. Gullbransson, Assignors to Farbwerke vorm. Meister, Lucius und Brüning. U.S. Pat. 858,065, June 25, 1907. *See* IV.

(*B*.)—RESINS, VARNISHES.

The clay turpentine cup. Oil, Paint and Drug Rep., Aug. 5. [T.R.]

TWENTY million turpentine cups are now used in the pine forests of the South to catch the flow of resin from the trees, and seven or eight million are added each year. These simple-looking cups are not unlike flower pots in size and shape.

The old plan of cutting deep boxes in the trees, in which turpentine collected after running down the scarified trunks, was universal until a few years ago.

The cup and gutter were devised to take the place of the old method. Small galvanised iron gutters, attached to the tree, lead the turpentine from the scarified wood to the cup. The amount thus collected is greater than by the old method, it is of superior quality, and it commands a higher price. Further than this, the tree thus operated upon is productive about eight years, instead of four, as under the old method, and produces more each year. (See also this J., 1902, 651, 652; and 1906, 821.)

PATENTS.

Pine resin; Apparatus for distilling ——. G. Lagrolet. Fr. Pat. 375,287, Feb. 28, 1907.

THE still is heated by means of a steam-jacket and an interior steam coil, and is also provided with a perforated tube for the injection of steam into the resin.—C. A. M.

Siccative for paints, varnishes, &c.; Manufacture of a colourless ——. G. Guittet. Fr. Pat. 375,856, March 18, 1907.

COLOURLESS siccatives are obtained by dissolving one or more suitable metallic salts (notably those of lead, manganese, or zinc) in water, and adding about 10 per cent. of glycerin to the solution.—C. A. M.

Linseed oil ; Manufacture of products [*varnish*] *from* ——. A. Genthe. Fr. Pat. 375,985, March 22, 1907.

In the manufacture of varnishes, &c., from linseed or other drying oils, claim is made for the preparation of peroxides of the nature of the auto-catalytic agents formed in the natural process of drying. For this purpose linseed oil may be exposed to the action of atmospheric oxygen and light, or it may be oxidised in an anode chamber under conditions favouring the formation of peroxides *e.g.* by means of lead electrodes in a slightly alkaline solution of sodium sulphate. Varnish thus prepared is stated to dry uniformly and rapidly, yielding a hard brilliant coating resembling enamel.—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

India-rubber from an abnormal latex. P. Schidrowitz and F. Kaye. Gummi-Zeit., 1907, **21**, 1026—1027.

The latex was tapped in the usual way from the upper bark of a five-year-old *Hevea ;* it yielded only 4·6 per cent. of crude rubber, which contained : moisture, 3·27 ; resin, 4·19 ; ash, 2·25 ; and nitrogen, 0·41 per cent. The clear separated liquid shewed 0·05 per cent. of total solids, and was free from sugars and glucosides ; about two-thirds of the nitrogen contained in the latex was found in the rubber. The surface of the rubber was covered with a substance, which was also traced in the separated liquid, having the property of rapidly turning red and then grey under the action of light and air ; there is no evidence, however, for the presence of an oxydase. It is stated that if kept for a month or so, whether light and air were admitted or not, the rubber showed enhanced figures for moisture, but these figures may include volatile matter, since the determinations were carried out by drying *in vacuo* over calcium chloride.—W. A. C.

India-rubber tyres ; Examination of certain ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 55—56.

Four varieties of solid tyres were subjected to chemical analysis by the usual methods. Tensile tests were also made, the test pieces consisting of rings cut out of sheets about 1 mm. thick and slung over smooth iron hooks in the testing machine (see next column). The following results were obtained :—

Sample.	1.	2.	3.	4.
Resin (extracted by acetone)	9·0	8·6	7·2	7·4
Substitute (extracted by alcoholic potash)	10·2	8·9	9·1	11·7
Mineral matter (by incineration)..	38·5	39·2	40·7	33·2
Caoutchouc (by difference).......	42·3	43·3	43·0	47·7
Total sulphur (per cent. on caoutchouc)	7·8	9·0	10·0	11·3
Free sulphur do.	3·5	3·7	5·6	6·1
Combined sulphur do.	4·3	5·3	4·4	5·2
Breaking strain in grms.	3718	2509	3403	3217
Elongation at rupture, per cent. .	55	38·5	52	45·5
Elongation under 1500 grms., per cent.	23·5	24	24·5	26·5

In adjudicating as to quality, the authors award the first place to No. 3. Whereas the above figures do not shew much difference between No. 1 and No. 3, the latter is stated to have behaved better under a dry heat test (4 hours at 320° F.).—W. A. C.

Rubber in Ceylon. Col. Off. Rep., 1906, Ann. No. 527. [T.R.]

Rubber cultivation has greatly extended, and there are probably 120,000 acres now under it as against 40,000 at the end of 1905, and 11,000 at the end of 1904. The value of that exported was Rs. 1,527,539 as against Rs. 557,945 in 1905, and Rs. 221,000 in 1904. The trees are, as a rule, remarkably healthy, and in suitable soil the growth is vigorous, giving every promise of success in the future.

Refuse india-rubber. U.S. Customs Decision. Oil, Paint and Drug Rep., Aug. 5, 1907. [T.R.]

Scrap or refuse india-rubber is entitled to free entry under paragraph 579 of the tariff act of 1897 and is not dutiable as a manufacture of india-rubber at the rate of 30 per cent. ad valorem under paragraph 449.

Plantation rubbers ; Vulcanisation tests with ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 37—39.

The authors carried out comparative experiments with (*a*), a sample of plantation rubber of the " block " type, containing : moisture, 0·4 ; resins, 4·0 ; protein, 2·8 ; ash, 0·1 ; and caoutchouc (by difference), 92·7 per cent. ; and (*b*), a sample of fine hard cure Parà rubber, containing : moisture, 12·7 ; resins, 3·1 ; protein, 2·9 ; ash, 0·3 ; and caoutchouc (by difference), 81·0 per cent. 50-grm. samples of the washed, dried rubber were mixed with sulphur and compressed into the form of cylindrical blocks, from which slices were afterwards cut and vulcanised in moulds. From the vulcanised strips, 1 mm. thick, small rings (40 mm. diam. and 2·5 mm. wide) were punched, and these were tested by stretching them between smooth round iron hooks, the load being gradually increased to the point of rupture. The results, which are given in tabular form, show a slight superiority for the plantation rubber with respect to tensile strength and elongation at the point of rupture, and a slight inferiority as regards elongation under a load of 1·5 kilos. The extensibility of vulcanised plantation rubber under a gradually increasing load has been studied and a curve plotted from the results. Preliminary tests have also been made with rubber containing mineral admixtures : it is found that, generally speaking, such admixtures tend to increase the tensile strength and diminish the extensibility.—E. W. L.

Patents.

Rubber ; Process for the regeneration of ——. G. Biéron. Fr. Pat. 375,547, March 9, 1907.

Finely-divided waste vulcanised rubber is heated with caustic alkali solution to remove free sulphur, washed with cold water, dried, and then gradually heated under pressure with aniline to 180° C., whereby, it is stated, the whole of the combined sulphur is converted into hydrogen sulphide. After five minutes heating at 180° C., the pressure is released, and the escaping hydrogen sulphide is absorbed in caustic alkali solution. The residual mass is discharged into a 10 per cent. solution of sulphuric acid to remove excess of aniline, and the purified rubber is washed with water.—A. S.

Rubber, gutta-percha, and analogous substances ; Process and apparatus for drying ——. H. Bubenheim. Fr. Pat. 375,643, March 13, 1907. Under Int. Conv., Oct. 29, 1906.

An ordinary kneading cylinder is mounted so as to rotate in a double-walled receptacle connected to a suction pump. A heating agent is supplied to the jacket, and the processes of drying and kneading or grinding are thus carried out in a single operation.—A. S.

Vulcanised gums ; Process for the regeneration of ——. E. A. L. Rouxeville. Fr. Pat. 375,709, May 21, 1906.

The waste vulcanised gum is mixed with a resin, *e.g.*, pine resin, and heated for 1½—2 hours at 140°—145° C., and the mass is boiled in a concentrated alkaline solution (sodium carbonate, potassium carbonate, or sodium sulphide) which dissolves the resin, with formation of a soap. The residual devulcanised gum is washed with water, then with acidulated water, and finally with pure water again. It may be further purified, if necessary, by dissolving it in a suitable solvent, filtering the solution, and re-precipitating the gum by means of alcohol or acetone.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tanning analysis; The new "International" method of ——. Collegium, 1907, 7, 249—253.

The report of the International Commission, appointed at the Frankfort Conference of September, 1906, to investigate the various methods of tanning analysis, has been accepted by the executive committee of the I.A.L.T.C. This new method may be brought into immediate use, but becomes compulsory for all members of the I.A.L.T.C. from Sept. 15th, 1907. The regulations will be found this J., 1907, 702.—H. Br.

Leather dyeing; Acid in ——, its absorption and effect. M. C. Lamb and J. W. Lamb. *See* V.

Patents.

Skins; Apparatus for applying liquid to ——. The Turner Tanning Machinery Co. Fr. Pat. 375,747, Jan. 8, 1907.

The apparatus comprises one or more mechanical kneaders actuated by endless chains or otherwise, and so arranged that when in action they form a plane surface. The skins to be treated are placed on a bed, the surface of which is practically level, and means are provided for imparting to the bed and the mechanical kneaders a motion obliquely to the surface of the bed. There are also means for applying to the skin a liquid in any desired quantity.—C. A. M.

Agglutinant; Manufacture of a non-poisonous —— specially intended for attaching various substances to uniform non-porous surfaces. W. Plinatus. Fr. Pat. 375,767, Feb. 26, 1907.

A solution of an albuminous substance, such as egg albumin, gluten, &c., is mixed with glycerin or other suitable hygroscopic agent. By heating objects treated with this preparation, the albuminous substance is coagulated and the cement rendered insoluble.—C. A. M.

Leather; Process for accentuating the grain of ——. G. and W. Feldmann. Fr. Pat. 375,579, March 11, 1907.

See Eng. Pat. 6048 of 1907; this J., 1907, 540.—T. F. B.

Meerschaum in New Mexico. Bd. of Trade J., Aug. 1, 1907. [T.R.]

The "Engineering and Mining Journal" announces that meerschaum mines have been located in the Diablo range of mountains about 20 miles north-west of Pinos Altos, to which a branch of the Santa Fé Railroad runs from Deming. There have been stripped two true fissure veins, continuous for 1500 feet each, in which meerschaum is carried between strongly defined walls in widths of 20 inches. A wagon road is now being built from the mines to Pinos Altos, a distance of 20 miles, and when this is completed the meerschaum will be marketed.

XV.—MANURES, &c.

Nitrification in Egyptian soils. R. Roche. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1699—1701.

Analysis of thirty samples of Egyptian soil showed that the poorest soils either contain no nitric nitrogen or only very small quantities. Experiments were also carried out to determine the influence of irrigation, manuring, and aëration on the nitrification of a soil of known composition. The chief results were as follows:—With proper irrigation (water content of the soil maintained at 15—25 per cent.), Egyptian soil nitrifies well. Soil which is not watered, undergoes no nitrification. With insufficient irrigation (5—10 per cent. of water), the amount of nitrification is much less than when the soil is properly irrigated. With excessive irrigation (above 25 per cent. of water), the soil very rapidly undergoes denitrification. The addition of nitrogenous manure to the soil has a favourable effect on nitrification; the same is true of a second dressing. The injurious effect of excessive irrigation explains why it is that low-lying soils, subject to infiltration, and impermeable soils, are of poor quality. The retention of water prevents aëration, and the evaporation of this water lowers the internal temperature of the soil. The author concludes that an excess of clay is the principal adverse factor in the nitrification of soil.—L. E.

Patents.

Hydrofluosilicic acid and alkali fluosilicates; Manufacture of —— in superphosphate factories. L. Rivière. Fr. Pat. 375,989, May 28, 1906.

It is proposed to cheapen the manufacture of hydrofluosilicic acid in two ways. (1) By substituting sodium bisulphate for sulphuric acid in the decomposition of the fluoride, the normal sodium sulphate formed, being recovered. (2) By utilising the mixture of hydrofluoric acid and silicon fluoride evolved as a by-product in the manufacture of superphosphate (from apatite, &c.), instead of fluorspar. The hydrofluosilicic acid is formed in absorption towers, more hydrofluoric acid or gelatinous silica being added according to requirements. Where the object is the recovery of alkalis present in liquors from soap-works or distilleries, these liquors are conveyed to the superphosphate factory and are used direct in the absorption towers in place of water. The precipitated alkali fluosilicates are decomposed by sulphuric acid to recover the fluorine, and the sulphates are converted into alkali carbonates by treatment in an autoclave with chalk, in the presence of water.—F. Sodn.

Manure; [Electrolytic] Process of manufacturing dicalcium hydrogen phosphate for employment as —— from apatite or other phosphatic mineral. W. Palmaer. First Addition, dated March 4, 1907, to Fr. Pat. 326,917, Dec. 2, 1902 (this J., 1903, 876).

A solution of an alkali chloride is electrolysed to obtain a caustic alkali and chlorine, which latter is mixed with the hydrogen evolved at the cathode, and converted into hydrochloric acid by the action of a catalytic body, such as wood charcoal or platinum sponge; or the chlorine may be mixed with steam and passed over incandescent coke. The apatite or crude phosphate is dissolved in the hydrochloric acid, and dicalcium hydrogen phosphate is precipitated by adding to the solution a suitable proportion of the electrolytic caustic alkali. (See U.S. Pats. 707,886 of 1902, and 748,523 of 1903; this J., 1902, 1189; 1904, 124.)—E. S.

Ammonia; Transformation of the nitrogen of peat into ——. M. L. Gaillot and P. Brissett. Fr. Pat. 375,792, March 15, 1907. See VII.

XVI.—SUGAR, STARCH, GUM, &c.

Beetroot; Cold aqueous diffusion for the direct determination of sugar in the ——. (Pellet's method.) H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1625—1627. (See this J., 1907, 27.)

The author has shown experimentally, that, in the analysis of beetroot pulp (prepared with the Sans-Pareille press) by the method of cold aqueous diffusion, the time occupied in preparing the solution is sufficient to allow of the complete diffusion of the sugar. This is not the case, however, when a coarser pulp (prepared with a conical grater) is used, nor, with this pulp, are the results obtained by Herles' modification of the hot aqueous digestion method very satisfactory. For finely divided pulp, the cold aqueous diffusion method is suitable; if the quality of the pulp is doubtful, it should be regarded as coarse and analysed by the hot aqueous digestion method adapted to such a case. Results obtained with the cold aqueous diffusion method should be frequently verified with the hot aqueous digestion method in order to make sure that the pulp employed is sufficiently fine. —L. E.

Cane and beetroot sugar products; Inaction of the lead precipitate in the analysis of ——. Inaction also of potassium acetate in the polarisation of sucrose. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1630—1633. (See this J., 1907, 27, 60.)

According to Sachs and Debarbieri, potassium acetate appreciably decreases the polarisation of sucrose. They consider that the non-influence of the volume of the lead precipitate, obtained in the clarification of raw beetroot sugar, on the polarisation, is due to the compensating action of this salt (which is produced by double decomposition between the basic lead acetate and the potassium salts in the raw sugar). According to these workers, the lead precipitate does not absorb sucrose. The author has proved experimentally that potassium acetate has no effect on the polarisation of sucrose, and points out that several chemists have shown that the lead precipitate does absorb sucrose.—L. E.

Cane sugar products; Non-influence of dilution on the polarisation of solutions of ——. H. Pellet. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1627—1629.

According to N. Deer ("Sugar Cane," Jan., 1907), the non-influence of the lead precipitate on the polarisation of cane sugar products, is due to an increase in the specific rotation of sucrose with increasing dilution, *i.e.*, the amount of increase of polarisation due to the volume of the lead precipitate is reduced by increasing the dilution, but this reduction is compensated by the increasing specific rotation of the sucrose with dilution. The author's experiments show, however, that the dilution of solutions of cane sugar products (previously filtered from the lead precipitate) has no appreciable effect on the results. The non-influence of the lead precipitate in the case of cane sugar samples (as with beetroot sugar samples) is due to absorption of sucrose by the precipitate. —L. E.

Cereal flours; Rotatory powers of the proteins extracted from —— by aqueous alcohol. Lindet and L. Ammann. *See* XVIII*A*.

Patents.

Beetroot chips and similar substances; Drying system for —— by indirect heating. W. Greiner. Fr. Pat. 375,545, Mar. 9, 1907. Under Int. Conv., Mar. 13, 1906.

The system of multiple effect evaporation is applied for the purpose of drying beetroot chips or other similar materials. The heating chamber of the first vessel of the system is provided with direct steam, and the vapours given off from the material in this chamber are drawn into the heating chamber of the next. The transference of the material from one vessel to another at each stage of the drying process may be avoided by providing the necessary stop-valves and connections for working the series of vessels on the "battery" system as in the case of diffusion vessels.—J. F. B.

Saccharine juices and molasses; Displacement of potash by other bases in ——. J. D. Riedel Akt.-Ges. Fr. Pat 375,870, Mar. 19, 1907. Under Int. Conv., Nov. 7, 1906.

Silico-aluminates are prepared either by the action of aluminates upon silicic acid or on aqueous solutions of silicates, or by fusing alumina with alkali silicates or with a mixture of alkali carbonate and sufficient quartz to decompose the whole of the carbonate, and washing the product of the fusion with water. These silico-aluminates are said to be far more efficient in exchanging their bases with those present in saccharine liquids than the double aluminium silicates employed by Rümpler, and in the case of molasses it is not necessary to dilute the latter. When hot molasses is passed through a filtering bed of calcium silico-aluminate, about 85 per cent. of the potassium and 40 per cent. of the sodium are replaced by calcium. When a bed of sodium silico-aluminate is used, almost the whole of the potassium and calcium in the molasses is displaced by sodium.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Barley; Influence on quality of brewing —— by cultivation. E. von Proskowetz. Woch. f. Brau., 1907, **24**, 397—402.

The author has made a study of the recent literature on the scientific cultivation of barley with a view to the evolution of the finest types for brewing purposes. In a general summary he points out that the cultivator should distinguish between the single properties of the plant each by itself, but should nevertheless always keep as his ultimate aim, the harmonisation of all the properties taken together, avoiding exaggeration of any one at the expense of the others. Whilst aiming at productive capacity, the physiological characters of the plant should receive particular attention. These characters include: period of growth (early ripening), unrestricted and vigorous development and the requirements of the plant as regards water. The question of quality is very largely a water question. According to the soil and climate, types which correspond best with the particular conditions are necessary, and these should respond as little as possible to external influences and should not show a tendency to "adaptation." Thus, with ordinary varieties which have been converted by culture into fine varieties, the conditions of culture under which they have benefited should be taken into account. Large and rounded corns are only good so long as no disturbance of the physiological equilibrium is produced in obtaining them, also no increase in the protein contents and no deterioration in the structure and constitution of the husks. The fineness and structure of the husks are very important subjective indications of the valuable properties of the corn; the coloured extractive matters of the husks and their tendency to discoloration must also receive attention. Quantitative determinations of the yield of starchy flour (extract) should be made on half-ear samples, or at any rate, the poverty in protein should be ascertained by analysis. Purity of variety (botanical) is important, and parallel with this should go uniformity of variety as regards district.—J. F. B.

Barleys; Inapplicability of European standards to American brewing ——. R. Wahl. Woch. f. Brau., 1907, **24**, 388—392.

The high-class American brewing barleys may be divided into three groups:—(*a*) Six-rowed barleys with relatively high protein contents, 10·5—14 per cent., corns of medium size and weight (25—35 grms. per 1000 corns), husks of medium thickness. These barleys are descended from the original stock of Manshury barley introduced into Wisconsin in 1861. They germinate in five days on the floor and develop high diastatic powers. Variations above or below the limits mentioned indicate abnormal qualities which are generally unsatisfactory. The 6-rowed barleys of the Manshury or allied species are the only ones which are considered as really first class for the manufacture of chill-resistant, pasteurised, bottled beers. The laboratory yield of malt extract, determined on fine meal, is 72—75 per cent. on the malt dry substance. (*b*) Six-rowed barleys with low protein contents, under 10·5 per cent., large and heavy corns (35—45 grms. per 1000), coarse husks, descended from the Bay brewing barleys or Utah "White Club" of Californian origin. These require longer malting and do not develop such high diastatic powers as the Manshury, neither are they so well adapted for the special bottled beers. The laboratory yield of extract from the malts is 71—74 per cent. (*c*) Two-rowed barleys with protein contents below 11·5 per cent., weight per 1000 corns 35—45 grms., thin husks. These are derived from the German Chevalier or Hanna varieties. They require long germination and do not yield malts with high diastatic powers. The laboratory yield of extract is 75—80 per cent. on the malt dry substance. The great range of differences existing between the varieties of American brewing barleys does not permit of any general standards for size of corn or percentage of protein. The American brewer, moreover, brewing large quantities of raw grain without any special clarifying devices, has not such a strong objection to a barley with a high proportion of husk as the European, since the husks assist the filtration of the wort. The only objective test of general application is the determination of the foreign substances; otherwise the barleys are valued each on its merits by subjective tests only.—J. F. B.

Starch pastes; Diastatic liquefaction of ——. A. Fernbach and J. Wolff. Compt. rend., 1907, **145**, 261—263. (Compare this J., 1906, 898.)

Fifty c.c. of a 5 per cent. starch paste were cooled immediately after making, and definite quantities of various substances were added. The paste was then treated with 4 c.c. of a 10 per cent. infusion of malt. After a few minutes the action was stopped by the addition of 2—3 drops of sodium hydroxide, and the viscosity of the solution was determined. It was thus found that the addition of very small quantities of disodium hydrogen phosphate impedes the liquefaction, the retardation increasing as the alkalinity towards methyl orange increases; liquefaction is most rapid in neutralised media. Monosodium dihydrogen phosphate has no influence on the action when the medium is neutral to methyl orange; when the medium is not previously neutralised, this phosphate if added in relatively large proportions favours the liquefaction. When the medium (starch paste and malt extract) is rendered exactly neutral to methyl orange, the slightest alteration of its reaction, whether by the addition of sodium hydroxide or of sulphuric acid, impedes the liquefaction. The liquefying enzyme is extremely sensitive towards free mineral acids but resists organic acids; even in neutralised media there is a sensible destruction of the liquefying enzyme at a temperature of 45° C. Small quantities of neutral salts, chlorides and sulphates, have no action on the liquefaction, with the exception of barium chloride, which stimulates the action in a remarkable degree.
—J. F. B.

Abrastol; Some new reactions of ——. G. Salomone.
See XXIII.

Red wines; Origin of the deposits of colouring matters in ——. V. Martinand. Compt. rend., 1907, **145**, 258—259.

It has been previously shown that aldehydes bring about a precipitation of the colouring matters of red wines, similar to the deposition which takes place during ageing or when the wine is suffering from the disease known as "casse." The production of aldehydes in the wine is not, however, the principal cause of the formation of deposits of colouring matters. The main cause is the direct oxidation of the polyphenolic constituents (tannin and colouring matters) with production of insoluble substances. Oxidation may be brought about by two distinct enzymes or oxydases, one of which is present in all fruits and is a compound system of oxygenase and peroxydase (Bach), whilst the other is secreted in cultures of *Botytris cinerea*, the latter being the more powerful of the two. These oxydases when added to wines in presence of air, bring about a precipitation of colouring matters and cause changes in the bouquet of the wine similar to those observed on ageing. In musts, the oxydases precipitate colouring matters and produce at first, traces of vanillin; as the oxidation proceeds, the odour of this substance and the bouquet of the liquid disappear. The author considers that the effects of the "casse" disease are due to oxidation in this manner, but that the changes which take place during ageing, are due principally to the very much slower action of the aldehydes.—J. F. B.

Malic acid in musts and wines, and its consumption during fermentation. W. Mestrezat. Compt. rend., 1907, **145**, 260—261.

The proportions of malic acid in grape musts are fairly considerable, amounting in some cases to over 3 grms. per litre; the proportions of this acid in wines are not so large. The author finds that there is a considerable consumption of malic acid during the fermentation of the must by yeast. The quantity of malic acid which disappears in spontaneous fermentations exceeds 1 grm. per litre, but in pure fermentations with culture yeasts or in sulphited musts, the consumption is not so great. The consumption of malic acid appears to be confined to the period of primary fermentation and depends on the presence of active yeast.—J. F. B.

Brandy; Study of Charente ——. E. Kayser and A. Demolon. Compt. rend., 1907, **145**, 205—208.

Musts of the vintage *Folle blanche* inoculated with pure yeast from the lees of Charente wine had undergone intense oxidation after 4 to 8 months, and this was also very manifest in the corresponding brandies. The non-alcoholic coefficient, calculated in the usual way, showed an average of 425·25 and a maximum of 633·86, the latter being double the maximum given by Rocques. This difference was mainly due to aldehydes and higher alcohols. Experiments showed that aldehydes were formed here much more rapidly than in the ageing of brandy in casks. Living yeast was found to be an essential for the formation of aldehyde, for, on the addition of an antiseptic agent, oxidation was very slight, notwithstanding that the liquid was being kept in intimate contact with the air. The aërobic yeast which is deposited in the lees of wine was proved to be the active agent. There is apparently antagonism between the formation of aldehydes and esters, for the minimum of esters in the authors' experiments always corresponded with the maximum of aldehydes, and, hence, in those brandies containing an excess of aldehydes the proportion of esters was below the average. Darkness favours the formation of volatile acids, whilst light promotes the formation of higher alcohols the proportion of which also depends upon the growth of the yeast. The species of yeast is a secondary factor, and a Charente yeast and a Champagne yeast gave practically the same results. All pure yeasts can produce higher alcohols, as was also found by Ehrlich and Pringsheim. No artificial culture medium has given us so large a proportion of higher alcohols as did the Charente grape musts, utilised for the production of brandies. In the authors' opinion the production of higher alcohols must be attributed to the multiplication of the yeast rather than to its zymotic function. Thus the addition of asparagin, which increases the speed of fermentation and diminishes the growth of the yeast, also reduces the proportion of higher alcohols. Moreover in two experiments in which large and small amounts of yeast were used respectively, the yields of higher alcohols were approximately the same.—C. A. M.

Alcohol ; Detection of methyl ——. J. Wolff. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1623—1624.

The author has observed that when spirits, free from methyl alcohol, but containing sucrose or caramel, are treated with chromic acid mixture and distilled, the distillate gives the reaction characteristic of the polymerisation products of formaldehyde (method of testing for methyl alcohol in spirit). Further investigation showed that this result is due to the decomposition of lævulose (neither dextrose, lactose, nor galactose gives these polymerisation products of formaldehyde when treated with chromic acid mixture). Hence, in testing spirit containing sucrose, invert sugar, or caramel, for methyl alcohol, the sample should be subjected to a preliminary distillation.—L. E.

Peat in the distillery ; Industrial experiments on the employment of ——. R. Pique. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1730—1741.

Analyses of samples of peat taken from various depths, showed that the water-content decreased from about 80 per cent. in the case of surface peat, to about 44 per cent. in the case of peat taken from a depth of 1—2 metres. The pentosan- and cellulose-contents also decreased in the same direction. The author considers that, for the industrial preparation of alcohol, peat taken from a depth of 0·5—1 metre (or as far down as 2 metres in the case of a mixture of peats) is most suitable. Experiments were also carried out to determine the yield of alcohol obtainable from peat. Quantities of 225 kilos. of peat were heated with 400—460 litres of water and 3—4 litres of sulphuric acid under a pressure of 3 kilos. for 45 minutes. The juice expressed from the saccharified product was neutralised and fermented with a vigorous race of *S. ellipsoideus* (acclimatised to an acidity of 3 grms. of sulphuric acid per litre and to the prejudicial substances of the peat juice) by being first cultivated in beetroot molasses hydrolysed with sulphuric acid. In this way, 10·02 litres of alcohol were obtained from 100 kilos. of the dry substance of the peat. The compressed and dried solid residue, in the form of briquettes, makes an excellent fuel, and the vinasse contains valuable fertilising substances.—L. E.

Indian alcohol. Chem. and Drug., Aug. 3, 1907. [T.R.]

The Commissioner of Excise has issued a statement in regard to the manufacture of spirits in India by European methods. He says the terms on which Government is prepared to sanction contracts for the entire output of a distillery render the undertaking a desirable investment free from all speculative elements. It has been definitely proved, he adds, that mahua will yield 4 gals. of proof-spirit per maund. This is as good a result as can be procured from any known raw material other than sugar or beetroot. Beyond the demand for potable spirit there is ample prospect of heavy future demand for industrial purposes. There is ample scope for at least three more distilleries working solely on mahua, for one in Jessore or Nadia working on date molasses, and for two in North Behar working on the refuse of the sugar factories. Any place in the vicinity of Baidyanath or Bhagalpur would also be suitable for obtaining raw material and as a convenient distributing centre.

French consumption of denatured alcohol. Ch. of Com. J., August. [T.R.]

The American Consul at Havre reports that, according to official statistics, the total quantity of denatured alcohol consumed in France during 1906 was 14,409,547 gals., against 12,475,186 gals. in 1905, showing an increase of 1,934,361 gals.

American regulations for denatured alcohol. Pharm. J., Aug. 10, 1907. [T.R.]

The United States Commissioner of Inland Revenue has issued amended regulations affecting denatured alcohol, to take effect on September 1. Under the new regulations manufacturers using specially denatured alcohol are relieved from keeping a record of the goods in the manufacture of which denatured alcohol is used. Manufacturers recovering alcohol in manufacturing processes where but a small quantity of alcohol is denatured, are not now required to provide themselves with denaturing material rooms, or to have the denaturing agents regularly tested. They may procure approved authorised denaturants, either from central denaturing warehouses or from distilleries at which regular denaturing warehouses are established. Manufacturers using completely denatured alcohol are not required to swear to application for a permit, and a permit when secured will continue in force until revoked. Retail dealers in denatured alcohol will not be required to keep a record of any kind. The regulations have also been made easier in many points affecting the distillers of alcohol. It has been found necessary to alter the old regulations on account of the relatively small quantities of denatured alcohol used.

Patents.

Saccharimeter. L. Kunz. U.S. Pat. 859,453, July 9, 1907. *See* XXIII.

Distillery by-products ; Apparatus and process for treating —— *in the wet way.* L. Rivière. First Addition, dated May 12, 1906, to Fr. Pat. 362,654, Jan. 23, 1906. (See also this J., 1906, 773.)

The liquors to be treated (besides distillery residues &c.) may also be fermented worts or wines before distillation, or the same liquors or vinasses after distillation, or glycerin lyes from soapmaking. The process consists in precipitating the sodium and potassium salts dissolved in the liquors by the addition of hydrofluosilicic acid. Certain modifications are introduced in the process of manufacturing the hydrofluosilicic acid, for instance, hydrofluoric acid is prepared by the action of sodium bisulphate on fluorspar, and the normal sulphate produced is recovered by crystallisation. The utilisation is claimed of the hydrofluosilicic acid, hydrofluoric acid, and gelatinous silica, which are collected in the absorption towers, in the manufacture of superphosphates from apatite, hydrofluoric acid or gelatinous silica being added to make up whichever constituent is in deficit.—J. F. B.

Wines, liqueurs, spirits, etc. ; Apparatus for rapidly ageing ——. S. Cassisa. Fr. Pat. 375,301, Mar. 2, 1907. Under Int. Conv., Mar. 4, 1906.

The apparatus consists of a cask or tun containing a coil through which either steam or a cooling liquid can be circulated at will. Inside the tun is also situated a rotary stirrer with hollow perforated arms. The axis of the stirrer is in connection with a gas cylinder by means of which oxygen, hydrogen or other gas can be injected through the perforated arms into the liquid under treatment. A worm-condenser is inserted in the bung-hole of the tun in order to condense any alcoholic vapours which may be driven off from the liquid.—J. F. B.

Fermentation ; Process and vat for ——. C. and E. Rombaut. Fr. Pat. 375,321, Mar. 2, 1907.

Fermentation is conducted in a square vat lined with glazed tiles or slate and rounded at the corners ; the vat is surrounded by a space enclosed by outer walls of brickwork and filled with insulating material. The sides of

the vat are extended upwards to the ceiling of the room, so that there is a closed space above the fermenting liquid. In this chamber is placed a refrigerator containing ice through which air is drawn from the outside, cooled, and circulated above the wort by means of ventilators. In the same chamber is situated a trough which serves for mixing the wort with the seed yeast, also for draining the beer from the scums and for collecting the yeast from the surface after fermentation. The water draining from the ice in the refrigerator is circulated through an attemperator coil which can be lowered into the wort at will.
—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Cereal flours; Rotatory powers of the proteins extracted from —— by aqueous alcohol. Lindet and L. Ammann. Compt. rend., 1907, **145**, 253—255.

The proteins were extracted by treating the various flours with 70 per cent. alcohol and were then precipitated by water or salt solution. The proteins were re-dissolved, and the polarimetric observations were all made with solutions in 70 per cent. alcohol, since higher concentrations of alcohol affect the rotatory powers. The concentrations of the protein solutions were calculated from their nitrogen contents, employing the factors 5·66 for wheat and rye, 5·80 for barley, and 6·25 for maize. The gliadin extracted from wheat had a rotatory power, varying between $[\alpha]_D = -81{\cdot}6^\circ$ and $-92{\cdot}7^\circ$. Owing to these variations the optical methods for the determination of glaidin are worthless. There appear to be two gliadins extracted by 70 per cent. alcohol; these can be separated by adding water to the solution, one, with $[\alpha]_D = -81{\cdot}6^\circ$, is completely insoluble in 40 per cent. alcohol, whilst the other, with $[\alpha]_D = -95{\cdot}0^\circ$, dissolves. The rotatory power of the crude protein extracted from rye varies from $[\alpha]_D = -107{\cdot}6^\circ$ to $-112{\cdot}2^\circ$. On addition of alcohol until the alcoholic strength reaches 80 per cent., a new protein, hordeïn, $[\alpha]_D = -137{\cdot}5^\circ$, is precipitated. A mixture of gliadins, $[\alpha]_D = -87{\cdot}8^\circ$, resembling those from wheat, remains in solution. Barley contains the same proteins as rye, but the quantity of gliadin is extremely small. Of the two proteins extracted from maize, one, α-maizin, is soluble in both ethyl and amyl alcohols, and has $[\alpha]_D = -29{\cdot}6^\circ$, whilst the other, β-maizin, is soluble only in ethyl alcohol, and has $[\alpha]_D = -40{\cdot}0^\circ$. Oats and rice yield only traces of proteins on extraction with 70 per cent. alcohol.—J. F. B.

Dumoria Heckeli; Fat from the seeds of ——. A. Chevalier. Compt. rend., 1907, **145**, 266—269.

The tree, *Dumoria Heckeli*, the only known species of the genus *Dumoria*, belonging to the *Sapotaceæ*, is common in the forests of the Ivory Coast and other parts of West Africa, where it attains a height of 35 to 50 metres. The ripe fruit is about the size of a large apple, and has a soft yellow pulp of bitter taste, and the seeds are in the form of an elongated oval about 7 cm. by 3 cm. in size. The wood of the tree has long been exported from the Gold Coast to Liverpool, whilst the fat obtained from the seeds is used by the forest tribes as a food and a medicine.
—C. A. M.

Formaldehyde; New reaction for the detection of ——. E. Gabutti. *See* XXIII.

Patent.

Butter; Process for making ——. A. H. Borgström. Fr. Pat. 375,583, March 11, 1907.

See Eng. Pat. 6394 of 1907; this J., 1907, 887.—T. F. B.

(*B.*)—SANITATION; WATER PURIFICATION.

Sterilisation of effluents. S. Rideal. J. Roy. San. Inst., 1905, **26**, 378—406.

Experiments on a large scale are described on the use of electrolytic chlorine at a sewage purification works dealing with a strong sewage from a town. Daily analyses established the fact that there was a constant relation between "the five minutes oxygen absorption figure and the amount of available chlorine required in parts per 100,000 for disinfection," this relation being expressed by the ratio 1 : 1·7. The total number of organisms in the crude sewage was reduced by the addition of 3 parts of available chlorine per 100,000 from several millions to 50,000 per c.c., the *B. coli* from a million to an average of less than 1 per c.c., and the *B. enteritidis* spores to less than 10 per c.c., after 4½ hours' contact, while the addition of 5 and 7 parts of available chlorine effected a still more complete reduction. With septic tank effluent similar results were obtained, and incubation tests showed that the treated samples were non-putrefactive. With primary, secondary, and tertiary contact-bed effluents, similar results were obtained with less quantities of chlorine, the tertiary effluent only requiring 0·25 part of available chlorine to reduce the *B. coli* from 10,000 per c.c. to *nil* in 5 c.c. in an hour. The general conclusion was that 0·5 part of available chlorine per 100,000, added to a good effluent was sufficient to remove *B. coli* and *B. enteritidis*, which would be all that would be required for discharges near shellfish grounds or watercress beds, though absolute sterility was not practicable on account of the spores present, which however were non-pathogenic. Using other substances than chlorine as sterilising agent, it was found that mineral acids were efficient in cases of serious infection, 4 grms. of sulphuric acid per gallon killing the *B. typhosus* in the drainage from a hospital, and that copper sulphate in the proportion of 1 in 8500 could be used for oyster or watercress beds without danger.—J. H. J.

Patents.

Sewage and foul liquids; Process for forming and filling bacterial and other beds or tanks for the purification of ——. G. H. Ellis and R. K. Slade, Reading. Eng. Pat. 17,948, Aug. 10, 1906.

The walls of the bed or tank are constructed of blocks of lignite cemented together. Or, a mixture of powdered lignite with about 25 per cent. of fine sawdust may be kneaded into plastic material with water, "a solution of coal tar and water," or aluminous clay and water, and the blocks prepared from this dried and carbonised in an oven until the whole of the sawdust has been consumed. The beds themselves are composed of layers of graded lignite particles, or of the artificial blocks broken up and graded by sifting.—C. A. M.

(*C.*)—DISINFECTANTS.

Patents.

Copper formate, and the application of this product to the treatment of cryptogamic diseases of vines; Process of manufacture of ——. F. and P. Malvezin. Fr. Pat. 375,665, May 17, 1906.

Formic acid, copper sulphate solution, and quicklime are introduced separately into a mixing vessel, provided with a stirrer. The copper formate is withdrawn from the mixing vessel in the form of a thin blue paste, and, after suitable dilution, can be used, either alone or mixed with other substances for the treatment of cryptogamic diseases of vines and plants in general.—W. C. H.

Insecticide; Manufacture of soap to be used as ——. E. Fichtenau. Fr. Pat. 375,877, March 19, 1907.

Resinous or fatty soap in the form of paste or powder is incorporated with, say, 15 to 20 per cent. of extract of aloes and left to solidify, or dried. The addition of alum (10 to 20 per cent.), oil of lavender (33 per cent.) or both, with or without petroleum spirit before solidification or drying, increases the insecticidal properties of the soap.—C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

German paper industry in 1906. Bd. of Trade J., Aug. 1, 1907. [T.R.]

According to the recently published report of the "Union of German Paper Manufacturers," the German paper industry only shared to a limited extent in the general development of business during 1906. It is true that the demand for all kinds of paper was great, so that mills could scarcely carry out all their orders; but advances in prices were rare, and falls were frequent. The past year again showed that the German paper industry was unable, even under the most favourable conditions, to adapt its prices to the costs of production. The efforts made towards effecting combinations of manufacturers, so far, remained unsuccessful. The number of new establishments and of extensions of the already existing factories made during the past year were apparently not in excess of the demand. There was last year rather a want of workmen, as if the total number of workmen employed in the industry had decreased.

It would seem that the present favourable state of trade is likely to pass away without benefit to the German paper factories.

The apprehensions entertained by the German paper manufacturers regarding the effects of the new German Customs Tariff, that is to say, regarding the reduction in the tariff rates of duty by the Commerical Treaties, have not been altogether unfounded. The importation of packing paper and some other sorts has increased considerably. It is considered certain that the already difficult position of the German paper industry will be still further prejudiced by the facility now accorded to foreign competition for flooding the German market.

In view of this fact, the results of business for the year 1907 cannot be looked forward to without anxiety.

Fibres and fibrous substances for paper-making; Philippine ——. *III.* G. F. Richmond. Philipp. J. Sci., 1907, **2**, 81—112. (See also this J., 1906, 863; 1907, 274).

Philippine woods.—The author has investigated the woods of certain readily available Philippine trees suitable as raw materials for paper pulp. The most important of these woods are: White "lauan" (*Shorea contorta*), "mayapis" (*Anisoptera vidaliana*), "cupang" (*Parkia roxburghii*), and "dita" (*Alstonia scholaris*). Of these, mayapis is the most promising; the fibres have an average length of 1·92 mm. and a diameter of 0·023 mm., and the fibre-walls are thick. The fibres of cupang and dita are too short. When boiled with 20—22 per cent. of their weight of caustic soda, these woods yield about 40 per cent. of bleached pulp. When boiled with bisulphite liquor for about 12 hours, the temperature rising to 155° C. in 4—5 hours, they yielded 42—43 per cent. of bleached pulp.

Sulphite pulps other than wood.—The author has prepared pulps very successfully by the bisulphite process from dwarf bamboo, old rope, jute bagging, and abaca waste. Bamboo is easily treated in spite of its richness in silica. The mature, seasoned stems were crushed between rollers and chopped into lengths of 3—4 inches. When boiled in the same manner as the woods mentioned above, the bamboo yielded 45 per cent. of bleached pulp. Rope and bagging require a much shorter treatment than bamboo, the total period of boiling being only 4—6 hours with a maximum temperature of 150° C. The sulphite pulp from these materials has, in the unbleached state, as good a colour as the partially bleached pulp usually prepared by the alkaline process. Attempts are being made in Europe and America to utilise hand-stripped abaca [Manila hemp] waste for the manufacture of pulp. When packed into bales in the crude form, this material requires a mechanical treatment, by which it may lose as much as 50 per cent., before it is fit for boiling. When thoroughly cleaned and concentrated mechanically, the abaca waste is very readily treated by the bisulphite process, yielding 48—50 per cent. of cellulose, fit for use for "manila" papers without bleaching. In this case the material must first be steamed in the boiler to reduce its bulk before admitting the liquor; the rise of temperature need not be graduated, since the material is so porous. The pulp consists of a mixture of long, strong fibres and non-fibrous cells. The immediate prospects for the pulp industry in the Philippines lie in the direction of the treatment of abaca waste on the spot by the bisulphite process and the manufacture of a high-grade pulp of the esparto class from Cogon grass (this J., 1906, 863). This grass is available in unlimited quantities; it is free from nodes and can be economically treated by the soda process, yielding a pulp which is easily bleached. —J. F. B.

Lignocelluloses; Colour reactions of ——. C. F. Cross, E. J. Bevan, and J. F. Briggs. Ber., 1907, **40**, 3119—3126.

The reactions of the lignocelluloses with aromatic compounds may be divided into reactions with phenols and reactions with bases. Of the first class, the brilliant crimson colour developed with phloroglucinol in presence of hydrochloric acid is the most characteristic. The authors found that when mechanical wood pulp was treated with 1 per cent. and with 10 per cent. of its weight of phloroglucinol, dissolved in equal volumes of liquid, the colour developed with the smaller proportion was even rather more intense than that obtained with the larger proportion. In the first case the whole of the phloroglucinol was absorbed from the liquid; in the latter case there was still excess. This excess was determined by titrating the filtrate with furfural, and it was found that the wood had absorbed 6·7 per cent. of the phenol. Hence, since the maximum colour is developed with the absorption of less than 1 per cent., the authors conclude that the colour reaction represents only a small portion of the total reaction. They regard the main reaction as the formation of a definite lignone phloroglucide which is colourless, whilst the colour reaction is attributed to the presence of small quantities of a by-product of the nature of hydroxyfurfural. In fact by simple treatments of the lignocellulose, the constituent which gives the colour reaction can be destroyed, and the combination then takes place without the development of colour and with very slight alteration in the total absorption of phloroglucinol. The maximum absorption of phloroglucinol under standard conditions is regarded as a new chemical "constant" of the lignocelluloses, proportional to the degree of lignification of the substance, and is independent of the furfural-yielding constituents. As a type of the reactions of lignocelluloses with bases, the authors have studied the absorption of dimethyl-*p*-phenylenediamine, which gives a crimson coloration. When wood meal was treated with increasing proportions of this base, dissolved in equal volumes of water, the solutions were never completely exhausted. The intensities of the colorations, the proportions of nitrogen fixed, and the quantities of uncombined base remaining in the liquids were all roughly proportional to the quantities of base originally taken. Hence, this reaction is not a definite one, and the distribution of the base between the lignocellulose and the liquid is the result of an equilibrium depending on the relative proportions of each. Thus it is comparable with the phenomenon of the absorption of dyestuffs. The reaction between lignocellulose and phenylhydrazine with the development of a yellow colour is of mixed type. Wood meal combines with about 0·7 per cent. of the base with complete exhaustion of the solution, corresponding with the formation of small quantities of a definite phenylhydrazone. With larger proportions, the reaction follows the same law as that with the diamine base and becomes one of equilibrium. After treatment with phenylhydrazine, the wood gives no immediate coloration with phloroglucinol and hydrochloric acid, the colour appearing only gradually as the hydrazone is decomposed by the acid. The reaction of wood with hydroxylamine takes place with partial bleaching of the wood. It has not been studied quantitatively, but that combination does take place is shown by the fact that the washed product no longer reacts with aniline or dimethyl-*p*-phenylenediamine.—J. F. B.

Lignocellulose ; Phloroglucinol-absorption of ——. Determination of mechanical wood pulp. C. F. Cross, E. J. Bevan, and J. F. Briggs. Chem.-Zeit., 1907, **31**, 725—727.

In connection with a previous note (see preceding abstract) the authors describe a method for the determination of the phloroglucinol-absorption value of lignocelluloses. Two grms. of the disintegrated material are dried at 100° C., and weighed dry. The substance is then placed in a dry flask and covered with 40 c.c. of a solution of 2·5 grms. of pure phloroglucinol in 500 c.c. of hydrochloric acid, sp. gr. 1·06. The mixture is allowed to remain all night, the liquid is then strained through a very small plug of cotton-wool in the stem of a funnel, and 10 c.c. of the filtrate are measured off for titration. The phloroglucinol may be titrated either with furfural or formaldehyde, the procedure being identical in both cases. The standard solution is prepared by dissolving 2·0 grms. of either furfural or 40 per cent. " formalin " in 500 c.c. of hydrochloric acid, sp. gr. 1·06. The 10 c.c. of the phloroglucinol solution are diluted with 20 c.c. of the same hydrochloric acid, and the liquid is heated to about 70° C. The aldehyde solution is then added, 1 c.c. at a time, with an interval of 2 minutes between each addition. A piece of newspaper of poor quality is employed as an indicator, a red stain being produced by a drop of the liquid so long as any phloroglucinol remains unprecipitated. If the drop be dried at a gentle heat, a perceptible stain is produced by the presence of 1 part of phloroglucinol in 30,000 of liquid. The amount of phloroglucinol which has been absorbed by the lignocellulose is deduced from a comparative titration of the original solution. Wood-flour absorbs 7·5, mechanical wood-pulp, 6·7 ; jute, 4·2 ; sulphite wood-pulp, 0·75 ; esparto cellulose, 0·5 ; and cotton, 0·2 per cent. of phloroglucinol. In the estimation of mechanical wood pulp in papers by this method, a correction is made for the ash and the sizing materials. If the absolute furfural value of the phloroglucinol solution be determined gravimetrically, this method affords a rapid volumetric process for the determination of the furfural obtained from pentosans.—J. F. B.

Wood pulp ; Alteration of —— during drying. H. Hofmann. Papier-Zeit., 1907, **32**, 2558.

The author shows that when wood cellulose is heated at temperatures above 90° C., it undergoes changes which result in a loss of weight. Parallel determinations of the moisture in moist pulp, containing 35—42 per cent. of dry substance, were made daily for 28 days. On the one hand the moist samples were dried in a steam-heated chamber at a temperature of 100°—120° C. for 24 hours ; on the other hand they were dried in an air-bath at 85° C. for 5—6 hours until of constant weight. Taking the average of 28 tests, there was a difference of 2·13 per cent., calculated on the original moist cellulose, between the results of the two methods, the prolonged heating at the higher temperature giving lower yields of dry pulp.
—J. F. B.

Cellulose ; Solution and determination of ——. C. Councler. Z. f. Forst-und Jagdwesen, **39**, 428.

The author has compared the method proposed by Zeisel and Stritar for the determination of cellulose (digestion with nitric and permanganic acids ; see this J., 1902, 642 ; 1903, 321) with those put forward previously by Schulze and Henneberg (digestion with nitric acid and potassium chlorate), H. Muller (successive treatments with bromine water and ammonia), and Cross and Bevan (chlorination). He finds that the first-named method gives considerably lower results (from 5 to 9 per cent. in the case of oak and pine woods) than the others, from which it would appear that the action of the permanganic acid is not limited to a specific or selective oxidation of the non-cellulose or lignone constituents of the wood. The three other methods yield fairly concordant results. The author prefers Cross and Bevan's chlorination process, on account of its relative rapidity and simplicity. By this method a maximum yield of cellulose is obtained in most cases, and the product has a composition corresponding to the normal cellulose formula.—A. S.

Strawboard waste ; Prevention of stream pollution by —— [in America]. E. B. Phelps and R. L. Sackett. Eng. Record, 1907, **55**, 407.

In 1900 over 10,239,000,000 gals. of liquor, containing about 184,700,000 lb. of straw and mineral matter and over 77,000,000 lb. of lime were discharged into the streams of certain states in the form of waste liquors from strawboard factories. The principal factories, 59 in number, are located within a comparatively small area. Indiana, Ohio and Illinois make about 80% of the strawboard produced in the country, and Indiana alone produces nearly 50 per cent. The present method of disposal of the waste is by preliminary sedimentation in open ponds. This method is described as both " unsatisfactory and unsavoury." The author has shown that a short period of sedimentation, followed by mechanical filtration through sand without coagulants, will produce an effluent which can be discharged into most streams without producing a nuisance. Furthermore, the cost of the process is reasonable. It is recommended that the sludge from the sedimentation tank could be dried or filter-pressed, and it is stated that some industrial use could then be found for it.

Patent.

Artificial silk, artificial hair, and plastic cellulose products ; Washing of, and the rapid and complete removal of copper from ——. E. Crumière. Fr. Pat. 375,827, March 16, 1907. *See* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Yttrium-niobium mineral ; A new ——. O. Hauser. Ber. 1907, **40**, 3118—3119.

The author describes a new mineral, consisting essentially of niobate of yttrium, an analysis giving the following results :—Nb_2O_5, 38·52 ; TiO_2, 6·48 ; Y_2O_3, 36·99 ; $La(Ce,Nd)_2O_3$, 4·01 ; Al_2O_3, 0·98 ; Fe_2O_3, 2·34 ; CaO, 1·93 ; PbO, 0·26 ; SnO_2, ThO_2, traces ; loss on ignition. 8·76 ; total 100·27.—H. B.

Chloral hydrate ; Assay of ——. P. A. W. Self. Pharm. J., 1907, **79**, 4—7.

The inaccuracy in the B.P. method for the determination of chloral hydrate (heating with alkali solution and titrating the excess of the latter) is due to the excess of the sodium hydroxide acting on the chloroform produced in the reaction. At the ordinary temperature this secondary reaction is almost exclusively that represented by the equation : $CHCl_3 + 3NaOH = 3NaCl + CO + 2H_2O$, and the extent to which it proceeds, can be ascertained by titration with silver nitrate. The method thus modified gives accurate results so long as other substances capable of reacting with sodium hydroxide solution are not present in the chloral hydrate. A more convenient method consists in heating 0·3 grm. of chloral hydrate with 1 grm. of aluminium powder (or 2·5 grms. of zinc filings), 15 c.c. of glacial acetic acid, and 40 c.c. of water for half an hour under a reflux condenser. The mixture is then filtered, and after washing, the chlorine in the solution is determined either gravimetrically as silver chloride, or volumetrically by adding excess of $N/_{10}$ silver nitrate solution, filtering, and titrating the excess of silver with ammonium thiocyanate solution.—A. S.

Condensations effected by sodium. [Production of ketones and tertiary alcohols.] P. Schorigin. Ber., 1907, **40**, 3111—3118.

SODIUM reacts vigorously on a mixture of benzoyl chloride and isobutyl bromide dissolved in benzene, yielding phenylisobutylisopropylethylene, $C_{15}H_{22}$. If isoamyl bromide be substituted for the isobutyl compound, phenyldi-isoamylcarbinol is produced. The author considers that the sodium reacts exactly as magnesium-alkyl halides would do, producing first a ketone:

$$C_6H_5COCl + R{\cdot}Br + 2Na = NaCl + NaBr + C_6H_5{\cdot}CO{\cdot}R,$$

then a tertiary alcohol or its derivative:

$$C_6H_5{\cdot}CO{\cdot}R + R{\cdot}Br + 2Na = NaBr + C_6H_5{\cdot}C(ONa){\cdot}R_2.$$

In the case of the isobutyl compound, the alcohol reacts on more benzoyl chloride to form the benzoic ester, which then decomposes into the substituted alkylene and benzoic acid. The similarity between the action of sodium and of the organo-magnesium compounds lends support to Nef and Acree's view that in all these syntheses by means of sodium, the first stage consists in the formation of the sodium-alkyl or sodium-aryl.—J. T. D.

Acetic ester [Ethyl acetate]; Purification of ——. J. K. H. Inglis and L. E. Knight. Chem. Soc. Proc., 1907, **23**, 198—199.

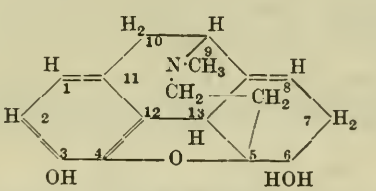
GREAT difficulty has always been experienced in preparing pure ethyl acetate, and although several methods have been suggested, no one of them is satisfactory, since the yield of pure ester is small and the process of preparing it laborious. For the preparation of ethyl acetoacetate, very nearly pure ethyl acetate is required, and the presence of a moderate quantity of alcohol—the most likely impurity—is fatal to success. A series of experiments has shown that the separation can be most easily carried out by first converting the alcohol into an ester of high boiling point and then distilling. If the crude ester, as obtained in the ordinary continuous process, be dried over potassium carbonate (which also removes any acetic acid) and treated with phosphorus pentoxide, a slow action takes place with the formation of phosphoric esters which are neither volatile nor decomposed at the boiling point of ethyl acetate (77·20° C., corr.). In this way a yield of 160 grms. of ester boiling within one degree was obtained in an experiment in which the theoretical yield was 264 grms., that is, 60 per cent. of ester was obtained pure. This process, however, is slow, and requires several days for completion at the ordinary temperature. On the other hand, the removal of the alcohol takes place more rapidly at the boiling point. Thus a mixture of 100 grms. of ester (b. p. 76·65—77·15° C.) with 8 grms. of absolute alcohol, distilled continuously between 73° and 77° C., only 21 grms. passing over above 76·3° C. When, however, the fractions had been mixed together and heated for half an hour with 10 grms. of phosphorus pentoxide, using a reflux condenser, a single distillation gave 72 grms. of distillate between 76·7° and 77·2° C., that is, 72 per cent. of an approximately pure substance. This result shows that it is easy to obtain by this method, a good yield of ethyl acetate boiling within 0·5°; it was found, moreover, that an ester of this purity gave a good yield of ethyl acetoacetate.

Morphine; Researches on ——. *III.* F. H. Lees. Chem. Soc. Proc., 1907, **23**, 200—201.

IN continuation of previous work (Schryver and Lees, this J., 1900, 687; 1901, 500, and Lees and Tutin, Chem. Soc. Proc., 1906, **22**, 253), the author has shown that chloromorphide and bromomorphide yield chlorocodeide and bromocodeide respectively on methylation, the two latter bases previously obtained by other methods being simply the codeine analogues of the two former bases. By the hydrolysis of chloromorphide, the author has isolated, besides β-isomorphine, an hitherto undescribed isomeride of morphine previously indicated by the hydrochloride ($[\alpha]_D = -92·5°$) obtained by Schryver and Lees. On methylation, this new base gives the so-called "ψ-codeine" (compare Merck, Arch. Pharm., 1891, **229**, 161, this J., 1901, 481; Vongerichten, this J., 1903, 758, and Knorr and Hörlein, this J., 1906, 494). As the name ψ-morphine belongs to a well known oxidation product of morphine, of which Merck's "ψ-codeine" is not the methyl ether or codeine analogue, the author has termed the new isomeride of morphine, *neoisomorphine* and its methyl ether, *neoisocodeine*. *Neoisomorphine*, $C_{17}H_{19}O_3N$, crystallises from alcohol in brilliant, prismatic needles containing one molecule of the solvent (m. p. 278°); its hydrochloride, $C_{17}H_{19}O_3N,HCl$, forms anhydrous crystals from alcohol ($[\alpha]_D = -79·1°$ in water); its methiodide, $C_{17}H_{19}O_3N,CH_3I$, forms glistening crystals from alcohol (m. p. 297° C.; $[\alpha]_D = -54·5°$ in water). *Neoisocodeine*, $C_{18}H_{21}O_3N$, forms large colourless prisms from ethyl acetate (m. p. 181—182° C.; $[\alpha]_D = -96·6°$ in alcohol). β-isomorphine on methylation furnishes *β-isocodeine*, $C_{18}H_{21}O_3N$, which did not crystallise. The methiodide, $C_{18}H_{21}O_3N,CH_3I$, forms tabular crystals from water (m. p. 215—216° C.; $[\alpha]_D = -145·5°$ in water), and on boiling with sodium hydroxide readily yields a methine base. It was also shown that the "*A-Base*" (m. p. 147—147·5° C.; $[\alpha]_D = -205·5°$ in chloroform) previously obtained by Lees and Tutin (*loc. cit.*) together with isocodeine (m. p. 171—172° C.; $[\alpha]_D = -155°$ in chloroform) by the hydrolysis of bromocodeide as a definite substance, not resolvable by recrystallisation, is in reality a molecular combination of isocodeine and β-isocodeine.

Morphine. XII. The attachment of the nitrogen-containing side-ring in codeine and the constitution of the morphine alkaloids. L. Knorr and H. Hörlein. Ber., 1907, **40**, 3341—3355.

IN view of recent researches on morphine by Knorr (this J., 1907, 66, and Ber., 1907, **40**, 376, 2034) and of the work of Pschorr (this J., 1907, 634), the following formula is put forward for morphine:—



It is yet uncertain to which of the two neighbouring fully-saturated carbon atoms the nitrogen is attached, and there is some doubt as to the position of the double bond in the third, partially reduced benzene ring of the phenanthrene nucleus. This formula is supported by results of experimental work upon pseudocodeinone, previously described as isocodeinone, but since shown to be derived from pseudocodeine. Pseudocodeinone methiodide when heated with alcohol, decomposes into a volatile base and methyltrihydroxyphenanthrene. The diacetyl derivative of the latter was hydrolysed by means of sodium and alcohol, and the phenanthiol thereby obtained was heated with sodium and methyl iodide. In this way, 3.4.8-trimethoxyphenanthrene, $C_{17}H_{16}O_3$, was produced. This compound is different from the 3.4.5-trimethoxyphenanthrene, melting at about 90° C., obtained from morphenol by Vongerichten and Dittmer (Ber., 1906, **39**, 1719), and from the oily 3.4.6-trimethoxyphenanthrene, which has been obtained from thebaine, and codeinone. Pseudocodeine was treated with phosphorus pentachloride, and part of the pseudochlorocodide obtained was converted into the methiodide, $C_{18}H_{20}ClO_2N,CH_3I$, melting at 185°—186° C. The remainder was reduced with zinc dust and alcohol, when desoxycodeine was produced, identical with that produced by the reduction of chlorocodide obtained from codeine. In order to confirm the presence of the group .CO.CH_2. in pseudocodeinone, this substance was dissolved in ether, and benzaldehyde and sodium ethoxide added. Benzalpseudocodeinone was obtained as an oil. Its methiodide, $C_{25}H_{23}O_3N,CH_3I$, crystallises in rectangular needles and leaflets, decomposing at about 250° C. Pseudocodeinone reacts with a benzene-diazonium solution to form a red solid, $C_{24}H_{23}O_3N_3$, which is a hydrazone of pseudocodeine-7.8-dione. In the same way, codeinone reacts with benzene-diazonium chloride in acetic acid solution to form the acetate of the phenylhydrazone of codeindione, $C_{24}H_{23}O_3N_3.CH_3COOH$, which is a red solid.—F. Shdn.

Morphine. XIII. Action of oxalic acid upon codeine. L. Knorr and P. Roth. Ber., 1907, **40**, 3355—3358.

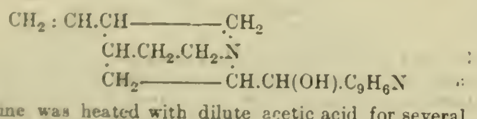
Codeine, or pseudocodeine was heated to 150° C. with anhydrous oxalic acid. On treating the residue with water, making alkaline with sodium carbonate, and extracting with ether, a mixture of pseudocodeine and pseudoapocodeine was obtained. Pseudoapocodeine, $C_{18}H_{19}NO_2$, crystallises from alcohol in fine lamellæ, containing one mol. of alcohol of crystallisation. It melts between 100° and 110° C., is insoluble in water, and easily soluble in dilute acids or alkalis. In strong sodium hydroxide solution, a gelatinous sodium salt separates. When potassium iodide is added to the acetic acid solution of pseudoapocodeine, the hydriodide, B,HI, separates in fine needles, melting at about 288° C. with decomposition. On boiling the base with acetic anhydride, a diacetyl derivative is obtained. This crystallises from alcohol in glistening leaflets, melting at 135° C.—F. Shdn.

Morphine; Solubility of —— in ether. M. Marchionneschi. Boll. Chim. Farm., **10**, 393; Apoth. Zeit., 1907, **22**, 544.

The solubility of crystalline morphine in washed, distilled ether is 0·049 : 1000 at 5·5° C. In pure ether, distilled over sodium, the solubility of crystalline morphine is 0·263 : 1000, and of anhydrous morphine 0·560 : 1000 at 5·5° C.—J. O. B.

Narcotine; Conversion of —— into nornarceine. A contribution to the study of chinatoxine. P. Rabe. Ber., 1907, **40**, 3280—3287.

The author shows that there are four possible formulæ for cinchonine (not two only, as previously stated; this J., 1906, 1170) and considers that the following is the correct one:—



$$\begin{array}{lll} CH_2 : CH.CH & \text{———————} & CH_2 \\ & CH.CH_2.CH_2.N & \\ & CH_2 \text{———————} & CH.CH(OH).C_9H_6N \end{array}$$

Narcotine was heated with dilute acetic acid for several days in an oil-bath at 105°—110° C. Unchanged narcotine, gnoscopine, nornarceine, cotarnine, and meconine were found in the liquid after the reaction. Nornarceine, $C_{22}H_{25}O_8N$, for which a structural formula is given, is a keto-base resembling narceine. It is precipitated from its alkaline solution by carbon dioxide in the form of colourless, silky, matted needles, which contain 3 mols. of water of crystallisation, and have no constant melting point. The water is lost on heating to 105° C., and the substance decomposes at 147° C. When crystallised from alcohol, it separates in the form of anhydrous prismatic crystals, which melt with decomposition at 229° C. The hydrochloride, B,HCl,H_2O, separates from 20 per cent. hydrochloric acid as short, colourless, prismatic needles, melting at 144° C. When nornarceine is heated with sodium and methyl iodide, the methiodide of narceine methyl ester is formed, melting at 207°—208° C. (this J., 1907, 165). Nornarceine suffers no further change when heated with dilute acetic acid, whereas gnoscopine under the same circumstances yields nornarceine, meconine, and cotarnine.—F. Shdn.

Anisotheobromine. Sztankay. Pharm. Zeit., 1907, **52**, 407.

This name has been given to theobrominesodium anisate, $C_7H_7N_4O_2NaC_6H_4OCH_3.COONa$. It is a white, slightly hygroscopic powder, sparingly soluble in cold water, readily dissolved on warming, giving an alkaline solution. Although less soluble in water than the diuretins, its aqueous solutions are more stable, being less readily decomposed by atmospheric carbon dioxide. Acids precipitate theobromine and anisic acid from aqueous solutions of the compound. This precipitate, when washed and redissolved in strong alcohol, and the solvent expelled by heat, affords a residue which gives the murexide reaction when evaporated to dryness with chlorine water, and subsequently treated with ammonia.—J. O. B.

Calmatambin: A new glucoside. F. L. Pyman. Chem. Soc. Trans., 1907, **91**, 1228—1232.

This substance has been isolated during a chemical examination of the bark of *Canthium glabrifolium*. It has the formula, $C_{19}H_{28}O_{13},2H_2O$, and crystallises in prismatic needles melting at 100° C. It is optically active; from measurements on an aqueous solution, $[\alpha]_D$ is $-130·4°$. *Calmatambin* is not physiologically active. It is easily hydrolysed by emulsin giving dextrose and "*calmatambetin*" ($C_{13}H_{18}O_8$). Calmatambetin is not optically active.—C. E. F.

Essential oils; Constituents of ——. The sesquiterpenes of East Indian sandalwood oil. F. W. Semmler. Ber., 1907, **40**, 3321—3324. (See this J., 1907, 431.)

The first fractions of the oil from the wood of *Santalum album* L., contain two sequiterpenes: *viz.*, α-santalene, $C_{15}H_{24}$, b. pt., 118°—120° C. at 9 mm.; sp. gr., 0·8984 at 20° C.; $n_D = 1·491$; and $\alpha_D = -15°$ in a 100 mm. tube; and β-santalene, b. pt., 125°—127° C. at 9 mm.; sp. gr., 0·892 at 20° C.; $n_D = 1·4932$; and $\alpha_D = -35°$ in a 100 mm. tube. α-Santalene on oxidation with ozone yields tricyclic eksantalal, $C_{11}H_{16}O$. When β-santalene is oxidised in the same way, bicyclic eksantalal, and the bicyclic acid, $C_{11}H_{16}O_2$, are obtained (*loc. cit.*). It is probable, therefore, that α-santalene and α-santalol contain the same tricyclic residue, $C_{11}H_{16}$, and that β-santalene and β-santalol contain the bicyclic residue, $C_{11}H_{16}$.—F. Shdn.

Citronella oil and camphor in Ceylon. Col. Off. Rep., 1907. Ann. No. 527. [T.R.]

Citronella oil.—The output, viz., 1,213,748 lb., remained practically constant, but the average value in 1906 rose from 84 to 99 cents per lb. Experiments with the distillation of oil from lemon grass and citronella are continuing at Peradeniya with a view to extending these industries.

Camphor.—Owing to the high price more attention has been bestowed upon this product, and large quantities of seed were imported from Japan and Formosa, with disappointing results as regards germination. Experience has, however, since shown that where fresh seed is sown without delay, the germination is satisfactory. Attempts are being made to strike plants from cuttings. The distillation of camphor has been improved, and a larger yield is now obtained than formerly.

Essential oils; Action of bromine upon ——, and the determination of the total quantity of bromine absorbed and the quantity converted into hydrobromic acid. G. Mossler. Z. Allgem. Oesterr. Apoth.-Ver., 1907, **45**, 223—225, 235—236, 251—253, 267—269, 283—285, 299—301. Chem. Zentr., 1907, **1**, 1758—1760; **2**, 102—104.

The author finds that under suitable conditions, satisfactory results can be obtained in the determination of the bromine values of essential oils. From 0·2 to 0·3 grm. of the oil is treated in a stoppered flask, of 300 c.c. capacity, with 20 c.c. of carbon tetrachloride, 50 c.c. of a bromide-bromate solution (37 grms. of potassium bromide and 10 grms. of potassium bromate per litre), and 20—25 c.c. of dilute sulphuric acid. The flask is then closed, the stopper sealed with paraffin wax, and the whole shaken vigorously and then allowed to stand for six hours in the dark. A control determination is also carried out, and the bromine separated in this is ascertained by adding stannous chloride solution (42 grms. of stannous chloride and 100 c.c. of concentrated hydrochloric acid per litre) until, after vigorous agitation, the mixture is decolorised, whereupon starch solution is added, and *N*/10 iodine solution run in until a blue colour is produced. The oil-mixture is treated in an exactly similar manner, and the difference between the number of c.c. of *N*/10 iodine solution used in the two titrations, when multiplied by 0·8 and divided by the weight of oil taken, gives the bromine value of the oil.

Another useful constant in the case of essential oils is the "hydrobromic acid value," *i.e.*, the quantity of bromine converted into hydrobromic acid during the reaction. This is determined in a similar manner to the bromine value, except that exactly 25 c.c. of dilute sulphuric acid are used, and after the reaction is complete, 50 c.c. of a potassium bromate solution (3 grms. per litre) are added both to the actual test mixture and to the control mixture. After vigorous agitation and allowing to stand, the mixture is passed through a dry filter which retains the carbon tetrachloride solution of free bromine. The filtrate is shaken three times with 10 c.c. of carbon tetrachloride or chloroform, then again passed through the dry filter, and in 100 c.c. of the filtrate, the excess of bromate is determined by adding 1 grm. of potassium iodide and titrating with *N*/10 thiosulphate solution in presence of starch. The difference between the number of c.c. used in the control test and in the actual determination when multiplied by 0·01 gives the weight of bromine converted into hydrobromic acid, and this weight expressed as a percentage of the weight of oil taken, is termed the "hydrobromic acid value" of the oil. The following results were obtained:—Anise oil, 33·8, 34·7; anethol, 35·1, 36·9; bergamot oil, 48·6, 50·3; cajeput oil, 34·5, 35·8; carraway oil, 34·2, 35·0; carvone, 26·3, 27·3; eugenol, 152·1, 157·9; cinnamic aldehyde, 20·0, 20·2; lemon oil, 42·9, 43·5; fennel oil, 35·3, 36·5; geranium oil, 49·9, 51·0; juniper oil, 70·7, 70·9; lavender oil, 57·7, 58·9; peppermint oil, 80·0, 85·3; menthol, 85·3, 89·5; oil of *Pini pumil.*, 56·9, 58·1; rosemary oil, 55·7, 56·2; oil of turpentine, 70·2, 71·3. Some of the results can be explained only by the assumption that the primarily formed bromine compounds are decomposed by water, with liberation of a further quantity of hydrobromic acid.

The author has applied the methods described, to the examination of oil of turpentine as a type of oils free from oxygen; peppermint oil, which contains a hydroaromatic alcohol; *Eucalyptus globulus* oil, containing an oxide; clove oil, containing a phenol; and Ceylon cinnamon oil, which contains both a phenol and an aldehyde. *Oil of turpentine.* The bromine value varies between 249·2 and 259·0, and the hydrobromic acid value between 67·5 and 69·6. The former is diminished strongly by addition of petroleum hydrocarbons, and to a much smaller extent by rosin oil and "pinoline"; the latter adulterants, however, increase the hydrobromic acid value, which is not affected by petroleum. The addition of rosin oil or pinoline is indicated more clearly by the alteration of the ratio value, *i.e.*, the ratio of the bromine value to the hydrobromic acid value. *Peppermint oil.* The bromine value of Japanese oil is about 20 units higher than that of American and European oils. The bromine values of oils of similar origin do not greatly vary, notwithstanding differences in the percentage of menthol. Terpene-free oil, with an average content of menthol, has a lower bromine value than the original oil. Differences were also observed in the calculated bromine values of the portion of the oil other than menthol:—*viz.*, 190·9 for English oil, 222·6—228·3 for the cheap Japanese oil, and intermediate values for other oils; for terpene-free oil, the corresponding value is lower than that for English oil. *Clove oil.* The percentage of total eugenol may be calculated from the bromine values of the original oil and of the terpenes dissolved in carbon tetrachloride after saponification of the oil. *Eucalyptus globulus oil.* Pure cineol should have a bromine value lower than 2, and, indeed, in the examination of eucalyptus oils, the value may be taken as 0. The bromine value of an oil containing cineol is lower, the higher the percentage of cineol. For *Eucalyptus globulus* the limits, 65—70, are given. Adulteration with other essential oils or with eucalyptus oil containing phellandrene is indicated by an increase in the bromine value. *Ceylon cinnamon oil.* Determinations are made of the bromine values of the original oil, the carbon tetrachloride extract of the oil, the aldehyde separated by means of sodium bisulphite solution, and of the carbon tetrachloride extract after removal of the eugenol. From these values the percentages of cinnamic acid and eugenol in the oil can be calculated.—A. S.

Sandalwood oil; Adulteration of ——. E. J. Parry and C. T. Bennett. Chem. and Drug., 1907, **71**, 19—20.

The authors express the opinion that some of the numerous specimens of adulterated sandalwood oil contain the so-called West Indian sandalwood oil, or, probably, a fractionated oil with the more insoluble portions removed. Two specimens examined gave the following results:—

	1.	2.
Specific gravity	0·976	0·9755
Optical rotation	—10°	—9° 30'
Refractive index	1·5070	1·5068
Esters (as santalyl acetate)	5·7%	5%
Total santalol	82·2%	83%
Solubility in 6 vols. of 70% alcohol	soluble	soluble
Sp. gr. of acetylated oil	0·983	0·9846
Rotation „ „	—8°	—8°
Refr. index „ „	1·4952	1·4963

The oils were separated by distillation into ten fractions of 10 per cent. each. The properties of the fractions indicated the presence of sesquiterpene derivatives, and the odour of the first fractions suggested that of the West Indian oil. The optical rotations of the fractions were much lower than in the case of normal pure oils (see this J., 1904, 203), indicating the presence of a dextro-rotatory oil. The following standards for *Oleum Santali* are suggested:—Sp. gr., 0·975—0·982; optical rotation, —16° to —20°; refractive index, not below 1·5030; santalol (total), at least 90 per cent.; esters (as santalyl acetate), 4—6·5 per cent.; rotation of first and second fractions of 10 per cent. each, not below —16°; solubility in 70 per cent. alcohol, 1 in 5.—A. S.

Odoriferous constituents; Distribution of —— *in plants.* E. Charabot and G. Laloue. Compt. rend., 1907, **145**, 201—203.

In a previous communication (Compt. rend., **144**, 808; this J., 1907, 484) the authors showed that in the case of vervain (*Verbena triphylla*) the relative solubility of the odoriferous constituents (myrcene, geraniol, citral and verbenone) was an important factor in their distribution among the different organs of the plant, and especially between the blossoms and the leaves and stems. They now give analytical results which show that the essential oil from the blossoms contains more citral than the oil from the leaves, and that the same is true of the portion of oil which remains dissolved in water as compared with the portion that separates. In other words the essential oil from the blossoms is more soluble than the oil from the leaves. The accumulation of thujone in the green organs of *Artemisia absinthium* must also be attributed to this characteristic of relative insolubility (see this J., 1907, 166). The act of fertilisation causes in the oil of the blossoms an increase in the proportion of esters, and a decrease in the proportion of citral. It would seem that the geraniol first formed in the green organs of vervain is partially esterified and oxidised into citral.

A relatively soluble fraction of the oil is then transferred by osmosis to the blossoms, where it appears as an essential oil more soluble than that in the leaves. The reactions that take place in the blossoms favour the formation of citral, and thus tend to increase the relative solubility of the oil. But in the process of inflorescence the destruction of odoriferous constituents furnishes part of the energy for the work of fertilisation. It is mainly citral that disappears, and probably through oxidation.—C. A. M.

Brucea antidysenterica, Lam., and Brucea sumatrana, Roxb.; Examination of the barks of ——. A. H. Salway and W. Thomas. Pharm. J., 1907, 128—130.

The bark of *Brucea antidysenterica* was extracted with alcohol, and the extract distilled with steam, when traces of volatile fatty acids were obtained. The aqueous portion of the liquid left after distillation was found to contain dextrose and a small amount of a bitter principle. The resinous residue gave a small amount of a phytosterol, m.pt. 133° C., and some solid fatty acids. The bark of *Brucea sumatrana* was extracted first with cold alcohol, and the extract examined in the same way as before. Volatile fatty acids were detected. A deep red bitter principle was obtained by shaking the aqueous portion, left after steam-distillation, with chloroform. This aqueous portion contained protein substances but no sugar. The drug was subsequently extracted with hot alcohol, which deposited a light brown amorphous resin on cooling. This resin, on hydrolysis, afforded volatile fatty acids, and a solid acid melting at 66°—67° C., probably behenic acid.—F. Shdn.

Brucea antidysenterica, Lam.; Examination of the fruit of ——. F. B. Power and A. H. Salway. Pharm. J., 1907, 126—128.

The more important constituents of the fruit of *Brucea antidysenterica*, Lam., are the following:—A fatty oil containing oleic, palmitic, and stearic acids, together with a small amount of linolic acid, besides two phytosterols melting at 135°—136° C., and 147° C. respectively. There were also found resinous substances, a bitter principle, and an amorphous yellow colouring matter. Dextrose was found in considerable amount. The constituents of this fruit are very similar to those of the fruit of *Brucea sumatrana*, Roxb. ("Kô-sam seeds"), though the bitter principles in the latter are present in larger amount.

—F. Shdn.

Abrastol; Some new reactions of ——. G. Salomone. *See* XXIII.

Formaldehyde; New reaction for the detection of ——. E. Gabutti. *See* XXIII.

Cocaine in New York. Chem. and Drug., Aug. 10, 1907. [T.R.]

The Board of Trade have received a copy of a law recently passed by the New York State Legislature restricting the retail and wholesale sale of cocaine and its salts, and of *alpha* and *beta* eucaine and their salts. The Act, which takes effect on September 1, may be seen at the Commercial Intelligence Branch of the Board of Trade, 73 Basinghall Street, London, E.C.

Agreement as to the importation of drugs and medical preparations. United Kingdom—Italy. Bd. of Trade J., Aug. 1, 1907. [T.R.]

The British and Italian Governments have agreed that, so far as sanitary regulations are concerned, and in order to avoid the necessity of applying special precautionary measures in individual cases, drugs and medical preparations produced in either of the two countries shall be reciprocally granted unrestricted entry into the other country. In this reciprocal agreement it is to be noted:—

1. That medical preparations must bear on the label attached to each receptacle an exact indication—

(*a*) As to the component parts of the product expressed in the usual medical nomenclature (chemical formulæ excluded).

(*b*) As to the relative doses as prescribed for similar products manufactured and sold in Italy or the United Kingdom.

2. That serums, vaccine, virus, toxins, and similar products are not included in the terms "drugs and medical preparations."

3. That each of the two Governments reserves to itself the right to prohibit the importation of any particular product.

With reference to the exclusion of serums, vaccine, virus, toxins, and similar products from the terms "drugs and medical preparations" as used in the above-mentioned agreement, the Board of Trade have received a copy of the Italian Law and Regulations governing the manufacture and sale in Italy of the articles in question. From these documents it appears that products of this kind may not be introduced into Italy from foreign countries until permission has been obtained from the Ministry of the Interior; and in applying for this permission, proof must be afforded that the products have been manufactured under safeguards equivalent to those in operation in Italy. The Law and Regulations referred to (in Italian) may be seen by persons interested at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Medicines in Italy. Regulations governing their importation. Oil, Paint and Drug Rep., Aug. 5. [T.R.]

The U.S. Consul-General at Rome sends the following translation of a circular published by the Ministry of the Interior regulating the importation of drugs and medicines:—

In accordance with the circular of January 3, 1906, no medicinal specialities may be introduced or sold in the Kingdom except by previous approval of the Superior Board of Health.

The following general instructions are published as to the *modus operandi* for obtaining such approval:—

The applications must be directed to the Ministry of the Interior and must indicate the formula, quality and quantity of the medicinal product, the institute or the laboratory where the same was prepared. They must also give a general idea of the method of manufacturing. The formula of composition or the indication of the principal components in their respective quantities must conform to the provision of Article 27 of the law on public health and hygiene now in force, and must be reproduced upon the package, the product imported and in the notices to the public.

The therapeutic benefits attributed to the product must also be specified in the application, and to this effect it is well to remind that the said Article 27 of the sanitary law, applicable in every sense also to the foreign products to be sold in the Kingdom, prohibits absolutely the attributing to medicinal preparations special therapeutic qualities other than those that they really have and pertaining to their components.

The applications must also contain an explicit declaration to the effect that the products of import have been manufactured by authorised persons, institutions or laboratories, and in accordance with the existing laws of the country of production. Should the law of that country prescribe that prior to the sale of the determined article a special control is required, a declaration that the same was observed with favourable results must be produced.

A sample of the medicinal speciality must be presented with the application, and it would be advisable to furnish also all the notices, acts and certificates which might place the Superior Board of Health in better condition to promptly and with full knowledge to express its decision. And as the Superior Board, in the interest of public health, shall have to ascertain if the laws of the country of origin have been observed in regard to the medicinal products imported, it will be advisable that the interested importers furnish in the most satisfactory manner the proof of the observance of such laws.

Text of the law.—Article 27 of the law on public health referred to in the regulations as to the importation of medicinals provides :—

"Whoever shall sell or distribute substances or preparations advertised as remedies or secret specifics not approved by the Superior Board of Health, or whoever shall sell or distribute remedies and attribute to them upon the labels or by advertisemennt a different composition than their real one and virtues or special therapeutic qualities not recognised by the said Superior Board, shall be punished with a fine of not less than $40, and, in case of a second offence, with imprisonment up to fifteen days."

Patents.

Condensation products from formaldehyde, tannin, and aromatic monohydroxyl compounds ; Process for manufacturing ——. H. Hildebrandt, Halle on Saale, Germany. Eng. Pat. 3665, Feb. 14, 1907.

By the action of formaldehyde, trioxymethylene, &c., on a mixture of tannic acid with an aromatic monohydroxy-derivative which contains no alkyl-substituted hydroxy group, in presence of a condensing agent, new products are obtained which possess antiseptic and astringent properties, without the irritant properties of the analogous compounds produced from cotoin, guaiacol, and similar aromatic alkyloxy-compounds. The tannic acid in the above process may be replaced by other acids of the tannic series, or by their bromine or other substitution products.—T. F. B.

4-*Antipyryldimethylamine ; Manufacture of* ——. Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 10,025, April 30, 1907. Under Int. Conv., May 30, 1906.

By the action of hydrocyanic acid and formaldehyde on 4-antipyrylamine, 4-antipyrylcyanomethylamine is obtained ; by treatment with acids, this is converted successively into the amide and an inner anhydride of antipyrylaminoacetic acid. Carbon dioxide cannot be liberated directly from the latter, but after methylation, any one of the three above-mentioned compounds can be converted into 4-antipyryldimethylamine by heating with an acid, carbon dioxide being eliminated.—T. F. B.

Isobornyl esters ; Manufacture of ——. C. Weizmann and The Clayton Aniline Co., Ltd., Manchester. Eng. Pat. 18,280, Aug. 14, 1906.

Isobornyl esters are obtained by heating pinene hydrochloride with glacial acetic acid, a small quantity of a zinc salt (*e.g.*, zinc acetate), and the formate, acetate, or benzoate of an alkali or alkaline-earth. (See also Eng. Pats. 8266 and 10,798 of 1906 ; this J., 1907, 223 and 343.)—T. F. B.

Aminoacetopyrocatechin, and new intermediate products ; Manufacture of ——. Farbenf. vorm. F. Bayer and Co., Germany. Eng. Pat. 25,718, Nov. 14, 1906.

Aluminium chloride is added to a mixture of hippuryl chloride and carbon bisulphide. The solvent is poured off and a dialkyl ether of pyrocatechin (catechol) such as veratrol is added. The mixture is heated to 80° to 110° C. If veratrol be used, *N*-benzoylaminoacetoveratrol is obtained, which crystallises from alcohol in needles melting at 155° C. When this substance is heated with concentrated hydrochloric acid to 190° C., it is hydrolysed with the formation of aminoacetocatechol $C_6H_3(OH)(OH)CO.CH_2.NH_2$, 1 : 2 : 4.—F. Shdn.

Pharmaceutical product [*Theobromine*] ; *Manufacture of a new* ——. G. W. Johnson, London. From Verein. Chininfabr. Zimmer und Co., Frankfort, Germany. Eng. Pat. 26,838, Nov. 26, 1906.

A product of value in pharmacy is obtained by evaporating, preferably *in vacuo*, a solution of equimolecular weights of theobromine-sodium and sodium lactate ; it is readily soluble in water, and has an alkaline reaction. —T. F. B.

Fatty substance ; Production of a —— *from microorganisms.* G. W. Johnson. From Kalle and Co. Eng. Pat. 26,077, Nov. 17, 1906. *See* XII.

Methylene citrylsalicylic acid and its salts. R. Berendes and J. Callsen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 858,142 and 858,143, June 25, 1907.

Methylene-citrylsalicylic acid is obtained by the action of the acid dichloride of methylene-citric acid on salicylic acid ; it melts at 157°—161° C., is soluble in acetone, chloroform, and ether, and very sparingly soluble in water. Its salts, obtained by the usual method, are readily soluble in water, their solutions being neutral. All the foregoing compounds are stated to be of therapeutic value.—T. F. B.

Condensation products from formaldehyde, tannin, and aromatic monohydroxyl compounds ; Process for preparing ——. H. Hildebrandt. Fr. Pat. 375,737, March 15, 1907.

See Eng. Pat. 3665 of 1907 ; preceding these.—T. F. B.

Isobornyl acetate ; Manufacture of ——. Farbenfab. vorm. F. Bayer und Co. Fr. Pat. 375,590, Mar. 11, 1907. Under Int. Conv., June 12, 1906.

Pinene hydrochloride, dissolved in acetic acid, is heated in an autoclave at 180° C. with an acetate of an alkaline-earth metal for about 20 hours. The isobornyl acetate formed is then separated and washed.—J. F. B.

Essential oil ; Extraction of —— *from oils or fats, and notably from cocoanut oil.* Soc. Rocca, Tassy et de Roux. Fr. Pat. 375,364, March 4, 1907.

The vapours resulting from the treatment of cocoanut oil or other fats with a current of steam are condensed, and the essential oil they contain separated by any suitable process of rectification, such as distillation at a suitable temperature.—C. A. M.

Camphene ; Manufacture of ——. Fabr. de Prod. Chim. ci-devant Sandoz. Fr. Pat. 375,897, Mar. 19, 1907.

The conversion of pinene hydrochloride into camphene is effected by heating with lime or similar oxides dissolved in a solution of a higher alcohol or a sugar or polysaccharide such as starch. The camphene is distilled by means of a current of steam, and the residual solution is treated for the recovery of the lactic acid which is produced by the action of the lime on the carbohydrate.—J. F. B.

Amides of the higher fatty acids ; Process and apparatus for preparing the ——. Chem. Werke Hansa. Fr. Pat. 375,921, March 20, 1907.

See Eng. Pat. 6731 of 1907 ; this J., 1907, 637.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Three-colour photography and plates and the like therefor. O. Pfenninger, Brighton. Eng. Pat. 25,906, Nov. 16, 1906.

In the three-colour process in which two of the component negatives are obtained simultaneously on two plates, the films of which face each other, and preferably with a colour filter between the films, it is proposed to stain the emulsion of the front plate with a dyestuff which will not affect the colour-sensitiveness of the plate, but will convert it into a colour filter for the rear plate. Thus an ordinary (blue-sensitive) plate may be treated with a dilute solution of tartrazine, naphthol orange, etc. The use of such a dyestuff is also said to prevent halation in the plate.—T. F. B.

Quinoline dyestuffs, and process of making the same ; Blue ——. B. Homolka, Assignor to Farbwerke vorm. Meister, Lucius und Brüning. U.S. Pat. 844,804, Feb. 19, 1907. *See* IV.

XXII.—EXPLOSIVES, MATCHES, &c.

Phosphorus; Direct oxidation of ——. E. Jungfleisch. *See* VII.

Phosphorus; Allotropic modifications of ——. J. Böeseken. *See* VII.

PATENTS.

Explosives; Method of manufacturing ——. H. N. Wessel, Christiania, Norway. Eng. Pat. 2286, Jan. 29, 1907. Under Int. Conv., Feb. 7, 1906.

AMMONIUM nitrate explosives or "metallic ammonium nitrate explosives" are difficult to detonate in the compressed condition. If guncotton be incorporated with the mass of the explosive, it transmits the explosive wave throughout the compressed charge. Example: Ammonium nitrate (50—80 parts), ferrosilicon (5—20), nitrocellulose (5—25), organic or free carbon (0—10) and ammonium oxalate or chloride (0—8 parts). Gunpowder may also be added to the explosive.—G. W. McD.

Explosive; High ——. W. S. Winchester, Chanute, Kans. U.S. Pat. 860,509, July 16, 1907.

A LIQUID composition consisting of picric acid, nitrobenzene, nitroglycerin, and gum camphor.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

The Tintometer, &c. U.S. Customs Decision. Oil, Paint and Drug Rep., Aug. 5, 1907. [T.R.]

Chemical glassware.—Protests were filed against the assessment of 60 per cent. ad valorem duty upon articles invoiced as "tintometers" and "standard glasses," under paragraph 100 of the tariff. The importers claimed that duty should have been assessed thereon at 45 per cent. ad valorem under paragraph 112. "The testimony shows," writes the General Appraiser "that the tintometers are instruments by means of which the depth of colour in liquids and solids can be accurately measured in degrees by the use of a number of small pieces of coloured glass and that the standard glasses are severally composed of a piece of white glass to the two surfaces of which is cemented a thin layer of coloured glass, and furthermore that such colouring is done for purposes of utility only, not for decoration, and that none of said glass has been cut for decorative purposes or ground. Based upon our finding we sustain the protests, the decision of the collector in each case being reversed."

PATENTS.

Saccharimeter. L. Kunz, New York. U.S. Pat. 859,453, July 9, 1907.

THE saccharimeter has two sets of graduations, representing respectively, the Balling scale and the "pounds extract in barrels." The graduations of the latter scale are based on the formula: "258·5 × sp. gr. of wort × Balling scale + 100," in which 258·5 is the "water weight" of a barrel.—A. S.

Gas analysis; Recording apparatus for ——. H. J. Westover. Fr. Pat. 375,685, March 14, 1907. Under Int. Conv., April 4, 1906.

SEE U.S. Pat. 833,274 of 1906; this J., 1907, 115.—T. F. B.

INORGANIC—QUANTITATIVE.

Mercury; Iodometric determination of ——. E. Rupp. Ber., 1907, **40**, 3276—3277.

IN the author's process (this J., 1906, 1175) after addition of formaldehyde to reduce the mercury compound to metal, the liquid must be continuously and vigorously shaken for 1—2 minutes, and then acidified. If this be omitted, portions of the mercury compound may be reduced no farther than to mercurous oxide, which may then go into solution as acetate, and not react with iodine, thus leading to low results.—J. T. D.

ORGANIC—QUALITATIVE.

Formaldehyde; New reaction for the detection of ——. E. Gabutti. Boll. Chim. Farm., 1907, **46**, 349—351. Chem. Zentr., 1907, **2**, 98—99.

CARBAZOLE, $C_{12}H_8NH$, when treated with concentrated sulphuric acid in presence of a small quantity of formaldehyde, gives a blue coloration, and in presence of larger quantities, a bluish-green precipitate. This test is capable of detecting 1 part of formaldehyde in 10,000 in either aqueous or alcoholic solutions; the coloration resists the action of alkalis, but not of ammonia. The carbazole and also the solution to be tested must be free from nitric acid, nitrates, or other oxidising agents, which give a colour reaction with carbazole alone. Under similar conditions, acetaldehyde gives a yellow coloration changing to yellowish-red. For the detection of formaldehyde in milk, a few drops of the latter are added to a mixture of carbazole with excess of concentrated sulphuric acid. If formaldehyde be absent, instead of the blue coloration, a reddish colour is produced after some time.—A. S.

"Abrastol" ("Asaprol") $(C_{10}H_6OH\,SO_3)_2Ca+3H_2O$, *Calcium β-naphtholsulphonate; Some new reactions of* ——. G. Salomone. Giorn. Farm. Chim., 1906, **55**, 481—485. Chem. Zentr., 1907, **1**, 306.

IF red fuming nitric acid be added to a solution of abrastol, a permanent, ruby-red coloration is produced, insoluble in ether and chloroform; after some hours, or immediately on addition of alkali, the colour changes to light yellow. With 1 part of abrastol in 300,000, the reaction appears after a few minutes, especially on warming to 40°—50° C. On addition of a small crystal of sodium thiosulphate ("hyposulfit"), sulphur dioxide and sulphur are liberated, and the red colour changes successively to blue, violet, green, and yellow; on further addition of alkali, the yellow changes to deep red. The colour change from red to yellow is effected immediately by sodium sulphite. If stannous chloride be added to the abrastol solution which has been treated with nitric acid, and a few drops of hydrogen peroxide or ammonium persulphate solution introduced, then at the points of contact of the two liquids, a reddish-violet colour appears, which, on shaking, spreads throughout the liquid; the colour is intensified by addition of sulphuric acid. For the detection of abrastol in wine, 25—50 c.c. are shaken with 15—30 c.c. of amyl alcohol and a few drops of ammonia, the amyl alcohol solution is filtered and evaporated, the residue treated with 1—2 c.c. of water, and the solution tested as described above. Or, the evaporation-residue of the amyl alcohol solution is fused with metallic sodium or potassium, the product treated with water, and the solution tested for alkali sulphide by means of sodium nitroprusside. This reaction serves to distinguish abrastol from β-naphthol.—A. S.

Lignocelluloses; Colour reactions of ——. C. F. Cross, E. J. Bevan, and J. F. Briggs. *See* XIX.

Alcohol; Detection of methyl ——. J. Wolff. *See* XVII.

ORGANIC—QUANTITATIVE.

Palladium; Use of —— *as contact-substance in elementary analysis.* A. Jacobsen and G. Landesen. Ber., 1907, **40**, 3217—3225.

PALLADIUM, in the form of palladium-asbestos, gives excellent results when used as contact-substance in combustion analyses. It may be prepared according to Winkler's method, by precipitation of a solution of pure palladium chloride in presence of asbestos, by means of alkaline sodium formate. The authors' preparation contained 17·7 per cent. of palladium, and 1·6 grms. (= 0·3 grm. of metal) have served, without apparent depreciation, for some 70 analyses. A suitable combustion tube for use with palladium-asbestos is obtained by taking a tube 30—35 cm. long and 1 cm. diameter, heating it at about

6 cm. from one end, and drawing it out so that the constricted portion is about 15 cm. long and 0·5 cm. diameter. The constricted part is filled loosely with the palladium-asbestos (which is kept in place by a small perforated earthenware stopper), the longer wide portion of the tube serves to receive the porcelain boat containing the substance to be analysed, and by means of perforated rubber stoppers at each end, the tube is connected to an oxygen holder and absorption bulbs as usual. The constricted part of the tube lies upon asbestos paper in an iron gutter, which during the combustion is kept at an incipient red heat by means of a Teclu slit-burner. The combustion is carried out with the usual precautions. A convenient rate of oxygen to use is, 10 to 15 bubbles per 5 seconds, as observed in a "Wulff flask" having an inlet tube of 4 mm. diameter. In analysing substances containing nitrogen or sulphur, a combustion tube having a length of 25 cm. between the constricted portion and the outlet to the absorption bulbs is used, porcelain boats containing lead peroxide being placed in this portion. Before the combustion, the peroxide and the tube must be dried by heating them to about 200° C. During the combustion the peroxide is kept at 200—300°, in the case of nitrogenous substances, and, in the case of substances containing sulphur, at 300—350°; in the latter case the sulphur may afterwards be determined by shaking the lead peroxide for 2 hours with a 5 per cent. solution of sodium carbonate, and precipitating an aliquot portion of the liquid with barium chloride.—H. B.

Lignocellulose; Phloroglucinol-absorption of ——. *Determination of mechanical wood pulp.* C. F. Cross, E. J. Bevan, and J. F. Briggs. *See* XIX.

Chloral hydrate; Assay of ——. P. A. W. Self. *See* XX.

Beetroot; Instantaneous effect of the cold aqueous diffusion for the direct determination of sugar in ——. (*Pellet's method.*) H. Pellet. *See* XVI.

Cane and beetroot sugar products; Non-influence of the lead precipitate in the analysis of ——. *Non-influence of potassium acetate on the polarisation of sucrose.* H. Pellet. *See* XVI.

Cane sugar products; Non-influence of dilution on the polarisation of solutions of ——. H. Pellet. *See* XVI.

Starch in potatoes; Determination of ——. L. Pellet and Metillon. *See* XVI.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Animal charcoal; Decolorising action of ——. E. Knecht. Chem. and Drug., July 27, 1907, 179.

Animal charcoal from various sources contains the ash of the bodies it is made from. A good deal of this ash can be removed by hydrochloric acid, but there is still a considerable residue—ferric oxide—which can be yet further reduced by digestion with hydrofluoric acid. In this way an ash of 5·6 per cent. left after hydrochloric acid purification, can be reduced to 0·6 per cent. The difference between animal and wood charcoal as regards decolorising properties offers an incongruity which has never been satisfactorily explained. The author was led to examine various charcoals for any peculiarity. He found that there was not more than a mere trace of nitrogen in wood charcoal, but that in animal charcoal there is from 5 to 7 per cent. of nitrogen and 0·5 per cent. of sulphur. These are not casual impurities, and probably are the key to the explanation of the differences in behaviour of wood and animal charcoal. He had tried to eliminate the nitrogen from animal charcoal by heating with caustic soda, but could not effect much reduction—5·6 per cent. was reduced to 3·61 per cent.—but it was found that the decolorising properties of the charcoal, as tested with dyes, was proportionally reduced as the nitrogen was eliminated. The paper was published to secure priority in these observations: (1) That fixed nitrogen is present, and (2) that the decolorising action is in direct ratio to the amount of nitrogen.

High temperatures; Production of ——. C. Chabrié. Compt. rend., 1907, **145**, 188—189.

In order to heat any substance to a temperature above that of melted platinum, it may be placed in a crucible of magnesia contained in an ordinary earthenware crucible, and the space between the two filled with a mixture of ferric oxide and aluminium, which is ignited in the usual way (see Goldschmidt, this J., 1898, 543, 584, 649, 1151; 1899, 23, 870). The small crucible of magnesia may be replaced by a tube of the same material passed through openings in the outer vessel, but a porcelain tube will not resist the high temperature.—C. A. M.

Radio-activity of thorium products. O. Hahn. Ber., 1907, **40**, 3304—3308.

The author has shown that thorium does not break down directly into radio-thorium, but that there is an intermediate product, which emits no α-rays and to which he gives the name meso-thorium. It emits β-rays. Not only radio-thorium, but thorium itself, is found to emit α-particles. The following is a list of the various thorium products and the rays which they emit:—thorium, α-rays; meso-thorium, β-rays; radio-thorium, α-rays; thorium X, α-rays; emanation, α-rays; thorium A, sluggish β-rays; thoriums B and C, α-, β- and γ-rays.—H. B.

Peroxide of copper, and the catalysis of alkali hypochlorites and hypobromites. E. Müller. Z. anorg. Chem., 1907, **54**, 417—422.

When chlorine is passed into a strong solution of sodium hydroxide (13*N*, for instance), previously saturated with copper hydroxide by prolonged shaking, a yellow flocculent precipitate appears, and at the same time oxygen is evolved. If the supply of chlorine be stopped, this evolution of oxygen continues, until the colour of the solution becomes a deep clear blue, and no hypochlorite remains in it. The yellow precipitate is evidently identical with the peroxide, Cu_2O_3, obtained by electrolysis (this J., 1907, 156). A similar catalytic decomposition of hypochlorite solutions, wherein peroxide of copper is alternately formed and decomposed, may be brought about by the use of metallic copper instead of the hydroxide. The yellow peroxide is highly unstable. Bromine behaves like chlorine, but iodine is inactive as a catalyst.—F. Sodn.

Albumins; Coagulation of —— *by ultra-violet light and by radium.* G. Dreyer and O. Haussen. Compt. rend., 1907, **145**, 234—236.

The results of the experiments, in which the various albumins were exposed in quartz vessels to intense light, were as follows:—Egg-albumin and serum-albumin were coagulated by prolonged exposure, more readily in acid than in neutral or alkaline solutions. Globulin was coagulated less readily. Fibrinogen does not coagulate, and is rendered by the exposure less readily coagulable on heating. Horse serum is coagulated but slightly; more readily in a solution made faintly acid with acetic acid. Syntonin does not coagulate either in acid or alkaline solution. Solutions of peptone or of casein do not coagulate, but acquire a straw-yellow tint. Vitellin coagulates most readily of all the substances examined. By prolonged exposure, it is entirely precipitated. Lecithin, which is yellow to begin with, is decolorised, but not coagulated. No smell of trimethylamine was perceptible. In all these instances, true coagulation occurs, not a simple precipitation. The ultra-violet rays are the effective portion of the radiation. If the substance be exposed in a thin layer with large surface, the surface becomes covered with a membrane, the formation of which is probably a result of the increase, under the action of the light, of the surface viscosity of the liquid. Vitellin coagulates also on exposure to radium. This is not the case, however, with globulin, fibrinogen, nor solutions of ricin, trypsin, or coli-agglutin, though the enzymic activity of all these substances is lessened by exposure to radium.—J. T. D.

Trade Report.

The German chemical industry in 1906. For. Off. Ann. Series, 3796. [T.R.]

In the chemical industry, the demand was so great that the industry could hardly cope with it, and took refuge in contracts with exceptional extensions of time for delivery. Nor did the enlargement of works prove of any avail, as machinery and apparatus could not be obtained; so that the facility of increased production will only tell in the future. It is believed that in various branches the high-water mark has been reached, for manufacture and supply have natural limits, while the increase in the cost of raw material and in wages continues. The increased cost of raw material was most felt in coal and saltpetre. Wages increased on an average 5 to 10 per cent., yet prices of finished articles could be only raised somewhat towards the end of the year. With the exception of a few articles, the chemical industry has, during the first year of the new tariff, been able to increase its sales. While imports of raw materials have been much increased, exports of manufactured articles have either maintained the exceptional figures of 1905, or even surpassed them. The success of the year is assigned to the world's boom, and not to any advantages which the chemical industry has gained from the new treaties. It is thought that the German chemical industry is now handicapped in its export to France, Austria-Hungary, and Russia. In Austria-Hungary, the duty upon coal-tar colours has been increased twelvefold. In both Russia and Austria-Hungary branch factories have been established, so that an intensified working abroad of German capital, but not of German labour, will be the result. In the treaty with Switzerland, the Federal Government undertook to extend the benefits of its patent laws to chemical produce; but the Bill at present under discussion is condemned by the German chemical industry as illusory. There was also much dissatisfaction because the new commercial treaty with the United States was delayed. The United States are rapidly, under the existing Customs tariff, developing a coal-tar colour industry of their own, and if the new treaty brings no change in this respect. German branch factories in the United States will be the only means of preserving what is left of the market. A collapse of prices in the colour industry at home had suggested some understanding between the leading manufacturers. The lowest possible prices had been reached, together with the cheapest possible individual production. Further reduction in cost of manufacture could only be attained by means of combination, simplifying the organisation of the existing works, consolidating identical branches of manufacture, reducing the expenses in connection with sales and abolishing such incidental expenses of competition as advertisements, &c. The patent protection had proved of little avail. Any patent granted had stimulated research in competitive establishments, and the competition resulting from an alternative mode of production reduced the value of the manufactured article below cost price. Thus it is said that one of the direct inducements for combination was offered by the manufacture of synthetic indigo; in fact, so far as this article is concerned, an understanding has been arrived at, not only within certain groups, but between the leading groups themselves; and this understanding is pointed to as possibly the first step towards a gigantic German chemical trust. To-day, the use of natural indigo has been discontinued in Germany and Austria-Hungary, and even France now shows a preference for synthetic indigo. Russia, Turkey, Egypt, and North America have so far remained the most faithful customers for natural indigo, probably because the sale in those countries is controlled by middlemen, who find the sale of the artificial dyestuff less profitable, because it has a definite market price. There is no doubt that natural indigo has been more rapidly ousted than even the most hopeful manufacturers of the artificial article had anticipated. The values and quantities of import and export of indigo in 1905–06 are the following:—

1905.

	Imports.		Exports.	
	Quantity in 1000 Tons.	Value in 1,000,000 Marks.	Quantity in 1000 Tons.	Value in 1,000,000 Marks.
Indigo	0·2	0·1	11·2	25·7
Aniline and other tar dyestuffs .	1·7	4·8	36·6	100·0
Allzarin	—	0·1	9·3	15·5
Total ...	—	5	—	141·8

1906.

	Imports.		Exports.	
	Quantity in 1000 Tons.	Value in 1,000,000 Marks.	Quantity in 1000 Tons.	Value in 1,000,000 Marks.
Indigo	0·1	0·1	12·7	29·3
Aniline and other tar dyestuffs ..	2	5·5	52·4	116·0
Anthracene dyestuffs (10 m'ths.)	—	0·1	4·0	12·8
Alizarin red	—	—	7·2	9·8
Total ...	—	5·7	—	168·5

From this short table it follows incidentally that the value of the excess export of artificial dyestuffs has risen in 1906 against 1905, by 27,000,000 marks. The following are the dividends of the more important chemical factories:—

	1903.	1904.	1905.	1906.
	Per cent.	Per cent.	Per cent.	Per cent.
Badische Anilin und Soda Fab.	26	24	27	30
Chem. Fab. vorm. Weiler ter Mer (Uerdingen) ..	10	8	8	10
Verein chem. Fab. Mannheim	—	16	19	20
Chem. Fabr. Buckau. Magdeburg..............	—	—	10	12
Chem. Fabr. Elektron, Griesheim	12	12	12	12
Farbwerke vorm. Meister, Lucius und Brüning ..	20	20	24	30
Deutsche Gold und Silberscheide-Anstalt, Frankfurt-on-Maine.........	—	18	22	—
Chem. Werke Albert, Biebrich	15	18	19	22½
Friedrich Bayer u. Co., Elberfeld.............	25	30	33	36

The German match industry is practically controlled by a manufacturers' convention, which embraces more than 80 per cent. of the total manufacture. In spite of the increased cost of wood and chemicals, and the increased price of labour, the price of the finished article was not raised, because it was hoped that the outsiders would thus be compelled to join the syndicate. Matches in various packings are being more and more used for advertising purposes, and this development greatly benefits the industry. Possibly this branch of the industry might be pushed by British manufacturers. The Customs duty on matches—wooden, as well as wax, &c.—has remained unaltered under the new treaties, *viz.*, 10 marks per 100 kilos. The figures for the import and export 1905–06 are as follows:—1906, imports, ·500 tons, £1,500,000; exports, 1·400 tons. £375,000. 1905, imports, ·200 tons, £500,000; exports, 1·300 tons, £350,000.

Chemical imports of Japan in 1906. Oil, Paint and Drug Rep., Aug. 5, 1907. [T.R.]

Artificial indigo continues to make headway and natural indigo to lose ground. In dyes, colours and paints the net advance was £71,843; in drugs and chemicals the net decline £103,046. Saccharin now appears in the tables with a value of £12,017. The great falling off in leather was principally to the disadvantage of the United States, as the great increase in that import in 1905 had been to the profit of that country; from the United Kingdom the import to all ports slightly increased. The increase of £104,769 in ammonium sulphate and in some other chemical manures is significant of an intention to improve agricultural methods in Japan. Printing paper was imported to a value of £140,332, and wood pulp to a value of £40,299. an increase of £18,960.

New Books.

Subject List of Works on Military and Naval Arts, including Marine Engineering, in the Library of the Patent Office. [Patent Office Library Series: No. 18. Bibliographical Series: No. 15.] Darling and Son, Ltd., 34–40, Bacon Street, London, E., and Patent Office, 25, Southampton Buildings, Chancery Lane, W.C. 1907. Price 6d.

Small 8vo book, containing 304 pages, and filled with references and directions to works in the library of H.M. Patent Office library. Attention is specially drawn to the important references to explosives and ammunition, the former extending from pages 67 to 77, and the latter from pages 7 to 11.

Beet-Sugar Manufacture and Refining. By Lewis S. Ware. Two Volumes. First Edition. John Wiley and Sons, New York, U.S.A. 1905. Price 17s., or 4 dollars. Chapman and Hall, Ltd., London.

Vol. I. of this work is of full 8vo size, and contains 537 pages of subject matter, with 261 illustrations, and an alphabetical index. The subject matter is classified as follows:—I. Introduction, with practical considerations on the beet sugar industry. II. Delivery, unloading, and tare estimation. III. Siloing, and changes during keeping. IV. Transportation. V. Beet washing. VI. Weighing of beets. VII. Beet slicers. VIII. Diffusion. IX. Exhaustion of cossettes, and their drying. X. Preliminary epuration and heating of diffusion juices. Epuration: XI. Limestone and lime kilns. XII. Liming. XIII. Carbonatation. XIV. Filter-presses. XV. Second carbonatation. XVI. Mechanical filtration of juices and syrups. XVII. Sulphuring of juices and syrups. XVIII. Other epurating agents, and electrical epurating processes.

Vol. II. contains 641 pages of subject matter, with 225 illustrations, and including 20 pages devoted to an appendix consisting of a collection of tables. At the end, is an alphabetical index of subjects. The subject matter is classified under the following heads:—I. Evaporation. II. Manufacture of raw sugar. III. Working after-products. IV. Manufacture of white sugar. V. Utilization of residues. VI. Steam economy. VII. Practical work of a beet-sugar factory.

Australia: Conditions and Prospects of British Trade. Board of Trade Commerical Intelligence Committee. [Cd. 3639.] Price 11d.

This report is based upon materials collected by Mr. R. J. Jeffray in Australia and information drawn from other sources. After some general trade statistics and a list of the imports into the Commonwealth, an account is given of the more important Australian industries, among which Soap-making and Candles, Tanning, Brewing and Chemicals and Drugs are dealt with in detail. Then follows a survey of the various branches of trade, Textiles, Iron and Steel, Paper, Chinaware, Oils and Colours, Matches, &c., and a discussion on the causes of the success of foreign competition, with conclusions and appendices.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

17,323. Hawes. Obtaining dry products from liquids and semi-liquids. July 29.

17,580. Disher and Goldring. Treating smoke and fumes so as to destroy their obnoxious properties. Aug. 1.

17,607. Macherski and Koperski. Improvement or refinement of liquids.* Aug. 1.

17,688. Stevens and Richards. Machine for centrifugal separation of gaseous mixtures, also liquids and solids either from gaseous mixtures or from each other. Aug. 2.

17,784. Kestner. Centrifugally operating apparatus for atomising liquids. [Belgian Appl., Aug. 4, 1906.]* Aug 3.

17,793. Baron and Fuel Saving and Water Treating Co. Separating solid matter from fluids. Aug. 3.

17,876. Tetley and Clayton. Apparatus for pumping and controlling the passage of fluids and semi-fluids.* Aug. 6.

17,884. Beeman. *See under* XVI.

17,976. Pirsch. Method of manufacturing emulsions. [Belgian Appl., Aug. 8, 1906.]* Aug. 7.

Complete Specifications Accepted.

14,653 (1906). Blackie. Rendering certain powders miscible with water and retaining them in such condition and the products prepared thereby. Aug. 8.

18,123 (1906). Lacy. Method of and apparatus for producing radio-active effects. Aug. 14.

23,105 (1906). Gardner and Gardner. Purification of sea water in connection with power plants. Aug. 14.

4366 (1907). Scherfenberg. Reaction towers, regenerative chambers, &c. [Appl under Int. Conv., Feb. 21, 1906.] Aug. 8.

II.—FUEL, GAS, AND LIGHT.

Applications.

17,267. Pownall. Gas producer. July 29.

17,360. Coolidge. Conductive filaments for electric lamps.* [U.S. Appl., Aug. 1, 1906.] July 29.

17,438. Botley and Cutler. Gas generators. July 30.

17,687. Koch. *See under* X.

17,768. De Fazi, Claussen, and Cobbett. Filaments for electric incandescent lamps. Aug. 3.

17,802. Lessing. Treatment of by-product coke oven gases rising in the ascending-pipes between the coking periods. Aug. 6.

17,858. Koppers. Retort furnaces for manufacturing gas and coke.* Aug. 6.

17,912. Wilkie and Simon-Carves By-Product Coke Oven Co., Ltd. Coke and like wagons. Aug. 7.

17,913. Wilke and Simon-Carves By-Product Coke Oven Co., Ltd. Method of and appliances for quenching coke. Aug. 7.

17,973. Bloxam (Siemens und Halske). Manufacture of electric incandescent lamp filaments consisting of difficultly fusible metals.* Aug. 7.

17,986. Carroll. Water gas apparatus.* Aug. 7.

17,987. Ainsworth. Gas generating apparatus. Aug. 7.

17,991. Ernst. Production of lighting gas. [Danish Appl., Aug. 8, 1906.]* Aug. 7.

18,010. Adams. Gas generating apparatus. Aug. 8.

18,026. Loomis and Pettibone. Method of making and delivering mixed gases to gas engines.* Aug. 8.

18,053. Jahoda and Electrische Gluhlampenfabrik "Watt." Manufacture of filaments for incandescent electric lamps. Aug. 8.

18,060. Sefton-Jones (Hartmann und Braun A.-G. and Santa). Apparatus for measuring dangerous gases in mines.* Aug. 8.

18,125. Clark. Fuel. Aug. 10.

18,141. Jones. Coke ovens. Aug. 10.

18,153. Wilton. Treatment of producer, water, and other poor gases with particular reference to the firing of coke ovens. Aug. 10.

18,156. Schirp. Carbonising plants. Aug. 10.

18,170. Claussen and De Fazi. Production of a combustible gas. Aug. 10.

Complete Specifications Accepted.

12,465 (1906). Hartenstein. Manufacture of carbide. Aug. 8.

18,081 (1906). Becker and Greener. Gas producers. Aug. 14.

18,622 (1906). Justice (Deutsche Gasglühlicht A.-G.). Producing metallic incandescence bodies for electric glow lamps. Aug. 8.

18,974 (1906). Vanino and Lambrecht. Method of producing stone-hard luminous bodies. Aug. 14.

20,359 (1906). Fritz. Producing gas and its by-products from coal and peat. Aug. 8.

24,144 (1906). Crossley and Rigby. Ammonia recovery gas-plants. Aug. 8.

5658 (1907). Petersson. Continuously producing carbide from lime and carbon. Aug. 14.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

17.440. Burgess and Anfilogoff. Treatment of benzine. July 30.

17.450. Nikiforoff. Treating naphtha and carburetting water gas to obtain aromatic hydrocarbons. July 30.

17.523. Knopf. Producing a fat from mineral oils for industrial purposes and as a basis for ointment.* July 31.

17,883. Wohle. Treatment of mineral oils. Aug. 6.

18,118. Parker. Distillation of carbonaceous substances. Aug. 9.

Complete Specification Accepted.

16,446 (1907). Chemische Fabriken vorm. Weiler-Ter-Meer. Manufacture of pure α-naphthylamine. [Appl. under Int. Conv., Aug. 1, 1906.] Aug. 8.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

17,610. Johnson (Kalle und Co.). New colouring matters for dyeing wool.* Aug. 1.

17,675. Ulrichs. Manufacture of dyes. [Ger. Appl., Oct. 12, 1906.]* Aug. 2.

17,676. Ulrichs. Manufacture of dyes. [Ger. Appl., Nov. 2, 1906.]* Aug. 2.

17,677. Ulrichs. Manufacture of dyes. [Ger. Appl., Nov. 17, 1906.]* Aug. 2.

17,749. Hirschberger, Maron, and Levinstein, Ltd. New sulphurised dyestuffs and the production thereof. Aug. 3.

18,149. Friswell. Manufacture of phenylglycine and its homologues. Aug. 10.

Complete Specifications Accepted.

20,802 (1906). Newton (F. Bayer und Co.). New dyestuff of the oxazine series and its leuco-derivatives. Aug. 8.

593 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of methyl thio-phenol-ortho-carboxylc acid and derivatives thereof. Aug. 14.

1593 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of sulphurised dyestuffs. Aug. 14.

1594 (1907). Imray (Meister, Lucius, und Brüning). Sulphurised leuco-bodies. Aug. 14.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

89A. Haddan (Lumière). *See under* XIX.

17,430. Ransford (Cassella). Method of dyeing wool. July 30.

17,460. Diamanti. *See under* XIX.

17,856. Ransford (Mehler and Rey). Dyeing and shaping hat bodies. Aug. 6.

Complete Specifications Accepted.

29,134 (1906). Calico Printers' Association and Fourneaux. Printing textiles. Aug. 14.

16,495 (1907). Vereinigte-Glanzstofffabriken A.-G. Manufacture of artificial textile fibres. Aug. 14.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

23,165A (1906). Sarason and Haller. Generating oxygen for effervescing baths. [Appl. under Rule 5, Oct. 19th, 1906.]* Aug. 10.

17,376. Govan. Manufacture of sulphate of ammonia. July 30.

17,810. Ashworth and Anselm. Manufacture of stable hydrosulphite compounds. Aug. 6.

18,096. Johnson (Chem. Fab. Schlempe). Manufacture of hard cyanide briquettes. Aug. 9.

Complete Specifications Accepted.

16,910A (1906). Johnson (Verein Chemischer Fabriken). Removing impurities from hydrochloric acid gases. [Appl. under Rule 5, July 26, 1906.] Aug. 8.

18,505 (1906). Feld. Treatment of gases for extraction of ammonia. Aug. 8.

91 (1907). Boult (Stange). Apparatus for concentrating sulphuric acid. Aug. 8.

7836 (1907). Joseph and Ozonair, Ltd. Ozonising air. Aug. 8.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

17,743. Marino. Metallization of vitreous porcelain and earthenware surfaces for the electrolytic deposit of metal or metallic alloy thereon.* Aug. 3.

17,744. Noble. Applying bodies and glazes in the manufacture of glazed bricks and tiles. Aug. 3.

18,162. Milliron and Irwin. Glass-working furnaces.* Aug. 10.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

17,270. Oates. Continuous kilns.* July 29.

17,562. Müller. Manufacture of cement. Aug. 1.

17,728. Goodwin. Kilns for calcining flints, felspar, and the like. Aug. 3.

17,744. Noble. *See under* VIII.

17,826. Stanley. Fireproof plaster. Aug. 6.

Complete Specifications Accepted.

17,534 (1906). Wolman. Solutions for preserving wood and other fibrous materials. Aug. 8.

430 (1907). Hitchings and Dunz. Concrete for use in building. Aug. 8.

5327 (1907). Sefton-Jones (Dada and Fuchs). Treatment of wood with solution of chromium salts. Aug. 8.

X.—METALLURGY.

Applications.

16,504a. Becker and Lamb. Production of metallic alloys. [Appl. under Rule V., July 18, 1907.] July 30.

17,343. Dwight and Lloyd. Roasting and sintering ores.* July 29.

17,344. Dwight and Lloyd. Ore roasting and sintering processes. [U.S. Appl., July 30, 1906.]* July 29.

17,364. De Bavay. Separating parts of the constituents of ores from the remainder. July 29.

17,519. Schneider. Manufacture of steel for armour plates.* July 31.

17,546. Collins. Manufacture of briquettes for metallurgical purposes. July 31.

17,613. Plathner and Dorn. Coating metals.* Aug. 1.

17,627. Cowper-Coles. Manufacture of metallic mirrors. Aug. 1.

17,687. Koch. Smelting furnace heated with oil having chambers acting alternately as smelting or preliminary heating chambers. [Ger. Appl., Aug. 4, 1906.]* Aug. 2.

17,779. Lavington (Brown). Treatment of ores for the separation of metals contained therein.* Aug. 3.

17,788. Siemens. Gas-fired crucible furnaces for melting steel. Aug. 3.

17,805. King's Norton Metal Co. and others. Extracting copper from ores and residues. Aug. 6.

18,043. Schmidt. Production of metallic deposits. [Ger. Appl., Aug. 10, 1906.]* Aug. 8.

Complete Specifications Accepted.

17,441 (1906). Ellis (Produits Chimiques de Croissy). Extraction of copper and other metals from pyrites. Aug. 14.

17,935 (1906). Marks (Gio Ansaldo Armstrong and Co.). Manufacture of armour plates. Aug. 14.

18,574 (1906). Gathy. Extracting copper from ores, &c. [Appl. under Int. Conv., Aug. 21, 1905.] Aug. 8.

23,230 (1906). Simpson. Process for carburising, hardening, and tempering steel. Aug. 14.

28,746 (1906). Zahn. Processes of enamelling and annealing. [Appl. under Int. Conv., Dec. 22, 1905.] Aug. 8.

2789 (1907). Thelberg. Process for treating ores containing zinc and lead sulphides. Aug. 14.

3174 (1907). Siemens und Halske A.-G. Manufacture of ductile tungsten or alloys thereof. [Appl. under Int. Conv., March 22, 1906.] Aug. 8.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

17,458. Hickley. Electrolytic cells.* July 30.

17,489. Fennell and Perry. Electrodes for storage batteries. July 31.

17,492. Finlay. Anode.* July 31.

17,717. Cowper-Coles. Electroplating.* Aug. 2.

17,743. Marino. *See under* VIII.

17,968 and 17,969. Classen. Electrolytic production of metallic dark coatings upon metals.* Aug. 7.

18,082. Szek. Carbonelectrodes. Aug. 9.

18,101. Wunner'sche Bitumen Werke. Process for manufacture of insulating materials. [Ger. Appl., April 29, 1907.] Aug. 9.

Complete Specifications Accepted.

20,380 (1906). Cowper-Coles. Electrolytes for the electro-deposition of copper. Aug. 14.

27,120 (1906). Jumau. Electrometallurgical process for extracting copper from its ores. [Date Appl. for Nov. 29, 1905.] Aug. 14.

27,215 (1906). Marino and Barton-Wright. Agglutinant for consolidating active material of electric accumulators. Aug. 14.

13,618 (1907). Geb. Siemens und Co. Electrodes for search lights. [Date Appl. for July 13, 1906.] Aug. 14.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

17,481. Isherwood and Brown. Apparatus for recovering waste fat or refining neatsfoot oil. July 31.

17,799. Hoffmann. Clarification of fats and oil and treatment of skins. Aug. 3.

17,910. King's Norton Metal Co. and others. Composition for cleaning and lubricating gun and rifle barrels. Aug. 7.

18,137. Shaw. Filter for purifying oils. Aug. 10.

Complete Specification Accepted.

27,036 (1906). Lees, Lees, and Lees. Oil-testing apparatus. Aug. 14.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

Applications.

17,720. Fabre and Espinasse. Waterproofing agglomerate solid.* Aug. 2.

17,778. De Roquefort. Treatment of india-rubber waste to adapt it for industrial treatment and utilisation. Aug. 3.

17,868. Grognot. Manufacture of resinous and gumming products. Aug. 6.

Complete Specifications Accepted.

19,870 (1906). Snyder. Process of treating wood for extraction of turpentine. [Date Appl. for Dec. 1, 1905.] Aug. 14.

24,969 (1906). Gentzsch. Utilisation of waste rubber. [Date Appl. for Nov. 16, 1905.] Aug. 8.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

17,711. Smith. Treatment of horns, hoofs, and bones. Aug. 2.

17,799. Hoffmann. *See under* XII.

17,953. Kathe. Producing plastic masses from casein. [Fr. Appl., Aug. 8, 1906.]* Aug. 7.

Complete Specification Accepted.

17,667 (1906). Thoma. Material for manufacture of boots and shoes. [Date Appl. for Aug. 28, 1905.] Aug. 14.

XV.—MANURES, &c.

Complete Specifications Accepted.

24,901 (1906). Catto. Condensing and deodorising gases arising from fish manure drying plant.

12,741 (1907). Roth. Process for manufacturing a fertiliser from atmospheric nitrogen. Aug. 14.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

17,884. Beeman. Dehydration of solutions, liquid mixtures, and syrups. Aug. 6.

17,885. Beeman. Rendering concentrated solutions of liquid mixtures of vegetable sugars non-fermentable and subsequently restoring that capacity. Aug. 6.

Complete Specification Accepted.

22,387 (1906). Mirrlees Watson Co. (Knight). Process and apparatus for removing impurities from cane juice. Aug. 14.

XVII.—BREWING, WINES, SPIRITS, &c.

Appfications.

17,841. Durupt. Combined denaturalisation and carburation of alcohol. Aug. 6.

17,893. Epstein. Production of fermented and other products from vegetables. Aug. 6.

Complete Specification Accepted.

24,082 (1906). Linzel. Manufacture of non-alcoholic drinks from fermented liquors. Aug. 8.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

Applications.

17,285. Liversedge. Manufacture of butter and butter substitutes. July 29.

17,325. Lewicki. Treatment of sewage matter for separating floating material from liquids.* July 29.

17,389. Malabar. Filtration or purification of sewage and trade liquids. July 30.

18,135. Radcliffe. Treatment of alkaline effluents. Aug. 10.

18,143. Faucon (*née* Berger). Hygienic and aseptic process. [Fr. Appl., Aug. 13, 1906.]* Aug. 10.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

89A. Haddan (Lumière). Apparatus for manufacture of collodion filaments, artificial silk, horsehair, &c. [Appl. under Rule V., Jan. 1, 1907.] Aug. 3.

17,460. Diamanti. Process of denitrating artificial silk on spools.* July 30.

18,164. Crumière. Manufacture of a plastic, transparent, imputrescible material of considerable resistance from a solution of cellulose. [Fr. Appl., Sept. 3, 1906.]* Aug. 10.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

17,619. Imray (Meister, Lucius, und Brüning). Manufacture of reduction products of *p*-aminophenylarsenic acid and its derivatives. Aug. 1.

17,723. Everett and Cox. Manufacture of camphor substitutes. Aug. 2.

17,971. MacDougall. Manufacture of oxalic acid. Aug. 7.

Complete Specification Accepted.

17,154 (1906). Imbert. Producing hydroxy-fatty acids. Aug. 8.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application.

18,068. Spitzer. Process for making photo-mechanically etched plates after any desired negative or transparent positive.* Aug. 9.

Complete Specifications Accepted.

29,480 (1906). Bloxam (Neue Photographische Gesellschaft). Converting silver pictures into platinum pictures having catalytic power. Aug. 8.

716 (1907). Brasseur. Process for producing multicolour photographs by means of one negative. Aug. 14.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

17,284. Martin and Kynoch. Method of testing nitro-explosives. July 29.

17,521. Wolffenstein and Boeters. Manufacture of nitro-compounds. [Ger. Appl., Aug. 3, 1906.]* July 31.

17,877. Luck. Treatment and preservation of explosives. Aug. 6.

Journal of the Society of Chemical Industry.

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Journal and Patent Literature.

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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Energy of expansion of gases and vapours; Means for transferring the —— to liquids and air. G. Meyersberg, Berlin. Eng. Pat. 15,786, July 12, 1906.

See Fr. Pat. 368,235 of 1906; this J., 1906, 1209.—T. F. B.

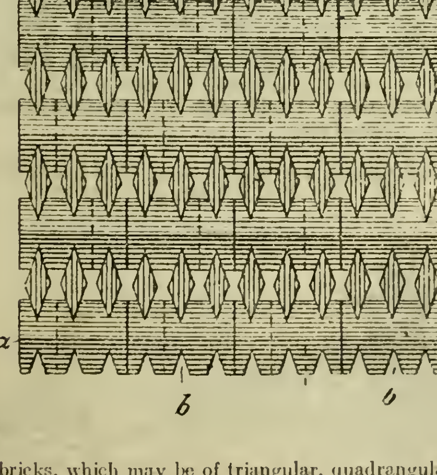
Mixing liquids in definite proportions; Apparatus for ——. H. Collet, London. Eng. Pat. 26,146, Nov. 19, 1906.

One of the liquids is fed into a tank provided with a siphon, which discharges into a smaller cistern placed below. This latter cistern is provided with an inlet pipe closed by a ball- or float-valve, a siphon, and a large straight overflow, the top of which is above the level of the siphon. The chemical solution or other liquid to be mixed with that from the first tank, is fed into this cistern through the ball-valve, which closes when the desired proportion has entered the cistern. As liquid flows from the first cistern to the second, the latter fills up to the overflow, the siphon is started, and the contents of both cisterns are emptied into a mixing tank or channel. When the tanks are empty the process starts over again.
—W. H. C.

Kilns; Rotary ——. W. R. Warren, New York. Eng. Pat. 26,875, Nov. 26, 1906.

See U.S. Pat. 839,053 of 1906; this J., 1907, 189.—T. F. B.

Reaction-towers, regenerative chambers and the like. R. Scherfenberg, Berlin, Germany. Eng. Pat. 4366, Feb. 21, 1907. Under Int. Conv., Feb. 21, 1906.



The bricks, which may be of triangular, quadrangular, or polygonal section, are provided with several V-shaped notches, *b*, on their lower edges, which fit over the bevel, *a*, of the upper edges. The bricks are packed with the layers alternately at right angles, as shown, so that the whole structure is well bound together.—W. H. C.

Drying-stove or kiln [for drying coal, etc.]. P. Ostertag, Winterthur, Switzerland. Eng. Pat. 7784, April 3, 1907.

The kiln is intended for drying substances which, when wet, can be exposed to a high temperature, but which, as they become drier, must only be exposed to lower temperatures to prevent ignition. The drying-stove is of the ordinary kind with superposed rotating floors supported by a central hollow shaft and rotated by gearing. The material is fed on to the top floor, and the hot air or other drying medium which enters slightly in advance, is compelled by a partition, carried by the outer casing, to travel round the annular space in the same direction as the material being dried. The material falls from floor to floor, fresh supplies of drying medium at suitable temperatures being supplied to each of the upper floors. The lower floors serve to cool the material and they are each provided with several air holes in the outer wall. Cold air enters here, passes over the hot material and through corresponding openings in the central hollow shaft, from which it escapes. The roof of the uppermost chamber is preferably made of cast iron and formed like a floor, carried by the central shaft. It may be covered with stones if desired to retain the heat.—W. H. C.

Separating, and simultaneously extracting water from, mineral, vegetable or animal substances. Farbwerke vorm. Meister, Lucius und Brüning, Hoechst am Main. Eng. Pat. 10,024, April 30, 1907. Under Int. Conv., May 1, 1906.

The substances are treated by electro-osmosis and this is conducted in such a manner as to fractionally separate the constituents. This is rendered possible by the fact that the solid particles separate upon the electrode (cathode) with varying ease and rapidity, the finer particles being the first to deposit and coarser particles separating out at each subsequent operation.

The process may be carried out intermittently with mechanical removal of the individual fractions; or the liquid with its suspended particles may be caused to pass through a series of electro-osmosis vessels. A modification of the process provides that the solid particles on their way to the electrode, where they are to be deposited, are caused to pass through the attenuated liquid surrounding the other electrode.—R. S. H.

Diffusion apparatus. F. von Klaudy and F. Junger, Regensburg, Germany. U.S. Pat. 860,810, July 23, 1907.

See Fr. Pat. 371,041 of 1906; this J., 1907, 267.—T. F. B.

Liquids; Process of separating the moisture from the constituent solids of ——. L. C. and I. S. Merrell and W. B. Gere, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 860,929, July 23, 1907.

See Fr. Pat. 369,337 of 1906; this J., 1907, 110.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

PATENTS.

Coal; Apparatus for the washing of ——, for the filtering and recovery of fine coal from the effluent water, and for the subsequent draining or drying of the washed coal. J. Shaw, Kirby Moorside, Yorks. Eng. Pat. 20,699, Sept. 18, 1906.

THE washed coal and slack from the washing plant are delivered into a large tank, the bottom of which is formed by an inclined travelling belt, made of plates with open joints, the descending coal being guided by a partition plate in order to prevent escape of water through the rubbing joint at the lower end of the belt. The fine coal settles down, and is filtered from the water by the layer of coal on the belt, whilst the drained water and that escaping through an overflow near the top of the tank, is led into a sump, to be returned to the washer. The draining belt delivers the coal on to a similar belt, in order to dry the coal, or else is itself prolonged in an upward direction for the same purpose.—C. S.

Artificial-fuel process and production. P. Grayson, London. U.S. Pat. 863,028, Aug. 13, 1907.

SEE Eng. Pat. 10,866 of 1905; this J., 1906, 306.—T. F. B.

Briquettes; A composition for —— and method of preparing same for use as fuel. D. Drawbaugh and B. F. Gamble. Fr. Pat. 375,336, March 4, 1907.

CARBONACEOUS material is powdered, mixed with manganese dioxide and incorporated with an intimate mixture of hydrated calcium sulphate and chrome-gelatin containing sufficient water to form a binding medium, the mass being formed into briquettes and dried. The approximate proportions are powdered carbonaceous material 92 per cent., hydrated calcium sulphate 7¾ per cent., manganese dioxide ¼ per cent.—C. S.

Tar oils; Application of ——, for lighting and heating in vapour burners. L. Denayrouze. Fr. Pat. 375,540, March 6, 1907.

THE tar is distilled at temperatures below 200° C., in order to extract the heavy and medium oils without driving over the vapours of naphthalene which would, by sublimation, obstruct the Bunsen burner or the wick conveying the oil to the vaporising chamber. The distillates are then redistilled slowly, in order to keep back the viscous and less readily combustible constituents present. The vaporisation of the resulting oils at the base of the Bunsen burner, and their combustion under the incandescence mantle, are facilitated by providing the vaporiser with a large heating surface, by arranging for an abundant supply of air to the Bunsen burner, and by forming the combustible mixture in a chamber conveniently close to the burner.—C. S.

Retorts; Refractory lining for ——. F. B. Smith and G. C. Glynn, Iola, Kans. U.S. Pat. 860,701, July 23, 1907.

THE surface of the fireclay retort is first coated with a mixture of alumina and magnesia with calcium fluoride. This fuses to an enamel which adheres both to the fireclay and to the refractory coating. This latter is a mixture of refractory materials, carborundum and chromium oxide. This is put on over the "enamel" and fired.—W. H. C.

Gas generating apparatus. A. Rosenberg, London. Eng. Pat. 16,901, July 26, 1906.

SEE Fr. Pat. 370,270 of 1906; this J., 1907, 310.—T. F. B.

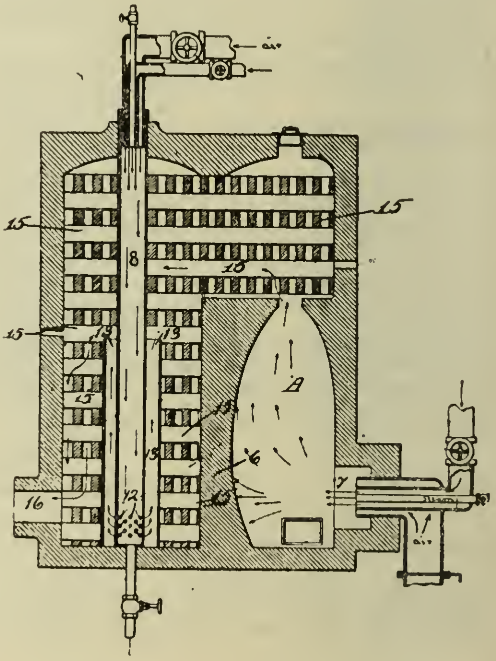
Gas and its by products from coal, peat and similar substances; Method for producing ——. F. Fritz, London. Eng. Pat. 20,359, Sept. 13, 1906.

THE coal or peat is first carbonised in continuously-working retorts provided with chain conveyors or the like, and then drops into a retort where it is quenched by a spray of finely atomised water, or a jet of air and atomised water, for the production of water-gas and ammonia.—H. B.

Gas producers. C. L. Armstrong, St. Louis, U.S.A. Eng. Pat. 24,666, Nov. 3, 1906.

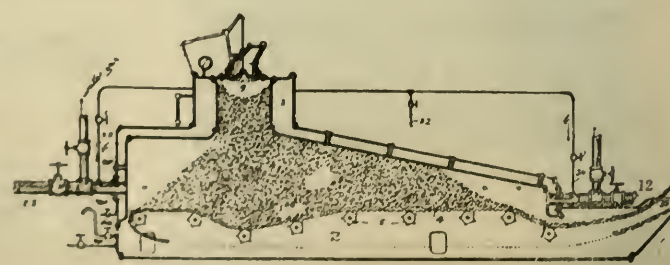
SEE U.S. Pat. 837,026 of 1906; this J., 1907, 144.—T. F. B.

Gas; Apparatus for the manufacture of ——. J. S. Smith, Chicago, Ill. U.S. Pat. 859,988, July 16, 1907.



"GAS generating materials" are injected through the orifice, 7, into the chamber, or "cupola," A, in such a way that they strike violently against the curved wall or "breaker," 6. The resulting gas passes upwards into the chequer-work chamber, 15, as indicated by the arrows, then passes downwards and mixes with gas produced in the retort, 8, the mixture finally escaping through the outlet, 16. "Gas producing materials" are fed into the retort, 8, at the top, and the gas produced escapes through the perforations, 12, and passes up the annular pipe, 13, to the mixing chamber, 15.—W. H. C.

Producing gas; Apparatus for ——. J. S. Smith, Chicago, Ill. U.S. Pat. 859,989, July 16, 1907.



The coal is fed through the hopper, 9, into the generator chamber, 2, the lower part of which is filled with water. The coal is supported by the travelling bottom, 4, which dips at places, as shown, below the level of the water seal; it is carried forward and caused to "wedge" between the bottom and the roof. The ashes are carried below the water and discharged through the opening, 35. The upper part of the generator is surrounded by a water jacket, 3, from which steam can be supplied to the generator by the pipes, 28, 32, 34. Air enters through the pipe, 12, and producer-gas escapes by the pipe, 23. —W. H. C.

Gas; Illuminating liquefied ——, *and method of treating distillation gases to produce the same.* H. Blau, Augsburg, Germany. U.S. Pat. 862,383, Aug. 6, 1907.

See Fr. Pat. 347,508 of 1904; this J., 1905, 430.—T. F. B.

Gas generator. V. Sepulchre, Paris. U.S. Pat. 863,323, Aug. 13, 1907.

See Fr. Pat. 361,127 of 1905; this J., 1906, 583.—T. F. B.

Cooling and purifying gases; Apparatus for ——. A. Meyer and E. Hastert, Dudelange, Luxembourg. Eng. Pat. 17,999, Aug. 10, 1906.

See Fr. Pat. 369,305 of 1906; this J., 1907, 85.—H. B.

Gases; Treatment of —— *for the extraction of ammonia therefrom.* W. Feld, Hönningen on Rhine, Germany. Eng. Pat. 18,505, Aug. 17, 1906.

See Fr. Pat. 369,258 of 1906; this J., 1907, 87.—T. F. B.

Ammonia recovery gas plants. W. J. Crossley and T. Rigby, Manchester. Eng. Pat. 24,144, Oct. 30, 1906.

The recovery plant is designed for use with producers working with an excess of steam, whereby the destruction of ammonia is avoided. The hot gases from the producer flow through a horizontal scrubbing tank of the kind described in Eng. Pat. 20,716 of 1901 (this J., 1902, 1268), through which there flows, in counter-current, a scrubbing liquor containing 0·5 per cent. or less of free sulphuric acid. The hot liquor, on leaving the tank, is pumped to the top of a tower filled with checker-work, and descends through the latter, meeting an upward current of air, which is thereby heated and saturated with water vapour, prior to entering the producer. The liquor, cooled by the air, on leaving the tower, returns to the inlet end of the scrubbing tank. The gases are thus scrubbed by an acidified solution of ammonium sulphate, which simultaneously fixes the ammonia and recovers the latent heat of the condensing steam, subsequently giving up the heat to the air required by the producer.—H. B.

Sulphur; Extraction of —— *from gangue or other material.* A. J. Boult. From E. Günther and R. Franke. Eng. Pat. 11,187, May 13, 1907. *See* VII.

Carbide; Manufacture of ——. H. L. Hartenstein, Constantine, Mich., U.S.A. Eng. Pat. 12,465, May 29, 1906.

See reissue No. 12,519, dated Aug. 7, 1906, of U.S. Pat. 819,222; this J., 1906, 842.—T. F. B.

Hydrocarbon for explosion motors and other purposes. G. T. B. Cobbett. Fr. Pat. 375,735, March 15, 1907.

Petroleum spirit is employed to dissolve a certain quantity of shale oil, previously refined with sulphuric acid, and the solution is afterwards refined with sulphuric acid, followed by treatment with oxalic acid or other decolorising agent. The proportion of shale oil varies according to the destined uses of the product: about 25 per cent. being added to produce a fuel for heavy motors, and 50 per cent. for fuel for lighter motors.—C. S.

Metallic incandescence bodies for electric glow-lamps; Method of producing ——. P. M. Justice, London. From Deuts. Gasglühlicht A.-G., Berlin. Eng. Pat. 18,622, Aug. 20, 1906.

See Fr. Pat. 368,225 of 1906; this J., 1906, 1212.—T. F. B.

Filaments of metallic tungsten or molybdenum for electric incandescent lamps; Manufacture of ——. A. Lederer, Vienna. Eng. Pat. 18,738, Aug. 21, 1906.

Metallic tungsten or molybdenum, or a mixture of these, or their lower (conducting) oxides, are mixed with an agglutinant consisting of camphor, pinene hydrochloride, or other volatile aromatic compound having a melting-point exceeding 30° C. and a boiling-point exceeding 70° C. The crumbly mass is formed into filaments by pressure, and these are then heated in absence of air, to volatilise the agglutinant and ultimately consolidate the filament.—H. B.

Tungsten or alloys thereof [*for electric lamp filaments*]*; Manufacture of ductile* ——. Siemens und Halske A.-G. Eng. Pat. 3174, Feb. 8, 1907. *See* XI*B*.

Metallic conducting bodies for incandescence lamps; Process for making ——. A. Just, F. Hanaman, Verein. Elektricitäts A.-G., H. Landesberger, and I. Salzmann. First Addition, dated May 31, 1906, to Fr. Pat. 358,272, Oct 4. 1905.

See Eng. Pat. 11,944 of 1906; this J., 1907, 675.—T. F. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Thiophen; Determination of ——. V. Paolini. Gaz. chim. ital., 1907, 37, I., 58—62.

One grm. of pure thiophen was shaken with 15·15 grms. of mercuric acetate in 60 grms. of water. A white crystalline powder separated, insoluble in all neutral solvents, but soluble in boiling acetic acid. This compound has the same properties as that described by Dimroth (Ber., **32**, 758); its composition is not $C_4H_2S(HgOC_2H_3O)HgOH$, as stated by that author, but $C_4H_4S(HgC_2H_3O_2)_4$. On heating 5 grms. of this compound, suspended in 50—60 grms. of water, with 1 grm. of sodium chloride dissolved in water, the corresponding chloro-compound, $C_4H_4S(HgCl)_4$, was obtained as a white, insoluble micro-crystalline powder. The hydroxy-compound, $C_4H_4S(HgOH)_4$, produced by boiling the chloro-compound with aqueous alkalis, explodes on heating, with separation of metallic mercury in the form of a mirror.—A. S.

Petroleum; Accumulation of —— *in pools.* Report of U.S. Geological Survey. Oil, Paint, and Drug Reporter, Aug. 19. [T.R.]

The primary object of this investigation was to make clear certain facts concerning the accumulation of petroleum in pools as found in developed areas, so that the deductions drawn therefrom might be put to practical use. Three questions have been dealt with: first, the determination of the physical laws under which oil accumulates in pools; second, how many of the conditions of this accumulation can be determined prior to actual test by the drill; and third, the practicability of mapping an oil sand on the basis of a comparatively small number of well records. The area selected for study is that portion of the Appalachian oil field comprising the Steubenville (Ohio-West Virginia) and the Burgettstown and Claysville (Pennsylvania) quadrangles, within which lie most of the white-oil-producing sands of the Appalachian field. This area, about 680 square miles in extent, has been tested by numerous wells and includes large and well developed oil pools from the Berea, Hundred-Foot, the Gordon, the Fourth and the Fifth sands. The conditions of accumulation subject to determination prior to actual test by the drill are defined, and a method of mapping oil sands on the basis of a minimum number of well records is described, covering the general conditions in the Appalachian oil fields, the theory of accumulation of oil and gas, the practical application of principles governing the accumulation of oil, and the method of investigation.

Petroleum exports of California. Bd. of Tr. J., Aug. 24, 1907. [T.R.]

The quantity of petroleum exported during the first six months of the current year amounted to over 31 million gallons, valued at 1,594,434 dols.; the exports during the year 1906 to nearly 41½ million gallons (1,627,313 dols.); during 1905 to nearly 12½ million gallons (389,400 dols.); during 1904 (the first year of this trade) to nearly 2 million gallons (123,250 dols.). A pipe-line has been laid from the oil fields in Bakersfield to the refinery at Point Richmond, on the Bay of San Francisco, where the vessels are loaded.

Petroleum; Composition of crude Boryslaw ——, from the third level. M. Wielezynski and J. Gruszkiewicz, Naphta; Petroleum, 1907, 2, 917.

The crude oil obtained from the third oil horizon, tapped by the Natan borehole at a depth of 1272 metres, has approximately the same composition as that from the higher levels, except that the paraffin content is rather smaller.—C. S.

Petroleum; Composition of Roumanian ——. P. Poni. Monit. Petr. Roum. 1907, No. 20; Petroleum, 1907, 2, 918.

The author finds that Campina oil contains ready-formed aromatic hydrocarbons, to an extent exceeding 20 per cent. of the fractions distilling over between 35° and 70° C. Large quantities of naphthenes are also present.—C. S.

Mineral lubricating oil and petroleum residuum; Influence of water on the flashing point and viscosity of ——. K. Charitschkow, Westnik. shirow. prom. 1907, **8**, 60; Chem.-Zeit. 1907, **31**, Rep. 376.

The presence of small traces of water, difficult to eliminate by settling or heating, affects the accuracy of the flashing-point test, the vapour from 1 per cent. of water extinguishing the test-flame. In high-flash oils (above 150° C.) the water can be separated by adding petroleum spirit (b. p. 70° C.), and filtering through paper or cottonwool. Calcium chloride will also serve to extract the water, but the oil must then be diluted with petroleum spirit till the mixture is specifically lighter than the chloride, or the latter may even part with water to the oil. Before applying the flash test, the diluent is expelled by heating to 80—90° C., assisted by an air blast. In the case of lighter oils, the water is preferably removed by distillation with the fraction 150—180° C., the distillate being thoroughly cooled, carefully separated from the water in a separating funnel, and returned to the residue in the still. The viscosity of thick and viscous oils is unaffected, in the Engler apparatus, by the presence of 3—4 per cent. of water.—C. S.

Petroleum ether as an extracting medium; A source of error in the use of ——. J. Marshall. *See* XX.

PATENTS.

Distilling organic matter; Method of ——. T. M. U. von Post, Stockholm, Sweden. U.S. Pat. 860,058, July 16, 1907.

The material to be distilled is charged into a series of retorts. The first retort is heated by direct fire and the waste gases pass round the rest of the retorts in turn. The products of distillation from the first retort are passed round the succeeding charges, whereby the latter receive a preliminary heating, and the vapours are partially condensed and separated. The gases escaping at the end of the series are passed through an external condenser, and the uncondensed gas is returned through the series of charges, so that it absorbs heat, after which it is used to fire the first charge. When the first charge is exhausted, it is emptied out, and the retort recharged and connected at the end of the series, the former No. 2, becoming No. 1, and being heated by direct fire.—W. H. C.

Carbonizing apparatus for wood, peat, and the like. R. Juergensen, Ziskow, Austria-Hungary. U.S. Pat. 860,483, July 16, 1907.

The apparatus consists of a carbonizing chamber fitted with a number of horizontal heating pipes and valved connections between these pipes and a drying chamber, which latter is fitted with a number of channels opening into the atmosphere. There is also a cooling chamber provided with a number of radiation pipes in communication with the furnace. The carbonizing chamber is placed in "interrupted communication" with the other chambers. To facilitate discharging the contents, the bottom of the apparatus slopes lengthwise and also from the centre towards both sides.—C. S.

Acetone; Manufacture of ——. L. A. A. Pagès, E. C. A. Camus, and R. P. T. Duchemin, Paris. Eng. Pat. 13,508, June 11, 1907. Under Int. Conv., July 27, 1906.

See Addition of July 27, 1906, to Fr. Pat. 361,379 of 1905; this J., 1907, 43.—T. F. B.

Alpha Naphthylamine; Manufacture of pure ——. Chem. Fab. vorm. Weiler-ter Meer, Uerdingen a/Rhein, Germany. Eng. Pat. 16,446, July 17, 1907. Under Int. Conv., Aug. 1, 1906.

Commercial α-naphthylamine (solidifying point, 44—45° C.) is heated with 8—15 per cent. of xylene, solvent naphtha, or similar organic solvent, and the mixture is allowed to cool and solidify. The mass is broken up and treated in a hydro-extractor, when a product is obtained free from β-naphthylamine and having a solidifying point of 47°—48° C. The expelled liquid contains the β- and the remainder of the α-naphthylamine, and after driving off the solvent, the residue is dissolved in warm dilute hydrochloric acid. On cooling, most of the α-naphthylamine is precipitated as hydrochloride and is filtered off. From the filtrate the pure β-naphthylamine is precipitated as sulphate by the addition of dilute sulphuric acid.—W. H. C.

Petroleum; Method of and automatic electron ioniser for treating cold crude —— or any of its distillates to obtain an explosive mixture for use in internal combustion engines. D. Martini, London. Eng. Pat. 13,840, June 16, 1906.

Air is ionised by drawing it (by means of the suction stroke of the engine) through a tube filled with copper scraps and then through a "sparking chamber" composed of a number of positive and negative metallic electrodes provided with a number of alternately disposed points, where it is exposed to the action of a current of preferably about 4000 volts. The ionised air enters an atomising chamber (a hollow sphere with spiral flanges) where it is mixed with finely-sprayed petroleum, also drawn in by the suction stroke of the engine, the mixture being then passed through a "cone chamber" containing relatively adjustable positive and negative metallic electrodes also provided with points. The electrodes are "stepped" in such a manner that the mixture of oil and air receives in succession a two-, four-, six- and eight-fold expansion, and at the same time is exposed to the action of an alternating current of 4000 to 6000 volts, according to the class of oil. This treatment releases certain radioactive forces present in the oil, and furnishes a cloudlike mixture the individual corpuscles of which are of the requisite size for complete explosion.—C. S.

Mineral oil; Refining —— by fractional distillation. J. Noad, East Ham, and E. J. Townsend, London. Eng. Pat. 22,395, Oct. 10, 1906.

See Fr. Pat. 370,603 of 1906; this J., 1907, 250.—T. F. B.

Hydrocarbon oils; Method of producing purified ——. L. B. De Camp, Alhambra, Cal. U.S. Pat. 861,232, July 23, 1907.

The product of oil wells, consisting of an emulsion of asphaltum, hydrocarbon oil, water, and a light brown granular saline substance, in the form of a dark coloured, non-translucent fluid of considerable viscosity, is passed in a stream, vertically over a heated coil, to break up the emulsion, and remove the water and saline substance. The upper portion of the coil is kept at a higher temperature than the lower portion, by exhausting the heating medium of the coil at different points below the inlet. The temperature of the medium and of the coil is arranged so that the total evaporation of the water will exceed the volatilisation of the lighter portions of the oil.—W. C. H.

Petroleum; Process and apparatus for distilling ——. C. J. Faller and U. Ganz. Fr. Pat. 375,889, March 19, 1907.

To prevent danger of explosion, a certain quantity of water, containing a salt of potassium or sodium, is introduced into the still with the oil, and is vaporised, either by the steam from the water-jacket of the still or by an internal steam coil, the water vapour thus produced being conducted, by means of a series of pipes arranged inside the still, to the space above the surface of the oil, where it mixes with the oil vapours and removes those of an explosive character. The residual oil is suitable for lubricating quick-running machinery and is not decomposed at high temperatures. A filtering and a condensing apparatus are connected with the still, the former to facilitate the collection of an inodorous distillate, suitable for oiling parquet floors, and the condenser for collecting a product capable of replacing oil of turpentine.—C. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

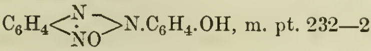
Dyewood industry of Jamaica. U.S. Cons. Reps., July, 1907. [T.R.]

The Jamaican output of logwood represents about one-fifth of the world's supply. Within the past few years two factories have been established in Jamaica for the purpose of extracting the colouring matter from the wood. Since the establishment of these factories the consumption of logwood has increased, with consequent higher prices to the growers.

Notwithstanding the advances made in coal-tar colours, the shipment of logwood and fustic forms an increasing factor in the trade of Jamaica.

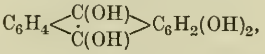
Sodium hyposulphite (hydrosulphite); Use of —— as a reducing agent for organic substances. E. Grandmougin. J. prakt. Chem., 1907, **76**, 124—142.

The method already described (this J., 1906, 805, 1142) is most conveniently carried out in neutral or weakly alkaline solution and has been extended to the following substances. Hydroxyazobenzene yields aniline and *p*-aminophenol. Benzeneazosalicylic acid yields aniline and *p*-aminosalicylic acid. Ponceau 2R gives xylidine and the acid sodium salt of 1-amino-2-naphthol-3 : 6-disulphonic acid. Ponceau 2G gives aniline and the same sulphonic acid as in the preceding case. Orange G gives aniline and the acid sodium salt of 1-amino-2-naphthol-6 : 8-disulphonic acid. Crystal Ponceau gives *α*-naphthylamine and the same acid. Bordeaux S gives naphthionic acid and the acid sodium salt of 1-amino-2-naphthol-3 : 6-disulphonic acid. Azo Rubine gives naphthionic acid and 2-amino-1-naphthol-4-sulphonic acid, the latter being also obtained, together with aniline, from anilineazo-1-naphthol-4-sulphonic acid. Benzeneazo-1-hydroxynaphthoic acid yields 4-amino-1-hydroxynaphthoic acid, and benzeneazo-*β*-naphthylamine gives 1 : 2-naphthylenediamine, aniline being in each case also obtained. Benzeneazo-*p*-ethoxybenzene is reduced partly to the corresponding hydrazo compound and partly to aniline and *p*-phenetidine. Alizarin Yellow B and Alizarin Yellow GG are normally reduced to the corresponding aminosalicylic acids and *p*-phenylenediamine, but the *o*-nitrobenzeneazosalicylic acid furnishes benzotriazole-2-salicylic acid. *o*-Nitrobenzeneazophenol gives *p*-hydroxyphenylaziminobenzene oxide,



$$C_6H_4{<}\genfrac{}{}{0pt}{}{N}{\dot{N}O}{>}N.C_6H_4.OH, \text{ m. pt. } 232—233° \text{ C.}$$

From *o*-nitroazobenzene are produced aniline, *o*-phenylenediamine, phenylaziminobenzene, and phenylaziminobenzene oxide. *p*-Nitrophenol is readily reduced to *p*-aminophenol. and nitroso-*β*-naphthol gives 1-amino-2-naphthol-4-sulphonic acid. Quinizarin yields Leucoquinizarin II,



$$C_6H_4{<}\genfrac{}{}{0pt}{}{C(OH)}{\dot{C}(OH)}{>}C_6H_2(OH)_2,$$

and Alizarin yields probably 1 : 2-dihydroxyoxanthranol. Finally, Indigo is smoothly reduced to Indigo White.
—J. C. C.

Patents.

5-Oxy-1.2-naphthimidazole-7-sulphonic acid; Manufacture of derivatives of ——. C. D. Abel, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 16,086, July 16, 1906.

See Fr. Pat. 368,297 of 1906; this J., 1906, 1215.—T. F. B.

Para-nitrodiphenylamine; Manufacture of ——, or homologues or derivatives thereof. A. G. Bloxam, London. From Act.-Ges. für Anilinfabr., Berlin. Eng. Pat. 24,091, Oct. 29, 1906.

It has not been possible, up to the present, to condense *p*-chloronitrobenzene with aniline, but the patentees have found that in the presence of cuprous iodide or of a mixture of copper and iodine, condensation may be effected with any aromatic amino compound, according to the general equation:—

$$Cl.C_6H_4.NO_2 + NH_2.R = R.NH.C_6H_4.NO_2 + HCl.$$

For example, 10 parts of *p*-chloronitrobenzene are mixed with 0·1 part of iodine and 0·3 part of finely-divided copper, the mixture is heated until it loses its colour owing to formation of cuprous iodide, and then 75 parts of aniline and 5 parts of potassium carbonate are added, and the mass heated in a reflux apparatus for 20 hours in order to obtain *p*-nitrodiphenylamine.—F. M.

Tertiary butyl-xylene or tertiary butyl-toluene; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 28,147, Dec. 10, 1906.

See Fr. Pat. 372,603 of 1906; this J., 1907, 638.—T. F. B.

p-Aminodiphenylamine; Process for making a new sulphonic acid of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 376,566, June 16, 1906.

See Eng. Pat. 13,772 of 1906; this J., 1907, 146.—T. F. B.

Colouring matters containing sulphur [Thioindigo dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 17,558, Aug. 3, 1906.

See Fr. Pat. 373,513 of 1906; this J., 1907, 680.—T. F. B.

Vat colouring matter containing sulphur; Production of ——. Badische Anilin und Soda Fabrik. Eng. Pat. 28,578, Dec. 14, 1906. Under Int. Conv., Jan. 22, 1906.

See Fr. Pat. 373,513 of 1906; this J., 1907, 680.—J. C. C.

Anthraquinone compound and process of making same. M. Isler and F. Kacer, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 863,397, Aug. 13, 1907.

SEE Fr. Pat. 365,920 of 1906; this J., 1906, 979.—T. F. B.

Anthracene dyestuff and process of making same. F. Kacer, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 863,401, Aug. 13, 1907.

SEE Eng. Pat. 20,633 of 1906; this J., 1906, 1143.—T. F. B.

Dyestuffs; Production of red, vat-dyeing ——. Badische Anilin und Soda Fabrik. 1st Addition dated Feb. 22, 1907, to Fr. Pat. 365,920, May 4, 1906 (this J., 1906, 979).

DYESTUFFS resembling those described in the chief patent are obtained by condensing β-dihalogen derivatives of anthraquinone with two molecular proportions of 1-aminoanthraquinone, its derivatives or diaminoanthraquinones, according to the method already detailed. With alkaline hyposulphite solution, yellowish-red vats are obtained in which cotton is dyed in red shades. The dyestuffs obtained from 1-aminoanthraquinone furnish shades redder than do those prepared from the diaminoanthraquinones.—J. C. C.

Indigo White; Production of dry and stable alkali salts of ——. Badische Anilin und Soda Fabrik. 1st Addition, dated Mar. 14, 1907 (under Int. Conv., Feb. 16, 1907), to Fr. Pat. 360,447, Dec. 9, 1905.

SEE Eng. Pat. 6336 of 1907; this J., 1907, 605.—J. C. C.

Indoxyl and its homologues, analogues, and derivatives; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 376,095, March 25, 1907. Under Int. Conv., May 5, 1906.

SEE Eng. Pat. 12,243 of 1906; this J., 1907, 88.—T. F. B.

Dyestuff of the oxazine series [from gallocyanine] and its leuco-derivative; Manufacture of a ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 20,802, Sept. 19, 1906.

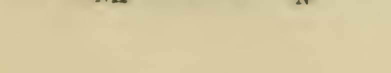
SEE Fr. Pat. 369,835 of 1906; this J., 1907, 195.—T. F. B.

p-Diaminoanthrarufinmonosulphonic acid and p-diaminochrysazinmonosulphonic acid; Method of production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 376,109, Mar. 25, 1907. Under Int. Conv., Sept. 4, 1906.

THESE acids are prepared by heating the corresponding disulphonic acids with sulphuric acid in presence of a reducing agent, whereby one sulphonic acid group is eliminated. *Example* 1: 50 kilos. of diaminochrysazindisulphonic acid are mixed with 500 kilos. of sulphuric acid (63° B.) and 25 kilos. of boric acid and heated to 130° C. 1—2 kilos. of stannous chloride or 4 kilos. of iron filings are now added, and the temperature kept at 130° C. until the monosulphonic acid is formed, as shown by its sparing solubility in water. The mass is poured into water and the product isolated by filtration. *Example* 2: 50 kilos. of diaminoanthrarufindisulphonic acid are mixed with 500 kilos. of sulphuric acid (63° B.) and 20 kilos. of boric acid and heated to 120° C. 2—4 kilos. of phenol are added and the end of the reaction determined by means of the spectroscope. The product is worked up as before. In a further example, the same mixture is heated to 150° C. and 1—2 kilos. of the leuco-compound of diaminoanthrarufindisulphonic acid added.—J. C. C.

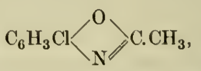
Chloroaminophenolsulphonic acid; Production of a new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 376,135, Mar. 26, 1907. Under Int. Conv., Nov. 3, 1906.

CARBONYL-4-CHLORO-2-AMINOPHENOL,



$$C_6H_3Cl\left\langle{}^{O}_{NH}\right\rangle CO \text{ or } C_6H_3Cl\left\langle{}^{O}_{N}\right\rangle C.OH,$$

(20 parts) is heated with sulphuric acid (80 parts containing 10 parts of sulphur trioxide) for 10 hours at 80° C. The mass is then diluted with water, neutralised with chalk, and the filtrate mixed with sodium hydroxide to saponify the resulting sulphonic acid, and concentrated by evaporation. On acidifying, the new acid ($OH : NH_2 : Cl : SO_3H = 1 : 2 : 4 : 5$) is obtained as a crystalline powder. It is sparingly soluble in water and its diazo-derivative is pure yellow and readily soluble; the latter is precipitated in yellow needles by the addition of salt or hydrochloric acid to its solutions. The same acid is obtained by heating ethenyl-4-chloro-2-aminophenol,



$$C_6H_3Cl\left\langle{}^{O}_{N}\right\rangle C.CH_3,$$

(100 parts) with sulphuric acid (475 parts containing 100 parts of sulphur trioxide) for 10 hours to 140—150° C. The subsequent saponification and isolation of the new acid is carried out as before.—J. C. C.

Anthrachrysone; Manufacture of a new product from ——, and of nitrogenous derivatives of the anthraquinone series therefrom. Farbwerke vorm. Meister, Lucius und Brüning. Eng. Pat. 22,202, Oct. 8, 1906.

ANTHRACHRYSONE is condensed with two molecular proportions of formaldehyde in alkaline solution at 20—25° C., and the product is heated in a closed vessel with excess of aniline until the formation of water has ceased. Orange-red crystals are formed, which dissolve in dilute mineral acids to a yellow, and in dilute caustic alkalis to an orange solution. Similar compounds are obtained if ammonia, or primary or secondary amines of the aliphatic or aromatic series are used instead of aniline. The same products are obtained if the anthrachrysone, formaldehyde and amine (for example, dimethylaniline) are heated together on the water-bath in presence of alcohol, or if the amine (for example, *o*-toluidine) and formaldehyde are first condensed, and the product heated on the water-bath with anthrachrysone and alcohol.—J. C. C.

Dyestuffs; Manufacture of substantive red ——. Farbwerke vorm. Meister, Lucius und Brüning. Eng. Pat. 9548, April 24, 1907. Under Int. Conv., April 25, 1906.

YELLOWISH-RED to blue-red dyestuffs are obtained by diazotising the aminoazo-compound produced by combining a diazo compound (for example, diazobenzene) with para- or meta-aminobenzoyl-2 : 5 : 7-aminonaphtholsulphonic acid in alkaline solution, and combining the diazotised compound in alkaline solution with 2 : 5 : 7-aminonaphtholsulphonic acid, its acyl (amino) derivatives or one of the thiourea derivatives mentioned in Eng. Pat. 7250 of 1901 (this J., 1902, 337). The dyestuffs produce corresponding shades on cotton direct, which are fast to acids.—J. C. C.

Dye [Disazo dyestuff]; Blue cotton ——, and process of making same. A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 860,220, July 16, 1907.

THE tetrazo-compound of dianisidine is combined with one molecular proportion of a *peri*dihydroxynaphthalenesulphonic acid and one molecular proportion of 2-arylamino-5-naphthol-7-sulphonic acid. The use of 1 : 8-dihydroxynaphthalene-3 : 6-disulphonic acid is claimed, the resulting dyestuffs being brown-black powders, giving greenish-blue solutions in concentrated sulphuric acid and reddish-blue solutions in water, and producing bright blue shades on cotton.—J. C. C.

Disazo dye; Blue ——, and process of making same. A. L. Laska, Offenbach on Maine, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. U.S. Pat. 860,221, July 16, 1907.

THE tetrazo-compound of dianisidine is combined with one molecular proportion of a naphtholsulphonic acid and one molecular proportion of 2-arylamino-5-naphthol-7-sulphonic acid. The use of 1-naphthol-3 : 6-disulphonic acid is claimed, the resulting dyestuffs being black powders, giving greenish-blue solutions in concentrated sulphuric acid and reddish-blue solutions in water, and producing bright blue shades on cotton.—J. C. C.

Indigo ; Process of making ——. N. Caro, Charlottenburg, Germany, Assignor to Soc. Gen. per la Cianamide, Rome. U.S. Pat. 860,900, July 23, 1907.

Indigo is prepared by heating a mixture of disodium cyanamide and sodium cyanide with an equal weight of phenylglycine to 350—400° C., extracting the cooled mass with water, and blowing an oxidising gas through the solution.—J. C. C.

Sulphide dyestuffs ; Preparation of blue and black ——. E. Vidal. First Addition, dated May 7, 1906, to Fr. Pat. 374,800, April 26, 1906 (this J., 1907, 865).

Sulphur or a mixture of sulphur and sodium sulphide is allowed to react with methyl-, dimethyl-, ethyl-, diethyl-, tolylphenylamines, -ditolylamines, -tolylxylylamines or the corresponding indophenols, instead of the substances mentioned in the chief patent.—J. C. C.

Dyestuff derived from salicylthioacetic acid ; Process for producing a red vat-dyeing ——. Soc. pour l'Ind. Chim. à Bâle. Second Addition, dated May 8, 1906, to Fr. Pat. 362,876, Jan. 31, 1906. (See also this J., 1906, 470,752.)

The condensation of salicylthioacetic acid with isatin or its homologues as described in the chief patent may be effected by the aid of acetic anhydride, and the dyestuffs produced are said to be identical with those obtained by using nitrobenzene. Other substances containing the COH or CO group, such as acetone, phthalic anhydride or anthraquinone may be substituted for isatin in this process.—J. C. C.

Dyestuffs ; Production of vat-dyeing ——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 375,459, May 14, 1906.

See Eng. Pat. 11,760 of 1906 ; this J., 1906, 751.—J. C. C.

Indoxyl and its derivatives ; Preparation of ——. Ges. für Chem. Ind. in Basel. Fr. Pat. 375,812, March 16, 1907. Under Int. Conv., June 2, 1906.

The fusion of arylglycines with caustic alkali for the production of indoxyl is carried out in presence of formamide as a condensing agent, with or without the addition of potassium cyanide, sodium, sodium oxide, sodium ethoxide, etc. *Example :* 120 parts of anhydrous potassium hydroxide, 40 parts of potassium cyanide and 40 parts of potassium phenylglycine are heated out of contact with air to 240° C. ; there are then added during 10 to 20 minutes, 20 to 35 parts of formamide, preferably through a reflux condenser. A vigorous reaction ensues and the temperature of the mixture, having fallen somewhat, rises to 225° C. After being stirred for a short time at 250° C., the mass is cooled, extracted with water, and the indigo isolated in the usual manner. Other examples are given illustrating the preparation by the use of formamide alone and also in presence of the other agents mentioned above.—J. C. C.

Indigo ; Production of halogen derivatives of ——. Ges. f. Chem. Ind. in Basel. First Addition, dated March 18, 1907 (under Int. Conv., Feb. 18, 1907), to Fr. Pat. 375,514, Feb. 25, 1907.

The process already described for preparing tri- and tetra-bromo-derivatives of Indigo (this J., 1907, 818, 819) may be used for obtaining mono- or di-bromo-indigo. The monobromo-derivative produces redder and brighter shades on cotton which are faster to washing and chlorine than those furnished by Indigo R ; the latter is therefore probably isomeric with the new dyestuff. Similarly the dibromo-derivative produces bright reddish-blue shades on cotton which are brighter and stronger as well as being faster to washing and chlorine than are those obtained from Indigo RR.—J. C. C.

Colouring matter for dyeing cotton or union goods direct ; New ——. Read Holliday and Sons, Ltd. Fr. Pat. 375,476, March 8, 1907. Under Int. Conv., Feb. 8, 1907.

When certain colouring matters dyeing cotton direct are mixed together in presence of an organic acid such as oxalic or tartaric acid or an inorganic salt such as sodium bisulphate, ammonium acetate, etc., the mixture is found to produce on cotton brilliant shades, fast to light and alkalis, which are much superior to those furnished by the component dyestuffs taken separately. The dyestuffs especially mentioned are the Rosaniline mono-, di-, or tri-β-naphthylsulphonic acids on the one hand, and those dyeing cotton direct derived from benzidine, tolidine and dianisidine on the other.—J. C. C.

Gallocyanine ; Process of preparation of a leuco base of ——. Fabr. de Prod. Chim. ci-devant Sandoz. Fr. Pat. 375,864, March 18, 1907.

When the leuco derivative of Gallocyanine is heated with dilute acids for some hours to 95° C., a carboxylic group is eliminated and a new leuco compound is formed which is distinguished by the extreme solubility of its hydrochloride. The carboxylic group may also be split off from Gallocyanine itself either in alkaline or weak acid solution. The new dyestuff is readily obtained by oxidising the leuco base ; its hydrochloride forms a greenish crystalline powder dissolving in acidified water to a red-violet, and in concentrated sulphuric or hydrochloric acid to a pure blue solution.—J. C. C.

Dyestuffs ; Process for preparing bright ——. C. Henry. Fr. Pat. 376,084, March 25, 1907.

In the manufacture of dyestuffs, before salting out the finished product from its solution, a very small quantity of chlorine water is added, whereby, it is stated, the colouring matter is purified and becomes brighter.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Fibre of a species of Agave. Bull. Imp. Inst., 1907, **5**, 107—108.

A sample of sisal hemp from Sierra Leone was of fair strength though only 22 to 27 inches long. The following results were obtained :—Moisture, 9·0 ; ash, 0·8 ; [*]α-hydrolysis (loss), 9·2 ; β-hydrolysis (loss), 14·5 ; acid purification (loss), 0·8 ; and cellulose, 75·4 per cent. Length of ultimate fibre, 0·9 to 3·0 mm. These results compared favourably with those given by samples of sisal hemp from Trinidad and the Bahamas. The fibres were very short, but of fair colour and good strength. Being too short for machine spinning, they were valued at only £28 to £30 per ton, as against £33 and upwards for sisal hemp of the usual length (about 4 feet).
—C. A. M.

Fibre of a species of Furcræ. Ibid., **5**, 108—109.

The plant producing this fibre is believed to have been introduced into Sierra Leone from Kew. The sample was pale brown, of poor strength, and 3 to 4 feet in length. Moisture, 9·1 ; ash, 1·0 ; α-hydrolysis (loss) 11·1 ; β-hydrolysis (loss), 16·0 ; acid purification (loss), 2·6 ; and cellulose, 79·1 per cent. Length of ultimate fibre, 1·7 to 2·8 mm. It was of fair length and colour, but of poor quality and inferior to the fibre of *F. gigantea* (Mauritius hemp). Value, £24 to £25 per ton.—C. A. M.

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[*] See this J., 1907, 757.

Fibres of species of Musa. Ibid., 5, 109—111.

Two samples of fibre, resembling banana fibre in appearance, were received from Nigeria. The names of the plants producing them are unknown, but they are termed "Nkupup" and "Ndehe Ukom" by the natives. The first was a badly cleaned, buff-coloured fibre of poor strength, varying from 1 ft. 9 in. to 3 ft. 4 in. in length. Reported to be useless in this condition for rope-making and to be worth about £10 per ton. The second sample was nearly white, lustrous, of fair but uneven strength, and about 2 ft. in length. It appeared suitable for rope-making, if properly prepared. Value in present condition about £25 per ton.—C. A. M.

Fibre of Sansevieria guineensis. Ibid., 5, 111—113.

THIS plant grows on the coast of Sierra Leone, and has recently been planted at Lumley and Mabang. An unretted sample was white, lustrous, of fair strength, and ranging in length from 1 ft. 10 in. to 3 ft. 9 in. It gave:—Moisture, 9·7; ash, 0·7; α-hydrolysis (loss), 10·8; β-hydrolysis (loss), 13·3; acid purification (loss), 0·8; and cellulose, 78·1 per cent. Length of ultimate fibre, 0·8 to 4·3 mm. Commercial valuation, about £40 per ton. Reported too short for rope-making. A retted sample from Sierra Leone was not so lustrous or white, and though richer in cellulose and less affected by hydrolysis, was inferior in strength. Commercial valuation, £28 to £30 per ton. Samples of the same fibre from Lagos were badly prepared and of uneven length. They appeared to be worth £20 to £25 per ton if properly prepared.—C. A. M.

Fibres of species of Dracæna. Ibid., 5, 113—116.

A SAMPLE from a species of *Dracæna* growing in Sierra Leone was nearly white, lustrous, fairly fine, and 13 to 16 ins. in length, but of poor strength. Analytical results:—Moisture, 10·5; ash, 0·8; α-hydrolysis (loss), 13·8; β-hydrolysis (loss), 18·5; acid purification (loss), 1·5; and cellulose, 75·2 per cent. Length of ultimate fibre, 1·4 to 3·6 mm. These results were much better than those given by a sample of fibre from *D. Draco* from Victoria. Reported too short for machine spinning; possible value £12 to £13 per ton. A sample of *Dracæna* fibre from the Gold Coast was white, lustrous, fairly strong, and 12 to 15 ins. in length. Moisture, 8·4; ash, 0·5; α-hydrolysis (loss), 16·2; β-hydrolysis (loss), 18·5; acid purification (loss), 1·7; and cellulose, 66·5 per cent. Length of ultimate fibre, 0·4 to 2·6 mm. Commercial valuation, £12 to £15 per ton. It was too short for rope-making.—C. A. M.

Fibre and cloth from Southern Nigeria. Ibid., 5, 119—120.

THE fibrous bark of an unidentified plant stated to be abundant near the Niger, yielded on treatment with hot dilute sodium hydroxide solution a mass of fibres 0·7 to 1·3 in. long and averaging 0·00063 in. in diameter. The fibre was fairly regular, and had transverse markings resembling those on flax fibre, though fainter. It was found to be about twice as strong as "middling" American cotton, but was brittle and inelastic. A specimen of cloth woven by the natives of Onitsha was found to consist of a warp of the fibre from this bark with a weft of native cotton yarn. If imported to this country special machinery would be required to treat the fibre before spinning, and it is doubtful whether it could be produced as cheaply as cotton or flax, or whether it would yield a fine yarn. —C. A. M.

Fibre of Eriodendron anfractuosum. Ibid., 5, 120—121.

THE seed hair or floss of this plant is largely exported from Java, and is known as "kapok." A sample from Lagos was darker than the ordinary commercial product, but resembled it in other respects. Length of fibres:—0·0012 to 0·00033 in. with an average of 0·00075 in. Results of examination of this sample and of two commercial samples:—

	Sample from Lagos.	Genuine Java kapok.	Kapok from Seychelles.
	Per cent.	Per cent.	Per cent.
Moisture	9·9	10·9	10·0
Ash	2·8	1·3	2·08
Cellulose	50·3	63·6	61·3

Commercial valuation, 3½d. per lb. in London. It is stated that the fibre would be of better quality if collected from the tree instead of being left to fall to the ground. Would probably sell well if regular supplies were assured. —C. A. M.

Metastannic acid; Detection of —— in pink salt and in silk weighting baths. H. Bayerlein. Färber-Zeit., 1907, **18**, 241—244.

STANNIC chloride, prepared from tin-plate cuttings by stripping with chlorine, has lately been placed upon the market, but complaints have been received from many silk-dyers that it contains metastannic acid or tin oxychloride, or tends to produce these compounds in the weighting bath. Silicic acid, iron, lime, magnesia, ammonium salts, sulphates, etc., are present in the baths after use, consequent upon the nature of the water employed or the operations incidental to the weighting process. Solutions of metastannic acid give a yellow coloration with stannous chloride, and a precipitate of metastannic acid is produced by addition of concentrated hydrochloric or sulphuric acid. The baths complained of did not give a coloration with stannous chloride, and with concentrated acids, the precipitate obtained was found to be calcium sulphate. With pure stannic chloride, caustic soda gives a precipitate which is dissolved by an excess of the reagent, but when metastannic acid or tin oxychloride is present, the precipitate does not redissolve. An insoluble precipitate was obtained on testing the weighting baths in question, but it was readily dissolved by hydrochloric acid (sp. gr. 1·12); metastannic acid is not dissolved by acid of this strength, and analysis showed the precipitate to be calcium metastannate. In place of caustic soda the author recommends the use of hydrochloric acid (sp. gr. 1·12) or a solution of arsenious acid (1 grm. of arsenious oxide in 200 c.c. of water, with 15 drops of hydrochloric acid) for testing for the impurities mentioned. A small quantity of the stannic chloride (or 10 c.c. of the bath) should be gently shaken with a few c.c. of the acid; if metastannic acid or tin oxychloride be present, even in traces, a turbidity will be produced, at once in the case of arsenious acid, and after standing for a short time when hydrochloric acid is employed as the reagent. Pure stannic chloride gives no turbidity even after standing for several days.—F. M.

Basic dyestuffs; Fixing —— by means of complex cyanides. R. Haller. Z. Farben-Ind., 1907, 6, 249—252.

IT is known that basic dyestuffs are precipitated from their solutions by an addition of ferro- or ferricyanide of potassium, and, when dyed upon cotton, may in some cases be rendered faster to washing and light by an after-treatment with these salts. The beneficial effects of copper salts upon substantive dyestuffs is also well known, and the author has investigated the effect of a combined treatment with ferro- and ferricyanides and copper salts upon the fastness of some fugitive basic dyestuffs.

Ethyl Green (Berlin), printed upon cotton with tannin and copper sulphate, gave a very unsatisfactory result, the shade being dull and the fastness not being equal to that with antimony.

White material was padded with a liquor containing 10 grms. of potassium ferrocyanide, 20 c.c. of Turkey-red oil and 5 c.c. of ammonia per litre and printed with the two following colours:—

I.	II.
500 c.c. of gum solution (1 : 1)	500 c.c. of gum solution (1 : 1)
10 grms. of Ethyl Green	50 grms. of copper sulphate
30 grms. of acetin	10 grms. of Ethyl Green
30 grms. of acetic acid (6° B.)	30 grms. of acetin
	30 grms. of acetic acid (6° B.)

Colour I. gave a bright, light green which resisted soaping very well, but was very fugitive to light. Colour II. gave a dark green which was very fast to both soaping and light. Thus it appears that the presence of copper ferrocyanide renders the colour fast to light, and this was confirmed by the fastness of the shade obtained by fixing the salt upon the fibre and printing upon it No. I. colour. Similar results were obtained with Magenta, Methyl Violet, Vesuvine, etc.

A trial showed that copper sulphate alone was not capable of fixing basic dyestuffs satisfactorily. In colour No. II. the copper sulphate was replaced by salts of other metals (nickel, cobalt, mercury, lead, etc.), but although in general the fastness of the shades obtained was good towards soap, in no case was the fastness to light satisfactory. On cotton prepared with potassium ferricyanide, almost identical results were obtained.

Colours I. and II., printed upon cloth upon which insoluble copper salts (sulphide, thiocyanate, etc.) had been deposited, both gave shades fast to soaping but fugitive to light. Printed upon cloth prepared with potassium cuprocyanide, both gave shades fast to soap but only that with No. II. was fast to light. It is interesting to note therefore that copper is only effective in the salt form ($Cu_2Fe(CN)_6$, etc.) and not when contained in the radical,

$$\rangle Cu_2(CN)_6.$$

The effect of printing colours I. and II. upon cotton prepared with other double cyanides ($K_2Zn(CN)_4$, $K_2Ni(CN)_4$, etc.) showed that No. II. alone gave shades fast to light. Potassium chromocyanide ($K_3Cr(CN)_6$) gave with colour II., a shade which was remarkably bright and clear, and besides being very fast to light, did not show any tendency to bleed into the white on soaping. The colour lakes with complex cyanides being soluble in acetic acid, these may be used in place of tannin in steam colours, but the brightness of the shades obtained is not so good.—F. M.

Patents.

Ammoniacal copper solutions; Preparation of ——. A. Lecœur, Rouen, France. Eng. Pat. 16,442, July 20, 1906.

See Fr. Pat. 374,277 of 1906; this J., 1907, 761.—T. F. B.

Collodion filaments, artificial silk, horsehair and the like; Process for the manufacture of ——. H. J. Haddan, London. From Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Monplaisir, France. Eng. Pat. 89, Jan. 1, 1907.

See Fr. Pat. 361,960 of 1905; this J., 1907, 197.—T. F. B.

Cellulose derivatives and their solutions; Method for the preparation of ——. Knoll und Co. Fr. Pat. 376,578, April 10, 1907. *See* XIX.

Volatile solvents employed in the manufacture of artificial silk; Recovery of ——. H. Diamanti and C. Lambert, Paris. Eng. Pat. 5020, March 1, 1907. Under Int. Conv., March 3, 1906.

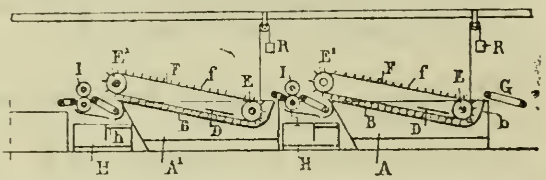
See Fr. Pat. 372,889 of 1906; this J., 1907, 525.—T. F. B.

Grease; Removal of ——, *resinous and similar matter from textile fabrics, wool, sawdust, etc.* C. W. Fulton and E. Hardcastle. Eng. Pat. 27,072, Nov. 28, 1906.

The plant employed in carrying out this process comprises a kier into which the material is placed to be treated with the solvent, and in which it remains (without intermediate handling) until it is dried; a vaporiser, into which the solvent passes from the kier, carrying with it the soluble matters, which on distillation remain behind, whilst the vapours of the solvent pass to a condenser, and are condensed for use again in the kier; also, an air drier and heater from which hot air is passed by a pump into the kier, to remove all traces of the solvent and to dry the material.

The material being placed in the kier, the solvent is sprayed over it and the greasy matters thus dissolved out, are carried by the solvent through a siphon pipe, from the bottom of the kier to the vaporiser. The mixture is here distilled and the vapours of the solvent pass to the condenser, in which they are condensed, and flow back to the top of the kier. This circulation continues until a sample drawn from a small tap on the siphon pipe between kier and vaporiser, is free from grease, when a direct connection between the two vessels is opened and the kier thus drained. To recover the solvent still remaining in the material and to dry the latter, hot air is now forced through the kier and passes to the condenser, where the solvent which it had taken up is recovered. —F. M.

Desuinting and degreasing raw wool; An electrical process for ——. J. M. Baudot. Fr. Pat. 375,237, May 8, 1906.



Two becks, A, A¹ (see Fig.), made of wood or some other insulating material, are provided with inclined, perforated false bottoms, B, which are used as the negative electrodes of the machine. E, E¹ are wooden rollers which carry an endless band of slightly porous cloth, F, across which wooden cross-pieces are fastened. These cross-pieces are provided with teeth, *f*. In front of each beck a small tank, H, is arranged, which has a partition down the middle. One compartment in each tank is provided with a filtering device, *h*. The positive electrodes consist of suitable metal plates, D, so arranged that the endless cloth band, F, travels between them and the negative electrodes, B. Both becks are filled with clean water at a temperature of 25—30° C. The raw wool travels along the movable table, G, and falls into the beck, A. It is at once caught by the toothed cloth, F, and travels with it through the beck. During its passage it is exposed to an electrical current of low voltage, which is passing between the two electrodes. The action of the current saponifies and decomposes the suint and other impurities contained in the wool. As soon as it emerges from the first beck the wool automatically falls on to a movable table and then passes through a pair of squeezing rollers, I. Another table then carries the wool to the second vat, A¹, where the process is repeated. The liquid which is expressed from the wool by the squeezing rollers is led on to the filter-plate in the tank, H. Any loose wool is thus separated and the filtered liquid is then pumped back into the becks. The suint and saline matters which accumulate in the becks are recovered.—P. F. C.

Silk in skein or in piece; Method of weighting ——. E. Barrillot, Lyons, France. Eng. Pat. 3536, Feb. 12, 1907. Under Int. Conv., Feb. 15, 1906.

See Fr. Pat. 372,279 of 1906; this J., 1907, 525.—T. F. B.

Oils and soaps suitable for Turkey-red dyeing; Manufacture of ——. A. Schmitz, Heerdt, Germany. Eng. Pat. 8245, April 9, 1907.

To prepare an oil or soap which will not form insoluble calcium compounds when mixed with calcareous waters, castor oil (or other suitable oil, fat, or mixture) is sulphonated in the usual manner, and the product washed free from acid. By boiling the sulphonated oil in an open vessel (either alone or mixed with water), the sulphonic acid is split up, sulphuric acid being liberated and a fatty hydroxy-acid produced which is quite insoluble in water. This fatty hydroxy-acid is washed free from sulphuric acid, dried, mixed with castor oil or similar oil or fat, and heated to 40—100° C. The mixture is allowed to cool and is then sulphonated in the usual manner; the sulphonation product is well washed and mixed with alkali to produce a neutral or alkaline oil, soluble in water as required. Whereas ordinary Turkey-red oils give precipitates of insoluble calcium soaps with calcareous waters, oils prepared by the above process, give clear solutions, any acid calcium soap produced remaining dissolved in the fatty solution in excess.—F. M.

Fatty compounds suitable for Turkey-red dyeing; Manufacture of ——. A. Schmitz, Heerdt, Germany. Eng. Pat. 11,903, May 22, 1907.

INSTEAD of heating the mixture of fatty hydroxy-acid and oil or fat to 40—100° C., as described in the preceding abstract, and sulphonating after cooling, the sulphonation is carried out immediately after mixing at the ordinary temperature. The sulphonated mixture is then allowed to stand until a sample, mixed with alkali, dissolves in hot calcareous water without formation of a precipitate, when it is washed and treated as before.—F. M.

Fatty compounds for use as Turkey red oils; Process of manufacturing ——. A. Schmitz, Heerdt, Germany. U.S. Pat. 861,397, July 30, 1907.

SEE Eng. Pat. 11,903 of 1907; preceding.—T. F. B.

Fatty compounds for use in Turkey red dyeing; Process for preparing ——. A. Schmitz. Fr. Pat. 376,555, April 9, 1907.

SEE Eng. Pat. 11,903 of 1907; preceding these.—T. F. B.

Dyeing with sulphur [sulphide] dyestuffs. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 23,083, Oct. 18, 1906.

SEE Addition to Fr. Pat. 367,921 of 1906; this J., 1907, 253.—T. F. B.

Sulphur colouring matters; Dyeing with ——, *and preparations for use therein.* J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 12,219, May 27, 1907.

INSTEAD of using sodium sulphide or hydrosulphite, the dyestuff may be brought into solution by mixing with fermentable matter and alkali. The mixture may be made up dry or in the form of paste, and upon mixing with water, the fermentation which is set up reduces the colour to its leuco compound, and in the vat so prepared, animal or vegetable fibres are readily dyed. For example, 200 parts of Kryogen Black TBO, 50 parts of finely-ground wheat bran, 50 parts of potato flour, 50 parts of calcined sodium carbonate and 50 parts of sugar syrup are mixed to form a homogeneous paste. Or, 400 parts of cold water are mixed with 1 part of Kryogen Black TBO, 3 parts of wheat flour, 2 parts of bran, 1 part of syrup and 1 part of calcined sodium carbonate. The dyestuff goes gradually into solution; the bath becomes green in colour with a dark "flurry" and is then ready for use. The vat is kept weakly alkaline and can be strengthened or prepared for fresh dyeings by additions of dyestuff and bran or syrup.—F. M.

Dyeing, bleaching, or washing apparatus. L. Destrée and A. Wiescher, Haren lez Vilvorde, Belgium. Eng. Pat. 780, Jan. 11, 1907.

SEE Fr. Pat. 373,450 of 1907; this J., 1907, 683.—T. F. B.

Dyeing or printing in shaded colours or tints; Colour feeding attachment for machines for ——. M. Becke, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 860,893, July 23, 1907.

SEE Eng. Pat. 11,758 of 1906; this J., 1907, 316.—T. F. B.

Dyeing and printing machines; Device for filling the divided troughs of —— *with colour.* Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 376,136, May 31, 1906.

SEE Eng. Pat. 11,758 of 1906; this J., 1907, 316.—T. F. B.

Printing circular fabrics for hosiery; Machine for ——. Soc. Anon. de Blanchiment, Teinture, Impressions et Apprêts de Saint-Julien. First Addition, dated March 5, 1907, to Fr. Pat. 364,806, March 31, 1906.

IN printing tubular fabrics, such as are used for hosiery, the material is passed over a flattening and stretching device, and the desired pattern is then printed on each side of the flattened tube. This stretching device is supported by two rollers, which are suspended by plates from a metal rod. The distance between the two rollers can be varied according to the dimensions of the stretched fabrics. The stretching device consists of two thin plates which are connected by two cross-pieces of variable length. Four eccentric wheels are mounted on an axis, which is parallel to the cross-pieces, in order to stretch the material in a direction at right angles to the tension which is exerted by the two metal plates.—P. F. C.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

PATENT.

Paper; Coating —— *in continuous lengths with heavy colours.* P. A. Newton, London. From Dresdner Chromo- und Kunstdruckpapierfabrik Krause und Baumann, Dresden, Germany. Eng. Pat. 4590, Feb. 25, 1907.

THE web of paper is led between two horizontal rollers, the distance between which can be regulated. The lower one runs in the colour box and its rate of rotation is about 40 per cent. greater than that of the upper one, which acts as the support for the paper. The difference in speed between the two rollers brings about an accumulation of colour upon the paper at the point of contact, and a kneading of the layer carried forward by the web, thus tending to break up any lumps. The surface of the layer of colour is then smoothed by means of reciprocating straight edges, which are carefully adjusted at such an angle that no pressure is exerted upon the web, which after passing them is led away and dried under tension.
—F. M.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Production of aluminium salts in U.S.A. Annual Report of U.S. Geol. Survey for 1906. [T.R.]

THE following table show the production of alum and aluminium sulphate for the years 1902 to 1906:—

Year.	Alum.		Aluminium sulphate.	
	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.	
1902 ...	8,539	$299,500	80,075	$1,938,671
1903 ...	7,754	210,910	80,726	1,614,520
1904 ...	11,563	319,189	74,481	1,417,867
1905 ...	10,114	289,716	93,917	1,660,515
1906 ...	16,613	450,125	89,246	1,613,050

Certain undeveloped deposits of aluminium salts are near Silver Peak, Nev., where both alum and sulphur occur closely associated in decomposed cryolite. The alum is present in far larger quantity than the sulphur, and from the character of its formation, the deposit doubtless continues downward. The decomposed cryolite is so friable that the material could easily be worked on a large scale.

The alum deposits on Gila River, New Mexico, have also attracted much notice. The alum rock is altered and leached, and consequently porous; analyses indicate that it is essentially aluminium silicate. The incrustations observed are of two classes: (a) hydrated aluminium sulphate, and (b) halotrichite, the double sulphate of aluminium and iron. These materials have been derived from the alum rock by leaching followed by deposition from solution wherever conditions were favourable for their accumulation. The alum rock itself probably still contains a large supply of soluble sulphates, and upon this fact depends the value of the deposit, although the present surface accumulations of alunogen probably amount to thousands of tons besides. No test has been made of the rock below drainage level.

Bauxite.—The production of bauxite in the United States in 1906 amounted to 75,332 long tons, valued at $368,311, and in 1905, 48,129 tons, valued at $240,292. The average price remains nearly the same. The principal deposits of bauxite in the United States have been found in Georgia, Alabama and Arkansas.. During 1906 bauxite was discovered in Tennessee, Virginia and Pennsylvania, far north of the deposits previously known. In Tennessee developments have already begun of deposits on Missionary Ridge, at East Lake and Sherman Heights, suburbs of Chattanooga. Bauxite has been noted in California, in Shasta county, and also in Kentucky, in Edmonson county. The use of low-grade bauxite for the manufacture of refractory brick and prospective new developments in the aluminium industry have stimulated interest in supplies of bauxite, so that it is probable that the promising districts will be well investigated in the near future. The Georgia-Alabama bauxite district extends along Coosa Valley from the vicinity of Summerville or Adairsville, Ga., to Jacksonville, Ala., and lies in Bartow and Floyd counties, Ga., and Cherokee county, Ala. The ore bodies are easily found and quickly developed, and many of them are speedily exhausted. The number of producing mines varies with the market.

Ammonium sulphate production in Germany. For. Off. Ann. Ser. [T.R.]

The production in Germany of sulphate of ammonia amounted to about 200,000 tons, an increase of about 25 per cent. over the previous year's output, and consequently the importation both into Germany and at Hamburg fell off considerably. The imports to Hamburg amounted to 7,646 tons against 11,602 tons in 1905. The exports of this substance from the United Kingdom to Germany amounted to 17,545 tons, against 29,009 tons in 1905.

Chamber process [Sulphuric acid]; The ——, and oxides of nitrogen. F. Raschig. Z. angew. Chem., 1907, 20, 694—722.

The author criticises, in detail, Lunge and Berl's communication (this J., 1906, 533), and brings forward fresh evidence in favour of his own theory of the reactions occurring in the chamber process (this J., 1904, 934, 1213; 1905, 923). Lunge and Berl's experiments on the absorption of nitrogen peroxide, mixed with air or oxygen, by acids and alkalis, are vitiated by the fact that they were carried out with undried gases. Dry nitrogen peroxide, mixed with oxygen or air, is absorbed by concentrated sulphuric acid with formation, not as would be expected, of 1 mol. each of nitric acid and nitrous acid, but of somewhat more of the latter (in the form of nitrosulphonic acid). When absorbed in dilute sodium hydroxide solution, on the other hand, dry nitrogen peroxide, in presence of oxygen, forms exactly 1 mol. each of nitrate and nitrite. The formation of nitrite alone when a mixture of nitric oxide and nitrogen peroxide is led into sodium hydroxide solution, can be satisfactorily explained only by the author's view that the two gases mentioned unite immediately to nitrous anhydride. When nitric oxide is mixed with excess of air, different oxidation products are obtained according to the duration of the reaction. The "first product" (after $\frac{1}{4}$ to 1 sec.) behaves towards concentrated sulphuric acid as though it were nitrous anhydride. The "after-product" (after 25 seconds), on the other hand, behaves like nitrogen peroxide; it is absorbed (completely) by sodium hydroxide solution, with formation of equimolecular proportions of nitrate and nitrite, and by concentrated sulphuric acid (not quite completely), with formation of rather more than half of nitrite. The difference in the behaviour of the two products is brought out still more clearly by sulphuric acid of 79 per cent. (60° B.) strength, such as is present in the Gay-Lussac tower. The "first product" dissolves completely, apparently as nitrogen trioxide, whilst the "after-product" is absorbed only to the extent of 81 per cent., and the absorbed portion, as before, appears somewhat poorer in oxygen than nitrogen peroxide. These results are in accord with the practical experience that highly-oxidised, red nitrous fumes are badly absorbed in the Gay-Lussac tower. When the gases are led into an aqueous solution of sulphurous acid, the "first product" yields more sulphuric acid than the "after-product" does. This is explained by the fact that with water, the "first product" yields only nitrous acid, whereas the "after-product" yields equimolecular proportions of nitric acid and nitrous acid, of which only the latter reacts with the sulphurous acid, with the ultimate production of sulphuric acid, the nitric acid remaining unaltered. An action of sulphur dioxide upon nitrogen peroxide, according to the equation: $SO_2+NO_2+H_2O=SO_5NH_2$, as given by Lunge and Berl, does not take place. The nature of the different oxidation products of nitric oxide was ascertained by studying, on the one hand, their behaviour with acids and alkalis, and on the other, the amount of oxygen they give up to stannous chloride solution, which has no action on nitric oxide (nor on nitric acid), but reduces all higher oxides of nitrogen to nitrous oxide. Experiments on these lines showed that on oxidising nitric oxide with a large excess (9 vols. : 1 vol.) of air or oxygen, the "first products" are nitrogen isotetroxide, N_2O_4, and nitrogen hexoxide, N_2O_6 or NO_3, respectively. These compounds dissolve quantitatively in sulphuric acid and almost quantitatively in sodium hydroxide, with formation of nitrous acid and evolution of oxygen. They may be regarded as the mono- and tri-oxy derivatives respectively of nitrous anhydride. The "after-products" under similar conditions are nitrogen isopentoxide, N_2O_5, and nitrogen heptoxide, N_2O_7, respectively, which dissolve completely in sodium hydroxide, with formation of equimolecular proportions of nitrate and nitrite, and not quite completely in sulphuric acid, with formation of somewhat more than half of nitrite, in both cases with evolution of oxygen. These "after-products" are also formed from oxygen and ordinary nitrogen peroxide, and may be regarded as oxy-derivatives of the latter. All of these new oxides of nitrogen contain oxygen in a loosely-combined condition. (See this J., 1907, 686.) Nitrogen isotetroxide, $N:O:O:O:O:N$, when absorbed in sodium hydroxide, yields besides nitrite, also a certain quantity of nitrate, increasing as the alkali is diluted, *e.g.*, 5 per cent. in $N/1$ solution, 20 per cent. in $N/10$ solution, and 30 per cent. in $N/100$ sodium hydroxide solution, but in no case is nitric oxide evolved as stated previously (this J., 1905, 923). This formation of nitrate is due to an inner oxidation of a portion of the molecule by the loosely-combined oxygen, with formation of ordinary nitrogen peroxide. In concentrated alkali solution this action is largely prevented by local rise of temperature, the atomic oxygen being rapidly converted into the molecular condition and becoming inactive. By dilution, on the other hand, the inner oxidation is favoured, and under certain conditions, with pure water, the limit may be reached, with formation of equimolecular proportions of nitric and nitrous acids. If it be desired to obtain nitrite with as little nitrate as possible from the nitrous gases obtained from air by electrical discharge, the nitrogen oxides, immediately after formation, and hence composed mainly of isotetroxide, should be led into concentrated sodium hydroxide solution. The red vapours produced from nitric oxide and air, usually regarded as nitrogen peroxide, are really nitrogen isopentoxide, $O<\begin{array}{l}N:O:O\\N:O:O\end{array}$ When absorbed in alkali, this gives 1 mol. each of nitrous and nitric acids and 1 mol. of oxygen, but it may also decompose to a small extent by losing the atom of oxygen connecting the two nitrogen atoms, and thus yielding only nitrite. This accounts for the formation of more than half of nitrous acid on dissolving the isopentoxide in sulphuric acid. Nitrogen hexoxide is formulated as $N:O:O:O$. On dissolving it in sulphuric acid or alkali, an inner oxidation takes place, with formation of nitrogen trioxide. A small portion of the oxygen is evolved as ozone on dissolving in sulphuric acid, and this is also the case with the heptoxide, $O<\begin{array}{l}N:O:O:O\\N:O:O:O\end{array}$ The latter, like the isopentoxide, may decompose to a small extent by losing the linking atom of oxygen, and thus yield rather more than half of nitrous acid, instead of equimolecular proportions of nitric and nitrous acids. At the ordinary temperature, the "after-products" represent the stable form of the oxides of nitrogen, but at high temperatures, probably even at 2000° C. and above, the "first-product" is the stable form. Thus the isotetroxide when kept in contact, at the ordinary temperature, with a quantity of air insufficient for the formation of the isopentoxide, is converted into ordinary nitrogen peroxide, $O<\begin{array}{l}N:O\\N:O:O\end{array}$ which is the simplest member of the oxides of the type of the "after-products." On the other hand, on heating to a high temperature, nitrogen peroxide and isopentoxide are converted into the isotetroxide (compare Fr. Pat. 363,643; this J., 1906, 847). With regard to the formation of nitrosulphonic acid and of nitrosisulphonic acid in the chamber process, the author describes a series of experiments in which portions of sulphuric acid of different concentrations—from 97 per cent. (66° B.) to 55 per cent. (45° B.)—in which sodium nitrite and copper sulphate were dissolved, were treated, on the one hand, with mercury, and on the other, with sulphur dioxide, with the following results. The formation of nitrosisulphonic acid is indicated by the intense blue colour of its copper salt.

% H_2SO_4.	°B.	Treated with mercury.	Treated with SO_2.
97	66	Intense blue	Not coloured
91	65	Dirty blue	,, ,,
85	63	Faint blue	Blue after 15 minutes
79	60	Blue after 15 minutes	,, ,, 1 minute
73	57	Not coloured	Intense blue
67	53	,,	Blue, but soon decolorised
61	49	,,	Faint blue, but soon decolorised
55	45	,,	Not coloured, NO evolved

The results confirm the author's previous statement that nitrosisulphonic acid, $HO.SO_2.NOHO$, is formed from nitrosulphonic acid only by reducing agents such as mercury (or copper), and not by the action of sulphur dioxide. It appears evident that as the concentration of the sulphuric acid is diminished, the nitrosulphonic acid gradually decomposes into sulphuric and nitrous acids, until with acid of 73 per cent. (57° B.) strength, there is no longer any nitrosulphonic acid present. The fourth column of the table shows that it is only the nitrous acid arising from the decomposition of the nitrosulphonic acid, which reacts with sulphur dioxide to form nitrosisulphonic acid. The stability of nitrosulphonic acid is also diminished by rise of temperature: at 100°—200° C. it is completely decomposed even in sulphuric acid of 79 per cent. (60° B.) strength. Sulphuric acid of 60° B. which in the cold Gay-Lussac tower, absorbs nitrous acid with formation of nitrosulphonic acid, will thus give it up again in the Glover tower at a temperature 100° higher. The most important conclusion, however, is that in sulphuric acid of a strength not above 73 per cent. (57° B.), no undecomposed nitrosulphonic acid can be present, even at the ordinary temperature, much less at the temperature of the lead chamber, and therefore any theory based on the formation of this compound in the chamber, falls to the ground. The author maintains that all the evidence is still in favour of his theory that nitrous acid is the catalyst in the chamber process. It combines first with a molecule of sulphur dioxide to form nitrososulphonic acid, $NO.SO_2.OH$, which immediately unites with another molecule of nitrous acid to form nitrosisulphonic acid, $HO.SO_2.NOHO$ and nitric oxide. In the weak chamber acid and at the high temperature, the nitrosisulphonic acid is decomposed with formation of sulphuric acid and nitric oxide. Oxidation of nitrosisulphonic acid to nitrosulphonic acid can take place only if the chamber be too cold or the supply of water be too small. Under these latter conditions, the nitrosisulphonic acid may exist for a sufficient length of time to become oxidised by atmospheric oxygen to nitrosulphonic acid. The latter is then deposited in the form of chamber crystals which are thus a sign of defective working. That the blue nitrosisulphonic acid is not oxidised with such rapidity as would be the case if this action were an essential intermediate reaction in the chamber process, as stated by Lunge and Berl, is shown by the fact that the acid from the Gay-Lussac tower is frequently coloured purple by nitrosisulphonic acid, although the gases in this part of the system are always relatively rich in oxygen. Lunge and Berl have stated that if the reactions in the chamber proceed according to the theory put forward by the author, nitrous oxide, hydroxylamine, and ammonia should make their appearance in many parts of the chamber. It must be borne in mind, however, that the chamber acid contains either nitrous acid (the usual case) or sulphurous acid. In presence of nitrous acid, hydroxylamine is decomposed with formation of nitrous oxide, whilst ammonia yields nitrogen, and nitrous oxide and nitrogen have been proved to be present in chamber gases. In presence of sulphurous acid on the other hand, hydroxylamine is converted into aminosulphonic acid, which in turn yields ammonia and sulphuric acid, and in agreement with this, ammonia is actually found to be formed when the chamber acid contains a considerable proportion of sulphurous acid.—A. S.

Ferric sulphate. A. Recoura. Ann. Chim. et Phys., 1907 [8], **11**, 263—288. Chem. Zentr., 1907, **2**, 441. (See this J., 1903, 906, 970; 1905, 801, 844.)

For the preparation of anhydrous ferric sulphate, a solution of ferrous sulphate is oxidised by means of dilute nitric acid in presence of sulphuric acid, the solution is evaporated to dryness to expel the nitric acid, and the residual white ferric sulphate combined with a certain quantity of water and with the excess of sulphuric acid, is heated first for 2—3 days at 120° C. to remove the water, and then at 130° C. to expel the sulphuric acid. Pure anhydrous ferric sulphate obtained in this manner, is insoluble in cold water, but is gradually decomposed by the latter.—A. S.

Cuprous iodide. G. A. Barbieri. Atti R. Accad. dei Lincei, Roma, 1907 [5], **16**, I., 528—531. Chem. Zentr., 1907, **2**, 128—129.

When dilute solutions of potassium iodide are distilled in presence of much sodium chloride and copper sulphate, more iodine is set free than corresponds to the equation: $2CuSO_4+4KI=2CuI+2K_2SO_4+I_2$. Whilst a pure solution of copper sulphate does not liberate iodine from cuprous iodide, even on warming, reaction takes place in the cold in presence of alkali chloride or bromide, and also on introducing cuprous iodide into concentrated aqueous solutions of cupric chloride or cupric bromide. The author has found that an indifferent organic solvent, such as xylene, which has a lower density but higher boiling point than water, and is immiscible with the latter, facilitates the expulsion of iodine from aqueous solutions, and also its condensation by means of a simple Liebig's condenser. On warming cuprous iodide with a solution of cupric chloride or bromide, the whole of the iodine is liberated in accordance with the equation : $2CuI + 2CuX_2 = 4CuX + 2I$. That under certain circumstances, the reverse reaction can take place, was shown by experiments in which concentrated alkali halogenide solutions containing dissolved cuprous chloride or bromide were shaken with a solution of iodine in xylene in an atmosphere of carbon dioxide.—A. S.

Hydrogen ; Preparation of —— by means of iron and carbonic acid in the cold at the ordinary pressure. A. Bruno. Bull. Soc. Chim., 1907, 1, 661—662.

The reaction which takes place in the spontaneous formation of iron rust : $CO_2 + H_2O + Fe = FeCO_3 + H_2$, may be accelerated by agitation, etc., so as to become a practicable method for the production of hydrogen. In one experiment, 250—300 grms. of fragments of flint were introduced together with water into a steel bottle 50 cm. high and of 2½ litres capacity, and carbon dioxide was passed in until the air was displaced and the liquid was saturated with the gas. The bottle was then closed by a steel cover, and placed in an apparatus where it made about 2000 revolutions per hour. In another experiment, the contents of the bottle consisted of 10 grms. of cast-iron filings, 250 grms. of pieces of cast-iron or steel, 250 grms. of water, and carbon dioxide. In both cases there was no appreciable change in the pressure inside the vessel, and after 36—40 hours, the gas withdrawn from the bottle consisted of pure hydrogen. At the end of 20 hours the gas consisted of about two-thirds of hydrogen and one-third of carbon dioxide. If the reaction be effected in a glass vessel, there is a decrease in the pressure within the vessel, owing to absorption of carbon dioxide by alkali from the glass. By introducing nitrobenzene into the vessel together with the other raw materials, aniline can be produced.—A. S.

Molten salts ; Electrolytic dissociation of ——. R. Lorenz. *See* XIA.

Patents.

Hydrochloric acid gases ; Effecting the removal of impurities from ——. G. W. Johnson, London. From Verein Chem. Fabr. of Mannheim, Germany. Eng. Pat. 16,910a, July 26, 1906.

It is found that impurities other than arsenic, such as sulphuric acid, chlorine, nitrosyl compounds and iron chloride, liable to occur in hydrochloric acid gases, are removable, as well as the arsenic, by the treatment with oils described in Eng. Pat. 16,910 of 1906, (this J., 1907, 760). The gases thus obtained are stated to be suitable for the manufacture of pure hydrochloric acid, and also for the manufacture of chlorine by the Deacon process. (See also Fr. Pat. 368,452 of 1906, this J., 1906, 1219.) —E. S.

Hydrochloric acid gases ; Purifying ——. W. Hasenbach, Mannheim, Germany. U.S. Pat. 862,906, Aug. 13, 1907.

See Fr. Pat. 368,452 of 1906 ; this J., 1906, 1219.—T. F. B.

Sulphuric acid chamber. O. H. Eliel, La Salle, Ill. U.S. Pat. 860,968, July 23, 1907.

A series of connected acid chambers, having their greatest extension horizontally, and arranged side by side, is interposed in the flow of gases between the Glover and Gay-Lussac towers. Induction and eduction flues communicate with the several chambers near the same end, the former being placed nearer the axial centre and in a higher plane than the latter. Set pipes for discharge of steam open into the induction flues near their discharge ends. Means are provided for forcing the gases and fumes " into the several chambers through such induction ports and out through such eduction ports, producing reverse currents inwardly toward the rear, and outwardly toward the front of the chambers."—E. S.

Sulphuric acid ; Apparatus for concentrating ——. L. Stange, Aix-la-Chapelle, Germany. Eng. Pat. 91, Jan. 1, 1907.

See U.S. Pat. 837,592 of 1906 ; this J., 1907, 151.—T. F. B.

Ammonia and formic acid from cyanides ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,038, Oct. 5, 1906.

See Fr. Pat. 372,714 of 1906 ; this J., 1907, 527.—T. F. B.

Lime ; Manufacture of an improved dry chlorinated compound of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 24,101, Oct. 29, 1906.

See Fr. Pat. 370,863 of 1906 ; this J., 1907, 256.—T. F. B.

Cyanides ; Manufacture of —— in a condition fit for transport and storing. J. Y. Johnson, London. From Chem. Fabr. Schlempe, Frankfort on Maine, Germany Eng. Pat. 29,383, Dec. 24, 1906.

See Fr. Pat. 373,297 of 1907 ; this J., 1907, 689.—T. F. B.

Crystals ; Manufacture of large ——. J. Bock, Radebeul, Saxony. Eng. Pat. 5295, March 5, 1907. Under Int. Conv., Sept. 8, 1906.

See Fr. Pat. 374,968 of 1907 ; this J., 1907, 872.—T. F. B.

Hydrosulphites ; Production of stable, dry ——. M. Bazlen, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 861,014, July 23, 1907.

See Addition of Oct. 25, 1904, to Fr. Pat. 341,718 of 1904 ; this J., 1905, 333.—T. F. B.

Hydrosulphite mixture ; Stable ——, and method of making same. W. Majert, Berlin, Germany. U.S. Pat. 861,218, July 23, 1907.

The salt of an acid weaker than sulphurous or hydrosulphurous acid is added to a solution of a hydrosulphite, in less quantity than is necessary to salt out from the solution anhydrous hydrosulphite. The solution is evaporated in a vacuum to obtain a mixture of the hydrosulphite and added salt in a solid form.—E. S.

Lead acetate ; Process of manufacturing ——. A. Wultze, Charlottenburg, Germany. U.S. Pat. 861,345, July 30, 1907.

See Fr. Pat. 352,050 of 1905 ; this J., 1905, 892.—T. F. B.

Metal peroxides ; Process of producing ——. F. Fuhrmann, Assignor to Kirchhoff und Neirath, Berlin. U.S. Pat. 861,826, July 30, 1907.

See Fr. Pat. 362,249 of 1906 ; this J., 1906, 884.—T. F. B.

Sulphocyanide ; Manufacture of ——. J. Tcherniac, Streatham Hill. U.S. Pat. 862,678, Aug. 6, 1906.

See Eng. Pat. 2708 of 1906 ; this J., 1906, 427.—T. F. B.

Sulphur ; Process for the extraction of ——. M. Rohleder, Danzig, Germany. Eng. Pat. 23,967, Oct. 27, 1906. Under Int. Conv., Nov. 15, 1905.

See Fr. Pat. 370,893 of 1906 ; this J., 1907, 256.—T. F. B.

Sulphur ; Extraction of —— from gangue or other material. A. J. Boult, London. From E. Günther and R. Franke, Eisleben, Germany. Eng. Pat. 11,187, May 13, 1907.

Boiling acetylene tetrachloride, or a mixture of the same with certain hydrocarbons such as xylol, is used as solvent. Separation takes place, either by boiling the sulphur-containing material with the solvent, and pouring off from the residue, or with the aid of the usual forms of extractors. Sulphur separates from the solution on cooling, only 1 per cent. being retained at the ordinary temperature. The process is specially applicable to the separation of sulphur from the purifying mass which is used for removing hydrogen sulphide from coal gas. The purifying material (hydrated ferric oxide) remains active after treatment with acetylene tetrachloride, and may therefore be used over and over again. It thus accumulates a greater content of cyanogen compounds than is possible when sulphur-extracting methods are used, which render the purifying mass unsuitable for further operations.—O. R.

Disintegration of amorphous bodies ; Process for the ——. E. G. Acheson. Fr. Pat. 376,332, April 3, 1907. Under Int. Conv., Dec. 31, 1906.

See U.S. Pat. 843,426 of 1907 ; this J., 1907, 417.—T. F. B.

Graphite ; Deflocculated ——, and its manufacture. E. G. Acheson. Fr. Pat. 376,333, April 3, 1907. Under Int. Conv., Dec. 10, 1906.

See U.S. Pat. 844,989 of 1907 ; this J., 1907, 417.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Glass, Means for pouring —— directly from melting furnaces. P. T. Sievert, Dresden, Germany. U. S. Pat. 861,401, July 30, 1907.

See Eng. Pat. 5605 of 1906 ; this J., 1906, 760.—T. F. B.

China clay ; Grading or dressing ——. H. J. Batt and W. Bowden, London. Eng. Pat. 18,294, Aug. 15, 1906.

A current of air heated to about 250° F. is passed over the broken up clay, which is constantly stirred and turned. The finer particles are removed as they are broken off, by screening, and after this, the already screened particles may again be screened to any desired degree. A second drying operation, in which air of 150° F. impinges upon the clay, as it falls in a thin wide stream through variously graded screens, completes the operation. The fine sands, mica clay, and other floating particles, are drawn by an induced draught of the hot air against baffles, and are collected separately.—O. R.

Enamelling and annealing ; Processes of ——. O. Zahn, Berlin. Eng. Pat. 28,746, Dec. 17, 1906. Under Int. Conv., Dec. 22, 1905.

The working chamber in which the enamelling and annealing are to be carried out, is first raised to the required temperature by heating it both internally and externally by means of furnace gases ; the flue leading from the interior of the chamber to the chimney is then closed by means of a damper, so as to cause the flame to circulate only around the exterior of the chamber, which is thus kept at the required temperature. This procedure also serves to remove the gases remaining in the chamber through the flue leading from the furnace, and any injurious action on the ware is thus prevented.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Wood and other fibrous material ; Solutions for preserving ——. K. H. Wolman, Idaweiche, Germany. Eng. Pat. 17,534, Aug. 3, 1906.

A salt of hydrofluoric acid, such as sodium fluoride, is added to solutions of salts of strong mineral acids, such as ferrous sulphate, or aluminium sulphate, employed for preserving wood and other fibrous material, with the object of preventing the liberation of a strong acid (*e.g.*, sulphuric acid) in the wood, and of increasing the antiseptic action of the solution.—W. C. H.

Wood ; Treatment of —— with solution of chromium salts. H. Sefton-Jones, London. From J. Dada, Budapest, and G. Fuchs, Vienna. Eng. Pat. 5327, March 5, 1907.

The wood is impregnated with a solution composed of 15 parts of chromo-phosphoric oxide, 70 parts of chrome alum, and from 1,500 to 15,000 parts of water. The chromo-phosphoric acid is prepared from 1500 grms. of freshly-prepared, wet chromic oxide, 750 grms. of phosphoric acid of 60° B., and 10 to 13 litres of water.—W. C. H.

Wood ; Process for the impregnation of ——. J. Dada and G. Fuchs. Fr. Pat. 376,248, March 1, 1907.

See Eng. Pat. 5327 of 1907 ; preceding.—T. F. B.

Concrete or other compositions for use in building and like constructions. J. R. Hitchins, London, and W. Dunz, Shoreham. Eng. Pat. 430, Jan. 7, 1907.

This invention relates to a fireproof and damp-proof composition which can be used either in the form of blocks or slabs, or applied directly as a plastic mass to walls, partitions, iron work or other structures. The composition consists of a mixture of 24 bushels of aggregate material, such as coke, brick, pumice, clinker, ash, &c., 4 bushels of plaster of Paris, 8 lb. of gelatin, in solution, and a coagulating agent, such as 1 lb. of chrome alum, or potassium bichromate, or ½ lb. of tannic acid, or 1 quart of a 40 per cent. solution of formaldehyde, and 7 lb. of alum ; this last ingredient is added to accelerate the hardening of the mass.—W. C. H.

Sorel cement ; Manufacture of ——. A. J. Boult, London. From B. Neuburger, Nürnberg, Germany. Eng. Pat. 16,164, July 17, 1906.

See Fr. Pat. 368,434 of 1906 ; this J., 1907, 49.—T. F. B.

Cement for building and like purposes ; Manufacture of ——. P. Timofeeff, St. Petersburg. Eng. Pat. 17,006, July 27, 1906.

See Fr. Pat. 368,339 of 1906 ; this J., 1906, 1221.—T. F. B.

Cement ; Method of and apparatus for burning ——. T. M. Morgan, Longue Pointe, Canada. U.S. Pat. 860,685, July 23, 1907.

See Eng. Pat. 6946 of 1906 ; this J., 1906, 848.—T. F. B.

Portland cement, and process of manufacturing the same. T. A. Edison, Llewellyn Park, N.J. U.S. Pat. 861,241, July 23, 1907.

The process consists in subjecting the clinker to a single crushing operation, as distinct from grinding, in powerful crushing rolls, removing the sufficiently fine particles by means of an air blast, and returning the tailings, together with fresh material, to be re-crushed. Crushed Portland cement having no appreciable proportion of ground particles, and in which more than 80 per cent. of the particles will pass a 200-mesh screen, and less than 10 per cent. of the mass is in a condition of "flour," is claimed as a new product.—W. C. H.

X.—METALLURGY.

Ferro-silicon. Bd. of Trade J., Aug. 22, 1907. [T.R.]

Professor Cronquist, of Stockholm, who was instructed to investigate the causes of the death of four of the passengers on the Swedish steamship "Olaf Wijk." confirms the view that their death must be attributed to the gases given off by ferro-silicon contained in the hold under the cabins. Ferro-silicon is made by heating together iron ore, quartz, coke, and lime in the electric furnace, a product containing up to 80 per cent. of silicon being obtained. It is generally packed in iron drums or casks for export.

Certain kinds of ferro-silicon seem to be disintegrated into powder by the action of moist air; this apparently is not dependent on the proportion of silicon present, as specimens containing up to 80 per cent. of silicon have been found to remain unchanged for weeks. Ferro-silicon may evolve phosphoretted and arseniuretted hydrogen in contact with moisture. These properties of ferro-silicon indicate that considerable danger is connected with its transport, not only to persons on the ship, but to dock labourers engaged in unloading it at docks. *Prima facie*, it seems that the presence of moisture is the cause of the accidents, and every effort should be made to ensure that the material is in a dry condition when packed, and that there is no possibility of moisture gaining access to the receptacles containing it.

Pig iron production in Canada. Bd. of Trade J., Aug. 15, 1907. [T.R.]

The production of pig iron in Canada in the first half of 1907 amounted to 270,100 tons, as compared with 282,010 tons in the corresponding period of 1906. 265,253 tons consisted of coke iron and the remainder of charcoal iron. The production of Bessemer pig iron in the first half of 1907 amounted to 73,023 tons as against 79,051 tons in the first half of 1906. The production of basic pig iron amounted to 161,403 tons, as compared with 135,298 tons. The production of malleable Bessemer, foundry, forge and miscellaneous grades was 35,674 tons, as against 67,661 tons in the first half of 1906. On June 30, 1907, Canada had 14 completed blast furnaces, of which 10 were in blast and four idle. Twelve were equipped to use coke and two to use charcoal.

Pig iron production in the United States. Bd. of Trade J., Aug. 15, 1907. [T.R.]

The production of pig iron in the United States during the first half of the current year as compared with the first half of 1906 was as follows:—

	1906.	1907.
	Tons of 2,240 lb.	Tons of 2,240 lb.
Bessemer and low-phosphorus pig-iron	6,884,881	7,185,878
Basic pig-iron (not including charcoal iron)......	2,449,275	2,671,136
Charcoal pig-iron	207,722	205,796
Spiegeleisen and ferro-manganese pig-iron	160,833	172,675
Other kinds of pig-iron ..	2,879,539	3,242,559
Total	12,582,250	13,478,044

Steel-hardening metals in the United States. Bd. of Trade J., Aug. 15, 1907. [T.R.]

An investigation is to be undertaken by the United States Geological Survey into the deposits of steel-hardening metals (other than manganese) in the country. The known steel-hardening metals, named in the order of importance of production and use, are nickel, chromium, manganese, tungsten, molybdenum, vanadium, titanium, cobalt and uranium. The value of these metals produced in the United States in 1906 amounted to 458,327 dols., of which 393,667 dols. was for tungsten. The price of tungsten, which has been increasing for a number of years, was quoted at 5 dols. to 6 dols. per unit (1 per cent. of a ton) in 1905, and at 12 dols. per unit in the spring of 1907.

Mineral production of Cornwall in 1906. Eng. and Min. J., Aug. 10, 1907. [T.R.]

During 1906 the output of tin concentrates in Cornwall was 6226 tons, and in Devonshire 32 tons, and there was also produced 1313 tons of undressed tin ore. These figures are almost identical with those of the previous year. The output of copper ore was 4170 tons, as compared with 5466 tons during 1905. The production of arsenic and arsenical pyrites during 1906 was 1599 tons and 610 tons, respectively, as compared with 1528 tons and 641 tons, respectively, in 1905.

Zinc industry in Canada. U.S. Cons. Reps., July, 1907. [T.R.]

The Canadian Government has recently published the report of a commission appointed to investigate the zinc resources of British Columbia.

The conclusions drawn are that, although the zinc industry is yet in its infancy in British Columbia, it is capable of great development. While several of the mines now being worked are essentially zinc mines, there are some silver-lead mines in which zinc blende is found in considerable quantities. Until recently the zinc in the silver-lead ores was regarded as an impurity to be got rid of by the easiest and cheapest means possible. The increased demand for zinc of late has made valuable as a by-product, this zinc blende, which was formerly a troublesome impurity. 15,000 tons of zinc ore of 50 per cent. grade is regarded as a liberal estimate of the present annual production of the Slocan district, and it is calculated that the Ainsworth district can produce 100 tons daily of 50 per cent. ore. A zinc smelter has been established at Frank, Alberta, the plant being close to a coal mine and on the route from the mines to the market. Coal can be delivered at the Frank smelter at less than $1 per ton.

Bauxite; Discovery of —— in Dalmatia. Eng. and Min. J., Aug. 17, 1907. [T.R.]

The British Consul at Trieste, Austria, reports that several bauxite deposits have been discovered in Lesina, which is one of the islands in the Adriatic, forming part of the State of Dalmatia. New coal mines have recently been opened up in the same State.

Waste heat; Utilisation of —— in slimes settlement. A. Salkinson. J. Chem., Metallurgical and Min. Soc., S. Africa, 1907, **7**, 403—406.

The waste heat of exhaust steam was utilised to heat the slimes solutions by circulating the latter through the shell of a boiler, the exhaust steam being passed through the tubes of the latter. It was found that increasing the temperature by 6° F. in this way caused a diminution in the depth of the sediment of 8·8 in., on about 5 ft., which, with two transfers, and a total increase in temperature of 16° F., amounts to nearly 2 ft., on about 10 ft. At the same time, the amount of gold dissolved increased, from 91·192 to 92·887 per cent. in one experiment. The cost for power for running the circulating pump does not exceed £10 per month, the maintenance cost is negligible, and the higher temperature has no decomposing effect on the cyanide.—A. G. L.

Base bullion; Notes on the refining of ——. C. W. Lee and W. O. Brunton. J. Chem., Met. and Min. Soc., S. Africa, 1907, **7**, 358—360.

T. K. Rose's method of refining by means of air or oxygen is used for bringing unusually base bullion up to a fineness of 800 or over. The bullion to be refined is melted in a clay-lined "salamander" crucible of suitable size, standing on an inverted crucible in the furnace. The air used for the refining is introduced into the molten metal through one of Morgan's 24 in. by $\frac{1}{8}$ in. bore, porcelain chlorine tubes fitted into the expanded end of a short length of $\frac{1}{2}$ in. iron piping, the joint being made air-tight with plaster of Paris. This short length of piping, fitted with the porcelain tube, is attached to the end of a vertical iron pipe connected to the main air-supply pipe by flexible metallic tubing. The flexible tubing is suspended from the roof by means of a rope running through a pulley, so that the height of the porcelain tube in the crucible can be readily adjusted. When treating 500 oz. of base bullion, 1½ lb. of borax and 3 lb. of fine tube-mill sand are added, and the slag is preferably removed by skimming, more sand being added if the slag becomes thin. The authors find that by carefully regulating the air supply, there is no loss of metal by spirting, and that there is no great loss of silver, either in the slag or by volatilisation. —O. F. H.

Platinum silicide ; and a double silicide of platinum and copper. E. Vigouroux. Compt. rend., 1907, **145**, 376—378.

The silicide, SiPt, obtained by Lebeau and Novitzky (this J., 1907, 927) was last year described by the author. He obtained it by direct combination of the elements, when platinum was heated in a wind furnace with excess of silicon, in an atmosphere of hydrogen. Aluminium, heated with this silicide, tends to dissociate it ; copper forms with it copper silicide and sets the platinum free. Copper silicide, heated either with platinum silicide or with metallic platinum, forms a compound having the formula, $SiCu_2Pt$.—J. T. D.

Copper matte, etc. ; Use of zinc in assaying ——. D. M. Levy. Eng. and Mining J., 1907, **84**, 262.

The author has substituted zinc for aluminium for removing the copper from solution in the assaying of matte in which iron is also to be determined. Zinc does not interfere with the delicacy of the iodide estimation for copper, so that method may be used. The author finds that with zinc a more complete separation is obtained than with aluminium, the conditions are less rigid and the method is more suitable than the thiosulphate one, and can be advantageously used with most copper-bearing materials met with in works practice, especially when both copper and iron have to be determined. The zinc used is in thin strips, about 3 × 0·25 in., rolled up for about half their length, so that they float vertically in the liquid and extend the whole depth of the solution.

The assay is conducted by dissolving the matte in fuming nitric acid, diluting with 20 c.c. of water, adding 5 c.c. of strong sulphuric acid and heating the solution until white fumes are copiously evolved. When cool, 60 c.c. of water are added, and the solution is heated to a gentle boil when the zinc is introduced and a small funnel inserted in the mouth of the flask. When the precipitation and reduction are complete, the funnel is washed and removed, and a glass wool plug placed in it. The solution is then decanted through the wool, the flask rinsed out with dilute sulphuric acid several times, passing the rinsings also through the wool. The iron in the filtrate is then immediately titrated with permanganate or bichromate. The funnel is replaced in the mouth of the flask, a little nitric acid poured on the wool to dissolve any copper, washing with about 20 c.c. of water. The funnel is removed and the iodide method for copper proceeded with in the usual way. A blank experiment should be tried on each fresh lot of zinc.

Copper mirrors. F. D. Chattaway. Chem. News, 1907, **96**, 85.

When solutions of cupric oxide are reduced by means of aromatic hydrazines in clear glass vessels, copper is deposited upon the glass in the form of a brilliant coherent film. The mirrors obtained have the lustrous red colour of burnished copper, and are as perfect in reflecting surface and uniformity as the similar mirrors obtained by the deposition of silver.—O. R.

Silicon ; Action of —— on pure and impure aluminium. E. Vigouroux. Bull. Soc. Chim., 1907, **1**, 789—792.

Silicon has no action on pure aluminium, but with impure aluminium, yields silicides of the latter and another element, i.e., silicoaluminides, or carbosilicides or carbosilicoaluminides when carbon is present. The presence of argillaceous material should therefore be guarded against in the preparation of metals capable of forming such silicoaluminides. It is owing to the formation of these compounds that it has been impossible hitherto to obtain metals such as vanadium, uranium, titanium, etc., in a pure state.—A. S.

Calcium : its properties and possibilities. A. E. Pratt. Pharm. J., 1907, **79**, 223.

The calcium alloys are brittle, crystalline, and hard ; undergo oxidation and disintegration on exposure to air ; decompose water, and exhibit increased chemical activity, especially in respect of any properties shared by both constituents of the alloy. The hardening property of calcium would seem to be the only one of practical utility in alloys ; and the chief applications of the metal promise to be as a reducing agent, and for refining metals.—C. S.

Metals ; Occlusion and diffusion phenomena in ——. A. Sieverts. Z. phys. Chem., 1907, **60**, 129—201.

Occlusion and diffusion, though probably causally connected, do not proceed *pari passu*. According to the author's experiments, copper begins to absorb hydrogen at 400° C., but no diffusion can be observed below 640° C. Soft iron wire absorbs hydrogen, and allows it to diffuse from 400° C. upwards; nitrogen does not appear to diffuse below 1000° C., but is occluded above 900° C., and is not disengaged at 500° C. in vacuo. Chemically pure iron, however, takes up nitrogen at 900° C. and gives it up quantitatively below this temperature; this is considered to be a peculiarity of gamma-iron. Nickel absorbs hydrogen below 200° C. ; diffusion begins at 450°. Cobalt absorbs the same gas above 700° C. For the occlusion of hydrogen and oxygen by silver, no trustworthy data could be obtained ; there is no diffusion below 640° C. Hydrogen diffuses through platinum at 576° and upwards ; no other gases diffuse through it, and there is hardly any occlusion of hydrogen below 1000° C. In all cases the rate of diffusion through metals increases with the temperature. The solubility of hydrogen in copper, iron, nickel, and cobalt increases with the temperature, but for palladium the converse holds good.—W. A. C.

Patents.

Steel ; Process for manufacturing ——. H. Delporte, Ougrée, Belgium, Assignor to Eisen-und Stahlwerk Hoesch Akt.-Ges., Dortmund, Germany. U.S. Pat. 861,440, July 30, 1907.

See Fr. Pat. 360,750 of 1905 ; this J., 1905, 804.—T. F. B.

Iron ; Process of extracting —— from its ores. C. G. P. de Laval, Stockholm. U.S. Pat. 861,593, July 30, 1907.

See Fr. Pat. 356,098 of 1905 ; this J., 1905, 1311.—T. F. B.

Steel of high grade ; Process for preparing —— from ordinary iron. A. Massott, jun., Mutterstadt, Assignor to F. Andre, Haardt, Germany. U.S. Pat. 861,999, July 30, 1907.

See Fr. Pat. 362,371 of 1906 ; this J., 1906, 700.—T. F. B.

Iron ores ; Process of agglomerating pulverulent ——. W. Schumacher, Oberdollendorf, Germany, Assignor to E. Thalmann, New York. U.S. Pat. 862,666, Aug. 6, 1907.

See Eng. Pat. 28,019 of 1904 ; this J., 1906, 220.—T. F. B.

Iron smelting ; Charge mixture for ——. H. W. Lash, Cleveland, Ohio. U.S. Pat. 862,978, Aug. 13, 1907.

See Eng. Pat. 387 of 1907 ; this J., 1907, 696.—T. F. B.

Iron and steel ; Treatment of —— to prevent oxidation or rust. T. W. Coslett. Fr. Pat. 376,536, April 8, 1907. Under Int. Conv., April 10, 1906.

See Eng. Pat. 8667 of 1906 ; this J., 1907, 207.—T. F. B.

Copper; Process for extracting —— from its ores or mineral compounds. J. Gathy, Mons, Belgium. Eng. Pat. 18,574, Aug. 18, 1906. Under Int. Conv., Aug. 21, 1905.

See Fr. Pat. 368,467 of 1906; this J., 1907, 53.—T. F. B.

Metals; Method of depositing and recovering ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 860,661, July 23, 1907.

A stream of metalliferous solution is passed through a granular precipitating agent, which is agitated by means of a rotatory movement, whereby the metallic deposit is separated and carried on by the stream of liquid, whilst fresh surfaces of the precipitant are exposed.—A. G. L.

Slimes treatment. C. E. D. Usher, Jeppestown, Transvaal. U.S. Pat. 860,775, July 23, 1907.

The apparatus comprises a vat provided with a discharge door; means for maintaining slimes contained in the vat in a uniform state of suspension; slowly revolving and perforated arms at the bottom of the vat, fitted with agitating vanes; and means for supplying solvent or washing liquid to one or more of these arms, means for continuously drawing off clear liquid from above the slimes, and means for ejecting washing liquid or flushing water from the whole of the arms simultaneously.
—A. G. L.

Metals; Method of manufacturing —— and compositions used therein. H. Goldschmidt and O. Weil, Essen on Ruhr, Germany. U.S. Pat. 860,799, July 23, 1907.

See Fr. Pat. 358,071 of 1905; this J., 1906, 185.—T. F. B.

Oxides; Process of reducing refractory ——. K. A. Kühne, Dresden, Germany. U.S. Pat. 861,129, July 23, 1907.

See Fr. Pat. 364,329 of 1906; this J., 1906, 890.—T. F. B.

Compound metal bodies; Apparatus for producing ——. J. F. Monnot, Assignor to Duplex Metals Co., New York. U.S. Pat. 861,220, July 23, 1907.

See Eng. Pat. 8913 of 1906; this J., 1907, 532.—T. F. B.

Sulphide ores containing zinc; Treatment of ——. R. W. E. MacIvor, Assignor to Metals Extraction Corporation, Ltd., London. U.S. Pat. 863,411, Aug. 13, 1907.

See Fr. Pat. 362,677 of 1906; this J., 1906, 765.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Molten salts; Electrolytic dissociation of ——. R. Lorenz, Ber., 1907, 40, 3308—3311.

The conclusions of K. Arndt (this J., 1907, 829) as to the complete dissociation of molten salts are criticised by the author. It is pointed out that similar relations to those found by the former would hold, whatever the degree of dissociation, so long as this did not vary with the dilution by some inert solvent. Further, if the simple salts in a molten condition are completely dissociated, the inverse proportionality between the viscosity and the ionic mobilities would hold, not only for one salt but for all salts, provided equal concentrations were considered. This deduction is found not to hold, wide variations existing between different salts. An extended series of measurements with sodium and potassium nitrates over a wide range of temperature, indicate that the degree of dissociation of these salts varies only slightly with the temperature, a fact previously established by the author.
—R. S. H.

Patents.

Electrodes for use in the treatment of gases by arc discharges. H. Pauling, Gelsenkirchen, Prussia. Eng. Pat. 18,600, Aug. 20, 1906.

See Fr. Pat. 371,883 of 1906; this J., 1907, 417.—T. F. B.

Filaments of metallic tungsten or molybdenum for electric incandescent lamps; Manufacture of ——. A. Lederer. Eng. Pat. 18,738, Aug. 21, 1906. *See* II.

Amorphous bodies; Disintegration of —— and the subsequent treatment thereof. E. G. Acheson, Stamford, Canada. Eng. Pat. 7776, April 3, 1907. Under Int. Conv., Dec. 31, 1906.

See U.S. Pat. 843,426 of 1907; this J., 1907, 417.—T. F. B.

Ozonising atmospheric air; Apparatus for ——. E. L. Joseph and Ozonair, Ltd., London. Eng. Pat. 7836, April 3, 1907.

Each electrode panel or screen comprises a pair of metal gauze sheets, applied to the opposite faces of a plate of dielectric material, with a pair of metal grids extending over the outer surface of the gauze sheets, and serving as a means for the distribution and collection of the current to and from the sheets. The panels are supported in upright planes, parallel to each other, and to the current of air, by means of a series of blocks of insulating material engaging with them, the blocks on one side of each panel being stationary, whilst those on the opposite side are carried by springs. A panel may thus be easily inserted or withdrawn.—B. N.

Separating, and simultaneously extracting water from, mineral vegetable or animal substances. Farbwerke vorm. Meister, Lucius und Brüning. Eng. Pat. 10,024, 1907. *See* I.

Cell; Electrolytic ——. G. A. Gabriel, Assignor to Bleach and Caustic Process Co., New York. Re-issue, No. 12,672, July 16. 1907 of U.S. Pat. 822,109, May 29, 1906.

See this J., 1906, 643.—B. N.

Water; Apparatus for [*electrolytically*] *purifying ——.* A. O. Tate. U.S. Pat. 860,771, July 23, 1907. *See* XVIII*B*.

Electrolysis. G. Rambaldini, Grosseto, Italy. U.S. Pat. 861,226, July 23, 1907.

See Eng. Pat. 2376 of 1902; this J., 1903, 216.—T. F. B.

Oxidation of liquids by electric discharges; Process for the ——. A. de Hemptinne. Fr. Pat. 376,111, March 25, 1907. Under Int. Conv., April 9, 1906.

See Eng. Pat. 13,023 of 1906; this J., 1907, 829.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

Tin cathodes; Quantitative electrolytic deposition of zinc, copper, silver, cadmium and nickel with ——. L. T. Sherwood and G. Alleman. J. Amer. Chem. Soc., 1907, 29, 1065—1074.

The authors have used dishes stamped from block tin sheets as substitutes for platinum dishes for cathodes in the determination of metals by electrolysis. A platinum wire spiral conforming to the shape of the dish served as an anode, which was rotated at a speed of 700 revolutions per minute. Zinc is deposited from its solutions in sodium hydroxide, and since the latter tends to attack the tin, the current should be started before the alkaline solution is added to the water in the dish. Sodium acetate also yields good results as an electrolyte in the case of zinc. In the determination of silver, hot water is first placed in the dish, the circuit is closed, oxalic acid and a trace of isinglass solution are added, and lastly the silver solution mixed with potassium cyanide. The current should not exceed 1·0—1·5 ampère or the deposit will be spongy. For cadmium, an electrolyte consisting of 1 c.c. of sulphuric acid, sp. gr. 1·115, per 100 c.c. of liquid is employed, the circuit being closed before the acid is added. The deposition of copper gave the most trouble, the deposit readily becoming spongy. A mixture of ammonium oxalate, oxalic acid and a trace of isinglass gave the best results with copper sulphate, more oxalic acid being added at intervals; the solution must be cold at first. With nickel good results are easily obtained, the electrolytes being ammonia and ammonium sulphate or ammonia and ammonium acetate.—J. F. B.

Patents.

Furnaces; Electric ——. A. Reynolds, London. Eng. Pat. 26,981, Nov. 27, 1906.

A resistance of loose carbon traversed by an electric current serves as the source of heat. In order to prevent the destructive effect upon the walls of the furnace, of excessive local temperature, due to arcing within the granular carbon, the loose carbon is wholly or partially enclosed within walls of plumbago, carborundum or similar material. The resistance is embedded in the hearth of the furnace, in the crucible lining, or in a chamber within the crucible.—R. S. H.

Furnaces; Electric ——. F. M. Chaplet, Laval, and Soc. la Néo Métallurgie, Paris. Eng. Pat. 4927, Feb. 28, 1907. Under Int. Conv., Sept. 25, 1906.

See Fr. Pat. 370,005 of 1906; this J., 1907, 210.—T. F. B.

Charging electric furnaces; Means for ——. W. H. Huffmann, Niagara Falls, N.Y., Assignor to Internat. Acheson Graphite Co., Niagara Falls, N.Y. U.S. Pat. 860,477, July 16, 1907.

Temporary walls consisting of paper or metal sheets are used to retain the charge around the central heating core of the furnace. These walls are surrounded with a mixture having a relatively low conducting capacity and the temporary walls are then withdrawn.—R. S. H.

Removing scale and oxide from metal plates, wire, strip, or ribbon; Continuous process for [electrolytically] ——, and drying and galvanising the same. S. O. Cowper-Coles, London. Eng. Pat. 17,672, Aug. 7, 1906.

The metal to be treated, in order to remove scale and oxide, is passed over rollers, and then along guiding grooves between insoluble anodes, and through an electrolyte in a suitable tank, the metal acting as the cathode. After leaving the tank, the metal is passed between hot rollers and across a drying plate, or through heated tubes, direct to the galvanising tank.—B. N.

Coating wire [electrically] with zinc and other metals. S. O. Cowper-Coles, London. Eng. Pat. 18,910, Aug. 24, 1906.

The wire is passed through a molten bath of the coating metal, which is connected to one pole of a source of electricity, a rubbing device, through which the wire is drawn after leaving the bath, being connected to the other pole. The temperature of the wire is thus raised above that of the bath, and the excess of metal is removed and runs back into the bath. A smooth, firmly-adherent coating, free from holes and flaws, is thus obtained.
—B. N.

Alloys; Electrodeposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 19,411, Aug. 30, 1906.

An anode of the alloy, such as brass, to be deposited is employed, and anodes of the metals (copper and zinc) composing the alloy are placed in circuit with it. The amount of current flowing through the zinc and copper anodes is regulated by inserting resistances in the circuit, and the amount of each metal which is dissolved may thus be regulated. Double cyanides of copper, zinc, and potassium are employed as the electrolyte.—B. N.

Metallic wire, strip, or the like; Electrolytic manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 21,583, Sept. 29, 1906.

A spiral thread, of ordinary square section, is cut around the periphery of the mandrel, and insulating material is applied to the bottom or top of the thread, so that the spiral groove is partly or completely filled with insulating material; or the sides and bottom of the groove may be left exposed. The mandrel is revolved, in a suitable electrolytic apparatus, during the deposition of the metal.
—B. N.

Tungsten or alloys thereof [for electric lamp filaments]; Manufacture of ductile ——. Siemens und Halske A. G., Berlin. Eng. Pat. 3174, Feb. 8, 1907. Under Int. Conv., Mar. 22, 1906.

Powdered tungsten, or a mixture of powdered tungsten with other metallic powders, is moulded into solid bodies under great pressure, without the use of non-metallic agglutinants, preferably by stamping the powder into a tube of iron or other ductile metal, which is then drawn or rolled, after which the metallic shell is removed, preferably by chemical means. The tungsten rod is then heated to a white heat by passing an electric current through it in a vacuum or an indifferent atmosphere. The bodies obtained are claimed to be very ductile and well suited for making lamp filaments.—A. G. L.

Electrotypes; Production of ——, *and apparatus therefor.* S. O. Cowper-Coles, London. Eng. Pat. 4051, Feb. 18, 1907.

The cases, containing the moulds or impressions forming the cathodes, are slowly passed through the electrolytic bath in close proximity to the anodes, the cases being carried on an endless chain or band working over pulleys which are placed above the bath. "Air is projected on, between, or in close proximity, to the cathodes."—B. N.

Copper from old bronze and bronze waste; Regeneration of the electrolyte employed in the extraction, by the electrolytic process, of ——. A. J. M. Thirot, Bourges, and L. A. Mage, Avignon, France. Eng. Pat. 6502, March 18, 1907. Under Int. Conv., March 26, 1906.

See Fr. Pat. 364,588 of 1906; this J., 1906, 892.—T. F. B.

Electrical separation; Method of ——. H. A. Wentworth, Lynn, Mass., Assignor to Electrostatic Separator Co., Boston, Mass. U.S. Pat. 859,998, July 16, 1907.

The mixed solid material to be separated is placed upon a conducting electrode and is there subjected to an ionised gaseous jet from an opposing electrode, for a time insufficient to more than locally charge the poorer conducting constituents. In the meantime the superior conducting constituents are deprived of their charge by contact with a conducting electrode, or have a repelling charge conducted to them, and are thus removed. Subsequently the local charge on the poorer conducting constituents is either increased by direct conduction or is corrected by subjecting the particles to the influence of a second electrostatic field.—R. S. H.

Cathode. H. S. Hatfield, Brighton. U.S. Pat. 860,657, July 23, 1907.

See Eng. Pat. 20,770 of 1905; this J., 1906, 1103.—T. F. B.

Ferrosilicon; Process of producing ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 861,224, July 23, 1907.

An electrically-conductive charge of a silicon compound, carbon, and a source of iron, is smelted by establishing an electric arc within the charge, the zone of reduction being surrounded, and the electrodes protected from the oxidising and cooling effect of the atmosphere, by a considerable body of the charge. The minimum potential difference, necessary to effect reduction, is maintained between the electrodes, thus preventing loss of electric current by leakage through the charge, and also preventing loss of heat by radiation. The product may be tapped from the furnace and charge materials supplied as required. —B. N.

Silicospiegel; Process of producing ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 861,225, July 23, 1907.

The process is similar to that described in U.S. Pat. 861,224 (see preceding abstract), the charge consisting of compounds of manganese and silicon, carbon, and a source of iron.—B. N.

Sheet metal; Treating —— by electrolysis. J. Müller, Schönau, Austria. U.S. Pat. 862,409, Aug. 6, 1907.

See Fr. Pat. 365,456 of 1906; this J., 1906, 1054.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Coquilho nuts. For. Off. Ann. Ser., 3901. [T.R.]

Coquilho nuts are exported from Bahia in steadily increasing quantity yearly. The nuts average in size something larger than a hen's egg, and consist of a central kernel embedded in an extremely hard pulp. The kernel yields an oil of very fine quality, which is used locally as a lubricant for watches and for other delicate mechanisms. The chief value of the nuts, however, would seem to lie in the pulp surrounding the kernel. Most of the coquilho nuts exported from Bahia go to France, where the pulp is utilised for the manufacture of buttons and rosaries.

Cottonseed oil and its possibilities. U.S. Cons. Reps., June, 1907. [T.R.]

Italy.

Cottonseed oil imported here is said to be mixed with olive oil in warehouses, where the oil remains without paying duty until the process is completed, when the whole produce is exported under the name of olive oil.

Taking the average value of cottonseed oil imported here as 5·45 cents per lb., and adding the duty of 4.55 cents, would make a total of 10 cents per pound. The current prices of pure olive oil in Genoa are, per quintal of 100 kilos. or 220 pounds:—Extra quality, 150 lire; fine first quality, 135 lire; fine second quality, 120 lire, and edible good, 100 lire (lire = 19·3 cents). Thus the poorest quality of pure olive oil sells for 9·09 cents, against 10 cents for cottonseed oil. A grade between the "edible good" and the "fine second quality" sells at 115 lire, which would be about the price of cottonseed oil, with duty added to cost.

The cottonseed oil imported into Italy during 1905 amounted to 119,798 quintals, and during 1906 to 27,472 quintals. The decrease is explained by the small yield of olive oil in 1904–5 and by the passage of the Food and Drugs Act, June 30, 1906. In addition to the cottonseed oil which Italy imports, it is shipped in considerable quantities to Italian seaports and mixed upon the wharves with other edible oils. The resulting compound is exported to nearly every country of Europe and the Americas. The oils and greases with which cottonseed oil comes into competition in Piedmont and elsewhere in Italy, are olive oil, linseed oil, sesame oil, cocoanut oil, colza oil, lard, butter and tallow. It is believed that the duties and taxes must effectively prevent, in all but exceptional cases, the extended introduction of cottonseed oil into Italy, and that furthermore, should such an increase of trade occur, taxes notwithstanding, it could only result in the promulgation of higher rates. It is unlikely that cottonseed can be successfully imported into Italy. Apart from the fact that the seed deteriorates in conveyance, and that the percentage of oil contained in a given weight of it is low, the seed is subject to a duty of 5 lire per quintal (44 cents per cwt.).

Spain.

Olive oil of a low grade, not considered by Americans as fit for edible purposes, but exported in large quantities from Malaga to the United States for lubrication and other industrial uses, would be the only oil or grease to come into competition with American cottonseed oil if the latter were imported. The importation of cottonseed oil is, however, legislated against by the Spanish law of July 5, 1892, which makes it mandatory to mix 1½ per cent. of tar or petroleum with all cottonseed oil imported into Spain. This regulation has put an effectual stop to the importation of cottonseed oil. When the olive-oil production of Spain is small, importations are usually made from Italy.

Russia.

Unmixed cottonseed oil, as such, is not known at Vladivostock. Lard compounds, made of cottonseed oil and suet, have been introduced, and the quantity is estimated at about 600,000 pounds for the past year. The average price here is 7 roubles per pood, or 10 cents a pound, in large quantities.

Edible oils now on the market, with which cottonseed oil would have to compete, and their current prices are as follows per English pound, when sold by the pood (36 pounds):—

Olive oil, first quality, 43 cents; second quality, 37 cents; so-called low grade olive oil, non-edible, for burning, 18 cents; sunflower-seed oil, 17 cents; nut oil (various nuts), 14 to 22 cents; hempseed oil, 10 cents; bean oil, 9 cents.

The total quantity of vegetable oils imported in 1906 was 1,997,648 pounds. Of these oils 1,266,153 pounds came from foreign countries, the remainder by sea from Russia. The bean oil is of poor quality, and is mostly imported from China.

Other products that would compete with cottonseed oil are butter, a good grade of which is produced in Siberia, (18 to 22 cents per pound). Margarine sells at 19 cents per pound; American lard at 13½ cents; Chinese lard, very crude, at 7 cents, and edible tallow at about the same. The amount of butter imported in 1906 is stated at 1,083,766 pounds, and of other animal fatty products at 861,413 pounds.

Cottonseed oil in the province of Warsaw when cheaper than animal tallow is employed in the manufacture of soap; it is also used in the manufacture of varnish, as an ingredient added to other oils, and also as edible oil, consumed as substitute for sesamé oil. The aggregate import is estimated at some 20 carloads per annum. The price of cottonseed oil varies from 5.15 to 5.50 roubles ($2.57 to $2.75) per pood (36 pounds net), free Warsaw.

In Poland cottonseed oil as an edible oil competes with sunflower oil, linseed oil, hempseed oil, rape oil, and olive oil. The railway statistics—the only reliable source of information—state that the import amounts to 20,000 poods (about 330 tons) per annum. The price varies from 14 to 16 roubles ($7 to $8) per pood (36·1132 pounds), wholesale prime cost, free Warsaw. Sunflower oil is from 4.80 to 4.90 roubles ($2.40 to $2.45). Linseed and hempseed oil vary from 4.90 to 4.95 roubles ($2.45 to $2.47); rape oil from 5.20 to 5.40 roubles ($2.60 to $2.70) per pood, free Warsaw.

Cottonseed oil is imported into Poland from Russia proper. There are four manufactories in Russia which produce it as a specialty, the three varieties or grades being known on the market as raw, refined, and double refined.

Sunflower oil is imported from southern Russia, principally from Ekaterinoslav and Armavir. The mill at Ekaterinoslav is known to produce daily during the season not less than 5 carloads of this oil.

Linseed oil is imported from the north-west country and Volga district. Hempseed oil comes from southern Russia. Rape oil is produced within the province by two large mills, one of which is in Warsaw, the other at Kutno. The produce of the latter amounts to about 1000 tons per annum.

Cottonseed products in India. Report to Bureau of Manufacturers, U.S.A. W. A. G. Clark. Oil, Paint and Drug Reporter, Aug. 14, 1907.

Native mills.—Numerous mills have been started in India for the expression of oil from home-grown seeds, but these deal chiefly with linseed, rape and sesamé seeds. Attempts are being made by the native press to promote the establishment of cottonseed mills, but the movement is not favoured by the exporters of the seed. So far the only plant which deals regularly with cottonseed is that established, in 1900, at Myangian in Burma. In this mill cottonseed purchased in Burma, and also in Bombay and Madras, is separated from the lint and expressed, the oil refined, and the residues worked up into soap and lubricants. The average yield from a *maund* (40 lb.) of clean cottonseed is about 4 *tolas* (12 lb.) of lint, 6¾ to 7 lb. of oil, and 19 lb. of oil-cake and meal, the residue being hulls. The mill works 22 hours and deals with 30 tons of seed a day. The workmen receive 4 to 8 annas a day, mechanics 1 to 1½ rupee per day, and the engineer about 300 rupees per month. The total cost of working is about 6 rupees per ton, which is about half the average expense of working up the seed in America.

Manufacturing processes.—In the Myangian mill approximately the same proportion of oil is obtained from Rangoon, Calcutta and Madras seed. The seeds are decorticated and expressed at a pressure of 1½ tons to the sq. in., and the oil refined by treatment with a lye of potassium or sodium hydroxide. The crude oil is in good demand at a price of about 65 rupees for 100 vishas (300 lb.) for use as a lamp oil, or for lubricating purposes on the railways, whilst the refined oil, which fetches 80 rupees per 100 vishas in Burma, is used for food in India, China, and Japan. The "foots" from the refining process are made into soap of various kinds, the hulls of the seeds are used as fuel, and the oil-cakes sold at about 1 rupee per maund (40 lb.) for use as a feeding-stuff in Burma and India. Some is also exported to China, where it is used as fuel, and to Japan for feeding cattle and as a fertiliser. The refined Indian cottonseed oil is not so pure or clear as the American product, and has a different flavour and colour. Lard being forbidden to the Mohammedans, of whom there are over 60,000,000 in India, there should be a good demand for cottonseed oil for culinary purposes. The Burmese mill has met with considerable success in the manufacture of refined oils, lubricants and soaps, especially soap intended for washing silk goods, and various companies for the manufacture of similar products are being projected in different parts of India, though as yet only one has been definitely formed.

Exportation of Indian seeds.—A movement against the exportation of oil-seeds is being carried on in the native press, the chief reasons urged against the practice being the impoverishment of the land through loss of fertilising material, and the loss of sources of employment and of profit upon capital. Last year there was a rise in the price of all oil seeds, though this was relatively less in the case of cottonseed than of the other seeds. In recent years $12 a ton was considered a good price, but cottonseed is now sold at $16 at local stations and at $19.6 per ton in Bombay, which would correspond to about $26.35 per ton when landed in England.

The following table gives the comparative quantities of oil-seeds exported from India during the past six years:—

Oil seeds	1902.	1903.	1904.	1905.	1906.	1907.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Cottonseed	2,036,000	3,974,000	2,677,000	2,529,000	3,891,000	4,842,000
Linseed	7,328,000	6,328,000	8,616,000	11,182,000	5,789,000	4,349,000
Rape	6,925,000	3,927,000	4,343,000	5,155,000	1,994,000	3,725,000
Sesamé	2,447,000	3,733,000	3,513,000	2,517,000	1,685,000	2,761,000
Arachis	1,085,000	1,036,000	1,922,000	1,674,000	1,374,000	1,750,000
Castor	1,324,000	1,752,000	1,567,000	1,461,000	1,299,000	1,501,000
Poppy	954,000	966,000	1,315,000	2,363,000	797,000	803,000

Half the total quantity of seeds exported, and at least three-quarters of the cottonseed, is sent to Great Britain, whilst the remainder is bought by Germany, France and Belgium. The prices quoted for oil-seeds on July 1st, 1907, in Bombay were:—Cottonseed, 20 rupees, 8 annas, per 756 lb.; rape seed (bold), 8 rupees, 3 annas, per cwt. (112 lb.); rape seed (yellow Guzerat), 9 rupees, 13 annas per cwt.; castor seed (ordinary), 8 rupees per cwt.; and poppy seed, 10 rupees, 4 annas, per cwt.

Cottonseed cake.—Hull does a large import trade in cottonseed, mainly Indian and Egyptian. The latter is superior to the Indian seed and fetches a higher price, owing to its giving a higher yield of oil and being free from the adhering woolly substance ("fuzz") which renders Indian seed more difficult to deal with, and causes the oil-cake to be less digestible. It is stated that the cake from Indian seed has been found to have a bad effect upon English cattle. Cottonseed oil-cake is practically unknown in India, for the attempts to express the seeds in the rough native presses (*ghani*) have been unsuccessful owing to the large amount of oil retained by the husk and woolly fibre. The hydraulic presses used at Lahore and Akola are capable of dealing with cottonseed, but at present are only used for other oil-seeds. Analyses of 64 samples of cottonseed in 1903 gave the following average results:—

	Madras Presidency.	Bombay Presidency.	Central Provinces.	United Provinces.
Oil, per cent. ..	17·41	17·66	19·65	19·89
Fibre, per cent.	17·41	17·04	16·90	16·89

Experiments in the United States.—Samples of cottonseed from Baroda recently examined contained 20·9 and 18·1 per cent. of oil respectively. Experiments are to be made to determine whether American cottonseed mills can be adapted to the treatment of the smaller and more woolly Indian seed; and if the results are favourable, American plant will be used in the mills shortly to be started in Baroda State and other parts of India. Some of the American quotations for complete oil-mill plant are lower than the English quotations, so that it only remains to be decided whether the American machinery is suited to Indian conditions.—C. A. M.

Tristearin; Occurrence of —— in beef and mutton tallows. A. Bömer, A. Schemm, and G. Heimsoth. Z. Untersuch. Nahr. u. Genussm., 1907, **14**, 90—117.

Hansen (this J., 1902, 553) isolated from beef and mutton fats a glyceride (m. pt. 62·5° C.) which he regarded as distearo-palmitin, and he concluded that tristearin was not present. Kreis and Hafner (this J., 1904, 755) also found palmito-distearin in these fats, but no tristearin. With reference to the phenomenon of double melting point, Hansen (*loc. cit.*) and Guth (this J., 1903, 427) concluded that since tristearin was the normal ester of only one fatty acid, the occurrence of two modifications of that glyceride was out of the question, and that the glycerides separated by Heintz and by Duffy having this property were not pure tristearin, but impure mixed glycerides. The authors point out that the fact that Hansen failed to obtain glycerides with double melting points is to be attributed to his having examined them only after crystallisation from solvents. They find that there are two *physically* distinct isomeric modifications of glycerides, one stable and the other unstable. The form in which glycerides crystallise from solvents is the stable modification, whilst the unstable modification is produced when the melted glyceride is rapidly cooled. The so-called first melting point marks the transformation of the unstable into the stable modification. For the identification of glycerides the melting point of the substance after crystallisation from solvents is the most distinctive characteristic, but the relationship between the two melting points will afford a test of purity, especially in the case of glycerides of solid fatty acids. Contrary to the experience of Hansen and of Kreis and Hafner, the authors find that tristearin (m. pts. 55° and 72·1° C.) is present both in beef tallow and mutton tallow. From the former it was isolated by means of 20 crystallisations from ether, and its amount in the original fat was calculated to be about 1·5 per cent. In like manner a sample of pressed beef tallow was found to contain from 4 to 5 per cent. of tristearin, and a sample of mutton tallow about 3 per cent. A portion of the actual palmito-distearin (m. pts. 52° and 63° C.) prepared by Kreis and Hafner (*loc. cit.*) from beef tallow was crystallised eight times from ether by the authors. The final crystals were found to consist of nearly pure tristearin (m. pts. 55·0° and 71·8° C.); and hence, in the authors' opinion, this palmito-distearin was not pure, but contained about 15 per cent. of tristearin. (See also this J., 1899, 377, 590, 693; 1901, 1003, 1121; 1903, 1136.)—C. A. M.

Cacao butter; Detection of adulteration of —— by cocoanut oil. L. Robin. Ann. Chim. anal. appl., 1907, 12, 181—182. Chem. Zentr., 1907, 2, 187.

THE method previously described for the detection of adulteration of butter and lard by cocoanut oil (this J., 1906, 1055; 1907, 720), can also be used for the detection of foreign fats in cacao butter. If cocoanut oil be present in the latter, the value for the acids soluble in alcohol is at least 3; the ratio value (*loc. cit.*) is smaller than 60. A ratio value between 45 and 60 corresponds to an addition of 5—10 per cent. of cocoanut oil, 35—45 to 10—15 per cent., and 25—35 to an addition of 15—20 per cent.

—A. S.

Myrtle-seed oil. F. Scurti and F. Perciabosco. Gaz. chim. ital., 1907, 37, I., 483—486.

THE seeds of the myrtle (*Myrtus communis*) yield, on extraction with ether, 12 to 15 per cent. of a yellow oil of characteristic flavour. It is readily soluble in ether, turpentine oil, and carbon bisulphide; less soluble in alcohol. A sample prepared in the laboratory gave the following results:—Sp. gr. at 15° C., 0·9244; acid value, 1·7; saponification value, 199·84; Reichert-Meissl value, 9·65; Hehner value, 95·31; and iodine value (Hübl), 107·45. The oil did not form a solid mass in Poutet's elaidin test, or give characteristic colorations with sulphuric or nitric acids. The insoluble fatty acids were separated by the lead-ether method, the liquid portion being then examined by Hazura's oxidation method, and the solid acids by fractional precipitation. Oleic, linolic, myristic and palmitic acids were thus detected. The absence of stearic acid was proved by Hehner and Mitchell's method of crystallisation from a saturated alcoholic solution of pure stearic acid.

—C. A. M.

Fats of Garcinia species. D. Hooper. J. Asiatic Soc. of Bengal, 1907, 3, 257—259.

Fat from Garcinia morella (*Gamboge butter*).—The specimen was a semi-solid yellow fat that had been obtained from the seeds of "Gurgi" growing in Mysore, where the oil is used for cooking, lighting, and as a liniment for sprains. A very similar fat was prepared in Mysore from the seeds of "Murga" (*Garcinia*) and is used, like ghee, in cooking. Both fats were without taste or odour. They gave the following analytical results:—

Fat.	Sp. gr. at 50° C.	Melting point.	Acid Value.	Saponification Value.	Iodine Value.	Reichert-Meissl Value.	Hehner Value.	M.pt. of Fatty Acids.	Iodine Value of Fatty Acids.
		°C.						°C.	
Murga	0·900	37	3·49	198·20	53·72	0·69	94·89	56	56·38
Gurgi	0·902	33·5	13·79	194·74	55·46	0·62	95·20	55	57·81

The fatty acids were found to contain oleic acid, stearic acid (about 30 per cent.), and palmitic acid in small proportion. It was concluded that the oleic and stearic acids were present as stearodiolein.

Fat from G. indica (*Kokum or Goa butter*).—The sample gave the following results:—Sp. gr. at 50° C., 0·9106; m. pt., 43° C.; acid value, 41·3; saponification value, 191·5; iodine value, 25·0; Reichert-Meissl value, 0·978; Hehner value, 93·5; m. pt. of fatty acids, 61° C.; and solubility in 50 c.c. of 90 per cent. alcohol, 30 per cent. Stearic, palmitic and oleic acids were found to be present, but no lauric acid. The author confirms Heise's conclusion that the fat consists chiefly of oleodistearin. (See this J., 1898, 991.)—C. A. M.

Fat from the seeds of Canarium commune. P. Pastrovich. Chem.-Zeit., 1907, 31, 781—782.

THIS large tree is cultivated in the Dutch Indies for the sake of the kernels of the nuts, which are termed "*Java almonds*" and resemble in form the almonds of *Prunus amygdalus*, though they are somewhat longer. Extracted with petroleum spirit they yielded 65·73 per cent. of a light yellow odourless oil, whilst expression gave 56·12 per cent. The oil solidified at 17° C., began to melt at 18° C., and was completely fluid at 28° C. It gave neither Halphen's nor Baudouin's reactions. Analytical values:—

	Oil.								
	Sp. gr. at 40°/40° C.	Acid Value.	Saponification Value.	Reichert-Meissl Value.	Hehner Value.	Iodine Value (Wijs).	Refractometer reading (Zeiss) at 40° C.	Unsaponifiable Matter.	Saponification Value of acetylated oil.
								Per cent.	
Extracted oil ...	0·9050	1·31	194·28	0·0	95·36	65·94	51·3	—	197·76
Expressed oil....	0·9050	0·84	194·29	0·0	95·73	65·28	51·1	0·46	196·92

		Insoluble Fatty Acids.						
	Sp. gr. at 50°/50° C.	Solidification Point.	Neutralisation Value.	Mean Molecular Weight.	Acetyl Value.	Iodine Value.	Refractometer at 45° C.	Iodine Value of liquid fatty acids.
		°C.						
Extracted oil	0·8827	40·95	201·55	278·64	16·39	67·29	35·8	110·40
Expressed oil............	0·8824	41·0	201·58	278·60	15·68	67·16	35·7	

The insoluble fatty acids were separated by means of their lead salts into 44·6 per cent. of solid acids (m. pt. 54·4° C; mol. weight, 266) and 55·4 per cent. of liquid acids. The solid fatty acids were fractionated by precipitation with magnesium acetate and found to consist of stearic and palmitic acids. The liquid acids contained oleic and linolic acids, but not linolenic acid. The insoluble fatty acids consisted approximately of 29·5 per cent. of palmitic acid, 15·0 per cent. of stearic acid, 43·0 per cent. of oleic acid, and 12·5 per cent. of linolic acid. There was no lipolytic enzyme in the kernels of the nuts.—C. A. M.

"Ikpan" seed oil. Bull. Imp. Inst., 1907, **5**, 132—134.

"Ikpan" seeds are produced by an unidentified plant, probably belonging to the *Cucurbitaceæ*, growing abundantly in the Cross River district of Southern Nigeria, where the natives use them as food. On extraction with petroleum spirit they yielded 40 to 41 per cent. of a pale yellow oil resembling cottonseed oil in composition and properties. *Analytical values*:—Sp. gr. at 15° C., 0·9184; acid value, 5·5, saponification value, 194·0; iodine value, 106·0; Hehner value, 95·5; and titer test, 36·0° C. A commercial firm reported that the oil could generally be used for the same purposes as cottonseed oil; but that its value for soap-making would probably be £1 per ton less than that of cottonseed oil. For food purposes the oil from these "Ikpan" seeds "might prove equal" to the best arachis oil. Oil cake rich in albuminoids and would probably prove a valuable cattle food.—C. A. M.

Oil from Aleurites Fordii. Bull. Imp. Inst., 1907, **5**, 134—135.

This species of *Aleurites* is grown in the Fokien province of China, and the tung oil of commerce appears to be obtained from its seeds as well as from those of *A. cordata*, formerly regarded as the sole source of the oil. The kernels extracted with petroleum spirit yielded 58·3 per cent. of oil (36·4 per cent. on the whole nuts) of a light colour and with good drying properties. *Analytical values*:—Sp. gr. at 15° C., 0·9404; acid value, 2·89; saponification value, 191·8; Hehner value, 94·6; iodine value, 166·7 and titer test, 42°—42·5° C. The oil was lighter in colour and had a higher titer than has the tung oil of commerce (37·1° to 37·2° C.).—C. A. M.

Oil from Aleurites triloba [Candle-nut oil]. Bull. Imp. Inst., 1907, **5**, 135—136.

This tree (which is often termed *A. moluccana* in technical literature) grows rapidly in Hong-Kong where it is used to shade the streets. The seeds, commercially known as "candle nuts," are already exported from Fiji, Australia and New Zealand. The kernels from the nuts of the Chinese plant yielded, on extraction with petroleum spirit, 60·8 per cent. (= 19·8 per cent. on the whole seeds) of an oil which, exposed in thin layers, dried in about 10 days. *Analytical values*:—Sp. gr. at 15° C., 0·9274; acid value, 1·72; saponification value, 204·2; iodine value, 139·7; Hehner value, 96·4; Reichert-Wollny value, 1·98; and titer test, 17·8° C. These values agree well, in the main, with those recorded by Lewkowitsch and others for candle-nut oil, but the saponification value is considerably higher. The kernels were commercially valued at £12 to £13 per ton, but it was pointed out that there would be no sale for the unshelled nuts in this country.—C. A. M.

Croton seeds; Hydrolytic property of ——. F. Scurti and A. Parrozzani. *See* XXIV.

PATENTS.

Hydroxy-fatty acids; Process for producing ——. G. Imbert, Nuremberg, Bavaria. Eng. Pat. 17,154, July 30, 1906.

See Fr. Pat. 368,543 of 1906; this J., 1907, 25.—T. F. B.

Fats; Process for purifying ——. J. Harris. First Addition, dated March 8, 1907, to Fr. Pat. 372,946, Dec. 27, 1906. Under Int. Conv., Oct. 10, 1906.

See Eng. Pat. 22,430 of 1906; this J., 1907, 102.—T. F. B.

Soap in compressed cakes; A super-alkalinated, dry ——, *and method of manufacturing the same.* The Soc. Française "La Cremonline," Paris. Eng. Pat. 2519, Jan. 31, 1907. Under Int. Conv., Jan. 7, 1907.

An intimate mixture is prepared consisting of dry white soap, 300 parts; anhydrous sodium carbonate containing from 14 to 16 per cent. of sodium hydroxide, 400 parts; and anhydrous sodium carbonate, 220 parts, these constituents being pulverised previously as finely as possible. Eighty parts of glycerin are next added, and then sufficient light petroleum to enable the powder to be worked into a plastic, non-sticky paste. The latter is divided into pellets of a certain size which are moulded rapidly under strong pressure. The tablets thus obtained are exposed in a current of dry air in order to evaporate the petroleum, and are then wrapped in paraffined paper, tinfoil, or other material. A similar product, but without the sodium hydroxide, may be prepared in the same way. —W. P. S.

Oils and soaps suitable for Turkey-red dyeing; Manufacture of ——. *Fatty compounds suitable for Turkey-red dyeing; Manufacture of* ——. A. Schmitz. Eng. Pats. 8245 and 11,903 of 1907. *See* V.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Barytes production in 1906. Oil, Paint and Drug Rep., Aug. 13, 1907. [T.R.]

In 1906 the quantity of crude barytes mined in the United States amounted to 50,231 short tons, valued at $160,367, and in 1905, 48,235 short tons, valued at $148,803. The value per ton shows the following steadily increased averages since 1904:—1904, $2.66; 1905, $3.08; and 1906, $3.19.

By the terms of a decision of July 26, 1906, precipitated barium carbonate became dutiable at the rate of 25 per cent. *ad valorem* under the provisions of paragraph 3 of the Tariff Act of 1897. Barium carbonate, or witherite, had been on the free list for several years previous to 1906. This gave opportunity for large quantities of precipitated carbonate to be brought into the country under that designation. The addition of the duty to precipitated carbonate has revived its manufacture in America, and one plant, with an output of two tons daily, is producing material testing 98·5 per cent. $BaCO_3$.

In the following table are given the quantity and value of the manufactured and crude barytes imported into the United States since 1902:—

Year.	Manufactured.		Unmanufactured.	
	Quantity.	Value.	Quantity.	Value.
	Tons.		Tons.	
1902 ...	3,908	$37,389	3,929	$14,322
1903 ...	5,716	48,726	7,105	22,777
1904 ...	6,630	48,658	7,492	27,363
1905 ...	4,803	39,803	14,256	62,459
1906 ...	4,807	37,296	9,190	27,584

The table below gives the kind and value of the imports of various other barium compounds in 1904, 1905, and 1906:—

	1904.	1905.	1906.
Witherite	$46,133	$45,073	$55,405
Barium peroxide	102,076	111,856	152,403
Barium chloride	43,694	47,386	65,242
Precipitated barium sulphate	50,901	53,112	61,961
Totals	$242,804	$257,427	$335,011

Canadian production.

According to the Geological Survey of Canada, there were produced in 1906 in the Dominion 4000 short tons of barytes, valued at $12,000, as against 3360 short tons, valued at $7500, in 1905.

Zinc oxide; Method for the separation and determination of —— in zinc-white, zinc-dust, paints, and lithopone. J. Tambon. Bull. Soc. Chim., 1907, 1, 823—829.

THE method of separation proposed depends on the solubility of zinc oxide in a solution containing ammonia, ammonium carbonate and ammonium chloride. In the case of zinc white, 10 grms. of the sample are placed in a stoppered vessel and shaken for some minutes with 300 c.c. of the ammoniacal solution. The latter is prepared by mixing equal volumes of ammonia (22° B.), 20 per cent. ammonium carbonate solution, and 20 per cent. ammonium chloride solution. After allowing the insoluble portion, if any, to settle, the liquid is poured through a tared filter, the residue is washed with ammonium carbonate solution, then with boiling water, and, finally with alcohol. The weight of the insoluble matter, subtracted from the weight of the sample taken for the determination gives the quantity of zinc oxide. The zinc oxide in solution may also be titrated with sodium sulphide solution. The insoluble matter generally consists of iron oxide, lead oxide, barium sulphate, etc., and these may be determined separately by the usual methods. The method may be applied to the determination of oxide in zinc dust. For the determination of zinc oxide in paints, 25 grms. of the latter are treated with a solvent, such as ether, to remove the turpentine, oil, and resin, and the insoluble residue is then acted on by the ammoniacal solution as described above. In case the paint contains Schweinfurt green, as is generally the case with marine paints, the insoluble residue obtained after treatment with ether, is treated with ammonia, which dissolves out the copper aceto-arsenite and free arsenious oxide, before separating the zinc oxide by the above process. Products, such as lithopone, which may contain water-soluble salts, are boiled out with water and the residue is treated with the ammoniacal solution for the determination of any zinc oxide present.—W. P. S.

Zinc sulphide [pigment]; Composition of commercial ——. C. Coffignier. Bull. Soc. Chim., 1907, 1, 681—682.

THE author has examined two samples of the white pigment obtained by dissolving zinc in caustic soda solution, and then precipitating with sodium sulphide. The results obtained by the method previously used for the analysis of lithopone (this J., 1902, 1146, 1337) were not satisfactory. It was found that besides zinc sulphide, the pigment contained some zinc oxide, of which part was soluble and part insoluble in weak acetic acid. If it be accepted that the zinc sulphide is present in the form of the hydrate, $4ZnS,H_2O$, which, according to Villiers (Bull. Soc. Chim., 1895, 257), is formed when hydrated zinc sulphide is dried at 150° C., then the composition of the two samples of the pigment examined may be expressed as follows:—

	(1)	(2)
Zinc sulphide, ZnS	81·44	80·78
Zinc oxide soluble in weak acetic acid	1·60	1·24
„ „ insoluble „ „ „	11·15	11·52
Moisture	1·54	1·56
Matter soluble in water	1·04	1·08
Water combined with the zinc sulphide	3·78	3·74

—A. S.

PATENTS.

Body colours [from azo dyestuffs]; Manufacture of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Höchst a/Main, Germany. Eng. Pat. 6722, March 20, 1907. Under Int. Conv., June 1, 1906.

SEE Fr. Pat. 375,828 of 1907; following.—T. F. B.

Colouring matters [Lakes] with covering power; Process of manufacture of ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 375,828, Mar. 16, 1907. Under Int. Conv., June 1, 1906.

THE azo dyestuff obtained by combining diazotised ortho- or para-nitraniline with 2-naphthol-6-sulphonic acid, furnish, with metallic salts, red-orange to scarlet lakes possessing good covering power and very fast to light. *Example:* A solution of 5 kilos. of sodium *o*-nitrobenzeneazo-2-naphthol-6-sulphonate is mixed with a suspension of 100 kilos. of barium sulphate in water and a solution of 6 kilos. of calcium chloride is added. The whole is heated to boiling and the lake is separated in the usual way. The dyestuff and the lake may also be prepared in one operation; after combining the diazo salt from 13·8 kilos. of *o*-nitraniline with 24·8 kilos. of sodium naphtholsulphonate in caustic soda solution, a solution of 4 kilos. of barium chloride is added and the whole heated to boiling. On cooling, a paste prepared in the usual manner from 100 kilos. of aluminium sulphate, 50 kilos. of sodium carbonate and 70 kilos. of barium chloride is added and the lake isolated by filtration.

—J. C. C.

Paint resistant to the atmosphere. R. Plönnis. Fr. Pat. 376,058, March 23, 1907. Under Int. Conv., May 2, 1906.

SEE U.S. Pat. 858,536 of 1907; this J., 1907, 881.—T. F. B.

(C.)—INDIA-RUBBER, &c.

Rubber exports of Bahia (Brazil). Bd. of Trade J., Aug. 22, 1907. [T.R.]

THE export of rubber from the State of Bahia has risen from 100 tons in 1900 to over 1100 tons in 1906. The greater proportion has hitherto consisted of "Mangabeira" rubber, which comes from Minas Geraes and Piauhy. But it has lately been discovered that Bahia is rich in a rubber-producing tree, locally known as "Jiquié Manicoba." The tree is a new and distinct species of Manihot, which apparently is peculiar to Bahia. The rubber, when properly prepared, would seem to be equal in quality to Para rubber.

H.M. Consul has forwarded a sample of Jiquié rubber, which may be examined at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Patent.

Rubber ; Utilisation of waste ——. A. Gentzsch, Vienna. Eng. Pat. 24,969, Nov. 6, 1906. Under Int. Conv., Nov. 16, 1905.

See Fr. Pat. 370,871 of 1906 ; this J., 1907, 265.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Disinfection of imported hides in the United States. Bd. of Trade J., Aug. 22, 1907. [T.R.]

A circular has been issued by the Treasury Department at Washington, of which the following is an extract:—"No hides of horses or cattle exported after August 1, 1907, from any country, except dry hides which have been arsenic cured, shall be admitted to entry at any port of the United States unless a certificate, signed by the American consul at the place from which exported, be produced on entry showing that such hides were disinfected prior to shipment by immersion in a 1 to 1000 solution of bichloride of mercury until thoroughly wet with such solution, and kept immersed for not less than thirty minutes.

"Dry hides, when shown to have been arsenic cured will be admitted without requiring the production of certificates of disinfection therefor."

Chrome liquors and chrome extracts ; Method of determining the basicity of ——. W. Appelius and R. Schall. Collegium, 1907, [267], [268], 266—268 ; 270—273.

In the authors' experience reliable results cannot be obtained by the methods usually employed ; for if the sulphuric and hydrochloric acid be determined in the filtrate from the precipitated chromium, the alkalis are too low owing to their partial retention by the chromium hydroxide. On the other hand, if the sulphuric acid be precipitated in the presence of chromium, some of the latter will be present in the barium sulphate, whilst that precipitate is so soluble in water containing hydrochloric acid in the presence of chromium chloride that the error may amount to 1 or 2 per cent. These drawbacks are obviated in the following method based upon the fact that in a mixture of alkali sulphates and chlorides with *e.g.* chromium sulphate, only the acid combined with the chromium liberates from calcium carbonate an equivalent quantity of carbon dioxide—

$$Cr_2(SO_4)_3 + 3CaCO_3 + 3H_2O = Cr_2(OH)_6 + 3CaSO_4 + 3CO_2.$$

From 1 to 1·5 grms. of pure calcium carbonate are placed in the decomposition flask of a carbon dioxide apparatus together with 40 c.c. of water, and the mixture heated to boiling for 10 minutes whilst a current of air freed from carbon dioxide is aspirated through the flask and the two calcium chloride tubes. Fifty c.c. of the chrome extract, which should contain from 0·35 to 0·5 grm. of chromic oxide, are now boiled for 5 or 10 minutes to expel carbon dioxide, and then introduced through a stoppered thistle funnel into the decomposition flask, to which the weighed soda-lime tube has meanwhile been attached. A slow current of air (one to two bubbles per minute) is again drawn through the apparatus, without checking the boiling, and after 45 minutes the soda-lime tube is weighed. From the weight of carbon dioxide obtained the corresponding amounts of combined sulphuric acid and chromic oxide are calculated. The tabulated results of test experiments agree closely with the theoretical values.—C. A. M.

Mineral tannage ; Application of new tanning materials, and study of the ——. F. Garelli. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 532—538. Chem. Zentr., 1907, **2**, 197—198.

The author treated weighed quantities of hide powder with solutions of the nitrates of trivalent lanthanum, didymium, and cerium, which had previously been shaken with magnesium carbonate to neutralise acidity. The salts of these rare earths tanned the hide powder just as chromium and aluminium salts do, the effect being heightened by the addition of 2—3 per cent. of sodium chloride. Salts of tetravalent cerium, thorium and zirconium also have the power of tanning hide powder. In the case of ceric salts, a portion is reduced to the cerous condition during the process, and this reduction is of importance, since Fahrion has shown that for the production of a good, durable leather, it is necessary that the hide should absorb a certain quantity of oxygen. A tanning action is exerted by ceric sulphate solutions prepared from crude cerous oxalate by igniting, and dissolving the resulting oxides in sulphuric acid, and this result may prove of some technical value, since at present, there is no rational method of utilising the cheap impure cerous oxalate.—A. S.

Leather manufacture ; Science of ——. F. E. Kopecky. Collegium, 1907, No. 269.

The author holds that tanning is a purely physical phenomenon and attributes the different processes of tanning to the agency of dialysis, osmosis, diffusion, absorption or adsorption. Mineral tannage, he says is the coating of hide fibre with a layer of a basic salt or oxide. All metals forming insoluble or difficultly soluble hydroxides are thus to some extent tanning agents, the property decreasing with the increasing solubility or dissociation of the hydroxides. Readily soluble hydroxides, as shown by Procter, actually combine with the hide substance to form addition compounds. The success of vegetable tanning depends on keeping it a physical process by making the liquor acid at first and avoiding loss of soluble hide-substance and precipitation of addition compounds. Fat and oil tannage is a protective process preventing hydrolysis of the hide fibre, in which the omnipresence of the oil is more important than its state of oxidation. Well rubbed in, minute quantities of oil effect a tannage, and tanning by formaldehyde is only a special case in which the formaldehyde emulsifies the oil and makes it go further. Its acid nature favours its absorption by the pelt, the natural fat of which, a trace is sufficient to emulsify, inducing tannage. The author regards tanning by means of dyeing as a more complex case of the purely physical phenomena which govern the commoner methods of tanning. Osmosis and dialysis come into play and the hide fibre becomes coated with a coloured colloid. Crystalloids, on the other hand, dye by absorption and adsorption.—S. R. T.

Leather ; Determination of nitrogen in ——. F. P. Veitch and T. C. Trescot. J. Amer. Leather Chemists Ass., 1907, **2**, 221—3.

The authors review the work of Procter and Turnbull (this J., 1900, **19**, 130), Nihoul (this J., 1901, **20**, 1249) and Law (this J., 1902, **21**,) and give the results of tests they have made on American sole leather with the Gunning and Kjeldahl methods as laid down by the Association of Official Agricultural Chemists. The time of digestion was three, four, and six hours in the Gunning method and four hours in the Kjeldahl method. The authors conclude that it is necessary to digest for four hours, and that inaccurate results are due to insufficient digestion, non-uniformity of sample, and the use of too little of the reagents. The addition of sodium chloride to the sample did not cause loss of nitrogen.—A. T. L.

Patents.

Extracts ; Apparatus for the production of —— *by diffusion and concentration.* L. F. Jury, Vernaison, France. Eng. Pat. 20,918, Sept. 20, 1906. Under Int. Conv., Oct. 7, 1905.

See Fr. Pat. 358,783 of 1905 ; this J., 1906, 327.—T. F. B.

Tanning of hides. E., S., and E. Bocciardo, A. Odera, and V. Spanola, Genoa, Italy, Eng. Pat. 15,418, July 6, 1906. Under Int. Conv., July 6, 1905.

SEE Fr. Pat. 367,768 of 1906; this J., 1906, 1162.—T. F. B.

Adhesive material from casein; Manufacture of an ——. A. Bernstein, Berlin. Eng. Pat. 19,557, Sept. 1, 1906.

SEE Fr. Pat. 370,940 of 1906; this J., 1907, 266.—T. F. B.

XV.—MANURES, &c.

Chemical manures in Egypt. For. Off. Ann. Ser., 3869. [T.R.]

THE value of chemical manures imported into Alexandria in 1902 was 12,912*l*.E.; in 1905 it rose to 56,801*l*.E., and in the past year to 122,709*l*.E. The share of the United Kingdom was 4003*l*.E. in 1902, 4136*l*.E. in 1905, and 17,959*l*.E. in 1906. One-half of the demand is supplied by Belgium. Belgian manures consist of nitrate of soda and superphosphates. British manufacturers might study this growing demand.

Seedlings; Influence of magnesium sulphate on the growth of ——. G. S. Burlingham. J. Amer. Chem. Soc., 1907, **29**, 1095—1112.

MAGNESIUM sulphate in solutions of greater concentration than $m/8192$ has a toxic action on most seedlings. Solutions of this concentration are toxic towards peas, slightly stimulating to *Abutilon* and markedly stimulating towards maize seedlings. More dilute solutions are more stimulating, maximum stimulation being produced at concentrations of $m/32,768$ to $m/131,072$, according to the kind of seedling. The stimulation produced by very dilute solutions of magnesium sulphate extends both to the root growth and the growth of the hypocotyl and plumule. At the same concentrations calcium nitrate produces very little stimulation. The magnesium sulphate also increases the vitality of the seedlings, which outlived the control seedlings by several weeks. Thus, magnesium sulphate, in the absence of other salts, may be highly beneficial, and any inhibitory action is due to the presence of relatively large proportions of it.—J. F. B.

PATENT.

Organisms which fix or gather atmospheric nitrogen; Process of preparing, growing, and distributing ——. G. H. Earp-Thomas, Wellington, New Zealand. Eng. Pat. 15,949, July 14, 1906. Under Int. Conv., Sept. 29, 1905.

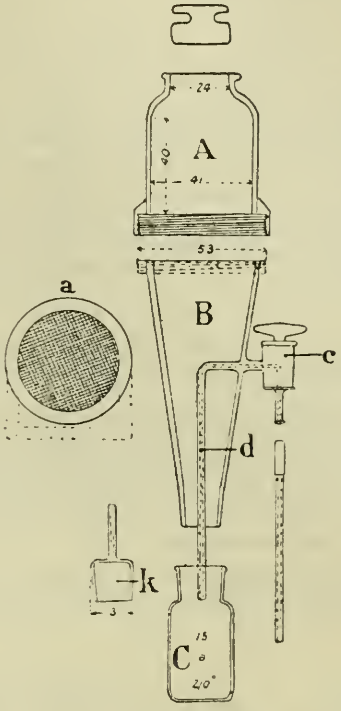
SEE U.S. Pat. 816,850 of 1906; this J., 1906, 436.—W.P.S.

XVI.—SUGAR, STARCH, GUM, &c.

The Sugar Convention. "Times," Aug. 13, 1907. [T.R.]

BY the terms of the additional Act adopted by the Permanent Committee of the Brussels Sugar Convention on July 27, the contracting parties agree to prolong for five years from September 1 of next year the Convention of 1902, any one of them, however, being free to withdraw from the Convention on September 1, 1911, on condition of having given notice one year before, provided that at the last meeting held before September 1, 1910, the Permanent Committee has decided by a majority vote that circumstances warrant leaving this option to the contracting Powers. By Clause 2, Great Britain will be dispensed on and after September 1, 1908, from the obligation imposed in Clause 4 of the Convention. But from the above date the other contracting Powers may require sugar refined in the United Kingdom and exported into their territory to be accompanied by a certificate stating that no portion of that sugar comes from a country recognised by the Permanent Committee as granting bounties on the production or export of sugar. This additional Act must be ratified before February 1, 1908.

Starch in potatoes; Determination of ——. L. Pellet and Métillon. Bull. Assoc. Chim. Sucr. Dist., 1907, **24**, 1720—1730.



Exact method.—The authors recommend the following modification of Baudry's method:—About 100 grms. of the sample (taken from 10 potatoes) are ground in a Sans-Pareille press. The requisite quantity of the pulp (8·65 grms. for German saccharimeters) is transferred to a funnel provided with a wad of glass-wool, freed from adherent liquor by suction, and then washed with 20 c.c. of cold water. The pulp and glass-wool are transferred to a 200 c.c. flask, made up to about 100 c.c. with water, treated with 0·5 grm. of salicylic acid, and heated for 20 minutes, under a reflux tube, in a calcium chloride bath maintained at 110°—115° C. The flask is then removed from the bath, filled up nearly to 200 c.c., cooled, treated with 1 c.c. of ammonia, and made up exactly to 200 c.c. The filtered solution is polarised in a 200 mm. tube; the reading gives the percentage of starch directly. By employing the Sans-Pareille press, the thorough disintegration of the sample is insured, thus facilitating the subsequent solution of the starch and rendering the addition of zinc chloride unnecessary. The preliminary washing of the pulp, frees it from soluble, optically active substances.

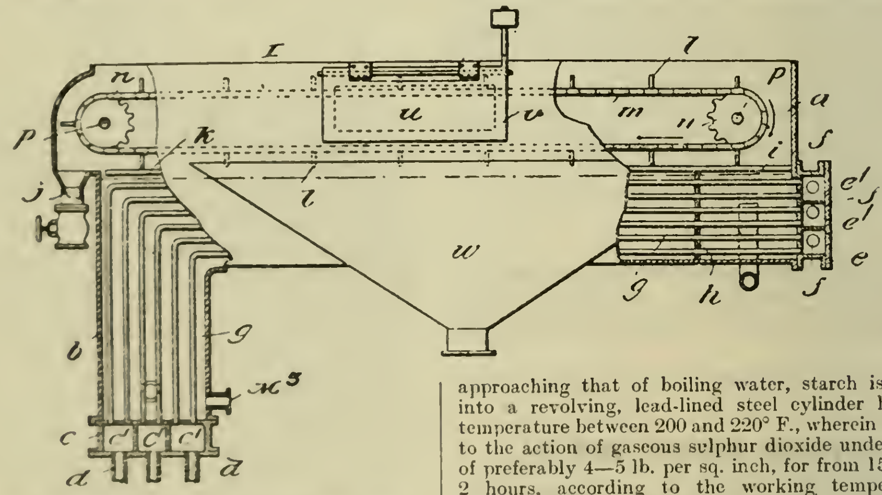
Rapid determination of the amount of starch which can be extracted under industrial conditions.—The potato pulp is prepared with a Sans-Pareille press provided with very small teeth (1/10 mm.). The determination is effected with a special picnometric apparatus (see Fig). This includes a dome-shaped top, A, (provided with a stopper), the lower end of which screws on to the large end of an elongated conical vessel, B; placed between these is a metallic sieve, *a* (4000—5000 meshes per sq. cm.), the circumference of which is rimmed. To insure a perfect joint, rubber rings are placed above and below the sieve. The lower, small end of the conical vessel fits into the neck of a 25 c.c. picnometer, C; the latter is also provided with a separate ground stopper, *k*, fitted with a vertical exit tube for adjusting the amount of liquor in the picnometer. The conical vessel is provided with a siphon, *d* (and stop-cock, *c*), one arm of which projects into the picnometer. The *modus operandi* is as follows:—The conical vessel, with the picnometer, being filled with water, the dome is unstoppered; 10 grms. of potato pulp are introduced into the dome with enough water to half fill it. About 150 nickel balls (of about 3 mm. diam.) are then placed in the dome, and the latter is stoppered. The apparatus is then agitated with a horizontal motion for 10 minutes, being held, during this process, in various positions somewhat inclined to the vertical, to facilitate the descent of the starch. The apparatus is then allowed to stand for about 15 minutes in a vertical position. The liquor in the apparatus is next decanted by means of the siphon; the dome and sieve are removed, and the walls of the conical vessel are rinsed with water into the picnometer; the latter is filled with water, stoppered, and weighed. The percentage of starch, x, is given by the formula, $x = \frac{(P^1 - P)d \times 10}{d - 1}$, in which, P = wt. of picnometer filled with water, P^1 = wt. of picnometer containing the starch and filled up with water, and d = average specific gravity of starch (1·54).—L. E.

PATENTS.

Invert sugar; Process for making and purifying ——. J. J. Eastick, London. Eng. Pat. 25,340, Nov. 10, 1906.

THE diluted syrup or sugar solution is treated with hydrofluosilicic acid in the cold, and after the precipitated fluosilicates of the alkali metals, &c., have been removed, the inversion of the sugar is effected by the application of heat, the time required varying inversely with the temperature employed. The excess of acid is removed by subsequent neutralisation.—C. S.

Cane juice; Apparatus for defecating ——. M. Altolaguirre and J. Zubillaga, Artemisa, Cuba. Eng. Pat. 4620, Feb. 25, 1907.



THE cane juice after being limed and passed through a decanting tank, enters the primary heater of the defecating apparatus, which comprises a casing of sheet-metal having a horizontal portion, *a* (see Fig.), open at the top, and a leg *b* depending from one end of *a*. An endless chain, *m*, is provided with blades, *l*, rigidly mounted thereon and arranged to remove scum at necessary intervals from the liquid over which they pass, the blades being supported from end to end of the casing by horizontal supports, *k*. The scum may also be removed through the opening, *u* (normally closed by a weighted door, *v*), into the receiver, *w*. As soon as the juice covers the first or lowermost set of heating tubes, *g*, steam is passed into the lower chamber, *e'*, of the head, *e*, and as the juice rises in the horizontal portion of the casing, steam is let into the other chambers in succession and then the whole body of liquid is heated to 90° C. The liquid is compelled to flow over the upright partition, *h*, in order to get into the chamber, *i*. The clear juice then passes into a secondary heater, similar to the primary one, with the exception that it lacks the leg, *b*, and in this the liquid is heated to 96° C. When the juice treated, is taken from cane in good condition, the treatment thus far described, is amply sufficient to assure the production of clear liquid. When, however, the cane from which the juice is taken is in a burnt state, or is left standing for a considerable period after being cut, it is preferable to pass the juice through an auxiliary heater, where its temperature is raised to one or two degrees below the boiling point. The auxiliary heater is a cylindrical tank with conical bottom and contains a cylinder open at both ends through which passes a steam coil. It also contains an annular pipe with a downwardly directed discharge, whereby the juice is thrown in a fine stream against the outer side of the cylinder entirely around it, and between it, and the wall of the tank.—L. J. DE W.

Soluble starch and dextrin; Production of ——. A. Fielding, Salford. Eng. Pat. 20,488, Sept. 15, 1906.

STARCH is treated in a revolving cylinder mounted on trunnions one of which is hollow. The interior of the cylinder is fitted with plates or shelves, so that as the cylinder revolves, the starch is showered down from the shelves. The hollow trunnion is connected with a reservoir containing acid, which is vaporised or atomised and introduced in this condition together with steam into the cylinder whilst it is rotating. Another method consists in impregnating the starch with liquid acid in the ordinary way, placing it in the rotating cylinder and injecting steam through the hollow trunnion.—J. F. B.

Starch, modified or soluble; Manufacture of ——. W. Thomson, Manchester, and J. A. Morrice, Glasgow. Eng. Pat. 21,973, Oct. 5, 1906.

To obtain a product that is soluble only at a temperature approaching that of boiling water, starch is introduced into a revolving, lead-lined steel cylinder heated to a temperature between 200 and 220° F., wherein it is exposed to the action of gaseous sulphur dioxide under a pressure of preferably 4—5 lb. per sq. inch, for from 15 minutes to 2 hours, according to the working temperature and pressure. The reagent may be used for treating further quantities of starch in other cylinders.—C. S.

Starch; Treatment of ——. F. Thörl, Harburg on Elbe, Germany. Eng. Pat. 9931, April 29, 1907.

STARCH is produced in the form of sticks or blocks by rapidly drying the wet starch *in vacuo*, grinding the starch so dried, pressing the powder into tablets in hydraulic presses, wrapping the tablets in paper or cardboard and subjecting them to a current of warm or moist air or steam.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Industrial alcohol. Report of Commissioners of Inland Revenue for the year ended March 31, 1907. [Cd. 3686.] [T.R.]

THE remarks of the Commissioners on the results of the new law, which came in force on October 1, 1906, with regard to industrial alcohol are as follows:—

(1) A new variety of methylated spirit, to which the name of industrial methylated spirit was given, was authorised for use solely in arts and manufactures. It takes the place of that previously known as ordinary methylated spirit, and is required to contain only half the proportion of the denaturant which was present in the ordinary spirit. The relative compositions are :—

Industrial methylated spirit—alcohol, 95 parts, wood naphtha, 5 parts; ordinary methylated spirit—alcohol, 90 parts, wood naphtha, 10 parts.

The composition of the methylated spirit allowed to be sold to the public generally for domestic and other purposes has not been altered ; this spirit is known as mineralised methylated spirit, and contains the same proportion of wood naphtha as was required in the ordinary methylated spirit above referred to, with the addition of a small proportion of mineral naphtha.

(2) The payment was authorised of an allowance on all spirits used by an authorised methylator for making industrial methylated spirit, and on all spirits, except foreign methylic alcohol, received by any person for use in any art or manufacture under Section 8 of the Finance Act, 1902. The allowance is the same as that which is paid upon plain British spirits exported—*viz.*, 3d. per proof gallon, which is the estimated cost to the distiller of the revenue restrictions on the manufacture of spirits. It is paid in the one case direct to the authorised methylator, and in the other to the authorised user.

(3) Foreign methylic alcohol may now be received and used under Section 8 of the Finance Act, 1902, without payment of the differential duty payable on foreign spirits.

(4) Under Section 8 of the Finance Act, 1902, any person allowed to receive spirit in a pure state duty free for use in any art or manufacture was required to pay the expenses incurred in placing an officer in charge of his premises to supervise the use of the spirit. The Act of 1906 authorised relief from this payment unless special attendances of the officer to suit the convenience of the user are required.

(5) Under the previous law the *maximum* quantity of methylated spirit which a licensed retailer could keep in stock was 50 gallons, and the *maximum* quantity he could sell at one time was 1 gallon. This limitation was repealed, and power was given to the Commissioners to fix the limits by regulation, which has been done by increasing them to 200 and 4 gallons respectively.

The effect of alterations (1) and (2) has been largely to reduce the initial cost of methylated spirit used for industrial purposes, and to provide for use by manufacturers and others a spirit purer than was previously available, and consequently better suited for many purposes for which spirit is required. There is good reason to believe that the industrial purposes are relatively few, of which the requirements in respect of alcohol cannot be satisfactorily met by the use of industrial methylated spirit, and in future it is probable that the cases which will require to be dealt with under the provisions of Section 8 of the Finance Act, 1902, will not be numerous.

The purer character of the new variety of methylated spirit undoubtedly exposes the revenue to greater risk than was the case with ordinary methylated spirit. It was felt, however, that if users of industrial methylated spirit were not to be deprived of much of the benefit of the new arrangements it was necessary to avoid making the restrictions on its use too stringent ; and accordingly applications for permission to receive such spirit, which have been very numerous, have been dealt with as liberally as possible, and the conditions which have been drawn up to govern generally the receipt and use of the spirit have been made as few and as simple as is consistent with adequate protection against abuse.

Duty-free spirit under the Finance Act, 1902. Inland Revenue Rept. [T.R.]

The use of pure duty-free spirit in the science laboratories of universities, colleges, &c., has increased somewhat during the past year—the quantity issued to these institutions during the year ended March 31 last being 4017 proof gallons, as compared with 3314 proof gallons in 1906, and 2277 proof gallons in 1905. There has also been a considerable increase in the quantity of specially denatured alcohol used for manufacturing purposes—alcohol equivalent to 431,898 proof gallons having been issued to manufacturers in the year ended March 31 last, as compared with 351,615 proof gallons in 1906, and 267,706 proof gallons in 1905. One manufacturer who had received permission, and who used alcohol of this kind for two years, has, however, relinquished the concession, and now uses the new industrial methylated spirit. The following table gives the quantities of British and foreign spirits issued duty free under the provisions of the Finance Act, 1902, for the years ending March 31, 1906 and 1907 :—

Year ending March 31.	1907.			1906.		
	British.	Foreign.	Total.	British.	Foreign.	Total.
	Gallons at Proof.			Gallons at Proof.		
To universities, colleges, &c.	1,221	2,796	4,017	1,037	2,277	3,314
,, manufacturers	431,189	709	431,898	350,115	1,500	351,615
Total	432,410	3,505	435,915	351,152	3,777	354,929

The total quantity of duty-free spirit expressed in proof gallons used for all purposes, domestic and manufacturing, during the years ending March 31, 1906 and 1907, was as follows :—

Year ended March 31.	1907.	1906.
	Proof Galls.	Proof Galls.
In mineralised methylated spirit for domestic use	2,338,000	2,500,000
In industrial methylated spirit for manufacturing	3,717,000	3,200,000
In spirit otherwise denatured—manufacturing	432,000	352,000
Used in universities, colleges, &c. .	4,000	3,300
Total	6,491,000	6,055,300

For purposes of controlling the use of methylated spirit a large number of samples have been examined. They include spirits, both methylated and duty-paid, recovered in various manufacturing operations, denaturing-agents, such as petroleum ether, camphor, toluene and bone oil ; and preparations for medicinal, toilet, or flavouring uses in which alcohol is employed. No illegal use of methylated spirit has been discovered at any manufacturing premises where the receipt of this form of alcohol has been sanctioned. In thirteen instances, samples believed to be methylated spirit, and sold by retailers without licence, were forwarded for the determination of their character. They were found to be either methylated spirits, or "finish" containing in solution less than the legal proportion of gum resin. In either case the articles were not such as could be legally sold without licence, and proceedings were therefore initiated against, or cautions issued to, the vendors of the spirit.

Methylated spirit; Uses of ——. Inland Revenue Rept., 1907. [T.R.]

A return which has been prepared showing the quantities of ordinary and industrial methylated spirit used in the principal manufacturing operations and for other purposes during the year ended March 31, 1907, supplies the following figures :—

Manufacture of finish for sale, 399,485 gallons ; varnish, polishes, and lacquers for sale, 817,140 ; stains, paints, enamels, &c., for sale, 31,356 ; varnishes, finish, stains, lacquers, &c., and spirit used for polishing purposes in manufacturers' own workshops, 254,234 ; felt hats, 114,062 ; celluloid, xylonite, and similar substances, 36,606 ; oil-cloths, leather cloths, pegamoid and similar substances, 164,077 ; linoleum and similar substances, 534 ; smokeless powders, fulminates, and other explosives, 27,152 ; soap, 146,797 ; electric lamp filaments, 10,800 ; electric cables, &c., 2042 ; incandescent gas mantles, 13,269 ; ether, 163,430 ; chloroform, 10,305 ; ethyl chloride and bromide, 800 ; solid medicinal extracts, 23,610 ; alkaloids and fine chemicals, 21,375 ; embrocations, liniments and lotions, 38,501 ; surgical dressings, 4358 ; capsules and other medicinal appliances, 809 ; hair washes, 1832 ; cattle medicines, 515 ; plant washes, insecticides, and sheep dips, 11,677 ; aniline and other dye solutions, 11,431 ; inks, 244 ; fireworks and matches, 4190 ; photographic plates and papers and other photographic purposes, 33,641 ; steel pens, 2992 ; silk, crape, and embroidery, 6278 ; artificial flowers, &c., 1264 ; rubber, 1852 ; artificial silk, 195 ; ships' compasses, spirit levels, &c., 801 ; for dyeing and cleaning operations in laundries, and dye works, 33,555 ; calico printing, 3981 ; the preservation of specimens in museums and hospitals, 9845 ; educational and scientific purposes in colleges and schools, 3783 ; analytical and scientific purposes in the laboratories of analysts, works' chemists, &c., 5428 ; use in hospitals, asylums, and infirmaries, 28,373 ; electrotyping and printing, 491 ; various miscellaneous manufactures, &c., including candles, porcelain, cork, mirrors, oil-refining, brush-making, wall-paper, &c., 3409 ; Admiralty dockyards and War Office arsenals and workshops, chiefly for varnishes and polishes, 22,100 ; total quantity used, 2,468,619 gallons.

Barley; Determination of extract of ——. E. Glimm. Z. ges. Brauw., 1907, **30**, 393—395, 405—407.

The time required for the estimation by Graf's method (this J., 1906, 201) of the extract yielded by barley may be considerably diminished by proceeding as follows. Twenty-five grms. of the finely ground barley are mixed in a nickel beaker with 100 c.c. of cold or warm water, 25 c.c. of N/2 sulphuric acid being then stirred into the mixture. The mass is boiled for 10 minutes on wire-gauze coated with asbestos and, after cooling somewhat, is neutralised by the addition of 1 grm. of calcium carbonate. The mash is next further cooled to about 45° C. and mixed with 100 c.c. of malt extract, which is allowed to flow down the stirring rod to remove adherent particles of starch. 50 c.c. of luke-warm water are added and the mash brought to a temperature of 45° C. and then heated so that in 25 minutes it attains the temperature of 70° C. After the completion of the saccharification, which usually occupies less than five minutes, the beaker is allowed to stand for a further 5—10 minutes. When the mash has been cooled, its weight is made up to 326 grms. (300 grms. water + 25 grms. barley + 1 grm. $CaCO_3$) and the specific gravity of the filtered wort determined.

During the mashing, particles of the barley adhering to the beaker are loosened, best by means of a spatula-shaped stirring-rod, and are finally washed down with luke-warm water.

The malt extract employed, is prepared by mashing coarsely ground pale malt with 4 times its weight of water, and filtering bright after 15 minutes. To determine its extract, 100—200 grms. are heated, at the same time as the barley mash, in a nickel beaker to 70° C., at which temperature it is maintained for 10 minutes. After cooling, the extract is made up to its original weight by the addition of water and filtered, the specific gravity of the filtrate being determined.

The specific gravity of the barley-mash prepared in the above manner, is 0·0026 (water = 1) greater than that given by Graf's method. The proportion of reducing sugar present is the same in the two cases.

Examination of a number of barleys of various origins showed that, with few exceptions, an increase in the protein content is accompanied by a diminution in the yield of extract.—T. H. P.

Malt trade; Analytical guarantees in the ——. E. Prior. Woch. f. Brau., 1907, **24**, 438—440. Paper read at the Eighth Internat. Agric. Congress, Vienna.

The points on which guarantees should be obtained in the purchase of malt include : purity, freedom from culms, moulds and parasites, normal modification, moisture and extract. The maximum standard of moisture varies according to season : from the autumn to May, it is 5·0 per cent., from May to August 5·5, and from August to the autumn, 6·0 per cent. The standard yields of extract determined on fine meal, dry substance, are : Pilsen malt 77·5, Vienna malt 77·0 and Bavarian malt 76·5 per cent. Differences of 0·5 per cent. in the moisture and the extract and of 0·05 c.c. of N/10 iodine in the colour are not taken into account. The type is determined by the degree of modification, the colour, odour and flavour of the malt and the mash or wort, the behaviour on mashing and the "apparent maltose" in the extract. The author does not approve of the cutting test for judging the mealiness or modification of the malt. This test is only useful for indicating the colour and detecting any burnt corns. The degree of modification should be determined by Prior's method on at least 50 grms. of malt and the results expressed numerically; this test is the only one which takes account of the steely ends. In analyses of the same samples in different laboratories the following differences have been recognised as permissible : Moisture 0·4 per cent., extract on dry substance 0·8 per cent., sugar contents of extract 1 per cent., colour 0·05 c.c. N/10 iodine solution, time of saccharification 5 minutes, acidity 0·4 per cent. If the results agree within these limits the average is taken as correct.
—J. F. B.

Malt trade; Analytical guarantees in the ——. J. Sautner. Woch. f. Brau., 1907, **24**, 440—441. Paper read at the Eighth Internat. Agric. Congress, Vienna.

The author, as manager of a brewery, enumerates the conditions under which the malt is purchased. The malt must not contain more than 6 per cent. of moisture (analytical error, 0·25 per cent.). The normal moisture is 5 per cent. ; a higher moisture than this is deducted from the price whilst the price is proportionately increased for a lower moisture. An excess of moisture over the normal excludes any allowance for overweight. Referring to pale malts, the yield of extract in normal seasons must not be below 75 per cent. on the dry substance (analytical error, 0·5 per cent. ; determinations made on coarse grist, Seck mill adjusted to 25). The normal extract is 77 per cent. and the allowance for more or less is calculated on the same basis as that for the moisture. The time of saccharification must not exceed 20 minutes. The colour of the 10 per cent. wort must not exceed 2·0 c.c. of N/100 iodine solution (analytical error, 0·2 c.c.). The final curing temperature must be at least 81° C., measured in the malt, and must be maintained for at least 3 hours. The total period on the kiln must be 48 hours ; the malt must not be sulphured and must be free from parasites. As a control for the curing temperature, the author recommends a determination of the germinating power of the kilned malt. A malt cured as specified above will show only a small percentage of corns capable of germination and, further, it will not readily become mouldy.—J. F. B.

Alcoholic yeasts; Influence of manganese salts on ——. E. Kayser and H. Marchand. Compt. rend., 1907, **145**, 343—345 ; compare this J., 1907, 479.

The authors have studied the fermentation of solutions containing dextrose and lævulose in various proportions by means of two champagne yeasts and two sauterne yeasts, both before and after these organisms have been acclimatised to a 0·3 per cent. solution of a manganese salt. In all cases the fermentations were carried further by the acclimatised yeasts. With one champagne and one sauterne yeast this was accompanied by an increase in the amount of dextrose attacked, whilst with the other two yeasts, the amount of lævulose fermented was increased by acclimatisation to manganese salts. That this acclimatisation may be utilised advantageously in hot countries, where fermentations are sometimes slow, is shown by the results of similar experiments with Algerian yeasts.—T. H. P.

Enzyme; Different hydrolytic actions of a single ——. L. Marino and G. Sericano. Gaz. chim. ital., 1907, **37**, I., 45—51.

Twenty kilos. of fresh beer yeast were washed, pressed, triturated with water, and the mixture introduced, with stirring, into nine times its quantity of 95 per cent. alcohol. The precipitate was pressed, dried over sulphuric acid in a vacuum, and the dry material (200 grms.) was mixed with powdered glass and water saturated with thymol, and after some time, strongly pressed. The liquid was evaporated to half its bulk in a vacuum, then poured into five times its quantity of 96 per cent. alcohol, and the precipitate collected and dried. This was dissolved in a small quantity of water, filtered, and the solution subjected to dialysis for 8 days with water saturated with thymol, which was frequently renewed. The solution thus obtained was evaporated in a vacuum to one-third of its volume, poured into alcohol, and the precipitate dried. In this way there was obtained 5 grms. of material, completely soluble in water, which hydrolysed sucrose, but was not capable of decomposing α-methylglucoside, maltose, lactose, or salicin, and was therefore free from maltase. Maltase is more soluble than invertase in 90 per cent. alcohol. With amygdalin the purified invertase preparation forms, in a few hours, a solution which reduces Fehling's solution, but contains no hydrocyanic acid; a small quantity of benzaldehyde is produced in the course of a few days. After 8 days, an amygdonitrileglucoside can be extracted, identical with that prepared by E. Fischer by the action of maltase on amygdalin. Invertase is thus capable of splitting off a single glucose group from amygdalin; and the disaccharide in amygdalin must be different from ordinary maltose. Since these experiments show that one and the same enzyme can cause hydrolysis of different disaccharides, the existence of special enzymes, as trehalase, melibiase, melizitase, and gentiobiase, appears improbable. It is stated that reversible enzymic reactions have never been proved with certainty with well-defined enzymes.—A. S.

Laccase; Influence of acids on the action of ——. G. Bertrand. Compt. rend., 1907, **145**, 340—343.

The action of a solution of 1 part of laccase in 4000 of water on guaiacol is prevented by the presence of 1 gram-equivalent of any of the following compounds in 2000 litres of the solution: Hydrochloric, phosphoric, arsenic, formic, acetic, n-butyric, benzoic, lactic, sulphuric, oxalic, tartaric and citric acids, potassium hydrogen sulphate and potassium hydrogen oxalate. Potassium hydrogen tartrate and potassium dihydrogen citrate are somewhat less active. Even 1 part of sulphuric acid in 100,000,000 has a marked effect on the action of laccase solution of the concentration 1 : 10000. On the other hand, the action of laccase is not affected by boric or carbonic acid or alkali hydrogen phosphates or arsenates, or di-alkali hydrogen citrates. These inactive compounds are all neutral to helianthine, whilst those which prevent or retard the action of laccase are acid to this indicator. This enzyme thus attains its maximal activity in a solution neutral towards helianthine.

It is noteworthy that Fernbach, and also Maquenne and Roux have found that the saccharification of starch by malt extract occurs most rapidly in a solution which contains primary phosphates but no phosphoric acid in the free state, that is, one which is neutral to helianthine.
—T. H. P.

Alcoholic fermentation; Chemical theory of ——. W. Lob. Z. f. Elektrochem., 1907, **13**, 511—516.

The author started with the hypothesis that in alcoholic fermentation, aldehydes, *viz.* glyceric, glycollic and formic aldehydes, were formed in the intermediate stages. Fermentation experiments in presence of reagents, which would fix these aldehydes if they were produced, gave, however, negative results. The author has subsequently formulated the theory that the sugar molecule may be regarded as a polymerised carbon monoxide-hydrogen compound $(CO.H_2)_6$, which is dissociated or depolymerised under the influence of the zymase and exists in its simplest embryonic form. In this state the carbon monoxide-hydrogen units are ready to re-combine synthetically in other configurations, and the re-combination which takes place most readily is that which results in the production of alcohol and carbon dioxide. Alcohol and carbon dioxide can be converted into a hexose sugar by the action of the silent electric discharge, but the first stage of this process is the formation of carbon monoxide and hydrogen. This is regarded as a reversal of alcoholic fermentation. The reaction $6CO + 6H_2 = C_6H_{12}O_6$ is endothermic but the reaction $6CO + 6H_2 = 2C_2H_6O + 2CO_2$ is exothermic.
—J. F. B.

Nitrates occurring naturally in certain musts; Reduction during alcoholic fermentation of ——. M. Spica. Gazz. Chim. Ital., 1907, **37**, ii, 17—22.

Wines prepared from "*Carricante*" and "*Vispara*" grapes clarify more rapidly in the light than in the dark, the action being accelerated by the presence of air. Reduction of the nitrates in a must to nitrites during fermentation only occurs when there is a scarcity, in both the must and the surrounding medium, of the oxygen required by the yeast; under such conditions, the yeast assumes the functions of an anaërobic organism and makes use of part of the oxygen contained in the nitrates, which thus undergo reduction. Hence since genuine wines and musts may contain nitrates and, under certain circumstances, nitrites, the presence of these salts is by no means a proof of adulteration with water containing nitrates or nitrites.
—T. H. P.

Apple juice; Studies on ——. H. C. Gore. J. Amer. Chem. Soc., 1907, **29**, 1112—1119.

Analyses of the juices of "cull" apples, *i.e.* rejections from the packing rooms, showed that they became richer in sugar and acid as the season advanced. The undetermined solids, consisting of proteins, tannins, ether-extract, pectin and ash, remained practically constant. The composition of the juice from the mill differed somewhat from that of the "cull" apples, because windfalls and other apples were mixed in the bins; the sugar and acid contents, however, gradually increased during the season. Average analyses of the juices of ripe autumn and winter apples of 10 varieties grown in Nebraska showed: total solids, 13·24; acid as malic acid, 0·42; reducing sugar as invert, 7·87; total sugar as invert, 11·40; sucrose, 3·35; undetermined, 1·48 per cent. Summer apples are not considered good for vinegar stock; the juices are deficient in sugar, and alcoholic fermentation takes place at summer temperatures, in which case acetic fermentation is almost sure to set in and retard or entirely inhibit the production of alcohol. Thus the vinegar produced is deficient in acetic acid. On the other hand, experiments showed that with careful treatment a cider yielding a vinegar containing 4 per cent. of acetic acid could be produced from these apples, but in that case the solids of the vinegar would be low. Analyses of juice from decayed apples showed that the sucrose was practically entirely inverted, the total sugar had decreased from about 8 per cent. to 5·76 per cent., and 0·75 per cent. of alcohol and 0·67 per cent. of acetic acid were found. The juice from apples still further decayed contained less than 3 per cent. of sugar, about 0·5 per cent. of alcohol and over 2 per cent. of acetic acid.
—J. F. B.

Red wines; Precipitation of the colouring matter of ——, and detection of foreign colouring matters. F. Jean and C. Frabot. Bull. Soc. Chim., 1907, 1, 748.

The precipitation of the colouring matter of red wines by means of formaldehyde, as described by Trillat (this J., 1907, 834) is very slow, and the filtrate is still distinctly coloured. The authors recommend the following method:—50 c.c. of the wine are treated with about 1 c.c. of a 40 per cent. solution of formaldehyde and 4 c.c. of pure hydrochloric acid. The whole is heated for a few minutes on a water-bath, till a precipitate is formed, then rendered ammoniacal, and the heating continued until all free ammonia is expelled. The liquid is then cooled and filtered. All the natural red wines examined gave a colourless filtrate, whilst wines containing added colouring matters gave coloured filtrates.—A. S.

Patents.

Starch; Saccharification of ——, for the distilling industry and the production of yeast. F. Braunbeck, Berlin. Eng. Pat. 25,595, Nov. 13, 1906.

Wheat malt, referred to in the specification as "Solamalt," containing a high percentage of proteid and having a diastatic power of from 160° to 200° Lintner, is crushed as finely as possible and then kneaded in a mashing tub. The dough containing but little water, is well mixed with warm water at a temperature not exceeding 60° C., and the mashing process is continued in the usual manner. —W. P. S.

Malt extracts rich in diastase; Process of making ——. G. Sobotka, New York. U.S. Pat. 860,340, July 16, 1907.

Crushed malt is separated from the malt meal and grit, and mashed with lukewarm water so as to extract the diastase. The extract is then drawn off and condensed, the residue it left being added to the meal and grit which had been first separated as already described. The mixture of residue, meal, and grit is now mashed with water of a higher temperature than before, and a second extract is thus obtained, and is drawn off and also condensed. To the residue this second extract left behind is added "distillers' slop," the residue being mashed with the slop. The thin liquid extract drained off from this, is also condensed. Finally, the different extracts obtained by the foregoing different operations, are mixed, and the mixture is concentrated to a syrupy consistency.—T. H. P.

Hops; Preparation of extracts of ——. W. S. Davidson and W. P. Burra, Ashford, Kent. Eng. Pat. 4009, Feb. 18, 1907.

The use of yeast in any suitable form and any convenient proportions is claimed for the preparation of hop extracts. For instance, 5 lb. of yeast are mixed with 30 lb. of hops and the mixture is subjected to extraction by any of the usual processes for making hop extracts.—J. F. B.

Beer-wort; Preparation and filtration of ——. A. Hellwig, Belchatow, Russia. Eng. Pat. 4174, Feb. 19, 1907.

This invention differs from that described previously (this J., 1907, 335), as regards the form of the stirring apparatus, which here consists of a number of rotating horizontal arms inclined to one another, and carrying vertical, sword-shaped blades for stirring the mash during the sparging operations. The time of filtration may be shortened and the extract augmented by increasing the number of blades and blade-arms. By arranging the blades on the different arms alternately, the number of cuts effected in the mash is equal to the product of the number of blades on one arm and the number of arms. The arms are adjustable so as to allow of the tun being entered for cleaning purposes.—T. H. P.

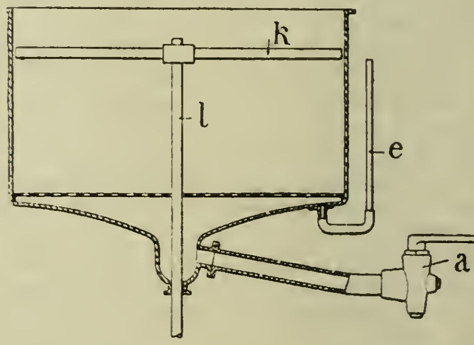
Settling and clarifying tank [Musts or worts]. H. Unckel. Fr. Pat. 375,288, Feb. 28, 1907.

The apparatus consists of a circular tank in which is a horizontal strainer. Below this is the cone-shaped bottom of the tank, the space between the strainer and the bottom thus gradually increasing in depth towards the outside of the tank. The liquid is drawn off through a pipe situated at the side of the tank, extending upwards from just below the strainer to a point outside the tank above the level of the liquid.—W. P. S.

Beer wort from malt; Process and apparatus for the rapid preparation of ——. A. Hellwig. Fr. Pat. 376,038, March 19, 1907.

See Eng. Pat. 4174 of 1907; preceding these.—T. F. B.

Wort; Process and apparatus for accelerating the running off of clear —— from the mash tun. N. Minuth. Fr. Pat. 375,963, March 21, 1907.



By giving to the bottom of the mash-tun the shape shown in the illustration and by providing only a single discharge pipe, *a*, for the wort, the liquid passes between the false bottom and the real bottom at a uniform rate and in a nearly horizontal direction; thus the mash is maintained in a buoyant condition and the local clogging of the bed of grains is avoided. The level of the mash is prevented from falling dangerously low by providing an indicator of the pressure existing below the false bottom. This indicator is shown at *e*, and is graduated so that the fall of the goods can be regulated systematically. The filter-bed proper is thus kept independent of disturbances at the surface, so that the cloudy wort can be pumped back, the rakes, *k*, *l*, can be rotated, the sparging water can be turned on at an early stage and the upper layers of the liquid can be heated, all without interrupting the steady flow of the wort. In another form of the apparatus the discharge pipe is partially choked by a diaphragm, which keeps the pipe always full of liquid, and thus causes the liquid to rise up into a vertical indicator pipe fixed in the discharge pipe. A saccharimeter can be placed in this indicator pipe, and by means of a three-way cock, this pipe can be filled and emptied at will for observations of density.—J. F. B.

Non-alcoholic drinks; Manufacture of —— from fermented liquids. H. Linzel and C. Bischoff, Berlin. Eng. Pat. 24,082, Oct. 29, 1906.

The current of air which is employed for removing the alcohol from the beverage prepared by the process described in Eng. Pat. 17,651 of 1904 (this J., 1905, 810) is subjected to a previous heating in a steam boiler, the air being forced directly into the boiler, or introduced together with the water through the injector of the boiler. Both steam and air are then blown through the liquid to be freed from alcohol.—W. P. S.

Vinaceous beverages from pure hemoglobine free from serum; Process of producing ——. F. G. Sauer, Berlin-Schöneberg, Germany. Eng. Pat. 816, Jan. 11, 1907.

See Fr. Pat. 373,403 of 1907; this J., 1907, 709.—T. F. B.

Lactates; Process of manufacturing ——. A. A. Claflin, Concord, Mass., Assignor to Lactic Process Co., N.J. U.S. Pat. 861,163, July 23, 1907.

A wort, containing about 10 per cent. of fermentable material, is submitted to lactic fermentation, additional material being added from time to time until the quantity so added amounts, in the aggregate, to as much more as that present originally. The fermentation is then completed, the temperature of the solution being maintained at about 130° F. The lactic acid thus produced is neutralised by the addition of alkalis in order to obtain the lactates.—W. P. S.

Spirits; Process and apparatus for distilling and treating ——. J. E. Carroll. Fr. Pat. 376,151, March 26, 1907. Under Int. Conv., Oct. 30, 1906.

See Eng. Pat. 24,229 of 1906; this J., 1907, 427.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Wheaten flour; Causes of the quality strength in ——. A. E. Humphries. Chem. News, 1907, **96**, 85.

Climate and soil are not determining factors of the "strength" of wheat. The term is applied to the capacity of a flour for making big and shapely, *i.e.* well aërated loaves. This implies a capacity both for producing gas in fermentation with yeast, and for retaining the gas generated. The former is largely dependent on the content of sugar and the diastatic capacity of the wheat. The causes that determine the gas-retaining power are complex. Wood suggests that this property of a dough depends on the ratio of the protein to the salts, which it contains.—O. R.

Salicylic acid in milk and cream; Determination of ——. C. Revis and G. A. Payne. Analyst, 1907, **32**, 286—288.

The following method, applicable to both milk and cream, has been found to give satisfactory results:—Twenty c.c. of milk, or 20 grms. of cream, are placed in a stoppered flask and rendered exactly neutral to litmus paper by the addition of *N*/1 sodium hydroxide, the volume of the latter added being noted. Forty c.c. of neutral absolute alcohol are then added and the flask is immersed in a water-bath, heated to 95° C., for 15 minutes, the contents of the flask being shaken occasionally. After cooling, an amount of water necessary to compensate for the proteïds and fat is added, less the amount of *N*/1 sodium hydroxide used previously. This correction in the case of 20 c.c. of milk, may be taken as 2 c.c., but in the case of cream it will vary with the percentage of fat. Cream containing 55 per cent. of fat requires 12·5 c.c. of water; 40 per cent., 9·3 c.c.; 30 per cent., 7·2 c.c., and so on. The mixture is then subjected to centrifugal action; 40 c.c. of the clear solution are placed in a flask with 100 c.c. of water and sufficient sodium hydroxide to render the solution distinctly alkaline, and the mixture is distilled until 60 c.c. of distillate have been collected. The residue in the flask is then transferred to a 250 c.c. flask, 2 c.c. of a solution consisting of 1·35 grms. of mercuric chloride, 3·32 grms. of potassium iodide, 64 c.c. of water, and 20 c.c. of concentrated sulphuric acid, are added, and the whole is diluted to the mark. In the case of cream, a further 1 c.c. of water is added to allow for the slight precipitation of proteid. After the lapse of a few minutes the solution is filtered and 100 c.c. of the filtrate are extracted several successive times with ether. The united ethereal solutions are washed with a little water, and then shaken out twice with dilute sodium hydroxide solution, an excess of about 1 c.c. of *N*/10 solution being used each time. A final extraction is made with 20 c.c. of water, and the alkaline solutions are mixed; a quantity of *N*/10 sulphuric acid equivalent to the *N*/10 sodium hydroxide used, is added, and the solution is diluted to 100 c.c. with water. This solution is then used for the colorimetric determination of the salicylic acid, in the usual way by means of iron alum and standard salicylic acid solution. The iron solution is best prepared by dissolving 1 per cent. of ferric ammonium sulphate [" ammonium iron alum "] in water, diluting the solution with about 5 times its volume of water, evaporating it to its original volume, and filtering. A concentration of from 0·0005 to 0·001 grm. of salicylic acid in 50 c.c., gives the best coloration for comparison. Boric acid has no effect on the determination, nor has benzoic acid, even when present to the extent of 5 times the amount of the salicylic acid.—W. P. S.

Foods; Dyes, chemicals, and preservatives in ——. U.S. Dept. of Agric., Food Inspection Decision **76**.

The decision provides that, with certain exceptions, preservatives as a class are injurious to health, and that their addition to articles of food be inhibited. Common salt, sugar, wood-smoke, potable distilled spirits, vinegar, and condiments may be used. Pending further investigation, the use of saltpetre is allowed. No prosecution will be instituted in the case of the application of the fumes of burning sulphur (sulphur dioxide) to those foods and food-products which contain acetaldehyde, sugars, &c., with which the sulphur dioxide may combine, provided that the total amount of sulphur dioxide in the finished product does not exceed 350 mgrms. per litre in wines, or 350 mgrms. per kilo. of other food-products, of which not over 70 mgrms. is in the free state. Foods and food-products manufactured in 1907 may contain sodium benzoate in quantities not exceeding 0·1 per cent., or an equivalent amount of benzoic acid, provided that sodium benzoate or benzoic acid has hitherto been used generally in such foods, &c. The label on each package of sulphured foods, or of foods containing sodium benzoate or benzoic acid, must bear a statement that the food is so preserved. Until the announcement of the results of further investigations now in hand, the following coal-tar dyestuffs may be used in foods: Amaranth, Ponceau 3 R, Erythrosin, Orange I, Naphthol yellow S, Light green S.F. yellowish, and indigodisulphonic acid, but in every case the colours must represent the actual substance the name of which they bear, and a certificate must be filed with the Secretary of Agriculture that the dyestuff in question has been tested and found to be free from harmful constituents. The question of the entry into the United States of vegetables " greened " with copper salts has not been finally determined, but, meanwhile, all such vegetables as do not contain an excessive amount of copper will be admitted to entry if the label bear a statement to the effect that copper salts have been used. The decision provides that no prosecution will be instituted on goods containing prohibited substances, but manufactured prior to the date of the decision (June 18, 1907); however the manufacturer will be required to prove that such is the case.—W. P. S.

Starch in potatoes; Determination of ——. L. Pellet and Metillon. *See* XVI.

Cottonseed products in India. W. A. G. Clark. *See* XII.

Patents.

Milk; Process for improving the palatability and digestive qualities of sterilised ——. R. Emmerich, Munchen, Germany. Eng. Pat. 29,425, Dec. 24, 1906.

To milk, which has been sterilised previously by heat, are added oxydase, catalase, rennet ferment, a proteolytic ferment, and a bacteriolytic enzyme. The enzyme solution employed is prepared by cultivating *Bacillus pyocyaneus* for 3 weeks at a temperature of 36° C., in a medium consisting of:—Water, 1000 grms.; peptone, 10; dipotassium phosphate, 2; asparagine, 2; mannitol, 3; sodium acetate, 2; ammonium phosphate, 0·3;

sodium bicarbonate, 0·5; sodium chloride, 5; and magnesium sulphate, 0·1 grm. The magnesium sulphate is added, preferably, after sterilising and cooling the solution. After 3 weeks the culture is freed from germs by filtration, partially neutralised, and concentrated under reduced pressure to one-tenth of its volume. The concentrated liquid is then kept in a refrigerator for several days to allow a part of the salts to crystallise out, and the clear liquid is siphoned off for use. To it may be added oxydase obtained from rye flour, and a solution, containing catalase, tryptic enzyme, &c., prepared from freshly germinated malt.—W. P. S.

Milk-powder; Manufacture of ——. M. Riegel, London. U.S. Pat. 860,327, July 16, 1907.

This process of producing soluble milk-powder is carried out as follows: Milk is heated to the temperature of pasteurisation, the lime thus precipitated being removed, and replaced by adding to the milk soluble calcium compounds of polyatomic alcohols of the carbohydrate group, such as calcium sucrate, in such quantities that the original percentage content of calcium is restored. The liquid is then evaporated to dryness.—T. H. P.

Chemical ingredients used in the manufacture of baking powder or incorporated with substances such as flour to make it self-raising or for other purposes; Process for rendering impervious to moisture ——, *at ordinary temperatures.* R. A. Craig, Edinburgh. Eng. Pat. 3035, Feb. 7, 1907.

The chemical ingredients of the baking powder are coated with gum, gelatin, or agar-agar, and are then waterproofed with a vegetable oil or fat, preferably cacao butter.—W. P. S.

Cereals; Process and apparatus for bleaching and ageing ——. J. M. Williams. Fr. Pat. 375,832, Mar. 18, 1907. Under Int. Conv., May 18, 1906.

The process consists in treating the cereal or, especially flour, with the gases produced by the electrolysis of a suitable acid or salt, preferably nitric acid. Such gases are diluted with air before being brought into contact with the cereal, and the apparatus employed consists of an electrolytic cell, an air pump for forcing a current of air through the cell, a resistance, and a chamber with a stirring device in which the cereal is treated.—W. P. S.

Proteose preparation [from fish]; Process of making a ——. K. Schwickerath, Bonn, Germany. U.S. Pat. 860,414, July 16, 1907.

See Fr. Pat. 375,028 of 1907; this J., 1907, 887.—T. F. B.

Albuminous product from fish; Process for obtaining a soluble ——. Fr. Pat. 375,534, Mar. 2, 1907.

The fish is cleaned, and heated in an autoclave by means of steam under a pressure of 3·5 atmospheres. The pressure is maintained for about 1 hour, and the contents of the autoclave are then allowed to cool without opening the apparatus. Ammonia and salicylic acid are added, the amount of the former being about 4 per cent. of the total liquid, and of the latter about 1 per cent., and the mixture is filtered under pressure. The residue from the filtration is then heated, dried, ground, and washed with alcohol containing ammonia in order to remove salicylic acid.—W. P. S.

Cattle food for young beasts; Preparation of a ——. W. Schwartz. Fr. Pat. 375,695, Mar. 17, 1907.

The food is prepared by adding a mixture of molasses and peat to skimmed milk, and separating the insoluble matter. About 7 parts of molasses sugar are added for every 3 parts of fat in the original milk.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Heading of yarn dyed by means of a lead compound; Regulations for ——. Statutory Rules and Orders, Aug. 6, 1907, No. 616. [T.R.]

Whereas the process of heading of yarn dyed by means of a lead compound has been certified in pursuance of Section 79 of the Factory and Workship Act, 1901, to be dangerous;

I hereby, in pursuance of the powers conferred on me by that Act, make the following Regulations, and direct that they shall apply to all factories in which the said process is carried on.

Provided that if the Chief Inspector of Factories is satisfied, with regard to any such factory, that the heading of yarn dyed by means of a lead compound will not occupy more than three hours in any week, he may, by certificate, suspend Regulations 2, 3, 4, 7 (*a*), and 8 (*a*), or any of them. Every such certificate shall be in writing, signed by the Chief Inspector of Factories, and shall be revocable at any time by further certificate.

Definitions.

"Heading" means the manipulation of yarn dyed by means of a lead compound over a bar or post, and includes picking, making-up, and noddling.

"Employed" means employed in heading of yarn dyed by means of a lead compound.

"Surgeon" means the Certifying Factory Surgeon of the district or a duly qualified medical practitioner appointed by certificate under the hand of the Chief Inspector of Factories, which appointment shall be subject to such conditions as may be specified in that certificate.

"Suspension" means suspension by written certificate in the Health Register, signed by the surgeon, from employment in heading of yarn dyed by means of a lead compound.

Part I.

Duties of employers.

1. No yarn dyed by means of a lead compound shall be headed unless there be an efficient exhaust draught so arranged as to draw the dust away from the worker, as near as possible to the point of origin. The speed of the draught at the exhaust opening shall be determined at least once in every three months and recorded in the General Register.

2. No person under 16 years of age shall be employed.

3. A Health Register, containing the names of all persons employed, shall be kept in a form approved by the Chief Inspector of Factories.

4. Every person employed shall be examined by the Surgeon once in every three months (or at shorter intervals if and as required in writing by the Chief Inspector of Factories) on a date of which due notice shall be given to all concerned.

The Surgeon shall have power of suspension as regards all persons employed, and no person after suspension shall be employed without written sanction from the Surgeon entered in the Health Register.

5. There shall be provided and maintained for the use of all persons employed—

(*a*) A suitable cloak-room for clothing put off during working hours;

(*b*) A suitable meal-room separate from any room in which heading of yarn dyed by means of a lead compound is carried on, unless the works are closed during meal hours;

and, if so required by notice in writing from the Chief Inspector of Factories,

(*c*) Suitable overalls and head-coverings which shall be collected at the end of every day's work, and be washed and renewed at least once every week;

(*d*) A suitable place, separate from the cloak-room and meal-room, for the storage of the overalls and head-coverings.

6. Relates to the supply of lavatories (this J., 1905, 1263).

Part II.

Duties of persons employed.

7. Every person employed shall—

(*a*) Present himself at the appointed time for examination by the Surgeon as provided in Regulation 4 ;

(*b*) Wear the overall and head-covering (provided in pursuance of Regulation 5 (*c*), while at work, and shall remove them before partaking of food or leaving the premises, and shall deposit in the cloak-room, provided in pursuance of Regulation 5 (*a*), clothing put off during working hours ;

(*c*) Wash the hands before partaking of food or leaving the premises.

8. No person shall—

(*a*) Work in heading of yarn dyed by means of a lead compound after suspension without written sanction from the Surgeon entered in the Health Register.

(*b*) Introduce, keep, prepare, or partake of any food or drink, or tobacco, in any room in which heading of yarn dyed by means of a lead compound is carried on ;

(*c*) Interfere in any way, without the concurrence of the occupier or manager, with the means and appliances provided for the removal of the dust, and for the carrying out of these Regulations.

H. J. Gladstone.

Patents.

Water ; Apparatus for use in the filtration of ——. The Candy Filter Co., Ltd., and F. Candy, London. Eng. Pat. 27,700, Dec. 5, 1906.

The invention relates to the introduction of the "hardening" materials into the rotating cylinder described in Eng. Pat. 14,464 of 1906 (this J., 1907, 429), and also to means for rotating the said cylinder. Where the cylinder is mounted horizontally within a closed filter, the material may be introduced by the aid of a trough-shaped appliance which can be passed through openings in the end of the filter and cylinder. By inverting the appliance when in the cylinder, the material is discharged into the latter. The material may also be introduced through a tubular passage, being allowed to fall by gravity or aided in its movement by a stream of water. The cylinder may be rotated by means of a crank and toothed-gearing, or buckets may be provided on the exterior of the cylinder so that it works after the manner of a water-wheel. —W. P. S.

Water ; Apparatus for [electrolytically] purifying ——. A. O. Tate, Brooklyn, N.Y. U.S. Pat. 860,771, July 23, 1907.

An apparatus for purifying water containing solids in solution is described. It consists of a tank in which the water is treated electrolytically for a sufficient length of time to disintegrate or precipitate the solids, and a separating tank, situated at a lower level, and connected with the first tank by means of a pipe. A cock is placed on this pipe, and a pump is provided for forcing the water through the separating tank, both pump and cock being operated and controlled by an electrical time-device, so that the water is submitted to the electrolytic action for a definite length of time. The movements of the pump and cock are regulated, in order that, while one volume of water is being treated in the first tank, a similar preceding volume is passing through the separating tank. A number of electrolytic and separating tanks may be combined in one apparatus.—W. P. S.

Water ; Process of sterilising —— *by means of hydrogen peroxide.* L. Eilertsen. Fr. Pat. 375,728, Mar. 15, 1907.

The water is treated with a quantity of hydrogen peroxide, and the excess of the latter is removed by passing the treated water through a filter composed of finely divided manganese dioxide and sand, previously washed with a dilute solution of potassium permanganate.—W. P. S.

(*C.*)—DISINFECTANTS.

Sodium hydrindenesulphonate as a solvent for cresols. A. Kraus. Arb. aus dem Kais. Gesundheitsamt, 1907, **26**, 130. Chem-Zeit., 1907, **31**, Rep., 420.

Cresols are more soluble in aqueous solutions of sodium hydrindenesulphonate than in water, so that by this means concentrated solutions of cresols may be obtained. Such solutions have, towards anthrax spores and staphylococci, a stronger disinfecting action than diluted cresol-soap solutions containing the same quantity of cresol, but a weaker action than solutions of cresolsulphonic acid. Sodium hydrindenesulphonate has only a very low disinfecting power and its poisonous action is comparatively slight.—J. C. C.

Patents.

Tar-oil emulsions ; Process of producing ——. W. Wildenhayn, Giessen, Germany. Eng. Pat. 23,381, Oct. 22, 1906.

See Fr. Pat. 370,538 of 1906 ; this J., 1907, 257.—T. F. B.

Disinfecting and deodorising process. E. Fournier, Paris. U.S. Pat. 860,456, July 16, 1907.

See Fr. Pat. 351,518 of 1905 ; this J., 1905, 901.—T. F. B.

Compound for destroying fungi on plants ; Process for making a ——. Soc. "Cuprosa," Soc. Anon. Suisse pour la Production du Sulphate de Cuivre. Fr. Pat. 375,849, Mar. 18, 1907.

The compound is prepared by treating the cuprous oxychloride, obtained in Granier's process (See Fr. Pat. 330,963 of 1903 ; this J., 1903, 1086), with ammonium salts and grinding the product to so fine a degree that it will remain in suspension in water.—W. P. S.

XIX.—PAPER, PASTEBOARD, &c.

Fibre of Andansonia digitata. Bull. Imp. Inst., 1907, **5**, 118—119.

The "baobab" or "monkey bread" tree is abundant in West Africa, where the fibre from the inner bark is used by the natives for making ropes and sacking. The fibre is exported in small quantity, and is used in this country in the manufacture of paper, for which it is stated to be particularly suitable.—C. A. M.

Pentoses and pentosans in relation to the paper industry. B. Tollens. Papier-Zeit., 1907, **32**, 2641—2643, 2685—2687.

The author describes his standard method for the distillation and precipitation of furfural from vegetable substances in the form of phloroglucide. The results are calculated in terms of "pentosans" by means of the formula : $\text{Pentosans} = (a + 0{\cdot}0052) \times 0{\cdot}8824$, where $a =$ mgrms. of phloroglucide obtained. A very large number of vegetable materials have been investigated for their contents in pentosans, the following percentage numbers being quoted :—Spruce wood 11·6, beech 25·9, guaicum wood 20·6. Counceler's numbers for woods are also given :—beech 23·1 and 33·1, spruce 8·8 and 9·2, oak 19·7, birch 25·2, maple 30·7. As a general rule the broad-foliage woods contain more pentosans than the coniferous woods. Wood gum (xylan) is extracted from beech wood or straw by sodium hydroxide and is precipitated by alcohol ; this substance contains 54—88 per cent. of pentosans, according to its purity. "Crude fibre" prepared from straw, hay and other fodder stuffs will retain various amounts of pentosans according to the method of preparation. "Crude fibre" from hay, prepared by Henneberg's method (residue after boiling with dilute sulphuric acid and potassium hydroxide) contained 4·13 per cent. of pentosans, but that prepared by König's method (heating with sulphuric acid and glycerin) retained only 0·5—0·8 per cent. For the paper-making raw materials the following approximate percentages are given, calculated on the dry, ash-free pulps: Mechanical wood pulp 12·0, bleached sulphite wood pulp 7·0, bleached soda wood pulp 6·4, unbleached ditto 7·8, bleached straw cellulose 26·7, linen pulp 2·2, cotton pulp 1·0, old waste paper and filter paper 1·4. When a paper is composed of only two of these materials, the quantities of each can be determined by a determination of the pentosans, but the method is not available when more than two kinds of fibre are present. Various papers, mostly containing straw, mechanical wood and sulphite pulps, showed 12·9—5·2 per cent. of pentosans on the dry ash-free substance.—J. F. B.

Cellulose in wood; Determination of —— by the chlorination process. A. L. Dean and G. E. Tower. J. Amer. Chem. Soc., 1907, **29**, 1119—1126.

Cross and Bevan's chlorination process gives the most accurate results for the determination of cellulose in the lignocelluloses, but considerable care is required to obtain a pure cellulose without unnecessary losses. In applying this method to wood the material is softened in boiling water and sampled by rasping lightly. The sample is dried in the air and freed from large splinters and fine powder; it is then dried at 100° C. and 5 grms. are weighed out for analysis. The substance is boiled in 200 c.c. of a 1 per cent. solution of sodium hydroxide for half an hour and filtered on a perforated plate in a funnel. After washing, the mass of fibre is loosened with a glass rod and a stream of chlorine gas is passed up through the stem of the funnel, the mass being turned over occasionally. After chlorination the fibre is washed and transferred to a dish in which it is heated with 150 c.c. of a 2 per cent. solution of sodium sulphite, to which 3 c.c. of 10 per cent. sodium hydroxide are added when boiling has begun. After boiling for 5 minutes the fibre is again collected on the filter plate, washed with hot water and again treated with chlorine. The first chlorination should be for one hour, the length of subsequent chlorinations will be less and depends on the colour produced by the action of the gas. When the fibre is bleached by the chlorine, the action must be immediately stopped by means of an "antichlor," the fibre is then washed and transferred to a Gooch crucible in which it is washed with alcohol and ether and dried, finally at 100° C. In this way with two or three chlorinations, white oak sapwood yielded 56·3 per cent. of cellulose; red cedar sapwood, 42·0; ditto heartwood, 43·0; red spruce heartwood, 58·9; cherry sapwood, 54·7 per cent.; results are satisfactory if they agree within 0·5 per cent.
—J. F. B.

Cellulose peroxide; Formation of —— by ammonium persulphate. H. Ditz. Chem.-Zeit., 1907, **31**, 833—834.

The fixation of active oxygen by cotton cellulose, which had gone through the ordinary industrial bleaching operations, was recorded by Cross and Bevan (this J., 1907, 44) who regarded it as due to the formation of a somewhat unstable cellulose peroxide. The author has observed that the same phenomenon can be produced by gradually heating cellulose, in the course of 1½ hours, with an acid solution of a persulphate up to a temperature of 80° C., and then gradually cooling. A considerable evolution of gas takes place, which is not observed to the same extent in the absence of the cellulose, and when the product is thoroughly washed with cold water, it is found to possess the same properties as the peroxide described by Cross and Bevan. The author proves that the phenomenon is not due to the adsorption of persulphate by the cellulose. When heated at 100° C. with the persulphate solution, the cellulose exerts a powerful "activifying" action on the decomposition of the persulphate. Oxygen and carbon dioxide are evolved, together with a strongly irritating gas. This "activification" is attributed to the momentary production of the cellulose peroxide. In this case, however, owing to the high temperature, the cellulose residue does not preserve the properties of a peroxide.—J. F. B.

Patents.

Paper, cardboard, textiles, etc.; Process for making water- and fat-proof ——. J. Pering, Dellbrueck, Germany. Eng. Pat. 24,308, Oct. 31, 1906.

The process is intended to be used in connection with the machine described in Eng. Pat. 26,944 of 1906 (this J., 1907, 430). The paper or textile is moistened with a solution composed of 60 parts of benzine, 50 parts of colophony and 40 parts of paraffin. The solution is evaporated at a low temperature and the treated paper is polished with talc.—J. F. B.

Bi- or multi-coloured designs on paper; Production of ——. Farbwerke vorm. Meister, Lucius, und Brüning, Germany. Fr. Pat. 375,668, May 18, 1906.

According to this process, a pattern, made of some flexible, impermeable material such as indiarubber, is cut out according to the desired design and is applied to the wire-cloth of the machine. The coloured paper pulp is then spread over the pattern and allowed to cover the unprotected parts of the mould. When this layer of pulp has been sufficiently drained by the aspirators, which are placed under the wire-cloth, a second layer of pulp of a different colour is then applied to the whole of the mould in order to form a background for the design. To make this process applicable to a continuous machine, the endless pattern is applied to the wire cloth of the machine just before the coloured pulp is brought on to it, and the contact is preserved until the pulp has been thoroughly drained. The wire cloth, bearing the coloured design, then passes under a second pulp chest which discharges on to it a pulp of a different colour to form a background for the coloured design.—P. F. C.

Cellulose base; Process for the manufacture of a product with a ——. E. A. L. Rouxeville. Fr. Pat. 376,269, June 5, 1906.

The process relates to the manufacture of celluloid in which camphor is replaced by an oxidised hydrocarbon. Turpentine is treated in the cold with an equal weight of sulphuric acid. The mixture is allowed to stand, and the upper dark layer separated and washed with water. It is then gently heated with 50 per cent. nitric acid, and the resulting light brown product is washed with water, and dissolved in acetone. Collodion-cotton is now added and incorporated until a uniform paste is obtained. On evaporating the acetone, a plastic mass is obtained which can be worked up as desired. The addition of resin produces a hard product, whilst the use of linseed oil gives a softer material. (See also this J., 1906, 83.)—G. W. McD.

Cellulose; Process for dissolving —— by means of copper salts. G. Boucquey. Fr. Pat. 376,065, March 23, 1907.

Cellulose (14 parts) is immersed in a mixture consisting of ammonia (100), water (100), sodium hydroxide (10 parts) and copper acetate. The cellulose fibres thus become swollen, and a further addition of sodium hydroxide (5 parts), water (10) and ammonia (10 parts), brings the cellulose completely into solution.—G. W. McD.

Cellulose formate; Process for making ——. J. P. Bemberg Akt.-Ges. Fr. Pat. 376,262, March 30, 1907.

See Eng. Pat. 2511 of 1907; this J., 1907, 634.—T. F. B.

Cellulose derivatives and their solutions; Method for the preparation of ——. Knoll und Co. Fr. Pat. 376,578, April 10, 1907. Under Int. Conv., April 10, 1906.

Cellulose (1 part) is dissolved in acetic anhydride (4 parts) and glacial acetic acid (4 parts), with the addition of sulphuric acid (0·1 part). Sodium acetate (0·2 part), dissolved in glacial acetic acid, is added gradually and intimately mixed with the cellulose solution. By this means the solution can be used direct for the production of threads and films without the necessity of precipitation and re-dissolving.—G. W. McD.

Celluloid; Manufacture of ——. H. H. Lake, London. From Chem. Fabr. vorm. Weiler-Ter Meer, Uerdingen on Rhine, Germany. Eng. Pat. 16,271, July 18, 1906.

In the manufacture of celluloid, carboxylic acid derivatives (formyl, acetyl, ethoxalyl and benzoyl) of secondary aliphatic-aromatic amines are employed, either entirely or partially, as substitutes for camphor. It has been found that these substances, even when purified by fractional distillation, do not give a satisfactory product unless they are also purified by treatment with organic solvents, such as light petroleum spirit or benzene.—J. F. B.

Celluloid; Process for making —— non-combustible and non-inflammable. P. Marino. Fr. Pat. 376,399, Ap. 5, 1907. Under Int. Conv., March 11, 1907.

Celluloid is dissolved in acetone, methyl alcohol or other solvent. To this solution are added, in acetic acid solution, metallic salts which are insoluble in water and alcohol. Twenty-four suitable salts are mentioned including barium phosphate, calcium arsenite, basic lead nitrite, and ferric phosphate. The proportions used are three parts of metallic salts to fifteen parts of celluloid. Carbon tetrachloride, trichloronitromethane and a nitrohydrocarbon are then added, and the mixture is allowed to stand for twenty-four hours in a closed vessel to complete the reaction. A solution of formaldehyde is now added and left in contact with the mixture for ten hours. At the end of this time the celluloid forms a compact mass on the surface of the liquid, and is then removed, dried and worked up into the desired form.—G. W. McD.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Free alcohol for ethyl chloride. Oil, Paint and Drug Rep., Aug. 12, 1907. [T.R.]

The Commissioner of Internal Revenue has ruled that the use of alcohol will be allowed tax free in the manufacture of ethyl chloride in accordance with Section 40, Part VI., of the revised regulations, after September 1, 1907, provided the finished product contains no alcohol. The following formula has been authorised for use in the manufacture of ethyl chloride: To 100 gallons of ethyl alcohol add 5 gallons of approved wood alcohol.

Allowance of drawback on imported alcohol in the United States. Oil, Paint and Drug Rep., Aug. 9, 1907. [T.R.]

The U.S. Treasury has prepared the following regulations for the allowance of drawback of duty paid on imported alcohol used in the manufacture of flavouring extracts:—

On the exportation of flavouring extracts of various kinds in the manufacture of which no other than imported alcohol has been used, a drawback will be allowed equal in amount to the duty paid on the imported alcohol so used, less the legal deduction of 1 per cent.

The preliminary entry must show the marks and numbers of the shipping packages and the quantity of each kind of flavouring extract contained in each package separately and in the entire shipment.

The drawback entry must show the total number of gallons of each kind of flavouring extract exported, and the total quantity of absolute alcohol consumed in the manufacture of each kind, and the total quantity of imported alcohol consumed in the manufacture thereof, and, in addition to the usual averments, that the merchandise was manufactured of materials and in the manner set forth in the manufacturers' sworn statement, on file at the port of exit.

In liquidation, the quantity of absolute alcohol, which may be taken as the basis for allowance of drawback may equal the quantity consumed as declared in the drawback entry after official verification of exported quantities, but in no case shall it exceed the quantities shown in the manufacturers' sworn statement.

Samples may be taken, or sworn samples furnished, as ordered by the collector, for required determinations.

Should the manufacturers desire to export other forms of extracts than that herein provided for, entries may be liquidated on the filing of supplementary sworn statements setting forth process of manufacture, sizes of containers, the mode of packing for export, and the quantity of absolute alcohol consumed according to the form contained in the aforesaid manufacturers' sworn statement.

Monazite gravel in the State of Bahia (Brazil). For. Off. Ann. Ser., 3901. [T.R.]

Monazite gravel has lately been discovered along the course of the Parahyba River in the interior of the State of Bahia. Some Brazilians, who have secured from the State a concession for exploiting their discovery, have erected plant for concentrating the gravel at the places where it is found. A sample of the monazite sand may be examined at the Commercial Intelligence Branch, 73, Basinghall Street, E.C.

India and the Imperial Institute. Chem. and Drug., Aug. 24, 1907. [T.R.]

The annual report of the Indian Section of the Imperial Institute for 1906–7 contains a report by Professor Wyndham Dunstan, F.R.S., on the Scientific and Technical Department, in which it is stated that thirty-seven Indian investigations have been in progress in the laboratories in consultation with technical and commercial referees, being an increase of seven on the record of the previous year. Of these investigations twenty-two were completed and reports forwarded to the Government of India, an increase of eight as compared with the previous year. They included reports on resin of *Hopea odorata*, extract of xylia-wood from Malabar, oil of *Amoora Rohituka*, Pará rubber from Mergui, roots of *Onosma echoides*, oil of *Calophyllum tomentosum*, leaves and bark of *Baccaurea sapida*; while investigations are in progress concerning Indian species of *Strychnos*, leaves and seeds of *Hyoscyamus reticulatus*, composition of turpentine oil and resin from *Pinus longifolia*, improvement of processes for the manufacture of opium-alkaloids at Ghazipur, constituents of the seeds of *Datura fastuosa* from Assam, and the constituents of roots of Indian aconites. Another report is that of Mr. B. J. Rose (in charge of the India Trade Inquiry Office), who makes several suggestions for the development of Indian products. He advocates a more systematic official advertisement and exploitation, especially of the lesser-known products, and would like to see a commercial traveller appointed to visit the large manufacturing centres both in this country and the Continent.

Acetanilide, phenacetin, caffeïne and salol; Solubilities of —— in several solvents. A. Seidell. J. Amer. Chem. Soc., 1907, **29**, 1088—1091.

In one table the author shows the solubility of acetanilide in mixtures of ethyl alcohol and water. At a temperature of 25° C. its maximum solubility is in 90 per cent. alcohol, which dissolves 27·65 per cent. of acetanilide by weight. At 30° C. the maximum solubility is in 85 per cent. alcohol, which dissolves 31·70 per cent. In another table the author has re-calculated in percentages the solubility of acetanilide in methyl and ethyl alcohols and in chloroform at different temperatures from results published by Speyers in terms of grm.-molecular proportions. Lastly, with a view to separating the various constituents of "headache powders" by means of various solvents, the author has determined their solubilities as given in the following table:—

Solvent.	Temperature °C.	Solubility per cent. by weight.			
		Acetanilide.	Phenacetin.	Caffeïne.	Salol.
Water	25°	0·56	0·11	2·14	insoluble
Ether	,,	7·7	1·56	0·27	,,
Chloroform	,,	16·6	4·76	11·0	,,
Acetone	30°—31°	31·15	10·68	2·18	90·99
Benzene	,,	2·46	0·65	1·22	88·57
Benzaldehyde ..	,,	18·83	8·44	11·62	?
Amyl acetate ..	,,	10·46	2·42	0·72	85·29
Aniline	,,	19·38	9·46	22·89	very soluble
Amyl alcohol ...	25°	14·00	3·51	0·49	20·44
Acetic acid (99·5 per cent.)	21·5°	33·21	13·65	2·44	63·24
Xylene	32·5°	1·65	1·25	1·11	87·14
Toluene	25	0·50	0·30	0·57	83·62

Thus, mixtures containing salol, caffeïne and acetanilide can be separated fairly well by digesting first in toluene to remove the salol and then in amyl alcohol to remove the acetanilide; there is no solvent which affords a good separation of acetanilide from phenacetin.—J. F. B.

Petroleum ether as an extracting medium; A source of error in the use of ——. J. Marshall. Amer. J. Pharm., 1907, July. Pharm. J., 1907, **79**, 211—212.

A SAMPLE of petroleum spirit (fraction 20°—50° C.) from Pennsylvania oil was found to leave a residue when evaporated after being stored for some time exposed to diffused sunlight. The residue resembled "cosmoline" in appearance, blackened on being heated to 100° C. and solidified on being recooled. 1900 c.c. of a similar fraction, redistilled in a Glinsky fractionating apparatus at 20—50 C., left behind 135 c.c. which yielded 0·5062 grm. of residue when evaporated at ordinary temperature; and a proportionate amount of residue was obtained from part of the distilled spirit from this experiment, after being allowed to stand for some time before redistillation. The composition of the residues was not determined; but it is considered evident that such petroleum spirit is unsuitable for extraction purposes. —C. S.

Cerous salts from cerium dioxide; Rapid method for the direct preparation of ——. L. Marino. Gaz. chim. ital., 1907, **37**, I., 51—54.

QUINOL (hydroquinone) reduces cerium dioxide to cerous oxide, being itself converted chiefly into quinhydrone, but to a small extent, also, into quinone. For the preparation of cerous sulphate, $Ce_2(SO_4)_3.5H_2O$, a mixture of equal parts by weight of cerium dioxide and quinol, together with distilled water and more than the calculated quantity of sulphuric acid is heated nearly to boiling for 4—5 minutes. Cerous chloride, $2CeCl_3.15H_2O$, can be prepared in an analogous manner from 10 parts of cerium dioxide, 7 parts of quinol, and concentrated hydrochloric acid. The conversion of cerium dioxide into cerous sulphate in presence of dilute sulphuric acid in this way, can be utilised for the separation of cerium from thorium, as thorium dioxide, after ignition, is only slightly soluble in dilute acid.—A. S.

Colloidal suspensions; Filtration of ——. H. Bechhold. *See* XXIV.

Linarin and pectolinarin; Two new glucosides ——. T. Klobb. *See* XXIV.

Croton seeds; Hydrolytic property of ——. F. Scurti and A. Parrozzani. *See* XXIV.

Croton seeds; Occurrence of a proteolytic enzyme in ——. F. Scurti and A. Parrozzani. *See* XXIV.

PATENTS.

Esters of alcohols of terpenes; Process of manufacturing ——. A. A. Shukoff, St. Petersburg. Eng. Pat. 20,526, Sept. 15, 1906.

SEE Fr. Pat. 369,794 of 1906; this J., 1907, 223.—T. F. B.

Alcohols and fatty acids; Process of effecting a combination between selected members of the ——. E. Twitchell, Wyoming, U.S.A. Eng. Pat. 25,747, Nov. 14, 1906.

SEE Fr. Pat. 371,689 of 1906; this J., 1907, 434.—T. F. B.

Santalol carbonate. H. Vieth, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 862,857, Aug. 6, 1907.

SEE Eng. Pat. 20,586 of 1906; this J., 1907, 167.—T. F. B

Sandalwood oil preparations; Insipid ——. H. Vieth, Assignor to Knoll und Co., Ludwigshafen on Rhine, Germany. U.S. Pat. 862,858, Aug. 6, 1907.

SEE Eng. Pat. 20,586 of 1906; this J., 1907, 167.—T. F. B.

Powders; Method of rendering certain —— *readily miscible with water, and of retaining them in such a condition, and the products prepared by such method.* A. Blackie, Tunbridge Wells. Eng. Pat. 14,653, June 27, 1906.

POWDERS which are not readily wetted by water, are mixed with a small proportion, ½ to 5 per cent., of glycerin. The material retains its powdered form, but owing to the affinity of glycerin for water, the particles are readily wetted by and consequently easily mixed with, or, if soluble, dissolved in water.—W. H. C.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Mercuric chloride; Effect of the vapours of —— *on photographic plates.* K. Kof and H. Haehn. Z. physik. Chem., 1907, 60, 367—383.

WHEN a photographic plate is exposed in the dark to the vapour of a solution of mercuric chloride in water, alcohol, benzene, or toluene, and then subjected to prolonged development, the area exposed shows white in a darker field. Solid mercuric chloride and solutions of sodiomercuric chloride do not act in the same manner. It is shown that deposition of mercuric chloride on the plate actually takes place, and that the reaction is sensitive enough to detect 5×10^{-6} grm. of this salt. The action of the salt is exerted before, not during, development (mercuric chloride is not a restrainer like potassium bromide) and is held to consist in a "negative catalysis." Hydrogen peroxide is known to act in an inverse sense, as a "positive catalyst," and the authors have succeeded in compensating the effect of the one reagent by that of the other. Further, the formation of a latent image by the agency of light, which is to be regarded as a special case of positive catalysis, can be cancelled by subsequent exposure to the vapour of mercuric chloride solution. The only other substance found to act similarly, though in a less degree, is arsenic acid in concentrated aqueous solution.—W. A. C.

PATENTS.

Silver pictures; Process for converting —— *into platinum pictures having catalytic power.* A. G. Bloxam, London. From Neue Photographische Ges., Berlin. Eng. Pat. 29,480, Dec. 27, 1906.

SEE Fr. Pat. 373,060 of 1906; this J., 1907, 717.—T. F. B.

Photographic film. G. Macaire, Rickmansworth. U.S. Pat. 861,472, July 30, 1907.

See Eng. Pat. 12,152 of 1899; this J., 1900, 559.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives. Statutory Rules and Orders, 1906. [T.R.]

The mixtures of picric acid with other substances specified in the Schedule to this Order, shall be exempt from being deemed to be explosives within the meaning of the said Act when being kept or conveyed, subject to conditions set forth in the said Schedule.

Schedule.—(1) Picric acid thoroughly mixed with not less than three times its own weight of anhydrous sulphate of soda.

(2) Picric acid thoroughly mixed with not less than three times its own weight of crystallised sulphate of soda when packed in hermetically closed packages.

(3) Picric acid thoroughly mixed with not less than three times its own weight of potash alum.

Patents.

Explosive nitro-substances; Process of and apparatus for increasing the density of fusible ——. C. E. Bichel. Hamburg, Germany. Eng. Pat. 19,215, Aug. 28, 1906.

See Fr. Pat. 369,371 of 1906; this J., 1907, 115.—T. F. B.

Explosives. C. Claessen, Berlin. Eng. Pat. 24,240, Oct. 30, 1906.

An ammonium nitrate safety explosive characterised by the fact that chrome alum or chrome-ammonia alum is added to the known explosive components. The following composition is given:—Ammonium nitrate (66 parts), potassium nitrate (14·5), guncotton (9), vaseline (0·5) and chrome-ammonia alum (10 parts). The guncotton may be replaced by trinitrotoluene, nitrobenzene or nitronaphthalene, and the vaseline by oils or resins. —G. W. McD.

Nitrated cellulose; Process of manufacturing ——. A. Voigt, Schönbeck, Germany. U.S. Pat. 860,776, July 23, 1907.

See Eng. Pat. 5126 of 1904; this J., 1904, 560.—T. F. B.

Explosive; High ——, and process of making the same. F. B. Holmes, Woodbury, N.J., Assignor to The Eastern Dynamite Co., Wilmington, Del. U.S. Pat. 861,177, July 23, 1907.

The explosive consists of a mixture of a nitrated carbohydrate, a solid inorganic oxidising substance, and a non-volatile liquid organic compound. The latter is a solvent of the nitrated carbohydrate but is insoluble in water. Only the surfaces of the particles of the nitrated carbohydrate are gelatinised by the liquid, and the particles of the oxidising substance are coated with the superficially gelatinised carbohydrate.—W. P. S.

"Pyroxylated" powders; Process for detonating charges of wet ——. O. F. von Schroetter. Fr. Pat. 376,339, April 3, 1907. Under Int. Conv., April 11, 1906.

See Eng. Pat. 8157 of 1907; this J., 1907, 893.—T. F. B.

Explosives: Process for the preparation of ——. O. F. von Schroetter. Fr. Pat. 376,340, April 3, 1907. Under Int. Conv., April 11, 1906.

See Eng. Pat. 8156 of 1907; this J., 1907, 893.—T. F. B.

Explosives; Manufacture of ——. G. Cornaro. Fr. Pat. 376,607, April 11, 1907. Under Int. Conv., April 21, 1906.

Metals such as aluminium and antimony in a very fine state of division are used with oxidising agents to form an explosive. The metals are preferably obtained in a suitable state of division by electrolysis, and to prevent superficial atmospheric oxidation they may be coated with varnish. Advantage is said to be gained by the easy oxidation of the antimony in the first instance, the heat from this reaction facilitating the oxidation of the aluminium.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Nitrometer with water jacket. G. F. Ayers. J. Chem., Met. and Min. Soc. S. Africa, 1907, **7**, 371.

A nitrometer fitted with a water jacket, through which a constant stream of water of known temperature is allowed to flow, and which can be adjusted by means of a vertical screw attached to the clamp, possesses the advantages of being light, strong, durable, easily handled and inexpensive, while by its use, it is stated, an accurate result can be obtained within the space of half an hour. —O. F. H.

Patent.

Water of a boiler; Apparatus for testing the —— under pressure. A. Schmitz, Aix-la-Chapelle, Germany. U.S. Pat. 862,870, Aug. 6, 1907.

See Eng. Pat. 22,621 of 1905; this J., 1906, 195.—T. F. B.

INORGANIC—QUANTITATIVE.

Copper; Iodometric determination of ——. F. A. Gooch and F. H. Heath. Amer. J. Science, 1907, **24**, 65—74.

The authors have examined the various modifications which have been proposed for the iodometric determination of copper, and find that for amounts of copper not exceeding about 0·3 grm., the following procedure is most satisfactory. The solution of the cupric salt, containing not more than 3 c.c. of concentrated sulphuric acid, hydrochloric acid, or nitric acid (free from oxides of nitrogen) or 25 c.c. of 50 per cent. acetic acid, is made up to 100 c.c., 5 grms. of potassium iodide, free from iodate, are added, and the free iodine is titrated as usual with thiosulphate, using starch indicator at the end. If the titration is not complete when 25 c.c. of thiosulphate solution have been used, 2—3 grms. more of potassium iodide should be added. The error will not exceed a few tenths of a milligram of copper.—A. S.

Thiosulphate; New volumetric determination of —— in presence of sulphite. A. Gutmann. Z. anal. Chem., 1907, 8, 485—500.

The reaction is based on the decomposition of thiosulphate by potassium cyanide with the production of sulphite and thiocyanate, the latter being estimated by Volhard's method with *N*/10 silver nitrate solution. The process is carried out as follows. To an approximately *N*/10 thiosulphate solution are added 1 grm. of potassium cyanide and 2 c.c. of a 15 per cent. solution of sodium hydroxide, both free from chloride, and the mixture heated for half an hour on the water bath. The solution containing sulphite, thiocyanate and excess of cyanide is cooled and made up to 100 c.c. The excess of cyanide is then estimated in 20 c.c. of this solution with *N*/10 silver nitrate by Liebig's process. A known excess of the silver nitrate solution is then added, together with dilute nitric acid, for the complete precipitation of the thiocyanate, and its amount estimated by back titration with standard thiocyanate solution by Volhard's process—G. W. McD.

Chlorate ; Volumetric estimation of —— with iodine. R. Luther and T. F. Rutter. Z. anal. Chem., 1907, **8**, 521—522.

IODINE is liberated from potassium iodide by potassium chlorate in the presence of sulphuric acid and a vanadium salt, the latter acting as a catalytic agent, when the mixture is heated for 15 minutes at 100° C. in a closed flask. The liberated iodine is then titrated with thiosulphate solution. Potassium chlorate (0·03745 grm.) was dissolved in 35 c.c. of water, and mixed with 10 c.c. of $N/1$ potassium iodide solution, 5 c.c. of $2N$ sulphuric acid and 10 c.c. of $N/100$ solution of a vanadium salt. The mixture was heated for 15 minutes, in a closed flask, at 100° C., cooled and diluted to 100 c.c. Ten c.c. of this solution required 18·33 c.c. of $N/100$ thiosulphate for the titration of the liberated iodine.—G. W. McD.

Zinc oxide ; Method for the separation and determination of ——, in zinc-white, zinc-dust, paints, and lithopone. J. Tambon. *See* XIII*A*.

Chrome liquors and chrome extracts ; Method of determining the basicity of ——. W. Appelius and R. Schall. *See* XIV.

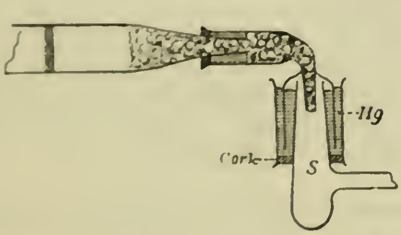
Tin cathodes ; Quantitative electrolytic deposition of zinc, copper, silver, cadmium and nickel with ——. L. T. Sherwood and G. Alleman. *See* XI*B*.

ORGANIC—QUALITATIVE.

Metastannic acid ; Detection of —— in pink salt and in silk weighting baths. H. Bayerlein. *See* V.

ORGANIC—QUANTITATIVE.

Mercury joint instead of cork or rubber in organic analysis. J. Marek. J. prakt. Chem., 1907, **76**, 180—184.



To avoid the errors incidental to the use of cork or rubber stoppers the author recommends the use of a mercury joint which is made as follows : One end of the combustion tube is drawn out to the extent of 4—5 cm., and connected with a tube bent at right angles, the lower part of which is surrounded by a wider tube extending beyond the end. The bent tube and the narrow part of the combustion tube are packed with interlaced silver to avoid condensation of water as far as possible, and the joint between them is made by wrapping asbestos paper round the combustion tube until it fits closely into the bent tube and covering the exposed edges of asbestos with molten silver chloride which makes the whole air-tight. A simpler way is to bend the narrow end of the combustion tube at right angles and unite with a tube, 1·5 cm. in diameter, by means of asbestos and molten silver chloride, the latter sealing each end of the asbestos packing. The top of the water-absorption bulbs is surrounded by a wider tube, 2·5 cm. in diameter and 5 cm. long, fitted by means of a cork, and mercury is poured into the annular space thus provided. On dipping the combustion tube into this, a mercury joint is obtained (see fig.). (The absorption tube, S, ends in a bulb and exit tube not shown in the figure.) When the combustion is finished, the combustion tube is raised out of the mercury, and the latter removed from the absorption tube before weighing. When lead peroxide is used, a larger and wider bent tube is necessary (if the peroxide is confined entirely to this and not placed in the combustion tube) which is kept hot by means of an air-bath.—J. C. C.

Hydrogen ; Volumetric determination of ——. A. Lidow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 195—211. Chem. Zentr., 1907, **2**, 181—182.

THE method proposed by the author is based upon the fact that the hydrogen is evolved quantitatively from most substances, organic and inorganic, containing it, on heating with magnesium powder. From 50 to 100 mgrms. of the substance are mixed with 0·8—1 grm. of magnesium powder, which has previously been ignited in a current of hydrogen, and the mixture is introduced into a test-tube of refractory glass, 12—13 cm. long and 0·7—0·8 cm. diameter. The charge in the tube is covered with a layer of magnesium powder, 2—3 cm. high, and a thin spiral of aluminium ribbon is introduced. The tube is connected with a Lunge "volumenometer," exhausted of air, filled with pure dry hydrogen, and then heated, starting at the upper part and proceeding gradually downwards ; the hydrogen evolved is measured. In the residue, sulphur, halogens, and nitrogen may be determined by known methods. In the analysis of hydrocarbons, the magnesium is preferably replaced by aluminium powder.—A. S.

Phenylcarbylamine ; A reaction of ——. A. Chwala. Z. angew. Chem., 1907, **20**, 1366—1367.

IN the manufacture of phenylcarbylamine, it is a remarkable, though unfortunate fact that hitherto there has been no method known for determining the amount of the carbylamine in the reacting mixture of aniline on chloroform, sodium hydroxide and alcohol. However a reaction is now described which serves this end. It has been found that under suitable conditions mercuric chloride is completely reduced to the mercurous salt by phenylcarbylamine. To estimate the latter by means of this reaction, an alcoholic solution of corrosive sublimate is added to an alcoholic solution of the base until no further precipitate is produced. The calomel thus obtained is washed with hot water and dried, and its weight forms a direct measure of the amount of phenylcarbylamine present.

The process can be used to estimate the carbylamine present in the reaction-mixture in course of manufacture. It is pointed out that this reaction can take place even in extremely dilute solutions.—E. W. L.

Starch in potatoes ; Determination of ——. L. Pellet and Metillon. *See* XVI.

Salicylic acid in milk and cream ; Determination of ——. C. Revis and G. A. Payne. *See* XVIII*A*.

Cellulose in wood ; Determination of —— by the chlorination process. A. L. Dean and G. E. Tower. *See* XIX.

Leather ; Determination of nitrogen in ——. F. P. Veitch and T. C. Trescot. *See* XIV.

Thiophen ; Determination of ——. V. Paolini. *See* III.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Chromium, aluminium and magnesium salts; Relative toxicity of ——, compared with those of the rare earths. A. Hébert. Compt. rend., 1907, **145**, 337—340.

THE results now obtained, together with those already published (this J., 1906, 1176), lead to the following arrangement of the metals studied in the order of diminishing toxicity of their salts towards various plants, animals and enzymes: Zirconium, thorium, chromium, aluminium, cerium, lanthanum, magnesium. The toxicities or antiseptic powers of these metals are not related to their atomic weights, valencies or order of chemical classification. The first four metals in the above series are distinctly toxic towards lower animals or organisms, this property depending either on the metals themselves or on the acidity of their solutions; the last three metals are, on the other hand, more or less completely innocuous.
—T. H. P.

Colloidal suspensions; Filtration of ——. H. Bechhold. Z. Chem. Ind. Kolloïde, 1907, **2**, 3—9 and 33—41. Also Z. physik. Chem., 1907, **60**, 257—318.

IN these papers the passage of dissolved colloids through gelatinous filtering media (this J., 1906, 1177) is dealt with at length. The filters employed in most of the experiments consisted of either nickel gauze or paper impregnated with aqueous jellies of collodion or gelatin. In both publications the apparatus is fully described and illustrated. The principle that the retention or passage of colloidal particles in suspension, depends on the concentration of the filtering medium is confirmed. Although it is proved that neither the size of the particles nor that of the pores of the filter are uniform, a table is given showing the strength of filtering medium which just retains the substance, allowing the "solvent" to pass. The order agrees with the size of the particles as determined by ultramicroscopy. Fractional filtration of Witte's peptone into proto- and deutero-albumoses runs parallel with the fractional precipitation by means of ammonium sulphate. Filtration through jellies is capable of replacing dialysis in many cases, especially where products of proteolysis are concerned, but some dialysable mixtures (*e.g.*, Prussian blue and oxalic acid) cannot thus be separated. For obtaining absolutely sterile water, jelly filters are not so effective as the earthenware filters generally used; they are, however, well adapted for the production of filtrates relatively poor in germs. A number of data have been collected relating to the adsorption of suspended colloids by filtering media and by one another, and it is found that certain physiologically active substances (rennin, arachnolysin, staphylolysin, but not anti-rennin, or diphtheria toxin) are peculiarly liable to adsorption by jelly filters.—W. A. C.

Linarin and pectolinarin; two new glucosides. T. Klobb. Compt. rend., 1907, **145**, 331—334.

THE flowers and leaves of *Linaria vulgaris* contain the following two new glucosides: (1) Linarin, which separates in slender needles almost insoluble in solvents with the exception of concentrated acetic, hydrochloric or nitric acid and is lævo-rotatory. (2) Pectolinarin, which is an amorphous, straw-yellow substance melting at 188—190° C. on the Maquenne block. It is soluble in boiling water or alcohol, the saturated solutions gelatinising on cooling. It is also readily soluble in concentrated hydrochloric acid and in potassium hydroxide solution, and, when boiled for a long time with water, it loses water of constitution and is converted into crystalline linarin.

When hydrolysed, both of these glucosides yield a reducing sugar, which has not yet been studied, and a mixture of linaric and anhydrolinaric phenols. When crystallised from acetic acid and heated at 100—110° to remove the acid, linaric phenol, $C_{19}H_{14}O_7$, is obtained in lemon yellow crystals, m.p. 245° C.; it forms an acetyl-derivative, $C_{19}H_{10}O_7(C_2H_3O)_4$ or $C_{19}H_{11}O_7(C_2H_3O)_3$, and dissolves in sodium hydroxide giving a solution which, in contact with air, deposits a dark green flocculent precipitate. Anhydrolinaric phenol, $C_{19}H_{12}O_6$, crystallises from alcohol or glacial acetic acid in slender, straw-yellow needles, m.p. 267—268°, forms an acetyl-derivative, $C_{19}H_9O_6(C_2H_3O)_3$ and dissolves in sodium hydroxide solution yielding a golden yellow liquid which exhibits no traces of a green deposit.

Under the influence of alkalis, pectolinarin is converted into a β-modification, which yields only linaric phenol on hydrolysis; linarin is similarly transformed into β-linarin, which gives only anhydrolinaric phenol when hydrolysed.

The formula, $C_{50}H_{50}O_{25}$, is suggested for linarin, the hydrolysis of which would then be represented by the equation: $C_{50}H_{50}O_{25} = C_{19}H_{14}O_7 + C_{19}H_{12}O_6 + 2C_6H_{12}O_6$.
—T. H. P.

Croton seeds; Hydrolytic property of ——. F. Scurti and A. Parrozzani. Gaz. chim. ital., 1907, **37**, I., 486—488.

CROTON seeds have not only a specific action upon fats, but also a general hydrolytic action. Thus, when 15 grms. of the seeds were triturated with 1 grm. of salol, 10 c.c. of water, and 5 c.c. of 6 per cent. acetic acid, free salicylic acid could be detected after 48 hours. In similar experiments with 2 grms. of ethyl butyrate and ethyl benzoate, the amounts of free alcohol found after 48 hours were 0·016 and 0·014 grm. respectively. The crushed seeds also effected a rapid hydrolysis of saccharose, and converted raffinose into reducing sugars. Thus, 5 grms. of raffinose treated with 10 grms. of the seeds, 100 c.c. of water, and 5 c.c. of 6 per cent. acetic acid, yielded, after 36 hours, 3·1 grms. of reducing sugars (control experiment, 0·08 grm.). Starch was also hydrolysed in like manner, with the formation of dextrose.—C. A. M.

Croton seeds; Occurrence of a proteolytic enzyme in ——. F. Scurti and A. Parrozzani. Gaz. chim. ital., 1907, **37**, I., 488—504.

CROTON seeds contain, probably in zymogenic form, a proteolytic enzyme capable of acting very rapidly upon proteins, to form simpler nitrogenous compounds, which are soluble and diffusible. By the action of the enzyme upon the proteins in the croton seeds themselves, bodies such as arginine, lysine, glutamine, aspartic acid, and leucine are produced. The action of the enzyme resembles that of animal trypsin, and it may therefore be regarded as a vegetable trypsin. Under its influence the same compounds are formed as are produced by the action of mineral acids upon proteins, so that the enzyme appears to be an active hydrolytic catalysing agent capable of imparting to very dilute organic acids the hydrolytic power of boiling mineral acids. Since the decomposition products formed by mineral acids are actually present in the germinating seeds, the authors conclude that a hydrolytic process must be regarded as one of the phenomena of germination.—C. A. M.

Fenchone; Use of —— in determining molecular weights by the boiling-point method. E. Rimini and F. Olivari. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 665—670. Chem. Zentr., 1907, **2**, 241.

THE authors have found that fenchone is a good solvent of many elements and inorganic salts and is well suited for use in the determination of the molecular weight of such substances by the boiling-point method. For pure fenchone the value of the constant, k, was found to be 59·4, a value not differing greatly from those for menthone ($k = 62·5$) and camphor ($k = 58·5$). By using fenchone as solvent, the molecular weight of sulphur was found to be 266 ($S_8 = 256$) and of arsenious anhydride, 386 ($As_4O_6 = 396$).—A. S.

Prizes.

Denatured alcohol. Chem. and Drug. Aug. 17, 1907.

The French Committee on Analytical Methods has defined the programme for competitions for prizes offered for alcohol-denaturation in connection with the law of November 29, 1905. This Act instituted two prizes: one of £800 for the discovery of a denaturing agent more advantageous than those now used while safeguarding the revenue against frauds, and a second (£2000) prize for a system of utilising alcohol for lighting in the same manner as paraffin. The denaturant must have a taste and smell which will effectually discourage any desire to use the alcohol as a beverage. The denaturant should not be sufficiently objectionable in smell to prevent its domestic or industrial use. No soluble substance which could leave a deposit on lamp wicks, and thus render combustion difficult, may be used. It must not consist of a substance much more or less volatile than alcohol and which could thus be removed by fractional distillation. It should contain no substance which might injure the metallic part of lamps or motors. It should not be poisonous or contain poison. It should be sufficiently inexpensive, should not normally exist in commercial alcohol, and its presence in alcohol should be capable of easy and certain detection.

Mangrove bark extract. Chem. and Drug., Aug. 17, 1907.

The President of the German Colonial Society offers a prize of £150 for a method to produce an extract from mangrove bark that will impart as light a colour as possible to leather and will only slightly darken by exposure to light. The mangrove bark contains a large amount of tannin and also a red colouring-matter that prevents the bark and its extract from successfully competing with other tanning agents. The problem to be solved is the practical removal of this red colour. Competitors are invited to send in their methods by July 20, 1908, to the Deutsche Kolonialgesellschaft, Schellingstrasse 4, Berlin.

New Books.

The Electric Furnace in Iron and Steel Production. By John B. C. Kershaw. The "Electrician" Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, London, E.C. 1907. Price 3s. 6d. net. The D. van Nostrand Co., 23, Murray Street, New York. Z. P. Maruya & Co., 14, Nihonbashi Tori Sanchome, Tokyo, Japan. Thacker, Spink & Co., Calcutta. Higginbotham & Co., Madras. George Robertson and Co., Australia: Melbourne, Sydney, Adelaide and Brisbane.

8vo volume, containing 66 pages of subject matter and an appendix of two pages. There are 24 illustrations, and a table of contents. The following subjects are dealt with in the text:—I. Historical introduction. II. Héroult furnace and process. III. Keller furnace and process. IV. Kjellin furnace and process. V. Stassano furnace and process. VI. Miscellaneous furnaces and processes. VII. Yields and costs. VIII. British and American patents. IX. The Colby furnace and process.

The Mineral Industry: its Statistics, Technology, and Trade during 1906. Founded by Richard P. Rothwell. Edited by Walter Renton Ingalls, Editor of "The Engineering and Mining Journal," &c. Volume XV. Supplementing Volumes I. to XIV. Hill Publishing Company, 505, Pearl Street, New York; 6, Bouverie Street, London, E.C. 1907. Price £1 0s. 10d. or 5 dollars.

Large 8vo volume, containing 931 pages of subject matter, and the alphabetical index. The subjects and sections under which the work is arranged, are as follows:—I. Aluminium and alundum. II. Ammonia and ammonium sulphate. III. Antimony. IV. Arsenic. V. Asbestos. VI. Asphaltum. VII. Barytes. VIII. Bauxite. IX. Bismuth. X. Borax. XI. Bromine. XII. Calcium carbide. XIII. Carborundum. XIV. Cement. XV. Chromium and chrome ore. XVI. Coal and coke. XVII. Copper. XVIII. Copperas. XIX. Corundum and emery. XX. Cryolite. XXI. Felspar. XXII. Fluorspar. XXIII. Fuller's earth. XXIV. Garnet. XXV. Glass. XXVI. Gold and silver. XXVII. Graphite. XXVIII. Gypsum. XXIX. Iodine. XXX. Iron and steel. XXXI. Lead. XXXII. Limestone. XXXIII. Lithia. XXXIV. Magnesium and magnesite. XXXV. Manganese. XXXVI. Mica. XXXVII. Mineral wool. XXXVIII. and XXXIX. Molybdenum. XL. Monazite. XLI. Nickel and cobalt. XLII. Ochre and iron oxide pigments. XLIII. Petroleum. XLIV. Phosphate rock. XLV. Platinum. XLVI. Potassium salts. XLVII. and XLVIII. Precious stones. XLIX. Mercury. L. Salt. LI. Silica. LII. Silicon. LIII. Sodium and soda salts. LIV. Strontium sulphate. LV. Sulphur and pyrites. LVI. Talc and soapstone. LVII. Tantalum. LVIII. Tin. LIX. Tungsten. LX. Uranium. LXI. Vanadium. LXII. Zinc. LXIII. Literature on ore deposits in 1906. LXIV. Improvements in sampling and assaying. LXV. Advance in ore dressing in the last decade. LXVI. Progress in ore dressing and coal washing in 1906. LXVII. Mineral statistics of foreign countries.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

18,312. Wallach. Concentration of diluted lyes.* Aug. 13.

18,549. Bévenot. Apparatus for extracting and desiccating the solids in natural fluids, particularly milk and saccharine juices. [Belg. Appl., Aug. 20, 1906.]* Aug. 16.

18,576. Kestner. Continuously-acting concentrating apparatus. [Belg. Appl., Aug. 16, 1906.]* Aug. 16.

18,959. Thwaites. Rotary kilns. Aug. 22.

19,005. Reeves and Bramwell. *See under* XVIII*B*.

19,127. Hellwig. Hastening the lixiviation, solution, and filtration of materials when making extracts. Aug. 26.

19,292. Schmidt. Solvent for calcareous fur deposit.* Aug. 27.

19,431. Hencke. Vacuum drum filters. [Ger. Appl., Aug. 31, 1906.]* Aug. 29.

Complete Specifications Accepted.

18,732 (1906). Lake (Bush). Furnaces. Aug. 28.

29,264 (1906). Lindahl and Halling. Centrifugal apparatus for removing suspended solids from liquids. Aug. 28.

1448 (1907). Robert. Drying chamber or steriliser. Aug. 28.

3302 (1907). Soc. l'Air Liquide, and Lévy. Separating gases from their mixtures, particularly separating the constituents of air. Sept. 4.

4806 (1907). Schilde. Apparatus for drying, cooling, and moistening material. Sept. 4.

5019 (1907). Diamanti and Lambert. Recovery of vapours given off by volatile liquids. Aug. 28.

11,925 (1907). Lamort. Recuperating filter. Aug. 28.

II.—FUEL, GAS, AND LIGHT.

Applications.

18,196. Armstrong. Manufacture of coke and gas and apparatus therefor. Aug. 12.

18,238. Forbes. Manufacture of inflammable hydrocarbon fuels. Aug. 12.

18,561. Mount. Gas producers. Aug. 16.

18,720. Cutler and Husband. Gas purifiers. Aug. 19.

18,825. Parker, and Automobile Gas Producer Syndicate. Gas producer plant. Aug. 21.

18,856. Parker. Fuel. Aug. 21.

19,009. Bardot. Gas generators. [Fr. Appl., Sept. 7, 1906.]* Aug. 23.

19,082. Parker. *See under* III.

19,100. Bernheimer and Gut. Incandescent mantles. Aug. 24.

19,157. Imray (Glühlampenfabr. "Union"). Manufacture of filaments for electric lamps. Aug. 26.

19.228. Woltereck. Removal of tarry matter from hot gases. Aug. 27.

Complete Specifications Accepted.

18,014 (1906). Meyer and Hastert. Apparatus for cooling and washing gases. Aug. 21.

18,488 (1906). British Thomson-Houston Co. (Gen. Electric Co.). Filaments for electric lamps, furnaces, &c. Aug. 28.

18,602 (1906). Coxhead. Incandescent gas mantles. Aug. 28.

18,680 (1906). Simmance and Abady. *See under* XXIII.

18,745 (1906). British Thomson-Houston Co. (Gen. Electric Co.). Manufacture of conductive filaments and other incandescing bodies. Aug. 21.

18,748 (1906). British Thomson-Houston Co. (General Electric Co.). Conductive filaments for electric lamps, &c. Aug. 28.

18,749 (1906). British Thomson-Houston Co. (General Electric Co.). Manufacture of electric conductors for lamps, furnaces, &c. Aug. 21.

18,828 (1906). Gobbe. Coke ovens. Sept. 4.

18,967 (1906). Jouques. Manufacture of briquettes for fuel. Aug. 28.

19,146 and 19,146a (1906). Defays. Regenerating coke ovens. Sept. 4.

21,269 (1906). Koppers. Withdrawing low grade, combustible gases during charging or discharging of retorts, coke ovens, &c. Aug. 28.

21,654 (1906). Johnson (Hollefreund und Co.). Filaments for incandescence electric lamps. Aug. 28.

24,348 (1906). Von Dulong. Carburetting air or gases. Aug. 28.

3610 (1907). Grobach. Production of water gas. Aug. 21.

7407 (1907). Allgem. Elektricitäts-Ges. Manufacture of tungsten filaments for electric lighting and heating. Aug. 21.

7879 (1907). Reneaux. Artificial fuel. Sept. 4.

8223 (1907). Reneaux. Agglomerating carbon dusts of all kinds. Sept. 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

18,238. Forbes. *See under* II.

18,706. Rütgerswerke A.-G. Increasing the explosiveness of hydrocarbons having a high boiling-point. [Ger. Appl., Oct. 17, 1906.]* Aug. 19.

19,082. Parker. Apparatus for the destructive distillation of carbonaceous substances. Aug. 24.

19,184. Bateman. Presses for treating paraffin scale or wax, fats, fatty acids, &c. Aug. 26.

19,565. Schulz. Production of aromatic nitro-compounds from solvent naphtha, and their use for producing safety explosives.* Aug. 31.

Complete Specification Accepted.

2559 (1907). Laboschin. Rendering volatile oils, balsams, &c., soluble in water. Sept. 4.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

18,698. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Aug. 19.

19,001. Durand, Huguenin, et Cie. Derivatives of gallocyanine dyestuffs. [Ger. Appl., May 18, 1907.]* Aug. 23.

19,002 and 19,003. Durand, Huguenin, et Cie. Manufacture of gallocyanines. [Ger. Appl., June 4, 1907.]* Aug. 23.

19,027. Chaumat. Electrolytic preparation of indigo dyes. [Fr. Appl., Aug. 28, 1906.]* Aug. 23.

19,158. Imray (Soc. Chem. Ind. in Basle). Manufacture of red vat dyestuffs. Aug. 26.

19,172. Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters of the anthracene series. Aug. 26.

19,479. Johnson (Badische Anilin und Soda Fabr.). Manufacture of azo colouring matter.* Aug. 30.

19,548. Newton (Bayer und Co.). Manufacture of a new sulphur dyestuff. Aug. 31.

Complete Specifications Accepted.

20,124 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of dyestuffs of the triphenylmethane series. Aug. 21.

24,008 (1906). Hirschberger, Maron, and Levinstein, Ltd. Safraninones and reddish sulphurised dyestuffs therefrom. Sept. 4.

25,193 (1906). Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of yellow monoazo dyestuffs. Sept. 4.

26,190 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of derivatives of 3-oxy-1-thionaphthene. Aug. 21.

6814 (1907). Imray (Soc. Chem. Ind. in Basle). Substantive dyestuffs. Aug. 21.

V.—PREPARING, BLEACHING, DYEING. PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

18,337. Sefton-Jones (Syndicat des Proc. Rousseau). Treatment of flax and other fibres with hydrocarbons. Aug. 13.

18,816. Kur. Dyestuff solutions in paste form for printing and dyeing.* Aug. 21.

18,936. Lecoeur. Manufacture of threads, filaments, or bands of cellulose. Aug. 22.

19,392. Levi. Obtaining edestin from cotton seeds.* Aug. 29.

19,475. Morison. Composition for preserving and waterproofing fabrics, wool, and other material. Aug. 30.

19,533. Hall and Brandt. Machines for scouring, bleaching, and dyeing spun or manufactured fibrous materials. Aug. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

18,127 (1906). Rogers. Retting, degumming, cleaning, and drying fibrous materials preparatory to obtaining the fibre. Aug. 21.

21,144 (1906). Friedrich. Manufacture of artificial threads. Sept. 4.

21,590 and 22,026 (1906). Sharp, and Sharp and Sons. Producing watered effects on textile fabrics. Sept. 4.

27,527 (1906). Kunstfäden Ges. Manufacture of artificial silk filaments from nitrocellulose. Aug. 21.

28,375 (1906). Ita. Felting animal fibres. Aug. 28.

2356 (1907). Biedermann. Production of two- or many-coloured effects in fabrics dyed in the piece. Aug. 21.

2428 (1907). Pickles and Pickles. Schreinering apparatus for fabrics. Sept. 4.

11,928 (1907). Kraemer, and Kraemer und Van Elsberg A.-G. Improving textile threads, fibres, and fabrics. Sept. 4.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

APPLICATION.

18,545. Shorrock. Means for fixing flat bodied colours in wall papers. Aug. 16.

COMPLETE SPECIFICATION ACCEPTED.

20,119 (1906). Schwalbe. Dyeing paper with colours fast to light and water. Aug. 21.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

18,417. Mount. *See under* X.

18,750. Beilby and Beilby. Manufacture of sodium ferrite and aluminate or analogous compounds.* Aug. 20.

18,922. Westinghouse Metal Filament Co. Production of tungsten dioxide. [Ger. Appl., Nov. 23, 1906.]* Aug. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

19,033 (1906). Knudsen. Treatment of liquid air. Aug. 28.

22,039 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of barium cyanide. Aug. 21.

25,605 (1906). Cunnington. Separation of atmospheric nitrogen for making nitrogen compounds. Aug. 28.

25,978 (1906). British Thomson-Houston Co. (General Electric Co.). Production of boron. Aug. 21.

27,828 (1906). Roth. Manufacture of nitrides from atmospheric nitrogen. Aug. 21.

3392 (1907). Soc. l'Air Liquide, and Lévy. *See under* I.

7641 (1907). Jaubert. Manufacture of potassium peroxide or a mixture rich in potassium peroxide. Aug. 28.

9636 (1907). Chem. Fabr. Buckau. Recovery of chromic acid from solutions of chromium sulphate in an electrolytic manner. Sept. 4.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

18,417. Mount. *See under* X.

19,429. Schmidt. Method of enamelling.* Aug. 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

19,105. Wilson. Apparatus for the manufacture of cement.* Aug. 24.

19,180. Goldman. Manufacture of cement from furnace slag. Aug. 26.

19,320. Moeller. Manufacture of cement. Aug. 28.

19,523. Jupillat. Plaster composition. Aug. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

19,038 (1906). Schwanenberg and Rinne. Hardening artificial stone formed of hydrate of lime by carbonic acid. Aug. 21.

21,708 (1906). Barnett and Hadlington. Kilns for bricks and the like. Aug. 28.

27,059 (1906). Hocke. Calcining the raw material for making cement. Sept. 4.

629 (1907). Gery. Drying and burning bricks, &c. Aug. 28.

X.—METALLURGY.

APPLICATIONS.

18,398. Biewend. *See under* XI.

18,417. Mount. Furnaces for melting metals, glass, &c., or roasting or calcining ores, salt cake, &c. Aug. 14.

18,563. Gutensohn. Reducing metals from ore. Aug. 16.

19,016. Richter. Removal of copper from copper, tin, antimony, and lead alloys.* Aug. 23.

19,165. Hardenberg, Beier, Cordes, and Weist. Coating metal objects with liquid metal.* Aug. 26.

19,348. Flohr. Manufacture of iron and steel by the open-hearth process or in electric furnaces. Aug. 28.

19,449. Smith and Rogers. Separation of the constituent metals of gun-metal and other alloys. Aug. 30.

19,547. Ruthenburg. Cementation processes.* Aug. 31.

COMPLETE SPECIFICATIONS ACCEPTED.

18,489 (1906). British Thomson-Houston Co. (General Electric Co.). Purifying metallic compounds. Aug. 28.

18,792 (1906). Churchward. Production of steel alloys. Sept. 4.

19,130 (1906). MacIvor and Fradd. Treatment of sulphide ores containing zinc. Aug. 28.

19,229 (1906). Clawson. Ore roasting and volatilising furnace. Sept. 4.

19,493 (1906). Hodgkinson. Treatment of iron or steel. Sept. 4.

19,712 (1906). Snyder. Treatment of ores. Aug. 28.

22,033 (1906). Brandenburg. Extracting tin from iron-containing tin products. Aug. 28.

24,905 (1906). Fernau. Extraction of metals from ores. Sept. 4.

28,575 (1906). Thompson (Mojana). Obtaining metallic zinc. Sept. 4.

4336 (1907). Levy. Preparing metal objects destined to receive metallic coatings. Sept. 4.

10,230 (1907). Steiner. *See under* XI.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

18,210. Monge and Arzano. Electrolytic processes and apparatus.* Aug. 12.

18,348. Fennell and Perry. Electrodes for storage batteries. Aug. 14.

18,398. Biewend. Manufacture of steel and electro-metallurgical induction furnaces therefor. [Ger. Appl., Aug. 14, 1906.]* Aug. 14.

18,480. Schmidt. Treatment of galvanic metal deposits. [Ger. Appl., Sept. 5, 1906.]* Aug. 15.

18,898. Bailey. Apparatus for electro-deposition of metals. Aug. 22.

19,027. Chaumat. *See under* IV.

Complete Specifications Accepted.

21,338 (1906). Naville, Guye, and Guye. Application of the electric arc for producing reactions in a gaseous mass. Aug. 21.

26,867 (1906). British Thomson-Houston Co. (General Electric Co.). Electric furnaces. Sept. 4.

5655 (1907). Petersson. Electrically reducing oxide ores and the like. Aug. 21.

9636 (1907). Chem. Fabr. Buckau. *See under* VII.

10,230 (1907). Steiner. Refining tin electrolytically, and extraction of tin from alloys, residues, and the like. Aug. 28.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

18,253. Bloxam (Jacobi). Soap frames. Aug. 12.

18,471. Farquhar. Detergent or cleansing composition. Aug. 15.

19,184. Bateman. *See under* III.

Complete Specifications Accepted.

18,925 (1906). Thompson. Manufacture of soap. Sept. 4.

27,280 (1906). Bacon. Manufacture of certain kinds of soap. Sept. 4.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*)—Pigments, Paints.

Application.

19,396. Bruhn and Timpke. Producing a colour binding medium from Iceland moss. Aug. 29.

Complete Specifications Accepted.

29,504 (1906). Ramos-Garcia. Paints for buildings. Aug. 28.

10,363 (1907). Badische Anilin und Soda Fabrik. Manufacture of colouring matter lakes. Sept. 4.

(*B*.)—Resins, Varnishes.

Application.

18,481. Linoleum Manufacturing Co., and Vincent. Manufacture of linoleum. Aug. 15.

(*C*.)—India-Rubber.

Applications.

18,404. Just and Sharp. Rubber substitute. Aug. 14.

18,580. Gottschalk. Manufacture of india-rubber. Aug. 16.

18,581. Gottschalk. Manufacture of isoprene. Aug. 16.

18,877 and 18,878. Commercial Products Co. (Stange and Berend). Production of plastic and elastic substances. Aug. 21.

19,336. Tupper. India-rubber substitute. Aug. 28.

Complete Specification Accepted.

27,616 (1906). Sauton. Manufacture of a plastic material applicable as a substitute for caoutchouc. Aug. 21.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

18,281. Lewis. Regeneration of waste or scrap leather.* Aug. 13.

18,769. Smith, and Buffalo Leather Co. Apparatus for treating skins and the like.* Aug. 20.

18,773. Rasmussen. Methods of and extracts for tanning. Aug. 20.

19,019. Weiss. Extraction of glue from mineral dressed material.* Aug. 23.

Complete Specifications Accepted.

18,499 (1906). Meers. Artificial leather. Aug. 28.

23,789 (1906). Desgeorge and Lebreil. Treatment of casein and other albuminous substances. Sept. 4.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

18,341. Ekström. Manufacture of grape sugar and ethyl alcohol from materials containing cellulose.* Aug. 13.

18,549. Bévenot. *See under* I.

19,099. Stewart. Process for making sugar.* Aug. 24.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

18,341. Ekström. *See under* XVI.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A*.)—Foods.

Applications.

18,220. Wesener. Bleaching and ageing flour.* Aug. 12.

18,549. Bévenot. *See under* I.

19,163. Mauvernay. Sterilisation of fermentable liquids.* Aug. 26.

Complete Specifications Accepted.

19,321 (1906). Ransford (Lallemand). Substitutes for butter, lard, cream, and the like. Sept. 4.

24,439 (1906). Thompson (Smith). Dressing, purifying, or separating, meal, flour, and other substances. Aug. 28.

4919 (1907). Newlands and Eastick. Food for cattle and other animals. Aug. 28.

12,355 (1907). Sörensen. Manufacture of artificial butter. Aug. 21.

(*B.*)—Sanitation; Water Purification.

Applications.

18,347. Scott-Moncrieff. Bacterial treatment of sewage and apparatus therefor. Aug. 14.

18,694. Sands. Septic treatment of sewage.* Aug. 19.

19,005. Reeves and Bramwell. Apparatus for purifying, decanting, and treating liquids.* Aug. 23.

Complete Specification Accepted.

21,444 (1906). Lucas. Apparatus for the bacteriological treatment of faecal matter, sewage, &c. Aug. 28.

(*C.*)—Disinfectants.

Complete Specification Accepted.

5079 (1907). Smith. Sheep wash fluid. Aug. 28.

XIX.—PAPER, PASTEBOARD, &c.

Application.

18,936. Lecoeur. *See under* V.

Complete Specifications Accepted.

10,164 (1907). Hanauer Kunstseidefabr. Manufacture of cellulose solutions. Aug. 21.

18,977 (1906). Linfoot. Manifold paper. Aug. 28.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

18,658. De Geofroy and Oberländer. Method of refining camphor. Aug. 19.

18,942. Imray (Meister, Lucius, und Brüning). Manufacture of diamines of alkylated diaminobenzoylkamines. Aug. 22.

19,576. Askenasy and Mugdan. Manufacture of dichloro-ethylene from symmetrical tetrachloro-ethane.* Aug. 31.

Complete Specifications Accepted.

23,875 (1906). Weizmann, and Clayton Aniline Co. Treatment of turpentine for use in the manufacture of pinene hydrochloride. Aug. 21.

24,222 (1906). Reitz. Production of radio-active crystals. Aug. 21.

2559 (1907). Laboschin. *See under* III.

4250 (1907). Newton (Bayer und Co.). Pharmaceutical compounds. Aug. 28.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

18,597. Haddan (Lehmann). Accelerating the separation of nitro-glycerine from acids.* Aug. 16.

18,703. Cotton Powder Co., Arnold, Fox, and Scott. Recovery of volatile solvents used in making explosives, &c. Aug. 19.

19,565. Schulz. *See under* III.

Complete Specifications Accepted.

19,408 (1906). Duttenhofer. Manufacture of explosives. Aug. 21.

3179 (1907). Himalaya. Production of explosives. Aug. 28.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Complete Specifications Accepted.

18,680 (1906). Simmance and Abady. Gas analysis apparatus. Aug. 28.

6313 (1907). Wellington. Photometers. Aug. 28.

Journal of the Society of Chemical Industry.

No. 18, Vol. XXVI. SEPTEMBER 30, 1907. No. 18, Vol. XXVI.

Obituary.

FREDERIC JAMES MONTAGUE PAGE.

F. J. M. Page, B.Sc., A.R.S.M., an original member of the Society of Chemical Industry, was born at Chelmsford, in 1848, and received his education at the City of London School, where he gained numerous distinctions. In 1866, at the age of 18, he gained a Royal exhibition to the Royal School of Mines, and subsequently he took the B.Sc. degree with honours in Chemistry and Physics at London University. In 1883, he was elected Lecturer in Chemistry and Physics at the London Hospital Medical College, and later on he became Examiner in Chemistry and Physics to the Society of Apothecaries, London. These posts he held until his death. He published jointly with Dr. A. P. Luff, a "Manual of Chemistry, Inorganic and Organic," for the third edition of which he was solely responsible. Recently he published a short work on elementary physics.

He was the inventor of the well-known gas-regulator, which bears his name.

He died after a brief illness, on August 16th, at Weymouth, aged fifty-nine years.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Centrifugal apparatus for removing suspended solids from liquids. J. T. Lindahl and C. A. Halling, Stockholm. Eng. Pat. 29,264, Dec. 22, 1906.

See Fr. Pat. 373,459 of 1907; this J., 1907, 674.—T. F. B.

Separating liquids from vapours; Apparatus for ——. H. W. Aitken and W. Mackie. Fr. Pat. 376,972, March 23, 1907. Under Int. Conv., Aug. 4, 1906.

See Eng. Pat. 17,612 of 1906; this J., 1907, 460.—T. F. B.

Separator for gaseous mixtures; Centrifugal ——. E. Mazza. First Addition, dated March 27, 1907, to Fr. Pat. 365,534, April 24, 1906 (this J., 1906, 976).

The additions consist in making the diameter of the machine as small as possible, and in arranging the diaphragms in the form of segments of a circle and separated by only a very small interval. The outlet openings are made adjustable in order that the amount of separation may be controlled, and the speed of the gases in the apparatus is increased by delivering the gas to the separator under pressure.—W. H. C.

Vapours given off by volatile liquids; Recovery of ——. H. Diamanti and C. Lambert, Paris. Eng. Pat. 5019, March 1, 1907. Under Int. Conv., March 3, 1906.

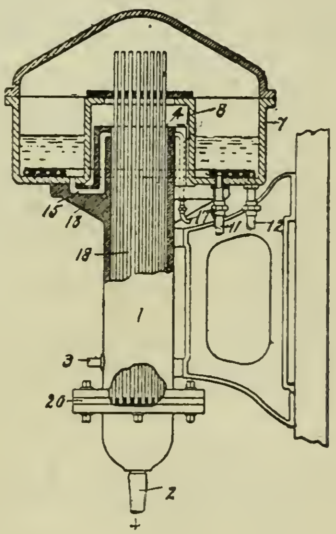
See Fr. Pat. 372,888 of 1906; this J., 1907, 518.—T. F. B.

Filter; Recuperative ——. M. Lamort, Paris. Eng. Pat. 11,925, May 22, 1907. Under Int. Conv., June 2, 1906.

See Fr. Pat. 366,807 of 1906; this J., 1906, 1081.—T. F. B.

Still. F. J. Stokes, Philadelphia, Pa. U.S. Pat. 861,485. July 30, 1907.

The water enters the casing, 1, by the pipe, 3, passes upwards and becomes heated, the gases given off escaping from the open top, 4, of the casing, 1, and the warm water flowing, as required, by the passage, 15, into the boiler, 7. The latter is supported from the casing, 1, by a number of brackets, 13, spaced apart to allow the escape of the gases from the water. It has a depression, 8, in the bottom, through which the upper ends of the tubes, 18, project into the boiler, 7. The lower ends of the tubes pass through the tube-plate, 20. Steam formed in the boiler, 7, passes down the tubes, 18, and is condensed, the distilled water escaping through the pipe, 2. An overflow, 17, is provided to keep a constant level in the apparatus. The boiler is heated by the coil, 11, 12.—W. H. C.



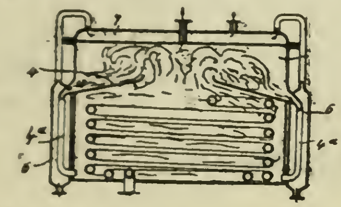
Distilling apparatus. W. F. M. Goss, La Fayette, Ind., Assignor to United States Distillation Co., Indianapolis, Ind. U.S. Pat. 862,631, Aug. 6, 1907.

The apparatus comprises a series of vertical tubular evaporators, each provided with a heater. The first evaporator is heated by external means, but the subsequent ones are heated by the vapours given off from the preceding evaporators. The heaters are also heated to the temperature of their respective evaporators by the vapours from the latter. The heaters are fed with liquid at a pressure at least equal to that obtaining in the evaporators, and the latter are fed from the heaters.—W. H. C.

Carboys; Packing-receptacle for ——. V. Verity, Assignor to Merrimac Chemical Co., Boston, Mass. U.S. Pat. 862,424, Aug. 6, 1907.

The carboy is placed in a square box provided with a yielding ring support in the bottom for the carboy and with a series of crossed "resilient" slats, fixed below and capable of being contracted above, which engage and hold the carboy. The box is provided with a cover having a hole for the neck of the carboy and which rests on the contracting device for the slats.—W. H. C.

Foaming liquids; Apparatus for treating ——. F. H. Lehnert, Assignor to E. Fischer, Dresden, Germany. U.S. Pat. 863,031, Aug. 13, 1907.



The vessel is divided into upper and lower compartments by the partition, 4, and is provided with a hollow condensing cover, 7, through the supply- and exit-pipes, 6, 6, of which, cooling ducts, 4a, lead from the upper to the lower compartment.—W. H. C.

Separating the more soluble constituents of a material from the less soluble constituents thereof; Method of ——. T. Griswold, jun., Midland, Mich., Assignor to The Ontario Nickel Co., Ltd., Worthington, Canada. U.S. Pat. 863,061, Aug. 13, 1907.

Mixing and settling vessels are arranged alternately in a series, and the material to be separated, and the solvent, are passed through the series in opposite directions. The general direction of the solvent and material through the whole series being maintained, the solvent and material pass in the same direction through the mixing vessels, but in opposite directions through the settling vessels. The solvent and material are consequently alternately thoroughly intermixed and separated.—W. H. C.

Washing; Method of ——. T. Griswold, jun., Assignor to E. O. Barstow, Midland, Mich. U.S. Pat. 863,062, Aug. 13, 1907.

The process is similar to that described in the preceding abstract, but the separation takes place in centrifugal chambers arranged alternately with the mixing chambers. —W. H. C.

Separating the more soluble constituents of a material from the less soluble constituents thereof; Means for ——. T. Griswold, jun., Midland, Mich., Assignor to The Ontario Nickel Co., Ltd., Worthington, Ontario. U.S. Pat. 863,168, Aug. 13, 1907.

The claims are similar to those of the preceding abstracts of U.S. Pats. 863,061, and 863,062, of 1907, and provide for conveying the material from the upper part of one settling chamber and the lower part of another settling chamber to a mixing chamber. From the latter the mixture is delivered to a third settling chamber. The settling chambers are provided with baffle-boards. —W. H. C.

Drying apparatus. A. O. Dupuy, East Bridgewater, Mass. U.S. Pat. 863,704, Aug. 20, 1907.

The apparatus consists of a tier of substantially horizontal "return bend flues" forming shelves on which the material to be dried is placed. The inner ends of the flues are connected by "flow and return headers," and the outer ends are carried by brackets movably attached to standards placed between the flues. Air and the products of combustion are circulated from a furnace through the flues.—W. H. C.

Drying stove. P. Ostertag, Winterthur, Switzerland. U.S. Pat. 864,186, Aug. 27, 1907.

See Eng. Pat. 7784 of 1907; this J., 1907, 955.—T. F. B.

Vacuum; Apparatus for creating and maintaining a ——. A. Manvers and H. Phillips, Sydney, N.S.W. U.S. Pat. 863,863, Aug. 20, 1907.

See Eng. Pat. 11,724 of 1906; this J., 1906, 1081.—T. F. B.

Vacuum apparatus; Low temperature ——. Soc. L'Air Liquide, A. d'Arsonval and G. Claude. Fr. Pat. 376,565, June 16, 1906.

The vessels in which the vacuum is to be produced, and the absorbing vessels, are each connected to an intermediate chamber, one side of which is tightly closed by a membrane. By means of a screw or other device, this membrane can be caused to close the end of one of the tubes, so that the vessel to which it is connected is entirely shut off.—W. H. C.

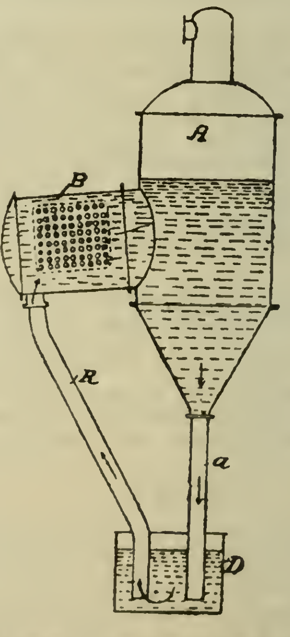
Emulsions; Process of making ——. O. Pirsch. Fr. Pat. 375,594, March 11, 1907. Under Int. Conv., Aug. 8, 1906.

The emulsion is made by using one of the component liquids as the working fluid in an injector so that it draws in the other liquid and the two leave the injector thoroughly mixed. A further quantity of liquid may be added to the emulsion by using the already formed emulsion as the working fluid in the injector.—W. H. C.

Heating, cooling and evaporating liquids; Arrangement for ——. F. Rehne. Fr. Pat. 376,337, April 3, 1907.

The liquid to be treated is contained in a tank in which the heating or cooling device is placed. This consists of a drum or tube, of any convenient section, with double walls, through the space between which, the heating or cooling medium is circulated. The outer and inner walls of the drum are connected by a large number of short tubes through which the liquid to be heated or cooled can circulate, so that a large surface is afforded for the action of the medium. Further, double-walled cross tubes are provided. The heating or cooling medium circulates through the annular space of these tubes, and the liquid to be treated circulates through the inner tubes.—W. H. C.

Evaporator for saline liquids. C. Heckmann. Ger. Pat. 183,313, April 9, 1904.



The liquid is heated in one or more chambers, B, connected to the side of the chamber, A, in which the separation of the crystals takes place. The crystals which separate in A, fall through the pipe, *a*, into the receptacle, D, from which they are removed from time to time. As vapour cannot escape in the chamber, B, a vigorous circulation of the liquid is attained between A and B by way of the pipe, R.—A. S.

Clear extracts ; Apparatus for obtaining ——. Besemfelder and Firma W. Schuler. Ger. Pat. 180,598, Oct. 13, 1905.

The apparatus consists of a jacketed cylindrical vessel of porous "filter-stone," provided with inlet and outlet openings and with a worm-conveyor. The sides of the vessel next to the material under treatment have relatively large pores, whilst the reverse sides have very fine pores, so that the extract is clarified on passing through, and can then be passed on to the next extraction vessel or to the apparatus for recovering the solvent.—A. S.

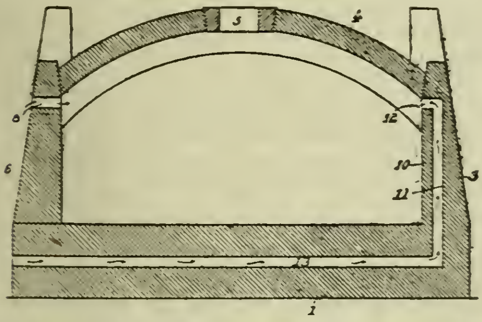
II.—FUEL, GAS, AND LIGHT.

Patents.

Peat ; Process of preparing ——. C. U. Greeley, Bangor, Me. U.S. Pat. 863,385, Aug. 13, 1907.

This process of treating peat and similar non-fibrous vegetable deposits, so that they may be freed from moisture by pressure, consists in breaking up the structure of the peat, and dissolving out the binding constituents, by boiling it with an aqueous alkaline solution, such as sodium carbonate, and then coagulating the mass both in suspension and in solution, and cooling it, by adding a cold solution of a reagent that has an acid reaction, such as alum, in a quantity more than sufficient to neutralise the alkalinity.—W. C. H.

Coke-oven. G. C. Landis, Connellsville, Pa. U.S. Pat. 864,099, Aug. 20, 1907.



The coke-oven has the form shown in the figure, which is a vertical section from front to rear. Each oven has an opening, 5, in the roof, 4, and an air-passage, 13, in the floor, 1. Air passes as shown by the arrows through the passage, 13, up the passage, 11, in the rear wall, 3, and through the opening, 12, above the inner wall, 10. This opening, 12, extends the whole width of the rear wall, so that a sheet of air, the width of the oven, passes over the contents. There is also an air-opening, 8, in the front wall, 6, of the oven.—W. H. C.

Gas furnace installation. H. Koppers, Essen on Ruhr, Germany. U.S. Pat. 864,545, Aug. 27, 1907.

See Eng. Pat. 10,412 of 1906 ; this J., 1907, 672.—T. F. B.

Gases of dry distillation or gasification ; Process for withdrawing without danger the combustible but low-grade —— during the charging and discharging of retorts, coke ovens, and the like. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 21,269, Sept. 25, 1906. Under Int. Conv., Oct. 23, 1905.

See Fr. Pat. 370,690 of 1906 ; this J., 1907, 310.—T. F. B.

Gas producers. H. Becker, Pontypool, and O. T. Greener, Griffithstown. Eng. Pat. 18,081, Aug. 11, 1906.

See Fr. Pat. 369,682 of 1906 ; this J., 1907, 191.—T. F. B.

Carburetting air and gases or for gasifying hydrocarbons ; Process and apparatus for ——. W. von Dulong, Witaschütz, Germany. Eng. Pat. 24,348, Oct. 31, 1906.

See Fr. Pat. 371,005 of 1906 ; this J., 1907, 249.—T. F. B.

Air-gas ; Method and apparatus for producing ——. G. Grobach, Berlin. Eng. Pat. 3610. Feb. 13, 1907. Under Int. Conv., Feb. 14, 1906.

This apparatus for vaporising liquid combustibles consists of a receptable partly filled with the liquid hydrocarbon, and containing a number of absorbent bodies dipping into the liquid. These bodies are in the form of long thin rods, and are "arranged in rows in such a manner that the absorbent bodies of one row are reciprocally displaced with regard to the other rows," and consequently in horizontal cross-section produce a sort of checker-work appearance. The air is compelled to follow an ascending zig-zag course through the receptacle by the arrangement of horizontal partitions. The absorbent bodies may consist of rods provided at intervals along their length with projecting rings.—W. C. H.

Gas-producing apparatus. J. N. Whitman, Philadelphia, Pa. U.S. Pat. 863,817, Aug. 20, 1907.

The apparatus consists of a combustion chamber, provided with mechanism for feeding in solid fuel, and for withdrawing ashes, and a gas-holder. A passage leads from the top of the combustion chamber to the gas-holder, and another from the gas-holder to the combustion chamber. This latter passage contains an automatically operating valve, controlled by the pressure of the gas in the gas-holder, which regulates the rate at which the mechanism supplies fuel to the combustion chamber. —W. C. H.

Hydrogen gas ; Installation for the production of ——. A. Thoms. First Addition, dated March 14, 1907, to Fr. Pat. 366,658, May 29, 1906 (this J., 1906, 1034).

The present additional patent covers the application of the arrangements described in the main patent, to installations for the manufacture of gas from hydrocarbons such as petroleum, ligroïn, benzine, &c.—A. S.

Gases ; Apparatus for cooling and washing ——. A. Meyer and E. Hastert, Dudelange, Luxembourg. Eng. Pat. 18,014, Aug. 10, 1906.

The apparatus consists of a horizontal, cylindrical vessel, having on its under side funnel-shaped projecting pieces, provided with slides at the bottom for removing the mud. A longitudinal central rotating shaft passes through the vessel and carries a number of perforated plates or sieves for distributing the gas, which enters the vessel at one end, and leaves at the other. One or more series of perforated tubes are arranged in such a manner that each plate is uniformly cooled by fresh water, and each element of the sieve surface is freed from dust by rotation. The level of the water in the bottom of the vessel is maintained at such a height that the sieves do not dip into it during rotation.—W. C. H.

Gas separator and scrubber ; Centrifugal ——. F. Burger, Assignor to H. M. Williams, Fort Wayne, Ind. U.S. Pat. 861,634, July 30, 1907.

The apparatus consists of a casing with an inward projection, provided with a circular groove, and a rotating disc, provided with paddles on its under side, arranged adjacent to the groove. On the upper side of the disc, is a sleeve extending upwards, which embraces the inlet pipe of the apparatus. The disc is supported and rotated by a shaft surrounded by a sleeve connected with the bottom of the casing. Beneath the disc and paddles, is a dished plate which engages the groove and has perforations at its edges and a central opening surrounding the supporting shaft.—W. C. H.

Gas filter. F. D. Marshall and S. Hersey, London. U.S. Pat. 864,012, Aug. 20, 1907.

See Fr. Pat. 369,965 of 1906 ; this J., 1907, 190.—T. F. B.

Filaments and other incandescing bodies for use in electric lamps or other apparatus ; Methods of manufacturing conductive ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co. of Schenectady, N.Y., U.S.A. Eng. Pat. 18,745, Aug. 21, 1906.

The method described is designed for the removal of mercury, cadmium, etc., from filaments obtained by first mixing together powdered tungsten and an amalgam of mercury and cadmium, then squirting the mixture into filaments, and finally expelling the volatilisable metals by heat. The filament, containing the volatilisable substances, is attached to leading-in wires, and is introduced into a glass vessel which contains a perforated plate of aluminium, or other mercury absorbent, and a tray containing an energetic drying agent such as phosphorus pentoxide. The air is then pumped out of the vessel, and an alternating current is passed through the filament to drive off the mercury, cadmium, etc. The aluminium plate appears to take up the metallic vapours, whilst the phosphorus pentoxide absorbs the moisture due to water, hydrocarbons, etc., in the materials used.—H. B.

Electric conductors from refractory metals and materials suitable for use in electric lamps, furnaces, and other apparatus; Manufacture of ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co. of Schenectady, N.Y., U.S.A. Eng. Pat. 18,749, Aug. 21, 1906.

In manufacturing filaments, etc., from refractory non-ductile metals, such as tungsten, molybdenum, titanium, etc., the material is compressed into a rigid rod, the latter is heated *in vacuo* to expel occluded gases, and the end of it is dipped into a bath of fused ductile metallic substance (such as copper, cadmium, or alloys). The molten substance diffuses through the rod to its extreme upper end. The impregnated rod is allowed to cool, removed from the vacuum vessel, and is then capable of being rolled, drawn, or extruded into filaments, etc., from which the fusible, ductile metal is subsequently evaporated by means of a strong electric current *in vacuo*, leaving the refractory metal in a coherent, sintered condition.—H. B.

Tungsten filaments for electric lighting and heating; Manufacture of —— *by the reduction of tungstic acid.* Allgem. Elektricitäts-Ges., Berlin. Eng. Pat. 7407, March 27, 1907. Under Int. Conv., March 30, 1906.

Filaments of metallic tungsten are prepared by moulding colloidal tungstic acid, without the addition of an organic binding material, into the desired shape and then heating it in a reducing atmosphere. The colloidal substance may be diluted more or less with water, according to the thickness of filament required.—H. B.

Electric incandescence lamps; Process of manufacture of luminous bodies for ——. H. Kuzel. Fifth Addition, dated March 9, 1907, to Fr. Pat. 359,025, Jan. 9, 1905.

This addition comprises a method of carrying out the process of the original patent (see Eng. Pat. 28,154 of 1904; this J., 1906, 115), for making articles of all kinds, in which colloïdal elements ("peptisés") are employed: *viz.*, chromium, manganese, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, iron, nickel, cobalt, arsenic, antimony, lead, copper, boron, and silicon, either separately, or two or more together. The mixture may be used alone, or added to amorphous or crystalline powders of these elements to form plastic masses, which are moulded in any known way, and are then dehydrated by the use of a pressure of from 20 to 200 atmospheres, and after drying, are brought to a crystalline condition by the process described in the original patent.—W. C. H.

Filaments for electric lighting; Process of manufacture of ——. Parker Clark Electric Co. Fr. Pat. 376,412, April 5, 1907.

The filament is heated by means of an electric current, in an atmosphere of hydrocarbon gas, such as marsh gas, and olefiant gas, and a reagent containing oxygen, such as carbon dioxide, in the presence of a volatile compound of silicon. In this way the compound of silicon (*e.g.*, silicon tetrachloride) is decomposed, and the silicon deposited on the filament; the chlorine liberated, is absorbed by the olefiant gas with the formation of ethyl- or ethylene chloride, and the carbon dioxide is reduced to the monoxide.—W. C. H.

Filament for incandescence lamps. Parker Clark Electric Co. Fr. Pat. 376,413, April 5, 1907.

The filament is designed in such a way that its surface may have a better conductivity than the interior, and may carry a greater current density. It is composed of two or more different substances, each of which has a negative temperature coefficient; the substances are placed one within the other, that on the exterior being the better conductor. As the substances employed have almost the same negative temperature-coefficient, and the better conductor is on the outside, a larger proportion of the total current passes along the surface, from which light is emitted by radiation. The substances specially applicable for this purpose are carbon and silicon, of which the former has a greater electrical resistance than the latter. The method of manufacture is described in the preceding abstract.—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Wood vinegar. D. Hooper. Indian Museum Ann. Rep. 1906/7, 14.

Two samples of pyroligneous acid contained 8·5 and 10·1 per cent. of acetic acid respectively, the first sample being distilled from wood, and the second from cocoanut shells. This acid is useful for coagulating rubber latex, and its preparation is recommended as a means of utilising forest refuse.—W. P. S.

Patents.

Wood-distilling apparatus. E. G. Jewett, Bellingham, Wash. U.S. Pat. 863,718, Aug. 20, 1907.

The wood contained in a crate is lowered into a vertical retort set in a furnace, and the top of the latter is closed. Steam is passed through a "fire-screen" around the retort and becomes superheated; it is then admitted into the upper part of the retort through a number of nozzles. The steam, along with the products of distillation, escapes from the bottom of the retort through a pipe. The crate is divided into upper and lower compartments by a slatted partition, under which troughs are arranged to convey the products of distillation from the upper half of the crate on to the inclined bottom of the retort. —W. H. C.

Acetone; Industrial manufacture of ——. Pagès Camus et Cie. Second Addition, dated March 8, 1907, to Fr. Pat. 361,379, April 14, 1905 (this J., 1906, 687).

The addition consists in employing thin layers of good conducting material as supports for the reacting or catalytic body, and in arranging the decomposer so that it presents a surface of great length but of small diameter. The pyroligneous acid is preheated and deprived of its tar, before it is delivered to the decomposer, and the condensation and washing of the gas is effected at increased pressure.—W. H. C.

Tar; Process and apparatus for treating ——. The Waterworks, Lighting, and Power Investment. Fr. Pat. 376,876, April 18, 1907.

See Eng. Pat. 4427 of 1906; this J., 1906, 632.—T. F. B.

Oil testing [*viscosity and flash point*] *apparatus.* W., T. W., and A. Lees. Eng. Pat. 27,036, Nov. 28, 1906. *See* XXIII.

Petroleum and other similar hydrocarbons; Process for saponifying ——. F. J. Lothammer and C. Trocquenet, Assignors to E. Leon, Paris. U.S. Pat. 864,753, Aug. 27, 1907.

See Fr. Pat. 338,636 of 1903 and addition thereto; this J., 1904, 655.—T. F. B.

Petroleum oil and spirit, shale oil, resin oil, and similar products; Method of purifying and deodorising ——. A. Haller, P. Sabatier and J. B. Senderens. Fr. Pat. 376,496, June 14, 1906.

The vaporised liquid under treatment is passed, along with a current of hydrogen or a gaseous mixture rich in hydrogen (*e.g.*, water-gas, coal-gas, etc.) over metals (*e.g.*, nickel, copper, cobalt, iron, platinum, etc.) in a divided state and heated to a temperature between 100° and 350° C. Impurities in the oil, likely to affect the above metals, are removed by first passing the oil vapours through a column of copper heated above 350° C. For treating crude oil, the method may be combined with the distillation process.—C. S.

Petroleum spirit; Method of purifying ——, and the resulting product. A. Fama. Fr. Pat. 376,601, April 11, 1907. Under Int. Conv., April 12, 1906.

HEAVY petroleum spirit (sp. gr. 0·700—0·750) is purified by emulsifying it with oxidising agents, such as potassium bichromate, potassium permanganate, barium dioxide, chloric acid, chlorates or perchlorates, which disengage a certain quantity of ozone in presence of sulphuric acid or other strong mineral acids: or the spirit may be treated with ozone directly. The product is said to be free from the impurities that otherwise render it unsuitable for use in internal combustion motors.—C. S.

Sulphuric acid, spent, of different origins; Process for the regeneration of ——. J. Fleischer. Ger. Pat. 182,846, July 22, 1906. *See* VII.

IV.—COLOURING MATTERS AND DYESTUFFS.

Dyestuff of the antique purple from Murex brandaris. P. Friedlaender. Monatsh. Chem., 1907, **28**, 991—996.

THE dyestuff extracted from *Murex brandaris* by digestion with dilute hydrochloric acid (1 : 1) on the water-bath until almost dry, and, after washing with hot water, alcohol, and ether, extraction with anisol, separates from nitrobenzene in blunt crystals with a coppery lustre. It is insoluble in all the ordinary solvents, but dissolves slightly in high-boiling hydrocarbons, quinoline, phenol, and aniline with a blue-violet colour. It resembles Indigo very closely, but differs from this in being more insoluble and also in being only slightly soluble in sulphuric acid in the cold, giving a red-violet coloration, which on gently warming, becomes brownish-violet. On the addition of water to this solution, a red-violet precipitate, apparently of the original substance, is obtained. With fuming sulphuric acid, sulphonation takes place with formation of a blue colour, and, on standing, red-violet flakes separate. The dyestuff behaves like Indigo on treatment with alkaline reducing agents, giving a pale yellow vat from which however, on contact with air, the colouring matter separates in red-violet flakes. The quantity of dyestuff hitherto obtained (0·15 grm.) was too small to allow of quantitative analysis or dyeing experiments, but it was found to contain nitrogen and no sulphur.
—J. C. C.

Datisca Cannabina; Dyestuffs from the root of ——. II. A. Korczynski and L. Marchlewski. Anz. Akad. Wiss., Krakau, 1907, 124—127. Chem. Zentr., 1907, 2, 700—701. (See this J., 1906, 1088.)

TETRABENZENESULPHOYLDATISCETIN, $C_{15}H_6O_6(SO_2C_6H_5)_4$, is obtained by adding gradually 12·3 grms. of benzene-sulphonic chloride to a solution of 5 grms. of datiscetin in 50 grms. of pyridine at 0° C. After standing for 24 hours, the mixture is poured into dilute sulphuric acid, and after 2 days more, the new compound is separated, and re-crystallised from acetic acid. It forms white needles, melting at 188° C., fairly easily soluble in glacial acetic acid, almost insoluble in alcohol and ether. The glucoside from which datiscetin is derived, after drying over phosphorus pentoxide, has the composition, $C_{21}H_{22}O_{12}$. On hydrolysis it yields 56 per cent. of datiscetin and 33 per cent. of dextrose.—A. S.

PATENTS.

Dyestuffs of the triphenylmethane series and of intermediate products; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 20,124, Sept. 10, 1906.

SEE Fr. Pat. 369,696 of 1906; this J., 1907, 194.—T. F. B.

Monoazo dyestuffs; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort, Germany. Eng. Pat. 22,021, Oct. 5, 1906.

DYESTUFFS which give very fast, yellowish-brown shades on wool after treatment with bichromate, are obtained by combining diazotised *o*-aminophenol derivatives with *m*-diaminodiphenyl- or *m*-diaminophenylnaphthylether sulphonic acids of the general formula, $(NH_2)_2C_6H_3.O.Ar.SO_3H$, when Ar represents C_6H_4 or $C_{10}H_6$. The latter compounds are obtained by condensing dinitrochlorobenzene with phenol- or naphthol-sulphonic acids in alkaline solution, and subsequently reducing the nitro-compounds.—T. F. B.

3-Oxy-[hydroxy-](1)-thionaphthene; Production of derivatives of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 26,190, Nov. 19, 1906.

SEE Fr. Pat. 374,287 of 1907; this J., 1907, 757.—J. C. C.

Lake; Colouring matter ——. C. Immerheiser, Assignor to Badische Anilin und Soda Fabr. U.S. Pat. 863,396, Aug. 13, 1907. *See* XIII*A*.

Methylthiophenol-ortho-carboxylic acid and derivatives thereof; Manufacture of ——. O. Imray, London. From Meister, Lucius und Brüning, Hoechst on Maine, Germany. Eng. Pat. 593, Jan. 9, 1907.

METHYLATING agents are caused to react with thiophenol-carboxylic acid or its derivatives, or with intermediate products obtained in the preparation of the latter. Thus the parent material may be the product of reaction of diazotised *o*-aminobenzoic acid on a soluble metallic sulphide, or it may be an ethereal thiocarbonate of the general formula, $C_6H_4{<}\begin{matrix}CO.OH & (1)\\ S.CS.OR & (2)\end{matrix}$, or a thiocyanogen compound of the formula, $C_6H_4{<}\begin{matrix}CO.OH & (1)\\ S.CN & (2)\end{matrix}$, etc.
—F. M.

[Azo] dyestuffs fast to acid; Process of making substantive ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 376,888, April 18, 1907. Under Int. Conv., April 25, 1906.

SEE Eng. Pat. 9548 of 1907; this J., 1907, 960.—T. F. B.

Dyestuffs; Manufacture of new substantive ——. O. Imray, London. From Soc. of Chem. Ind. in Basle, Switzerland. Eng. Pat. 6814, Mar. 21, 1907.

THE tetrazo-derivative of an azoxyamine or an azoamine is combined with two molecular proportions of substituted amino-naphtholmono- or di-sulphonic acids containing an aminoarylacidyl, an anhydroaminoarylacidyl, an aminoarylthiazole or an aminoaryloxazole group having a heteronuclear amino-group. One molecular proportion of one of these acids and one molecular proportion of another or of a phenol- or naphthol-carboxylic or -sulphonic acid may also be used. The dyestuffs obtained, dye cotton direct and when diazotised on the fibre or in substance and developed with naphthol or a naphthol derivative, yield shades varying from orange to blue-red which are fast to acids and, in some cases, very fast to washing. Example 1: The tetrazo-derivative of *m*-diaminoazoxybenzene is combined with two molecular proportions of *m*-aminobenzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid in alkaline solution. Example 2: The tetrazo-derivative of azoxytoluidine (from *p*-nitro-*o*-toluidine) is combined with one molecular proportion each of *m*-aminobenzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid and *m*-aminobenzoyl-2-amino-8-naphthol-6-sulphonic acid in alkaline solution. Example 3: The tetrazo-derivative of the first example is combined with one molecular proportion of *m*-aminobenzoyl-2-amino-5-naphthol-1 : 7-disulphonic acid in alkaline solution, and the intermediate product combined with one molecular proportion of 1 : 4-naphtholsulphonic acid in neutral or faintly alkaline solution.—J. C. C.

Tetrazo dyestuffs ; Production of substantive ——. Société pour l'Industrie Chimique à Bâle. First Addition, dated June 22, 1906, to Fr. Pat. 337,449, Dec. 5, 1903.

SEE Eng. Pat. 6814 of 1907 ; preceding.—T. F. B.

Azo dyestuff ; Black mordant ——. A. L. Laska, Offenbach on the Maine, Assignor to Chem. Fabrik Griesheim Elektron, Frankfort, Germany. U.S. Pat. 863,290, Aug. 13, 1907.

BY combining diazotised *o*-aminophenol or its derivatives with 2.8-dihydroxynaphthalene-6-sulphonic acid, a dyestuff is obtained "which dyes cotton from an acid bath" in bordeaux to black-violet shades, which become deep black on chroming.—F. M.

Leucogallocyanines ; Process of making ——. C. De la Happe, Assignor to The Firm of Dye Works, formerly L. Durand, Huguenin and Co., Basel, Switzerland. U.S. Pat. 863,907, Aug. 20, 1907.

THE leucogallocyanine corresponding to the gallocyanine derived from nitrosodimethylaniline and gallic acid is heated to 100° C. with water in presence of an alkali oxide, whereby a leucogallocyanine is obtained which corresponds to the gallocyanine derived from pyrogallol.—J. C. C.

Leucogallocyanine derived from pyrogallol ; Process of preparing a ——. Manuf. des Mat. Col., ancien. L. Durand, Huguenin et Cie. Fr. Pat. 377,024, April 20, 1907. Under Int. Conv., Jan. 21, 1907.

SEE U.S. Pat. 863,907 of 1907 ; preceding.—T. F. B.

Dyestuffs by condensing gallocyanines with aromatic diamines ; Production of greenish-blue ——, *and conversion of the dyestuffs into leuco-compounds.* Manuf. des Mat. Col., ancien. L. Durand, Huguenin et Cie. Fr. Pat. 376,794, April 16, 1907. Under Int. Conv., Sept. 25, 1906.

SEE Eng. Pat. 21,949 of 1906 ; this J., 1907, 403.—T. F. B.

V.—PREPARING, BLEACHING, DYEING PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Dyeing of wool with Crystal Scarlet ; Distribution of acid and base in the ——. E. Knecht. J. Soc. Dyers and Col., 1907, 23, 230.

THE author has studied the behaviour of the pure magnesium salt of Crystal Scarlet towards wool when dyed in a bath containing sulphuric acid. At the end of one hour the amount of dyestuff remaining in the bath was about 1½ per cent. of the original amount, and the whole of the magnesium was found in solution. When the magnesium salt of the dyestuff is treated with sulphuric acid, about 90 per cent. separates from the hot solution unchanged, and the author considers that the relatively small amount of colour acid which is liberated by the excess of sulphuric acid in the dye-bath is taken up by the fibre, and, the equilibrium being thus disturbed, more of the salt is decomposed and the reaction proceeds in this way until dyeing is complete.—J. C. C.

PATENTS.

Textile fibres from woody plants or from plants containing "salicic acids" ; Process and apparatus for the production of ——. Soc. Anon. pour L'Acquisition et l'Exploitation des Brevets Typha. Fr. Pat. 376,016, Feb. 28, 1907.

THE plants *e.g.*, reeds or rushes, are digested under pressure with a solution of magnesium bisulphite, which has been previously neutralised with an ammoniacal solution of sodium carbonate. The product thus obtained is washed in a machine consisting of a number of small "cradles" which have perforated bottoms and are carried by an endless band. The material to be washed is placed in the "cradles" and these then pass underneath a series of pipes which discharge water directly on to the material. —P. F. C.

Silk, artificial ; Process for preparing initial material for the manufacture of ——. Hanauer Kunstseidefabrik. Fr. Pat. 377,326, May 1, 1907. Under Int. Conv., May 2, 1906.

SEE U.S. Pat. 839,825 of 1907 ; this J., 1907, 340.—T. F. B.

Artificial silk filaments from nitrocellulose ; Process for the manufacture of ——. Kunstfäden Ges.m.b.H., Jülich, Germany. Eng. Pat. 27,527, Dec. 3, 1906. Under Int. Conv., Dec. 4, 1905.

SEE Fr. Pat. 371,544 of 1906 ; this J., 1907, 468.—T. F. B.

Artificial textile fibres ; Manufacture of ——. Vereinigte Glanzstoff-fabriken, Elberfeld, Germany. Eng. Pat. 16,495, July 18, 1907. Under Int. Conv., Aug. 3, 1906.

THE threads or fibres passing from the nozzles through the precipitating liquor, are laid in groups on conveying bands which move in an upward direction, at a speed regulated to the rate of flow from the nozzles. On these bands the fibres are washed or irrigated (on the countercurrent principle, so that the chemicals used can be easily recovered) to free them from the precipitating liquid, and then passed to cylinders upon which they are dried. —F. M.

Filaments out of viscose or similar viscous material ; Process for forming ——. C. A. Ernst, Lansdowne, Pa. ; Assignor to S. W. Pettit, Philadelphia, Pa. U.S. Pat. 863,793, Aug. 20, 1907.

SODA-CELLULOSE, obtained by treating cellulose with sodium hydroxide, is subjected to the action of carbon bisulphide, and the cellulose xanthate thus formed is dissolved in an alkaline solvent which contains sodium sulphite. The freshly-prepared viscose solution is then ejected through minute apertures into a coagulating bath having a slightly acid reaction. A dilute solution of sodium bisulphite can be used for this purpose. The filaments thus prepared are immersed in a second bath of sodium bisulphite solution, until the coagulated viscose has been completely transformed into cellulose.—P. F. C.

Alcohol and ether contained in artificial silk, hair, films, and all products obtained by forcing a collodion solution through an orifice ; Recovery of the mixture of ——. Soc. pour la Fabr. en Italie de la Soie Artif. par le Procédé de Chardonnet. First Addition, dated Mar. 11, 1907, to Fr. Pat. 367,803, July 6, 1906.

ACCORDING to the principal patent, the products obtained by forcing a collodion solution through an orifice, are washed either by pure water, or by an aqueous solution of some metallic salt, which is led through a perforated pipe placed above the bobbins or rollers on which the product is being wound. In the present addition an apparatus is described which is applicable to rollers or bobbins which are driven by a rotating cylinder with which they are in contact. Around the lower half of the driving cylinder, a hemi-cylindrical trough is arranged, into which the washing liquor is led at one end by a pipe which almost touches the bottom, leaving by an overflow pipe at the other end of the trough. The overflowing liquor is run either into the next trough if several are being used, or into the distilling apparatus. When the machine is working, the rapidly rotating cylinder carries with it some of the washing liquid which is thus brought into intimate contact with the product which is being wound on the bobbins. It becomes charged with the mixture of alcohol and ether and then falls back into the trough.—P. F. C.

Fibrous materials ; Process of and apparatus for retting or degumming and subsequently cleaning or drying —— *preparatory to obtaining the fibre therefrom.* C. R. Rogers, Melbourne. Eng. Pat. 18,127, Aug. 13, 1906.

SEE Fr. Pat. 369,138 of 1906 ; this J., 1907, 92.—T. F. B.

Fibrous material ; Process of retting or degumming ——. C. R. Rogers, Melbourne. U.S. Pat. 864,565, Aug. 27, 1907.

SEE Fr. Pat. 369,138 of 1906 ; this J., 1907, 92.—T. F. B.

Ramie; Process for chemically decorticating ——, and retting and degumming all textiles in a single bath. A. Blachon and J. Peretmère. Fr. Pat. 377,316, July 7, 1906.

See Eng. Pat. 16,142 of 1906; this J., 1907, 819.—T. F. B.

Retting system and a process for the utilisation of the residual liquors. Soc. Civile d'Etudes de tous Procédés et Dispositifs de Rouissage. Fr. Pat. 376,150, Mar. 26, 1907. Under Int. Conv., Dec. 11, 1906.

The apparatus used comprises a double series of tanks which can be connected or isolated at will. Fresh or "regenerated" water is run into each tank by means of a pipe which reaches nearly to the bottom and then branches into a series of parallel perforated pipes which form a sort of grating or false bottom. The flax is placed upon this grating, so that a continuous flow of water through the material is obtained. After its passage through the flax, the water runs through a series of overflow pipes into discharge channels. The first part of the overflow contains the more soluble substances. It is led through a separate discharge channel and is then pumped into a vessel where the dissolved substances are recovered. The regenerated water is returned to the tanks. The rest of the overflow, which contains a much smaller proportion of soluble matter, is pumped into a different tank and separately treated. In each case the water is regenerated by the addition of chalk, potassium carbonate, or a suitable basic salt, and the precipitated organic matter can be used as a manure.—P. F. C.

Fats; Method of saponifying —— in globular state by means of alkali carbonates, and application thereof [cleansing textiles]. E. de Grousseau. Fr. Pat. 376,122, March 25, 1907. *See* XII.

Felting animal fibres; Method of ——. G. Ita, Vienna. Eng. Pat. 28,375, Dec. 12, 1906.

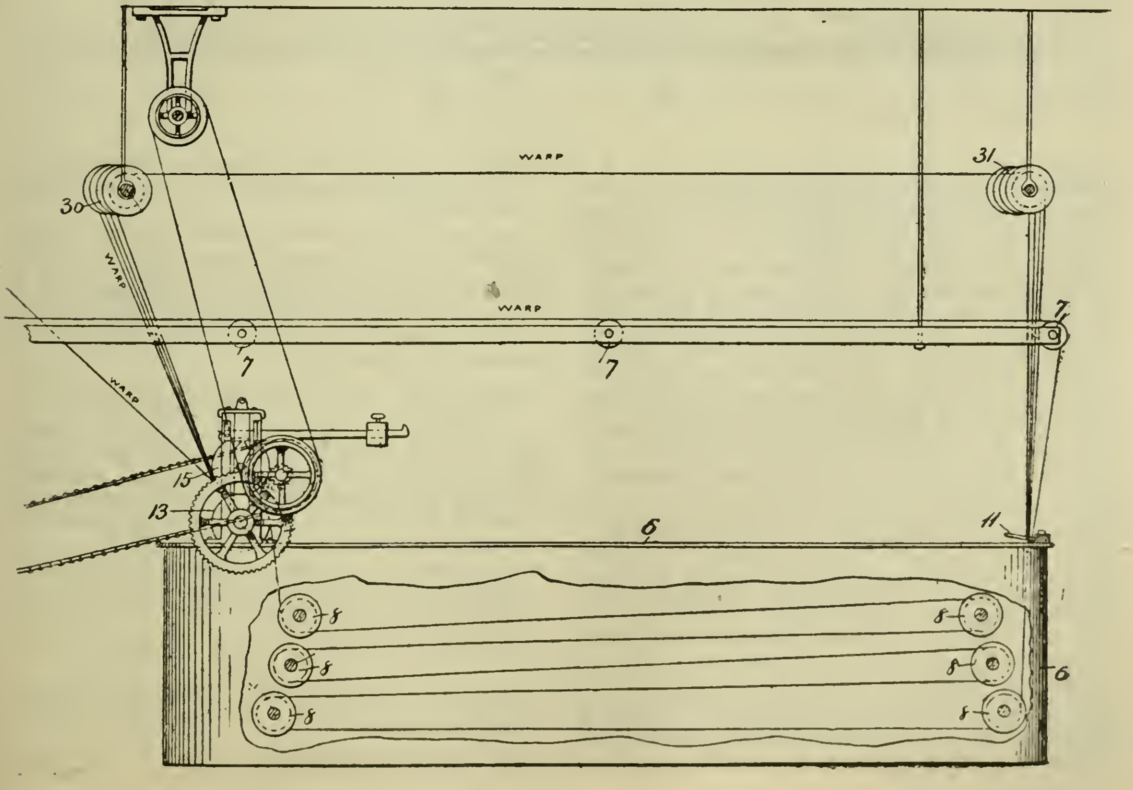
See Fr. Pat. 372,405 of 1906; this J., 1907, 525.—T. F. B.

Two-coloured or many-coloured effects in fabrics dyed in the piece; Producing ——. R. O. Biedermann, Barmen, Germany. Eng. Pat. 2356, Jan. 30, 1907.

A suitable metallic powder, such as zinc dust or finely-divided aluminium, is fixed on to part of the undyed thread by means of some suitable binding agent such as albumin or collodion. The fabric is then woven and dyed with a dyestuff which is reducible by hydrosulphite, but is stable to sulphurous acid. The dyed piece is next passed through a warm bath of sulphurous acid; the metallic powder, with which some of the threads are impregnated, reduces the sulphurous acid to hydrosulphite, which at once discharges the colour of the impregnated threads. Variegated effects can be obtained by dyeing the thread, before impregnation, with a dyestuff which is stable to hydrosulphite.—P. F. C.

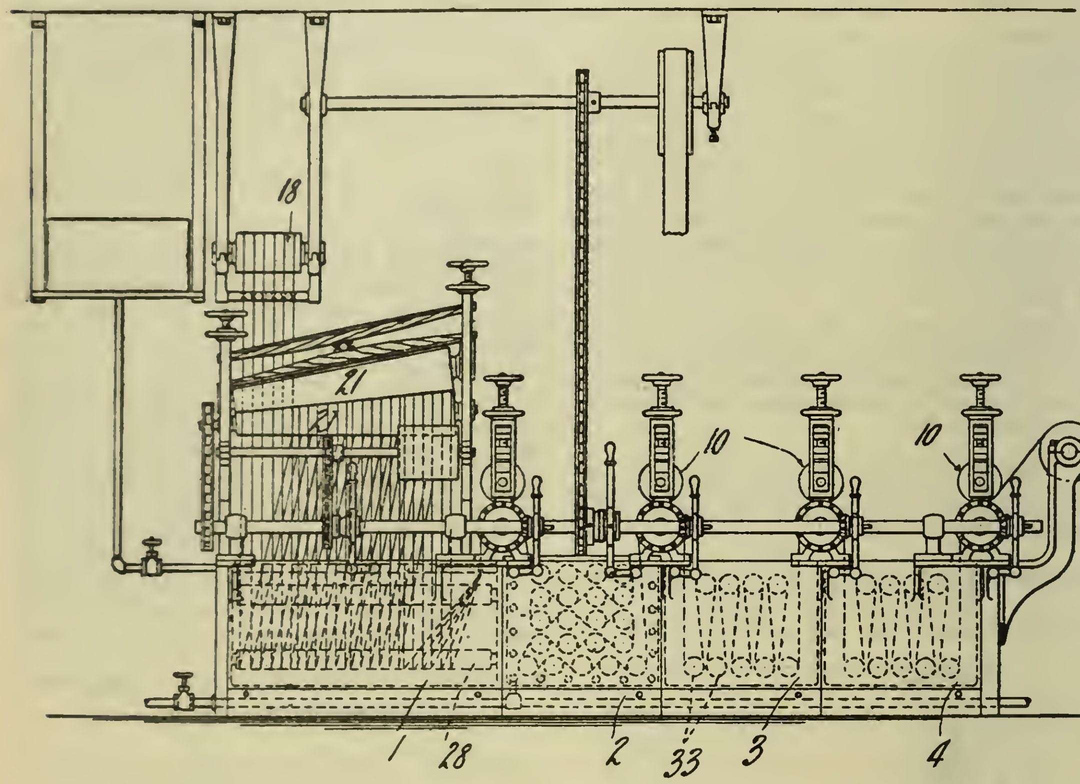
Textile fibres; Apparatus for treating [dyeing] ——. R. G. Campbell, Greensboro, N.C. U.S. Pat. 856,029, June 4, 1907.

The fibres, in the form of separate strands of warp, are unwound from the warp beams and travel over the guiding rollers, 7, towards the vat, 6, which contains the dye-liquor or the like. The warps, after being separated by the guide fingers, 11, pass down to the bottom of the tank and travel through the liquid contained in it. During their passage they are guided by a series of rollers, 8, each of which is provided with grooves in order to keep the warps separate. On leaving the tank, the material enters the nip of two rollers, 13 and 15, which draw the warps through the machine and also squeeze out most of the liquor they contain. The lower roller is connected to the driving shaft. The warps are next separated and passed over two sets of guiding rollers, 30 and 31, each warp having a separate roller. They are then led into a second vat which is placed at the side of the first and is similar to it. The drawing roller over which the warps pass on leaving this second vat, is mounted on the same shaft as the corresponding roller of the first vat and is of equal diameter. The warps are therefore kept at a constant



tension during their passage through the whole apparatus. After passing through the second pair of squeezing rollers, the warps travel to the winding machines.—P. F. C.

Dyeing, bleaching, and sizing cotton warps; *Apparatus for* ——. J. Hartley, Springfield, Mass. U.S. Pat. 858,068, June 25, 1907.



A large tank is divided into four compartments 1, 2, 3 and 4 (see Fig.). The first is used as the dye-vat, the second as a steam-chest, the third as a washing tank, and the fourth may contain suitable sizing. Pairs of suitable squeezing rollers, 10, are arranged above the partitions and also at the outer end of the sizing vat. The threads are guided over the roller, 18, and then pass between the small ends of two conical rollers, 21, which taper in the same direction. The threads next travel down to, and underneath, a guiding roller which is placed near the bottom of the dye-vat. From here they pass up to, and over a central roller which is also immersed in the dye-liquor, and finally descend to a third roller, 28. The warps then leave the tank and pass over the lower conical roller for the second time and again descend into the dye-vat. This is repeated for a number of operations, the threads being led each time over a portion of the roller, 21, of greater diameter and running at a greater peripheral speed. By this means the formation of slack of the warps, during the dyeing operation, is entirely prevented. After leaving the dye-vat for the last time, the threads pass between the first pair of squeezing rollers and then alternately under and over each of a series of horizontal rollers arranged inside the steam-box, 2, which is provided with a number of perforated steam-pipes, so arranged that the steam does not play directly on to the warps. After steaming, the threads are again squeezed and then travel through the washing tank, 3, by way of the rollers, 33. After a passage through the third pair of squeezing rollers, the warps finally pass through the sizing tank, 4.—P. F. C.

Dyeing frame. W. Hannah, Paterson, N.J. U.S. Pat. 861,649, July 30, 1907.

A rectangular frame carries a number of removable rods. The material to be dyed is supported (in the stretched condition) between these rods, and the frame then lowered into the dye-bath.—F. M.

Dye-houses or bleacheries; *Means for ventilating* ——. J. H. Lorimer, Philadelphia, Pa. U.S. Pat. 862,981, Aug. 13, 1907.

The ceiling of the dye-house is inclined upwards towards the sides. Flues are arranged here, up which any noxious gases, steam, etc., can escape, whilst fresh air enters at the lowest point of the ceiling, the current being made to divide by a screen which runs along the dye-house just below the lowest part of the ceiling. The fresh air may be warmed if necessary.—F. M.

Dyeing machine. R. P. Smith and G. E. Drum, Philadelphia, Pa. U.S. Pat. 863,460, Aug. 13, 1907.

A perforated receptacle (with perforated lid), fitting into a dye-vat, is hinged to the side of the latter so that after the dyeing is finished, the machine can be emptied by tilting up the inner vessel. A passage connects the upper and lower portions of the dye-vat, and means for circulating the dye-liquor are provided.—F. M.

Brown shades on the fibre; *Production of* ——. H. Schmid, Mulhouse, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 863,761, Aug. 20, 1907.

See Fr. Pat. 357,472 of 1905; this J., 1906, 120.—T. F. B.

Dyeing fabrics in the width with forward movement of the cloth; *Machine for* ——. W. Peters. Fr. Pat. 376,146, Mar. 26, 1907.

This machine is a variation of the ordinary jigger, its chief characteristic being that the dye-beck is divided into three compartments by two transverse partitions. The middle compartment is provided with a well-fitting false bottom, which can be raised or lowered. The two partitions are provided with holes near their bases, which place the two outside compartments in connection with one another when the false bottom is raised. The winding rollers of the jigger are fixed in the usual manner, but the guiding and tension rollers are so arranged that the cloth does not enter the middle compartment. At the beginning of the dyeing operation, the three compartments are all filled with the dye-liquor. The cloth is then unwound from one roller and passes through the dye-liquor contained in the two outside compartments on its way to the other winding roller. As soon as about one-third of the material has left the first winding roller, the false bottom of the middle tank is raised slowly. The dye-liquor contained in the middle compartment, runs over the tops of the partitions into the two outside compartments. The rate of this transference is so adjusted that when the whole of the fabric has travelled through the machine, about one-third of the contents of the middle compartment has run into the outside compartments. The machine is then reversed and the false bottom is further raised at such a rate that when the material has passed for a second time through the machine, the whole of the dye-liquor which was contained in the central compartment, has been transferred into the two outer divisions of the tank. The devices for raising the false bottom of the middle compartment are then automatically thrown out of action, and the false bottom is lowered below the holes near the bases of the partitions, thus placing all three compartments in communication. If necessary, a further quantity of dyestuff may be added to the whole bath, and the operations repeated. It is claimed that perfectly even dyeings are obtained by this process.—P. F. C.

Printing textiles. Calico Printers' Assoc. and E. A. Fourneaux, Manchester. Eng. Pat., 29,134, Dec. 21, 1906.

If, in the production of insoluble azo-colours on the fibre, the material be padded as usual with β-naphthol for instance, then printed with an omega-methyl-sulphonic acid (obtained by treating an aromatic amine with a formaldehyde-bisulphite compound) and finally dyed, padded or cover-printed with a diazotised solution of paranitraniline, a red will result where the diazo body comes into contact with β-naphthol, but a purple shade will be produced at those parts which have been printed with the omega-compound. The novelty, is the discovery of the fact that where β-naphthol and the omega-compound are present together, diazo compounds exert a selective affinity for the latter and combine mainly or entirely with it.—F. M.

Indigo dyestuffs on animal and vegetable fibres; Printing of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 376,436, Feb. 12, 1907. Under Int. Conv., Dec. 24, 1906.

Indigo and other similar dyestuffs can be fixed by the aid of formaldehyde-hydrosulphites or formaldehyde-sulphoxylates in the presence of feeble bases or of substances which behave as such when heated. Suitable reagents for this purpose are zinc oxide, sodium sulphite, zinc carbonate, etc. Example:—160 grms. of zinc oxide are mixed to a fine paste with 130 grms. of glycerin, and 100 grms. of indigo (20 per cent.) together with a solution of 60 grms. of Rongalite C in 150 grms. of water are added. The mixture is thickened with 400 grms. of British gum (1 : 1). The fabric is printed with the paste and well dried, then steamed for two minutes out of contact with air in the Mather-Platt and finally washed.—P. F. C.

Hydrosulphite compounds which can be used for discharging colours; Production of stable ——. Ges. für Chem. Ind. in Basel. Fr. Pat. 376,206, Mar. 28, 1907. Under Int. Conv., Oct. 1 and 4, 1906.

Stable compounds of hydrosulphites, which can be directly used for all discharge effects, are obtained by causing anhydroformaldehydeaniline and formaldehyde to act in quick succession on a concentrated aqueous solution of sodium hydrosulphite. The products of the reactions are sodium phenylaminomethylsulphite ($C_6H_5.NH.CH_2.O.SO_2Na$) and sodium formaldehydesulphoxylate ($OH.CH_2.O.SO.Na$). Example:—24 parts of finely-powdered anhydroformaldehydeaniline, suspended in 200 parts of water, are mixed with 52 parts of a 75 per cent. solution of sodium hydrosulphite, and well shaken for a short time in a closed vessel. 23—30 parts of a 30 per cent. aqueous solution of formaldehyde are then added rapidly, and the whole is allowed to stand for some time with frequent shaking. The liquid is next filtered and the filtrate is evaporated to dryness in a vacuum. The product thus obtained, if present in the proportion of 280—300 grms. for each litre of discharge paste, is said to give a perfectly white discharge on Paranitraniline Red. An analogous product is obtained by mixing a suitable proportion of anhydroformaldehydeanilinebisulphite with sodium formaldehydesulphoxylate (Hydrosulphite N.F. conc. or Rongalite C), or with the commercial mixture of sodium formaldehydesulphoxylate and formaldehydesulphite (Hydrosulphite N.F., Hyraldite A).—P. F. C.

Naphthylamine Claret; Process for the preparation of a —— *which can be easily discharged.* L. Cassella und Co. Ger. Pat. 181,721, Feb. 11, 1906.

A Naphthylamine Claret which can be readily discharged, is obtained by using a β-naphtholsulphonic acid, especially the 2.7-acid, in place of a portion of the β-naphthol ordinarily employed.—A. S.

Linen; Waterproof-coated ——, *and process for producing the same.* E. A. Closmann, Tegel, Germany. U.S. Pat. 861,435, July 30, 1907.

Starched and ironed linen is coated with a solution of pyroxylin in amyl acetate, containing zinc white in suspension, and then given a final coating with a clear pyroxylin solution.—F. M.

Enamel for paper, cardboard, and textiles; Non-inflammable protective ——. L. L. Degorce. Fr. Pat. 377,039, April 20, 1907. *See* XIX.

Drying machine for textile materials. J. H. Lorimer, Philadelphia, Pa. U.S. Pat. 862,982, Aug. 13, 1907.

The patent relates to a closed machine containing a chamber in which the air entering at the bottom is heated, and which communicates at the top with the top of the chamber in which the materials to be dried are placed. The chimney, drawing off the moisture-laden air from the bottom of the drying chamber, passes through the heating chamber and a draught is thus produced.—F. M.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patents.

Dyeing paper with colours fast to light and to water; Process of ——. C. G. Schwalbe, Darmstadt, Germany. Eng. Pat. 20,119, Sept. 10, 1906.

See Fr. Pat. 370,544 of 1906; this J., 1907, 253.—T. F. B.

Colour-printing on leather and skins; Process for ——. A. Dubois. First Addition, dated Mar. 27, 1907, to Fr. Pat. 365,361, April 18, 1906.

In the principal patent the use of solutions of basic dyestuffs in alcohol for colour-printing on leather and skins is claimed. The present addition covers the use of all tinctorial substances which are soluble in alcohol.—P. F. C.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Hydrosulphites; Import duty on —— *in Mauritius.* Bd. of Trade J., Sept. 5, 1907. [T.R.]

A proclamation (No. 15 of 1907), levies a duty of 30 cents per 1000 kilos. on hydrosulphite powder (also invoiced and known as blankit) when imported into Mauritius for use in local manufactures. A surcharge of 20 per cent. of the duty leviable is also imposed under Ordinance No. 21 of 1904.

Nitrous acid ; Determination of ——. and its separation from nitric acid. G. Maderna and G. Coffetti. Gaz. chim. ital., 1907, **37**, I., 595—598.

The author makes use of the vigorous evolution of nitric oxide on adding acetic acid to a mixture of potassium ferrocyanide and alkali nitrite, as a basis for a method for the determination of nitrous acid. The method is carried out with the aid of the Lunge nitrometer, and in order to avoid the necessity of making a correction for the vapour pressure of acetic acid, citric acid is used in place of the latter. The authors used in their experiments cold saturated solutions of citric acid and potassium ferrocyanide, and found that the requisite correction amounted to 1 mm. of mercury for a column of liquid about 12 mm. high. The method can be used for the determination of nitrous acid in presence of nitric acid. It possesses the following advantages over older methods:—(1), The volume of gas can be easily read, as there is a sharp separation between the mercury and the solution; (2), less mercury is used than in Lunge's method; (3), the method can be applied to strong solutions; (4), no strong acids are used.—A. S.

Calcium carbonate ; Dissociation of ——. D. Zavrieff. Compt. rend., 1907, **145**, 428—429.

The author has repeated Le Chatelier's experiments of 1894, with additional precautions to secure uniformity of temperature. Using 5 grms. of calcium carbonate, either alone or mixed with fusible mixtures of alkali and alkaline-earth carbonates, and keeping the whole heated at definite temperatures till equilibrium was established, the following values were obtained:—

Temperature, °C. ..	926	910	892	870	840	815	725
Pressure, mm. of Hg ..	1022	755	626	500	342	230	67

—J. T. D.

Cyanogen group in salts not readily dissociated [e.g., in mercuric cyanide] ; Determination of ——. V. Borelli. *See* XXIII.

Patents.

Contact-chamber [for sulphuric anhydride]. W. C. Ferguson, Flushing, N.Y., Assignor to General Chem. Co., New York. U.S. Pat. 857,389, June 18, 1907.

The contact chamber is a relatively long, narrow upright tube, containing a series of perforated shelves on which the contact material is placed. The chamber is exposed to the air, and is of such dimensions that the cooling by radiation is sufficient to prevent the temperature within the chamber from rising too high. In order to regulate the cooling by radiation under variations in the atmospheric conditions, the chamber is furnished externally with series of ribs, between which, asbestos or other heat non-conducting material, preferably in the form of split rings, can be packed as required. Instead of asbestos rings, channels for the passage of air, heated or otherwise, may be provided about the chamber, for regulating the temperature.—E. S.

Sulphuric acid and anhydride ; Manufacture of —— by contact [chromium oxide]. A. C. Matignon, R. E. M. Trannoy, E. Urbain, A. Feige, and A. Verley. Fr. Pat. 376,629, April 12, 1907.

The use of chromium oxide in a granulated and porous condition as contact material in the manufacture of sulphuric acid and anhydride, is stated to enable the process to be conducted within the wide range of temperature between 430° and 630° C. The oxide is preferably obtained by calcination of ammonium bichromate, or of chromium nitrate or similar salts. Or, the hydrated oxide may be calcined in presence of a substance disengaging a gas, so as to leave a porous oxide behind. Inert material, such as asbestos or pumice, may be added to the chromium oxide as diluent if desired.—E. S.

Sulphuric acid ; Purification of arsenical ——. J. Raschen, A. E. Wareing, and J. H. Shores, Assignors to United Alkali Co., Ltd., Liverpool. U.S. Pat. 863,940, Aug. 20, 1907.

See Fr. Pat. 363,947 of 1906; this J., 1906, 884.—T. F. B.

Sulphuric acid of different origins ; Process for the regeneration of spent ——. J. Fleischer. Ger. Pat. 182,246, July 22, 1906.

The claim is for the separation of impurities from the spent acid by means of diffusion through suitable porous material. The process is specially suited for the treatment of the spent acid from the petroleum and paraffin industries. The acid is placed in porous earthenware vessels, which are then immersed in water. Pure sulphuric acid diffuses through into the water, whilst resinous and tarry matters are left behind. It is stated that with the aid of suitable mixing devices, and by working on the counter-current principle, the acid can be completely separated, and recovered at a strength of 45°—50° B. —A. S.

Nitric acid ; Process of concentrating ——. R. Wolffenstein and O. Boeters, Berlin. U.S. Pat. 864,217, Aug. 27, 1907.

See Fr. Pat. 371,797 of 1906; this J., 1907, 407.—T. F. B.

Sodium carbonate ; Process for obtaining —— in small crystals. H. Ostermaier. Ger. Pat. 182,462, Feb. 24, 1906.

In order to obtain small crystals without appliances for stirring and for cooling, the concentrated sodium carbonate solution is treated with about 5 per cent. of a concentrated solution of alkali silicate. After a few minutes the sodium carbonate begins to separate, and after a few hours the whole sets to a mass of fine crystals, which can be converted into a dry, marketable product by the addition of a suitable quantity of anhydrous sodium carbonate.—A. S.

Barium cyanide ; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 22,039, Oct. 5, 1906.

See Fr. Pat. 370,420 of 1906; this J., 1907, 255.—T. F. B.

Nitrides from atmospheric nitrogen ; Process for manufacturing ——, and apparatus therefor. L. Roth, Canth, Germany. Eng. Pat. 27,828, Dec. 6, 1906.

See Fr. Pat. 371,397 of 1906; this J., 1907, 319.—T. F. B.

Peroxide of potassium or a mixture rich in the same ; Manufacture of ——. G. F. Jaubert, Paris. Eng. Pat. 7641, March 30, 1907. Under Int. Conv., July 18, 1906.

An alloy of potassium with lead, zinc, or sodium, is heated moderately (not above 300° or 350° C.) in a slow current of air, whereby, it is stated, practically only the potassium is peroxidised, and pure potassium peroxide or a mixture rich in the same is obtained. Or, a liquid alloy of potassium and sodium may be oxidised by means of air at the ordinary temperature, and the potassium oxide separated, and converted into peroxide as described above. By oxidising alloys of potassium and sodium, very rich in potassium, at as low a temperature as possible, a mixture of sodium and potassium peroxides is obtained.—A. S.

Felspar ; Extraction of potassium compounds from ——. A. J. Swayze, Great Meadows, N.J. U.S. Pat. 862,676, Aug. 6, 1907.

The crushed felspar is rendered amorphous by heating alone, and is then heated under pressure with a strong solution of potassium hydroxide. A solution of potassium silicate and aluminate is thus formed.—F. Sodn.

Sulphate crystals ; Method of recovering ——. H. E. Horton, Waukegan, and F. C. Gedge, Evanston, Ill., Assignors to American Steel and Wire Co., Worcester, Mass. U.S. Pat. 863,279, Aug. 13, 1907.

It is proposed to recover a metallic sulphate from its acid solution by the addition of the metal in question, so as to sufficiently neutralise the acid. The liquid is then withdrawn and evaporated to crystallisation in a vacuum, being artificially cooled and agitated, in order to furnish small crystals. The tanks are so arranged that the process is continuous.—F. Sodn.

Ammoniacal copper solutions ; Preparation of ——. A. Lecoeur, Rouen, France. U.S. Pats. 863,801 and 863,802, Aug. 20, 1907.

See Fr. Pat. 374,277 of 1906 ; this J., 1907, 761.—T. F. B.

Ammonium nitrate ; Production of ——. E. R. Caspari and O. Nydegger, Uerdingen, and A. Goldschmidt, Düsseldorf, Assignors to R. Wedekind und Co., Uerdingen, Germany. U.S. Pat. 864,513, Aug. 27, 1907.

See Fr. Pat. 369,389 of 1906 ; this J., 1907, 94.—T. F. B.

Alkali chlorides ; Process and apparatus for the electrolysis of ——. J. Billitzer. Fr. Pat. 376,329, April 3, 1907. *See* XIA.

Hydrogen peroxide ; Process for the preparation of ——. E. Merck. Ger. Pat. 179,826, March 3, 1905.

A pure neutral solution of hydrogen peroxide is obtained by the action of water or acids on barium percarbonate. —A. S.

Alkali cyanides ; Process for the manufacture of —— *from alkali metal, nitrogen, and charcoal at a high temperature.* O. Schmidt. Ger. Pat. 180,118, Oct. 10, 1905.

Alkali cyanides are prepared by heating a mixture of alkali metal and charcoal in atmospheric nitrogen, in presence of an alkaline-earth metal, especially magnesium. It is stated that the magnesium acts as a contact substance, probably in accordance with the equations :—

$$3Mg + N_2 = Mg_3N_2 ;$$
$$Mg_3N_2 + 2Na + 2C = 3Mg + 2NaCN.$$—A. S.

Alkali cyanates ; Process for preventing the decomposition of aqueous solutions of —— *on heating.* W. Siepermann. Ger. Pat. 180,925, April 8, 1906.

The decomposition of aqueous solutions of alkali cyanates on heating, is prevented by the addition of a small quantity of caustic alkali.—A. S.

Liquid air ; Treatment of ——. [*Separation of nitrogen and oxygen.*] H. Knudsen, London. Eng. Pat. 19,033, Aug. 25, 1906.

The separator consists of a series of concentric chambers surrounded by an outer vacuum chamber. Each of the concentric chambers communicates, at its lower end, with a pipe through which liquid air is supplied, and is surrounded by coils of pipe through which cooled, compressed air passes on its way to the liquefying apparatus. The compressed air effects the vaporisation of nitrogen from the liquid air, and is itself cooled, but not to an extent sufficient to liquefy it. The vaporisation of the nitrogen is controlled by regulating the vacuum in the outer chamber. The residual liquid oxygen may be gasified by passing it through a coil surrounding the separator ; or it may be conducted to a storage tank surrounded by a vacuum chamber, and thence through a coil surrounding an evaporator into the evaporator itself. The latter is filled with shavings of brass or other non-oxidisable metal, and the gasified oxygen is collected in cylinders or in a gasometer.—A. S.

Nitrogen ; Separation of atmospheric —— *for the manufacture of nitrogen compounds.* A. V. Cunnington, Winnington, Cheshire. Eng. Pat. 25,605, Nov. 13, 1906.

A mixture of carbonaceous fuel and limestone is burnt in a lime-kiln through which air is passed, and the resulting gases, consisting essentially of carbon dioxide and nitrogen, are passed through an ammoniacal solution of brine, in a suitable apparatus, in order to obtain practically pure nitrogen for use in the manufacture of calcium cyanamide, together with sodium bicarbonate as a valuable by-product.—A. S.

Air ; Separation of the constituents of —— *by means of liquefaction.* L'Air Liquide (Soc. Anon. p. l'Etude et l'Exploit. d. Proc. G. Claude). Fr. Pat. 376,270, June 5, 1906.

In processes utilising a liquefaction of air as precedent to its separation into its constituents by fractional distillation, instead of increasing the cooling effect by the regular admission of liquid air from an independent source, liquid oxygen is so admitted, not to the upper part of the distilling column, but to the lower part of the apparatus in which oxygen resulting from the separation of the constituents of air is being distilled.—E. S.

Sulphur ; Process of extracting —— *from hydrogen sulphide and from gases containing it.* G. H. Hellsing. Fr. Pat. 376,534, April 8, 1907. Under Int. Conv., April 9, 1906.

Gases containing hydrogen sulphide are brought into contact with a strong solution of sulphurous acid, which may traverse the absorbing apparatus, and pass thence into a reservoir in which the precipitated sulphur deposits, and whence the liquor is pumped into a vessel in which it is again saturated with sulphur dioxide, for use as before. It is preferred to add a coagulant, such as sulphuric or hydrochloric acid or a suitable salt, to the sulphurous acid solution, to prevent formation of a colloidal solution of the sulphur set free.—E. S.

Bromine and iodine from spent lyes ; Process for the electrolytic recovery of ——. B. Rinck. Ger. Pat. 182,298, Jan. 17, 1906. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Porcelain ; Process of manufacture of fireproof ——. A. Schöfl and Trautmann und Mayer. Fr. Pat. 376,359, April 4, 1907.

Porcelain which is very resistant to fire and to changes of temperature, is made from a mixture of two parts of kaolin, two of felspar, and one of quartz. It can resist a temperature of Seger cone 34—35, and is not vitrified at all at cone 14. The drying is carried out at a low temperature, and the burning at Seger cone 12. This porcelain is covered with a glaze composed of a mixture of two and a half parts of felspar, one part of silicious sand, and one part of kaolin.—W. C. H.

Enamelling ; Method of ——. C. R. Schmidt, Baltimore, Md. U.S. Pat. 862,285, Aug. 6, 1907.

This method of enamelling hollow cylindrical articles on their inner and outer surfaces simultaneously, consists in heating the articles, and placing enamelling material inside them, then rotating them in a horizontal position in a rotating enamelling chamber or muffle, and as each part of the external surface is brought uppermost, depositing enamelling material upon it.—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Stone formed of hydrate of lime and filling materials ; Process for hardening artificial —— *by means of carbonic acid or gases containing carbonic acid.* E. Schwanenberg and A. Rinne, Hanover, Germany. Eng. Pat. 19,038, Aug. 25, 1906.

See Fr. Pat. 369,206 of 1906 ; this J., 1907, 96.—T. F. B.

Wood ; Process of preserving ——. S. W. Labrot, New Orleans, La. U.S. Pat. 862,488, Aug. 6, 1907.

Wood contained in a closed vessel is subjected to air pressure to charge the cells with compressed air sufficient to prevent the absorption of a preserving fluid. A preserving fluid is then introduced into the vessel, the air pressure being relieved proportionally to the volume of fluid admitted, but without permitting a reduction of air pressure in the cells of the wood sufficient to allow absorption of the fluid. Additional fluid is next injected into the vessel to force the fluid into the cells, then the fluid is withdrawn from the vessel, and air pressure applied to distribute the absorbed fluid throughout the pores of the wood.—W. C. H.

Lime, or other substances; Process for burning ——. J. Reaney, jun., Sherwood, Md. U.S. Pat. 862,657, Aug. 6, 1907.

The limestone or other material is agitated and intermittently checked during its passage from end to end of the heated kiln. In this way the lighter burned particles rise to the surface and pass on, leaving the heavier unburned particles behind for further burning. The complete burning of each particle is thus ensured.—F. Sodn.

Refractory product and its applications to the manufacture of slabs, bricks, crucibles, pipes, muffles, receivers, and articles of all kinds. P. J. E. Velter. Fr. Pat. 376,179, March 28, 1907.

Broken, commercial carborundum is treated with concentrated hydrochloric, sulphuric, or nitric acids, together or separately, and the purified product obtained is mixed with an amount of refractory clay, sufficient to give the requisite degree of plasticity for moulding the mass into the required shapes. The articles are dried and burnt; they possess great solidity, and are very refractory and resistant to chemical action, especially that of molten steel.—W. C. H.

Cement clinker; Mode of producing ——. H. G. Barnhurst, and J. W. Fuller, jun., Catasauqua, Pa. U.S. Pat. 861,699, July 30, 1907.

The raw cement materials, thoroughly mixed but in a separate and non-cohering condition, are fed into one end of a rotary kiln, and unequal proportions of fuel of different textures are fed into both ends of the kiln. The coarser-grained fuel, fed into the outlet end, heats the internal walls of the kiln and the air passing through it, and the finer-grained fuel, fed into the inlet end together with the raw cement materials, is exposed to the heated air and walls of the kiln by the rotary movement, and by its combustion in direct contact with the cement materials, effects the complete clinkering of the latter.—W. C. H.

Cement; Method of burning —— in a rotary kiln. B. H. Thwaite, London, Assignor to T. C. Fawcett, Ltd., Leeds. U.S. Pat. 864,045, Aug. 20, 1907.

See Eng. Pat. 15,677 of 1906; this J., 1907, 824.—T. F. B.

Cement and other products; Manufacture of ——. A. P. Bjerregaard, Mineola, N.Y., Assignor to R. C. Mitchell, Mount Vernon, N.Y. U.S. Pat. 864,068, Aug. 20, 1907.

This process of modifying the intensity of a blast-flame, in the manufacture of cement and other products, consists in introducing into the flame, at or near its point of origin, a suitable proportion of finely-pulverised solid material, capable of generating within the flame a non-combustible gas, with absorption of heat. The non-combustible gas commingles with air, after leaving the flame, to form a combustible product. The material introduced is of a character to augment the clinker being formed.—W. C. H.

X.—METALLURGY.

Austrian iron industry during the last twenty-five years. W. Kestranek. Iron and Steel Inst., Sept. 1907. [Advance proof.]

The production of iron in Austria-Hungary has increased from 612,000 metric tons in 1882 (436,000 from Austria and 176,000 from Hungary) to 1,910,000 tons at the present time (Austria 1,434,000, Hungary 450,000, and Bosnia 46,000), and during this period Austria-Hungary has maintained its position of sixth among the iron-producing countries of the world. Austria-Hungary suffers from a scarcity of coking coal, having to import coke, and in consequence of this is one of the countries which export iron ore. The annual imports and exports of iron ore are 246,000 and 324,000 tons respectively. The quality and quantity of fuel available appear to be more decisive factors in the industrial development of the iron trade of a country than wealth of ores. In spite, however, of the want of suitable mineral fuel and of the circumstance that either the fuel or the ore has to be brought to the iron-producing centres by costly routes, Austria-Hungary has made herself, during the past twenty-five years, entirely independent of foreign countries with regard to iron manufactures. This is attributed to: (1), the protective import duties which shut out foreign iron; (2), the association of ironworks into a syndicate embracing nearly all the branches of the iron trade, whereby injurious competition is avoided; and (3), the concentration of the smaller works into larger units. The import duties imposed, together with those prevailing in other countries, are shown in the following table:—

	Duty per metric ton in crowns.			
	United States.	Germany.	France.	Austria-Hungary.
Pig iron	19·4	11·7	14·3	15·0
Rough plates ..	54·4—108·8	58·5	71·4	90·0
Girders	54·4	29·3	47·6	70·0
Rails	38·1	29·3	57·1	60·0
Iron bars	65·3—87·0	29·3	47·6	60·0

In 1895, the imports of iron and of iron manufactures amounted to 230,000 tons, against an export of scarcely 40,000 tons, but in 1906, the imports were 120,000 tons and the exports 240,000 tons. In 1895, 174,000 tons of pig iron were imported, and only 9000 tons were exported; in 1906 the figures were: imports, 62,000, and exports, 74,000 tons. At the Austrian blast-furnaces, 790,000 cb.m. of gas are produced per hour, of which 263,000 cb.m. are used for heating the blast, 358,000 cb.m. for boiler heating, 34,000 cb.m. in gas-engines, and the remainder partly for ore roasting and in drying kilns and partly allowed to escape unutilised. In the Austrian coke-works, 86,000 cb.m. of gas are produced per hour. Of this, 62,000 cb.m. are burnt in the ovens, and 5700 cb.m. are used in gas-engines, whilst the remainder serves for boiler heating.

In the author's opinion, within about twenty-five years, owing to the increasing consumption of iron, Austria will have to renounce its share of the supply of the world's market, and will have to import foreign iron to meet the demands of the home market.—A. S.

Chromium; Determination of ——, *in steel, especially in presence of tungsten.* G. von Knorre. Stahl u. Eisen, 1907, 27, 1251—1256.

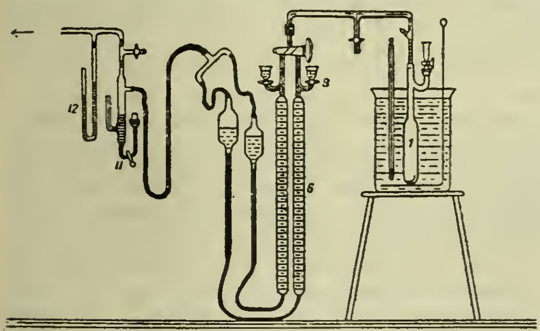
The author gives the following details for carrying out his method (this J., 1903, 1309) of determining chromium in ordinary steels:—Such a quantity is weighed out as will contain 0·02—0·03 grm. of chromium, and is dissolved in sulphuric acid (20 per cent. for steels containing 0·5—2·0 per cent. of chromium, up to 50 per cent. for ferrochromes with 33 per cent.), the acid being gently warmed and finally boiled. After the oxidation of the iron by means of nitric acid, or by persulphate, the free acid is neutralised, and then 5 grms. of ammonium persulphate are added. The liquid is then diluted to 400—500 c.c., treated with 20 c.c. of sulphuric acid of sp. gr. 1·18, and boiled for 20—30 minutes. If the sample contain but small percentages of chromium and manganese, it should not be boiled as above, but heated for an hour on the water-bath, and finally boiled for 10 minutes. If manganese peroxide separate, the oxidation of the chromium is complete, but if no manganese be present, the liquid should be cooled to 50° C., 2½ grms. of persulphate added, and the boiling continued for 20 minutes more. Any manganese peroxide is filtered off and washed, and the manganese separately determined (this J., 1903, 1104); the chromium in the filtrate is determined by addition of excess of ferrous sulphate solution of known strength, and back-titration by permanganate or bichromate.

If more than traces of tungsten be present, the sample is dissolved in 45—50 per cent. sulphuric acid, and boiled till no further trace of hydrogen is evolved. Nitric acid of sp. gr. 1·2 is then added gradually, and the liquid boiled till oxidation, both of ferrous salt and of tungsten, is complete. Sodium phosphate (20 c.c. of 10 per cent. solution) is then added, to convert the tungsten into soluble phosphotungstate, and the liquid is made distinctly alkaline with a concentrated solution of sodium hydroxide. Dilute sulphuric acid is now added very gradually, with constant stirring, till the precipitated ferric hydroxide is just dissolved. The solution should now be perfectly clear, and the treatment with ammonium persulphate can be proceeded with for the determination of the chromium. The manganese should be determined in a separate portion to which phosphate has not been added.—J. T. D.

Sterling silver; Annealing of ——. W. H. Walker. J. Amer. Chem. Soc., 1907, **29**, 1198—1201.

WHEN sterling silver is annealed, the polished metal shews a dark sheen which greatly detracts from its appearance, unless quite a sensible thickness of metal is removed during polishing. This "fire surface" is found by the author to be due to copper oxide, formed not only on the exterior, but to a certain depth below, through the penetration of oxygen into the metal. The formation of the oxide is prevented by conducting the annealing operation in an atmosphere free from oxygen; hydrogen or hydrocarbons are, however, unsuitable, for the metal occludes hydrogen, and then forms blisters if afterwards subjected to soldering by the blowpipe. The best annealing atmosphere is one containing sufficient hydrogen, hydrocarbon, or carbon monoxide to remove any oxygen accidentally present, and enough nitrogen or carbon monoxide to prevent the penetration of hydrogen. Producer gas is very suitable for the purpose.—J. T. D.

Copper and copper alloys; Corrosion of ——. J. G. A. Rhodin. Engineer, 1907, **104**, 53—54, 75—76, 106.



USEFUL results concerning the corrosion of copper alloys are obtained with the author's apparatus, shown in the figure, which serves to measure the hydrogen evolved during constant intervals of time by the action of 10-*N* hydrochloric acid (sp. gr. about 1·16) at 80° C. on the alloy. The best results are obtained by drawing the alloy into wire (of about 0·5 mm. diam.) of such a length (about 12 cm.) that the area of the surface shall be 2 sq. cm.; the wire is dropped into the vessel (1), containing 100 c.c. of the acid, previously heated to 80° C. in the water-bath, which also contains a thermo-regulator, not shown. The hydrogen is alternately passed into one of the two burettes (6), which are enclosed in a water-jacket, not shown; the gas in the burette not in use at the moment, is washed with water from the small funnels (8). In order to work under constant pressure, usually 750 mm., the levelling-vessels are connected with a water-pump, not shown, which constantly sucks in a small quantity of air through a mercury trap (11), so as to keep the manometer (12) at the required difference of level, which depends on the atmospheric pressure; the levelling vessels themselves must be constantly adjusted as the gas fills the burettes.

The author has used this apparatus to confirm his theories as to the dissolution of alloys. The rapidity of attack (per atomic weight) by hydrochloric acid varies with the fraction:

$$\frac{(\text{Valency}) \times (\text{mol. heat of formation of chloride}) \times (\text{conductivity})}{\text{Density}}.$$

From this it appears that an alloy with 61 per cent. of copper and 39 of zinc (Muntz metal) will dissolve as such, whilst from 70 : 30-brasses more copper than zinc dissolves. It is also found that the addition of a small quantity of aluminium to a 70 : 30-brass decreases its solubility, but increases that of brass with less than 60 per cent. of copper. With the substitution of an electro-negative metal, such as tin, for the positive aluminium, these effects are reversed, as shown in naval brass. When naval brass or gun-metal is in electrical connection with even the best brass, the latter alone suffers by corrosion, the tin in the two first alloys rendering them electro-negative to the brass.—A. G. L.

Tin-nickel alloys. E. Vigouroux. Compt. rend., 1907, **145**, 429—431.

THE alloys containing 57·65—66·76 of tin are described. When treated with hydrochloric acid, the tendency of these alloys is to lose tin until the residue contains 57·65 per cent. of tin, corresponding to the formula, Ni_3Sn_2; when treated with nitric acid, they lose nickel, and yield a residue containing 66·76 per cent. of tin, corresponding to the formula, NiSn. Those nickel-tin alloys only are magnetic which contain less than 40·22 per cent. of tin (corresponding to Ni_3Sn). Their brittleness increases with the tin-content up to 66·76 per cent.; those containing more than 85 per cent. are malleable. Those containing 66·76—85 per cent. are sonorous when struck.—J. T. D.

Tin-cobalt alloys. F. Ducelliez. Compt. rend., 1907, **145**, 431—433.

TIN-COBALT alloys containing 0—57 per cent. of tin, when attacked by nitric acid (and by potassium hydroxide where necessary) leave residues containing 57—60 per cent. of tin, most of these having a composition close to that (57·65 per cent. of tin) corresponding to the formula, Co_3Sn_2. These alloys increase in brittleness with the proportion of tin. No indication of a compound corresponding to the nickel compound, Ni_3Sn, was obtained. The alloys containing from 0 to 57 per cent. of tin are mixtures of cobalt and the compound, Co_3Sn_2. They are magnetic, but alloys containing more than 57—59 per cent. of tin are not.—J. T. D.

Vanadium, niobium, and tantalum; Experiments on metallic ——. W. Muthmann, L. Weiss, and R. Riedelbauch. Annalen, 1907, **355**, 59—99.

THE metals were prepared by the reduction of the purified oxides with the rare-earth metals, which had been obtained by electrolysis of the mixed chlorides. (See this J., 1904, 255.) The reaction was brought about in a magnesia crucible, about 200 grms. of turnings of the mixed metals being employed with the calculated proportion of the oxide. In the case of niobium and vanadium, well-fused ingots of metal are readily obtained, but with tantalum, since the reaction proceeds less vigorously, it is necessary to preheat the reacting mixture, otherwise only a fritted conglomeration of metal and slag is obtained. In each case the purity of the metals obtained exceeded 99·7 per cent. *Physical properties.* The colour of vanadium resembles that of finely crystalline high-carbon iron, that of niobium and tantalum is white. *Hardness:* Vanadium, 7·5; niobium, 6·5; tantalum, 6 to 6·5. All three metals are brittle. *Specific gravity:* Vanadium, 6·025; niobium, 8·40 to 8·43; tantalum, 14·49. *Specific heat:* Vanadium, 0·1240; niobium, 0·0617; tantalum, 0·0346. The authors have also carried out a detailed investigation of the chemical properties of the pure metals. Oxidation occurs slowly with vanadium, but rapidly with niobium and tantalum, when the finely-divided metals are heated in oxygen. The heats of combustion were determined in the calorimetric bomb: vanadium, 3057·2; niobium, 2350·0; tantalum, 837·9 calories per grm. Hydrides in the form of stable black powders are produced when the finely-divided metals are heated in a current of hydrogen, and nitrides are also slowly formed at a red heat by reaction of the metals with nitrogen.—R. S. H.

Patents.

Armour plates; Manufacture of —— and other steel objects. E. C. R. Marks, London. From Soc. Anon. Italiana Gio Ansaldo Armstrong and Co., Genoa. Eng. Pat. 17,935, Aug. 9, 1906.

By suitable carburisations, or de-carburisations, and by taking advantage of the laws governing the diffusion of carbon in iron at various temperatures, there is obtained in a mass of steel a series of layers having relatively different proportions of carbon, and therefore, when tempered, mechanical properties varying from one layer to another. Thus by a series of carburisations and de-carburisations, a mass could be obtained such that layers of high carbon content alternate with those relatively poor in carbon. —C. A. W.

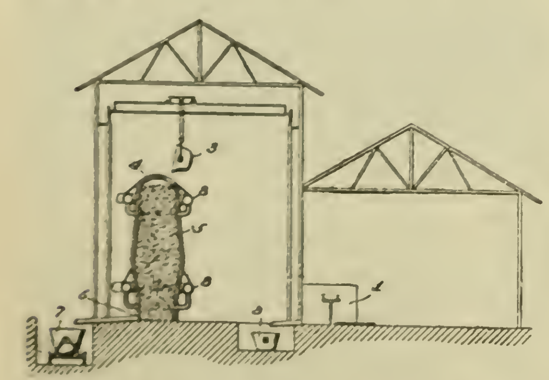
Iron or steel; Process for carburising, hardening, or tempering ——. W. S. Simpson, London. Eng. Pat. 23,230, Oct. 19, 1906.

See Fr. Pat. 371,098 of 1906; this J., 1907, 260.—T. F. B.

Steel alloys; Art of heat treatments of ——. J. Churchward, New York. U.S. Pat. 855,756, June 4, 1907.

The patent relates to a method of annealing and heat-treating steel alloys, especially in the form of armour plates, etc. It consists in subjecting the mass of metal to a series of heats or heat-waves of successively decreasing maximum temperatures, the first heating being carried to the annealing temperature of the mass of metal, and each successive heating to a temperature a little below the so-called retardation point of the corresponding alloying metal. For example, in the case of a steel alloy containing small percentages of chromium and vanadium, the metal is first heated gradually to the annealing temperature of "stock" steel (ordinary manganese-carbon-steel), say 2000° F., and then cooled slowly to 600° F. or lower. This treatment causes a certain amount of segregation of the alloying metals, and the ensuing operations are for the purpose of "restoring" the alloy. The metal is next heated to a temperature a little below the retardation point of chromium, cooled slowly to 600° F. or lower, then heated to a temperature a little below the retardation point of vanadium, and again cooled slowly.—A. S.

Pig-iron and steel; Method of producing ——. S. McDonald, Los Angeles, Cal. U.S. Pat. 859,572, July 9, 1907.



"Oxide iron ore" is melted in the furnace, 1, by means of fluid fuel, and tapped into the ladle, 3. The ladle is then raised, and the fused ore poured on to a mass of incandescent coke, 5, which is at a temperature of 2700° F. or more, contained in the furnace 4, the resulting metal being run out through the tap-hole, 6, into the ladle, 7. The two sets of tuyères, 8, supply air for maintaining the temperature of the coke.—O. F. H.

Steel Manufacture of ——. J. W. Spencer, Newburn. U.S. Pat. 863,763, Aug. 20, 1907.

See Eng. Pat. 15,032 of 1903; this J., 1904, 664.—T. F. B.

Gold and platinum; Machine for separating —— from other material. C. O. Michaelsen, Salt Lake City, Utah. U.S. Pat. 849,553, April 9, 1907.

The material to be treated is first introduced into a rocker-box with the necessary amount of water, and any lumps of clay or cemented material are broken up by the action of a pair of swinging chains. The coarser particles and waste material are carried off by a shoot to the tailings dump, and the finer particles pass through the screen into a second similar rocker-box beneath. The material which passes through the screen of the second box is received in a third box having a bottom of flexible material, to which an undulating motion is given by conical rollers moving beneath it. The heavy particles are caught in the third box on matting covering the flexible bottom, and the light particles pass on to a separating table and thence to an amalgamating pan. A concentrating table is also provided which can be used to treat the tailings from the amalgamating pan, or to concentrate the material at some earlier stage.—O. F. H.

[Gold] Ores; Process of treating ——. L. M. Pritchard, Boise, Idaho. U.S. Pat. 861,535, July 30, 1907.

The powdered ore is treated with iodine dissolved in a solution of potassium iodide, the solution is agitated with mercury, and the gold separated from the resulting amalgam.—A. G. L.

Metals, precious; Method of recovering —— from solutions. I. Anderson, Assignor to S. A. Whipple, McCabe, Arizona. U.S. Pat. 861,628, July 30, 1907.

Pulp (slimes), containing precious metals together with a large percentage of copper, is treated with a solution of potassium cyanide, from which the extracted metals are precipitated by the addition of sulphuric acid. The solution is then regenerated by neutralising the sulphuric acid, and used for the treatment of fresh pulp.—A. G. L.

Zinc-lead ores; Treatment of refractory ——. P. C. C. Isherwood, Harrow. Eng. Pat. 16,364, July 19, 1906.

The ore is carefully roasted, leached with water to remove any zinc and other soluble sulphates present, and the residues treated with a hot concentrated solution of ammonium chloride or ammonium sulphate. When ammonium chloride is used, most of the zinc, lead, copper, and some of the silver are removed from the residues, and on cooling the solution, the bulk of the zinc and lead are precipitated as double salts, while the copper and excess of ammonium chloride remain in solution. The copper may be separated from the solution by any convenient means, and the residual liquor used for the treatment of a further quantity of ore. The ammonia is also recovered from the precipitated double salts of zinc and lead, and re-converted into ammonium chloride. When ammonium sulphate is used, the method of procedure is similar, except that only traces of lead are removed, this together with the silver remaining in the ore.—O. F. H.

Zinc; Treatment of sulphide ores containing ——. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 16,912, July 26, 1906.

The ore is subjected to a "sulphating roast" to convert the zinc into a mixture of zinc sulphate and zinc oxide. The zinc sulphate is then leached out, converted into chloride by adding calcium chloride, and the zinc precipitated by milk of lime or the like. The zinc oxide remaining in the ore is dissolved out by sulphurous acid, and the zinc precipitated from its bisulphite solution by an alkali, or the zinc bisulphite is oxidised to sulphate by the action of air or other oxidising agent, and the solution treated with the first washings.—O. F. H.

Zinc residues; Treatment of ——. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 17,001, July 27, 1906.

The residues containing zinc silicate and other compounds of zinc and other metals, are powdered, mixed with sulphuric acid, and kneaded into a stiff paste. The mixture is then charged into a furnace and heated to a temperature of about 300° to 500° C., so as to avoid the production of gelatinous silica. The roasted material is leached with water to extract zinc sulphate, and the "values" are recovered from the residue by concentration.—O. F. H.

Zinc blende; Process of separating —— by flotation. A. J. F. de Bavay, Kew, Victoria. U.S. Pat. 864,597, Aug. 27, 1907.

See Eng. Pat. 18,660 of 1904; this J., 1905, 1019.—T. F. B.

Zinc; Molecularly transformed ——, and its process of manufacture. Soc. Française de Métallurgie. Fr. Pat. 375,241, May 9, 1906.

Zinc or aluminium is stated to be transformed molecularly into a hard, strong material by subjecting it in the cold to great pressure.—O. F. H.

Tin; Extraction of —— from ore. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 17,002, July 27, 1906.

Producer- or water-gas is burned inside a cylinder or other reducing chamber containing the ore, the amount of air used being sufficient only for partial combustion. The gas is thus used both to heat the ore and to effect the reduction of the tin to the metallic form. (See also Eng. Pat. 10,943 of 1905; this J., 1906, 988.)—O. F. H.

Tin from iron-containing tin products such as residues, scraps, ashes, slag, soot, and the like; Process for extracting ——. H. Brandenburg, Kempen on Rhine, Germany. Eng. Pat. 22,033, Oct. 5, 1906.

See Fr. Pat. 370,356 of 1906; this J., 1907, 260.—T. F. B.

Copper and other metals from pyrites; Extraction of ——. G. B. Ellis, London. From Les Produits Chimiques de Croissy, Paris. Eng. Pat. 17,441, Aug. 2, 1906.

See Fr. Pat. 364,512 of 1906; this J., 1906, 935.—T. F. B.

Copper ores and compounds; Method of smelting and refining ——. R. Baggaley, Pittsburg, Pa. U.S. Pat. 862,378, Aug. 6, 1907.

The ores are first smelted to give a matte, the necessary heat being obtained from the combustion of the impurities present. The matte is then treated in a converter with the addition of silicious ores to eliminate the iron, the slag being returned in the molten form to the smelting furnace or converter. After the removal of the iron, the blowing is continued to produce blister copper, which is transferred in the molten state to a preheated refining furnace. —O. F. H.

Ores; Process and apparatus for the treatment of ——. F. T. Snyder, Oak Park, Ill., U.S.A. Eng. Pat. 19,712, Sept. 4, 1906.

See Fr. Pat. 369,756 and U.S. Pat. 859,137; this J., 1907, 210 and 879.—T. F. B.

Ore concentration. H. L. Sulman, London. Eng. Pat. 19,944, Sept. 7, 1906.

In ore flotation processes the power of flotation is increased by warming the liquid to a temperature between 35° and 90° C., depending on the material treated.—O. F. H.

Ores containing zinc sulphide and lead sulphide; Process for treating ——. J. Thelberg, New York. Eng. Pat. 2789, Feb. 4, 1907.

See U.S. Pat. 851,187 of 1907; this J., 1907, 624.—T. F. B.

Ore-roasting process. A. R. Wilfley, Denver, Colo. U.S. Pat. 859,420, July 9, 1907.

The process consists in subjecting the finely-divided ore, while falling, to the action of a current of heated air travelling in the same direction as the ore. The roasted ore is cooled quickly, in order to prevent clotting, by allowing it to fall on to an inclined cooling (water-jacketed) surface.—O. F. H.

Pyritic smelting; Apparatus for ——. C. Antoonovich, St. Petersburg. U.S. Pat. 861,693, July 30, 1907.

The apparatus consists of a reverberatory furnace heated by the flame from a converter. The converter is supplied with a blast of hot air from regenerators heated by the waste gases, and can be moved when required into position to receive the matte from the reverberatory furnace.—O. F. H.

Ore; Process for separating ——. H. H. Wait, Assignor to Internat. Separator Co., Chicago. Ill. U.S. Pat. 861,782, July 30, 1907.

Ores consisting of materials of different porosity are treated with a solution of an iron salt, and then exposed to the action of the air or other oxidising agent so as to deposit magnetic oxide upon the more porous constituents (mica), which are then removed by the action of an intense magnetic field.—A. G. L.

Ores; Art of treating ——. R. McKnight, Pittsburg, Pa. U. S. Pat. 862,987, Aug. 13, 1907.

Ores containing one or more of the rare metals—tungsten, uranium, vanadium, molybdenum and tellurium—are treated with an alkali chloride and heated until volatile and soluble chlorides have been formed. The volatile chlorides are condensed, and the soluble chlorides extracted from the residue.—O. F. H.

Furnace for the treatment of refractory [antimony-gold] ores. W. P. Wynne and J. H. Grant, Ballarat, Victoria. U.S. Pat. 862,229, Aug. 6, 1907.

The furnace consists of three water-cooled hearths at different levels, each having a separate flue leading to a surface condenser and provided with reciprocating rabbles. The ore, such as antimonial gold ore, is fed by means of a hopper in the roof of the furnace on to a distributor, and falls through an air blast and the flame from two burners on to the top hearth. After treatment here, it passes through a pair of grinding rolls to the middle hearth which is similar to the top one, and thence to the finishing hearth.—O. F. H.

Furnaces, reverberatory; Automatic continuous ore-smelting process for ——. G. G. Vivian, Denver, Colo., Assignor to L. Hanchett, Salt Lake City, Utah. U.S. Pat. 862,683, Aug. 6, 1907.

Hot gases from the fire-box pass over the bed of the reverberatory furnace, on their way to the chimney, unequally heating the hearth. Ore is continuously fed in at the coolest (chimney) end, and is sintered by meeting the products of combustion: it then passes through the smelting zone into the settling zone of the furnace. Slag is continuously or intermittingly withdrawn from the hottest (fire-box) end of the furnace, and matte or metal is likewise withdrawn from the coldest end.—A. G. L.

Furnace; Smelting ——. G. G. Vivian, Denver, Colo., Assignor to L. Hanchett, Salt Lake City, Utah. U.S. Pat. 862,684, Aug. 6, 1907.

This automatic continuous ore-feeding reverberatory furnace consists of a fire-box and a hearth- chamber, whose angular side walls converge and meet in a point at the front end of the hearth. At this point and on a level with the floor of the hearth is provided a tap-hole for matte through the front wall of the furnace; at the back end of the hearth and a little above the floor level are placed tap-holes for the slag, on both sides of the fire-box. In the side walls of the furnace are placed a number of ore shoots terminating close to the floor of the hearth, and arranged so as to deliver ore continuously at both sides of the front end of the furnace as fast as the ore melts on the hearth of the latter. (See preceding abstract.) —A. G. L.

Furnace; Roasting ——. W. A. Rankin, Assignor to Allis-Chalmers Co., Milwaukee, Wis. U.S. Pat. 863,045, Aug. 13, 1907.

The claims are for one or more hollow, fluid-cooled stirrers for use in a roasting furnace.—O. F. H.

Furnace for the fusion or reduction of ores. Monarch Engineering and Manufacturing Co. Fr. Pat. 375,520, Feb. 27, 1907.

The furnace-body containing a crucible is mounted on trunnions for the purpose of tilting, and is provided with a cover which can be raised easily and moved to one side. The furnace is heated by means of oil or gas, the flame from a burner being injected through a side hole in the lower part of the furnace-body.—O. F. H.

Furnace for melting metals, heated by liquid fuel. L. Rousseau. Fr. Pat. 375,913, March 20, 1907.

The metals are melted in a shallow crucible or basin supported in the upper part of the furnace, which is mounted on trunnions and can be tilted. The furnace is heated by means of oil, the flame from a burner being injected into the comparatively large combustion chamber beneath the crucible, this chamber also serving as a reservoir for molten metal.—O. F. H.

Crucible furnace for melting metals. P. Fiérez and G. Philipin-Gerino. Fr. Pat. 375,914, March 20, 1907.

The furnace consists of several superposed parts, of which the lowest is the fireplace, the flames from which heat the crucible placed in the chamber immediately above, while the third part forms a dome-shaped cover to the crucible chamber, and opens into the two uppermost parts which constitute a short chimney. The fireplace supporting the crucible-chamber and cover, is carried on trunnions and may be tilted for the purpose of pouring the metal. The chimney, in which light scrap may be heated by the waste gases, is mounted on separate supports running on rails, so that this portion may be moved to one side when the furnace is tilted.—O. F. H.

Detinning: Process of ——. C. E. Acker, Niagara Falls, N.Y. U.S. Pat. 862,860, Aug. 6, 1907.

Different portions of a body of compressed tin-scrap are simultaneously exposed to the action of a liquid detinning agent, which may contain chlorine, and of a gaseous detinning agent evolved from the liquid. The liquid may be heated to assist the evolution of the gaseous agent, and the pressure in the reaction-vessel may be varied (increased).—A. G. L.

Vanadium ores: Process of treating ——. F. de Lucio, Huaraucaca, Peru. U.S. Pat. 863,076, Aug. 13, 1907.

Oxidised or roasted vanadium ores are boiled with a solution of sodium hypochlorite, whereby sodium vanadate is formed and chlorine evolved. The sodium vanadate is extracted with hot water and recovered as such, or the solution when cold may be treated with calcium hypochlorite to precipitate calcium vanadate and regenerate sodium hypochlorite.—O. F. H.

Alloys: Manufacture of ——. W. Ruebel, Assignor to A. Jacobsen, Hamburg, Germany. U.S. Pat. 864,139, Aug. 20, 1907.

See Fr. Pat. 342,054 of 1904; this J., 1904, 903.—T. F. B.

Alloy or compound; Metallic ——. W. Ruebel, Assignor to A. Jacobsen, Hamburg, Germany. U.S. Pat. 864,140, Aug. 20, 1907.

See Fr. Pat. 338,415 of 1903; this J., 1904, 610.—T. F. B.

Carborundum; Application of —— to the manufacture of drill heads. R. Bouvier. Fr. Pat. 375,338, March 4, 1907.

Carborundum may be used instead of diamonds by incorporating it in a suitable matrix, ceramic or metallic —O. F. H.

Antimony or other metals: Process of obtaining ——. E. Basse. Fr. Pat. 375,872, March 19, 1907.

The antimonial material is made into briquettes with the necessary quantity of a suitable reducing agent such as powdered charcoal, iron filings or turnings, and a small quantity of sodium carbonate and lime. The briquettes are dried, heated in a suitable furnace, and the metallic antimony tapped when reduction is complete.—O. F. H.

Metals; Process for depositing —— on other metals or metal objects. F. W. Gauntlett and The Sherardizing Synd., Ltd. Fr. Pat. 376,512, April 16, 1907.

See Eng. Pat. 9959 of 1906; this J., 1907, 765.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Electrolytic metal deposition; Influence of temperature upon ——. F. Foerster, F. Blankenberg, A. Brunner, H. Lee and W. Römmler. Z. Elektrochem., 1907, **13**, 561—567.

In all electrolytic processes increased temperature causes a more rapid diffusion of the salt to make up for the dilution caused by separation of metal at the cathode. In the case of ordinary sulphate or other simple salt solutions, the cathodic potential increases only very slowly with rise of temperature. A study of cyanide solutions has shown that at ordinary temperatures in the case of the complex copper and zinc cyanides, a marked rise of cathodic potential occurs with increase of current density. Other salts, such as the cadmium and silver double cyanides, behave like simple salt solutions. In the case of copper and zinc it has previously been found that a measurable interval of time is required for the formation of the complex ion from the soluble anode, and it is to this that the authors ascribe the phenomenon observed. With increase of temperature the cathodic potential falls, and at 75° C. is 0·3 volt less than at 18° C. in the case of copper cyanide, whereas with silver cyanide the decrease is only 0·05 volt. Important applications of these facts can be made in the electrolytic separation of metals, particularly as the current efficiency of the deposition rises rapidly with temperature in the abnormal cases. Similar phenomena are observed with complex cathions. In ammoniacal sulphate solutions the potential of copper and zinc is only slightly reduced by rise of temperature, whereas that of nickel decreases very greatly. A method for the quantitative electrolytic separation of zinc and nickel is founded on this behaviour. At ordinary temperatures the decomposition potential of zinc and nickel are too close to admit of the separation of the metals, but at a higher temperature the difference is much greater, and satisfactory electrolytic separation can be effected. The authors have, also observed in dilute acid solutions of iron and nickel salts, that the current efficiency of the metal deposition is much improved by rise of temperature, and in the case of iron, the metal obtained contains much less occluded hydrogen and consequently has improved physical properties. The explanation in these latter cases is not yet forthcoming. —R. S. H.

Mercury; Notes on the electrolytic determination of ——. V. Borelli. *See* XXIII.

Patents.

Filaments and other incandescing bodies for use in electric lamps or other apparatus; Methods of manufacturing conductive ——. The British Thomson-Houston Co., Ltd. From the General Electric Co. Eng. Pat. 18,745, Aug. 21, 1906. *See* II.

Electric conductors from refractory metals and materials suitable for use in electric lamps, furnaces, and other apparatus; Manufacture of ——. The British Thomson-Houston Co., Ltd. From the General Electric Co. Eng. Pat. 18,749, Aug. 21, 1906. *See* II.

Tungsten filaments for electric lighting and heating; Manufacture of —— by reduction of tungstic acid. Allgem. Elektricitäts-Ges. Eng. Pat. 7407, March 27, 1907. *See* II.

Electric incandescence lamps; Process of manufacture of luminous bodies for ——. H. Kuzel. Fifth Addition, dated March 9, 1907, to Fr. Pat. 359,025, Jan. 9, 1905. *See* II.

Filaments for electric lighting; Process of manufacture of ——. Parker Clark Electric Co. Fr. Pat. 376,412, April 5, 1907. *See* II.

Filaments for incandescence lamps. Parker Clark Electric Co. Fr. Pat. 376,413, April 5, 1907. *See* II.

Agglutinant for consolidating the active material of electric accumulators. Q. Marino and E. W. Barton-Wright, London. Eng. Pat. 27,215, Nov. 29, 1906.

See Fr. Pat. 373,044 of 1907; this J., 1907, 698.—T. F. B.

Electric arc; Application of the —— for producing reactions in a gaseous mass, and apparatus therefor. A. A. Naville, P. A. Guye, and C. E. Guye, Geneva. Eng. Pat. 21,338, Sept. 26, 1906.

See Fr. Pat. 361,827 of 1905 and addition thereto; this J., 1907, 23 and 209.—T. F. B.

Boron; Production of ——. The British Thomson-Houston Co., Ltd., London. From the Gen. Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 25,978, Nov. 16, 1906.

A boron compound, preferably boron nitride, is heated in a vacuum furnace, such as that described in Eng. Pat. 20,809, of 1904 (this J., 1905, 976), to a temperature above 1500° C., to produce conductive boron, from which resistance rods or glow bodies may be formed. A suitable boron nitride for the purpose may be obtained by passing ammonia over boric anhydride or boric salts.—E. S.

Carbide from lime and carbon; Process of continuously producing ——. A. J. Petersson, Alby, Sweden. Eng. Pat. 5658, March 8, 1907.

See Fr. Pat. 371,043 of 1906; this J., 1907, 327.—T. F. B.

Carbide from lime and carbon; Method of charging electric furnaces for producing ——. A. J. Petersson, Alby, Sweden. U.S. Pat. 863,044, Aug. 13, 1907.

See Fr. Pat. 370,911 of 1906; this J., 1907, 327.—T. F. B.

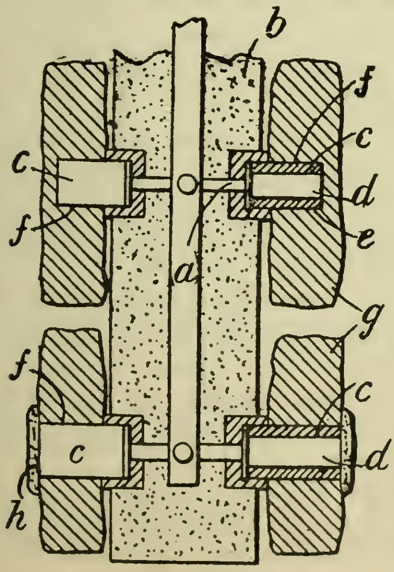
Cell; Electrolytic ——. E. A. Allen, Assignor to Allen Electro-Chemical Co., Rumford Falls, Me. U.S. Pat. 862,783, Aug. 6, 1907.

The electrolytic cell comprises a tank with oxidising and decomposing compartments, the latter containing an anode and a mercury cathode which also acts as a liquid seal between the two compartments. A circuit is provided, for the return of the amalgam, between the opposite ends of the tank, and an injector, supplied with a heated fluid oxidising agent, is placed in the circuit.—B. N.

Albuminous substances; [Electrolytic] Treatment of ——. R. Desgeorge. U.S. Pat. 863,268, Aug. 13, 1907. *See* XIV.

Leather for use as an insulating cover for electric conduits; Process for the preparation of ——. H. Egger. Fr. Pat. 376,660, March 18, 1907. *See* XIV.

Electrodes. The General Electrolytic Parent Co., Ltd. Fr. Pat. 376,548, April 9, 1907.



A metallic conductor, *a*, is covered almost entirely with Portland cement, *b*, and the extremity, *d*, of the conductor is surrounded with a mixture, *c*, of graphite, resin, and carbon tetrachloride, the exterior surface, *e*, of this mixture being made to conform to the inner surface, *f*, of an opening in the carbon electrode, *g*. Where the conductor passes completely through the carbon block, it is protected by a layer of cement, *h*. An alternative form is described, in which bars of carbon are employed, in place of the horizontal rods of the conductor, *a*.—B. N.

Alkali chlorides; Process and apparatus for the electrolysis of ——. J. Billitzer. Fr. Pat. 376,329, April 3, 1907.

Fig. 1

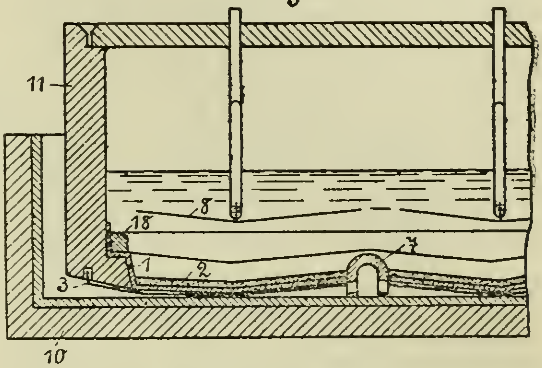
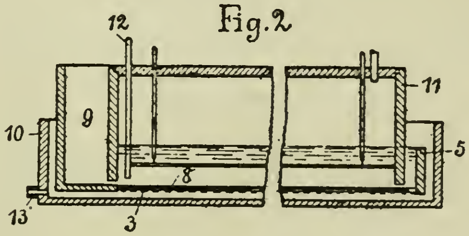


Fig. 2



The apparatus consists of a bell, 11, closed below by a diaphragm, 1, 2, the latter resting on a trellis-work cathode, 3, of iron or nickel wire, which is fixed to the bell and arched in order to permit of the escape of hydrogen bubbles through the channel, 7. The anodes, 8, of carbon or platinum, are arranged parallel to the cathode. The bell, which is supplied with electrolyte through the tube, 12, to a determined height, rests in an outer vessel, 10, which is empty at first, but the diaphragm being permeable to the liquid, the latter arrives at the cathode as a solution of caustic soda. The escape pipe, 13, for the caustic soda solution, is so arranged that the liquid is retained in the vessel, 10, to a height at which it just wets the cathode. The diaphragm consists of a sheet of asbestos 1, kept in position by a frame, 18, and by wedges, and over this is spread a layer, 2, consisting of a mixture of barium sulphate or alumina and asbestos fibre. The rapid deposition of the barium sulphate or alumina is attained by effecting their precipitation in a solution containing common salt and by agitating with asbestos fibre, a uniform mixture being at the same time obtained. In an apparatus of small dimensions, the sheet, 1, may be fixed to the bell, 11. A chamber, 9, containing solid salt, is in communication with the interior of the bell, and serves to maintain a heavy strong solution immediately above the diaphragm, with a weaker solution above nearer to the anode. The electrolyte is supplied in a continuous stream, and passes through the diaphragm or through a narrow slit and over the barrier, 5, backward diffusion of caustic soda being thus avoided. An alternative arrangement is described in which the vessel, 10, is closed above, and the hydrogen gas is collected.—B. N.

Mineral, animal, and vegetable matter; [Electrolytic] process for extracting and simultaneously separating water from ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 377,160, April 25, 1907. Under Int. Conv., May 1, 1906.

See Eng. Pat. 10,024, of 1907; this J., 1907, 955.—T. F. B.

Pure gases or mixtures of two gases in definite proportions; Apparatus for the electrolytic production of technically ——. R. Schaar. Ger. Pat. 181,656, Dec. 22, 1904.

The invention is based upon the observation that a gas evolved at an electrode produces a vortex, around the latter, of a diameter bearing an approximately definite relation to the area of the surface from which it proceeds, as well as to the volume of gas evolved per unit of time. A screen dipping into the electrolyte is disposed between vertical adjacent electrodes, and by altering the relative positions of the electrodes with respect to one another and to the screen, the surfaces of the electrodes left freely exposed below the lower edge of the screen can be varied, and consequently, also, the diameter of the vortex around each electrode, and the proportion of gas passing from the anode-space to the cathode-space, and *vice versa*. For this purpose means are provided by which either of the electrodes or the screen, or all of them can be moved vertically up and down. It is stated that by means of this device, technically pure hydrogen and oxygen (98—99 per cent. strength) can be prepared, if the free surface of one electrode is approximately double that of the other. —A. S.

Bromine and iodine from spent lyes; Process for the electrolytic recovery of ——. B. Rinck. Ger. Pat. 182,298, Jan. 17, 1906.

The object of the invention is to so concentrate the bromine and iodine electrolytically separated from liquors poor in these elements, that their recovery in a pure condition is rendered easier. The liquor containing the bromine and iodine is subjected to electrolysis in an earthenware tank, and the separated halogens are absorbed in the anode-liquid which consists of a concentrated solution of a halogen salt, *e.g.*, strong brine. The anode compartment is filled with the brine and contains a carbon anode. It is separated by an asbestos diaphragm from the large cathode compartment, through which the liquor to be electrolysed flows in a slow stream. Iron cathodes are used. The difference in density between the anode- and cathode-liquids is such that the use of a diaphragm may, if desired, be dispensed with. The strong brine has a high solvent power for the liberated bromine and iodine, which may thus be concentrated in the anode-liquor until the latter contains, for example, 30 per cent. of free bromine, when it is withdrawn, and the free halogens recovered in the usual manner.—A. S.

(*B.*)—ELECTRO-METALLURGY.

Molybdenum; Preparation of metallic ——. W. Muthmann, L. Weiss, and A. Mai. Annalen, 1907, **355**, 100—115.

After numerous unsuccessful attempts to prepare the metal from the sulphide (molybdenite) by alumino-thermic and electric furnace processes, the author finally discovered that a satisfactory method consists in heating a mixture of molybdenite, lime, and fluorspar in an electric furnace of the arc or resistance type. Fused lumps of homogeneous metal are obtained, the properties depending largely on the content of iron. A product containing 98·95 per cent. of molybdenum and 0·67 per cent. of iron was relatively soft; it could be cut with tools and forged when heated. A sample containing 94·31 per cent. of molybdenum and 4·58 per cent. of iron could only be worked with a carborundum wheel, and although very hard, was not brittle.—R. S. H.

Rare-earth metals; Preparation of the —— by electrolysis of the fluorides. W. Muthmann, L. Weiss, and J. Scheidemandel. Annalen, 1907, **355**, 116—136.

The disadvantages of the preparation of the metals of the cerium group by electrolysis of the chlorides, lie chiefly in the difficulty of preparing the anhydrous chlorides. The authors have found that the mixed fluorides readily dissolve the oxides and can then be electrolysed in a manner very similar to that employed in the manufacture of aluminium with a cryolite-alumina electrolyte. Despite the advantage of greater fusibility to be obtained by addition of an alkali fluoride to the electrolyte, this is not feasible in practice on account of the occurrence of explosions, evidently caused by the separation of the alkali metal. A rectangular furnace was employed, the sides and base being constructed of graphite plates. A number of graphite rods, fixed to an adjustable holder, depended into this receptacle and formed the anode, the base of the furnace serving as cathode. The mixed fluorides are fused (m. p., 900° C.) in the furnace itself, either with the arc, or by inserting a resistance of carbon between the anode and cathode; when fusion is complete, the oxides are added in quantity sufficient to reduce the potential difference to the low value characteristic of the electrolysis and to ensure the proper function of the anode. Electrolysis can be continued, fresh quantities of the oxides being added from time to time. In one case a charge of 6 kilos. of the mixed fluorides and a total quantity of 2 kilos. of the oxides were electrolysed with 750 ampères at 75 volts. The current density was 9—10 ampères per sq. cm. at the cathode and 3 ampères per sq. cm. at the anode. Electrolysis under these conditions, continued for 55 minutes, yielded a lump of 400 grms. and a further 250 grms. of metal disseminated in the form of buttons throughout the mass. In every respect the method appears to offer advantages over the electrolysis of the chlorides.—R. S. H.

Molten salts; Metal mist, current efficiency, and theory of additions in the electrolysis of ——. R. Lorenz. Z. Elektrochem., 1907, **13**, 582—585.

The very low current efficiency which is obtained in the electrolysis of molten halogen salts of the metals may in many cases be ascribed to the formation of a cloud or mist of metal. This phenomenon is observed independently of electrolysis when a molten metal is maintained beneath the surface of the molten salt; the metal evaporates and becomes disseminated through the fused salt in a very finely-divided state. Improved current efficiency is obtained by the use of diaphragms, or by enclosing the electrodes, both of which devices hinder the finely-divided metal from reaching the anode and there recombining with the separated halogen. Still better results are obtained by the addition of an alkali or alkaline-earth salt. The author finds that the improvement increases with the quantity of salt added and with the molecular weight of the particular salt used. The probable explanation lies in the change of surface tension of the molten metal occasioned by these additions.—R. S. H.

Patents.

Copper; Electrolytes for the electro-deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 20,380, Sept. 13, 1906.

By adding to the electrolyte varying quantities of aluminium sulphate, and using a large current-density, a deposit of copper is obtained, smoother and of better quality than hitherto. In practice a solution containing about 12 per cent. of copper, 12 per cent. of free sulphuric acid and 1 per cent. of aluminium sulphate is electrolysed at a temperature of 65° C.—C. A. W.

Copper from its ores; Electro-metallurgical process for extracting ——. L. Jumau, Paris. Eng. Pat. 27,120, Nov. 28, 1906. Under Int. Conv., Nov. 29, 1905.

See Fr. Pat. 359,913 of 1905; this J., 1906, 485.—T. F. B.

Metals and their alloys; Apparatus for the electro-deposition of ——. D. and M. K. D. Roberts, West Bridgford, Notts, and E. W. Jaffray, London. Eng. Pat. 20,716, Sept. 18, 1906.

The electrolyte is caused to circulate through a sealed tank, *a*, "in a rapid steady continuous homogeneous non-turbulent stream," with the result that deposition of metals, or alloys, may take place extremely rapidly.

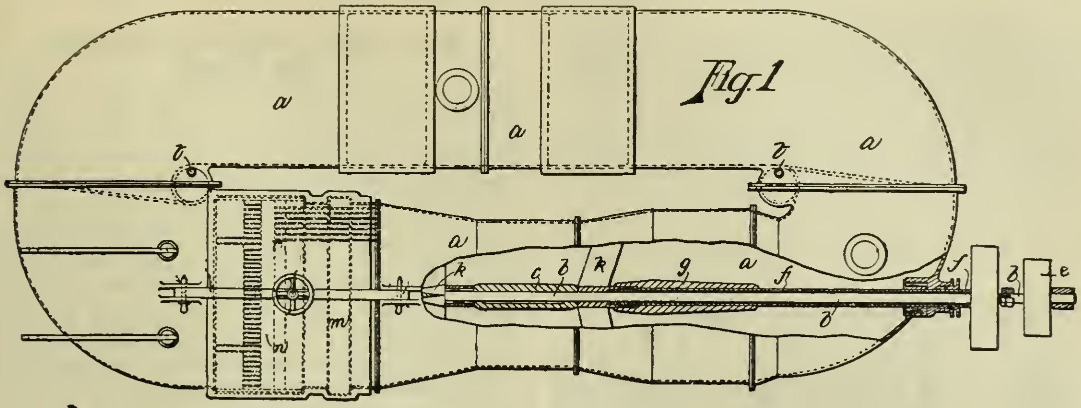


Fig. 1

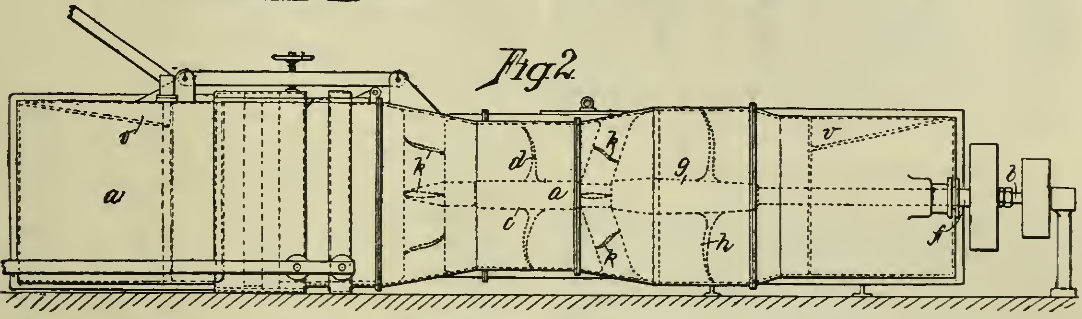


Fig. 2

It is mentioned that currents of from 10,000 to 25,000 ampères per sq. ft. may be used. The movement of the electrolyte is accomplished by means of blades, *d*, forming a species of propeller, mounted on a sleeve, *c*, attached to the rotating shaft, *b*, which is keyed to a pulley, *e*. A hollow shaft, *f*, is keyed to a shaft, *g*, which is provided with blades, *h*, working in the electrolyte and rotating at a slower speed than the propeller, *d*. A number of vanes, *k*, fixed to the sides of the chamber, *a*, force the electrolyte to pass in a steady stream through the portion of the chamber, *a*, containing the electrodes. The area of the anodes, *m*, is much greater than that of the cathodes, *n*, both cathodes and anodes being arranged parallel to the flow of the electrolyte. The portion of the apparatus where the blades, *d* and *h*, are situated, is of reduced area in cross-section, in order to prevent a space being left at the surface of the liquid where the gases could accumulate. Owing to the rapid flow of the electrolyte, the surface of the liquid tends to rise higher at the outer walls of the chamber, *a*, (near to the curved ends), thus leaving a space, *v*, where the gases accumulate, and out of which they are removed by vacuum pumps through the outlets, *t*.—B. N.

Oxide ores and the like ; Process of electrically reducing ——. A. Petersson, Alby, Sweden. Eng. Pat. 5655, March 8, 1907.

SEE Fr. Pat. 370,909 of 1906 ; this J., 1907, 327.—T. F. B.

Tin-scrap ; Apparatus for detinning ——. M. Leitch, Elizabeth, N.J., Assignor to American Can Co., Jersey City, N.J. U.S. Pat. 859,565, July 9, 1907.

THE apparatus consists of a metallic U-shaped basket having perforated sides and suspended in a tank containing an electrolyte. Tin scrap is charged continuously into one end of the basket, carried through it by a conveyor, and discharged on to another conveyor which takes the detinned scrap to a washing tank. Cathode plates are suspended in the electrolyte, the other terminal of the electric circuit being connected to the U-shaped basket, so that the tin scrap constitutes a moving anode.—O. F. H.

Tin-scrap ; Method of detinning ——. M. Leitch, Elizabeth, N.J., Assignor to American Can Co., Jersey City, N.J. U.S. Pat. 859,566, July 9, 1907.

TIN scrap, such as old tin cans, is passed continuously through a detinning bath (see preceding abstract), and then passed through a series of washing baths, the scrap being turned over in its passage from one washing bath to another in order to empty out any contained liquid.
—O. F. H.

Detinning. R. S. Wile, Pittsburg, Pa. U.S. Pat. 859,792, July 9, 1907.

THE process consists in dissolving the tin in a solution of stannic chloride of at least 15 per cent. concentration, adding hydrochloric acid, and then electrolysing the solution, using a current of sufficient voltage to give a deposit of tin in the crystalline form. The bath is restored to its original condition and may be used again, or water may be added and stannic oxide precipitated.—O. F. H.

Metals from ores or salts ; Apparatus for electrolytic reduction of ——. C. E. Robertson, St. Louis, Mo. U.S. Pat. 861,319, July 30, 1907.

THE electric furnace comprises a receptacle, provided with an interior lining of material, which is a conductor of electricity, and a disc is arranged in line with the upper face of the receptacle, and is provided on its upper face with conducting bars. Several carbons of tubular form are carried by the conducting bars, and project through the disc into the receptacle, means being provided for transmitting an electric current to the conducting bars and to the lining of the receptacle, the disc being continuously rotated.—B. N.

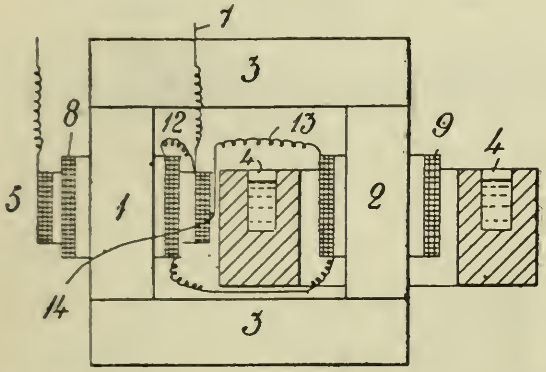
Metallic sulphides ; [Electrolytic] Process of reducing ——. E. L. Anderson, Assignor to T. B. Harvey, St. Louis, Mo. U.S. Pat. 862,871, Aug. 13, 1907.

THE current passes from an insoluble anode to a primary insoluble cathode, which is in contact with a quantity of the ore serving as a " secondary decomposable cathode." The electrolyte consists of hydrofluosilicic acid, which dissolves the metallic constituent of the ore. The current is then reversed, and the metal is deposited on the cathode.—B. N.

Furnaces ; Electric ——. C. A. Keller. First Addition, dated March 25, 1907, to Fr. Pat. 336,403, Nov. 2, 1903 (this J., 1904, 377).

THE channel joining the electrode chambers, is surrounded by an envelope containing a coiled tube, through which water is circulated. The envelope is provided. at its extremities, with projecting pieces through which the coiled tube passes, so as to cool the points of junction of the channel with the electrode chambers.—B. N.

Furnace ; Electric ——. Aktiebolaget Elektro-metall. Fr. Pat. 376.499, April 6, 1907. Under Int. Conv., May 28, and Nov. 5, 1906.



The iron core, 1, 2, 3, is provided with a primary winding, 5, the channel of fusion, 4, forming the secondary. In order to reduce the magnetic dispersion, a suitable current is passed through the coils, 8 and 9, connected in opposition, so as to generate magneto-motive forces, which oppose the escape of the lines of force out of the core. The terminals, 12 and 13, of these coils are connected to an independent source of current, or the terminal, 12, may be connected to the terminal, 7, of the primary coil, the other terminal, 13, being connected at a suitable point, 14, of the primary coil. An alternative form is described in which the coils, 8 and 9, are replaced by a coil arranged along the edges of the upper face of the cross-piece, 3, or several such coils may be used, and supplied with current from the primary coil or from an independent source as described above.—B. N.

Electric induction furnace ; Method of operating an ——, *and apparatus therefor.* A. Hiorth. Fr. Pat. 377,222, April 27, 1907. Under Int. Conv., May 5, 1906.

See Eng. Pat. 28,959 of 1906 ; this J., 1907, 209.—T. F. B.

Electrolytic deposits ; Methods adapted for obtaining ——, *on reversed moulds.* E. Friedheim. First Addition, dated March 4, 1907, to Fr. Pat. 364,737, March 30, 1906 (this J., 1906, 994).

In order to maintain the anode rods in a vertical position, they are passed through horizontal perforated plates, and a metallic mass is cast round the ends of the rods in order to fix them and make good contact with the anodes, after which the perforated plates are withdrawn. —B. N.

Iron oxides ; Process for the reduction of ——. H. W. Lash. Fr. Pat. 376,381, April 4, 1907.

The patent relates to a process of obtaining iron in a state of fusion from iron oxides, such as iron sand, magnetic concentrates, etc. The iron oxide is intimately mixed with cast iron having a high content of metalloids or of easily oxidisable metals such as manganese, and also with carbon (coke), all in a fine state of division. Fluxes and a small proportion of an easily combustible material, as sawdust, may also be added. The smelting is carried out in an electric furnace in a practically neutral atmosphere, the reduction of the iron oxide being effected by the metalloids or easily oxidisable metals contained in the cast iron. The molten iron is subsequently refined in the usual manner.—A. S.

Electrolyte for galvanoplastic work. R. H. Marshall. Fr. Pat. 376,796, April 16, 1907.

See U.S. Pat. 850,944 of 1907 ; this J., 1907, 622.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Olive oil in Spain. Bd. of Tr. J., Sept. 12, 1907. [T.R.]

The mean annual production of olive oil in Spain is estimated at about 200,000 metric tons. The estimated production for 1906 was 133,665 metric tons, as compared with 149,249 metric tons in 1905. This deficiency in the crop is reflected in the export figures during the two years in question. On the other hand, the imports of seed oil, cocoanut, and palm oil, which in many directions may be used as substitutes for olive oil, do not show a corresponding increase. This is, however, accounted for by the encouragement which the Tariff gives to the manufacture of these seed oils in the country, and to which the increase in the importation of seeds bears witness.

The following table shows the imports of seed oil, coco and palm oil, and oleaginous seeds, and the exports of olive oil, into and from Spain, during 1905 and 1906, and the first six months of 1907 :—

—	1905.	1906.	First 6 Months of 1907.
	Metric Tons.	Metric Tons.	Metric Tons.
Imports—			
Seed oil	684	895	330
Cocoanut and palm oil..............	279	548	400
Oleaginous seeds ..	39,526	45,233	32,917
Exports—			
Olive oil	34,228	18,911	6,150

Cottonseed oil ; Alcoholysis of ——. V. J. Meyer. Chem.-Zeit., 1907, **31**, 793—794.

The method of alcoholysis devised by Haller (this J., 1906, 1158, 1226 ; 1907, 328) has been applied by the author to the examination of cottonseed oil. The crude filtered oil (535 grms.) was heated on the water-bath with four times its weight of anhydrous methyl alcohol and about 60 grms. of methyl alcohol saturated with hydrochloric acid gas, the resulting mixture poured into ice-water and neutralised, and the esters (482 grms.), which separated as an oil, fractionally distilled *in vacuo*. The fraction boiling below 200° C. under a pressure of 18 mm. consisted, in the main, of the methyl ester of palmitic acid (m. pt., 28°—30° C.). The fraction boiling above 200° C. under the same pressure, contained a small amount of the same ester and also of an ester melting at 52°—54° C. (presumably the methyl ester of arachidic acid, m. pt. 54·5° C.), this being also present in the distillation residue. The main portion of this fraction remained liquid. It was repeatedly distilled *in vacuo*, and separated into six fractions, which, it was concluded, contained the esters of oleic, linolic, palmitic, and probably stearic and arachidic acids. The author infers from these results that cottonseed oil consists, for the most part, (up to 70 per cent.) of palmitin.—C. A. M.

Cocoanut oil ; Utilisation of the waste product from the refining of ——. O. Sachs. Chem. Rev. Fett- u. Harz-Ind., 1907, **14**, 211—213.

The waste product from the refining of cocoanut oil is sold under the name of "cocoanut oil fatty acid," although it is not, strictly speaking, a fatty acid. Whatever method of neutralisation and removal of proteins has been used in the refining of the cocoanut oil, the residue requires special treatment, to separate precipitated impurities, and to break up the emulsions which obstinately retain the unaltered neutral fat. This is best done by means of a centrifugal filter. The specifically lighter oil collects about the hollow axis of the centrifugal machine and is driven through the opening, whilst the heavier particles are deposited at the periphery. The recovered oil may be blended with a fresh quantity for the next refining, or if sufficiently pure may be sold as neutral cocoanut oil.

Preparation of "cocoanut fatty acid."—For the separation of fatty acids from the soap formed in the neutralising process and the separation of neutral fat from the emulsion, either hydrochloric or sulphuric acid is used according to the nature of the neutralising agent that was employed. The alkaline liquids are boiled in wooden vessels with an excess of the acid until a clear fatty layer rises to the surface. Any contact with iron must be avoided, or the fatty acids will acquire a reddish colour. Owing to their great solubility, the lower fatty acids (caproic and caprylic acids) are nearly all lost, but most of the capric acid separates with the lauric, myristic, palmitic, and oleic acids. The product separated by means of sulphuric acid is of better appearance than that separated by means of hydrochloric acid. After the steam has been shut off, the lower aqueous layer is drawn off into large tanks in the open, allowed to cool, and, after separation of any fatty acid, thrown away. The fatty acid layer in the wooden tank is pumped into a receiving tank where, on standing, further clarification takes place, after which it is washed with water, and finally drawn off into casks.

Properties of "cocoanut oil fatty acid."—In the solid state this is a rancid-smelling fat of a light yellow or reddish-yellow colour and of the consistency of butter. It varies in hardness according to the proportion of neutral fat it contains. The sp. gr. at 100° C. is about 0·880, and the average molecular weight, 202·6, whilst the iodine value usually exceeds 9·5. The m. pt. is generally between 19° and 22° C., and the solidification point between 13° and 18° C. The proportion of neutral fat in commercial samples may be as high as 72 per cent., but as a rule is about 40 per cent. In the last decade of last century this product was difficult to sell on account of the fact that it formed lumps in the saponifying process, and fetched 4 marks per 100 kilos. less than palm-kernel oil; but with increased experience in dealing with fatty acids, and especially since the introduction of carbonate saponification, the price has advanced and "cocoanut fatty acid" of good quality now fetches only 1 to 1·5 marks per 100 kilos. less than palm-kernel oil. The advantages of using the waste product are that the cheaper carbonate saponification can be used for the fatty acid portion, that the soaps prepared from it do not darken, and that it is valuable where rapid working and high yields are required.—C. A. M.

Cocoanut oil; Detection of —— by "salting out" the soap. R. Cohn. Chem.-Zeit., 1907, 31, 855—857.

The incomplete separation of the soaps of cocoanut and palm-kernel oils on the addition of salt is shown to be due to the presence of a large proportion of the glycerides of caproic, caprylic, and capric acids, and not, as stated by Benedikt, to the laurin, the soap from which can be "salted out" without much difficulty. On these facts is based the following method of detecting cocoanut and palm-kernel oils in other fats:—From 5 to 6 grms. of the filtered fat are saponified with alcoholic potassium hydroxide, the alcohol expelled in a current of air, and the soap dissolved in 100 c.c. of hot water. The cold solution is treated with 100 c.c. of a cold saturated solution of sodium chloride, and allowed to stand for 12 to 15 minutes with frequent stirring, after which the liquid is drawn off from the separated soap with the aid of the filter-pump, until 90 c.c. of filtrate have been collected. In the case of cocoanut oil the liquid is somewhat turbid, and on adding an additional 100 c.c. of the salt solution, there is an immediate thick white flocculent deposit and the fluid becomes milky, whereas with *e.g.* cacao butter, there is only a slight flocculent deposit and the liquid remains clear. After 10 minutes, the contents of the flask are filtered, and the filtrate treated with 2 c.c. of hydrochloric acid of sp. gr. 1·12, which immediately produces a turbidity, increasing on standing, in the cocoanut oil soap solution, whereas a cacao-butter soap solution will remain clear. If instead of the acid a third 100 c.c. of the salt solution be added, a further crystalline deposit will be obtained in the case of cocoanut oil. In this way from 10 to 15 per cent. of cocoanut or palm-kernel oils can be readily detected in other fats, whilst still smaller quantities may be found by taking 10 grms. of the original fat, dissolving the soap in 125 c.c. of water, and adding two successive portions of 150 c.c. each of the salt solution. In the case of butter it is necessary to modify the method, but the small amounts of caproic, caprylic and capric acids in butter fat may readily be removed by an extension of the fractional "salting out" process. The method is not applicable to rancid fats, which behave like palm-kernel oil in the test. The author attributes this to the formation of considerable quantities of caproic, caprylic and capric acids from the higher fatty acids in the process of becoming rancid. The method may also be used for the detection of these three acids in substances other than fats, *e.g.* in natural and artificial œnanthic ether (cognac oil). In the artificial product cocoanut oil is used as the source of the fatty acids, whilst in the natural product they are formed in the fermentation process.—C. A. M.

Black raspberry-seed oil. R. Krzizan. Z. öffentl. Chem., 1907, 13, 263—267. Chem. Zentr., 1907, 2, 923—924.

Raspberry seeds contain about 14·6 per cent. of a drying oil, the liquid fatty acids of which consist, for the most part, of linolic and linolenic acids, the former preponderating. Only insignificant quantities of oleic and isolinolenic acids are present in the oil, which, also, contains no volatile acids. The oxygen-absorption value of the oil, determined by Livache's method, was 8·4 per cent. in 2 days, as compared with 14·3 per cent. in the case of linseed oil. Raspberry-seed oil contains about 0·7 per cent. of phytosterol.—A. S.

Oils; Various Indian ——. D. Hooper. Indian Museum Ann. Rep., 1906/7, 8—9.

Cochlospermum Gossypium. The seeds of this silk-cotton tree yield an oil which occupies an intermediate position between a semi-drying and a non-drying oil. The oil can be produced in large quantities, and could probably be used for soap making, etc.

Myristica canarica. The seeds contain about 50 per cent. of fat which melts at 39° C. The fat yields 92 per cent. of crystalline fatty acids melting at 41° C. By recrystallisation from alcohol, crystals of myristic acid were obtained, showing that myristicin was present in the fat.

Myristica malabaricæ. Large quantities of fat, which might be more extensively used for technical purposes, can be obtained from the seeds and mace.—W. P. S.

Patents

Oil testing [viscosity and flash point] apparatus. W., T. W., and A. Lees. Eng. Pat. 27,036, Nov. 28, 1906. *See* XXIII.

Fats; Method of saponifying —— in globular state by means of alkali carbonates, and application thereof [cleansing textiles]. E. de Grousseau. Fr. Pat. 376,122, March 25, 1907.

The fat is dissolved in suitable hydrocarbons, and the solution mixed with an emulsifying agent such as soap or saponin (preferably soap containing 60 to 65 per cent. of fatty acids), and treated with an aqueous solution of alkali carbonate at 100° to 120° C. A suitable mixture of hydrocarbons for effecting the solution consists of 23·5 per cent. of petroleum oil, 36·5 per cent. of oleonaphtha, and 40 per cent. of turpentine oil, and this is used in the proportion of 10 kilos. to 10 kilos. of the fat. At the same time 50 kilos. of the finely-divided soap are mechanically mixed with about 50 kilos. of water in a vessel into which steam is being introduced, until the mixture forms a paste. The hydrocarbon solution is now introduced, the vessel hermetically closed, and the mixing continued for about 15 minutes to render the mass homogeneous, after which it is introduced little by little into a solution of 200 kilos. of anhydrous sodium carbonate in 500 kilos. of water at about 100° C. The alkali solution is contained in a boiler of special construction provided with a helical agitator, and the temperature is maintained at 100° to 110° C. Owing to the fine state of division of the fat, saponification takes place rapidly, and the hydrocarbons, remaining undissolved, are able to bring a fresh quantity of fat into solution. Thus by admitting the melted fat in a fine stream, the process becomes continuous until finally the whole of the sodium carbonate has been utilised. Soap thus prepared has great detergent power, owing to its containing most of the hydrocarbons used in its manufacture, whilst the turpentine oil has a bleaching effect. Claim is also made for the application of the process to the cleansing of textile fabrics. For this purpose, the partially saponified oil is separated after 15 minutes' treatment. The fabrics (100 kilos.) are heated, by means of steam, with about 30 to 35 litres of water and 100 to 150 grms. of the saponifying product, the tank being rotated for about 5 minutes. The liquid is now drawn off and replaced by the requisite amount of water containing 700 to 800 grms. of the product, and steam is admitted to the tank. The cleansing is finished in about 35 minutes.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Paints for buildings. M. Ramos-Garcia, Paris. Eng. Pat. 29,504, Dec. 27, 1906.

See Fr. Pat. 370,794 of 1905; this J., 1907, 264.—T. F. B.

Lake; Colouring matter ——. C. Immerheiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 863,396, Aug. 13, 1907.

Red colour lakes fast to light, are obtained by forming insoluble salts of azobenzeneazo-1-naphthol-4-sulphonic acid.—F. M.

(*B.*)—RESINS, VARNISHES.

Spanish turpentine. Chem. and Drugg., Sept. 5, 1907. [T.R.]

About seven years ago the various works in Spain engaged in the manufacture of rosin and oil of turpentine formed a trust, under the title of "L'Union Resinera Espanola," with headquarters at Bilbao. The undertaking, which has practically a monopoly in these products in Spain, has met with a great measure of success, judging from a report on its financial position which has recently been issued. The following figures illustrate the progress of the trust since its origin:

—	Turpentine oil.	Resin.	Profit.
	kilos.	kilos.	pesetas.
1898–1899	1,866,821	6,534,661	1,025,179·24
1899–1900	2,336,288	8,375,535	1,243,531·73
1900–1901	2,379,301	8,167,005	1,315,552·87
1901–1902	2,287,671	7,972,650	1,773,418·67
1902–1903	2,549,309	8,706,474	1,953,886·46
1903–1904	3,146,896	10,825,256	2,183,135·53
1904–1905	3,440,815	12,090,555	2,892,435·42
1905–1906	3,589,324	12,157,241	3,069,555·43

The trust now possesses twenty factories and thirteen saw-mills, and, as labour is cheap, the cost of production is kept very low. Last year a new method of distillation (the patent of N. Calixte Rodriguez) was given a trial, and as it proved satisfactory, it was eventually adopted at all the factories. Of the total output last year, 76·79 per cent. of the turpentine was exported, the remaining 23·21 per cent. being consumed in Spain. The prices obtained were very satisfactory, considering the fact that American turpentine oil at the beginning of 1905 stood at 38s. per cwt., advancing to 63s. odd in June, and receding to about 49s. by the end of the year. Good prices were also obtained for rosin, it being remarkable that clear Spanish for the first time realised 6d. per cwt. more than similar French. Exportation of the products was facilitated by the establishment of a depôt at Passages and by the use of tank-waggons. In 1905, 1,351,945 kilos. of turpentine oil was sent to Switzerland, Italy, and South Germany, whereas three years ago scarcely half a million kilos. was exported to those countries. It is only within the past two years that rosin has been exported to England, the quantity shipped from Bilbao being 3,187,000 kilos. Belgium received 1,527,938 kilos., Holland 213,790 kilos., and France 22,768 kilos.

Shellac analysis; Report of Sub-Committee on ——. J. Amer. Chem. Soc., 1907, **29**, 1221—1227.

The Committee recommend, for the determination of rosin in shellac, the Wijs method as described by Langmuir in this J., 1905, 12. All details of the method are there given, and the Committee confirm his choice of the figures 18 and 228 as the constants for shellac and rosin respectively. They suggest the use of acetic acid of melting-point between 14°·7 and 15° C., as determined by cooling to 10° or 11° C., a quantity contained in a test-tube suspended by a cork in a larger test-tube, and observing the temperature which remains constant after crystallisation has begun.—J. T. D.

Patents.

Turpentine; Process of treating wood for the extraction of ——. F. T. Snyder, Oak Park, Ill., U.S.A. Eng. Pat. 19,870, Sept. 6, 1906. Under Int. Conv., Dec. 1, 1905.

See Fr. Pat. 368,198 of 1906; this J., 1906, 1226.—T. F. B.

Turpentine; Process of obtaining —— *from wood.* J. W. Thompson, Raleigh, and T. J. Newsom, Clinton, N.C., Assignors to A. P. McPherson, Lillington, N.C. U.S. Pat. 862,680, Aug. 6, 1907.

The wood is immersed in crude molten turpentine and heated so as to volatilise the latter and also the turpentine contained in the wood, after which the heat is increased so as to extract the rosin from the wood.—A. G. L.

Varnish for producing matt surfaces. A. Herbig, Cologne-Bickendorf, Germany. U.S. Pat. 861,847, July 30, 1907.

The varnish is produced by mixing a fatty drying oil varnish with hydrated alumina.—A. G. L.

Siccative; Process for making a ——. L. G. Leffer, Cologne, Germany. U.S. Pat. 864,475, Aug. 27, 1907.

Resin which has not a strong acid reaction, or ordinary commercial resin which has been neutralised by the addition of alkaline salts, is liquefied by heating, and then cooled somewhat, but not to such a degree that the mass cannot be stirred. Oil of turpentine is now added, and after further cooling, the mass is mixed, with stirring, with an alcohol capable of dissolving resin, then filtered, and diluted with a suitable liquid.—A. S.

Colourless drier for paints, varnishes and oils. G. Guittet. 1st Addition, dated March 18, 1907, to Fr. Pat. 367,989, July 11, 1906 (this J., 1906, 1226).

An addition of acetic acid in the proportion of about 20 grms. per litre causes the drier to remain colourless, even when kept for a long time before use.—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

Latex from Funtumia elastica, Stapf; Analysis of ——. D. Spence. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.). Reprints 1907, [9], 3—10. (See this J., 1907, 626.)

The latex examined, was obtained from W. Africa, and had been preserved by the addition of formalin. It was practically neutral to litmus, but faintly acid to phenolphthalein. Its sp. gr. at 20°/4° was 0·9989, and its composition as follows:—water, 76·2; caoutchouc, 19·85; resins, 2·00; organic crystalloids (sugars, organic acids and certain nitrogenous compounds, compare following abstract), 1·39; insoluble constituents (largely protein), 0·36; total nitrogen, 0·438, (calculated as protein, 2·73); and mineral matter (K', Fe''', Ca'', Mg'', PO_4''', SO_4'', C_2O_4''), 0·266 (of which potassium salts constituted as much as 0·21) per cent. By the term "coagulation" the author understands the whole series of processes whereby a solid clot of what is known commercially as raw rubber is obtained from the latex; "agglutination" ("Zusammenballen") is a stage in the process, during which the caoutchouc globules are converted into fine flakes or solid particles which are not yet coalesced to form a clot. "Agglutination" of *Funtumia* latex is favoured by positive and inhibited by negative ions (compare V. Henri, this J., 1907, 264—265). By submitting the latex to centrifugal action at the rate of 3000 revs. per minute, only an incomplete separation of the rubber as a "cream" is effected; the separation is more nearly complete if the latex be first saturated with a salt such as ammonium sulphate, but the agglutinated product obtained, must in either case be submitted to pressure or to mechanical agitation, or to the action of some chemical agent, such as alcoholic phenol, to complete coagulation. A more simple and efficient method of coagulation is by the addition of a dilute solution of acetic acid mixed with an equal volume of an alcoholic solution of creosote (20 : 1). A sample of washed rubber, prepared by this method, had the following composition:—caoutchouc, 88·9; resins, 9·6; insoluble impurities (largely protein), 1·47; moisture, 0·4; nitrogen, 0·93 (calculated as protein, 5·8); and ash (Fe_2O_3,CaO,PO_4'''), 0·09 per cent. The potassium salts present in the latex were completely absent from the washed rubber. Attempts to bring about coagulation by digesting the protein of the latex by means of rennet, trypsin, or pepsin, were unsuccessful, although in the case of trypsin it was shown that digestion did, in fact, take place. The presence of a protein film surrounding the caoutchouc globules, as suggested by Weber, is therefore unlikely, and the author prefers the explanation that coagulation is the result of a disturbance of the equilibrium between two opposing forces—(1) the negative charge on the colloid aggregate (compare Henri, *loc. cit*); (2) the surface tension of the particles of caoutchouc, which originally held the globules in suspension. It is suggested that digestion may be found to be a suitable method of freeing the latex from the objectionable proteins. The value for protein, calculated from nitrogen content, which is usually shown in rubber analyses, is worthless and misleading, since part of the nitrogen is undoubtedly present in some other form than protein.—E. W. L.

Latex from Funtumia elastica, Stapf; Crystalloids and inorganic constituents in ——. D. Spence. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.). Reprints, 1907, [9], 11—17.

The method of analysis adopted for the determination of these inorganic and organic substances in latex is as follows:—50 c.c. of the latex are dialysed against 100—150 cc. of distilled water for 40 hours, and the dialysate is then evaporated to dryness on the steam-bath, the residue dried over sulphuric acid *in vacuo*, and weighed. Three experiments are made side by side. The dried residue from the dialysate of one of these is carefully incinerated, and the ash examined quantitatively as far as possible. The second dialysate serves for the determination of organic acids, their soluble salts, and soluble sugars, these being separated from inorganic salts and certain hexahydrobenzene derivatives by means of hot absolute alcohol. The third dialysate is reserved for qualitative examination, and isolation of the sugar-like substances. By this process the following results were obtained with *Funtumia* latex:—

By extracting the dialysate with water a product similar to the sugar-like product obtained by Weber from *Castilloa elastica* latex (Ber., 1903, **36**, 3110) was obtained. No evidence of the presence of pentoses could be obtained. The residue from the dialysate was practically insoluble in benzene and chloroform and but partially soluble in alcohol or acetone. It was faintly acid to litmus, and gave an intense yellow coloration with alkali, which darkened on boiling, but no volatile bases were evolved.

In two experiments the total crystalloids in the latex were found to be 1·565 and 1·575 per cent. respectively, of which about 20 per cent. were soluble in alcohol. The inorganic crystalloids as determined by incineration, amounted to 0·206 per cent. Hence the organic crystalloids, consisting of sugars, organic acids and nitrogen compounds, amounted to about 1·4 per cent. The portion soluble in alcohol probably represents organic acids and salts. In another sample of latex as much as 3·5 per cent. of sugars, organic acids and soluble salts was found. Potassium was present in the dialysate in quantity, magnesium in traces. Neither iron nor calcium were found in the dialysate, and are therefore present in an insoluble form in the latex, probably as insoluble phosphates, sulphates and oxalates, possibly also as resinates. The absence of potassium from washed, *Funtumia* rubber may be taken as evidence of the efficiency of the washing process. The nitrogenous product in the dialysate from *Funtumia* latex is not coagulated by boiling nor by nitric acid, and does not give the biuret reaction. It is probably one of the simpler end-products of protein digestion (compare Green, Proc. Roy. Soc. **40**, 28).
—E. W. L.

Rubbers from various Indian trees. D. Hooper. Indian Museum Ann. Rep., 1906–7, 6.

A specimen of rubber from Mergui was found to be of great purity. It was discovered in the crown of the root of *Hevea Brasiliensis* where the Hevea rubber termite had made a nest. It would appear that the insects had reduced the proportion of resins by consumption, or by some chemical process of separation in the crude latex. Three samples of rubbers from *Parameria glandulifera*, from Burma, were of very good quality and yielded 92·4, 95·1, and 96·7 per cent. of caoutchouc, respectively.

Ficus rubbers. None of the samples obtained from wild Indian fig trees approached in composition to the superior quality of the secretion of *Ficus elastica*. The five samples examined were from the following species, and contained large quantities of resinous constituents:—

	Caoutchouc.	Resins.	Ash.
Ficus tomentosa	31·2	65·9	2·9
,, *retusa*..........	24·1	74·5	1·4
,, *bengalensis*	21·4	76·4	2·2
,, *Rumphii*	12·6	84·4	3·0
,, *glomerata*......	4·9	94·0	1·1

The latex of *Streblus asper* yielded 25 per cent. of solid crude rubber, which consisted of 22·9 per cent. of caoutchouc, 76·5 per cent. of resin, and 0·6 per cent. of ash.
—W. P. S.

Rubber; New method of preserving articles of ——. R. J. Thal. Wojenno-med. J., 1907, **220**, 201. Chem.-Zeit. 1907, **31**, Rep., 414.

Rubber articles may be kept permanently in tightly-closed metal cases containing ammonium carbonate, which should be renewed once a year. The ammonium carbonate should be in hard, clear crystalline lumps containing 31—32·5 per cent. of ammonia. 5 grms. of the carbonate per litre content of the box employed is a suitable amount.—T. H. P.

Patents.

Plastic material applicable as a substitute for caoutchouc; Manufacture of a ——, and its application to the tyres of vehicle wheels and to other purposes. B. Sauton. Eng. Pat. 27,616, Dec. 4, 1906. Under Int. Conv., Aug. 10, 1906.

Powdered trioxymethylene or other substance capable of evolving formaldehyde, is mixed with an oxidising agent, such as sodium-, barium-, or lead peroxide, also in the form of powder, and the mixture is incorporated with a viscous mass prepared by heating together gelatin or the like and glycerin. The peroxide may be diluted with glycerin before mixing it with the trioxymethylene. The plastic material thus obtained may be applied to the wheels of vehicles by first moulding it, and then introducing it into an outer cover with the aid of a felloe that can be taken to pieces.—A. S.

Indiarubber; Apparatus for curing [coagulating] ——. H. A. Wickham, London. Eng. Pat. 7371, March 27, 1907.

The patent relates to an apparatus for the coagulation of rubber latex. The latex is placed in the lower portion of a ring or cylinder having one end open, and the upper portion of which is surrounded by a hood. A flue leading from a furnace in which dense smoke is produced, projects radially inside the cylinder, so that the smoke is directed against the inner surface of the latter. On rotating the cylinder, a thin film of the latex is carried round on its inner surface; this is coagulated and solidified by the smoke, and during the next rotation a fresh film of latex is carried round and coagulated, and so on.—A. S.

Rubber; Regeneration of manufactured ——. C. d'Authier de Rochefort and J. L. Sance. Fr. Pat. 376,448, March 4, 1907.

The waste rubber is introduced into a bath of molten metal composed of 100 parts of tin and 2 parts of bismuth. The mixture is well stirred, and the rubber which rises to the surface, is skimmed off, and freed from adhering metal by dissolving it in "mineral essence," from which it is subsequently recovered by evaporation.—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Puer liquor obtained from the dung of animals, principally of dogs; Process for the manufacture of a substitute for the ——*, for use in the manufacture of leather, especially glacé leather.* E. Kohn and O. Jellinek. Fr. Pat. 376,605, April 11, 1907.

The patentees have found that the active agent in ordinary puer liquor is a kind of ferment, a culture of which they prepare in the following manner. A fragment of dog-dung, several months old, is introduced into a sterilised tube, and kept at 30° C. for 2—3 weeks, when a considerable growth of the puer ferment takes place. A nutrient liquid composed of an aqueous solution of cane sugar, peptone, and meat extract is now prepared, and after addition of 3—4 grms. of dog-dung, is sterilised; it is then inoculated with the ferment prepared as described above. The surface of the liquid and the walls of the vessel soon become coated with a white skin composed of the ferment. The puer liquor is prepared by adding a small quantity of tartaric acid and a suitable quantity of the ferment to water, stirring well, and heating to 45° C.; and the skins after liming, are steeped in this liquor. —A. S.

Leather; Artificial ——*, and process of making the same.* S. Meers, New York. Eng. Pat. 18,499, Aug. 17, 1906.

See Fr. Pat. 369,220 of 1906; this J., 1907, 106.—T. F. B.

Leather for use as an insulating cover for electric conduits; Process for the preparation of ——. H. Egger. Fr. Pat. 376,660, March 18, 1907.

Skins which have been tawed by means of fish oil, are introduced into a mixture composed of: colophony, 4; shellac, 2; paraffin oil, 5; linseed oil, 10; and oil of turpentine, 5 parts, at a temperature of about 50° C. The leather is then beaten for about six hours, dried at 40—50° C., introduced into a mixture similar to the first but containing in addition, 2 parts of paraffin wax, and afterwards again beaten until it attains a temperature of about 40° C., and finally dried.—A. S.

Albuminous substances; [Electrolytic] Treatment of ——. R. Desgeorge, Lyon, France. U.S. Pat. 863,268, Aug. 13, 1907.

The albuminous substances are diluted with a solution of sodium chloride, and the product is submitted to an electrolytic treatment with metallic electrodes until it becomes insoluble. The electrodes are "of such a nature as to impart colour to the finished product."—B. N.

Horn-like mass; Process for producing a ——. H. Schwarzberg and E. Noa, Berlin. U.S. Pat. 864,388, Aug. 27, 1907.

See Fr. Pat. 358,172 of 1905; this J., 1906, 190.—T. F. B.

Elastic material, and process for manufacturing articles composed of it. R. Neufeld. Fr. Pat. 376,509, April 6, 1907.

The elastic material is prepared by mixing glue and glycerin with substances, such as barium sulphate, "fossil meal," starch, etc., which are bad conductors of heat, treating the mixture with chromium salts, and then hardening the mass by exposing it to the action of light. The process of manufacturing articles composed of this material, consists of building them up by means of superposed layers of the material with intervening layers of a light-reflecting substance. A thin layer of the elastic material of the desired shape, after the treatment with a chromium salt, is hardened by exposure to light, and then coated with a layer of a light-reflecting substance, *e.g.*, a white pigment such as zinc oxide. A second layer of elastic material is then applied, and the mass is subjected to compression and exposed to light; these operations are repeated until the desired thickness is attained, layers of zinc oxide and of elastic material being applied alternately, and the mass compressed strongly and exposed to light after each application of the latter.—A. S.

XV.—MANURES, &c.

Fertilizers and Feeding Stuffs Act, 1906. [T.R.]

The Board of Agriculture have issued a leaflet summarizing the chief amendments of the law relating to fertilizers and feeding stuffs which were effected by the Act of last year. Among the principal amendments of the Act of 1893, which it supersedes, is one to the effect that the actual percentages, and not merely the *minimum* percentages, of nitrogen, soluble phosphates, insoluble phosphates, and potash must be stated in the invoices of fertilizers which have been subjected to any artificial process in the United Kingdom or imported from abroad. Another stipulates that statements of the percentages of chemical and other ingredients in any article sold for use as a fertilizer, whether contained in the invoice or in an advertisement or circular descriptive of the article, will have effect as warranties; but in the case of statements in an invoice as to percentages of nitrogen, phosphates, and potash, the extent of the warranty is affected by the "limits of error" which are prescribed by regulations which have been made by the Board. Further, in the case of any feeding stuff artificially prepared otherwise than by being mixed, broken, ground, or chopped, the invoice must state the percentages of oils and albuminoids; and, finally, provision is made for analysis by the official agricultural analyst of samples taken without any communication of the fact to the seller.

Patents.

Fish manure drying plant; Condensing and deodorising gases arising from ——. C. Catto, Aberdeen. Eng. Pat. 24,901, Nov. 6, 1906.

A pipe is connected with the upper part of the cylinder in which the manure is dried, the outlet end of the pipe extending below the surface of a body of water, preferably the sea. Compressed air is blown through a jet or jets into tapering or contracted portions of the pipe, so that the gases are forced towards the outlet end of the pipe. —W. P. S.

Fertiliser from atmospheric nitrogen; Process for manufacturing a ——. L. Roth, Breslau, Germany. Eng. Pat. 12,741, June 1, 1907.

A tank provided with a false bottom made of sandstone or other porous material is employed in the process. On the false bottom is placed a sludge consisting of clay, 200; fine sand, 100; lime, 75; magnesia, 20; iron, 200; and water, 600 parts by weight. To the mixture is added 1 per cent. of its weight of ferrous sulphate or 0·5 per cent. of sulphuric acid, and air is admitted to the space below the false bottom, after the mixture has been heated to a temperature of 60° C. In a few hours a mixture containing 6 parts by weight of nitrogen is said to be obtained. —W. P. S.

Fertilising elements soluble in water; Fixation [in the soil] of ——, and especially of the nitrogen of nitrates, to prevent its loss by rain, etc. Les Fils de A. Derome. Fr. Pat. 376,572, June 16, 1906.

Fertilising elements soluble in water are prepared for use in agriculture, according to one process, by taking up their aqueous solution by dry peat or other suitable absorbent; or, according to a second process, are incorporated with or absorbed in solution by materials that will harden or set by hydration. For example, a solution of the nitrate or other fertiliser, is absorbed by cement, lime, or dried clay or the like, in a porous condition, and the material is dried; or the nitrate may be ground with the absorbent, in a dry state, and granulated.—E. S.

XVI.—SUGAR, STARCH, GUM, &c.

Patents.

Beetroots; Process and apparatus for the treatment of —— by diffusion. A. X., G. M. J., and R. M. J. Collette. Fr. Pat. 376,104, Mar. 25, 1907.

The beets are rasped to a pulp, and the pulp is introduced into the first of a series of open vats. The pulp, entering at one end of the vat, is elevated by means of an injector, operated by compressed air, at the other end of the vat. Above the series of vats is situated a corresponding series of rotary sieves into which the pulp is elevated. These sieves are so placed that the pulp from one vat is delivered into the next vat in one direction, and the liquid which drains from the pulp is delivered into the next vat of the series in the contrary direction.—J. F. B.

Cane juice; Process for removing impurities from ——, and apparatus connected therewith. The Mirrlees Watson Co., Ltd., Glasgow. From E. C. Knight, Tacuman, Argentine. Eng. Pat. 22,387, Oct. 10, 1906.

Limed cane juice is passed through a series of heaters, in which its temperature is raised to from 200° to 260° F., and is then delivered to a separating tank. From the latter the juice is allowed to flow by gravity to one or more filter-presses. A part, or the whole, of the juice may be delivered from the separating tank into a mixing tank where it is maintained at a temperature of 212° F., before being conducted to the filter-presses. Suitable stirring apparatus is provided in the mixing tank.—W. P. S.

Sucrate of lime; Apparatus for making ——. J. F. Pool, Philadelphia, Pa., Assignor to The American Sugar Refining Co., Jersey City, N.J. U.S. Pat. 861,893, July 30, 1907.

The apparatus consists of a vertical tank provided with two transverse tube-plates, the latter being connected by a large central tube or well and by a number of narrower tubes disposed around the well. A screw propeller situated at the bottom of the well, causes the molasses solution to circulate through the well and tubes, transverse partitions in the former preventing any whirling motion of the solution. Above the upper tube-plate is a deflector which guides the solution rising through the outer tubes towards the wall of the tank.—W. P. S.

Sugar manufacture and refining; Process for the rapid and complete exhaustion of low-grade syrups in ——. L. Prangey and J. de Grobert. Fr. Pat. 376,294, Mar. 30, 1907.

The massecuite is produced on a basis composed of crystalline sugar and the low-grade syrups to be treated. The quantity of sugar crystals used is calculated according to the quantity of recoverable sugar in the syrups. Boiling is continued with the addition of the low-grade syrups until a certain point of supersaturation and viscosity is reached. After this point the charge in the pan is fed with exhausted molasses in order to avoid the production of fine grain. The final degree of concentration of the massecuite, corresponds with 5—7 per cent. of water, and crystallisation is then carried on to exhaustion by cooling and malaxage.—J. F. B.

Starch from corn; Process of making —— in lumps or in stick form. Harburger Stärke-Fabrik F. Thörl. Fr. Pat. 376,767, April 15, 1907.

See Eng. Pat. 9931 of 1907; this J., 1907, 980.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Maltodextrin-γ, an intermediate product of the diastatic hydrolysis of starch. C. Rheinfeld. Z. Spiritusind., 1907, **30**, 371.

By the repeated fractionation, by means of different mixtures of alcohol and water, of a syrup obtained from a diastatic starch conversion continued until the red iodine reaction had disappeared, the author has obtained five samples of maltodextrin-γ. The value of $[\alpha]_D$ for these fractions varies from 163° to 167° and that of "R" from 58° to 62°. Grüters (this J., 1904, 875) gave the values $[\alpha]_D = 160°$ and "R" = 61°. As a certain amount of carbohydrate material always undergoes polymerisation and condensation when the solution is repeatedly evaporated, the author has determined Ost's dextrose values for the five samples of maltodextrin obtained, and from these the actual amounts of carbohydrate matter present. When corrected according to the numbers thus obtained, the values of $[\alpha]_D$ and "R" for maltodextrin-γ become 170°—173° and 61°—64° respectively; this method of correction is not quite exact, as it assumes that the condensation and decomposition products formed in the syrups are optically inactive and non-reducing. Maltodextrin-γ is fermented to the extent of about 50 per cent. by bottom-fermentation yeast of the Frohberg type, whilst with the dextrin prepared by Grüters the proportion fermented was only 24 per cent. —T. H. P.

Alcohol oxydases; Properties of ——. F. Rothenbach and W. Hoffmann. Z. Spiritusind., 1907, **30**, 368.

The authors have made experiments to ascertain whether the oxygenases of permanent preparations of acetic acid bacteria have their weakened oxidising power raised to its original value by means of hydrogen peroxide. The acetic acid bacteria employed, were pure cultures of the β-R-race, and the results of the tests showed that the presence of hydrogen peroxide causes no increase in the amount of acetic acid produced. The experiments were not absolutely conclusive owing to the small amounts of the permanent bacteria cultures available.—T. H. P.

Sarcina discovered by Beijerinck and Gosling; Study of the ——. J. F. A. Pool. Pharm. Weekblad, 1907, **44**, 664—672. Chem. Zentr., 1907, **2**, 551—552. (See this J., 1905, 1317).

A pure culture of the sarcina may be more easily obtained if the culture liquid, before the addition of garden soil, be boiled with potassium bitartrate. Before adding the garden soil, however, both it and the culture liquid should be brought to a temperature of 37° C., as otherwise, lactic and butyric bacteria may develop at the expense of the sarcina. The latter resists the action of lactic, sulphuric and hydrochloric acids, but is very sensitive to nitric and acetic acids, sodium chloride, and potassium binoxalate. It ferments dextrose, *d*-galactose, lævulose, maltose, sucrose, melibiose, and raffinose (the two last-named only slightly), but not *d*-mannose, lactose, erythritol, dulcitol, mannitol, sorbitol, amylum, dextrin, glycogen, and inulin. Invertase appears to be the only enzyme secreted by sarcinæ. The amount of acid formed during fermentation appears to be independent of the quantity of dextrose in the solution, but the volume of gas produced increases with the quantity of sugar present. The sarcina preparation gives a colour reaction with the zinc chloride and iodine reagent only after a 24-hours' treatment with 32 per cent. nitric acid or a 3—4 hours' treatment with 5 per cent. potassium hydroxide solution; in the first case, the colour produced is violet, in the latter, blue. After a thorough washing with distilled water, the preparation dissolves in cuprammonium solution, and from the liquid, on addition of hydrochloric acid, a white precipitate separates, which, after washing and drying, is coloured blue by the zinc chloride and iodine reagent.—A. S.

Patents.

Hops ; Apparatus for extracting the essential oils from ——. F. S. Davidson and W. P. Burra. Fr. Pat. 376,986, April 9, 1907.

See Eng. Pat. 23,113 of 1906 ; this J., 1907, 707.—T. F. B.

Hops ; Process for extracting the essential oils from ——. F. S. Davidson and W. P. Burra. Fr. Pat. 376,987, April 9, 1907.

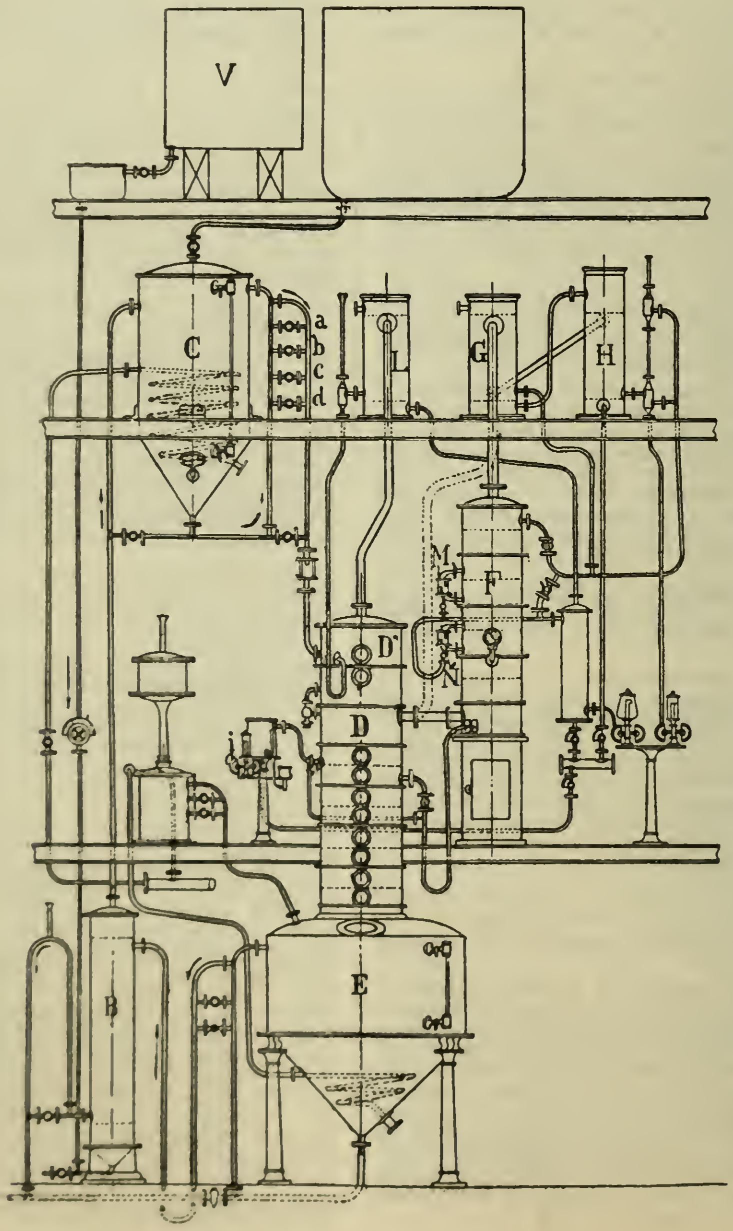
See Eng. Pat. 4009 of 1907 ; this J., 1907, 984.—T. F. B.

Liquids such as milk, bouillon, beer, etc. ; Process and apparatus for sterilising ——. J. Desmaroux. Fr. Pat. 376,226, Mar. 29, 1907. *See* XVIIIA.

Brandy ; Apparatus for the continuous distillation of fine ——. E. A. Barbet. Fr. Pat. 376,352, June 9, 1906.

The wine from the vat, V, passes through a preliminary heater, B, in which the exhausted vinasse from the still, E, is circulated. From B, it ascends to the heater, C, controlled by the cocks, *a*, *b*, *c*, and *d*, in which it remains for a longer or shorter time. The heated wine undergoes its first purification in the plate-column, D', and the vapours are condensed in L. The object here is only to expel the acid gases of the wine, particularly the sulphur-compounds, the condensed vapours being returned. The wine descends from D' to D, and finally to the still, E, from the bottom of which the vinasse is discharged. The vessels, C and E, are constructed with conical bottoms to prevent lodgments of yeast. The alcoholic vapours from D, then undergo the "repasse" in the rectifying plate-column, F. The head-products pass through G, and are condensed in H ; esterification and "maturing" take place in this column, and the fine brandy is drawn off at a suitable point in the column, F. M and N are closed inspection chambers for observing the strength, temperature and flow of the spirits.

—J. F. B.



XVIII.—FOODS ; SANITATION ; WATER PURIFICATION, & DISINFECTANTS.

(*A*).—FOODS.

Wheat flour ; Microscopic examination of —— for foreign flours, especially rice- and bean flour. J. Bellier. Ann. Chim. anal. appl., 1907, 12, 224—228. Chem. Zentr., 1907, 2, 430—431.

The method used by the author is based on the action of potassium hydroxide on starch granules of different kinds. The starches may be arranged, according to their behaviour with this reagent, in the following order : rice, buckwheat, maize, oats, wheat and barley, rye, and legumes, rice starch being attacked least. Three solutions are prepared :—(1) 5 grms. of potassium hydroxide (in rods, containing 2 mols. of water), 15 c.c. of glycerin of 30°, and 85 c.c. of water ; (2), 100 c.c. of solution (1) and 5 c.c. of glycerin of 30° ; (3), 100 c.c. of solution (1) and 300 c.c. of water. Rice starch is scarcely attacked by solution (1), whereas the other starches mentioned are gelatinised in from 1 to 2 hours. With solution (2), the starches from buckwheat and oats are less easily attacked than those following them in the list given above. With solution (3), the cavities and the fissures radiating therefrom, in the starches from legumes, become distinct after a few minutes, whereas they can only be detected in scarcely 1 per cent. of the granules before treatment ; in rye starch, also, the concentric markings become more distinct. —A. S.

Formic acid as a preservative. B. H. Smith. J. Amer. Chem. Soc. 1907, 29, 1236—1241.

Formic acid and its salts act as preservatives, though not so powerfully as benzoic acid. The substance to be preserved must contain at least 0·2—0·5 per cent. of sodium formate for efficiency. Formic acid is separated from food products by acidifying with phosphoric acid and distilling with steam. The distillate must be at least five times the bulk of the sample to ensure complete removal of the formic acid. To test for the acid, the distillate from 100 grms. of the sample is made alkaline with ammonia and evaporated to 3—5 c.c. To this, in a test-tube, are added 3—6 drops of 10 per cent. ferric chloride solution : a red colour indicates formate or acetate. Alcohol is now added, 5 c.c. for each c.c. of the liquid : a precipitate indicates formic acid. In presence of much acetate this precipitate may not form. Benzoic acid gives a precipitate with ferric chloride, which dissolves in alcohol. Sulphites are precipitated by alcohol, and if present, must be removed by adding alcohol before the ferric chloride, and filtering. If great excess of acetic acid be present, sodium hydroxide must be added to the distillate in quantity just more than enough to neutralise the expected formic acid, and the liquid is then evaporated to dryness (finally on the water-bath). The residue is dissolved in 3 c.c. of water and tested with ferric chloride. To determine the amount of formic acid, 25 c.c. of the distillate are treated by Sparre's method (this J., 1900, 568).—J. T. D.

Fertilizers and Feeding Stuffs Act, 1906. *See* XV.

Patents.

Butter ; Artificial ——, and method of manufacturing same. A. M. Sörensen, Höjsley, Denmark. Eng. Pat. 12,355, May 28, 1907.

" Cocoa fat " is intimately mixed, at a temperature of from 18° to 20° C., with about 3 per cent. of salt and from 0·1 to 1 per cent. of sugar. To every kilo. of the fat thus treated are added 100 grms. of milk containing lactic acid bacteria and, if desired, the yolk of an egg and some suitable colouring material. The whole is then mixed at the ordinary temperature. From 10 to 12 per cent. of natural butter may also be added.—W. P. S.

Butter ; Process for making ——. Aktiebolaget Baltic-Separator. Fr. Pat. 376,808, April 16, 1907. Under Int. Conv., April 20, 1906.

See Eng. Pat. 8708 of 1907 ; this J., 1907, 774.—T. F. B.

Flour ; Method of bleaching and ageing ——. J. A. Wesener, Chicago, Ill. U.S. Pat. 863,684, Aug. 20, 1907.

The flour is brought into intimate contact with a mixture of gases containing nitrosyl chloride prepared by passing air through a liquid consisting of from 3·5 to 4 parts of hydrochloric acid and 1 part of nitric acid. The flour is, preferably, allowed to fall in a shower through the air thus treated.—W. P. S.

Dehydration of materials which cannot be heated without undergoing alteration [milk, etc.] ; Process for ——. L. A. Morel. Fr. Pat. 376,426, June 11, 1906.

The material is first submitted to the sudden action of a very high vacuum, with the result that it is converted into a mass of froth or foam. This condition is fixed by next subjecting it to intense cold. The cold foam is then placed in a vessel which is in communication with other vessels containing moisture-absorbing bodies, and it is again subjected to a very high vacuum. This last operation causes the evaporation of the water and leaves the substance in the form of a dry powder from which the original material may be re-constituted by the simple addition of water. As the whole operation is conducted at a low temperature, no change of properties takes place. The use of a number of small pumps, arranged in cascade, to obtain the high vacuum is claimed.—W. H. C.

Liquids such as milk, bouillon, beer, etc. ; Process and apparatus for sterilising ——. J. Desmaroux. Fr. Pat. 376,226, Mar. 29, 1907.

The liquid is drawn by suction into the upper part of a closed vessel, above a perforated plate, through which it falls, ozonised air or oxygen being drawn in at the same time. From the bottom of this vessel the liquid passes to a closed cylinder, divided into two parts by a movable horizontal membrane, and is there subjected to a very low pressure so that a portion distils. By admitting air or water to the upper compartment of the vessel, the liquid is forced out and conducted to a heating arrangement where its temperature is raised to from 115° to 120° C. After sterilisation the liquid may be collected in a storage vessel before being bottled. The bottles are filled previously with an inert gas, such as nitrogen.—W. P. S.

Food product ; Process of preparing nitrogenous vegetable —— [from fungi]. K. Okazaki and H. Yenjo. Fr. Pat. 376,373, Apr. 4, 1907.

The food is prepared by cooking a mixture of rice bran and sawdust and then keeping it at a temperature of about 30° C. until the surface is covered with a growth of mould or fungus. The latter is removed and cultivated at a temperature of from 20° to 35° C., on the bran of cereals or on leguminous seeds mixed with pumice stone, the mixture being sprinkled with water and dried. The mass is then treated with hot water, dilute alcohol, or glycerol, the pumice stone is separated, and the solution is kept for about 18 hours at a temperature of from 40° to 50° C. The liquid is now filtered, and the filtrate evaporated to obtain a highly nitrogenous food material.—W. P. S.

Erratum.—P. 986, col. 1, line 18 from bottom, before Fr. Pat., insert J. Schäfer.

(*B*.)—SANITATION ; WATER PURIFICATION.

Patents.

Water ; Apparatus for the purification of ——. R. Reichling. Fr. Pat. 376,326, Apr. 2, 1907.

The apparatus is particularly designed for the treatment of water to which, preferably, lime has been added, with barium carbonate. The water falls on to a water-wheel contained in a small tank, where it is treated with the necessary quantity of lime, and then falls into a larger tank divided into two parts by a partition reaching nearly to the bottom of the tank. In one of the compartments the barium carbonate is continually stirred up and mixed with the water by means of a number of buckets carried on a chain conveyor actuated by the before-mentioned water-wheel. The treated water passes under the partition and overflows at the top of the second compartment.

A sludge-cock is placed at the lowest part of the first compartment. Two other forms of the apparatus are described; in one the mixing chamber is situated centrally in the tank, whilst in the second, the buckets are replaced by a screw-conveyor.—W. P. S.

Water and other liquids; Automatic apparatus for purifying and filtering ——. W. Boby. Fr. Pat. 376,391, Apr. 4, 1907.

THE water falls into an oscillating or tipping arrangement, which, by its movement, causes a predetermined quantity of reagent to flow into the water. The oscillating part of the apparatus also actuates stirring devices in the tank into which the water and reagent are discharged. Settling tanks capable of being heated, and filters, may be provided in connection with the apparatus.—W. P. S.

Liquids from septic tanks; Biological process for purifying ——. A. J. Carpentier. Fr. Pat. 376,637, Apr. 13, 1907.

THE liquid from septic tanks is subjected to oxidation by passing it in the form of a thin layer over a horizontal ridged surface. From the latter, it falls on to a bed of filtering material and thence, intermittingly, on to a number of inclined plates. A siphon arrangement provides for the intermittent discharge of the filtered liquid, and a current of air is passed over the surface of the liquid during its passage through the various parts of the apparatus.—W. P. S.

(*C.*)—DISINFECTANTS.

PATENTS.

Disinfecting or antiseptic composition, and process of making the same. H. S. Blackmore, Mt. Vernon, N.Y. U.S. Pat. 861,571, July 30, 1907.

METHYL acetate is added to an aqueous solution of formaldehyde, and the mixture is treated with camphor oil. The solution of camphor oil in water is not such a good solvent for formaldehyde as water alone, and, consequently the formaldehyde passes into solution in the methyl acetate. The mixture of methyl acetate and formaldehyde is afterwards separated, and forms the antiseptic claimed.
—W. P. S.

Disinfectant products; Process for making ——. H. Schneider. Fr. Pat. 377,141, April 25, 1907.

SEE Eng. Pat. 3789 of 1907; this J., 1907, 712.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Printing papers; Sizing —— without rosin. Wochenbl. für Papierfab., 1907, **38**, 2868—2869.

IT is stated that paper sufficiently hard for printing purposes can be obtained without the use of any rosin, by employing only a suitable proportion of calcined aluminium sulphate. This process is now being used in mills in Belgium and Germany. The grade of calcined aluminium sulphate employed contains a considerable proportion of silica, which remains in suspension when the salt is dissolved in boiling water; this gelatinous silica is added to the pulp in the beater together with the aluminium sulphate solution and contributes largely to the sizing effect obtained.—J. F. B.

Cellulose; Action of ammonium persulphate solutions on ——. *Cellulose peroxide. II.* H. Ditz. Chem.-Zeit., 1907, **31**, 844—845.

CONTINUING his studies on the action of ammonium persulphate on cellulose (this J., 1907, 988), the author shows that, when the reaction is carried out without the addition of acid, the peroxide properties of the product are very feeble. Using a 10 per cent. solution of persulphate, quantities of dilute sulphuric acid (1:4) ranging from 2 to 13 c.c. per 100 c.c. give good results. The amount of active oxygen fixed by the cellulose was determined in one case and was found to be 0·015 per cent. The products obtained with potassium persulphate are far less active than those obtained with the ammonium salt. The cellulose peroxide possesses the properties of an insoluble acid, as recorded by Cross and Bevan. Quite apart from its "active oxygen" reaction, it liberates iodine from a mixture of potassium iodide and iodate. When the peroxide is suspended in water, the latter shows the ordinary yellow colour on the addition of methyl orange, but if a solution of a neutral salt, *e.g.*, a chloride, iodide, or bromide, be added, the liquid turns red. Stearic acid behaves in a similar manner. The acidity of the peroxide is not destroyed, like the "active oxygen," by boiling with water for two minutes; in fact the acidity and the "active oxygen" appear to be properties of the peroxide quite independent of each other.—J. F. B.

Cellulose; Action of ammonium persulphate solutions on ——. *Formation and properties of a cellulose peroxide. III.* H. Ditz. Chem.-Zeit., 1907, **31**, 857—858.

IN a former communication (see preceding abstract) it was shown that cellulose that had been treated with ammonium persulphate contained free acid. When the peroxidised cellulose was gently heated with a 10 per cent. solution of potassium hydroxide, a golden-yellow coloration was produced, and partial solution occurred. The filtrate treated with hydrochloric acid in excess was almost decolorised, whilst a dirty white deposit was formed. The peroxidised cellulose also reduced Fehling's solution considerably on heating, and this fact and the characteristic golden-yellow colour indicated the presence of oxycellulose (compare Nastukoff, this J., 1902, 733). The author's peroxidised cellulose differed from the hydralcellulose of Bumcke and Wolffenstein (Ber., 1899, **32**, 2493), obtained by the action of hydrogen peroxide upon cellulose, in the fact that it contained an acid (possibly acid-cellulose). Hence the products of the action of ammonium persulphate in the presence of sulphuric acid upon cellulose are a peroxide, a free acid (possibly acid-cellulose) and a reducing substance (oxycellulose), with probably some unaltered cellulose. By the action of dilute sulphuric acid alone at 70° C. upon cellulose, traces of free acid were formed and a reducing substance, which was found to be, not oxycellulose, but hydrocellulose. Ammonium persulphate by itself oxidised cellulose with the formation of oxycellulose and the acid, but only traces of cellulose peroxide. The effect of the sulphuric acid appears to be to increase the velocity of the decomposition of the ammonium persulphate. Experiments were made to determine the influence of temperature in the oxidation of cellulose with a 20 per cent. solution of ammonium persulphate in the presence of sulphuric acid. It was found that at 20° to 25° C. there was slight formation of the peroxide with a small amount of oxycellulose and traces of the acid; at 40° C. the amounts of oxycellulose and peroxide were somewhat greater, whilst the quantity of acid was about the same; at 65° C. the amount of oxycellulose only showed a slight increase, but the quantities of cellulose peroxide and acid were relatively much greater. The cellulose peroxide in the products of the reaction was only stable for a relatively short time in the moist condition, and gave little or no coloration with potassium iodide and starch after 2 or 3 days, but when the oxidised products were dried over sulphuric acid after treatment with alcohol and ether, the cellulose peroxide remained stable for a long time (over 4 weeks).
—C. A. M.

PATENTS.

Enamel for paper, cardboard and textiles; "Non-inflammable" protective ——. L. L. Degorce. Fr. Pat. 377,039, Apr. 20, 1907.

THE essential ingredient of the enamel is gum lac, and the composition recommended consists of 20 parts of photographic collodion and 100 parts of gum lac, the mixture being dissolved in 80 parts of alcohol. This composition is spread on a glass plate. The material to be coated is caused to adhere to the enamel by means of a cement composed of water, glycerin, gum lac, borax, and formaldehyde. The two surfaces are pressed together in intimate contact, and the enamelled sheet is peeled off the glass when dry. Gelatin may be mixed with the cement if desired.—J. F. B.

Cellulose solutions ; Manufacture of ——. Hanauer Kunstseidefabrik G.m.b.H., Gross-Auheim, Germany. Eng. Pat. 10,164, May 1, 1907. Under Int. Conv., May 2, 1906.

See U.S. Pat. 840,611 of 1907 ; this J., 1907, 340.—T. F. B.

Filaments out of viscose or similar viscous material ; Process for forming ——. C. A. Ernst, Assignor to S. W. Pettit. U.S. Pat. 863,793, Aug. 20, 1907. *See* V.

Nitrocellulose films ; Process for coating ——. F. M. Cossitt, Assignor to the Anthony and Scovill Co., Binghamton, N.Y. U.S. Pat. 864,123, Aug. 20, 1907.

A solution of nitrocellulose is deposited as a film on a suitable surface on which it is partially dried. The film is stripped from the surface and, if necessary, the partial drying is continued further. The coating composition is then applied to the film whilst the latter is still soft and in a semi-dry condition. Subsequently the coating is dried by the aid of heat and pressure.—J. F. B.

Cellulose [Wood-pulp] ; Process and apparatus for manufacture of ——. A. Müntzing. Fr. Pat. 376,894, Apr. 18, 1907. Under Int. Conv., Apr. 19, 1906.

In the boiling of wood for the manufacture of cellulose, those fibres which have been resolved at an early stage of the process have to undergo the continued action of the boiling liquor until the whole mass is converted. This objection is surmounted by conducting the boiling with a liquor which is circulated outside the boiler. A filter-press is inserted in the liquor-circuit, so that the boiled fibres which float away with the liquor are collected continuously and removed, whilst the filtered liquor is returned to the boiler.—J. F. B.

Celluloid ; Manufacture of substances resembling ——. L. Lederer. Fr. Pat. 377,010, Apr. 20, 1907. Under Int. Conv., May 25, 1906, and Feb. 22, 1907.

Chloral hydrate and chloral alcoholate are claimed as camphor substitutes in the manufacture of celluloid. Mixed esters of cellulose with nitric and organic acids may be used instead of nitrocellulose, or mixtures of simple esters may be used. A substance resembling celluloid is prepared by intimately mixing together 3 parts of cellulose acetate and 2 parts of chloral alcoholate.—J. F. B.

Cellulose products of all kinds ; Process for making ——. Hanauer Kunstseidefabr. Fr. Pat. 377,325, May 1, 1907. Under Int. Conv., May 2, 1906.

See U.S. Pat. 840,611 of 1907 ; this J., 1907, 340.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Opium substitute. D. Hooper. Indian Museum Ann. Rep., 1906—7, 12/13.

The leaves of *Mitragyna speciosa* are used as a substitute for opium in Perak. Two trees of this genus are well known in India and would probably have the same properties; they are *M. diversifolia* and *M. parvifolia.* Some leaves of the last-mentioned tree were examined and found to contain a white crystalline bitter alkaloid which was soluble in ether and chloroform.—W. P. S.

Ibogaine. A. Landrin. Chem. and Drug., 1907, **71**, 300.

Ibogaine, $C_{52}H_{66}N_6O_2$, is an alkaloid recently isolated from the iboga (syn. aboua or abouete or liboka) (N. O. Acanthaceæ, *Tabernanthe Iboga,* Baill.), a plant which grows in West Africa, especially in the Congo, and has been used with some success in the treatment of sleeping sickness. Ibogaine is extracted by grinding the root of the plant with milk of lime, drying, extracting with ether, and treating the extract with 10 per cent. sulphuric acid. The alkaloid is insoluble in water, but dissolves in 28 parts of 95 per cent. alcohol at 15° C. ; it melts at 151° C. Its solutions are lævo-rotatory and suffer oxidation on keeping, but the crystalline base keeps well without decomposition. The hydrochloride forms white crystalline scales, soluble in 50 parts of water at 15° C.. and in 1½ parts of 95 per cent. alcohol at 20° C.—A. S.

Amygdonitrile glucoside ; Presence of —— *in Cerasus padus.* H. Herissey. J. Pharm. Chim., 1907, **26**, 194—198.

E. Fischer's amygdonitrile glucoside has been isolated for the first time, as a natural plant-constituent from the bark and shoots of *Cerasus padus.* The fresh incised twigs were extracted with boiling alcohol, in the presence of calcium carbonate, by Bougault's method, the glucoside isolated by means of hydrous ethyl acetate, and purified by recrystallisation from anhydrous ethyl acetate, ether, and chloroform. The colourless crystalline needles thus isolated, commenced to melt at 138—139° C., and had a rotatory power, $a_D = -27{\cdot}10°$ to $-26{\cdot}51°$, changing, on treatment with barium hydroxide solution, to $a_D = 53{\cdot}21°$, which is practically the rotation of prulaurasin. It is known that traces of barium hydroxide convert synthetic amygdonitrile-glucoside into its isomeride prulaurasin. The identity of the glucoside is further established by the formation of *l*-phenylglycollic acid on hydrolysis by means of hydrochloric acid. Similarly, the glucoside isomerised by means of barium hydroxide, prulaurasin, afforded the optically inactive acid on hydrolysis under like conditions.—J. O. B.

Resinous balsam of Pinus Sabiniana, and Yarrow oil. E. Kremers, F. Rabak and A. Sievers. Pharm. Rev., 1907, **25**, 212—218. Chem. Zentr., 1907, **2**, 909.

The specimen of the resinous balsam of *Pinus Sabiniana* (diggers' pine) examined by the authors, was collected in California. It was semi-solid, and had a dirty brown colour and a characteristic, agreeable odour. The sample, which was contaminated with pieces of bark and other foreign substances, had an acid value, 127, and ester value, 37 ; its alcoholic solution was optically inactive. By distillation with steam, 7·3 per cent. of a nearly colourless essential oil was obtained, having an odour resembling that of the orange The chief constituent of the oil is normal heptane ; pinene could not be detected. By extracting the oil with 50 per cent. alcohol, a small quantity of a golden-yellow oil of very pleasant odour was obtained ; this had an acid value, 42, and ester value, 124. The resin left behind on distilling the balsam was hard, opaque, and very brittle, and had an acid value, 142.

Specimens of yarrow oil distilled from : (1), the fresh undried plant, and (2), the fresh dried plant, gave the following results :—

	Yield.	Colour.	Specific gravity at 18° C. of :		Saponification value.	Saponification value after acetylation.
			fresh oil.	oil after about 1 year.		
1	0·234%	deep blue	0·8687	0·8760	37·7	75
2	0·237%	,,	0·8873	0·8935	29·3	66·4

The presence of pinene in the oil could not be detected. The acid obtained on saponification was mainly acetic acid.—A. S.

Sandalwood ; Characters of essential oil of East Indian ——. W. J. Bush and Co. Chem. and Drug., 1907, **71**, 448.

As showing the need for revision of the official requirements for East Indian sandalwood oil, the results of the examination of oils distilled from sixteen parcels of genuine East Indian sandalwood of good quality are given (see table).

Sp. gr.	Opt. Rot.	Amount of 70 per cent. alcohol required to dissolve oil : at 15° C.	at 20° C.	Santalol, per cent.	Santalol esters, per cent.	Acid value.
0·9754	– 17·2°	4½ vols.	—	95·07	4·51	—
0·9715	– 13·0°	insol. in 10 vols.	insol. in 10 vols.	89·51	8·13	—
0·9844	– 11·5°	„ „	—	99·93	9·64	—
0·9821	– 12·0°	„ „	—	99·60	8·80	—
0·9708	– 21·6°	4½ vols.	3½ vols.	97·33	1·35	1·6
0·9825	– 17·0°	5½ vols.	4½ vols.	96·9	5·36	3·8
0·9855	– 8·5°	—	barely sol. in 10 vols.	83·25	5·2	4·5
0·9796	– 14·8°	7½ vols.	5¾ vols.	93·55	3·97	5·8
0·9778	– 12·8°	—	insol. in 10 vols.	94·29	5·18	4·1
0·9786	– 13·5°	—	„ „	94·43	4·53	5·4
0·9738	– 17·9°	5 vols.	4½ vols.	95·88	5·94	5·6
0·9773	– 17·8°	3½ vols.	—	97·89	2·3	4·1
0·9847	– 14·7°	insol. in 10 vols.	5½ vols.	93·02	4·97	12·9
0·9863	– 15·0°	„ „	6 vols.	94·38	5·92	14·1
0·9770	– 15·0°	6½ vols.	5 vols.	95·73	4·9	—
0·9812	– 13·0°	insol. in 10 vols.	7½ vols.	97·02	7·31	—

These results show that only four of the sixteen specimens respond to the requirements of the B. P. The following opinions are expressed:—(1) The present official limits for the optical rotation of the oil are too narrow. (2). There is no constant relation between the degree of optical activity and the solubility in 70 per cent. alcohol. (3). The solubility test, even when performed at 20° C., excludes a large number of perfectly genuine oils. (4). The proposed limit of "not below 94 per cent. of santalol by acetylation" is too high.—A. S.

Alcohol; Dehydration of —— with lime. A. Kailan. Monatsh. Chem., 1907, **28**, 927—946.

The author has investigated the rate of dehydration of alcohol by boiling it with lime on the water-bath. The best proportion of lime (containing 80 per cent. of CaO) to alcohol (92—93 per cent. by weight) is 0·55 kilo. per litre; after 3½ hours, alcohol of 99·5 per cent. strength is obtained, and the strength rises to 99·9 per cent. after 6 hours. By increasing the amount of lime the dehydration proceeds more quickly, but the quantity of alcohol retained by the lime becomes much greater; when the above proportion of lime is used, the loss of alcohol (retained by the lime) amounts to 6·15 per cent. of the alcohol taken.—J. C. C.

Colloidal silver; Preparation of ——. N. Castoro. Gaz. chim. ital., 1907, **37**, I., 391—395.

Clear yellow colloidal silver solutions are obtained by boiling silver nitrate solution with acrolein. In ammoniacal solutions, an ash-coloured precipitate is produced, but not if a very dilute solution of gelatin be added. Ten c.c. of a 10 per cent. solution of silver nitrate are treated with ammonia until a slight turbidity persists, and is then filtered and diluted to 100 c.c. Thirty c.c. of the solution are diluted to 300 c.c., heated to boiling, a few drops of a 0·5 per cent. solution of gelatin and 2 c.c. of a 33 per cent. solution of acrolein added, and the whole again heated to boiling, until a reddish coloration is produced. The colour becomes reddish-brown, then greenish, and a dark-violet hydrogel is finally deposited, leaving a clear yellow neutral solution, which is more permanent than colloidal silver solutions prepared by other methods. Concentrated solutions are brown in colour, and may also be obtained by means of gelatin alone, without the addition of acrolein.—A. S.

Patents.

Pinene hydrochloride; Treatment of turpentine for use in the manufacture of ——. C. Weizmann and the Clayton Aniline Co., Manchester. Eng. Pat. 23,875, Oct. 26, 1906.

The turpentine is boiled for 1—2 hours with metallic sodium and afterwards distilled in presence of the same metal; 2 lb. of sodium are employed for treating 100 lb. of turpentine. It is stated that when the turpentine so purified is converted into pinene hydrochloride in the ordinary way, the product is practically colourless and extremely rich in the solid hydrochloride, so that it can be used direct, without purification, for the manufacture of isobornyl esters.—J. F. B.

Radio-active crystals; Production of ——. J. Reitz, Elster, Germany. Eng. Pat. 24,222, Oct. 30, 1906.

Crystals containing radio-active water of crystallisation are prepared by treating dried salts either with water which has been caused to absorb the emanation of radium or else with a dilute solution of a radium compound. For instance, 1 kilo. of anhydrous sodium carbonate is added to a solution of 1 mgrm. of radium bromide in a litre of water, and the mixture is allowed to crystallise to a rigid mass.—J. F. B.

Pharmaceutical compounds [xanthine derivatives]; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 4250, Feb. 20, 1907.

See Fr. Pat. 377,382 of 1907; following.—T. F. B.

Xanthine and its homologues; Production of hydroxyalkyl derivatives of ——. Farbenfab. F. Bayer und Co. Fr. Pat. 377,382, May 3, 1907. Under Int. Conv., Aug. 8, 1906, and Mar. 16, 1907.

Xanthine and its homologues, such as theophylline, theobromine, methylxanthine and other bases of this group which have replaceable hydrogen atoms in their imino groups, are treated with halogen-hydrins with or without the presence of an alkali, or else they are treated with an oxide of the ethylene series with or without condensing agents. The imino hydrogen atom is thus replaced by the hydroxy-alkyl group.—J. F. B.

o-*Dihydroxyphenylethanolethylamine; Production of ——.* F. Stolz and F. Flaecher, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 862,674, Aug. 6, 1907.

o-Dihydroxyphenylethanolamines of the formula $(OH)_2C_6H_3CH(OH).CH_2NHX$, where X may be an alkyl radical or hydrogen, are obtained by reducing aminoacetylpyrocatechols with sodium amalgam in the cold and in the presence of acid. After extracting the byproducts from the acid solution by a suitable solvent, the base is precipitated with alkali, and purified by crystallisation of its oxalate from alcohol.—F. Sodn.

o-*Dihydroxyphenylethanolamine.* F. Stolz and F. Flaecher, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 862,675, Aug. 6, 1907. (See preceding abstract.)

o-Dihydroxyphenylethanolamine,

$$(OH)_2C_6H_3CH(OH).CH_2NH_2,$$

is claimed as a new product. It is a white microcrystalline powder, stable when dry, and melting with decomposition at 192° C. It is soluble only with great difficulty in water, alcohol, and ether, but its hydrochloride and oxalate are very soluble in water, and the solutions become green on adding ferric chloride.—F. SODN.

Alkyl ethers of aromatic bodies [*Codeine from morphine*]; *Process of making* ——. M. Engelmann, Assignor to Farbenfab. vorm. F. Bayer und Co., Eberfeld, Germany. U.S. Pat. 863,792, Aug. 20, 1907.

ALKYL ethers of the aromatic series are prepared by treating bodies containing phenolic hydroxyl groups with nitroso derivatives of alkyl-ureas in presence of alkaline compounds. In applying the process to the manufacture of codeine, morphine is treated with nitroso-mono-methylurea in presence of an alkali.—J. F. B.

Glycerophosphates; Process of manufacturing ——. Soc. anon. des Etabl. Poulenc Frères. Fr. Pat. 376,564, June 16, 1906.

A DIBASIC phosphate, preferably di-potassium phosphate, is heated with a considerable excess of glycerin at a temperature of 215° C. under reduced pressure. As the reaction progresses, the temperature is gradually raised to about 230° C. The mixture is diluted with water, freed from a little uncombined phosphate by suitable addition of alkali hydroxide and calcium chloride, and filtered. The potassium glycerophosphate is then converted into the calcium salt by the addition of calcium chloride, and the calcium glycerophosphate is precipitated by alcohol. The recovery of the alcohol and excess of glycerin and the separation of the potassium chloride complete the process.—J. F. B.

Colloidal elements; Process for the preparation of ——. H. Kuzel. First Addition, dated Mar. 8, 1907 (Under Int. Conv., April 27, 1906), to Fr. Pat. 371,799, Nov. 26, 1906 (this J., 1907, 434).

"GELS" of the colloidal elements: chromium, molybdenum, uranium, tungsten, vanadium, tantalum, niobium, titanium, thorium, zirconium, boron, and silicon, are "peptonised," *i.e.* re-converted into colloidal solutions by digestion with ammonia or amines or with very dilute solutions of alkali hydroxides or carbonates. The "peptonised" solutions have a powerful agglomerating action on powdered metals.—J. F. B.

4-*Antipyryldimethylamine; Process of making* ——. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 377,130, April 24, 1907. Under Int. Conv., May 30, 1906.

SEE Eng. Pat. 10,025 of 1907; this J., 1907, 947.—T. F. B.

Camphene; Process of manufacture of ——. F. Koch. Fr. Pat. 377,311, May 1, 1907.

PINENE hydrochloride is heated with phenol or naphthol in presence of oxide of calcium, barium, strontium or magnesium, an earthy phenolate or naphtholate being produced as an intermediate product.—J. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Colour photography. A. Davies, Plymouth. Eng. Pat. 18,741, Aug. 21, 1906.

SEE Fr. Pat. 375,548 of 1907, following.—T. F. B.

Photographic film. Soc. des Plaques et Papiers Photographiques A. Lumière et ses fils. Fr. Pat. 375,433, March 6, 1907, and Addition, dated March 21, 1907.

THE film is a composite one, and consists of a support of gelatin, etc., containing a non-actinic colouring matter (black or red) and gum or glycerin, united to the sensitive film by an agglutinant which is soluble in the developer (gum arabic, etc.).—T. F. B.

Photography in colours. A. Davies. Fr. Pat. 375,548, March 9, 1907.

THIS invention relates to the process in which three negatives taken behind colour screens are employed: the three prints are made by the "carbon" process, the modification being that the transfer paper is previously hardened with alum or formaldehyde, in order to prevent uneven tension of the pigmented film. Another modification consists in the use of picric acid mixed with Prussian blue for the blue print; this is stated to blend better with the other two prints, and is more permanent than the purely organic dyestuffs generally employed.
—T. F. B.

Photographic plates, films, and papers called "autopositives"; Process of preparing anti-halo ——. G. A. E. P. Balmitgère. Fr. Pat. 375,703, March 14, 1907.

PLATES and films especially suited for "reversal," and not susceptible to halation, are obtained by interposing between the support and the sensitive film, a layer of some colloid (*e.g.*, gelatin) containing a colouring matter or a substance totally or partially opaque to actinic light rays, and which is removed by one of the solutions used in the ordinary reversing process. For example, the layer may consist of gelatin containing precipitated silver.
—T. F. B.

Photographic prints; Process for converting silver —— *into coloured prints.* A. Traube. Fr. Pat. 376,051, March 22, 1907.

SILVER photographic prints are treated in such a manner that all the silver is converted into iodide; they are then immersed in a solution of a dyestuff (*e.g.*, a 1 in 2000 solution of "quinoline red"), washed, and fixed in a solution of thiosulphate containing some substance which converts the dyestuff into an insoluble compound; for instance, tannin may be used with basic dyestuffs, and metallic salts with acid dyestuffs. If the dyestuff has a tendency to wash out of the print, it may be precipitated in the form of a lake.—T. F. B.

Photographs; Production of monochrome and polychrome ——. J. H. Smith and W. Merckens. Fr. Pat. 376,062, March 23, 1907. Under Int. Conv., April 6, 1906.

THIS invention is based on the property possessed by basic dyestuffs of passing from layers of gelatin, glue, albumin, or similar substances, which contain them, to layers of cellulose or its derivatives with which the gelatin, etc., is in contact. Thus, the three partial negatives of bichromated gelatin are stained with the requisite basic dyestuff, and a collodion film is pressed successively on them.—T. F. B.

Photographs in colours; Process of making —— *by the "bleaching-out" process.* J. H. Smith and W. Merckens. Fr. Pat. 376,380, April 4, 1907. Under Int. Conv., April 6, 1906.

IN order to get sufficiently strong prints by the "bleaching-out" process, it is necessary to use more of the sensitising agent than can be incorporated with the coloured film. It is proposed, therefore, to supply additional layers of a colloid containing the sensitiser either in front of the coloured film, or between it and the support, or attached to the back of the support.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

PATENTS.

Explosives; Manufacture of ——. C. Duttenhofer, Bergedorf, Germany. Eng. Pat. 19,408, Aug. 30, 1906.

SEE Addition of Aug. 30, 1906, to Fr. Pat. 364,413 of 1906; this J., 1907, 167.—T. F. B.

Explosives; Production of ——. M. A. G. Himalaya, Washington, U.S.A. Eng. Pat. 3179, Feb. 8, 1907. Under Int. Conv., Feb. 16, 1906.

SEE U.S. Pat. 853,085 of 1907; this J., 1907, 717.—T. F. B.

Smokeless powder; Apparatus for manufacturing ——. G. W. Gentieu, Peoria, Ill. U.S. Pat. 856,859, June 11, 1907.

The apparatus consists of a drum provided with rotating arms. The explosive is placed in the drum, and the gelatinising liquid is forced in by means of a pump through a spraying nozzle. An automatic pressure-valve is provided to keep the supply of liquid constant. —G. W. McD.

Explosive substances; Apparatus for drying ——. P. Butler, Lowell, Mass. U.S. Pat. 863,834, Aug. 20, 1907.

Cartridge shell primers and the like are dried in an apparatus comprising a chamber; a compartment adjacent to the chamber; a heated reservoir for liquid having pipe connections with the said compartment, leading from the reservoir at points above and below the compartment respectively, whereby natural circulation is set up. The chamber is connected with a vacuum apparatus and is provided with an air-tight cover. —G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Patents.

Oil testing [viscosity and flash point] apparatus. W., T. W., and A. Lees, Halifax, Yorks. Eng. Pat. 27,036, Nov. 28, 1906.

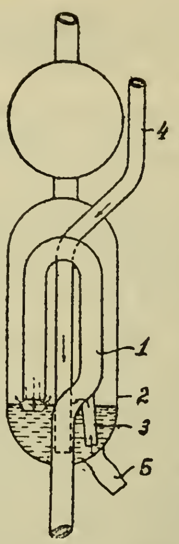
The apparatus consists of a solid base carrying a central pillar on which the cups for holding the oil to be tested are fixed, and two other pillars, one supporting a ring-burner and the second a pivoted flash burner. For taking the viscosity of a sample of oil, a cup or dish, having a smaller cup supported concentrically within it, is placed on the central pillar. At the bottom of the inner cup is a small nozzle extending through the outer cup, and closed by a valve. The space between the cups is filled with any suitable oil, the oil to be tested being placed in the inner cup, and heat is applied by means of the ring burner. When the desired temperature is reached, the valve is opened and the viscosity is estimated from the time taken by a definite quantity of the oil to flow out. In determining the flash point of the oil, a single cup, provided with a stirring apparatus, is placed on the pillar. The oil to be tested is placed in the cup, heat is applied, and the pivoted burner is passed over the surface of the oil, the temperature at which the oil flashes being taken by means of a thermometer inserted in the oil.—W. P. S.

Graphite melting crucibles; Process for the manufacture of ——. H. Putz. Ger. Pat. 181,979, March 17, 1906.

Tar or similar substances (rosin, rosin oils, tar oils, paraffin wax, oils, etc.) of high boiling point or decomposition-temperature, are added to the mass from which the crucibles are moulded. The amount of tar added is about 5 per cent. of the clay. On burning, it is stated that the tar takes the place of the evolved water of hydration, and thus retards and diminishes the shrinking, thereby lessening the danger of the formation of cracks. Further, the tar causes a better adhesion between the particles of clay and of graphite.—A. S.

Still-head. K. Deimler. Ger. Pat. 183,828, June 23, 1906.

The still-head consists of the chamber, 2, which can be filled by means of the tube, 4, the latter also serving to automatically regulate the pressure. The inlet-tube, 1, is bent downwards, as shown, until it reaches nearly to the level of the liquid. Into this tube, 1, a short tube, 3, opens, the lower end of which dips in the liquid. By means of this tube, 3, the level of liquid is kept constant. An outlet tube, 5, is provided for withdrawing the condensed liquid.—A. S.



INORGANIC—QUALITATIVE.

Nickel; Delicate qualitative test for ——. E. Pozzi-Escot. Compt. rend., 1907, **145**, 435—436.

Nickel molybdate is insoluble, in presence of excess of alkali molybdate, in water, or in very weak acid, whilst cobalt molybdate is very soluble. The substance to be tested (containing only cobalt, nickel, or both), is made almost neutral with alkali, and a large excess of saturated aqueous solution of ammonium molybdate is added; the liquid is then heated to 70° C. and shaken. In presence of cobalt, the solution is rose-coloured; if nickel be present, a dense crystalline greenish-white precipitate forms. If the quantity of nickel be very minute, there may be only a turbidity.—J. T. D.

INORGANIC—QUANTITATIVE.

Cyanogen group in salts not readily dissociated [e.g., in mercuric cyanide]; Determination of ——. V. Borelli. Gaz. chim. ital., 1907, **37**, I., 429—434.

For the determination of cyanogen in mercuric cyanide, the aqueous solution of the latter is made strongly alkaline with sodium hydroxide, and commercial aluminium powder, free from halogens, is added gradually with vigorous agitation. For each grm.-molecule of mercury, 12—15 grm.-mols. of sodium hydroxide and 4—5 grm.-molecules of aluminium are used, and the latter is added in the course of 2—3 hours at intervals of 10—15 minutes. When reduction is complete, the solution is filtered, and the cyanogen (now present as sodium cyanide) determined by one of the usual methods. The results are good in presence of chlorine-, bromine-, iodine-, and thiocyanogen ions, and analyses of the compounds, $Hg(CN)NO_3$, $Hg(CN)ClO_4$, and $Hg(CN)Cl$, are described. The method may be used for the determination of cyanogen in complex iron-cyanogen compounds, a weighed quantity being heated with excess of yellow mercuric oxide, and after filtering, treated as described above.—A. S.

Nitrous acid; Determination of ——, *and its separation from nitric acid.* G. Maderna and G. Coffetti. *See* VII.

Chromium; Determination of —— *in steel, especially in presence of tungsten.* G. von Knorre. *See* X.

Electrolytic metal deposition; Influence of temperature upon ——. F. Foerster, F. Blankenberg, A. Brunner, H. Lee, and W. Römmler. *See* XIA.

Mercury; Notes on the electrolytic determination of ——. V. Borelli. Gaz. chim. ital., 1907, **37**, I., 425—429.

In the electrolytic determination of mercury the chief difficulty is the prevention of loss in drying the deposited metal. The author finds that the most satisfactory method is to dry the mercury over fused potassium hydroxide in an exsiccator in which a capsule filled with mercury is placed. In the electrolytic deposition of mercury on a platinum dish cathode, platinum amalgam is formed, since on washing the dish with warm concentrated nitric acid (in which platinum amalgam is soluble), a decrease in weight is observed.—A. S.

ORGANIC—QUALITATIVE.

Cocoanut oil; Detection of —— by "salting out" the soap. R. Cohn. *See* XII.

ORGANIC—QUANTITATIVE.

Report of the Principal Chemist of the Government Laboratory for the year ended March 31, 1907. [Cd. 3603.]

The report states that the business of the Government Laboratory may be divided into three classes—(1) work in connection with the Revenue departments (Customs and Excise); (2) work in connection with other Government departments; (3) work in connection with the administration of the Food and Drugs Act, and Fertilisers and Feeding Stuffs Act. The number of tests made in the Customs branch was:—Goods tested for liability to spirit duty, 27,244; dry goods—coffee, tea, tobacco, &c., 8383; sugar products (imports), 7351; sugar products (exports), 3839; miscellaneous samples, 2695; hydrometer and other gauging instruments, 2776. The number of analyses and examinations made in the Inland Revenue branch of the laboratory was 121,318, as against 106,799 in the preceding year. The increase of over 14,000 was largely due to the large number of samples of offal tobacco, &c., taken in accordance with the regulations under which such tobacco is presented for drawback.

The number of samples of imported sugar products tested in 1906–7 was 7351, against 5769 in the previous year: this increase is due chiefly to tinned fruits in syrup, on which a new duty of 6d. per cwt. to cover 12 per cent. of added sugar, has been imposed. Of 1089 samples tested for saccharin, 52 were found to contain it.

Of the 9840 samples of beer wort analysed, the original gravity was found to have been understated in 1061 cases. 113 samples of beer for export on drawback, out of 8391 examined, were found to be not entitled to the drawback claimed. Out of 6045 samples of beer taken from publicans, 619 were found to have been diluted. Of the 1133 samples of "temperance drinks" examined. 116 contained over 3 per cent. of proof spirit, and were therefore liable to duty. 1268 samples of beer, wort, and brewing materials were examined for arsenic, and 49 were found to contain it in excess of the limit laid down by the Royal Commission on Arsenical Poisoning. Of the 132 samples of malt examined, two only exceeded the limit, whilst of 711 samples of glucose, invert sugar, caramel, &c., two exceeded the limit. The greatest amount found in any wort or beer was $\frac{1}{36}$ gr. per gallon; in a preparation intended for flavouring stout, $\frac{1}{5}$ gr. per lb. was found.

14,269 samples of spirits were examined. These represented tinctures, liniments, medicinal spirits, flavouring essences, hair washes, brilliantines, and dentifrices, presented for drawback and examined as a check upon the claim of the exporter. Cases occurred in which liniments prepared with methylated spirit were presented for drawback as liniments prepared from duty-paid spirit, and in other cases preparations were presented in which contamination with methylated spirit had occurred. 827 samples of wood naphtha, representing 338,833 gallons, submitted for approval for methylating purposes, were examined. Only five samples, representing 1617 gallons, could not be approved—a smaller number than in any previous year. There was a marked decrease in the quantity of wood naphtha used for methylating purposes. This was entirely due to the provisions of the Revenue Act of last year, which authorised the Commissioners of Inland Revenue to allow the alcohol intended for use in arts and manufactures, and now called industrial methylated spirits, to be denatured with 5 per cent. of wood naphtha instead of the 10 per cent. formerly required to be added to the ordinary unmineralised methylated spirit used for manufacturing purposes. The quantity of methylated spirits made during the year showed an increase of 306,600 gallons in the industrial or manufacturing spirit over 1906, and 283,600 gallons over 1905. 634 applications connected with the use of the industrial spirit were referred to the department for report since October 1, 1906, as compared with 31 such applications in the previous six months. (See also this J., 1907, 981.)

Twenty of the samples classed as "condensed milk" were "milk powder" or "dried milk." One sample, marked "sterilised milk powder, not sweetened," was milk sugar. Of the 67 samples of cream examined, 56 contained boron preservative, and 43 of these also contained salicylic acid.

Of 1875 samples of imported butter examined, 642 were from Holland, and of these 45·6 per cent. contained boron preservative and 28·6 per cent. contained added colouring matter; 93·8 per cent. of the 161 French samples, 93·6 per cent. of the 141 Belgian, 83·3 per cent. of the 72 Australian, 80·4 per cent. of the 46 South American, and 79·5 per cent. of the 117 New Zealand contained boron preservative; 67·3 per cent. of the Belgian samples contained added colouring matter. Of the 56 samples of Canadian butter, 53·5 per cent. contained boron preservative, and 16·0 per cent. had added colouring matter. There was a slight diminution—from 50·0 per cent. in 1905–6 to 44·4 per cent. in 1907—in the proportion of samples containing boron preservative, and there was a decrease in the number of samples containing added colouring matter, the number in 1905 being 42·7 per cent., in 1906 32·9 per cent., and in the present year 25·1 per cent.

At the request of the Local Government Board, a return was made to that department of the amount of boron preservative in the samples of butter examined. The figures showed that butter, from certain countries in particular, contained the preservative in excess of the amount recommended as the limit by the Committee on Preservatives in Food, but, in the absence of legislation on the point, and in view of the conflicting decisions in the Courts, it was not advised that proceedings should be taken.

114 reference samples were examined under the Sale of Food and Drugs Act, and 13 under the Fertilisers and Feeding Stuffs Act. The results obtained, in 91 and 9 cases respectively, agreed with those reported by the public analysts. Of the fertilisers examined, three were basic slag, of which two were deficient: four were superphosphates, and only one of these was up to standard; both samples of potassium chloride examined were found to be below the guarantee.

Shellac analysis; Report of Sub-committee on ——. *See* XIII*B*.

Latex from Funtumia elastica, Stapf; Crystalloids and inorganic constituents in ——. D. Spence. *See* XIII*C*.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Potassium iodide; Action of certain substances on ——. B. Szilard. Compt. rend., 1907, **145**, 433—435.

Many solid substances—oxides of uranium, thorium, iron, cobalt, manganese, copper, nickel, etc., prepared by ignition of their salts—when placed in a concentrated solution of potassium iodide, liberate minute quantities of iodine. Certain minerals (tourmaline, pyromorphite, samarskite, fergusonite, cleveite, pitchblende) produce the same effect. The effect does not seem to be connected with the composition of the mineral, and it has no connexion with its radio-activity. With pitchblende, contact is not necessary; starch and iodide paper placed above the moist pitchblende in a closed vessel becomes blue after 24 hours' exposure.—J T. D.

Patents.

Luminous bodies of considerable luminous power; Method of producing pulverous or stone-hard ——. L. Vanino, Munich, and R. Lambrecht, Vienna. Eng. Pat. 18,974, Aug. 24, 1906. Under Int. Conv., Aug. 30, 1905.

See Fr. Pat. 359,038 of 1905; this J., 1906, 336.—T. F. B.

Tobacco; Process for removing nicotine from ——. L. Parant, Assignor to Soc. Anon. des Tabacs Désintoxiques, Geneva, Switzerland. U.S. Pat. 862,583, Aug. 6, 1907.

See Eng. Pat. 1184 of 1907; this J., 1907, 895.—W. P. S.

Trade Report.

Patents and Designs (Amendment) Act, 1907. [7 Edw. 7, c. 28.] Aug. 28, 1907.

The following is the portion of the text of the new Patents and Designs (Amendment) Act, 1907, relating to patents:—

Part I.—Patents.

1. Where, after the commencement of this Act, a patent is granted to two or more persons jointly, they shall, unless otherwise specified in the patent, be treated for the purpose of the devolution of the legal interest therein as joint tenants, but, subject to any contract to the contrary each of such persons shall be entitled to use the invention for his own profit without accounting to the others, but shall not be entitled to grant a licence without their consent, and, if any such person dies, his beneficial interest in the patent shall devolve on his personal representatives as part of his personal estate.

2. Subsections (3) and (4) of section five of the Patents, Designs, and Trade Marks Act, 1883 (which Act, as amended by any subsequent enactment, is herein-after referred to as the principal Act), shall be repealed and in lieu thereof shall be substituted the following:—

"(3) A provisional specification must describe the nature of the invention;

"(4) A complete specification must particularly describe and ascertain the nature of the invention and the manner in which the same is to be performed;

"(4a) In the case of any provisional or complete specification where the comptroller deems it desirable he may require that suitable drawings shall be supplied with the specification, or at any time before the acceptance of the same, and such drawings shall be deemed to form part of the said specification."

3. The following paragraph shall be inserted in section five of the principal Act:—

"(6) Where the invention in respect of which an application is made is a chemical invention, such typical samples and specimens as may be prescribed shall, if in any particular case the comptroller considers it desirable so to require, be furnished before the acceptance of the complete specification."

4. Where the same applicant has put in two or more provisional specifications for inventions which are cognate or modifications one of the other, and has obtained thereby concurrent provisional protection for the same, and the comptroller is of opinion that the whole of such inventions are such as to constitute a single invention and may properly be included in one patent, he may accept one complete specification in respect of the whole of such applications and grant a single patent thereon. Such patent shall bear the date of the earliest of such applications, but, in considering the validity of the same and for the purposes of section eleven of the principal Act as modified by this Act, the court or the comptroller, as the case may be, shall have regard to the respective dates of the provisional specifications relating to the several matters claimed therein.

5.—(1) Where a patent for an invention has been applied for or granted, and the applicant or the patentee, as the case may be, applies for a further patent in respect of any improvement on or modification of the invention, he may, if he thinks fit, in his application for the further patent, request that the term limited in that patent for the duration thereof be the same as that of the original patent or so much of that term as is unexpired.

(2) Where an application containing such a request is made, a patent (herein-after referred to as a patent of addition) may be granted for such term as aforesaid.

(3) A patent of addition shall remain in force so long as the patent for the original invention remains in force, but no longer, and in respect of a patent of addition no fees shall be payable for renewal.

(4) The grant of a patent of addition shall be conclusive evidence that the invention is a proper subject for a patent of addition, and the validity of the patent shall not be questioned on the ground that the invention ought to have been the subject of an independent patent.

6.—(1) An investigation under section one of the Patents Act, 1902, shall extend to specifications published after the date of the application in respect of which the investigation is made, and being specifications which have been deposited pursuant to prior applications; and that section shall, subject to rules under the principal Act, have effect accordingly.

(2) Where, on such an extended investigation, it appears that the invention claimed in the specification deposited pursuant to an application is wholly or in part claimed in any published specification deposited pursuant to a prior application, the applicant shall, whether or not his specification has been accepted or a patent granted to him, be afforded such facilities as may be prescribed for amending his specification, and in the event of his failing to do so the comptroller shall, in accordance with such procedure as may be prescribed, determine what reference, if any, to other specifications ought to be made in his specification by way of notice to the public.

(3) For the purposes of this section an application shall be deemed to be prior to another application if the patent applied for when granted would be of prior date to the patent granted pursuant to that other application.

(4) This section shall come into operation at such date as the Board of Trade may by order direct, and shall apply only to applications made after that date, and the order shall be laid before both Houses of Parliament.

7. The following proviso shall be added to subsection (6) of section one of the Patents Act, 1902:—

"Provided that the comptroller, if satisfied that the invention claimed has been wholly and specifically claimed in any specification to which the investigation has extended, may, in lieu of requiring references to be made in the applicant's specification as aforesaid, refuse to grant a patent."

8. The following subsection shall be added after subsection (3) of section nine of the principal Act, which relates to the comparison of provisional with complete specifications:—

"(3a) If the examiner reports that the invention described in the complete specification is not substantially the same as that which is described in the provisional specification, the comptroller may, with the consent of the applicant, instead of refusing to accept the complete specification, cancel the provisional specification and treat the application as having been made on the date at which the complete specification was left, and the application shall have effect as if made on that date:

"Provided that where the complete specification includes an invention not included in the provisionl specification, the comptroller may allow the original application to proceed so far as the invention included both in the provisional and in the complete specification is concerned, and treat the claim for the additional invention included in the complete specification as an application for that invention made on the date at which the complete specification was left."

9. A patent shall not be held invalid on the ground that the complete specification claims a further or different invention to that contained in the provisional, if the invention therein claimed, so far as it is not contained in the provisional, was novel at the date when the complete specification was put in, and the applicant was the first and true inventor thereof.

10. In subsection (1) of section eleven of the principal Act (which relates to the grounds on which the grant of a patent may be opposed), for the words "on the ground "that the invention has been patented in this country "on an application of prior date" there shall be substituted the words "on the ground that the invention "has been claimed in any complete specification for a "British patent which is or will be of prior date to the "patent the grant of which is opposed, other than a "specification deposited pursuant to an application "made more than fifty years before the date of the "application for such last-mentioned patent, or on the "ground that the nature of the invention or the manner "in which it is to be performed is not sufficiently or fairly "described and ascertained in the complete specification."

11.—(1) Where in consequence of the neglect or failure of the applicant to pay any fee a patent cannot be sealed within the period allowed by section twelve of the principal Act, that period may, on payment of the prescribed fee and on compliance with the prescribed conditions, be extended to such an extent as may be prescribed.

(2) In such cases as may be prescribed and subject to the prescribed conditions this section shall apply where the period allowed for the sealing of the patent has expired before the commencement of this Act.

12. Where an application is made for an extension of time under section seventeen of the principal Act, it shall not be necessary for the patentee to allege or prove the cause of his failure to pay the prescribed fee within the prescribed time, and where under that section or under section three of the Patents, Designs, and Trade Marks (Amendment) Act, 1885, an application is made for an extension of time, the comptroller shall, on payment of the prescribed fee, grant an extension of time to the full amount applied for, not exceeding the amount which he is entitled to grant under those sections.

13. The following section shall be substituted for section nineteen of the principal Act:—

"In any action for infringement of a patent or proceedings before the court for the revocation of a patent, the court may by order allow the patentee to amend his specification by way of disclaimer in such manner and subject to such terms as to costs, advertisement, or otherwise, as the court may think fit:

"Provided that no amendment shall be so allowed that would make the specification, as amended, claim an invention substantially larger than, or substantially different from, the invention claimed by the specification as it stood before the amendment, and where an application for such an order is made to the court, notice of the application shall be given to the comptroller, and the comptroller shall have the right to appear and be heard, and shall appear if so directed by the court."

14.—(1) Any person who would have been entitled to oppose the grant of a patent, or is the successor in interest of a person who was so entitled, may, within two years from the date of the patent, in the prescribed manner apply to the comptroller for an order revoking the patent on any one or more of the grounds on which the grant of the patent might have been opposed:

Provided that when an action for infringement or proceedings for the revocation of the patent are pending in any court, an application under this section shall not be made except with the leave of the Court.

(2) The comptroller shall give notice of the application to the patentee, and after hearing the parties, if desirous of being heard, may make an order revoking the patent or requiring the specification relating thereto to be amended by disclaimer, correction, or explanation, or dismissing the application; but the comptroller shall not make an order revoking the patent unless the circumstances are such as would have justified him in refusing to grant the patent had the proceedings been proceedings in an opposition to the grant of a patent.

(3) A patentee may at any time by giving notice in the prescribed manner to the comptroller offer to surrender his patent, and the comptroller may, if after giving notice of the offer and hearing all parties who desire to be heard he thinks fit, accept the offer, and thereupon make an order for the revocation of the patent.

(4) Any decision of the comptroller under this section shall be subject to appeal to the court.

15.—(1) At any time not less than four years after the date of a patent, and not less than one year after the passing of this Act, any person may apply to the comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom.

(2) The comptroller shall consider the application, and, if after inquiry he is satisfied that the allegations contained therein are correct, then, subject to the provisions of this section, and unless the patentee proves that the patented article or process is manufactured or carried on to an adequate extent in the United Kingdom, or gives satisfactory reasons why the article or process is not so manufactured or carried on, the comptroller may make an order revoking the patent either—

(*a*) forthwith; or

(*b*) after such reasonable interval as may be specified in the order, unless in the meantime it is shown to his satisfaction that the patented article or process is manufactured or carried on within the United Kingdom to an adequate extent:

Provided that no such order shall be made which is at variance with any treaty, convention, arrangement, or engagement with any foreign country or British possession.

(3) If within the time limited in the order the patented article or process is not manufactured or carried on within the United Kingdom to an adequate extent, but the patentee gives satisfactory reasons why it is not so manufactured or carried on, the comptroller may extend the period mentioned in the previous order for such period not exceeding twelve months as may be specified in the subsequent order.

(4) Any decision of the comptroller under this section shall be subject to appeal to the court, and on any such appeal the law officer, or such other counsel as he may appoint, shall be entitled to appear and be heard.

16.—(1) Petitions for the grant of a compulsory licence or for the revocation of a patent under section three of the Patents Act, 1902, shall be referred by the Board of Trade to the court instead of to the Judicial Committee of the Privy Council, and accordingly in that section for references to the Judicial Committee there shall be substituted references to the court, and for references to Orders in Council there shall be substituted references to orders of the court, and subsections (8) (9) and (10) of that section shall be repealed.

(2) In lieu of subsections (5) and (6) of the same section the following subsection shall be substituted:—

"(5) For the purposes of this section the reasonable requirements of the public shall not be deemed to have been satisfied—

(*a*) if by reason of the default of the patentee to manufacture to an adequate extent and supply on reasonable terms the patented article or any parts thereof which are necessary for its efficient working or to carry on the patented process to an adequate extent or to grant licences on reasonable terms, any existing trade or industry, or the establishment of any new trade or industry, in the United Kingdom is unfairly prejudiced, or the demand for the patented article or the article produced by the patented process is not reasonably met; or

(*b*) if any trade or industry in the United Kingdom is unfairly prejudiced by the conditions attached by the patentee before or after the passing of this Act to the purchase, hire, or use of the patented article or to the using or working the patented process."

17. The following section shall be substituted for section twenty-five of the principal Act:—

"(1) A patentee may, after advertising in manner provided by rules of the Supreme Court his intention to do so, present a petition to the court praying that his patent may be extended for a further term, but such petition must be presented at least six months before the time limited for the expiration of the patent ;

"(2) Any person may give notice to the court of objection to the extension ;

"(3) On the hearing of any petition under this section, the patentee and any person who has given such notice of objection shall be made parties to the proceeding, and the comptroller shall be entitled to appear and be heard, and shall appear if so directed by the court ;

"(4) The court, in considering its decision, shall have regard to the nature and merits of the invention in relation to the public, to the profits made by the patentee as such, and to all the circumstances of the case ;

"(5) If it appears to the court that the patentee has been inadequately remunerated by his patent, the court may by order extend the term of the patent for a further term not exceeding seven, or, in exceptional cases, fourteen years, or may order the grant of a new patent for such term as may be specified in the order and containing any restriction, conditions, and provisions the court may think fit."

18. A patent granted under subsection (8) of section twenty-six of the principal Act to an inventor in lieu of a patent revoked on the ground of fraud shall bear the same date as the revoked patent, and accordingly in that subsection the words "the date of revocation of," and the words "but the patent so granted shall cease on the "expiration of the term for which the revoked patent was "granted," shall be repealed :

Provided that no action shall be brought for any infringement of the patent so granted committed before the actual date when such patent was granted.

19. Rules of the Supreme Court may be made for regulating the matters dealt with in subsections (5), (6), and (7) of section twenty-six and in section twenty-nine of the principal Act, which relate to the particulars to be delivered and the procedure to be adopted in proceedings upon petition for the revocation of a patent and in an action for infringement, and on the coming into operation of any rules of court made for that purpose the said enactments shall be repealed.

20. In section thirty-four of the principal Act (which relates to the grant of a patent on the application of representatives of a deceased inventor) the words "must be made within six months of the decease of such person and" are hereby repealed.

21.—(1) Section forty-four of the principal Act (which relates to secret patents) shall apply to the Admiralty in like manner as it applies to the Secretary of State for War.

(2) Rules may be made under the principal Act, after consultation with the Secretary of State and the Admiralty, for the purpose of ensuring secrecy with respect to patents to which the said section as so extended applies, and those rules may modify any of the provisions of the principal Act in their application to such patents as aforesaid so far as may appear necessary for the purpose aforesaid.

22. A patent shall not be held to be invalid by reason only of the invention in respect of which the patent was granted, or any part thereof having been published prior to the date of the patent, if the patentee proves to the satisfaction of the court that the publication was made without his knowledge and consent, and that the matter published was derived or obtained from him, and if he learnt of the publication before the date of his application for the patent that he applied for and obtained protection for his invention with all reasonable diligence after learning of the publication.

23. When any patent has become void owing to the failure of the patentee to pay any prescribed fee within the prescribed time, the patentee may apply to the comptroller in the prescribed manner for an order for the restoration of the patent. Every such application shall contain a statement of the circumstances which have led to the omission of the payment of the said prescribed fee. If it appears from such statement that the omission was unintentional and that no undue delay has occurred in making the application, the comptroller shall advertise the application in the prescribed manner, and within such time as may be prescribed any person may give notice of opposition at the Patent Office. Where such notice is given, the comptroller shall notify the applicant thereof. After the expiration of the prescribed period the comptroller shall hear the case and, subject to an appeal to the court, issue an order either restoring the patent or dismissing the application : Provided that in every order under this section restoring a patent, such provisions as may be prescribed shall be inserted for the protection of persons who may have availed themselves of the subject-matter of the patent after the patent had been announced as void in the illustrated official journal.

24.—(1) It shall not be lawful in any contract made after the passing of this Act in relation to the sale or lease of, or licence to use or work any article or process protected by a patent to insert a condition the effect of which will be—

(*a*) to prohibit or restrict the purchaser, lessee, or licensee from using any article or class of articles, whether patented or not, or any patented process, supplied or owned by any person other than the seller, lessor, or licensor, or his nominees ; or

(*b*) to require the purchaser, lessee, or licensee to acquire from the seller, lessor, or licensor, or his nominees, any article or class of articles not protected by the patent ;

and any such condition shall be null and void, as being in restraint of trade and contrary to public policy : Provided that this subsection shall not apply if—

(i) the seller, lessor, or licensor proves that at the time the contract was entered into the purchaser, lessee, or licensee had the option of purchasing the article or obtaining a lease or licence on reasonable terms, without such conditions as aforesaid ; and

(ii) the contract entitles the purchaser, lessee, or licensee to relieve himself of his liability to observe any such condition on giving the other party three months notice in writing and on payment in compensation for such relief in the case of a purchase, of such sum, or in the case of a lease or licence of such rent or royalty for the residue of the term of the contract, as may be fixed by an arbitrator appointed by the Board of Trade.

(2) Any contract relating to the lease of or licence to use or work any patented article or patented process, whether made before or after the passing of this Act, may at any time after the patent or all the patents by which the article or process was protected at the time of the making of the contract, has or have ceased to be in force, and notwithstanding anything in the same or in any other contract to the contrary, be determined by either party on giving three months' notice in writing to the other party ; but where any such notice is given determining any contract made before the passing of this Act, the party giving the notice shall be liable to pay such compensation as failing agreement may be awarded by an arbitrator appointed by the Board of Trade.

(3) Any contract made before the passing of this Act relating to the lease of or licence to use or work any patented article or process and containing any condition which, had the contract been made after the passing of this Act, would by virtue of this section have been null and void may, at any time before the contract is determinable under the last preceding subsection, and, notwithstanding anything in the same or any other contract to the contrary, be determined by either party on giving three months' notice in writing to the other party, but, where any such notice is given, the party giving the notice shall be liable to pay such compensation as, failing agreement, may be awarded by an arbitrator appointed by the Board of Trade.

(4) The insertion by the patentee in a contract made after the passing of this Act of any condition which by virtue of this section is null and void shall be available as a defence to an action for infringement of the patent to which the contract relates brought while that contract is in force.

(5) Nothing in this section shall—

(*a*) affect any condition in a contract whereby a person is prohibited from selling any goods other than those of a particular person ; or

(*b*) be construed as validating any contract which would, apart from this section, be invalid ; or

(*c*) affect any right of determining a contract or condition in a contract exerciseable independently of this section ; or

(*d*) affect any condition in a contract for the lease of or licence to use a patented article, whereby the lessor or licensor reserves to himself or his nominees the right to supply such new parts of the patented article as may be required to put or keep it in repair.

25. Any ground on which a patent may be revoked under this Act or as an alternative to the grant of a compulsory license under section three of the Patents Act, 1902, as amended by this Act, shall be available by way of a defence to an action for infringement, and shall also be a ground of revocation under section twenty-six of the principal Act.

26. A defendant in an action for infringement of a patent, if entitled to present a petition to the court for the revocation of the patent, may, without presenting such a petition, apply in accordance with the rules of the Supreme Court by way of counter-claim in the action for the revocation of the patent.

27. A patentee shall not be entitled to recover any damages in respect of any infringement of a patent granted after the commencement of this Act from any defendant who proves that at the date of such infringement he was not aware nor had reasonable means of making himself aware of the existence of the patent, and the marking of an article with the word "patent," "patented" or any word or words expressing or implying that a patent has been obtained for the article, stamped, engraved, impressed on, or otherwise applied to the article, shall not be deemed to constitute notice of the existence of the patent unless the word or words are accompanied by the year and number of the patent :

Provided that nothing in this section shall affect any proceedings for an injunction.

28. Where by virtue of this Act a decision of the comptroller is subject to an appeal to the court, or a petition may be referred or presented to the court, the appeal shall, subject to and in accordance with rules of the Supreme Court, be made and the petition referred or presented to such judge of the High Court as the Lord Chancellor may select for the purpose, and the decision of that judge shall be final except in the case of an appeal from a decision of the comptroller revoking a patent on any ground on which the grant of such patent might have been opposed.

SCHEDULE.

Enactments Repealed.

Session and Chapter.	Short Title.	Extent of Repeal.
46 & 47 Vict. c. 57.	The Patents, Designs, and Trade Marks Act, 1883.	In section seventeen, the words "by accident, mistake, or inadvertence," and the words "if satisfied that the failure has arisen from any of the above-mentioned causes." Section nineteen. Section twenty-five. In section twenty-six, subsections (5) (6) and (7) as from the date when rules of the Supreme Court dealing with the like matters come into force. In subsection (8) of section twenty-six the words "the date of revocation of" and the words "but the patent so granted shall cease on the expiration of the term for which the revoked patent was granted." Section twenty-nine, as from the date when rules of the Supreme Court dealing with the like matters come into force. In section thirty-four, the words "must be made within six months of the decease of such person and," subsections (2) and (3) of section forty-seven ; and section forty-eight from the date when rules under the principal Act dealing with the like matters come in force. In section 50, subsection (2). Section fifty-one, from "and if he fails" to the end of the section. Section fifty-four. Section fifty-nine. Section ninety. Section ninety-one. Section ninety-eight. Section one hundred and six.
51 & 52 Vict. c. 50.	The Patents, Designs, and Trade Marks Act, 1888.	Section twenty-four.
2 Edw. 7. c. 4.	The Patents Act, 1902 ..	In section three, the subsections numbered (5), (6), (8), (9) and (10).

JAPAN ; CHEMICAL IMPORTS OF ——.

For. Off. Ann. Ser., No. 3896.

The import of condensed milk into Japan in 1906 was 154,021*l.*, of which 38,890*l.* worth came from the United Kingdom. This roughly represents the proportion maintained for several years past. In several kinds of chemicals the British share is much below that of other countries ; such as carbolic acid (5610*l.* out of 20,120*l.*, mostly from Germany) ; alcohol (1290*l.* out of 18,790*l.*, mostly from Germany) ; bismuth subnitrate (8710*l.* against 28,160*l.* from Germany) ; potassium chlorate (37,970*l.* out of 112,150*l.*) ; while in the valuable artificial dyestuff trade the British share is practically *nil.* Practically all the window glass comes from Belgium, only 1680*l.* worth out of 233,260*l.* coming from the United Kingdom. Similar remarks apply in the case of plate glass, in which the British share is only 9360*l.* out of 45,157*l.* The increase in the number of foreign style houses and shops is leading to a great extension of the amount of glass used in Japan.

New Books.

REPORT ON COLOURS : SOLUBILITY AND EXTRACTION OF COLOURS AND THE COLOUR REACTIONS OF DYED FIBRE AND OF AQUEOUS AND SULPHURIC ACID SOLUTIONS. By H. M. LOOMIS. United States Department of Agriculture, Bureau of Chemistry. Circular No. 35. H. W. Wiley, Chief of Bureau. Washington, D.C.

THIS pamphlet contains three pages of explanatory introduction, and 48 pages of tables. The tables show the result of experimental work with various dyestuffs obtained from the principal manufacturers in the United States, Great Britain and Germany. TABLE I, gives the effects produced by solution of the principal dyestuffs in various solvents ("*Solubility of colours, with colour of solution*"). TABLE II, describes the results of attempts at the "*Extraction of colours with immiscible solvents from aqueous solutions.*" TABLE III, gives the "*Colour reactions*" (of these dyestuffs) "*on dyed fibre* (wool)," whilst TABLE IV, gives the "*Appearance and reactions of colours in aqueous solution and with concentrated sulphuric acid.*"

FIFTY-FIRST REPORT OF THE COMMISSIONER OF H.M. CUSTOMS (FOR THE YEAR ENDED 31ST MARCH, 1907). [Cd. 3701.] Wyman & Sons, Fetter Lane, London, E.C. Price 4*d.*

ACCORDING to this report the gross Imperial Customs Revenue collected in the year 1906–7. amounted to 34,542,133*l.*, or, after deduction of drawbacks and repayments, to 32,894,636*l.*, which is 664,636*l.* or 2·6 per cent. more than the Budget estimate for the year, and 1,590,184*l.* or 4·6 per cent. less than the net yield for 1905–6.

The largest items in the receipts during the last two financial years were as follows:—

	Year ended 31st March.	
	1906.	1907.
	£	£
Export—coal*	2,516,612	1,749,363
Import—		
Spirits—		
Rum	2,247,733	2,439,510
Brandy	1,187,217	1,210.518
Geneva and other sorts	461,235	568,481
Sugar, refined and unrefined	5,859,756	5,979,941
Tea	6,830,616	5,618,534
Tobacco and snuff	14,164,635	14,507,640
Wine	1,178,434	1,240,234

* The export duty on coal ceased on and from the 1st November, 1906.

STATISTICAL ABSTRACT RELATING TO BRITISH INDIA FROM 1896–7 TO 1905–6. [Cd. 3,724.] Wyman & Sons, Fetter Lane, London, E.C. Price 1s. 3d.

THIS is the forty-first number of the abstract that is issued annually by the India Office. It contains official statistics relating to the area and population, finance, trade, commerce, railways, agriculture, irrigation works, &c., of British India. Statements of the rates of import duty levied in British India and of the countervailing duties on bounty-fed sugar corrected up to 30th June, 1907, are appended to the volume.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

19,780. Artmann. Rectifying column.* Sept. 4.

19,813. British Oxygen Co. (Ges. f. Linde's Eismaschinen). Means for determining and recording the composition of boiling mixtures of liquids.* Sept. 4.

20,003. Dunn and Dunn. Apparatus for condensing, evaporating, concentrating, distilling, and the like.* Sept. 7.

20,177. Macfarlane and Macfarlane. Centrifugal drying machines actuated by fluid pressure. Sept. 10.

20,206. Bohac and Ssinjagin. Apparatus for heating liquids.* Sept. 10.

20,228. British Thomson-Houston Co. (General Electric Co.). Obtaining constant temperatures. Sept. 10.

20,268. Hutchinson, and United Railway and Trading Co. Digesters. Sept. 11.

20,349. Soc. l'Air Liquide. Separating constituents of fluid mixtures, particularly air. [Fr. Appl., Nov. 22, 1906.]* Sept. 12.

20,412. Birtwisle. Centrifugal separators. Sept. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

19,922 (1906). Grossmann. Retort for distilling by open steam. Sept. 18.

22,167 (1906). Dopp. Pressure filters. Sept. 11.

23,966 (1906). Johnson (Badische Anilin und Soda Fabrik). Apparatus for measuring fluids. Sept. 11.

25,750 (1906). Rasmussen. *See under* XVIII.A.

2477 (1907). Lake (Feuerheerd). Furnaces. Sept. 11.

2596 (1907). Prollius. Centrifugal separators. Sept. 18.

2909 (1907). Brunner und Bühring. Apparatus for separating liquids from gases or vapours. Sept. 18.

4589 (1907). Martini and Hüneke. Storage and transference of inflammable liquids. Sept. 11.

18,147 (1907). Spengler and Sommerschuh. Centrifugal separating apparatus. Sept. 18.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

19,672. Ges. f. Verwerthung Chem. Produkte. Metallic filaments for electric glow lamps. [Ger. Appl., Aug. 2, 1907.]* Sept. 3.

19,873. Rider. Manufacture of fuel gas from a mixture of carbonates and organic substances.* Sept. 5.

19,973. Babé and Pape. Separating sulphurous acid from combustion gases. [Ger. Appl., Sept. 10, 1906.]* Sept. 6.

20,139. Feld. Treatment of coal gas and analogous gases. Sept. 9.

20,208. Bailey. Water gas plant. Sept. 10.

20,223. "Z" Electric Lamp Synd. Manufacture of filaments for electric lamps. Sept. 10.

20,233. Bennett and Tapley. Suction gas producers. Sept. 10.

20,352. Tonkin and Puplett. Gas producer plants. Sept. 12.

20,372. Scholz. Manufacture of metal filaments from colloidal metals.* Sept. 12.

20,500. Feld. *See under* VII.

COMPLETE SPECIFICATIONS ACCEPTED.

20,085 (1906). Ling and Henry. Treatment and utilisation of boiler flue waste gases. Sept. 11.

21,258 (1906). Dowson. Manufacture of producer gas. Sept. 11.

21,486 (1906). Armstrong. Manufacture of coke. Sept. 18.

23,991 (1906). Busch. Apparatus for producing carburetted air. Sept. 11.

24,236 (1906). Brit. Thomson-Houston Co. (Allgem. Elektricitäts Ges.). Manufacture of metallic incandescing bodies. Sept. 11.

4911 (1907). De Vilar. Gas generators. Sept. 18.

7637 (1907). Lake (Parker-Clark Electric Co.). Filaments for incandescent electric lamps. Sept. 18.

10,226 (1907). Bormann. Gas generators. Sept. 11.

15,536 (1907). Thompson (Eisenmann). Immersion baths for incandescent mantles. Sept. 18.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

COMPLETE SPECIFICATION ACCEPTED.

1450 (1907). Steimel. *See under* XII.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

19,807. Ransford (Cassella und Co.). Manufacture of dyestuffs. Sept. 4.

20,367. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of ortho-nitrated amino-derivatives of the benzene and naphthalene series. Sept. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

19,962 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of arylated derivatives of 2-amino-5-naphthol-7-sulphonic acid. Sept. 18.

24,429 (1906). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Sept. 18.

3279 (1907). Ransford (Cassella und Co.). Manufacture of sulphide colours. Sept. 11.

17,610 (1907). Johnson (Kalle und Co.). Manufacture of colouring matters for dyeing wool. Sept. 11.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

19,621. Kron. Treatment of fibrous plants.* Sept. 2.

19,840. Levinstein, and Levinstein, Ltd. Dyeing union goods.* Sept. 5.

19,990. Reddaway. Printing fabrics, linoleum, paper, &c., in more than one colour. Sept. 7.

20,025 and 20,026. Higginson and Arundel. Gassing or singeing machines for yarn or thread. Sept. 7.

20,049. Karsam Soap Co., and Samuel. Treatment of vegetable fibres and fibrous materials. Sept. 7.

20,392. Turlur. Apparatus for drying yarns, fabrics, and other materials.* Sept. 12.

Complete Specifications Accepted.

20,005 (1906). De Perini. Production of textile fibre and paper pulp. Sept. 18.

21,591 (1906). Sharp, and Sharp and Sons. Apparatus for producing watered effects on fabrics. Sept. 11.

27,904 (1906). Clare. Size for yarns, warps, and cloth. Sept. 18.

1383 (1907). Mérou. Waterproof, impermeable fabric. Sept. 11.

7382 (1907). Sharp, and Sharp and Sons. Producing silk-like effects on textile fabrics. Sept. 11.

7749 (1907). Sharp, and Sharp and Sons. Apparatus for producing silk-like effects on textile fabrics. Sept. 11.

17,610 (1907). Johnson (Kalle und Co.). *See under* IV.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Application.

19,990. Reddaway. *See under* V.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

19,629. Stine. Treatment of wurtzilite or elaterite.* Sept. 2.

19,867. Boult (Soc. Anon. Miniere e Fonderie di Antimonio). Condensation of antimony oxides.* Sept. 5.

19,973. Babé and Pape. *See under* II.

19,988. Grossmann. Treatment of ammonia liquors before and after distillation.* Sept. 7.

20,000. Mason. Sal ammoniac. Sept. 7.

20,125. Von Belatini. Production of concentrated acetic acid hydrate solution from dilute acetic acid solution.* Sept. 9.

20,349. Soc. l'Air Liquide. *See under* I.

20,378. Herrenschmidt. Manufacture of silicate of magnesia. [Fr. Appl., Sept. 24, 1906.]* Sept. 12.

20,386. Cowper-Coles. Extraction of sulphur from sulphur compounds. Sept. 12.

20,500. Feld. Extraction of ammonia from coal gas and other gases. Sept. 14.

20,509. Crowther, Leach, and Gidden. Purification of sulphuric acid from arsenic and selenium. Sept. 14.

Complete Specifications Accepted.

974 (1907). Johnson (Chem. Fabr. Griesheim Elektron). Removal of arsenic from liquids and gases. Sept. 18.

4254 (1907). Gontard and Valentiner. Obtaining highly concentrated nitric acid. Sept. 18.

8232 (1907). Gans. Manufacture of hydrated aluminosilicates or artificial zeolites. Sept. 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

19,597. Owen. Preparation of clay for the use of potters. Sept. 2.

19,695. Woolley. Gas-fired potters' kilns. Sept. 3.

19,946. Moche. Glass melting furnaces.* Sept. 6.

20,222. Marks (Colburn.) Machines for drawing sheet glass.* Sept. 10.

20,505. Owens European Bottle Machine Co., and Schwenzfeier. Glass melting tanks or furnaces.* Sept. 14

Complete Specifications Accepted.

24,272 (1906). Murray. Kilns or ovens for firing porcelain, pottery, &c. Sept. 11.

27,048 (1906). Zahn. Enamelling and annealing and ovens therefor. Sept. 18.

5273 (1907). Spitz. Removing enamel or metal coatings from enamel or metal coated ware. Sept. 11.

9575 (1907). Pease. Apparatus for use in making glass articles. Sept. 18.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Applications.

19,650. Antrobus. Recovery and utilisation of by-products when producing Portland cement. Sept. 3.

20,227. British Thomson-Houston Co. (General Electric Co.). Manufacture of refractory bodies. Sept. 10.

20,458. Dondy. Manufacture of artificial marble or stone. Sept. 13.

Complete Specification Accepted.

1646 and 1647 (1907). Collos Portland Cement Co. (Colloseus). Manufacture of cement. Sept. 11.

X.—METALLURGY.

Applications.

20,092. Ingham. Manufacture of slag wool. Sept. 9.

20,249. Farnsworth. Drying and calcining ores and ore earths. Sept. 11.

20,277. Smethurst, and Arsenic Gold Mining Co. Furnaces for roasting and calcining ores. Sept. 11.

20,372. Scholz. *See under* II.

20,377. Herrenschmidt. Extraction of metals and metalloids from their ores or compounds. [Fr. Appl., Sept. 18, 1906.]* Sept. 12.

Complete Specifications Accepted.

13,275 (1906). Goschen (Solis). Apparatus for treating slimes, &c., with air and other fluids. Sept. 18.

20,057 (1906). Thomson. Utilising waste liquor from galvanising iron. Sept. 18.

20,452 (1906). Kelsall. Manufacture of high per-cent. manganese steel. Sept. 11.

27,048 (1906). Zahn. *See under* VIII.

598 (1907). Van der Toorn. Reduction of ferruginous sands. Sept. 11.

5273 (1907). Spitz. *See under* VIII.

13,979 (1907). Cowper-Coles. Manufacture of iron and steel. Sept. 18.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

19,602. Szek. Depolarising mass. Sept. 2.

19,926. Spence. Electro-magnetic separators. Sept. 6.

Complete Specifications Accepted.

17,384 (1906). Walker. Barrels for electroplating. Sept. 11.

27,099 (1906). Cowper-Coles. Electrolytic manufacture of metal wire, strip, &c. Sept. 11.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

20,059. Ridgill. Manufacture of oils and greases. Sept. 9.

Complete Specifications Accepted.

1450 (1907). Steimel. Purifying lubricating oil and the like. Sept. 11.

10,359 (1907). Fichtenau. *See under* XVIIIC.

13,382 (1907). Fenger. Making a conserving mixture of grease. Sept. 18.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

APPLICATION.

20,379. Herrenschmidt. Manufacture of coatings for painting. [Fr. Appl., Sept. 24, 1906.]* Sept. 12.

COMPLETE SPECIFICATION ACCEPTED.

14,693 (1907). Brownjohn. Paint for ships and the like. Sept. 18.

(*C.*)—INDIA-RUBBER.

COMPLETE SPECIFICATIONS ACCEPTED.

20,404 (1906). Olsson. Artificial gum or caoutchouc. Sept. 18.

22,105 (1906). Ormandy, and Harvey, Frost, and Co. Vulcanising. Sept. 18.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

19,495 (1906). Lund. Fixing tanning fat in leather. Sept. 11.

19,848 (1906). Schneider. Obtaining glue and gelatin from glue materials in the form of powder or grits. Sept. 11.

4605 (1907). Weinschenck. Tanning hides and skins. Sept. 11.

XVI.—SUGAR, STARCH, GUM, &c.

APPLICATIONS.

19,633. Boidin. Treatment of amylaceous materials Sept. 2.

20,266. Hutchinson, and United Railway and Trading Co. Treatment of bagasse. Sept. 11.

COMPLETE SPECIFICATION ACCEPTED.

20,638 (1906). Cross and Briggs. Manufacture of xanthates of certain carbohydrates. Sept. 18.

XVII.—BREWING, WINES, SPIRITS, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

21,250 (1906). Sureties. Utilisation of spent hops. Sept. 18.

1959 (1907). Elsner and Guttwein. Drying green malt. Sept. 18.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

APPLICATIONS.

20,381. Leuthardt-Thornton. Manufacture of a product from albumen. Sept. 12.

COMPLETE SPECIFICATION ACCEPTED.

25,750 (1907). Rasmussen. Evaporating the watery parts of milk, dissolved casein, and other liquids and semi-liquids. Sept. 18.

(*B.*)—SANITATION; WATER PURIFICATION.

APPLICATION.

19,598. Biggs and Digby. Measuring and recording variations in the saline or acid content of water in estuaries, sewers, &c., or in other liquids in motion. Sept. 2.

(*C.*)—DISINFECTANTS.

APPLICATION.

20,387. Howorth (Chem. Fabrikswerke). Disinfectant and insecticide. Sept. 12.

COMPLETE SPECIFICATION ACCEPTED.

10,359 (1907). Fichtenau. Non-poisonous, vermin destroying soap. Sept. 11.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATION.

20,267. Hutchinson, and United Railway and Trading Co. Manufacture of paper and material therefor. Sept. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

20,005 (1906). De Perini. *See under* V.

5891 (1907). Marino. Rendering celluloid incombustible. Sept. 18.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATION.

19,943. Elektrochem. Werke. Manufacture of oxalates from the corresponding formates. [Ger. Appl., Oct. 13, 1906.]* Sept. 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

20,050. Zimmermann (Chem. Fabr. auf Actien, vorm. E. Schering). Manufacture of new *p*-aminophenols specially suitable for use in photographic developers. Sept. 7.

20,329. Thorp. Colour photography. Sept. 12.

20,382 and 20,383. Leuthardt-Thornton. Treatment or manufacture of paper and other materials for photographic purposes. Sept. 12.

20,384. Sanger-Shepherd. Manufacture of plates or films for colour photography. Sept. 12.

20,472. Hyde. Adhesive photographic printing paper. Sept. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

2461 (1907). Smith and Merckens. Bleach out process of colour photography. Sept. 18.

7217 (1907). Smith and Merckens. Production of coloured photographs. Sept. 18.

7885 (1907). Newton (Lumen Ges.). Photographic plates or films. Sept. 18.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATION.

19,993. Ansay and Namèche. Explosive.* Sept. 7.

COMPLETE SPECIFICATION ACCEPTED.

9170 (1907). Cornaro. Manufacture of explosives. Sept. 11.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATION.

19,768. Evans-Jackson (Bryhni). Photometer.* Sept. 4.

COMPLETE SPECIFICATIONS ACCEPTED.

19,513 (1906). Hubbard. Apparatus for automatically analysing mixed gases, and recording the percentage of one of the gases. Sept. 11.

10,342 (1907). Della Santa and Spelmans. Apparatus for detecting and recording fire damp and other gases. Sept. 11.

Journal of the Society of Chemical Industry.

No. 19, Vol. XXVI. OCTOBER 15, 1907. No. 19, Vol. XXVI.

Obituary.

DURAND WOODMAN.

Durand Woodman, Ph.D., was born in New York in 1859. He studied at the Stevens Institute of Technology and afterwards at the Fresenius Laboratory in Wiesbaden, Germany. He was assistant to Prof. H. Wurtz during 1881 and 1882, and from 1883 to 1887, had charge of the laboratory of the United States Electric Light Co.

He was the Recording Secretary of the American Chemical Society in 1889, and was Secretary and Treasurer of the New York Section of that Society from 1895 to 1901. He was one of the organisers of the New York Section of the Society of Chemical Industry and served on the Committee of the New York Section from 1900 to 1904. He served as chemical examiner of supplies for the U.S. Lighthouse Establishments.

Dr. Woodman died on Sept. 4, 1907.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—

English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.

United States.—1*s.* each, to the Secretary of the Society.

French.—1 fr. 25 c. each, to Belin et Cie, 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Filters; Pressure ——. W. H. Dopp, Buffalo, N.Y., U.S.A. Eng. Pat. 22,167, Oct. 8, 1906.

See Fr. Pat. 370,934 of 1906; this J., 1907, 247.—T. F. B.

Filtering apparatus. D. J. Kelly, Salt Lake City, Utah. U.S. Pat. 864,308, Aug. 27, 1907.

A horizontal frame supporting a number of filter-frames, with filter-sides, is mounted on a carriage so that it can be run on rails into or out of a horizontal tank through one end of the latter, which is open. When the carriage is within the tank, the open end of the latter is closed by a door forming the end of the carriage. The liquid to be filtered is pumped into the tank, under pressure, the clear portion passes through the filters to the interior and is conducted away by a pipe passing through the movable end. The solid matter accumulates on the outside of the filters and is from time to time removed by scrapers, which are brought into action by the carriage as it is withdrawn from the tank.—W. H. C.

Filter; Composite ——. R. Reichling. Fr. Pat. 377,134, April 24, 1907.

A number of trays formed of coarse-meshed gauze are placed, one above the other, so that the wires of one tray are over the spaces of the next. In this way, although the mesh of each tray, considered separately, is coarse, yet, when the pile of trays is considered as a whole, the mesh is fine. The trays are coupled together by hinges or arms so that, the bottom tray being fixed, the rest can be opened out like an accordion, to allow easy access to each tray for cleaning purposes.—W. H. C.

Drying chamber or steriliser. L. A. Robert, Paris. Eng. Pat. 1448, Jan. 19, 1907.

See Fr. Pat. 377,343 of 1907; following.—T. F. B.

Dryer or steriliser. L. A. Robert. Fr. Pat. 377,343, May 2, 1907. Under Int. Conv., Jan. 19, 1907.

The materials to be dried are delivered by an elevator to the top of a square tower and fall on to the uppermost of a series of trays, alternately inclined in opposite directions. These trays are formed of metallic gauze with metal frames and are supported by chains. They receive a horizontal shaking movement from arms carried by a vertical shaft, actuated by a cam on a horizontal shaft above the tower. The material falls from tray to tray and is dried by a current of hot gas which enters the bottom of the tower from a furnace. The moisture-laden gas leaves the top of the tower by a down-take shaft and may be aspirated by a fan, and, after depositing its moisture, delivered under the grate of the furnace.—W. H. C.

Drying, cooling, and moistening material; Apparatus for ——. B. Schilde, Hersfeld, Germany. Eng. Pat. 4306, Feb. 21, 1907.

A tunnel-like chamber is divided by adjustable slides into three compartments: a drying chamber, a cooling chamber, and a moistening chamber. The material to be treated is fed intermittingly into the drying chamber, *e.g.*, on trucks, and every time this is done, some material is moved forward from one chamber to the next, the slides being temporarily opened for the purpose. Fresh cool air is drawn through the cooling chamber by means of a fan, and after cooling the hot overdried material, is passed through a heater, and into the drying chamber. It passes through this chamber in the opposite direction to that taken by the material, and having deprived the latter of moisture, is led to the moistening chamber, where it serves to moisten the cooled overdried material. If necessary, the air may be passed through an auxiliary moistener before passing it into the moistening chamber.
—W. H. C.

Drying liquids or semi-liquids; Process and apparatus for ——. J. Mecredy and D. M. A. G. Hawes. Fr. Pat. 377,895, Jan. 24, 1907.

See Eng. Pat. 1479 of 1906; this J., 1907, 110.—T. F. B.

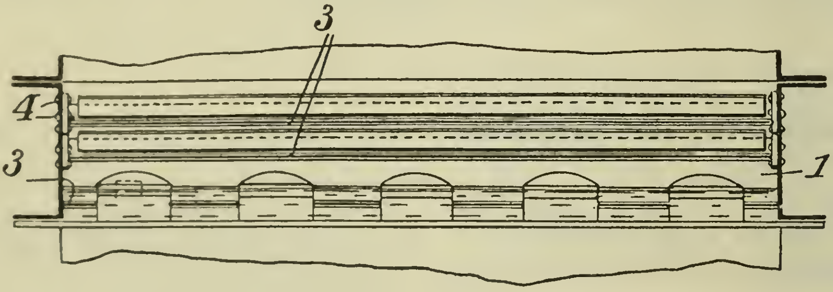
Dryer with steam-heated trays. O. Busse. Fr. Pat. 377,124, April 24, 1907.

THE dryer consists of a number of superposed circular floors in a casing. The material falls from floor to floor through openings which are alternately at the periphery and at the centre of succeeding floors. The dryer is provided with rotating agitator-rakes to move the material over the floors. Each floor is hollow and is divided into sectors heated separately by steam. The lower side of each hollow sector slopes to the outlet pipe to facilitate the removal of condensed water.—W. H. C.

Distilling apparatus. H. A. Mackie, New Orleans, La. U.S. Pat. 864,320, Aug. 27, 1907.

A VERTICAL retort provided with a charging door and a vapour-outlet pipe at the top, has a sloping bottom closed by a swing door. The latter carries on its upper side a steam distributor connected by a flexible pipe to a steam supply, so that when the door is swung down to discharge the contents of the retort, the steam distributor swings with it.—W. H. C.

Cooling and condensing devices for the chambers of columns for distilling or rectifying alcohol, petroleum, benzol and other liquids. R. Vallat. Fr. Pat. 376,872, April 18, 1907. Under Int. Conv., Sept. 13, 1906.



A SERIES of tubes, 3, is riveted as shown at 4, to the sides of the chambers, 1, of the column. Air or water is caused to circulate through the tubes and serves to cool and partially condense the vapours, so that a better fractionating effect is obtained. The tubes may be covered by curved hoods or baffle-plates, in order to render the passage of the vapours more tortuous and to bring them into better contact with the tubes.—W. H. C.

Kiln; Rotary ——. W. R. Warren, New York, N.Y. U.S. Pat. 864,816, Sept. 3, 1907.

THE claim is for a rotary kiln having a portion divided into compartments by a hollow lateral partition extending through it and communicating with the air at diametrically opposite points. The hollow space diverges at opposite ends where it communicates with the air. The other portion of the kiln forms a common chamber, the flame from which passes simultaneously into the compartments of the first portion.—W. H. C.

Separating solid particles from each other; Process and apparatus for ——. A. P. S. Macquisten, Glasgow. U.S. Pat. 865,194 and 865,195, Sept. 3, 1907.

SEE Eng. Pat. 15,119 of 1905; this J., 1906, 581.—T. F. B.

Separating solid particles from each other; Apparatus for ——. A. P. S. Macquisten, Glasgow. U.S. Pat. 865,260, Sept. 3, 1907.

SEE Eng. Pat. 25,204 of 1904; this J., 1906, 112.—T. F. B.

Ether or alcohol vapours contained in air [of artificial silk, celluloid, and smokeless powder factories, etc.]; Recovery of ——. A. de Chardonnet. Fr. Pat. 376,785, June 21, 1906.

THE air containing the vapours to be recovered, is passed successively through a series of three or more chambers or washers. The last vessel of the series is fed with a spray of water containing a little alcohol, it having been found that this mixture is a better absorbent than water alone. The liquid coming from this vessel is sprayed into the next and so on. The air passes in one direction through the series of vessels and the absorbing liquid in the opposite direction, so that the air is completely deprived of the contained vapours, and the absorbing liquid leaves the first of the series of vessels in a nearly saturated condition. The ether or alcohol is recovered by fractional distillation, sufficient alcohol being left in the residual water to allow of its being used again in the absorbers.—W. H. C.

Radio-pyrometer; Expansion ——. C. Féry. First Addition, dated Feb. 28, 1907, to Fr. Pat. 364,884, April 3, 1906 (this J., 1906, 916).

THE additions consist in:—Employing a diaphragm with fixed and movable sectors to assure a constant relation between the amount of central and marginal radiations. The use of an adjustable concave mirror to concentrate the rays on to the spiral, and an eye-piece opposite an aperture in the centre of the mirror to sight the apparatus. Two small oblique mirrors to ensure the spiral being at the conjugate focus of the hot body when the apparatus is correctly pointed. The use of a diaphragm in the tube of the apparatus to compensate for the variation in the distance from the hot body.—W. H. C.

Diffusion and defecating apparatus suitable for all kinds of liquids. A. F. Dumouchel. Fr. Pat. 377,273, Apr. 29, 1907.

THE apparatus consists of a rectangular tank provided with a steam coil for heating the liquid; at the top of the tank is a perforated plate and below this a second perforated plate, a channel being formed between the two. The second plate extends upwards out of the tank and is connected to a long inclined shoot. An endless travelling band fitted with paddles passes through the space between the plates and then upwards over the surface of the shoot so that the solid substances are carried up the latter and discharged at the top.—W. P. S.

II.—FUEL, GAS, AND LIGHT.

Non-metallic minerals in the Philippines. Eng. and Mining J., Aug. 31, 1907. [T.R.]

COAL is the most important non-metallic mineral occurring in the Philippines. It is found in practically every island of the group, and in many cases is associated with petroleum. The quality of the coal is pretty regular throughout the archipelago; it is a sub-bituminous coal having the appearance and specific gravity of lignite, but the carbon content and the streak of bituminous coal. These coals have stood fairly well in tests under stationary and marine boilers, but they are not entirely satisfactory. Apparatus is now being erected under the joint supervision of the Department of Chemistry and the Bureau of Science to test the merits of these coals in gas producers. Small amounts of petroleum have been discovered in three localities.

Patents.

Briquettes for fuel; Manufacture of ——. L. A. Jonques, London. Eng. Pat. 18,967, Aug. 24, 1906.

A solution of ½ lb. of resin in one pint of methylated spirit is well stirred into a hot solution of 30 lb. of size (preferably made from skin glue) in from 12 to 17 galls. of water. The mixture while still hot is added to one ton of coal dust and the whole is well mixed and briquetted. —W. H. C.

Fuel; Artificial ——. J. P. Reneaux, Paris. Eng. Pat. 7879, April 4, 1907. Under Int. Conv., April 28, 1906.

See Fr. Pat. 366,141 of 1906; this J., 1906, 1034.—T. F. B.

Carbon dusts of all kinds, notably dusts of coke or of anthracite; Process of agglomeration of ——. J. P. Reneaux, Paris. Eng. Pat. 8223, April 9, 1907. Under Int. Conv., June 19, 1906.

See Addition to Fr. Pat. 366,141 of 1906; this J., 1906, 1139.—T. F. B.

Combustible briquettes; Process for making ——. S. Suski. Fr. Pat. 378,110, March 25, 1907.

See Eng. Pat. 13,355 of 1906; this J., 1907, 247.—T. F. B.

Briquettes; Artificial fuel in the form of ——. A. V. Hassman and W. F. Puterbaugh. Fr. Pat. 376,874, April 18, 1907.

Carbonaceous material, such as coal-dust, etc., is screened, and the proper proportions mixed together of different sized grains to yield a dense briquette. This material is mixed with clay, and then with a solution of an "artificial combustible" containing potassium chlorate, permanganate, and nitrate, and sugar. An emulsion, consisting of resin, caustic soda, linseed or other similar oil, and water, may be incorporated in the mixture to render the briquettes impermeable; the impermeable coating is produced by precipitating the emulsion with alum. Lime, calcium chloride, and sodium chloride may also be incorporated in the mixture.—W. C. H.

Combustibles; Agglomerated ——. J. P. Serve. Fr. Pat. 377,221, April 27, 1907.

Resin in conjunction with soluble glass (alkali silicate) is used as the binding agent for the briquettes, which are also provided with a coating to protect them from moisture, by dipping them into a bath of coal- or wood-tar, or tar products such as pitch, heavy oil, etc.—W. C. H.

Coke ovens. O. Gobbe, Jumet, Belgium. Eng. Pat. 18,828, Aug. 22, 1906.

See Fr. Pat. 366,002 of 1906; this J., 1906, 975.—T. F. B.

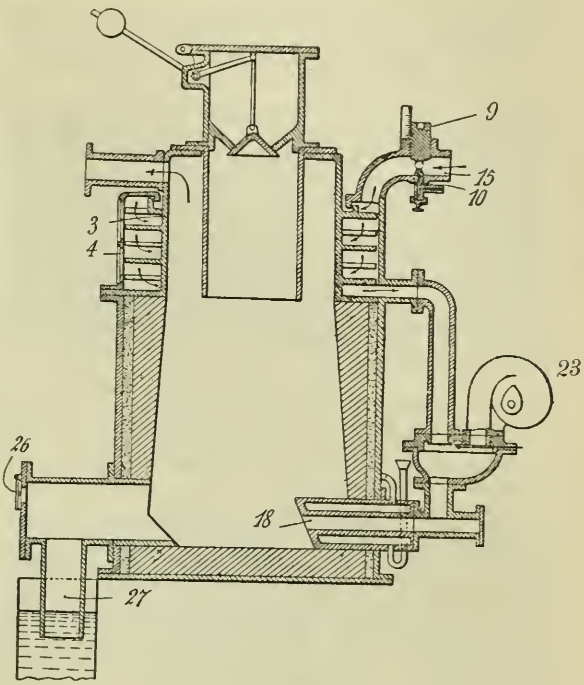
Coke oven; Regenerating ——. V. Defays, Brussels. Eng. Pats. 19,146 and 19,146a, Aug. 27, 1906.

See Fr. Pat. 369,262 of 1906; this J., 1907, 84.—T. F. B.

Coke oven. A. O. Jones. Fr. Pat. 377,756, May 13, 1907. Under Int. Conv., May 18, 1906.

See Eng. Pat. 11,660 of 1906; this J., 1906, 1138.—T. F. B.

Gas producer. F. Chavanon. Fr. Pat. 377,143, April 25, 1907.



The air blast enters the producer by the pipe, 15, and draws a spray of water through a jet, 10. a screw-plug, 9, serving to adjust the intensity of the injector action. The heat-exchanger 3, through which the mixture of air and water passes, is provided with doors, 4, by means of which the removal of deposits from the water is facilitated. The superheated air and steam enter the combustion zone through a water-cooled tuyère, 18, which extends some distance into the chamber for the purpose of preventing the adhesion of clinker to the chamber walls. To remove the ashes whilst the producer is in operation, a pick is introduced through the hole, 26, and the ashes are drawn into the water-sealed pit, 27. If the producer is to be operated by suction, the fan, 23, is used at the start. —H. B.

Cyanogen, hydrocyanic acid, and cyanogen- and thiocyanogen compounds; Process for the separation of —— *from gaseous mixtures.* P. von der Forst. Ger. Pat. 182,084, May 1, 1906. *See* VII.

Gas analysis apparatus. J. F. Simmance and J. Abady. Eng. Pat. 18,680, Aug. 21, 1906. *See* XXIII.

Photometers and the like. S. N. Wellington. Eng. Pat. 6316, March 15, 1907. *See* XXIII.

Incandescent [Self-lighting] gas mantles. G. Coxhead, East Ham. Eng. Pat. 18,602, Aug. 20, 1906.

To the mantle fabric, after impregnation, there is applied, at a part which will form one of the folds at the top of the mantle, "a strong solution of a particularly active platinum black," extending from the treated spot in a thin streak to the ignition point of the gas, and the mantle is finished off as usual. (Reference is directed to Eng. Pat. 609 of 1903; this J., 1903, 411.)—H. B.

Carbide of calcium for portable acetylene lamps and generators; Preparing ——. Sir C. S. Forbes, Bart., London. Eng. Pat. 27.842, Dec. 6, 1906.

A liquid for coating or impregnating calcium carbide is prepared by boiling a mixture of, say, equal parts of glycerin and sugar (or glucose or other equivalent for the sugar) until all water has been expelled.—H. B.

Filaments for use in electric lamps, furnaces, or other apparatus. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,488, Aug. 17, 1906.

A REFRACTORY metal, in fine powder, is mixed with a less refractory metal or metals, in the colloidal form, the mixture is shaped into filaments, etc., and the latter are then treated so as to volatilise the less refractory constituents and leave a coherent conductor. For example, powdered tungsten is mixed with colloidal silver, the pasty mass is squirted into filamentary form, the filaments are dried, and the collodial silver is converted into the metallic state by blowing traces of hydrochloric acid gas over the filaments. The silver is then driven out of the filaments by passing an electric current through them *in vacuo* or in a neutral atmosphere, a strong wire of tungsten being produced.—H. B.

Metallic compounds; Method of purifying —— [*for electric lamp filaments*]. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,489, Aug. 17, 1906.

PURE oxides of acid-forming metals, such as tungsten, molybdenum, tantalum, vanadium, chromium, etc., suitable for use in the manufacture of metal for incandescent electric lamp filaments, are obtained by fractional precipitation, with an organic base, of a solution containing the metal, and calcination of the final precipitate at a low temperature. For example, a solution of an alkali tungstate is acidified with hydrochloric acid, and the solution is fractionally precipitated with benzidine hydrochloride; the first precipitate contains most of the impurities, whilst the second consists of practically pure benzidine metatungstate, $C_{12}H_8(NH_2)_2,4WO_3,xH_2O$. The latter is washed with water, and calcined at a low temperature to obtain pure tungsten trioxide, in the form of an impalpable powder, stated to be especially suitable for the production of tungsten lamp-filaments.—A. S.

Filaments for use in electric lamps or other apparatus; Conductive ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 18,748, Aug. 21, 1906.

INCANDESCENCE filaments of refractory metal (*e.g.*, tungsten) are made in tubular form, by preparing a ductile mixture containing the metal (*e.g.*, by incorporating tungsten with cadmium-mercury alloy), shaping the mixture into tubes, and then removing all the constituents of the mixture except the refractory metal, by heating *in vacuo* or otherwise.—H. B.

Filaments for electric incandescent lamps; Supports for metallic ——. A. Lederer, Vienna. Eng. Pat. 18,812, Aug. 22, 1906.

SUPPORTS for metallic filaments, especially filaments of tungsten, are made by constructing supports of refractory oxides (*e.g.* of thorium and magnesium oxides) as usual, and then "metallizing" these supports. For example, the supports may be impregnated with a solution of a reducible compound of tungsten, such as meta-tungstic acid, dried, and then heated in a current of hydrogen until reduction is complete. Supports made of carbon may be similarly treated.—H. B.

Electric conductors [*incandescence filaments*] *of refractory metal; Manufacture of* ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 21,511, Sept. 28, 1906.

THE resistance of an incandescence filament made of pure refractory metal, *e.g.* tantalum, is increased by heating the filament in an atmosphere of nitrogen, at a pressure of, say, 15 mm. The treated filament may be of greater cross-section than one of the pure metal, for use with a given voltage.—H. B.

Filaments for incandescence electric lamps; Manufacture of ——. J. Y. Johnson, London. From Hollefreund und Co., Berlin. Eng. Pat. 21,654, Oct. 1, 1906.

PHOSPHORUS compounds containing hydrogen and nitrogen (and also, optionally, containing oxygen or sulphur), such as phospham, phosphoramide, etc., with or without the addition of red phosphorus, or the gases obtained by heating these compounds and mixtures *in vacuo*, are heated along with metallic filaments, for the purpose of eliminating carbon therefrom as completely as possible. For example, a little phospham may be added to the paste of metallic powder and carbonaceous binder from which the filament is formed, the latter being eventually raised to incandescence *in vacuo*; or, the phospham may be heated slowly, along with the formed filament, to 800—1000° C. in a vacuous vessel, in which case the gases produced by the decomposition of the phospham act upon the filament from without. The nitrogen of the phospham combines with the carbon in the filament to form cyanogen, and the phosphorus combines with any oxygen present.—H. B.

Glow bodies for lighting and heating, made of difficultly-fusible metals of the fifth and sixth groups, with addition of oxides. Allgem. Elektricitäts-Ges. Fr. Pat. 376,795, April 16, 1907. Under Int. Conv., April 17, 1906.

TUNGSTEN, tantalum, or other difficultly fusible metal of the fifth or sixth periodic group, is mixed with oxide of tantalum or an oxide of the yttrium group (preferably oxide of ytterbium), moulded into filaments, and the latter consolidated by raising them to a high temperature by an electric current *in vacuo*. It is stated that the above-mentioned oxides differ from those of thorium, zirconium and cerium in that they do not suffer decomposition *in vacuo* at the highest attainable degree of incandescence, and consequently no "pulverisation" of the filaments containing them ensues.—H. B.

Filaments for incandescence lamps or other purposes; Manufacture of ——. Ateliers Thomson-Houston (Anciens Etabl. Postel-Vinay). Fr. Pat. 376,870, April 18, 1907. Under Int. Conv. (Allgem. Elektricitäts-Ges.), April 19, 1906.

FILAMENTS of refractory metals, such as tungsten and molybdenum, having been formed with the aid of an organic agglutinant, are first heated cautiously in a limited amount of air so as to remove the carbon of the agglutinant, and are then heated at about 1000—1200° C., in presence of a non-carbonaceous reducing gas (*e.g.* hydrogen). The fragile, carbon-free filaments thus produced are then toughened by heating them at a temperature exceeding 1500° C. in a reducing, carbon-free atmosphere. For the latter operation an electric furnace may be employed.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

PATENTS.

Charcoal-kiln. C. D. Train, Belknap, Ill. U.S. Pat. 865,067, Sept. 3, 1907.

A CIRCULAR down-draught charcoal-kiln has an air-inlet in the domed top and a number of gas-outlet ports arranged in two rows round the side wall. These ports communicate with a chamber disposed below the floor and connected by a flue to the bottom of an external stack or chimney, taller than the kiln. The floor of the oven rises slightly from the periphery of the kiln to the centre, and the chimney is provided with a damper which is operated by the pressure of the gas within the kiln.—W. H. C.

Petroleum; Intermittent distillation of —— with special reheaters. T. Hillmer. Fr. Pat. 376,789, April 16, 1907.

The stills are connected with overhead reheaters for residuum and distillate, heated by the vapours given off in the stills. The connection is established in such a manner that the stills can be charged from the distillate reheaters, and the latter from the residuum reheater, which in turn can be charged from a tank or by a pump, whilst the residuum still—forming the heating element—is filled from each still as desired. The relative dimensions of the vessels are arranged so that the still for heating the residuum reheater is able to easily hold the residuum formed in any one still during a given time. The heating element consists of several hollow bodies traversed by vertical pipes conveying the vapours from the still. The condensed distillate remains in the hollow bodies up to a certain level, in order to permit an exchange of temperatures between the vapours and the liquid surrounding the reheating elements. The usual collecting dome is replaced by a horizontal partition.—C. S.

Cooling and condensing devices for the chambers of columns for distilling or rectifying alcohol, petroleum, benzol, or other liquids. R. Vallat. Fr. Pat. 376,872, April 18, 1907. *See* I.

Hydrocarbons; Deodorising ——. G. Ferrier. Fr. Pat. 377,088, April 23, 1907.

The hydrocarbons are treated directly with nascent oxygen or ozone generated within the liquid, for example by the action of hydrochloric acid on granulated zinc, the mixture being agitated and afterwards neutralised with quicklime, decanted, and filtered. The products are suitable for use in the preparation of paints, varnishes, driers, etc.—C. S.

Mineral oils; Deodorising and desulphurising ——. G. H. Hellsing. Fr. Pat. 377,197, April 26, 1907. Under Int. Conv., April 30, 1906.

The oils are agitated with aqueous solutions of salts of heavy metals (copper, mercury, cadmium, etc.). When salts other than chlorides are used, an addition of alkali chloride or ammonium chloride is made.—C. S.

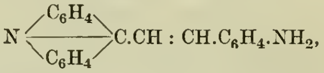
IV.—COLOURING MATTERS AND DYESTUFFS.

Azophenine; New method of preparation of ——. W. Schaposchnikoff. Z. Farben-Ind., 1907, **6**, 289—291. (Compare this J., 1905, 724.)

Quinonedichlorodi-imine is prepared by mixing a 10 per cent. aqueous solution of recrystallised *p*-phenylenediamine hydrochloride to which hydrochloric acid has been added (10 c.c. of 10 per cent. acid to 50 c.c. of solution) with a clear solution of bleaching powder containing slightly more than the theoretical amount of chlorine. A small quantity of the diamine solution is first treated with an excess of the chlorine solution and then the two ingredients are added alternately. The precipitated white product is crystallised from benzene. Azophenine is prepared from this by dissolving 3·5 grms. in 35 c.c. of benzene and adding 11 grms. of freshly-distilled aniline. Dark-brown crystals separate, and after 24 hours, 35 c.c. of ether are added and the whole allowed to stand for some time. The crystals are then collected, washed with ether (Filtrate *A*) and treated with hot water; the residue is extracted with alcohol and the insoluble portion is crystallised from hot benzene, when pure Azophenine separates. Filtrate *A* contained 0·5 grm. of azobenzene and 0·7 grm. of Azophenine, the total yield of the latter being 2·8 grms. No better yield was obtained by carrying out the condensation in presence of aniline hydrochloride.—J. C. C.

Methineammonium dyestuffs. A. Porai-Koschitz. Z. Farben-Ind., 1907, **6**, 291—295.

The author has prepared a number of the above dyestuffs containing on the one hand the aminobenzylidene—and on the other the *p*-methylquinaldine or 5-methylacridine nucleus. The compounds derived from *p*-aminobenzylidene are reddish-orange to red dyestuffs, whilst those derived from the corresponding *m*-amino-compounds are either faintly yellow or have no dyeing properties. *p*-Aminobenzylidene-6-methylquinaldine, $CH_3.C_9H_5N.CH : CH.C_6H_4.NH_2$, obtained by reducing the corresponding nitro-compound, gives salts which are readily soluble in water and dye wool, silk and tannin-mordanted cotton reddish-orange. The corresponding dimethyl-compound, $CH_3.C_9H_5N.CH : CH.C_6H_4.N(CH_3)_2$, dyes these materials in dark rose-red shades. *p*-Aminobenzylidene-5-methylacridine,



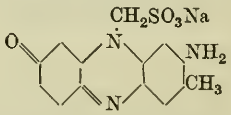
$$N\begin{cases}C_6H_4\\ \\ C_6H_4\end{cases}C.CH : CH.C_6H_4.NH_2,$$

prepared by reducing the corresponding nitro-compound and also by condensing dimethyl-*p*-aminobenzaldehyde with 5-methylacridine, dyes wool and silk violet from a faintly acid bath, and tannin-mordanted cotton brownish-violet. The corresponding dimethyl-compound in the form of its salts, dyes wool and silk indigo blue and tannin-mordanted cotton greenish-blue. All these dyeings are changed to yellow or orange by the action of acids or alkalis; the colour is restored, however, by washing or, if alkali was used, by treatment with very dilute acid.
—J. C. C.

Patents.

Saffraninones and reddish sulphurised [sulphide] dyestuffs therefrom, and the production thereof. J. Hirschberger, D. Maron, and Levinstein, Ltd., Manchester. Eng. Pat. 24,008, Oct. 29, 1906.

The product of reaction of molecular proportions of an aldehyde-bisulphite and *m*-toluylenediamine is mixed with an alkaline solution of nitrosophenol, the whole is made slightly acid, and stirred for some hours, when the indophenol partially separates; the mixture is then made slightly alkaline, and oxidised by manganese dioxide, with the result that a new safraninone is formed, having the constitution



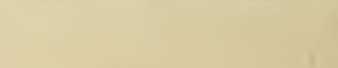
when formaldehyde-bisulphite has been used. Sulphide dyestuffs, which dye cotton reddish shades from sulphide baths, are obtained by heating the new safraninones with sodium sulphide and sulphur, with or without addition of metallic salts.—T. F. B.

Monoazo dyestuffs; Manufacture of yellow ——. H. H. Lake, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine. Eng. Pat. 25,193, Nov. 8, 1906.

See U.S. Pats. 849,690 and 849,739 of 1907; this J., 1907, 523.—T. F. B.

Sulphurised dyestuffs; Manufacture of ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1593, Jan. 21, 1907.

Sulphurised dyestuffs are obtained from *a*-hydroxythionaphthenes, of the general formula:



$$R\begin{cases}(1)\ C—OH\\ \qquad\quad >CH\\ (2)\ S\end{cases}\text{ or }R\begin{cases}(1)\ CO\\ \qquad\quad >CH_2\\ (2)\ S\end{cases}$$

(or their carboxylic acids) by heating them to 100—130° C. with about 10 times their weight of crystallised sodium thiosulphate or the thiosulphate of any alkali or alkaline-earth. Should the thiosulphate employed contain no water of crystallisation, water may be added to the mass. When cold, the melt is extracted with water and the residue collected and dried.—F. M.

Sulphurised leuco-bodies; Manufacture of ——. O. Imray, London. From Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1594, Jan. 21, 1907.

WHEN *a*-hydroxythionaphthenes or their carboxylic acids are heated with water-soluble thiosulphates in presence of glycerin, to temperatures above 100° C., they yield sulphurised leuco-bodies, which, when oxidised by themselves or on the fibre, yield blue, violet or red dyestuffs. Thus, *a*-hydroxythionaphthene may be heated with about 10 times its weight of crystallised sodium thiosulphate and 10—15 times its weight of glycerin to 130° C., without access of air, until conversion is complete. After cooling, the melt is treated with water, and the leuco-body obtained by filtering and washing, may be made into a paste or dried in a vacuum. These leuco-bodies are colourless and are but slightly soluble in water; they dissolve readily in alcohol, acetone, and dilute caustic alkalis. From the solution in alkali the sulphurised dyestuff rapidly separates on exposure to the air.—F. M.

Sulphur dyestuff, and process of making same. W. Herzberg, Berlin, O. Scharfenberg, Schöneberg, and M. Bonns, Berlin, Assignors to Act.-Ges. für Anilin Fabr., Berlin, Germany. U.S. Pat. 864,644, Aug. 27, 1907.

BY reacting with an alkali polysulphide upon an arylsulphonic acid derivative of *p*-amino-*p*-hydroxydiphenylamine, and eliminating from the product the arylsulphonic acid residue, a new sulphur dyestuff is produced which dyes unmordanted cotton in clear blue tones, fast to light and acids. Thus *p*-toluenesulpho-*p*-amino-*p*-hydroxydiphenylamine is treated in aqueous solution with sodium pentasulphide, and from the sulphurised intermediate product the residue, $SO_2.C_6H_4.CH_3$, is eliminated by treatment with concentrated sulphuric acid. The dyestuff forms a dark powder with bronzy lustre and is insoluble in water, hot dilute soda lye and the usual organic solvents, but dissolves in sulphuric acid with a reddish-blue colour. —F. M.

Monoazo dyestuff; Red-orange ——, *and process of making same.* W. Herzberg, Berlin, and O. Spengler, Nieder-Schönweide, Assignors to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 865,587, Sept. 10, 1907.

SEE Fr. Pat. 368,259 of 1906; this J., 1906, 1215.—T. F. B.

Azo dyestuffs. M. Kahn, Elberfeld, and R. Kothe, Vohwinkel, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pats. 865,252 and 865,253, Sept. 3, 1907.

SEE Fr. Pat. 377,381 of 1907; following.—T F. B.

Azo dyestuffs; Production of ——. Farbenfabr. vorm. F. Bayer und Co. First Addition, dated April 11, 1907 (under Int. Conv., Aug. 10, 1906), to Fr. Pat. 368,608, Aug. 3, 1906 (this J., 1907, 16).

2-AMINO-5-NAPHTHOL-7-SULPHONIC acid may be used instead of 2-amino-8-naphthol-6-sulphonic acid as in the chief patent. The dyestuffs obtained differ from those previously described in producing bluer shades.—J. C. C.

Monoazo mordant dyestuffs; Production of new ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 377,381, May 3, 1907. Under Int. Conv., Nov. 10, 1906.

THE diazo compound of 4-chloro-2-aminophenol-6-sulphonic acid is combined with 1-naphthol-4-(or 5-) sulphonic acid in alkaline solution. The dyestuffs produce on wool in an acid bath, bluish-red shades which on chroming become bright blue; the 1-naphthol-4-sulphonic acid gives rise to slightly redder shades than does its isomeride.—J. C. C.

Dyestuffs; Manufacture of new condensation products and leuco-derivatives of sulphurised vat ——. [*Leuco-thioindigo derivatives.*] Badische Anilin und Soda Fabrik. Second Addition, dated April 8, 1907 (Under Int. Conv., July 16, 1906), to Fr. Pat. 367,709, June 25, 1906 (this J., 1906, 1143; 1907, 89).

WHEN the leuco-derivatives described in the chief patent and the first addition thereto are treated with cold alkaline oxidising agents or by acid oxidising agents either hot or cold, oxidation products are obtained which are transformed into Thioindigo dyestuffs on heating their alkaline solutions. The dyestuffs are obtained directly when alkaline oxidising agents are used, if the operation is carried out by the aid of heat or if the reaction in the cold be suitably prolonged; they are also produced by treating the leuco-derivatives with sulphur or sulphur chloride.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Artificial silk; Testing varieties of ——. C. G. Schwalbe. Färber-Zeit., 1907, 18, 273.

THE methods of Süvern (this J., 1900, 283) for testing artificial silks are not altogether trustworthy. As a means of distinguishing between Chardonnet, Pauly, and viscose silks, Fehling's solution and a solution containing zinc chloride and iodine are recommended. If 0·2 grm. of each of these silks be treated in separate test-tubes with 2 c.c. of Fehling's solution, the Chardonnet silk, owing to its reducing action, imparts a green colour to the liquid, whilst the liquid in the other two tubes remains blue. To distinguish between Pauly and viscose silks, equal quantities of these are treated with a solution containing 20 grms. of zinc chloride, 2 grms. of potassium iodide and 0·1 grm. of iodine dissolved in 15 grms. of water. The silks are then washed with water. Both silks become at first somewhat coloured, but whereas the viscose silk keeps its colour (bluish-green) for a long time, the Pauly silk quickly loses its (brown) colour during the washing. —C. E. F.

Steam colours printed simultaneously with sulphide dyestuffs or indigo, and fixed by caustic soda in presence of formaldehyde-hydrosulphite. C. Favre. Sealed note, 1584, Dec. 16, 1905. Bull. Soc. Ind. Mulhouse, 1907, 77, 300—302.

CERTAIN dyestuffs which are not affected by weak alkali, and which can be fixed by means of an alumina-mordant, may be dissolved in alkaline sodium aluminate solution and printed together with sulphide dyestuffs or indigo. After printing, the material is steamed for two minutes, then immersed for one minute in a cold bath of sodium bisulphite of 30° B., washed, and dried. The bisulphite decomposes the sodium aluminate, and the aluminium lake of the dyestuff is precipitated on the fibre. Other substances having a weak acid character, *e.g.*, sodium bichromate or bicarbonate may be employed in place of the bisulphite. It is necessary finally to steam for one hour to render the precipitated lake fast to soaping. An interesting feature of the process is that it allows of the printing of Alizarin Red (Turkey red) together with sulphide dyestuffs or Indigo, on unprepared fabrics. The following recipes are given:—*Red:* One litre of Alizarin GF (B.A.S.), 2 litres of sodium aluminate, 0·75 litre of Gallipoli oil, and 0·25 litre of sulphoricinoleic acid. *Yellow:* One litre of Calico Yellow, 1 litre of aluminate, 0·75 litre of Gallipoli oil, 0·25 litre of sulphoricinoleic acid, and 500 grms. of dry dextrin. *Blue:* One litre of Phenocyanine TV, 1 litre of aluminate, 0·75 litre of Gallipoli oil, 0·25 litre of sulphoricinoleic acid, and 500 grms. of dry dextrin. *Violet:* One litre of Alizarin for violet VVAX (B.A.S.), 2 litres of dextrin thickening, and 3 litres of alkaline iron solution. The aluminate solution is prepared by mixing together 8 litres of gelatinous alumina and 3 litres of caustic soda of 38° B., so as to obtain 9 litres of solution at 20° B. The alkaline iron solution is made by adding a cold solution of 200 grms. of ferric chloride in 200 grms. of water, to a mixture of 240 grms. of caustic soda, 260 grms. of water, and 40 grms. of glycerin. The sulphur dyestuffs are prepared as described in this J., 1905, 797. When Immedial Blue or Indigo is used, the printed material after treatment with bisulphite, is passed through a cold solution of sodium bichromate. In every case the material is steamed for 1 hour before being soaped at 50° C.—A. S.

a-Naphthylamine Claret; White discharge on —— with formaldehyde-sulphoxylate. E. Justin-Mueller. Sealed notes 1647, July 16, 1906, and 1660, Aug. 17, 1906. Bull. Soc. Ind. Mulhouse, 1907, **77**, 290—300.

P. WILHELM has stated that whereas *α*-Naphthylamine Claret may be discharged with formaldehyde-hydrosulphite to which a little Cetopaline has been added, a good result could not be obtained with formaldehyde-sulphoxylate and Cetopaline. Trials were made with "hyraldite C" and "hydrosulphite NF conc." (with an addition of ammonium chloride, to produce a slightly acid condition) and Cetopaline. A good white was obtained with two minutes' steaming in the Mather-Platt, whereas without ammonium chloride, a steaming of 4 minutes did not give so good a discharge. In the trials, an addition of phenol, glycerin or sulphoricinate assisted the discharge, but in bulk, the results obtained were very poor, owing to decomposition during drying before steaming; in fact the discharge paste itself is not very stable. Better results were obtained by preparing the pieces with ammonium chloride instead of adding this salt to the discharge paste, and assisting the stability of this by the addition of a little ammonia.

An addition of aniline oil to the discharge paste also gives a good white, and the keeping powers of the paste are improved, but with an addition of aniline hydrochloride, the stability is less than with ammonium chloride. It is not the formaldehyde-sulphoxylate which decomposes, but the Cetopaline, so the additions of this are made only as required, in solution in aniline. After printing, the pieces are dried at as low a temperature as possible, and the discharge being stable when dry, the goods may lie if necessary some time before steaming. They should be steamed with very dry steam for 2 minutes at 102° C.

In a report on the preceding sealed notes, H. Schmid states that Justin-Mueller's process requires such care during drying and printing, besides demanding a supplementary operation (preparing with ammonium chloride), that it cannot satisfactorily replace the simpler, direct methods which are known.—F. M.

PATENTS.

Threads, artificial; Manufacture of ——. E. W. Friedrich, Blaton, Belgium. Eng. Pat. 21,144, Sept. 24, 1906.

SEE Fr. Pat. 369,957 of 1906; this J., 1907, 198.—T. F. B.

Artificial hair and ribbons; Process for the manufacture of very tough, elastic and transparent ——. E. Crumière. Fr. Pat. 377,118, April 23, 1907.

THE filaments or ribbons, from which all copper compounds have been eliminated, are immersed for a few seconds in a warm solution of zinc chloride of sp. gr. 1·7. They are then washed, first, in very dilute sulphuric or acetic acid and finally in pure water. The zinc can be recovered from the washing waters by the usual methods.—P. F. C.

Ether or alcohol vapours contained in air [of artificial silk, celluloid, and smokeless powder factories, etc.]; Recovery of ——. A. de Chardonnet. Fr. Pat. 376,785, June 21, 1906. *See* I.

Dyeing machines in which the dye-liquor is circulated by means of centrifugal or rotatory pumps; Apparatus applicable to ——. C. Fastenaekels. Fr. Pat. 376,788, April 16, 1907.

THIS machine comprises two cisterns which are placed in juxtaposition, each being connected by a separate pipe to the circulating pump. By means of stop-cocks the communication between either cistern and the pump can be interrupted at will. Branch tubes, also provided with stop-cocks, project from these pipes, and extend almost to the bottoms of two small storage tanks. Water is run into the cisterns and heated to the desired temperature, and a solution of the dyestuff is placed in the two storage tanks. The pump is then set in motion and by adjusting the stop-cocks, the solution of the dyestuff can be gradually aspirated into the bath at the desired rate. —P. F. C.

Vat dyeing with dyestuffs of the Gallocyanine series and their derivatives; Process of ——. Manuf. de Mat. Colorantes, ancien. L. Durand, Huguenin et Cie. Fr. Pat. 377,288, April 30, 1907.

THE essential feature of this process is that the dyestuff is present as the leuco-compound in a vat having a slightly acid reaction, small additions of hydrosulphite being made to keep the dyestuff in the state of leuco-compound. It is preferable to use the leuco-gallocyanine in making up the vat, instead of effecting the reduction in the vat. Example:—In a vat of 100 litres of water, 100—500 grms. of the leuco-gallocyanine are dissolved and 50—100 grms. of Hydrosulphite N.F. conc. are added to the solution. The liquor thus obtained should be perfectly clear and should have an acid reaction and a yellow to yellowish-brown colour. The material to be dyed, preferably mordanted, is introduced into the vat, the temperature of which may be between 25 and 50° C. The colour is developed and fixed by passing the material, after removing from the vat, through an oxidising bath containing 2—5 grms. of sodium bichromate per litre. By the addition to the oxidising bath of small quantities of some metallic salts, such as copper sulphate and ferric sulphate, the shade can be modified and rendered faster. The material is finally washed, soaped, and dried.—P. F. C.

Watered effects on textile fabrics; Method of producing ——. J. Sharp and S. H. Sharp and Sons, Leeds. Eng. Pat. 21,590, Sept. 29, 1906.

THE slightly damp fabric is passed between two rollers one or both of which is or are engraved with lines. The rollers are heated, and the water in the fabric being vaporised at the moment of contact, the surface of the cloth will assume the form corresponding to that of the surface of the roller. For moreens, in which the rib of the cloth runs in the direction of the warp, the lines on the roller are cut circumferentially, whereas for moirettes, in which the rib runs weft-wise, the lines are engraved parallel to the axis. For watered designs, the lines are not continuous, but the design is engraved in relief upon the roller, and the face of the design is then engraved with lines, at such a distance from each other as will best suit the rib of the fabric.—F. M.

Watered effects on textile fabrics; Apparatus for producing ——. J. Sharp and S. H. Sharp and Sons, Leeds. Eng. Pat. 22,026, Oct. 5, 1906.

WATERED effects are produced upon moreens or moirettes by passing the fabric in a damp condition between suitably engraved, heated rollers. In the machine described there are three rollers, so adjusted in bearings that the distances between them may be altered at will. The fabric is pressed between the bottom roller, which is engraved with suitable lines, and the middle one, which is plain, or a metal band may be placed around the middle and top rollers (the band being endless and kept under tension by fixing the rollers a suitable distance apart), and the fabric then passed between the bottom roller and the band. The bottom roller may be either engraved or plain, and in the latter case the design to be impressed upon the material is engraved upon the surface of the band. Various combinations for designs by engraving the bottom roller or the metal band, or cutting out designs in the thickness of the latter, or making the middle roller or the band grooved, with annular spaces, are given, whereby in the latter cases, striped effects are obtained. —F. M.

Schreinering apparatus for fabrics. T. and J. Pickles, Burnley. Eng. Pat. 2428, Jan. 31, 1907.

In schreinering machines an engraved metal roller is mounted in a heavy frame, in contact with one covered with fibre and turned quite smooth (a "fibre roller or bowl"). Being worked under heavy pressure, the bearings tend to get very hot and the fibrous layers are quickly spoilt by the heat, great inconvenience thus being caused. This heating of the fibre roller may be obviated by supporting it at its periphery upon a third roller instead of by its axle, the third roller being plain and possessing a hollow axle through which cooling media may be circulated. The fibre roller is placed between this and the engraved roller, the two latter carrying wheels upon their axes, which are in gear over a carrier wheel. The fibre roller receives its motion from contact with the surface of the plain roller, and under the pressure employed, its surface is kept in good condition. (Reference is directed to Eng. Pat. 1208 of 1863.)—F. M.

Warp printing machine. C. H. Landenberger, Philadelphia, Pa. U.S. Pat. 864,312, Aug. 27, 1907.

The machine is provided with arrangements whereby the warp threads are maintained side by side and are led, free from tension, over the printing devices. These are worked as desired by means of a jacquard machine, and the warp threads, after printing, are led between two endless "offset" webs, with which they pass into the steaming box.—F. M.

Paper, textile fabrics, or the like; Device for spraying fluid upon the surface of ——. C. A. Hanitzsch, Manchester. U.S. Pat. 864,784, Sept. 3, 1907.

See Eng. Pat. 20,220 of 1905; this J., 1906, 691.—T. F. B.

Fabrics; Decoration of ——. Soc. Lyonnaise de Teinture, Impression, Apprêt et Gaufrage. Fr. Pat. 377,216, July 3, 1906.

White designs are obtained on a background of uniform shade, either by discharging the colour according to the desired pattern or by printing a reserve upon the fabric before dyeing. These designs are then ornamented by discharging a jet of colour-paste on to them by means of a suitable apparatus. Those parts of the fabric which it is desired to protect from the colour-paste, are covered by a pattern which has been cut out in the required shape. The applied colour is afterwards fixed in the ordinary way.—P. F. C.

Torrefying or singeing threads; Apparatus for ——. C. F. Kaisser and C. G. Riche, Lille, France. Eng. Pat. 26,954, Nov. 27, 1906. Under Int. Conv., Nov. 28, 1905.

See Fr. Pat. 371,667 of 1906; this J., 1907, 468.—T. F. B.

Singeing threads; Apparatus for ——. C. F. Kaisser, Lille, France. Eng. Pat. 27,128, Nov. 28, 1906.

A groove, with overhanging edges, is cut along one face of a block of refractory material and along the base of the groove is laid an electrical resistance, *e.g.*, a strip of platinum coated with iridium or rhodium. The strip is rendered incandescent by an electric current, and the thread is passed through the groove. The sides of the groove reflect the heat, and assist in the singeing.—F. M.

Textile fibres, threads, and fabrics; Method of improving ——. G. Kraemer, and Kraemer und van Elsberg, G.m.b.H., Cologne, Germany. Eng. Pat. 11,928, May 22, 1907.

Supple, damp-resisting coatings are produced upon threads, fibres or fabrics by impregnating them with a solution of pyroxylin, containing chlorhydrin and a sulphonic acid derivative of an aromatic ester, chloride, or amide. (See Eng. Pat. 25,434 of 1899; this J., 1901, 62.) The threads, etc., treated in this way, possess a silky lustre and increased tensile strength, and remain supple, so that their capability for being woven is not affected. The impregnating liquor may be prepared by boiling together 450 parts of alcohol and 350 parts of acetone and dissolving 100 parts of guncotton or collodion-wool in the mixture. 50 or 60 parts of dichlorhydrin and 250 to 350 parts of *p*-toluenesulphonic chloride are then added, and the mixture well stirred.—F. M.

Cotton, silk, paper, wood, hemp and other similar substances, A solution for making —— *non-inflammable.* G. W. Wilkins. Fr. Pat. 377,223, April 27, 1907.

One part of a saturated solution of ammonium phosphate is added to two parts of a saturated solution of ammonium sulphate, and the material to be treated is immersed in the mixture and then dried. For most fabrics, however, the mixed solution may be considerably diluted.—P. F. C.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Paper; Process for dyeing and printing ——. C. Schwalbe. Ger. Pat. 180,831, Oct. 8, 1905.

Paper is padded with a β-naphthol soap solution (see this J., 1907, 45) containing little or no free alkali, dried, and developed in or printed with a diazo solution. —T. F. B.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Acid nitrating mixtures; Analysis of ——. G. Coffett and G. Maderna. *See* XXIII.

Caustic lime; Determination of —— *by the use of a sugar solution.* J. Hendrick. *See* XXIII.

Zinc salts; Theory of the action of sulphuretted hydrogen on ——. S. Glixelli. *See* XXIII.

Patents.

Denitrification in the Gay-Lussac tower; Process for preventing ——. H. Petersen. Fr. Pat. 377,567, May 7, 1907.

The claim is for the interposition of an extra chamber ("chamber regulator") between the last lead chamber and the Gay-Lussac tower (see this J., 1907, 870).—A. S.

Chromic acid ; Process for regenerating —— by the electrolysis of chromium sulphate. Soc. Chem. Fabr. Buckau. Fr. Pat. 377,027, April 20, 1907. *See* XIA.

Bisulphite liquor ; Tower for making ——. J. Bishop, Carthage, N.Y. U.S. Pat. 864,881, Sept. 3, 1907.

The claims are for a tubular wooden tower, closed below and open above, and divided into a number of superposed compartments by means of wooden gratings, on which wooden baffle-blocks are disposed in an irregular fashion. The lowest compartment serves as a receptacle for the bisulphite liquor. Lime-water is introduced at the top of the tower and flows downwards, whilst sulphur dioxide is admitted at the lower part, and by means of a "steam-actuated siphon" is forced upwards between and around the baffle-blocks in the several compartments. Manholes are provided through which the baffle-blocks can be removed from any one of the compartments.—A. S.

Alkali cyanides ; Process for the manufacture of ——. C. Griffiths. Fr. Pat. 377,672, July 17, 1906.

Nitrogenous charcoal, finely powdered and perfectly dry, is intimately mixed with alkali oxides or carbonates, and heated in earthenware retorts to a temperature of 1000°—1100° C. The reaction-product is lixiviated with hot or cold water, the solution is treated with milk of lime to convert the alkali carbonates into hydroxides, then filtered, concentrated *in vacuo*, and the alkali cyanides obtained by crystallisation.—A. S.

Oxides of nitrogen ; Process for the direct absorption of —— by dry fixed bases. A. T. Schloesing. Fr. Pat. 377,708, July 18, 1906.

The nitrous fumes, previously freed from water and carbon dioxide, are absorbed by means of dry fixed bases, preferably lime, maintained at a suitable temperature (say 150°—200° C. or higher). The absorption is effected on the counter-current principle, in a suitable apparatus, for example in a tower provided with a series of floors, the lime being passed forward from one floor to the next, and becoming intimately mixed with the nitrous fumes passing in the opposite direction. The product obtained consists of a mixture of nitrate and nitrite of calcium, the former greatly preponderating, sufficiently rich in nitrogen to form a commercial article.—A. S.

Potassium peroxide or a mixture rich in potassium peroxide ; Process for making ——. G. F. Jaubert. Fr. Pat. 377,709, July 18, 1906.

See Eng. Pat. 7641 of 1907 ; this J., 1907, 1008.—T. F. B.

Arsenic ; Process for separating —— from liquids and gases. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 376,931, Jan. 9, 1907.

Arsenic is to be separated from liquids, by treating them with hydrochloric or hydrofluoric acid, and then shaking them with benzene. The arsenic is afterwards separated from the benzene by washing it with water. Arsenic is to be removed from gases by bringing them into intimate contact with dichlorobenzene, from which the arsenic can be separated by washing with water.—W. C. H.

Arsenic ; Process for separating —— from liquids or gases. Chem. Fabr. Griesheim-Elektron. First Addition, dated Feb. 18, 1907, to Fr. Pat. 376,931, Jan. 9, 1907.

Pure derivatives of aliphatic hydrocarbons, *e.g.*, carbon tetrachloride or acetylene tetrachloride, may be used in place of the benzene derivatives mentioned in the main patent (see preceding abstract).—A. S.

Chlorinated compounds of lime ; Process of manufacture of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 376,846, April 17, 1907.

Basic compounds of calcium hypochlorite are produced by continuing the chlorination of "milk of lime" beyond a specific gravity of 1·15, and adding an amount of lime sufficient to precipitate these basic compounds. By continuing the introduction of chlorine, these compounds are decomposed, and concentrated solutions of calcium hypochlorite can be obtained ; whilst if the treatment be sufficiently prolonged, solid, non-basic calcium hypochlorite can eventually be obtained. The separation of the solid hypochlorite can be hastened by treating the solution with a soluble salt (*e.g.*, calcium chloride), and the product can be preserved from decomposition by separating the solid, washing, and drying it rapidly.
—W. C. H.

Furnace, with generator gas as fuel, for roasting limestone, dolomite, and other analogous materials. E. Schmatolla. Second Addition, dated April 19, 1907, to Fr. Pat. 352,549, Feb. 17, 1905.

The lower portion of the furnace (described in the main patent and in the first addition, see this J. 1905, 925 ; 1906, 267), which is cooled by the heat given to the gas and air, is narrowed in two successive portions, and air is admitted at these places so that it is delivered into the middle of the furnace. The calcined material is withdrawn through the same channels. A form of furnace, elliptical in shape, is described, the lower portion being divided into two parts by a bridge, through which the gas-channels pass ; and another form, circular in section, provided with two similar bridges in the form of a cross, so that the gas is delivered into the middle of the mass to be calcined. The vertical channels in the bridges are provided with horizontal dampers which are accessible from the outside, so that the supply of gas may be regulated.—B. N.

Fossil meal [kieselguhr], and other like substances ; Bleaching of ——. J. Barr. Fr. Pat. 377,086, April 23, 1907. Under Int. Conv., March 6, 1907.

Kieselguhr, or similar silicious or aluminous earths, are strongly heated in a retort through which water-gas, or other combustible and reducing gas is passed, with the object of reducing the iron oxides present to the metallic state. Or, the earths may be mixed with peat or the like, and similarly heated, for the same purpose. Chlorine gas is then passed over the highly-heated earth, and the ferric chloride vapour formed is carried away, and may be condensed if desired.—E. S.

Nitrogen compounds of oxygen ; Obtaining ——. Westdeutsche Thomasphosphat-Werke G.m.b.H. Fr. Pat. 377,199, April 26, 1907. *See* XIA.

Cyanogen, hydrocyanic acid, and cyanogen- and thiocyanogen compounds ; Process for the separation of —— from gaseous mixtures. P. von der Forst. Ger. Pat. 182,084, May 1, 1906.

The gases are treated with a washing liquor containing metallic copper or copper compounds in addition to ammonia or alkali- or alkaline-earth hydroxides. The double cyanides of copper formed are not decomposed by hydrogen sulphide or carbon dioxide, and a purer product is therefore obtained.—A. S.

Atmospheric air ; Process of separation of the constituents of ——. A. Helbronner, R. J. Lévy, and Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Procédés G. Claude). Fr. Pat. 376,854, June 22, 1906.

In the process of separating the constituents of atmospheric air by means of liquefaction, a part of the gaseous nitrogen.

obtained by separation under pressure, is liquefied again, by evaporation of liquid oxygen, under diminished pressure, obtained in the original separation of the liquid air. For this purpose the liquid oxygen is brought into a receiver provided with a bundle of tubes, in which the gaseous nitrogen is re-liquefied. This liquid nitrogen then passes into the upper part of the separating apparatus, in a rectifying column, in which it further purifies the gases, already rich in nitrogen, which are obtained by the distillation of liquid air. A portion of the nitrogen from the separator, being colder than the liquid oxygen obtained in the original separation, can be used to further cool the liquid oxygen: the nitrogen thus partially heated then undergoes an expansion and may thus be used to cool a fresh portion of air that is to be separated into its constituents.—W. C. H.

Sulphur; Process for extracting ——. E. Günther and R. Franke. Fr. Pat. 377,824, May 15, 1907.

See Eng. Pat. 11,187 of 1907; this J., 1907, 968.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glasses; Production and alteration of hydrated ——. F. Mylius and E. Groschuff. Z. anorg. Chem., 1907, **55**, 101—118.

Silicate glasses have the power of forming intimate mixtures with water, which constitute hydrated glasses. The water penetrates the glass substance, and is thus distinct from the hygroscopic layer on the surface. The authors have examined some hydrated glass tubes, which had been immersed for 15 years in dilute sulphuric acid in electrical accumulators. These tubes were apparently unaltered, but on gentle warming, the surface flaked off, and the tubes showed the appearance of strongly "weathered" glass, though such appearance is ordinarily only found on glasses of a defective character. Dilute sulphuric acid does not injuriously affect a resistant glass for a long time, and such glass does not become hydrated. On the other hand a glass of inferior quality, or defective composition, is distinctly affected by dilute sulphuric acid at ordinary temperatures, with the abstraction of alkali and the introduction of water up to 12 per cent., without the glass losing its vitreous character. The hydration of the glass substance is greater, the more the alkali is removed; with a resistant glass the introduction of water into the glass substance is small. Even after some years' contact with acid, the injured layer still contains a low proportion of alkali. A more marked injury of a glass object by dilute acid is recognisable on warming, by the change produced in the superficial layer. When gradually heated, the substance of a hydrated glass splits up, owing to the diminution of volume by loss of water, and the surface flakes off. The removal of the water of hydration goes on continuously, though most of it is driven off at a little over 100° C. A temperature of over 500° C. is required to fully dehydrate the glass substance, and exfoliation of the surface layer then takes place. Rapid heating of a hydrated glass from 100° C. upwards, causes a brisk evolution of steam, which destroys the vitreous character of the glass, and gives an appearance of small bubbles or foam on the surface; in other cases devitrification is produced by the separation of solid substances in the glass. The loss of the vitreous character is brought about by the removal of water. Both kinds of devitrification, viz.: the production of a "foam" surface, and the separation of solid bodies, may be observed in badly disintegrated glasses, occasionally without, but often accompanied by exfoliation. A temperature of about 400° C. is necessary for devitrification. The production of steam bubbles depends upon the plastic condition of the glass substance; thus, the formation of a "foam" surface does not occur on the disintegrated layers of high-melting glasses, or with hydrated silicic acid, whilst, on the other hand, devitrification arising from the separation of a solid phase, occurs especially with disintegrated layers which have a high silica content; the separated substance presumably is silicic acid. The separation of solid substances above 400° C. may not take place, when the water has been gradually removed at a lower temperature. By the action of an ethereal solution of iodeosin upon a freshly broken surface of a glass, it is possible to determine approximately the extent to which hydration of the glass has proceeded.—W. C. H.

Glass; Eosin reaction of ——. F. Mylius. Z. anorg. Chem., 1907, **55**, 233—260.

To compare quantitatively the chemical activity of two samples of glass, it is necessary to employ freshly broken surfaces. Exposure to the action of a moist ethereal solution of iodeosin (tetraiodofluorescein), as giving some rough indication of the amount of alkali liberated by hydrolysis, has already been suggested by the author (this J., 1889, 306), and this method has now been elaborated for purposes of quantitative comparison. The test piece is immersed in the solution for a given time, and the red alkali salt deposited on the fractured surface is then determined colorimetrically by transference to moist filter paper, or by solution in dilute alkali and comparison with a standard. Very careful attention to detail is necessary for obtaining trustworthy results, and full directions are given for carrying out the test. The initial hydrolysis may be considered complete for ordinary silicate glass, after an immersion of one minute, and the numbers obtained correspond to the "hygroscopic effect." The glass then becomes more or less passive, owing to the formation of a protecting surface layer poor in alkali. To ascertain the weathering capabilities of the glass, it is necessary to supplement this "minute test" by an immersion of 24 hours. The values given for various glasses are found to be well in agreement with their relative powers of resistance to the action of atmospheric moisture and carbon dioxide, as revealed by a microscopic examination extending over a period of 8 months. The test is specially useful in valuing glass for optical purposes, but its applicability for the heavy barium and lead glasses has yet to be established.—F. Sodn.

Porcelain colours. W. Muthmann, L. Weiss, and H. Heramhof. Annalen, 1907, **355**, 144—164.

The authors have investigated the use of compounds of neodymium, praseodymium, and cerium as porcelain pigments, and of lanthanum as a beautifying colour and as a substitute for zinc oxide. Owing to the high melting points of the finely-powdered oxides and silicates, the phosphates of the metals were found to be most suitable for firing on to the body. The phosphates of iron, cobalt, nickel, manganese, and chromium were also tried, and a series of titanates, tungstates, uranates, and molybdates. Neodymium and praseodymium phosphates were prepared as porcelain pigments in the following way. The oxide was strongly heated, washed with water, and dissolved in dilute nitric acid, and then heated for some time with dilute phosphoric acid; dilute ammonia was then added, while the solution was warm, until no further precipitation occurred. The precipitate was thoroughly washed, dried, and ignited strongly, and ground. The neodymium oxide was prepared from the oxalate; it readily forms the sulphate when heated in contact with a gas containing sulphur compounds. The oxides of praseodymium, samarium, iron, nickel, and manganese behave similarly, but the temperature at which the sulphates decompose is lower. Neodymium phosphate can be "burnt on" either in an oxidising or reducing atmosphere, and the temperature may be raised even to 1450° C., without fusion, or marked penetration of the "body." It gives a very strong, transparent, bright, rose-red colour, with a scarcely perceptible blue tinge in thin layers. It accurately represents flesh colour.

Compounds of the rare earths can be readily detected by their absorption spectra when viewed by reflected light, and the authors found this a very useful method

Praseodymium oxide, to be used in preparing the phosphate, must be as free as possible from neodymium oxide, as the colour of the latter is complementary. Praseodymium phosphate behaves very similarly to the neodymium compound, though its colouring power is not very strong. It gives a beautiful, bright, leek-green colour. Didymium is essentially cheaper than neodymium, of which it contains about twice as much as of praseodymium, and the phosphate gives a strong colour, that hardly differs from that of the neodymium compound, though it is not so bright. It was found that even up to 1500° C., ferric phosphate was quite permanent, and gave a yellow colour. The colouring power is not very strong, and if the pigment is not quite pure, the colour tends to a light brown.

Manganese phosphate and pyrophosphate are useless for colouring porcelain, giving only ugly, yellowish-brown, blistered colorations, and being often decomposed at high temperatures. Cobalt phosphate gives to porcelain a beautiful deep blue colour, more like the colour of ammoniacal copper solutions than the sky blue colour given by the ordinary cobalt oxide or silicate ; it is also much less fusible than either of these, and forms a very strong combination between the body and the glaze. Cobalt-ammonium phosphate gives a brighter and deeper blue than the neutral salt. Chromium phosphate gives a bright grass-green, and is much easier to burn properly than chromium oxide. It is not in the least fused at 1450° C. Copper phosphate does not give a useful porcelain colour, as it causes the glaze to blister, and nickel phosphate behaves in much the same way. Experiments were made to determine the behaviour of silica towards phosphates at high temperatures. Cobalt phosphate was heated with an excess of finely-ground quartz to 500°, for 2 hours, and also up to 1400° C. by a rise of 100° C. each time, and in each case the amount of phosphoric anhydride was determined in the mixture after cooling. This fell gradually from 43·98 to 29·22 per cent. At 1300° C., it amounted to 36·95 per cent. after 2 hours' heating, and after 6 hours' heating, to 36·4 per cent. When the temperatures had been raised to 1000° C. and over, the mass, on treatment with nitric acid, left a blue residue consisting of cobalt-silico-phosphate. Iron titanates were burnt on to a "body," and gave in a thick layer, orange-red colours of unequal quality, and studded with black spots. These may be avoided by preventing any reducing conditions, and occur less with a titanate obtained by precipitation with ammonia. With an increase in the content of titanium, the colour tends towards yellow. Cerium titanate, burnt on at 1400° C., gave a yellow colour, tending to brown ; with excess of titanic acid, bright yellow colours were obtained, without any spots. Manganese titanates gave strong, brilliant yellow colours, which were not destroyed by temperatures up to 1450° C. Intermediate tints from pure yellow, brownish-yellow, and orange-yellow can be obtained from mixtures in varying proportions of trimanganese tetroxide (Mn_3O_4), titanic acid, and cerium-ammonium-nitrate. Cerium tungstate gives an unpleasant blue-green, and neodymium tungstate a bluish-red colour. Cerium molybdate on burning on to a "body" gave a beautiful bright blue colour.—W. C. H.

PATENTS.

Glass-furnace provided with a cooling-chamber. F. Wieltschnig. Fr. Pat. 377,017, April 20, 1907.

THE glass-furnace is provided with a cooling chamber, the base of which is formed by the arched crown of the furnace proper. By means of lateral partitions, this cooling chamber is divided into a number of vertical compartments, the alternate ones serving for the cooling of the glass objects, which are conveniently handled by means of elevators.—A. G. L.

Aluminium oxides [*for ceramic articles*] ; *Process for the manufacture and treatment of compositions containing* ——. C. F. Boehringer und Soehne. Fr. Pat. 377,964, July 25, 1906.

THE use of artificial corundum (fused alumina) in the manufacture of ceramic goods, was claimed in Ger. Pat. 160,780 of 1901 (this J., 1905, 1016). It is now found that the character of the products can be modified in many ways by the use of alumina which has been mixed and fused with natural or artificial oxides of other metals or of metalloids, and the preparation and use of such mixtures forms the object of the present patent.—A. S.

Vessels indifferent to changes of temperature. H. Hidding. Fr. Pat. 377,171, April 26, 1907. Under Int. Conv., Dec. 8, 1906.

THE liability of clay vessels to crack when heated, is due to the molecular tension of their walls. To overcome this defect the walls of the vessels are formed of three or more superposed layers having different physical and chemical properties. The intermediate layer or layers are formed of a more porous material than the others.—W. H. C.

Enamel or metal coatings from enamelled or metal coated ware ; Process for removing ——. G. Spitz, Brünn, Austria. Eng. Pat. 5273, March 5, 1907.

SEE Fr. Pat. 370,986 of 1906 ; this J., 1907, 257.—T. F. B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

PATENTS.

Bricks and the like ; Drying and burning ——. A. A. Gery, Reading, Pa. Eng. Pat. 629, Jan. 9, 1907.

BY means of a movable partition a part of the tunnel in which the bricks are burnt, is converted into a closed drying chamber, through which the bricks are made to pass first of all. Heated air under pressure is passed into the lower part of this chamber at the centre, and passes out through restricted outlets in the lower parts of the side wall.—A. G. L.

Building materials : Artificial ——. A. Seigle. Fr. Pat. 377,315, July 6, 1906.

Two parts of calcined calamine, containing about 40 per cent. of zinc, and 3 parts of siderite, calcined in an indifferent or reducing atmosphere, and containing about 40 per cent. of iron, are mixed with 15 to 20 parts of lime ; to one part of this mixture are added about 15 parts of sand, or of blast-furnace slag, kieselguhr, etc., and the whole is gradually moistened with a solution containing 30 to 60 grms. of sodium and calcium chlorides per litre. The mass is moulded into bricks, tiles, etc., and heated for 8 to 10 hours in steam under a pressure of 7 to 8 kilos. per sq. cm.—A. G. L.

Wood ; Process for the impregnation of —— *under hydraulic pressure, using salts of heavy metals and compounds of aluminium.* E. Marmetschke and H. Brüning. Fr. Pat. 376,798, April 16, 1907. Under Int. Conv., April 17, 1906.

THE impregnation of the wood under hydraulic pressure by solutions of zinc chloride, copper sulphate, or aluminium sulphate or acetate, is carried out between the limits of temperature at which, on the one hand, albumin coagulates and, on the other, free acids having a destructive action on the wood fibre, are formed from the solutions, *viz.*, between 60° and 98° C.—A. G. L.

Plaster and other similar materials ; Process of burning and dehydrating ——. C. Chauffert. Fr. Pat. 376,878, April 18, 1907.

THE loss of weight of the material treated, due to the removal of the water it contains, is utilised to control automatically the supply of the material to, and its removal from the vessel in which the burning takes place. For this purpose the vessel, in which the dehydration is carried out, is mounted upon an axis, in the path of a stream of hot gases, and is capable of turning upon its axis, without affecting its weight. As soon as each batch of material has diminished in weight to the required amount, a system of levers comes into operation, and opens a door through which the treated material passes out from the vessel, and also opens another door through which fresh material can pass into the vessel.—W. C. H.

Cement ; Process for calcining the raw material for manufacturing ——. C. Hocke, Hamburg, Germany. Eng. Pat. 27,059, Nov. 28, 1906.

See Fr. Pat. 372,219 of 1906 ; this J., 1907, 612.—T. F. B.

X.—METALLURGY.

Mercury deposits in South Africa. South African Mines, July 13, 1907. [T.R.]

There are fairly extensive mercury deposits in the Transvaal, which promise to be capable of supplying all the needs of the gold-mining interests. Mercury claims in the eastern Transvaal and near Hector Spruit on the Delagoa Bay line, have been worked to a small extent. The most promising deposits, however, consist of two blocks of claims belonging to the Campbells Mercury, Ltd., and are located about 18 miles from Hector Spruit. On the northern block of claims is a creek in which native mercury has been found. The native metal assays three to four ounces gold, and two days' sluicing yielded 40 lb. of mercury ; but it is not stated from how much material this came. There are two creeks which contain native mercury, and at their intersection the amount present is greatest.

Iron ; Report of the Committee on the standard methods for the analysis of ——. Trans. Amer. Foundrymen's Assoc., May 20—24, 1907. J. Amer. Chem. Soc., 1907, 29, 1372—1376.

Determination of silicon. One grm. of metal is treated with 30 c.c. of nitric acid of sp. gr. 1·13 and 5 c.c. of concentrated sulphuric acid, and evaporated until fumes are no longer evolved. The residue is treated with water, and after boiling until all ferrous sulphate is dissolved, the solution is filtered through an ashless filter, using a cone. The insoluble matter is washed once with hot water, once with hydrochloric acid, and three or four times with hot water, then ignited and weighed. It is next evaporated with a few drops of sulphuric acid and 4 or 5 c.c. of hydrofluoric acid, ignited slowly, and again weighed. *Determination of sulphur.* Three grms. of drillings are dissolved slowly in concentrated nitric acid in a covered platinum dish, 2 grms. of potassium nitrate are then added, and the whole evaporated to dryness and ignited at red heat over an alcohol lamp. The residue is treated with 50 c.c. of a 1 per cent. solution of sodium carbonate, boiled for a few minutes, filtered, and the filter washed with a hot 1 per cent. solution of sodium carbonate. The filtrate is acidified with hydrochloric acid, and evaporated to dryness, the residue treated with 50 c.c. of water and 2 c.c. of concentrated hydrochloric acid, filtered, and the filtrate and washings diluted to 100 c.c., heated to boiling, and precipitated with barium chloride. *Determination of phosphorus.* Two grms. (or 1 grm.) of metal are dissolved in 50 c.c. (or 25 c.c.) of nitric acid of sp. gr. 1·13, 10 c.c. (or 5 c.c.) of hydrochloric acid are added, and the solution evaporated to dryness. The residue is heated until free from acid, re-dissolved in 25—30 c.c. of concentrated hydrochloric acid, diluted to about 60 c.c., and filtered. The filtrate and washings are evaporated to about 25 c.c., 20 c.c. of nitric acid of sp. gr. 1·2 are added, the whole is evaporated until a film begins to form, when a further 30 c.c. of nitric acid are added, and the solution again evaporated until a film begins to form. The solution is now diluted to about 150 c.c. with hot water, and allowed to cool to 70°—80° C., when 50 c.c. of molybdate solution are added. After agitating for a few minutes, the precipitate is collected in a tared Gooch crucible having a paper disc at the bottom, washed three times with a 3 per cent. solution of nitric acid and twice with alcohol, and dried at 100°—105° C. The molybdate solution is prepared by dissolving 100 grms. of molybdic acid in 250 c.c. of water, with the addition of 150 c.c. of ammonia, and, after solution is complete, of 65 c.c. of nitric acid of sp. gr. 1·42. This is poured slowly into a cool solution of 400 c.c. of concentrated nitric acid in 1100 c.c. of water, and two drops of ammonium phosphate solution are added. *Determination of manganese.* 1·1 grms. of drillings are dissolved in 25 c.c. of nitric acid of sp. gr. 1·13, and the solution is filtered into an Erlenmeyer flask, the filter being washed with 30 c.c. of the same acid. The cold solution is treated with about 0·5 grm. of sodium bismuthate until a permanent pink colour forms, then heated until the colour disappears, and sulphurous acid or ferrous sulphate solution added until the liquid is clear. After again heating, until all nitrous fumes have disappeared, the solution is cooled to 15° C., and an excess (about 1 grm.) of sodium bismuthate added. After stirring for 2—3 mins., 50 c.c. of water containing 30 c.c. of nitric acid per litre, are added, the solution is filtered through an asbestos filter, and the latter washed with 50—100 c.c. of the weak nitric acid. The filtrate is treated with an excess of ferrous sulphate and titrated back with permanganate. *Determination of total carbon.* The train of apparatus consists of a preheating furnace containing copper oxide, followed by potassium hydroxide solution (sp. gr. 1·2), calcium chloride, and the combustion furnace and tube, which latter contains 4—5 ins. of copper oxide between platinum gauze plugs (the plug to the rear of the tube is at about the point where the tube emerges from the furnace), and a roll of silver foil, 2 ins. long. The train after the combustion tube consists of anhydrous copper sulphate, anhydrous cuprous chloride, calcium chloride, and a single bulb containing potassium hydroxide solution, with an exit tube filled with calcium chloride. One grm. of well-mixed drillings is dissolved in 100 c.c. of potassium copper chloride solution (1 lb. of the salt in 1 litre of water) and 7·5 c.c. of concentrated hydrochloric acid, and the solution filtered through asbestos. The beaker in which the metal was dissolved is washed with 20 c.c. of hydrochloric acid (1 : 1), and the carbon is washed on to the filter with the same acid. The filter is washed free from acid with warm water, and dried at 95°—100° C. After making a blank trial with the combustion apparatus, the filter and carbon are placed in the ignition tube, and the preheating furnace and the portion of the combustion furnace containing the copper oxide are heated, and air or oxygen drawn through at the rate of three bubbles per second. The combustion is continued in the ordinary manner for 30 mins. with air, or 20 mins. with oxygen. The supply of gas is then cut off gradually, the oxygen supply stopped, and air drawn through for 10 mins. The potash bulb is weighed after 5 mins. The use of the preheating furnace may be dispensed with, and a Shimer or similar crucible may be used in place of the combustion furnace. In the latter case, the crucible is connected with a copper tube, $\frac{3}{16}$ in. diam., and 10 ins. long, with its ends cooled by water-jackets. A disc of platinum gauze is placed in the centre of the tube, with silver foil (3—4 ins.) on the side towards the crucible and copper oxide (3—4 ins.) on the other side. The ends of the tube are plugged with glass-wool, and the tube is heated with a fish-tail burner before the aspiration of air is started. The crucible is heated with a blast-lamp for the same time as given for the combustion furnace. *Determination of graphite.* One grm. of metal is dissolved in 35 c.c. of nitric acid of sp. gr. 1·13, filtered through asbestos, and the filter washed with hot water, then with potassium hydroxide solution of sp. gr. 1·1, and again with hot water. The graphite is ignited in the same manner as in the determination of total carbon.—A. S.

Mild steel; Case-hardening of ——. C. O. Bannister and W. J. Lambert. Iron and Steel Inst., Sept., 1907. [Advance proof.]

Mild steel bars were hardened in the usual manner for times varying between 2½ hours at a temperature of 871° C. to 120 hours at 982° C. Portions from each bar were quenched in water from a temperature of 843° C., and the bars themselves were slowly cooled. Photomicrographs were then obtained from the soft and hard specimens of one of these bars (that heated for 120 hours at 982° C.) on passing from the outside towards the centre, and these were compared. From the results recorded, the authors consider that the process of cementation can be satisfactorily explained on the solid solution theory without considering the formation of sub-carbides.—C. A. W.

Case-hardening. G. S. Scott. Iron and Steel Inst., Sept., 1907. [Advance proof.]

The most suitable temperature for case-hardening was found to be between 800° and 900° C., as above this range there is danger of overheating the metal, and a lower temperature is ineffective. Comparing the case-hardening qualities of a nitrogenous material, such as burnt leather, and a non-nitrogenous material, such as anthracite, the author found that with the former, the depth of penetration was about ten times as great as with the latter for a 4 hours' treatment at 900° C. The theory of case-hardening is discussed, and experiments were made to determine the part played by nitrogen, the author concluding that nitrogen causes iron to assume the γ-form, which combines more readily with carbon than does α-iron.—O. F. H.

Iron and steel; Corrosion of ——. W. H. Walker, A. M. Cederholm, and L. N. Bent. J. Amer. Chem. Soc., 1907, **29**, 1251—1264.

The authors repeated Moody's experiments (this J. 1906, 539) with practically identical results, but draw different conclusions therefrom, the non-production of rust being found to be due to the protective action of alkali dissolved from the glass. On using a flask of Jena glass which had been previously steamed for two days to remove easily soluble alkali, the iron corroded in presence of air freed from carbon dioxide almost as readily as when exposed to ordinary air. Moody's experiments in which chromic acid was used, are valueless, since, as is known, solutions of chromic acid or potassium bichromate render iron passive and inhibit rusting. This passivity is retained even after the iron has been washed with pure water and dried.

Whitney's electrolytic theory of the corrosion of iron (this J., 1907, 799) depends to a large extent upon his statement that iron will dissolve in pure water free from oxygen and carbon dioxide. The authors have experimentally confirmed this statement, and, in conjunction with A. S. Cushmann, have devised an indicator by means of which the electrolytic nature of the corrosion of iron can be plainly shown. The indicator, which has been named *ferroxyl*, consists of water containing phenolphthaleïn and a trace of potassium ferricyanide, and, if it be desired to preserve the effects produced, stiffened by means of neutral agar-agar or gelatin. On immersing a piece of bright iron in this reagent, the metal, in a few minutes, is seen to be divided into zones of opposite polarity. Where the iron is anodic, ferrous ions go into solution and react with the ferricyanide, with the production of Turnbull's blue, whilst where the iron is cathodic, hydrogen is liberated, and the hydroxyl ions concurrently formed, produced a red colour with the phenolphthaleïn. The primary function of oxygen in the corrosion of iron is to depolarise those cathodic portions of the iron which tend to become coated with a film of hydrogen, and thus to allow solution of the anodic portions of the iron to become continuous. A secondary effect of the oxygen is to oxidise the dissolved ferrous ions and thus lead to the precipitation of ferric hydroxide. The rapidity of corrosion of iron in water is a linear function of the partial pressure of the oxygen in the atmosphere above the water. Further support for the electrolytic theory of the corrosion of iron was found in the results of experiments which showed that areas with marked differences of potential exist in far greater number upon the surface of a piece of iron prone to corrosion than upon iron which is resistant to corrosion.—A. S.

Metals of the rare earths, and earth-acids; Preparation of —— *and their application. IV. Metallic calcium.* W. Muthmann, L. Weiss, and J. Metzger. Annalen, 1907, **355**, 137—143.

Commercial metallic calcium is always coated with a layer of calcium chloride, and contains varying quantities of chlorine compounds. A considerable proportion of the adhering calcium chloride can be removed with absolute alcohol, and the remainder can be separated by heating the metal in a closed iron bomb in a furnace; the re-melting is accelerated by the addition of some calcium fluoride. In this way, metal containing 99·44 per cent. of calcium, and 0·25 per cent. of alumina and silica, is obtained. The authors found the mean value of 1·4153 for the specific gravity of re-melted metal containing 99·44 per cent. of calcium, which is lower than the values found by Arndt and Setlik (1·54—1·58). The heat of combustion of Bitterfeld calcium in fine chips was determined in a Mahler's bomb, and was found to be 80·097 cals. per grm.-equivalent. Fused sodium chloride is reduced by calcium at about 950° C., yielding a product containing 98·61 per cent. of sodium, and 0·85 per cent. of calcium. Potassium chloride is reduced at 1200°—1600° C., potassium with a small content of calcium and a considerable amount of chlorine in the form of sub-chloride being obtained. A hard alloy was obtained from 16 grms. of calcium and 120 grms. of barium chloride, and after 1 hour's heating, contained 16·02 per cent. of barium and 82·33 per cent. of calcium. With longer heating the content of barium increased. These alloys oxidise very quickly in the air, and reduce permanganate solution almost at once. Similar products were obtained from strontium chloride, but with rather higher percentages of strontium. On fusing together equal weights of sodium and calcium, the regulus formed two layers, the upper of which was a soft, silvery, malleable mass with a small calcium content (about 20 per cent.), and the lower a hard alloy rich in calcium (about 80 per cent.). The metals alloy together when hot, but tend to separate in the cold. With potassium no homogeneous products could be obtained. By heating fragments of calcium with an excess of dry cryolite in a bomb in a wind-furnace, for two hours at a red heat, a mass of metallic aluminium, free from calcium, was obtained. By the action of metallic calcium upon calcium borate in a bomb at above 1400° C., a partially melted product of a black colour, and a smaller quantity of a brown, sintered substance were obtained. By treatment with acetic acid the mass becomes brown and the calcium boride can be separated; it corresponds with the formula, B_7Ca, and appears to be a mixture of amorphous boron, and the compound, B_6Ca, prepared by Moissan by the action of aluminium and sugar charcoal upon calcium borate.—W. C. H.

Alloys of tin or antimony; Method of analysis of some ——. A. Berg. Bull. Soc. Chim., 1907, 1, 905—909.

The process is based on the conversion of the metals into sulphides by heating them with a mixture of equal parts of anhydrous sodium carbonate and sulphur. On treating the resulting mass with water, tin, antimony, and arsenic dissolve in the form of sulpho-salts, whilst most other metals remain behind in the form of insoluble sulphides.

Lead-tin alloys, tinned ware.—0·5 grm. of the alloy is mixed in a porcelain crucible with about six times its weight of the mixture of sodium carbonate and sulphur, and heated at first gently and afterwards to bright redness for 5 minutes. After cooling, the mass is taken up with water, filtered, and the insoluble lead sulphide washed with water containing a few drops of ammonium sulphate. The filtrate is acidulated with hydrochloric acid, the mixture of tin sulphide and sulphur filtered off, and the tin determined as oxide. The lead is determined as sulphate. If iron is present in the insoluble sulphides, these are re-dissolved, and the lead precipitated as sulphate.

The process may be used for the detection of foreign metals in tin. If iron be present, the solution of the tin sulpho-salt is coloured dark green by colloidal iron sulphide. The method, with slight modifications, may also be used for the analysis of lead-antimony alloys and bronzes and other tin alloys (Darcet's alloy, Wood's alloy, etc.).—A. S.

Tellurium-tin alloys. H. Fay. J. Amer. Chem. Soc., 1907, 29, 1265—1268.

The freezing-point diagram of tin-tellurium alloys is very similar to that of lead-tellurium alloys (this J., 1902, 617). The two metals form the compound, SnTe, which melts at 769° C., and forms a eutectic with tellurium containing 85 per cent. of the latter metal, and a eutectic with tin very poor in tin. It has been found also that the lead compound, PbTe, forms with lead, not a solid solution, as previously stated (*loc. cit.*), but a eutectic having a very low content of lead.—A. S.

Magnesium; Existence of "passivity" with ——. R. Lohnstein. Z. Elektrochem., 1907, 13, 613—614.

Magnesium is readily attacked by acids and even by many salt solutions; it is rapidly dissolved in aqueous acetic acid, but the author finds that the addition of potassium bichromate to acetic acid solutions prevents the attack of the metal. With a 5 per cent. solution of acetic acid, the addition of 1 per cent. of potassium bichromate is sufficient to maintain the passivity of the magnesium; even when the quantity of bichromate is insufficient, the attack is very much less rapid than in pure acetic acid solutions. Addition of alkali- or alkaline-earth salts, such as chlorides and sulphates, reproduces the activity, the action depending upon the quantity of salt added.—R. S. H.

Patents.

Steel alloys; Production of [self-hardening] ——. J. Churchward, New York. Eng. Pat. 18,792, Aug. 22, 1906.

See U.S. Pat. 832,773 of 1906; this J., 1906, 1050.—T.F.B.

Iron or steel; Treatment [case-hardening] of ——. W. R. Hodgkinson, Blackheath, Kent. Eng. Pat. 19,493, Aug. 31, 1906.

This process for case-hardening iron or steel consists essentially in heating the metal in contact with a gaseous mixture of acetylene and ammonia, preferably 1 vol. of the former to 2 vols. of the latter. The iron or steel is heated in a muffle or similar chamber, into which the gases resulting from the action of strong ammonia solution on calcium carbide, are introduced; or, a mixture of calcium carbide and ammonium chloride may be placed directly in the chamber. The ammonia is said to prevent the separation of soot from the acetylene, and probably combines with the latter to form cyanogen, since the carburised metal contains some nitrogen. It is stated that a bar of mild steel of 1½ sq. in. sectional area and containing 0·04 per cent. of carbon, when exposed to the gaseous mixture for 30 mins. at 500—600° C., is carburised to the hardness of steel containing about 1 per cent. of carbon.—A. S.

Manganese steel; Manufacture of high per-cent. ——. C. H. Ke[illegible]ll, Harwich. Eng. Pat. 20,452, Sept. 14, 1906.

See Fr. Pat. 375,148 of 1907; this J., 1907, 874.—T. F. B.

Iron; Material for use in refining ——, and process of preparing the same. H. W. Lash, Cleveland. U.S. Pat. 864,972, Sept. 3, 1907.

See Eng. Pat. 3[illegible]7 of 1907; this J., 1907, 696.—T. F. B.

Ore roasting and volatilizing furnace. S. I. Clawson, Salt Lake City, U.S.A. Eng. Pat. 19,229, Aug. 28, 1906.

See U.S. Pat. 829,843 of 1906; this J., 1906, 934.—T. F. B.

Gold ores; Machine for treating ——. J. D. Pulbrook and H. N. de Wilde. Fr. Pat. 376,786, March 6, 1907.

The machine consists of a long inclined box, resembling the ordinary sluice-box, mounted on rockers, and provided at the lower end with amalgamated plates in the form of troughs. The material undergoes a preliminary disintegration in an additional box placed at the head of the machine.—O. F. H.

Sulphide ores containing zinc; Treatment of ——. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 19,130, Aug. 27, 1906.

Complex zinc ores, *e.g.*, Mount Read ore, is roasted at such a temperature as to convert the zinc sulphide into sulphate and oxide, and to decompose any iron sulphate formed. The roasted mass is then treated with a solution of calcium chloride into which sulphur dioxide is passed: zinc chloride remains in the solution, and calcium sulphate and sulphite are precipitated. The solution is next heated to recover the sulphur dioxide existing as calcium bisulphite, after which it is filtered. The residue may be treated for silver and gold. To the solution is then added lime, which precipitates zinc oxide, with regeneration of calcium chloride solution.—A. G. L.

Metals from [zinc-lead sulphide] ores; Extraction of ——. J. J. C. Fernau, London. Eng. Pat. 24,905, Nov. 6, 1906.

Molten iron is caused to circulate between an air-tight working chamber and a superheating chamber, and zinc-lead sulphide ores are introduced into the working chamber. The zinc is volatilised and the vapours are passed through a mass of incandescent carbon to a condenser. The lead settles to the bottom of the molten iron in the working chamber, and is tapped off, and iron sulphide (matte) is also withdrawn, from time to time, from the surface of the molten metal.—A. S.

Zinc; Process for obtaining metallic ——, and apparatus therefor. W. P. Thompson, Liverpool. From G. Mojana, Milan, Italy. Eng. Pat. 28,575, Dec. 14, 1906.

The process consists in mixing the zinc ore or other zinciferous material with charcoal or coke, and subjecting it to the action of chlorine gas at a relatively low temperature. The apparatus may consist of an open cylinder into which the charge is introduced at the top, provided with a chlorine-supply pipe, and also with a central pipe and surrounding jackets, through which hot furnace-gases are caused to circulate. Or, two cylinders or retorts may be used, the chlorine escaping from one being passed through the other before discharging it into the atmosphere. The reaction-product is first sifted to remove the charcoal, then lixiviated; the solution is filtered, treated with oxidising agents and substances containing zinc oxide, and the resulting solution of zinc chloride is electrolysed.—A. S.

Furnace; Automatic ore-roasting ——. W. F. Oesterle, Marion, Ind. U.S. Pat. 864,330, Aug. 27, 1907.

The furnace comprises a feed-hopper under which moves a slide having a rectangular slot, and a series of ore-roasting floors, each provided with an air-lock and a rake having a flap pivoted on its cross-bar. Both slide and rakes are moved by a car having an automatic intermittent reciprocating motion. This motion is caused by a rack and pinion together with a timing device, which consists of a cam mounted on a shaft with a worm-wheel; the cam actuates a lever which moves a sliding clutch on a shaft on which two worm-wheels rotate in opposite directions; these wheels are provided on their inner faces with teeth which engage the teeth of the sliding clutch. The whole mechanism is timed so that the car moves in, then immediately out, and then remains at rest for a given period.—A. G. L.

Ores; Apparatus for treating ——. J. C. Hames, Goldfield, Nev. U.S. Pat. 864,642, Aug. 23, 1907.

THE apparatus comprises a tank having a stone bottom and fitted with an agitator. The latter consists of a frame (of electrically conductive material) composed of two longitudinal bars mounted on wheels which move to and fro on opposite walls of the tank, together with hollow cross-bars, from which pipes project downwards to and through a series of stone ploughs or mullers which move backwards and forwards over the bottom of the tank. A layer of mercury is placed in the tank, and ore is fed in, at one end, through a hopper delivering close to the bottom of the tank. The pipes extending through the ploughs are connected, by means of the hollow cross-bars, with a source of liquid-supply. One pole of a source of electric current is connected to the mercury, and the other to the frame of the agitator.—A. S.

Ores; Apparatus for concentrating ——. A. S. Elmore, Assignor to The Ore Concentration Co. (1905), Ltd., London. U.S. Pat. 865,334, Sept. 3, 1907.

SEE Eng. Pat. 184 of 1903; this J., 1904, 22.—T. F. B.

Colloids; Process for the production of [metallic] bodies and objects of all kinds with the use of ——. H. Kuzel, Baden, Austria. Eng. Pat. 6110, March 13, 1907. Under Int. Conv., April 30, 1906.

SEE Addition of March 9, 1907, to Fr. Pat. 359,025 of 1905; this J., 1907, 1002.—T. F. B.

Nickel ores or other material containing nickel; Apparatus for treating with carbonic oxide ——. C. Langer, Clydach, Assignor to The Mond Nickel Co., Ltd., London. U.S. Pat. 865,969, Sept. 10, 1907.

SEE Eng. Pat. 13,351 of 1905; this J., 1905, 1113.—T. F. B.

Metals; Process for joining or soldering ——. W. S. Simpson. Fr. Pat. 376,868, April 18, 1907. Under Int. Conv., Dec. 4, 1906.

A "HARD metal" such as iron or steel may be joined to a "soft metal" such as aluminium, lead, copper, etc., or their alloys, by placing the two metals in contact, surrounding the junction with a layer of carbonaceous material, such as coke, coal or charcoal made into a paste with water and treacle, sugar or starch, and heating to above the melting point of the soft metal. The process may be used for plating iron or steel with a "soft metal."
—O. F. H.

Flux for brazing metals; Process for making a ——. H. F. Strout. Fr. Pat. 377,168, April 26, 1907.

A MIXTURE of borax and boric acid is heated to a high temperature until all moisture is eliminated, "boiling" has stopped, and the mass on solidifying is of a chalky character.—O. F. H.

Ores; Process for briquetting the waste of —— *and other similar material.* A. Raky. Fr. Pat. 377,257, April 29, 1907.

THE briquettes are made in the usual way with lime or other hydraulic cementing material, and are then hardened by being subjected to high pressure in the presence of steam, or to high-pressure steam alone.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

High temperatures; Production of —— *by the "Cascade" system of electrically heating oxides.* B. Saklatwalla. Z. Elektrochem., 1907, **13**, 589—592.

THE author finds that tin oxide conducts electrically at comparatively low temperatures, and that above 600° C. its conductivity increases only very slowly; this oxide is stable up to 1500° C., but above this temperature sublimes somewhat rapidly. The electrical conductivity of magnesia only becomes appreciable above 1500° C. The author proposes to construct a furnace with three steps of heating. First, nickel wire is used to heat the tin oxide, which is used in the form of compressed cylinders, until it becomes sufficiently conducting. This tin oxide in turn heats up the third step, which consists of a magnesia tube. Appropriate platinum-iridium terminals are provided for each of the oxides. Each heater is independently movable, so that it can be removed and its place taken by a suitable heat insulator, so soon as the next heater is in use. Only preliminary experiments have so far been conducted.—R. S. H.

Bleaching process [sulphite wood pulp]; Studies on the chemical mechanism of the [electrolytic] ——. J. Nussbaum and W. Ebert. *See* XIX.

PATENTS.

Filaments for use in electric lamps, furnaces, or other apparatus. The British Thomson-Houston Co., Ltd. From General Electric Co. Eng. Pat. 18,488, Aug. 17, 1906. *See* II.

Metallic compounds; Method of purifying —— *[for electric lamp filaments].* The British Thomson-Houston Co. From the General Electric Co. Eng. Pat. 18,489, Aug. 17, 1906. *See* II.

Filaments for use in electric lamps or other apparatus; Conductive ——. The British Thomson-Houston Co. From General Electric Co. Eng. Pat. 18,748, Aug 21, 1906. *See* II.

Filaments for electric incandescent lamps; Supports for metallic ——. A. Lederer. Eng. Pat. 18,812, Aug. 22, 1906. *See* II.

Electric conductors [incandescence filaments] of refractory metal; Manufacture of ——. The British Thomson-Houston Co., Ltd. From General Electric Co. Eng. Pat. 21,511, Sept. 28, 1906. *See* II.

Filaments for incandescence electric lamps; Manufacture of ——. J. Y. Johnson. From Hollefreund und Co. Eng. Pat. 21,654, Oct. 1, 1906. *See* II.

Glow bodies for lighting and heating, made of difficultly-fusible metals of the fifth and sixth groups, with addition of oxides. Allgem. Elektricitäts-Ges. Fr. Pat. 376,795, April 16, 1907. *See* II.

Filaments for incandescence lamps or other purposes; Manufacture of ——. Ateliers Thomson-Houston (Anciens Etabl. Postel-Vinay). Fr. Pat. 376,870, April 18, 1907. *See* II.

Chromic acid from solutions of sulphate of chromium; Process for recovering —— in an electrolytical manner. Chem. Fabr. Buckau, Magdeburg, Germany. Eng. Pat. 9636, April 25, 1907. Under Int. Conv., May 8, 1906.

See Fr. Pat. 377,027 of 1907; following.—T. F. B.

Chromic acid; Process for regenerating ——, by the electrolysis of chromium sulphate. Soc. Chem. Fabrik Buckau. Fr. Pat. 377,027, April 20, 1907. Under Int. Conv., May 8, 1906.

Chromium sulphate is obtained during the oxidation of organic substances by means of chromic acid, and the latter is regenerated, without the aid of a diaphragm, by employing an electrolyte containing chromium sulphate in the presence of an alkali sulphate or acetate, or a mixture of these.—B. N.

Phosphorus and calcium carbide; Manufacture of ——. J. T. Morehead, Leaksville, N.C., Assignor to Willson Laboratory Co., New York. U.S. Pat. 862,092, July 30, 1907.

Calcium phosphate mixed with lime and carbon is subjected to electric smelting in an enclosed furnace. The carbon is present in sufficient excess to form calcium carbide, and the resulting vapours are condensed. —R. S. H.

Calcium carbide product. J. T. Morehead, New York, Assignor to Willson Laboratory Co., New York. U.S. Pat. 862,093, July 30, 1907.

The product described is a metallic carbide containing a metallic phosphide, the substances being intimately combined by smelting them together in their formation. (See preceding abstract.)—R. S. H.

Furnace; Electric ——. W. G. Clark, New York, Assignor to Electric Furnace Co., Portland, Me. U.S. Pat. 865,016, Sept. 3, 1907.

The walls of the furnace are of relatively low electrical resistance, and serve as one of the electrodes. The other internal electrode, or heater, is of relatively high resistance, and is movable in and out of the furnace, means being provided for elevating it. The lower end of this electrode terminates in a foot-piece of less resistance than the body portion, the foot-piece being shaped to fit the furnace bottom and arranged to contact with the walls. An opening is provided at the side of the furnace, near to the bottom, for the removal of material.—B. N.

Carbon or graphite electrodes; Process for increasing the durability of ——, employed in the electrolysis of aqueous solutions. Soc. Chem. Fabrik Buckau. Fr. Pat. 377,026, April 20, 1907. Under Int. Conv., May 8, 1906.

The pores, throughout the whole of the electrode, are filled up with a good conductor of electricity, such as platinum. The electrode is impregnated with a solution of platinum tetrachloride, and afterwards heated to a temperature sufficiently high to decompose the salt.—B. N.

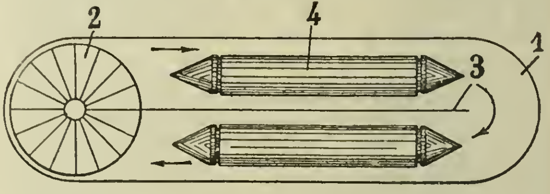
Nitrogen compounds of oxygen; Obtaining ——. Westdeutsche Thomasphosphat-Werke G.m.b.H. Fr. Pat. 377,190, April 26, 1907.

Air, or a mixture of nitrogen and oxygen is heated to a temperature of at least 1000° C., and is led successively through a great number of electric arcs; the heat of the residual nitrogen, after separation of the nitrogen oxides formed, being utilised, on the counter-current principle, to heat fresh portions of air before passage through the electrical apparatus.—E. S.

Air and other gases; Process and apparatus for the electrical treatment of ——. J. H. Bridge. Fr. Pat. 377,877, May 17, 1907.

See U.S. Pats. 832,767 and 832,768 of 1906; this J., 1906, 1053.—T. F. B.

Electrolytic apparatus. P. Borgnet. Fr. Pat. 377,249, April 29, 1907.



The electrolytic bath, 1, is provided with a vertical partition, 3, and a paddle-wheel, 2, so that a movement is given to the electrolyte in the direction of the arrows. The cathodes, 4, float on the electrolyte, and are only partially immersed. They are given a movement of rotation by belts, driven from a horizontal shaft above the bath, which work in the grooves near to the ends of the pointed cathodes. Other forms of cathodes are described, such as a solid cylinder provided with floats at its ends, or the cathode may have a propeller or screw fixed to it, so that the desired rotation is obtained from the movement of the electrolyte. The anodes are fixed below, and concentrically with, the cathodes.—B. N.

Boron; Manufacture of ——. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 377,683, May 8, 1907. Under Int. Conv., May 9, 1906.

See Eng. Pat. 25,978 of 1906; this J., 1907, 1015.—T. F. B.

(*B.*)—Electro-Metallurgy.

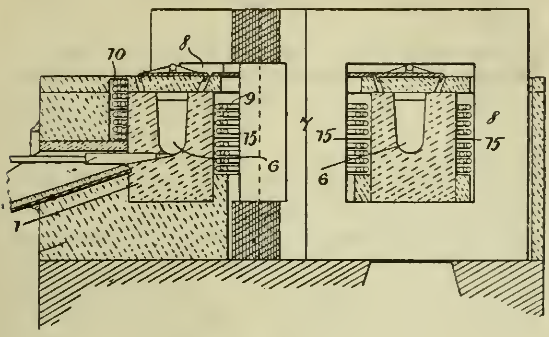
Nickel plate; Study of the causes of impure —— with special reference to the iron. D. F. Calhane and A. L. Gammage. J. Amer. Chem. Soc., 1907, **29**, 1268—1274.

The rusting of nickel plate on prolonged exposure to moisture is due to small amounts of iron, the presence of which is accounted for by the necessity of using in the plating process, anodes containing iron in order to obtain sufficiently rapid corrosion to furnish the necessary nickel to the electrolyte. A study of the conditions under which the iron is deposited, showed that when using the ordinary compound anode containing about 7·5 per cent. of iron, the amount of the latter element present in nickel plate will average about 0·10 to 0·14 per cent., but this quantity is increased very considerably if the electrolyte be stirred or the electrodes rotated. If the anodes are surrounded by bags or any suitable filtering medium, the amount of the iron contained in the plate is reduced to about one-half (0·04—0·05 per cent.); the use of the bags does not appreciably raise the voltage. If the cathode be rotated there is a surprising deficiency in the current-yield of nickel deposited, this deficiency increasing with the speed of rotation.—A. S.

Patents.

Furnaces; Electric ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 26,867, Nov. 26, 1906.

The annular crucible, 1, of refractory material, is provided with a channel, 6, the charge within which forms the

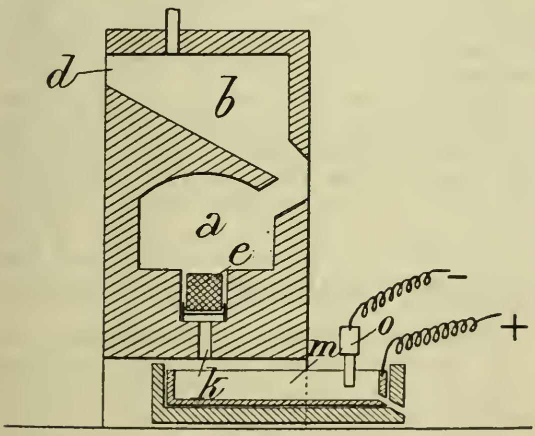


secondary circuit. One vertical leg, 7, of the core passes centrally through the crucible, whilst three vertical legs, 8, are outside. Between the crucible and the leg, 7, is a space in which is coiled a copper tube, 9, the turns being insulated from each other and from the core. Outside the crucible is a similar coiled tube, 10, and the two tubes, acting as the primary, are connected together by an insulating coupling, so as to form a continuous tube through which water is circulated. Each coil is divided into two sections by an insulating diaphragm, 15, the four sections being connected in multiple, and electrically separated by insulating couplings. A cable, interrupted at places coinciding with the couplings in the pipe, is provided inside the tube, in order to carry some of the current.—B. N.

Furnace ; Electric resistance ——. F. A. Kjellin. Fr. Pat. 376,821, April 17, 1907. Under Int. Conv., Oct. 19, 1906.

THE secondary circuit, adapted to contain molten material, is circular, with a vertical wall of stonework, through which the core passes, dividing it into two large chambers. The latter are connected, near to the bottom, by narrow passages which pass through the masonry, the slag thus being prevented from entering the passages.—B. N.

Furnace ; Electric ——. J. Bouneau. Fr. Pat. 377,119, April 24, 1907.



THE electrodes, *e*, are introduced on waggons into openings on opposite sides of the furnace, and can thus be easily replaced by taking away the waggons on branch lines, new electrodes being brought into position on the main lines which act as conductors of the current. The material receives a preliminary heating in the chambers, *b* and *a*, from the arc and from the gases produced in the reaction. The reduced material falls through the opening, *k*, into a carbon crucible, *m*, where it is refined by submitting it to the action of an auxiliary arc produced between the electrodes, *o* and *m*.—B. N.

Metallic objects destined to receive metallic coatings ; Process for the preparation of ——. A. Levy, Paris. Eng. Pat. 4336, Feb. 21, 1907. Under Int. Conv March 1, 1906.

SEE Fr. Pat. 372,842 of 1906 ; this J., 1907, 536.—T. F. B.

Tin ; Refining —— *electrolytically, particularly for extracting pure tin from alloys, wastages, residues, and the like, with the extraction of the foreign metals.* O. Steiner, Krefeld, Germany. Eng. Pat. 10,230, May 2, 1907. Under Int. Conv., Feb. 1, 1907.

THE electrolysis is carried out in a sodium sulphide solution (containing preferably 10 per cent. of the salt) in which 1 per cent. of flowers of sulphur is dissolved before use. The anodes consist of the impure tin, whilst the cathodes are made of pure tin. The temperature of the liquid is kept at about 90° C. ; great care must be used not to exceed the maximum drop of potential between the electrodes of 0·2 volt, and not to stir up the anode mud, which consists of the foreign metals. The current density increases with increasing concentration of the sodium sulphide ; for a 10 per cent. solution it is 0·5 ampère per 100 sq. cm. The electrolyte may be used over again, provided that a little fresh sodium sulphide and another 1 per cent. of sulphur is added to it.—A. G. L.

Electric smelting. P. L. T. Héroult, La Praz, Assignor to Soc. Electro-Metallurgique Francaise, Froges, France. U.S. Pat. 861,280, July 30, 1907.

A COLUMN of carbon is maintained between two electrodes and supports the charge of ore until the latter fuses, when it passes through the highly-heated carbon and becomes thereby reduced. A quantity of lime, or other refractory constituent, in excess of that required by the slag, is introduced with the charge with the object of forming a scale on the walls of the furnace and thus reducing the cross-section of the zone of fusion. In this manner the energy of the current is concentrated to any desired extent.—R. S. H.

Smelting apparatus ; Electric ——. J. C. Young, Jersey City, N.J. U.S. Pat. 865,285, Sept. 3, 1907.

AN adjustable carbon forms one pole, and a series of spaced receptacles, mounted so that they will rotate in a vertical plane, form the other pole of the apparatus. An arc may thus be established or interrupted between each of the receptacles in turn, and the carbon. A movable hopper, having a perforated bottom, is adapted to feed material to the arc, the material being agitated and forced from the hopper by suitable means of rotation within it.—B. N.

Ferro-alloys ; Process of reducing compounds and producing low-carbon ——. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 862,996, Aug. 13, 1907.

MOLTEN ferro-silicon, high in silicon and low in carbon, is obtained by electric smelting and is subsequently allowed to percolate through a column of a reducible compound of the metal to be obtained. The charge of the reducible compound mixed with a basic flux is heated independently by passing an electric current through it from electrodes placed at the top and at the bottom of the column. The silicon serves as the reducing agent, and the iron alloys with the metal produced by the reduction.
—R. S. H.

Earth-alkali [alkaline-earth] metals; Electrolytic production of ——. G. O. Seward and F. von Kügelgen, Holcombe Rock, Va., Assignors to Virginia Laboratory Co., N.Y. U.S. Pat. 864,928, Sept. 3, 1907.

Calcium is obtained by electrolysing a fused calcium salt, using a submerged cathode, the current density at the latter being maintained so high that the metal is formed in a molten state and ascends from the electrode. Above the cathode, the electrolyte is cooler, and the temperature of the metal is reduced sufficiently to prevent it burning in contact with the air, though it is soft enough to form a coherent mass. The metal accumulates within a water-cooled receiver.—B. N.

Galvanising apparatus. L. Potthoff. Fr. Pat. 377,049, April 22, 1907. Under Int. Conv., May 1, 1906.

The invention refers to a galvanising bath through which the material is passed by a conveyer, and delivered into a washing vessel, being automatically discharged from the latter by means of a suitable transporting arrangement. Two forms of apparatus are described, one for small objects, and the second for longer articles, such as rods, tubes, etc. In the former the galvanising bath is provided with a drum, containing the material to be treated, the latter being retained in the drum during one direction of rotation, but discharged through a pivoted door, when the drum has attained a determined position, if the direction of rotation be reversed. In the second form, the material is supported on submerged rails, acting as cathodes, brushes pressing on the material in order to give better contact. A conveyer, provided with teeth, moves the material through the liquid, so that the points of contact with the rails are automatically changed. The weight of the material is supported at the ends of the bath by rotating arms, which work independently of the conveyer.—B. N.

Copper; Production of —— *by electro-deposition.* S. O. Cowper-Coles. Fr. Pat. 377,884, May 17, 1907. Under Int. Conv., June 18, 1906.

See Eng. Pat. 13,972 of 1906; this J., 1907, 622.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Horse fat and "animal" oil; Notes on ——. H. Dunlop. Analyst, 1907, 32, 317—320.

Horse fat:—Samples of horse fat rendered in the laboratory from different parts of different animals gave the following analytical results:—Sp. gr. at 15·5° C. (4 samples), 0·9182 to 0·9212; free acid (4 samples), 0·46 to 8·80 per cent.; saponification value (5 samples), 195·6 to 198·4; Reichert-Wollny value (3 samples), 0·20 to 0·35; Zeiss refractometer reading at 25° C. (8 samples), 59·8 to 66·7; iodine value (8 samples), 85·66 to 114·85; and unsaponifiable matter (5 samples), 0·42 to 0·68 per cent. The high iodine values are remarkable, being much in excess of those hitherto recorded. The intense yellow colour of an ethereal solution of the unsaponifiable matter appears to be characteristic of horse fat. One of the samples gave a red coloration with sulphuric acid resembling that sometimes obtained with slightly oxidised fish-liver oils. This observation bears out Lewkowitsch's experience with a sample of genuine horses' foot oil, which gave colour reactions characteristic of marine animal oils (*Oils, Fats and Waxes*, p. 685). The drying properties of the samples were very pronounced, oils from the neck and from the kidneys becoming sticky after 2 hours at 95° to 97° C., and solid after 4 hours' exposure in thin films on glass. Viscosity tests showed that the horse oil from the neck was inferior to lard and tallow oils as a lubricant. The mixed fatty acids from two of the samples yielded no deposit in Hehner and Mitchell's test for stearic acid.

Commercial "animal" oil:—A lubricating oil prepared from cheap grades of tallow, scrap fat, etc., is sold under this name, and often as lard or tallow oil. Eight samples believed to be genuine gave iodine values of 66·3 to 77·6; sp. gr. at 15·5° C., 0·914 to 0·9165; and viscosity at 21·1° C., 330 to 460 seconds. It is more usual, however, to meet with commercial animal oils having a sp. gr. of 0·9170 to 0·9215 and iodine values of 90 to 116, many of these being adulterated with seed or fish oils, and others of lower sp. gr. containing 8 to 10 per cent. of mineral oil. The amount of free acid in 30 commercial samples ranged from 0·70 to 22·0 per cent. For a preliminary sorting test the author recommends the use of the Zeiss refractometer, a reading of over 61° at 25° C. indicating a high iodine value or the presence of mineral oil. For the detection of as little as one per cent. of the latter, Holde's test is advocated. To test the drying properties, a thin film of the oil on glass is exposed for 24 hours at a temperature of 95° to 97° C., and then tried with the finger. In the case of genuine tallow, lard, and neat's foot oils there should be no appreciable "gumming," whereas many samples of sp. gr. 0·9170 to 0·9215 gave sticky films in this test. The hexabromide test will detect the presence of as little as 5 per cent. of a fish oil, but the phytosteryl acetate test has often to be relied upon for the detection of seed oils, and in the presence of small amounts of mineral oil it is often difficult to obtain the correct melting points, even with the assistance of Polenske's method of separating mineral oil by means of petroleum spirit before acetylation. In the author's experience the alcohols are so soluble in the mineral oil solution, that an insufficient quantity is left for subsequent examination even when 100 grms. of the oil are used.—C. A. M.

Maumené values and iodine values of some oils. E. Richter. Z. angew. Chem., 1907, 20, 1605—1614.

The author carried out experiments to determine what proportion of sulphuric acid to oil gave the maximum rise of temperature in the Maumené test. With a constant initial temperature of 25° C. and using for each trial, 10 c.c. of acid containing 92·5 per cent. of H_2SO_4, and increasing quantities of oil, the maximum rise of temperature was obtained with: 25—30 grms. of olive oil (up to 51° C.), 50 grms. of poppyseed oil (up to 73·5° C.), 20—30 grms. of rape oil (up to 53·5° C.), and 25—30 grms, of arachis oil (up to 52° C.).

A large number of tests in which the starting temperature was varied between 10° C. and 50° C. gave results which lead the author to approve of Archbutt's suggestion that the initial temperature for the Maumené test should be about 20° C.

Experiments were also made with various mixtures of olive oil with poppyseed, rape, and arachis oils.

In all cases the observed Maumené values fell much below those obtained by calculation, and similar low figures for the mixed oils were obtained in determinations of the acid values of olive and poppyseed oils and of mixtures of the two. It was also found that on mixing olive oil with 15 per cent. of poppyseed oil in the Maumené reaction-vessel, both oils having previously been brought to 25° C., a rise in temperature in one case of 0·3° C. and in another of 0·4° C. was produced.

Determinations of the iodine values of the oils were also made, the methods employed being those of Waller and Wijs. The results showed that with Waller's solution, a minimum excess of 160 per cent. of iodine should be allowed to act for six hours in order to obtain a maximum iodine value, whilst a corresponding result is obtained in two hours by using a similar excess of iodine in Wijs solution; the tests should be kept in the dark during the period of contact otherwise too high results are obtained. The influence of a considerably varied temperature during the contact period was also studied, the results showing that constant figures are obtained when working between 15° C. and 25° C. It was found that the iodine value of the mixed oils is always in excess of theory and that this divergence is greatest when there is a wide difference in the iodine values of the oils forming the mixture. It is obvious, therefore, that the composition of a mixture which contains an oil having high Maumené and iodine values cannot be determined accurately from these figures.—J. A.

Butter-fat; The baryta value of ——. E. Avé-Lallemant. *See* XXIII.

Butter and other fats; Notes on Avé-Lallemant's baryta value of ——. M. Fritzsche. *See* XXIII.

Butter-fat; "Caprylic acid values" of ——. R. K. Dons. *See* XXIII.

Patents.

Lubricating oil and the like; Process for purifying ——, *and apparatus therefor.* C. Steimel, Hennef on Sieg, Germany. Eng. Pat. 1450, Jan. 19, 1907.

See Fr. Pat. 373,858 of 1907; this J., 1907, 768.—T. F. B.

Oils; Conversion of drying and semi-drying —— *into non-drying oils.* C. Dreymann. Fr. Pat. 377,262, April 29, 1907. Under Int. Conv., May 1, 1906.

Drying or semi-drying oils lose their drying properties when heated for from 15 minutes to 2 hours at 200°—300° C. in the absence of air, and the process may be accelerated by the addition of, say, 5 per cent. of an indifferent condensing agent, such as zinc chloride or aluminium chloride. Linseed oil thus treated also loses its odour, and yields stable soaps which hardly turn brown on keeping. By the same process fluid petroleum oils may be converted into lubricating oils of greater consistency. —C. A. M.

Soap; Manufacture of ——. A. F. Thompson, London. Eng. Pat. 18,925, Aug. 24, 1906.

Claim is made for the manufacture of bars or cakes of soap with a cruciform inlay or inlays of a different kind of soap; also for cutting dies for making such inlays. —C. A. M.

Soap; Manufacture of certain kinds of ——. W. N. Bacon, London. Eng. Pat. 27,280, Nov. 30, 1906.

The crystallised sodium monosilicate described in Eng. Pat. 24,226 of 1905 (this J., 1906, 846) may be employed in the saponification of oils and fats, without any necessity for the presence of resins or free fatty acids. It may also be used as a filling material for soaps.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Lakes [*from azo dyestuffs*]; *Manufacture of colouring matter* ——. Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,363, May 3, 1907. Under Int. Conv., June 11, 1906.

See U.S. Pat. 863,396 of 1907; this J., 1907, 1020.—T.F.B.

Zinc white and other substances [*from zinc ores*]; *Process for making* ——. J. W. Worsey and E. Hoal. Fr. Pat. 377,765, May 13, 1907.

See Eng. Pat. 19,839 of 1905; this J., 1906, 1056.—T. F. B.

(*B.*)—RESINS, VARNISHES.

Patents.

Wood; Process and apparatus for the extraction of by-products from ——. F. Pope and W. C. Clark. Fr. Pat. 377,646, April 3, 1907.

See U.S. Pat. 852,078 of 1907; this J., 1907, 626.—T. F. B.

Hydrocarbons; Deodorising ——. G. Ferrier. Fr. Pat. 377,088, April 23, 1907. *See* III.

(*C.*)—INDIA-RUBBER, &c.

Parà rubber; Cultivation of —— *in North-East India.* H. H. Mann. Agric. J. of India, 1907, 2, 273—276.

The results of tapping some ten trees of *Hevea brasiliensis*, planted among tea plants on the Dhulai Tea Estate, Hailakandi, Cachar, in 1897, indicate that successful cultivation of Parà rubber is possible in this district, though it has proved a failure in other parts of N.-E. India. These trees were tapped during 1906-7, and yielded an average of one pound of dry rubber of good quality per tree, between December and March.—E. W. L.

Assam rubber (Ficus elastica); The tapping of ——. H. H. Mann. Agric. J. of India, 1907, 2, 277—279.

By making vertical incisions in the bark with an ordinary $\frac{1}{2}$- or $\frac{3}{4}$-inch carpenter's chisel, in rows six inches apart, with half an inch between each incision, and conducting the latex into a cup by means of "tea-lead" channels, pinned below each row, the great loss of bark, amounting to as much as four per cent., entailed by the use of the methods hitherto in vogue in India, is avoided. About a third of the latex coagulates on the cuts, the remainder running into the cups, whence it is poured into longitudinally-split bamboos, mixed with 2 per cent. formalin solution, and allowed to coagulate. Eight trees, planted in 1882, gave an average of six pounds of rubber per tree in 1905-6, and the following season the average yield was five pounds per tree, a result which suggests that with the new method of tapping, the trees may be tapped more often than the usual once in two or three years. It is found that more latex is given by the large branches than by the main stem.—E. W. L.

Caoutchouc; Determination of —— *in cold-cured rubber goods.* T. Budde. Gummi-Zeit., 1907, 21, 1205—1208.

The determination of caoutchouc by way of caoutchouc tetrabromide, which has given good results with raw rubbers, is now applied to rubber goods vulcanised with sulphur chloride and free from heavy metals. The procedure is as follows:—To 0·1—0·15 grm. of material, or more if poor in caoutchouc, 50 c.c. of carbon tetrachloride are added and allowed to act for 24 hours. Fifty c.c. of bromine solution (6 c.c. of bromine and 1 grm. of iodine to a litre of carbon tetrachloride) are then introduced, and the mixture is occasionally agitated during 6 hours. Half the volume of absolute alcohol is now added. After settling, the supernatant liquid, with as little as possible of precipitate, is poured through a dried and weighed filter. The residue, if poor in caoutchouc, is squeezed and rinsed with a mixture of two parts of carbon tetrachloride and one of alcohol, with which also the filter is washed. With richer material, it is necessary to soak the residue for

24 hours in 30 c.c. of carbon bisulphide, precipitate with 50 c.c. of light petroleum spirit, and rinse with alcohol. The small quantity of matter on the filter is dried at 50°—60° C. and weighed as caoutchouc tetrabromide; this weight, when multiplied by the factor 0·298, gives the weight of caoutchouc. The bulk remaining in the flask is decomposed by boiling with 10 c.c. of fuming nitric acid in presence of 25 c.c. of N/5 silver nitrate solution, the residual dissolved silver being titrated back by Volhard's method. The bromine determination thus carried out is shown to give the same results as Carius' method. On the basis of the equation 320 Br = 136 $C_{10}H_{16}$ the bromine is calculated to caoutchouc, and the total caoutchouc is now known. Several possible sources of error are discussed. Resins, oils and substitutes yield no insoluble bromination-products, whilst the error due to the presence of chlorine in the goods is negligible, provided the rubber is not too highly vulcanised.—W. A. C.

Caoutchouc; Direct determination of —— in vulcanised rubber mixings. S. Axelrod. Gummi-Zeit., 1907, **21**, 1229—1231. (Compare preceding abstract.)

One grm. of the sample is dissolved by heating for about 2 hrs. with 100 c.c. of petroleum (b.pt., up to 300° C.) in a flask fitted with a reflux condenser. Ten c.c. of the solution are treated with 50 c.c. of Budde's bromine solution, the liquid is allowed to stand for 3—4 hrs. for the precipitate to settle, 100—150 c.c. of 96 per cent. alcohol are added, the precipitate allowed to settle once more, transferred to a weighed filter, washed with a mixture (1 : 1) of alcohol and carbon tetrachloride, then with alcohol, dried at about 60° C., and weighed. From the weight so obtained is deducted the ash of the dried precipitate, the difference representing the weight of actual bromo-derivative. This weight multiplied by the factor 314 gives the percentage of pure rubber hydrocarbon in the original sample, this factor being derived from the results of a series of analyses of vulcanised rubber bromides. Good results were obtained on applying the method to five different rubbers vulcanised with 10 per cent. of their weight of sulphur. The whole of the sulphur of vulcanisation appears to be present in the bromo-derivative, which can therefore be used for the determination of the vulcanisation-coefficient. In three instances the values for the latter, obtained (*a*) by direct analysis of the vulcanised rubber, (*b*) by analysis of the bromide, were as follows: (*a*), 4·31, 3·81, 2·10; (*b*), 4·14, 3·62, 2·21. The following results were obtained with mixings containing 4, 5, 4, and 8 ingredients respectively:—rubber hydrocarbon, 41·42 (41·8), 46·20 (45·3), 36·4 (35·9), and 23·13 (22·83) per cent., the figures in brackets being the calculated values.—E. W. L.

Patents.

Caoutchouc, gutta-percha, and balata; Process for extracting ——. D. Sandmann. Fr. Pat. 377,526, May 6, 1907. Under Int. Conv., June 1, 1906.

The coagulation of the latex is effected by the addition of a small quantity of a fluorine compound, such as hydrofluoric or hydrofluosilicic acid, alkali fluorides, etc. —A. S.

Factis or factice [vulcanised oil, rubber substitute] and process for making the same. R. Ditmar. Fr. Pat. 377,538, May 6, 1907.

The injurious effect exerted on rubber by substitute composed of vulcanised oils, is due to the presence of unvulcanised oil in the latter. According to the present patent, therefore, the oil after being vulcanised in the usual manner, is treated with a solvent (acetone, carbon bisulphide, etc.) which will dissolve any unattacked oil and sulphur, but has no action on the factis (vulcanised oil).—A. S.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Valonia extract. J. Paessler. Collegium, 1907, 309—313; 317—321.

A solid valonia extract which has recently been put upon the market was found to contain 68 per cent. of tannins, 24·3 per cent. of non-tannins, and 7·5 per cent. of water. The fact that the ratio of tannin to non-tannins was approximately the same as in valonia itself showed that no decomposition had taken place during the process of manufacture, while the small quantity of insoluble matter (0·2 per cent.) indicated careful clarification, although in this respect it must be remembered that the amount of insoluble matter or difficultly soluble tannins depends upon the strength of the solution used. Thus a dilute extract as prepared for analysis may contain very little insoluble matter, while a stronger liquor, as used in practice, may show a considerable quantity, the various extracts behaving quite differently in this respect. The solubility of valonia extract compares favourably with that of other extracts. The leather produced is of the same colour as that from a good quality valonia, but the extract is only suited to the production of leather in which valonia itself is employed. Its cost per kilo. of tannin is about the same as that of valonia. The author has already studied (this J., 1904, 991) the variation in tannin content of different liquors due to keeping. He has now extended these experiments to solutions of valonia extract and finds that, on standing, a considerable decrease in tannins and non-tannins takes place, accompanied by a corresponding increase in insoluble matter. In general, the value of an extract depends directly upon the clearness of its solution and the smallness of the deposit of insoluble matter. With a view of obtaining a numerical expression of the solubility of the extract, the following experiments were carried out. Quantities varying from 15 to 150 grms. of the extract were placed in flasks with 800 c.c. of water and shaken for two hours in a shaking apparatus after which the volume was made up to one litre and the solution filtered. In a second set of experiments the extract was digested with water at about 60° C. and then cooled and made up to the mark and filtered. The two sets of filtrates were analysed, with the result that the former series gave less insoluble matter than the latter, particularly with stronger solutions. Upon the supposition that the insoluble matter, separating on cooling from the hot solution, consists really of difficultly soluble tannins, it is possible to calculate the percentage efficiency not only on the total soluble matter, but also on the actual percentage of tannins found by analysis, and further to express, as a percentage of the extract, the quantity that goes into solution and the quantity that can be made use of. In the case of the valonia extract under consideration, these figures have been calculated and show that with the more concentrated liquors, as used in tanning, the solubility and the percentage of available tannin decrease with the concentration. In conclusion the author proposes the following method of determining the conditions of solubility of tannin extracts. Weights corresponding to 5, 12·5, 25, and 37·5 grms. of total soluble matter are treated in the following ways, *viz.*,—

(a) By shaking for two hours at ordinary temperatures with sufficient water to make the volume up to about 225 c.c.

(b) By digesting at 80 to 100° C. with sufficient water to give a volume of about 250 c.c. and afterwards cooling.

In both cases the final volume is made up to 250 c.c. and filtered. In the filtrate the specific gravity and total soluble matter are determined. For the latter from 50 to 10 c.c. are evaporated, according to the concentration. All the experiments should be made on the same day. The following example is given. The analysis of an extract gave: tannins, 30·4; soluble non-tannins, 7·5, or total soluble matter, 38·0 per cent. Therefore 2·64 grms. contain 1 grm. of total soluble matter. Thus the quantities necessary for the four concentrations are 13·150; 32·875; 65·750, and 98·625 grms. respectively. The weights of the residues were:—

Concentration.	Volume evaporated.	Weight of Residue.	Percentage of Extract.	Percentage of total soluble matter determined by analysis.
1	50	0·9850	37·4	98·5
2	20	0·9670	36·7	96·7
3	10	0·9430	35·8	94·3
4	10	1·3500	34·2	90·0

Since the deposits forming at the higher concentrations only concern the tannins, it is of importance not only to determine the efficiency upon the total soluble matter but also upon the tannin content as determined by analysis. The tannin which has gone into solution can be found for the separate concentrations by deducting the non-tannins from the total soluble matter. These results can be then expressed in percentages of the determined tannin content, and the nearer these numbers approach to 100, the more favourable are the conditions of solution.—S. R. T.

Patents.

Tanning fat in leather; Fixing ——. J. Lund, Sandefjord, Norway. Eng. Pat. 19,495, Aug. 31, 1906. Under Int. Conv., Sept. 1, 1905.

See Fr. Pat. 369,388 of 1906; this J., 1907, 103.—T. F. B.

Leather, artificial; Supple ——. A. Nodon. Fr. Pat. 377,944, May 13, 1907.

Sheets of felted material are prepared from vegetable fibres of great length and high resistance, such as those obtained from ramie, the Japanese mulberry tree, etc., and the artificial leather is prepared by uniting a number of these sheets by means of natural or artificial gum-resins. For example, the sheets are coated with a solution of caoutchouc in a volatile hydrocarbon, and pressed together; the composite sheet may be vulcanised in the usual manner. The surface of the artificial leather is coated with a varnish not containing any oils or fats capable of affecting the quality of the felted material or gum-resins.—A. S.

Caseine or other albuminous substances; Process for the treatment of ——. R. Desgeorge, Lyons, and F. Lebreil, Villeurbanne, France. Eng. Pat. 23,789, Oct. 25, 1906.

See U.S. Pat. 863,268 of 1907; this J., 1907, 1022.—T.F.B.

Gelatin; Manufacture of films of ——. E. Debant and Enocq Frères. Fr. Pat. 377,267, April 29, 1907.

The solution of gelatin kept hot in a tank above is distributed in layers of uniform thickness by means of a pipe mechanically moved backwards and forwards across the surfaces of a series of glass plates, which are constantly moved forward in a direction at right angles to the movement of the distributing pipe. Or, there may be several distributing pipes connected with tanks containing solutions of gelatin of different colours so as to obtain films marbled or striped with variously coloured bands. The glass plates coated with the gelatin are conveyed by means of endless chains to the outlet of the machine, whence they are removed to the drying chamber.—C. A. M.

XV.—MANURES, &c.

Soils; Relation between the properties of —— *and the absorption of food by plants.* J. König, E. Coppenrath and J. Hasenbäumer. Landw. Vers.-Stat., 1907, **66**, 401—461; Chem. Zentr., 1907, **2**, 725.

The investigation of six typical soils, *viz.*, sand, loamy sand, loam, chalk, clay and a slaty schist, and the determination of the nutrient which plants could extract from them, led to the following conclusions:—The six soils possess very different physical properties and contain varying amounts of plant food. In the usual solvents the several soils have different solubilities but contrary to previous experience, a single soil behaves similarly towards all the weak solvents used, so that it is indifferent which of these is employed for the determination of potassium, calcium or magnesium oxides. The most suitable solvent proved to be 2 per cent. citric acid, which is alone applicable to the estimation of the phosphoric anhydride. A new method for the extraction of plant food from the soil consists in treating this for some hours with water under 5 atmospheres pressure, which affords values more closely in agreement with those actually obtained with plants than any other method. In this way an agreement was found between the amount of potassium oxide absorbed by the water and by the plant.

The soil has the property of liberating oxygen from hydrogen peroxide, due in part to enzyme action, as enzyme poisons prevent the charge. It is also in part due to the action of manganese and iron oxides, the influence of which is often unaffected by hydrogen cyanide. A connection is observed between the catalytic power of the soils and their humus content, with the single exception of the clay soil which contains much manganese oxide. The growth of the plant and the absorption of food from the soil in addition to the amount of nutrient present depends on the moisture and the depth of the food layer. The crop increases with the amount of water up to 60 per cent. and with the depth of the food layer down to 30 cm. Too large a quantity of manure retards growth. On account of the fact that the soils were previously differently treated and had been still too short a time under identical cultivation, no definite relationship between the physical properties of the soils and plant growth could be established.—E. F. A.

Phosphates and potash in soils; Availability of ——. J. W. Leather. Mem. Dept. Agric. India, 1907, **1**, 45—57.

The citric acid method, advanced by Dyer in 1894, for estimating available phosphate and potash, has been tested on various Indian soils by means of pot-cultures. A large percentage of calcium carbonate (40 per cent.) is present in some of these soils, but the results furnished by using a 1 per cent. solution of citric acid, as originally recommended, are found to be well in accordance with the culture experiments. On the other hand, the use of an additional quantity of citric acid, corresponding to the calcium carbonate present in the soil, gives values which are higher, but misleading. For cereals, at any rate, Dyer's method and his limiting figures have been found generally applicable to the soils of India, although these differ widely in composition.—F. Sodn.

Calcium cyanamide; Use of —— *for manuring cultivated plants.* P. Wagner, R. Dorsch, S. Hals and M. Popp. Landw. Vers.-Stat., 1907. **66**, 285—372. Chem. Zentr., 1907, **2**, 726—727.

Calcium cyanamide absorbs water and carbon dioxide from the air and slowly loses nitrogen; in contact with moist earth, part of the nitrogen may be converted into poisonous dicyanodiamide, the change being accelerated by carbonic oxide, humic acids, or warmth. Bacteria, which convert calcium cyanamide into ammonia and nitric acid, oppose the change; their activity, however, is much restricted in other than dilute solutions. Urea-nitrogen under all conditions is far more rapidly converted into nitrates and ammonia than calcium cyanamide, but the formation of ammonia is influenced by the nature of the soil. Urea forms ammonia more rapidly in sand than in loam; calcium cyanamide, on the other hand, decomposes less rapidly in sand. Loss of nitrogen from the soil by evaporation of ammonia can more easily take place when calcium cyanamide is used than with ammonium sulphate. Extensive comparative trials showed that as manures, Chili saltpetre and ammonium sulphate regularly gave higher yields and showed more complete use of nitrogen than did calcium cyanamide, and this was the more obvious the greater the amount of nitrogenous manure administered. The use of calcium cyanamide on acid and sandy soils and in warm weather is to be avoided.—E. F. A.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar production of Germany. Bd. of Trade J., Sept. 19, 1907. [T.R.]

The "Reichsanzeiger" of Sept. 13 publishes statistics of the production of sugar in Germany during the campaign 1906–7 (from Sept. 1, 1906, to Aug. 31, 1907). In 1906–7 the quantity of raw beet used in sugar manufacture was 14,171,666 metric tons as compared with 15,733,478 metric tons during the 1905–6 campaign; the amount of raw sugar produced in 1906–7 was 1,941,810 metric tons against 2,127,948 metric tons in 1905–6, whilst the production of refined sugar amounted to 1,656,548 metric tons in 1906–7 as compared with 1,711,063 metric tons in 1905–6. The total output of sugar (raw and refined) during the period from September, 1906, to August, 1907, expressed in terms of raw sugar, was 2,241,110 metric tons as compared with 2,400,771 metric tons in the corresponding period of 1905–6.

Patent.

Food for cattle and other animals; Manufacture of —— [from molasses]. B. E. R. Newlands and J. J. Eastick. Eng. Pat. 4919, Feb. 28, 1907. *See* XVIII*A*.

XVII.—BREWING, WINES, SPIRITS, &c.

Mucoraceae; Spherical and giant cells of certain of the ——. G. Ritter. Ber. deut. Bot. Ges., 1907, **25**, 255—265. Z. ges. Brauw., 1907, **30**, 471.

The formation of spherical cells may be induced artificially by cultivating *Mucor racemosus* in a solution containing: peptone, 1·0; potassium phosphate, 0·1; magnesium sulphate 0·5; citric acid, 0·5 and sodium chloride, 9·25 per cent. The combination of citric acid and inorganic salts produces an intense poisonous action. In a solution containing 3 per cent. of dextrose, 1 per cent. of ammonium citrate and 6 per cent. of citric acid, the same organism forms giant cells having dimensions of 800 μ, whilst in sugar solutions containing inorganic ammonium salts and small proportions of organic salts or traces of hydrochloric or nitric acid (*N*/200), *Mucor spinosus* forms cells 650 μ × 400 μ. The hydrogen ions are evidently concerned in the formation of the giant cells, although the latter are formed by *Mucor racemosus* in certain nutrient solutions devoid of acid. If the giant cells are introduced into solutions which contain either no acid or an organic ammonium salt or peptone, they form mycelia again.—T. H. P.

Alcoholic fermentation; The volatile products of ——. E. Kayser and A. Demolon. Ann. Brass. et Dist., 1907, 313; Woch. f. Brau., 1907, **24**, 503.

Musts from the best Charentais grapes were fermented with pure-cultivated yeasts of the same origin. The wine was kept for eight months in presence of the yeast, protected from infection but with free exposure to air. After that time it was distilled, and the volatile by-products were determined. The results showed the effects of the ageing of the wine: the non-alcohol coefficient was 1·5—2 times the maximum specified by Rocques for brandies; the ester and acid values were almost unaffected, but the higher alcohols and especially the aldehydes were abnormally high. The increase of the aldehydes is attributed to the oxidising action of the aërobic yeast, since this increase is far more rapid than in brandies aged under similar conditions. The production of ethers (esters) in wine is also attributed to a physiological action of the yeast enzymes, since it is considerably greater than would be accounted for by the ordinary chemical laws of esterification. The esterifying and aldehyde-forming activities of the yeast appear to stand in opposition to each other, and a maximum production of aldehydes always corresponds with a minimum formation of esters. Darkness is favourable to the production of volatile acids, whilst exposure to light stimulates the fermentation and increases the proportions of ethyl and higher alcohols. In liquids of the same composition, the production of higher alcohols runs parallel with that of the ethyl alcohol. The race of yeast and its purity are only minor factors in influencing the production of higher alcohols. The authors confirm the conclusions of Pringsheim and Ehrlich (this J., 1907, 334, 480) that the production of higher alcohols is mainly a question of nutrition. The composition of the Charentais grape musts appears to be particularly favourable to the production of higher alcohols. In cases where a comparison is possible, the quantity of higher alcohols formed is proportional to the multiplication of the yeast.—J. F. B.

Saké; Study on diseases of ——. T. Takahashi. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, **7**, 531—562.

From saké showing the "Hyochi" disease, the author isolated a peculiar kind of bacillus, *B. saprogenes Saké*, which produced the characteristic "Hyochi" flavour, and, further, lactic acid. Other kinds of microbes are also frequently found in such diseased saké, and sometimes Mycoderma, which may favour indirectly the growth of *B. saprogenes Saké*; an acetic bacillus is specially active in this direction. *B. saprogenes Saké* may be divided into 17 sub-varieties belonging to two chief varieties. Some require protein matters, others assimilate simpler nitrogenous compounds; they also differ in their power of resistance to alcohol and their behaviour to sugars. Common lactic bacteria were also found in "Hyochi" saké; they showed a higher power of resistance to alcohol than the known varieties. Six varieties were distinguished, all capable of forming acid from xylose, and, with one exception, from starch or α-methylglucoside; they all grow well in koji-extract, and some also in "moto-" mash (koji-mash in which yeast and some microbes have grown). The acetic acid bacilli present in "Hyochi" saké belong to the variety of *B. Küttingianum*; they can grow in saké containing 14·4 per cent. of alcohol, and are not killed even when the percentage of alcohol rises to 16·4. They form acids from sugars more readily than *B. Küttingianum*. (See also this J., 1906, 602.)—A. S.

Anhydro-oxymethylenediphosphoric acid salts or "phytin"; Distribution of —— in plants, and an enzyme, "phytase," that decomposes the same. U. Suzuki, K. Yoshimura, and M. Takaishi. *See* XVIII*A*.

Soy sauce or "Schōyu"; Chemical composition of the Japanese ——. U. Suzuki, K. Aso, and H. Mitarai. *See* XVIII*A*.

Rum alcohol; Special formula for denaturing —— in the United States. Oil, Paint and Drug Rep., Sept. 7, 1907. [T.R.]

Following the promulgation of the revised general regulations under the supplemental free alcohol law, which went into force on the 1st instant, the U.S. Internal Revenue Bureau has authorised the use of a special formula for the denaturing of rum alcohol testing 150°. Under the original statute alcohol must test 180° to be entitled to be withdrawn for denaturing purposes free of tax. In certain industries, however, and notably in the manufacture of tobacco products, it was found that in carrying the spirits to so high a proof as 180°, certain qualities, and especially certain waxlike substances in the form of impurities, were lost. These waxy constituents were highly desirable for various reasons, and Congress, in amending the original free alcohol law, authorised the withdrawal of rum alcohol testing as low as 150°.

The following formula has been authorised as a special denaturant for use in the manufacture of smoking and chewing tobacco:—

To 100 gallons of alcohol there shall be added 1 gallon of the following solution:—Ten gallons of an aqueous solution containing 40 per cent. of nicotine; 0·4 lb. of Acid yellow dye (Fast Yellow); 0·4 lb. of Tetrazo brilliant blue, 12 B. conc.; water to make 100 gallons.

The tobacco denaturant must conform to the following analytical requirements:—

Determination of nicotine.—It must contain not less than 3·75 per cent. of nicotine when tested by the following process:—Ten c.c. of the solution are measured into a 500 c.c. Kjeldahl flask, provided with a suitable bulb tube, 10 c.c. of $N/10$ alkali added, the liquid made up to 50 c.c., and distilled in a current of steam until the distillate is no longer alkaline (about 500 c.c.). The distillate is then titrated with $N/10$ sulphuric acid, using rosolic acid as an indicator. Not less than 27·8 c.c. should be required for the neutralisation.

Test of colouring matter.—Take 1 c.c. of the denaturant and make up to 100 c.c. with water, acidulating with a few drops of sulphuric acid. Immerse in this solution a piece of white cotton cloth and boil the solution. Continue the process, adding more cloth and more water if necessary, until all the blue colour in the solution is fixed on the cloth. Then add a piece of white woollen cloth, and boil the bath as before, until all the yellow colour is fixed upon the cloth. Both the cotton and woollen cloths should show decided colours—the cotton blue and the woollen yellow.

Intensity of colour.—The denaturant solution, when observed in an eight-inch cell of Lovibond's tintometer, must show a colour of an intensity not less than No. 24 yellow, combined with No. 3 blue.

Though primarily intended for use in the tobacco industry, denatured rum alcohol will be permitted to be used in any other manufacture to which it is suited and which is not prohibited by the terms of the statute.

The Internal Revenue Bureau has decided to authorise the use of specially denatured alcohol for the manufacture of acetic ether, and for this purpose has approved a simple formula involving the addition of 5 gallons of wood alcohol to 100 gallons of ethyl alcohol. The wood alcohol is subject to the same specifications as are imposed upon the wood alcohol used in completely denatured alcohol, which are set forth in Section 26, Part 1, of the revised regulations.

Patent.

Cooling and condensing devices for the chambers of columns for distilling or rectifying alcohol, petroleum, benzol and other liquids. R. Vallat. Fr. Pat. 376,872, April 18, 1907. *See* I.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Casein; Action of dilute acids on ——, when no soluble compounds are formed; and the hydrolysis of the sodium salts of casein. L. L. Van Slyke and D. D. Van Slyke. New York Agric. Exp. Station, Bull. No. 3, 1906, 75—162.

The behaviour of casein was studied (1) with four acids of different dissociating power (hydrochloric, sulphuric, lactic and acetic); (2) with $N/125$, $N/500$, $N/1000$ and $N/2000$ concentrations of these acids; (3) after contact during different periods of time ranging from 5 minutes to 48 hours; (4) at different temperatures (0°, 25° and 45° C.), and (5) with dilute solutions of neutral salts (potassium chloride and magnesium sulphate). It was found that little, or no solution of casein takes place even after several hours' contact at 0° C., with acid solutions not stronger than $N/500$, or at 25° C., with solutions not stronger than $N/1000$; but on raising the temperature, prolonging the contact, or by concentrating the acid, the solubility is increased. The solvent action of the four acids above mentioned is in the following order, from strongest to weakest: hydrochloric, lactic, sulphuric, and acetic. The rate at which casein dissolves in different acids of the same normality is not proportional to the concentration of the hydrogen ions, or to the dissociation, but is disproportionately great in the case of the weak organic acids. By agitating casein with dilute acids of known strength for given periods of time, and then filtering the mixture, the decrease in the conductivity of the solution showed the amount of acid taken up by the casein. In this way it was found that 1 grm. of casein, shaken with 100 c.c. of $N/1000$ hydrochloric acid for 3 hours, takes from the solution nearly 50 per cent. of the acid. The amount of acid thus taken up is, however, not definite but varies with the concentration, the duration of contact until equilibrium is reached (several hours), the temperature, and kind of acid. Some acid is always taken up however small the amount used, but the acid is never removed completely from the solution no matter how large the proportion of casein to acid. The maximum amount of acid adsorbed by 1 grm. of casein varies almost directly with the concentration of the acid within the limits used ($N/125$ and $N/1000$). The equilibrium ratio reached when 1 grm. of casein is treated with 100 c.c. of $N/500$ solution at 0° C., is 675 for sulphuric acid, 147 for hydrochloric, 80 for lactic, and 30 for acetic acid. The greater part of the acid is taken up in the first half hour, and equilibrium is reached in from 2 to 24 hours according to the acid used, the temperature, and the degree of agitation. The acid taken up by casein may be extracted by shaking with water; the extraction continues until the equilibrium ratio (concentration of acid in 1 grm. of casein divided by concentration of acid in 1 c.c. of surrounding solution) is established, and then ceases. Neutral salts, such as potassium chloride and magnesium sulphate, are not adsorbed from dilute solution by casein. The experimental results obtained in the study of the behaviour of casein with dilute acids, when no solution occurs, can be best explained by the assumption of the formation of an adsorption compound. According to this explanation, the protein, which is precipitated when milk sours, is free casein in which lactic acid is held by adsorption.

It is known that, in determining the amount of alkali neutralised by casein, different indicators give different results, and the authors have endeavoured to ascertain the neutral point by means of conductivity measurements in comparison with the use of phenolphthalein and alkali. The results indicate that sodium salts of casein hydrolyse so readily that titration with alkali does not give the true equivalent weight of the protein. An excess of casein, as of phosphoric acid, is required to overcome the alkalinity of the hydrolysing normal salt. The point at which the alkalinity is overcome is indicated by the attainment of minimum conductivity and corresponds roughly with the point neutral to phenolphthalein. On account of its extremely weak acid properties, a much greater excess of casein is required to give an acid reaction to less sensitive indicators.—W. P. S.

Anhydro-oxymethylenediphosphoric acid salts or "phytin"; Distribution of —— in plants, and an enzyme, "phytase," that decomposes the same. U. Suzuki, K. Yoshimura, and M. Takaishi. Bull. Coll. Agric., Tokyo Imp. Univ. 1907, 7, 495—512.

The greatest part of the phosphorus in plant seeds exists in the form of an organic phosphorus compound, soluble in water and dilute mineral acids, *viz.* "phytin" or anhydro-oxymethylenediphosphoric acid. The authors isolated about 8 per cent. of phytin from rice-bran and about 2 per cent. from wheat-bran. Inorganic phosphorus is present in larger proportion than organic in roots, bulbs, and fruit. The presence of phytin in bones is doubtful. During the germination of seeds either in the light or in the dark, the amount of inorganic phosphorus increases considerably at the cost of the phytin, and this transformation also takes place when a suspension of finely-ground rice- or wheat-bran or different seeds, in water, is allowed to stand. This change is caused by an enzyme, *phytase*, which decomposes phytin into phosphoric acid and inosite. Phytase appears to be widely distributed in the vegetable kingdom. It was isolated from rice-bran by grinding with water, filtering, treating the solution with baryta water and barium chloride, filtering again, and precipitating with a mixture of alcohol and ether. The enzyme preparation, after further purification, forms a white powder, free from phosphorus, easily soluble in cold water, and not exhibiting diastatic, peptic, or tryptic action. (See also this J., 1904, 618.)—A. S.

Soy sauce or "Schoyu"; Chemical composition of the Japanese ——. U. Suzuki, K. Aso, and H. Mitarai. Bull. Coll. Agric., Tokyo Imp. Univ., 1907, 7, 477—494.

THE sauce examined was prepared by fermenting an infusion of equal parts of soy beans and kilned wheat with *Aspergillus oryzae*, and the main object was to determine the nitrogenous constituents. From 2 litres of the sauce there were obtained: 1·6 grms. of alanine and 5 grms. of impure alanine, 6 grms. of leucine, 3 grms. of proline, 2·6 grms. of lysine, 1 grm. of a base, $C_6H_9N_3$, 0·2 grm. of a base, $C_4H_{12}N_2$, 4·2 grms. of ammonia, 5·4 grms. of protein (calculated from the nitrogen), 0·1 grm. of formic acid, 0·4 grm. of acetic acid, 3·2 grms. of lactic acid. Tyrosine, asparagine, polypeptide-like compounds, cystine and probably phenylalanine were also present, but no glycocoll, histidine, arginine, serin or glutamic acid. Of the total nitrogen, only 3 per cent. is present in the form of protein substances.—A. S.

Butter-fat; The baryta value of ——. E. Avé-Lallemant. *See* XXIII.

Butter and other fats; Notes on Avé-Lallemant's baryta value of ——. M. Fritzsche. *See* XXIII.

Butter-fat; "Caprylic acid values" of ——. R. K. Dons. *See* XXIII.

PATENTS.

Soy sauce; Apparatus for preparing ——. T. Suzuki, Fr. Pat. 377,294, Apr. 30, 1907.

A NUMBER of semi-circular basins or pans are fitted in the top of a closed chamber, the latter being provided with heating coils, and valves for the introduction of a current of cold air. The basins are closed with lids and each contains a stirring arrangement consisting of a pair, or more, of sets of screw-blades, each set being constructed so as to move the liquid in opposite directions. The lower part of the basins may be provided with a jacket through which hot or cold liquids may be passed, so as to heat, or cool, the sauce rapidly if so required.—W. P. S.

Food for cattle and other animals; Manufacture of —— [*from molasses*]. B. E. R. Newlands and J. J. Eastick, London. Eng. Pat. 4919, Feb. 28, 1907.

A QUANTITY of molasses is mixed with finely-divided beet-pulp, peat, cane megass, flour, chaff, brewers' grain, etc., and the mixture is dried. A further quantity of molasses is then incorporated with the mixture, which is again dried, this addition and drying being once more repeated, or until the product contains the desired quantity of molasses. If desired, the product may be compressed into cakes and these may be coated with a waterproofing material such as an oxidisable oil, or wax. In place of alternately adding the molasses and drying the mixture, the molasses may be added while the material is being dried.—W. P. S.

Gluten; Process of obtaining dry ——. L. A. Morel, Meaux, France. U.S. Pat. 864,978, Sept. 3, 1907.

SEE Addition of July 6, 1905, to Fr. Pat. 344,631 of 1904; this J., 1905, 1319.—T. F. B.

Milk; Process of treating skimmed ——, *to convert it into a substitute for vinegar.* Soc. Lamouroux et Meunier. Fr. Pat. 377,147, Apr. 25, 1907.

SKIMMED milk is subjected to the action of invertase in the presence of an organic acid, such as citric acid; the curd is then separated, and the solution concentrated until its sp. gr. is about 1·070. The concentrated liquid is next inoculated with *Saccharomyces ellipsoideus* and the alcoholic liquid obtained by the action of the latter is finally subjected to the action of *Mycoderma lacti* in order to produce a vinegar-like liquid.—W. P. S.

Milk-fat; Process for the volumetric determination of —— *by means of alkaline solutions.* P. Funke und Co. Ger. Pat. 181,051, Sept. 16, 1904.

CLAIM is made for the addition of boric acid in the volumetric determination of milk-fat by means of alkaline solutions. It is stated that this addition prevents the decomposition of the milk-sugar, and the consequent darkening of the liquid.—A. S.

Protein substances contained in cacao husks; Process for obtaining the ——. J. Cracau. Ger. Pat. 187,195, Dec. 10, 1904.

THE husks are treated with lime-water, and the protein substances are then extracted by means of ammonia solution, the resulting extract being evaporated to dryness.
—A. S.

(*B.*)—SANITATION; WATER PURIFICATION.

PATENTS.

Faecal matter, domestic waste water, sewage, and the like; Apparatus for the bacteriological treatment of ——. G. A. Lucas, Levallois-Perret, France. Eng. Pat. 21,444, Sep. 27, 1906.

THE apparatus consists of a receiving chamber, an anaerobic chamber, and a filtering and oxidising chamber. The receiving chamber is completely closed and is filled to a certain height with water, the sewage, etc. entering at the top of the chamber through a pipe which dips below the surface of the water. The bottom of this chamber is connected, by means of a pipe, with the lower part of the anaerobic chamber the latter being divided into a number of cells or compartments by partitions which are alternately imperforate and perforated. The bacteria attach themselves to the imperforate partitions while the liquid circulates through the perforated partitions. A pipe at the top of this chamber conducts the sewage to the top of the oxidising chamber, where it is allowed to drop on to a number of filtering beds, composed of porous material supported on superposed horizontal perforated partitions. Air is forced into this chamber so as to circulate in the spaces between the filtering beds, these spaces containing blocks of porous material to aid the aëration. Above the upper filtering bed is placed a regulating device composed of perforated plates, the holes in two adjoining plates not corresponding with each other. The treated liquid leaves the chamber through a pipe at the bottom.
—W. P. S.

Sewage and other liquids; Method of screening ——. J. T. Neech, Halifax, and J. W. Brown, Bramley, Yorks. Eng. Pat. 23,455, Oct. 23, 1906.

A screening material, such as copper or galvanised iron wire gauze, is fixed on a frame in two layers with a space between them. This frame, or a number of them, is fixed to a pipe or tube in a settling tank, in such a way that the space between the screens is in communication with the interior of the pipe. The pipe moves in bearings at the sides of the tank. The screens are oscillated by mechanism connected to a tipping bucket operated by the inflowing sewage, so that the solid particles in the sewage do not collect on the screens.—W. P. S.

Sewage; Apparatus for the biological purification of ——. Soc. Sanitaire du Transformateur Intégral. Fr. Pat. 376,769, Apr. 15, 1907.

The sewage is conducted from the top of a settling tank through a siphon to the top of a closed chamber situated below the level of the settling tank. This chamber is filled with granular substances and is divided into two compartments by means of a vertical partition, openings being provided at the bottom of the partition to allow the liquid to flow from one compartment to the other. The sewage then passes up a pipe leading from the top of the closed chamber and is discharged over a number of oxidising beds situated one above another in a chamber above the closed chamber. A current of air is drawn through the oxidising chamber, and the treated liquid is drawn off at the bottom.—W. P. S.

(*C.*)—DISINFECTANTS.

Patents.

Vermin-destroying soap; Process for producing a non-poisonous ——. E. Fichtenau, Friedek, Silesia. Eng. Pat. 10,359, May 3, 1907.

See Fr. Pat. 375,877 of 1907; this J., 1907, 940.—T. F. B.

Antiseptic preparation; Process for preparing an ——. H. Wollheim. Ger. Pat. 182,087, April 14, 1904.

Powerfully antiseptic preparations are obtained by the addition of tertiary bases or their salts to alkali solutions, and allowing the mixture to stand in the air. 2 grms. of trimethylamine are added to one litre of milk of lime containing 50 grms. of calcium hydroxide, the mixture is well agitated, and allowed to stand.—T. F. B.

XIX.—PAPER, PASTEBOARD, &c.

Paper; Rate of reduction of length of cotton and linen fibres in manufacture of ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 139—140.

Tables and curves are given showing the progressive reduction in the average length of the fibres during the process of beating in hollanders of the ordinary type. With the usual manipulation of the beater roll, there is a very rapid decrease in the length of the fibres at first, the rate of reduction then becomes slower and is only very small during the second half of the beating operation. —J. F. B.

Bleaching process [sulphite wood pulp]; Studies on the chemical mechanism of the [electrolytic] ——. J. Nussbaum and W. Ebert. Papierfabrikant, 1907, Hefte 24 and 25.

The authors have made a careful study of the bleaching of sulphite wood pulp by sodium hypochlorite solutions prepared in Kellner electrolysers. The process may be divided into four phases: (a) At first the consumption of chlorine is too rapid to admit of accurate measurements. If the hypochlorite solution be acid, a red compound is first produced, but is rapidly oxidised again; in alkaline solutions this red colour does not appear. (b) During the second stage, the yellow coloured impurities of the cellulose are gradually oxidised, and the consumption of chlorine is slow and regular. (c) This stage consists of the still slower oxidation of the resistant oxidation products of the former stages. These products are partly coloured and partly colourless, but the latter, if not fully oxidised, will become yellow again on storage ("going back"). They are very difficult to remove in the cold, but yield more rapidly in warm or acid solutions. (d) Lastly, the cellulose itself may be attacked (over-bleaching), and abnormal losses in weight may occur, especially in the more strongly acid media. The general conclusions are summed up as follows: The rate of bleaching is very slow in alkaline solutions, and increases in acid solutions in proportion to the square of the acidity. The rate of bleaching is doubled for every rise of 7° C. in temperature. Between certain relatively wide limits the rate of bleaching is independent of the concentration of the hypochlorite. With equal consumptions of chlorine, the samples bleached at the higher temperatures are whitest. The higher the acidity of the bleaching liquor, the greater is the quantity of chlorine required to produce equal degrees of whiteness, owing to spontaneous decomposition, and the greater is the attack on the fibre. "Going back" in colour is more liable to occur the colder and less acid the bleaching solution. As a general rule, warm, weakly acid solutions are preferable to cold more strongly acid solutions. —J. F. B.

Wood-pulp industry of Norway. Board of Trade J., Sept. 26, 1907. [T.R.]

A large proportion of the wood-pulp produced in Norway is consumed in the country itself, the manufacture of paper having also made great progress. The export of Norwegian paper in 1906 amounted to 97,143 metric tons, having a value of 16,353,200 kroner (908,511*l.*).

The following table shows the amount of wood-pulp exported from Norway during the years 1902-6:—

	Metric tons.	Kroner.
1902..................	447,470	24,736,800
1903..................	447,744	23,876,600
1904..................	445,260	24,290,600
1905..................	442,325	27,620,400
1906..................	505,627	31,982,400

Of the wood-pulp exported during 1906, 362,228 tons was moist mechanical, and 122,923 tons dry chemical. Sweden, Finland, and Canada are Norway's most serious competitors. The export of wood-pulp from Sweden in 1906 was 414,811 tons, while that of Finland amounted to 56,181 tons.

The first Norwegian wood-pulp factory was established in 1868. There are now 72 factories, of which 53 are for mechanical wood-pulp and 19 for chemical wood-pulp. Sufficient motive power is furnished by Norway's natural waterfalls; the machinery used in the factories is almost entirely of Norwegian manufacture. A large quantity of Norwegian pyrites is used in the manufacture of chemical wood-pulp.

About 21 per cent. of the area of Norway is covered with forests. It is feared, however, that in course of time the pulp factories will exhaust the forests, owing to the very small dimensions of wood required in the chemical wood-pulp mills. Every year the State plants at least 1½ million trees in the public forests, in addition to which a large number are planted by private owners.

Sulphite-cellulose production of Sweden. Bd. of Trade J., Sept. 19, 1907. [T.R.]

The production of sulphite cellulose in Sweden during 1906 was about 6,000 tons of bleached, about 85,000 tons of easy bleached, and about 206,000 tons of strong bleached. The estimated production for 1907 is 9,500 tons bleached, 97,000 tons easy bleached, and 265,000 tons strong bleached. The following new sulphite mills are under construction, and will bring their production on the market in 1909:—1. Lyirsno mills, Söderhamns district, yearly production 15,000 tons; 2. Nyhamns mills, Sundsvall district, yearly production 10,000 tons; 3. Sunds, Aktiebolag pr. Sundsvall will build a mill at the outlet of the Indal River with an estimated production of 10,000 to 15,000 tons.

For both Sweden and Norway the production of cellulose this year is estimated at about 600,000 tons, Sweden's share being 400,000 tons. The total production for both countries in 1908 is estimated at 700,000 tons.

Patents.

Vegetable fibre. B. S. Summers, Port Huron, Mich. U.S. Pat. 864,574, Aug. 27, 1907.

Vegetable fibres or straw are digested under pressure with a solution of calcium chloride to which clear lime-water has been added, after which the calcium compounds are removed by washing.—F. M.

Paper stuff from beech wood, especially red beech; Process for producing ——. D. Nagy. Ger. Pat. 180,847, March 30, 1905.

Beech wood, cut into thin shavings, is first heated with sulphuric acid of 8°—12° B. at 60°—100° C., with or without application of pressure, then for 6 to 20 hours, according to the quality of the wood, in a second sulphuric acid solution of 14°—20° B., at 40°—60° C., and in a third solution of 20°—30° B., at 60° to 80° C., under pressure; this last treatment is continued until the wood is quite soft, when it is washed, and heated under pressure, at 80°—100° C., in a solution of lime.—T. F. B.

Ether or alcohol vapours contained in air [of artificial silk, celluloid, and smokeless powder factories, etc.]; Recovery of ——. A. de Chardonnet. Fr. Pat. 376,785, June 21, 1906. *See* I.

Celluloid; Process for making products similar to ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 377,671, July 17, 1906.

See Eng. Pat. 16,271 of 1906; this J., 1907, 989.—T. F. B.

Celluloid-like masses; Process for preparing ——. J. Basler und Co. Ger. Pat. 185,808, June 7, 1905.

Borneol is dissolved in a solvent of nitrocellulose, and the solution is added to nitrocellulose moistened with alcohol, and mixed until a homogeneous product is obtained, when the alcohol is removed by evaporation. A portion of the borneol may be replaced by camphor. —T. F. B.

Celluloid-like masses; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 180,208, Aug. 9, 1905.

Symmetrical methylbenzoyltrichloranilide (30 parts) is mixed with 100 parts of nitrocellulose, in presence of alcohol, and the product finished by known methods. —T. F. B.

Celluloid-like masses; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 180,126, April 21, 1906.

In making celluloid, the camphor may be wholly or partially replaced by certain ortho-diamines. Thus, 30 parts of methenyl-*o*-toluylenediamine (m.pt. 113°—115° C.) are mixed with 70 parts of alcohol and 65 parts of nitrocellulose, and worked up in the usual manner. —T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cuprous iodide. M. Guichard. Bull. Soc. Chim., 1907, 1, 897—900.

The author tried to obtain cupric iodide by the action of hydriodic acid gas on cupric chloride at a low temperature, in absence of moisture, but in every case a mixture of cuprous iodide and free iodine was formed. According to Soubeyran cuprous iodide prepared in the presence of water, retains one molecule of the latter, but the author finds that the quantity retained is much less than this, *viz.*, about 0·2 per cent. Complete dehydration is effected by heating to about 300° C. in a vacuum. When heated in the air, even at 200° C., cuprous iodide is oxidised, with loss of iodine. When it is heated in a vacuum, it changes in colour from white to yellow, and melts at about 600° C. to a brown liquid, with slight sublimation; on cooling, the reverse colour change—from brown, through yellow, to white—takes place. For the analysis of cuprous iodide and other anhydrous iodides, the following method has been found useful. A glass tube weighing about 30 grms. is shaped so that while one part is being heated, another part can be cooled to about $-60°$ C. A small quantity of the iodide is introduced into the weighed tube, and after again weighing, is heated, while a current of dry air is passed through. Copper oxide is formed, and the liberated iodine is condensed in the cold part of the tube; the increase in weight corresponds to the quantity of oxygen in the copper oxide. The iodine is now expelled by heating, and its quantity ascertained by again weighing the tube. —A. S.

Poison plants of Western Australia. E. A. Mann and W. H. Ince. Proc. Royal Soc., 1907, **B 79**, 485—491.

The "York Road" poison plant, *Gastrolobium calycinum*, was extracted with dilute alcohol, and the extract evaporated. The residue was treated with lead acetate, filtered, and hydrogen sulphide passed through the filtrate, which was afterwards neutralised. Tannic acid was added and the precipitate mixed with lead hydroxide. This was extracted with alcohol, the solution evaporated and hydrochloric acid added, causing the separation of a mixture of needle-shaped and cubical crystals. The temperature in all the above operations was not allowed to exceed 30° C. The cubical crystals were less soluble in alcohol than the needles, and appeared to be a decomposition product of the latter; analysis showed the composition to be $C_{12}H_{16}O_3$. The needle-shaped crystals proved to be the hydrochloride of a base, *cygnine*, $C_{19}H_{22}N_2O_3,HCl$. This salt slowly decomposes unless kept dry, and 1·932 grms. of it dissolve in 100 c.c. of water at 15° C. The free base is uncrystallisable and readily decomposes. The gold salt, $B,HAuCl_4$, forms yellow needles decomposing at 220° C. Other substances found in the plant were:—*cygnic acid*, $C_{10}H_{10}O_4$, which forms large colourless needles when its aqueous solution is evaporated, and which decomposes on heating; *gastrolobic acid*, $C_7H_{10}O_5,H_2O$, forming a yellow amorphous powder, which decomposes on heating, and yields ammonium and sodium salts crystallising in reddish-yellow needles; *gastrolobin*, $C_6H_{10}O_5$, a vegetable gelatinoid; and a sugar, *cygnose*, $C_6H_{12}O_6$, which gave an osazone, crystallising from alcohol in slender yellow needles melting at 179° C.

The "Box" poison plant, *Oxylobium parviflorum*, was examined in the same way. It was found to contain an alkaloid, *lobine*, $C_{23}H_{31}N_3O_4$, similar in its properties to *cygnine*. The hydrochloride crystallises in needles, and when the aqueous solution is heated above 35° C., cubical crystals of a substance, $C_9H_{14}O_3$, are deposited, melting at 107° C. The base was obtained in a semi-crystalline condition, and decomposed on heating. The gold salt, $B,HAuCl_4$, which is somewhat unstable, forms an amorphous yellow precipitate, melting at about 100° C. Malic acid was also found in this plant. Both alkaloids are toxic.—F. Shdn.

Taxicatin: a new glucoside obtained from Taxus baccata. C. Lefebvre. J. Pharm. Chim., 1907, **26**, 241—254.

The glucoside was discovered by the use of emulsin as an analytic agent, and was extracted from the leaves or young shoots of *Taxus baccata* with boiling water. The aqueous extract was reduced to a syrup in presence of calcium carbonate, and then extracted with ethyl acetate. After purification by means of the lead compound, 35 grms. of glucoside were obtained from 70 kilos. of plant. *Taxicatin*, $C_{13}H_{22}O_7$, crystallises in the anhydrous state from hot alcohol or with two molecules of water from this solvent in the form of colourless needles; it is inodorous and slightly bitter; the anhydrous substance melts at 166—167°, the hydrate at 165° C. It is soluble in 59 parts of water and has the optical rotation, $[\alpha]_D = -72{\cdot}9°$. When hydrolysed with sulphuric acid or emulsin, it yields 58 per cent. of dextrose and a compound, $C_7H_{12}O_2$. In addition to the glucoside, *Taxus baccata* also contains sucrose, raffinose, invertase and emulsin. Taxicatin occurs in greatest quantity in the plant during the autumn and winter; apparently it is utilised in the spring when the young shoots begin to assimilate.—E. F. A.

Aucubin; Presence of —— in different species of the genus Plantago. L. Bourdier. J. Pharm. Chim., 1907, **26**, 254—266.

A number of species of plantain have been examined for glucosides by Bourquelot's biological method, consisting in the addition of emulsin to an extract of the plant and the determination of the changes in optical rotation and cupric-reducing power. In every case the presence of glucosides was proved and a black coloration, characteristic of aucubin (the glucoside characteristic of *Aucuba japonica L*), was observed. This glucoside was isolated from *Plantago lanceolate*, *P. major* and *P. media*. To obtain the glucoside, the leaves have to be treated with boiling alcohol immediately after gathering as the glucoside disappears on keeping. Invertase and emulsin were also found to be present in every species of *Plantago* examined. —E. F. A.

Otto of rose. E. J. Parry. Chem. and Drug., 1907, **71**, 475.

The author states that otto of rose is being freely adulterated this season with a mixture of geraniol and other terpene-alcohols having a sp. gr. of about 0·875 and a refractive index of under 1·4700. The figures in the following table relate to (*a*), a pure otto of rose of the best quality, and to this otto mixed with 5 per cent. (*b*), 10 (*c*), 20 (*d*), and 30 per cent. (*e*) of the new adulterant.

	(*a*).	(*b*).	(*c*).	(*d*).	(*e*).
Sp. gr. at 30° C.	0·8550	0·8565	0·8575	0·8600	0·8618
Refractive index at 24° C.	1·4619	1·4622	1·4629	1·4637	1·4648
Optical rotation	−2° 38′	−2° 30′	−2° 20′	−2° 15′	−2° 5′
Melting point ..	23° C.	22·5° C.	21·5° C.	20·5° C.	20° C.
"M.pt." of stearoptene	34·5° C.	35° C.	34° C.	34° C.	33·5 C.

The "melting point" of the stearoptene, *i.e.*, the temperature at which the crystals disappear, depends largely on the relative solubility of the stearoptene in the liquid, and a trace of alcohol is sometimes added to raise the apparent melting point, the stearoptene being practically insoluble in alcohol. From an examination of samples from numerous sources, the author concludes that the best otto of rose of the present season has a sp. gr. not exceeding 0·8560, and a refractive index of less than 1·4620.—A. S.

Bergamot oil: determination of the acid value. S. Gulli. Chem. and Drugg., 1907, **71**, 475.

Attention is drawn to a new method of adulteration of bergamot oil, consisting in the addition of lemon or bergamot terpenes and of small quantities of volatile acids (benzoic acid, etc.) or of esters (ethyl succinate, ethyl citrate, terpinyl acetate, etc.). This form of adulteration is indicated by an increase in the acid value of the oil, which, in the case of pure specimens, should be between 0·05 and 0·15 per cent., and never more than 0·20 per cent. even in old oils.—A. S.

Camphor, artificial and natural; Distinctive test for —— with vanillin and hydrochloric acid. P. Borisch. Pharm. Zentralh., 1907, **48**, 527—531.

0·05 grm. of camphor is treated, in a test-tube, with 1 c.c. of vanillin-hydrochloric acid reagent (1 part of vanillin dissolved in 100 parts of 25 per cent. hydrochloric acid). The tube is then immersed in a beaker of water, and slowly warmed, so that the temperature gradually rises, and observations are made at 30°, 60°, 75° and 100° C. Under these conditions, "synthetic" camphor shows no colour reaction, but natural camphor gives varying shades of green or blue as the temperature rises, and borneol passes from dull yellow at 60° C. to deep blue at 100° C. —J. O. B.

Acetone; Detection of —— in alcohol and ether. H. Wester. *See* XXIII.

Benzoic and cinnamic acids; Separation of ——. K. Scheringa. *See* XXIII.

Patents.

Volatile oils, balsams or substances of like nature; Process of rendering —— soluble in water. J. Laboschin, Berlin. Eng. Pat. 2559, Feb. 1, 1907.

Alcohol, say 2 parts, is mixed with a saturated aqueous solution of potassium hydroxide or other alkali, say one part, and the essential oil, etc., stirred into the mixture while the reaction is still in progress. When the mixture cools, the essential oil will be found so modified that it dissolves readily in water, forming a clear permanent solution. The proportion of alcohol required varies with the nature of the essential oil.—C. A. M.

Camphor; Process of making ——. C. Glaser, Baltimore, Md. U.S. Pat. 864,162, Aug. 27, 1907.

A process for making camphor by heating a mixture of isoborneol, a hypochlorite and water, and distilling off the camphor formed.—G. W. McD.

Camphor from isoborneol; Process for preparing ——. Fabr. Bâloise de Produits Chimiques. Fr. Pat. 377,926, April 26, 1907. Under Int. Conv., April 28, 1906.

See Eng. Pat. 9857 of 1907; this J., 1907, 838.—T. F. B.

Camphor oil; Preparation of clear, fluid or stiff homogeneous substances from ——. L. Sarason. Ger. Pat. 183,190, July 3, 1904.

Camphor oil is treated with the alkali salts of fatty acids or with alkali resinates. The products are stated to be homogeneous substances, miscible with alcohol and glycerol in all proportions, and forming stable emulsions with water.—T. F. B.

Aminoalkylesters ; Process for preparing acidylated ——. J. D. Riedel A.-G. Ger. Pat. 181,175, Oct. 8, 1903. Addition to Ger. Pat. 169,787, Oct. 8, 1903. (This J., 1906, 909.)

Aminoalcohols with secondary amino-groups (this J., 1906, 909, 910) are converted into their diacidyl-derivatives by the usual methods of acidylation.—T. F. B.

Phosphate of iron preparation ; Process for preparing a ——. Ferro-Phosphat Ges. E. Schramm und Co. Ger. Pat. 179,646, April 22, 1904.

Phosphorus is burnt in presence of a limited quantity of air, and the product is " treated for a long time " with finely-divided iron. The preparation is said to possess the property of healing burns ; it is also a bactericide. —T. F. B.

Starch and cellulose with formaldehyde ; Process for preparing compounds of ——. E. R. L. Blumer. Ger. Pat. 179,590, Oct. 25, 1904.

A mixture of dilute alkali hydroxide (*e.g.*, 5° B.) and formaldehyde is allowed to act, in the cold, on starch, cellulose, etc., for some hours, when it is heated for a short time, and the product washed with water, and then with dilute acetic acid, and finally dried at moderate temperatures (*e.g.*, 50° C.).—T. F. B.

Cotarnine phthalates ; Process for preparing acid and normal ——. Knoll und Co. Ger. Pat. 180,395, Feb. 11, 1905. Addition to Ger. Pat. 175 079, Jan. 9, 1903.

When cotarnine and phthalic anhydride react, the cotarnine is said to lose 1 mol. of water between its aldehydic group and its ·NH· group, and forms a phthalate. —T. F. B.

3-*Methyl- and* 1.3-*dimethyl*-4-*amino*-2.6-*dioxypyrimidines ; Process for preparing* ——. P. Höring. Ger. Pat. 182,559, June 10, 1905.

3-Methyl- and 1.3-dimethyl-4-amino-2.6-dioxypyrimidines are obtained by heating cyanacetylmethyl- or -dimethylureas with aqueous solutions of salts having slightly alkaline reactions, *e.g.*, sodium borate or acetate, or disodium phosphate. The pyrimidine derivatives are thus obtained as such, without addition of acid.—T. F. B.

Carboxyalkyldialkylbarbituric acids ; Process for preparing compounds corresponding in composition to ——. W. Traube. Ger. Pat. 180,424, Oct. 10, 1905. Addition to Ger. Pat. 179,946, July 14, 1904. (See Eng. Pat. 14,161 of 1905 ; this J., 1905, 1188.)

The liquid product obtained by heating dialkylmalonyl chlorides with urethane is dissolved in dilute alkali, precipitated with acid, and distilled under very much diminished pressure until a viscous oil distils over. The product can be converted readily into dialkylbarbituric acids (*loc. cit.*).—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic bromide papers ; The coating of ——. Guilleminot. Bull. Soc. Franç. Phot., 1907, 23, 316—322.

The best materials for coating photographic papers, preparatory to receiving the emulsion, are gelatin and barium sulphate. The gelatin should be of medium hardness, and should not be capable of reducing ammoniacal silver nitrate solution, whilst the barium sulphate should be free from compounds of other metals ; the by-product obtained in making hydrogen peroxide is said to be unsuitable. For preparing glossy papers, the barium sulphate is precipitated cold, whilst for " matt " papers it is best obtained by hot precipitation. Suitable proportions are 8 to 10 per cent. of gelatin per 100 parts of barium sulphate, with addition of about 1 per cent. of colouring matter, if required.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Hydrazine chlorate and perchlorate. R. Salvadori. Gaz. chim. ital., 1907, **37**, II., 32—40.

A dilute solution of hydrazine hydrate was neutralised with a dilute solution of chloric acid, using litmus as indicator, and then evaporated *in vacuo* over sulphuric acid. The residue was washed rapidly with absolute alcohol. Hydrazine chlorate, $N_2H_5ClO_3$, was thus obtained in the form of very hygroscopic, white leaflets. It melts at about 80° C., and after melting, immediately explodes ; its explosive power is about one-third of that of mercury fulminate. It is easily soluble in water, very slightly soluble in alcohol, and insoluble in benzene, ether, and chloroform. The perchlorate, $N_2H_5ClO_4$, is much more stable than the chlorate : it can be obtained from its solutions, by evaporation on the water-bath. From alcohol it separates in long prisms which melt at 131°—132° C., burn quietly at a higher temperature, but explode when struck. One part of the salt dissolves in 34 parts of alcohol or 1·48 parts of water at 13° C. The dry salt absorbs moisture from the air, with formation of the hydrate, $2N_2H_5ClO_4,H_2O$, which melts at 85° C. and decomposes below 100° C. A specimen of the perchlorate which had been preserved for two years over calcium chloride, exploded on striking just as when first prepared.—A. S.

Acid nitrating mixtures ; Analysis of ——. G. Coffetti and G. Maderna. *See* XXIII.

Patents.

Explosives ; Manufacture of ——. G. Cornaro, Turin, Italy. Eng. Pat. 9170, April 19, 1907. Under Int. Conv., April 21, 1906.

See Fr. Pat. 376,607 of 1907 ; this J., 1907, 991.—T. F. B.

Nitrocellulose ; Manufacture of ——. H. Diamanti, P. Loisif and H. Champin. Fr. Pat. 377,425, July 10, 1906.

The principle is claimed whereby the acids are either partially or completely renewed during the process of nitration, continuous circulation being also employed. The process may be applied to nitrating vessels of all descriptions, and the composition and temperature of the mixed acid is thus kept constant.—G. W. McD.

Explosive ; Manufacture of a safety ——. J. A. Fürstenhoff. Fr. Pat. 377,103, April 23, 1907. Under Int. Conv., April 25, 1906.

Claim is made for the use of a metallic powder capable of forming an explosive mixture with liquid air or liquid oxygen, such powder consisting of one or more metals such as aluminium, magnesium, etc., in metallic form or as hydrides, or of a mixture of the metal or metals with one or more metallic hydrides.—C. A. M.

Ether or alcohol vapours contained in air [of artificial silk, celluloid, and smokeless powder factories, etc.]; Recovery of ——. A. de Chardonnet. Fr. Pat. 376,785, June 21, 1906. *See* I.

Nitrate explosives ; Manufacture of ——. A. Ermel. Fr. Pat. 377,509, May 4, 1907.

The addition of lead nitrate to ammonium nitrate explosives ensures certainty of detonation, and allows the use of a smaller detonator, but at the same time the sensitiveness of the explosive to shock and percussion is much increased, and the fine dust of lead nitrate produced during incorporation is deleterious to work-people. These defects are obviated by adding to the explosive a small percentage of a liquid hydrocarbon or other substance having a boiling point considerably above the temperature at which the explosive is dried. Glycerin is stated to be particularly suitable, and the mononitro derivatives of the aromatic series may also be employed for the same purpose.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Patents.

Gas analysis apparatus. J. F. Simmance and J. Abady, London. Eng. Pat. 18,680, Aug. 21, 1906.

An apparatus for the volumetric analysis of a gas, consisting of a bell fitted to rise and fall in a liquid seal, connected under the control of a positively operated valve, with a source of the gas to be analysed, and provided with a venting device, constituted by an open tube connected at one end to the top of the bell, the other end of the tube being adapted to dip into a liquid seal. A second bell is fitted to rise and fall in a liquid seal, connected on the one hand to the first bell, on the other hand to a waste outlet. Means are provided for subjecting the gas to an absorbent reagent during its passage from the first to the second bell, the arrangement being such that when the gas supply to the first bell is shut off, the venting device will automatically limit the pressure of the gaseous contents of the first bell when the latter attains a predetermined capacity. —G. W. McD.

Photometers and the like. S. N. Wellington, London. Eng. Pat. 6316, March 15, 1907.

The apparatus consists of an open-ended tube having a frame to carry a sheet of printed matter extending transversely to the axis of the tube. The tube can be angularly adjusted to bring its axis in line with the light to be tested, and means are provided by which the angle of the tube relatively to the horizontal plane can be ascertained. A measuring device is also provided for ascertaining the horizontal distance between the apparatus and the light being tested.—G. W. McD.

INORGANIC—QUANTITATIVE.

Acid nitrating mixtures ; Analysis of ——. G. Coffetti and G. Maderna. Gaz. chim. ital., 1907, 37, II., 13—17.

The total acidity is determined by diluting 2—3 grms. of the mixture to about 100 c.c., and titrating with $N/_2$ sodium hydroxide solution and methyl orange. Sulphuric acid is determined by the ordinary gravimetric process. Nitrous acid is determined by diluting a portion of the acid mixture, neutralising with sodium carbonate, and treating with potassium ferrocyanide and citric acid (see this J., 1907, 1008). The difference between the quantity of sulphuric and nitrous acids and the total acidity represents the nitric acid.—A. S.

Caustic lime ; Determination of —— by the use of a sugar solution. J. Hendrick. Analyst, 1907, 32, 320—325.

The following method based upon an extraction of the calcium oxide by means of a solution of sucrose and titration of the solution with standard acid differs from the method of Stone and Scheuch (this J., 1895, 304) in many respects :—Five grms. of powdered burnt lime are mixed with 10 c.c. of alcohol, the contents of the flask made up to 500 c.c. with a 10 per cent. solution of sugar, and the flask immediately placed in a shaking machine (50—60 revs. per minute), and shaken for at least 4 hours. A portion of the liquid is then filtered or decanted and titrated with standard hydrochloric acid, with methyl orange as indicator. The tabulated results show that the method, as a rule gives figures about one per cent. lower than those obtained by direct titration, and invariably lower than those calculated from a complete analysis. In the case of limes containing much silica, the amount of calcium oxide found by the complete analysis method was frequently 5 to 10 per cent. higher than that given by the sugar method. Experiments showed that a 5 per cent. solution of sugar was too weak for the extraction, but that little difference resulted from the use of solutions of 10, 20, or 30 per cent. strength. It is essential to start the shaking immediately after the addition of the sugar ; otherwise a cake of calcium sucrate is soon formed, and it is then almost impossible to obtain complete extraction. Magnesium oxide was found to be nearly insoluble in the sugar solution, though magnesium carbonate was dissolved to a considerable extent.—C. A. M.

Zinc salts ; Theory of the action of sulphuretted hydrogen on ——. S. Glixelli. Z. anorg. Chem. 1907, **55**, 297—320.

The solubility, in dilute sulphuric acid, of zinc sulphide which has been precipitated from an alkaline solution, is found to be about 4·6 times that of the same compound precipitated from acid solution. But in dilute sulphuric acid, saturated with sulphuretted hydrogen, the solubility of zinc sulphide is negligible, and the reaction, $ZnSO_4 + H_2S = ZnS + H_2SO_4$ is not reversible, as has been supposed. Its velocity is, however, reduced by an increase in the quantity of sulphuric acid present, which also lengthens the time which elapses before a precipitate appears. This latter is called the "induction period," and may extend over a few minutes or over months, if sufficient acid be added. The separation of zinc from nickel and cobalt in acid solution by sulphuretted hydrogen rests therefore, not on a difference in the conditions of equilibrium, but in their induction periods. Precipitation from acid solution is merely a question of time, but the state of pseudo-equilibrium may be upset and precipitation hastened by the catalytic action of zinc sulphide, cadmium sulphide, copper sulphide, silicic acid, or the walls of the containing vessel. The action of copper sulphide in this respect explains the difficulty experienced in precipitating it free from zinc, when both metals are present in solution. —F. Sodn.

Nickel ; Determination of —— as nickeldicyanodiamidine, and the separation of nickel from iron and from aluminium. H. Grossmann and B. Schück. Chem.-Zeit., 1907, 31, 911—912.

In the method already described by the authors (this J., 1907, 718) for the determination of nickel by precipitation as nickeldicyanodiamidine, the precipitate is ignited with sulphuric acid to obtain anhydrous nickel sulphate. A quicker method of manipulating the precipitate and one which gives more exact results, consists in collecting it in a Gooch crucible, washing with water containing ammonia, and drying at 115° C. The precipitate loses its water of crystallisation and has finally the composition, $Ni(C_2H_5N_4O)_2$.

The separation of nickel from iron or aluminium is carried out in the following manner. To the concentrated solution which should not contain much ammonium salt, 0·5—1 grm. of Rochelle salt is added for every

0·2 grm. of metals present, and a large excess of concentrated ammonia; the solution is then treated with dicyanodiamidine sulphate (1—2 grms. for every 0·1 grm. of nickel) and lastly, while keeping cool, with a 10 per cent. solution of potassium hydroxide, and allowed to remain cool overnight. The precipitate contains all the nickel, and is filtered off as already described. Iron will pass into the filtrate and can be completely precipitated as hydroxide by boiling. It is advisable however to dissolve this precipitate in hydrochloric acid and re-precipitate with ammonia in order to obtain the precipitate free from adsorbed alkali. As aluminium is not precipitated by boiling, the filtrate in that case is evaporated to dryness in a platinum basin, and heated with sulphuric acid and some fuming nitric acid to decompose all organic matter. The temperature must not however rise so high as to render the alumina insoluble in acids. The residue is dissolved in hydrochloric acid and the aluminium precipitated by ammonia. The precipitate of aluminium hydroxide should be dissolved, and again precipitated by ammonia in order to get rid of adsorbed alkali in the first precipitate.—C. E. F.

Cuprous iodide. M. Guichard. *See* XX.

Iron; Report of the Committee on the standard methods for the analysis of ——. *See* X.

Alloys of tin or antimony; Method of analysis of some ——. A. Berg. *See* X.

ORGANIC—QUANTITATIVE.

Butter-fat; The baryta value of ——. E. Avé-Lallemant Z. Untersuch. Nahr. Genussm., 1907, **14**, 317—329.

The following method, developed from that of König and Hart (Z. anal. Chem., 1891, **30**, 292), has enabled the author to form definite conclusions in cases of suspected adulteration:—From 1·9 to 2·0 grms. of the fat are saponified with alcoholic potassium hydroxide, the solution neutralised with *N*/2 hydrochloric acid, the alcohol expelled, the soap dissolved in boiling water, and the boiling solution (150 to 180 c.c.) treated with 50 c.c. (measured at 15° C.) of a solution of 25 grms. of barium chloride per litre. The flask is left for 15 minutes on the hot water-bath for the insoluble barium soaps to agglomerate, the contents then cooled, made up to 250 c.c. and filtered, and the barium precipitated as sulphate from 200 c.c. of the clear filtrate previously acidified with hydrochloric acid. The weight of barium (as oxide) in mgrms. *plus* one quarter of the weight found, is deducted from the total barium oxide used, and the difference, calculated upon 1 grm. of the fat, gives the amount of barium oxide that has combined with the insoluble fatty acids *i.e.* "*the insoluble baryta value.*" The saponification value of the fat is calculated into mgrms. of barium oxide, and the difference between the result and the insoluble baryta value gives "*the soluble baryta value.*" Fifty samples of genuine butter gave the results shown in the following table, which also shows the values obtained with some of the other edible fats and oils examined:—

Fat.	Refractometer reading at 40° C.	Reichert-Meissl Value.	Saponification Value.	Mgrms. of barium oxide for 1 grm. of fat.			Difference, $b-(200+c)$.
				Total, *a*.	Insoluble, *b*.	Soluble, *c*.	
Butter, highest ...	45·0	32·3	241·1	329·6	254·8	76·7	−23·8
do. lowest	40·8	24·6	220·3	300·9	247·4	50·8	− 0·7
do. mean	43·2	28·7	227·4	310·7	250·7	60·3	− 9·6
Sesamé oil	—	—	186·8	255·2	251·9	3·3	+48·6
Cottonseed oil ...	—	—	192·9	263·5	256·9	6·6	+50·3
Cocoanut oil	35·1	9·6	258·6	353·3	299·2	54·1	+45·1
do.	34·8	9·0	259·7	354·1	296·5	57·6	+38·9
Lard	50·6	—	194·3	265·5	257·4	7·6	+50·3
Beef Tallow	46·6	—	197·9	270·3	264·1	6·2	+57·9
Margarine	44·6	6·5	233·5	319·0	277·7	41·3	+36·4
Butter + 10% Cocoanut oil	41·8	28·8	232·9	318·2	259·2	59·0	+ 0·2
Do. + 10% Cocoanut oil + 10% Beef Tallow	42·8	23·4	227·7	311·0	257·2	53·8	+ 3·4

From these and similar results given in detail, the author concludes that sound normal butter-fat should have an insoluble baryta value of 247 to 251 (or 253—254 in the case of butter from cows fed on special food), whilst the soluble baryta value should range between 50 and 65. The difference, $b-(200+c)$, is invariably negative with pure butter-fat, and samples showing a positive difference are to be condemned. Cocoanut oil increases the insoluble baryta value by about 4·5 to 5 mgrms. for each 10 per cent. added. Rancid butter-fat or butter that has been strongly heated cannot be tested by this method.—C. A. M.

Butter and other fats; Notes on Avé-Lallemant's baryta value of ——. M. Fritzsche. Z. Untersuch. Nahr. Genussm., 1907, **14**, 329—333.

Thirty-one samples of Dutch butter of undoubted purity gave the following results when tested by the method described in the preceding abstract. Total barium oxide in mgrms. per 1 grm. of fat, 297·3 to 316·7; insoluble baryta value, *b*, 242·6 to 251·7; soluble baryta value, *c*, 50·6 to 69·4; and difference, $b-(200+c)$, − 2·2 to − 24·8. These results confirm the statement of Avé-Lallemant that, as a rule, pure butter fat gives a − difference for $b-(200+c)$, whilst animal and vegetable fats give a

ORGANIC—QUALITATIVE.

Acetone; Detection of ——, *in alcohol and ether.* H. Wester. Pharm. Zentral., 1907, **48**, 620.

Three c.c. of the ether are shaken with a 5 per cent. aqueous solution of hydroxylamine hydrochloride, then treated, with thorough agitation, with about 4 c.c. of sodium hypochlorite solution. In the presence of acetone, the ether layer shows a blue or bluish-green tint. Excess of hypochlorite solution should be avoided, but the amount of hydroxylamine hydrochloride solution employed is immaterial. The presence of 0·028 per cent. of acetone is readily detected.—J. O. B.

Artificial silk; Testing varieties of ——. C. G. Schwalbe. *See* V.

Camphor, natural and artificial; Distinctive test for —— *with vanillin and hydrochloric acid.* P. Borisch. *See* XX.

+ difference. Three abnormal samples of pure butter, however, gave the following results :—

Abnormal butter fat from	Refractometer reading at 40° C.	Reichert-Meissl Value.	Saponification Value.	Mgrms. of barium oxide for 1 grm. of fat.			Difference, $b-(200+c)$.
				Total, *a.*	Insoluble, *b.*	Soluble, *c.*	
Leipzig	41·5	28·27	231·7	316·5	255·6	60·9	− 5·3
Leyden	45·2	25·30	216·4	295·6	248·4	47·2	+ 1·2
,, ...	46·0	23·65	216·3	295·4	251·0	44·4	+ 6·6

The first sample from a single cow fed chiefly upon roots was characterised by an abnormally high insoluble baryta value, whilst the other two showed positive differences for the value $b-(200+c)$.—C. A. M.

Butter-fat ; " Caprylic acid values " of ——. R. K. Dons. Z. Untersuch. Nahr. Genussm., 1907, **14**, 333—342.

It was found by Jensen (this J., 1905, 1025) that the proportion of caprylic acid in the Reichert distillate of pure butter-fat was practically constant, whereas in the case of butter containing 10 per cent. of cocoanut oil, the proportion was greatly increased. Since the distillate only contains 24 to 25 per cent. of the total caprylic acid, the author prepares a second distillate by adding 110 c.c. of water to the residue in the flask, and distilling off the same quantity, about 30 per cent. of the residual caprylic acid being thus separated. The determination is made by shaking 100 c.c. of the neutralised distillate with 40 c.c. of $N/10$ silver nitrate solution, washing the separated silver salt with 20 c.c. of water, adding 50 c.c. of $N/10$ sodium chloride solution to the filtrate and washings, and titrating the excess of sodium chloride with the standard silver nitrate solution. The difference between the amounts of silver nitrate and sodium chloride solutions used, multiplied by 1·1 gives the " second caprylic acid value." The " first caprylic acid value " is determined by Jensen's method with some slight modifications. From experiments upon 200 samples of pure butter of diverse origin, the author concludes that the first and second caprylic acid values of pure butter-fat are approximately equal (1·0 to 1·6), the first value being fairly proportional to the Reichert-Meissl value. The first value is increased much more than the second value by the addition of cocoanut oil, the presence of 10 per cent. of that fat raising the first value by 0·8 to 1·0. Butter from cows fed upon cocoanut oil-cake did not show any great variation in the caprylic acid values of the fat, but the Polenske value (this J., 1904, 387) was influenced almost as much as by an addition of 10 per cent. of cocoanut oil to the butter obtained before the feeding experiments, this effect being produced by the lauric acid in the cocoanut oil.—C. A. M.

Benzoic and cinnamic acids ; Separation of ——. K. Scheringa. Pharm. Weekblad, 1907, **44**, 984—986. Chem. Zentr., 1907, 2, 1020.

The mixture containing the acids is dissolved in ammonia, and the solution diluted, and treated with calcium chloride solution, whereby most of the cinnamic acid is precipitated in the form of its calcium salt. After filtering, the solution is treated with potassium permanganate solution (1 : 50) until a permanent pink colour is produced, the excess of permanganate destroyed by a drop of sodium thiosulphate solution, and the whole warmed. After again filtering, the solution is boiled to expel benzaldehyde, acidified with dilute hydrochloric acid, the benzoic acid extracted by shaking with ether, the ether solution evaporated, and the residue dried and weighed. The cinnamic acid is obtained by difference.—A. S.

Caoutchouc ; Determination of —— *in cold-cured rubber goods.* T. Budde. *See* XIIIC.

Caoutchouc ; Direct determination of —— *in vulcanised rubber mixings.* S. Axelrod. *See* XIIIC.

PATENTS.

Milk-fat ; Process for the volumetric determination of —— *by means of alkaline solutions.* P. Funke und Co. Ger. Pat. 181,051, Sept. 16, 1904. *See* XVIII*A*.

Sugar content of urine ; Process for the approximate determination of the ——. Hausmann A.-G. Schweizerische Medizinal- und Sanitätsges. Ger. Pat. 182,326, March 1, 1906.

Urine is boiled with an alkali hydroxide, and the solution mixed with water until it is of the same colour as a standard colour solution : the amount of water added is taken as a measure of the sugar content. The results are not accurate, but the error is not greater than 0·5 per cent. Natural dyestuffs do not interfere with the determination.—T. F. B.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Carbon at high temperatures and pressures ; Notes on ——. C. A. Parsons. Proc. Roy. Soc., 1907, A, **79**, 532—535.

Carbon was heated by electrical resistance in a steel tube or mould under pressures ranging from 30—100 tons per sq. in., and in no case did the product contain more than a trace of diamond, the resulting stable form of carbon being apparently soft crystals of graphite. It was found, however, that under these conditions graphite has a great tendency to diffuse into its cooler surroundings. The author also concludes that pressure is not the cause of the production of diamond in rapidly cooled iron, since no more than a trace was found in iron highly charged with carbon cooled from high temperatures and under pressures of 30—50 tons and even 75 tons per sq. in.
—O. F. H.

Trade Report.

Australian trade. Chem. and Drugg., Sept. 28, 1907. [T.R.]

The following figures show the imports of drugs, chemicals, &c., into Australia in 1906. They are extracted from the official report by the Commonwealth Bureau of Census and Statistics in Melbourne :

——	Quantity.	Value.	U.K. Share.
Acids—		£	£
Acetic .... gal.	9,597	2,534	1,963
Boric and salicylic .. cwt.	5,496	7,813	6,218
Hydrochloric, nitric and sulphuric ..... ,,	519	950	716
Tartaric .... ,,	7,101	37,224	4,186
Other acids .... ,,	2,874	14,525	2,965

—	Quantity.	Value.	U.K. Share.
Soda—		£	£
Acetate .... cwt.	8,231	7,495	1,896
Ash .... ,,	92,193	25,538	25,492
Bicarbonate and carbonate .... ,,	61,390	22,080	20,080
Caustic .... ,,	72,004	43,630	43,583
Crystals.............. ,,	892	250	218
Nitrate .... ,,	70,764	38,239	1,610
Silicate .... ,,	19,516	5,263	5,241
Alum .... ,,	3,605	1,035	929
Ammon. carb. .... ,,	1,290	2,232	2,223
Calcium carbide .... cwt.	85,975	64,601	1,469
Caramel, &c. .... lb.	130,787	1,397	1,276
Drugs and chemicals—			
Bisulphites and sulphites of potassium, sodium, calcium and magnesium; foaming powders and liquids................	—	5,368	4,262
Potash cyanide ..... lb.	5,847,554	226,612	193,102
Cream of tartar ..... cwt.	30,727	120,560	3,765
Food preservatives	—	1,353	1,337
Dyes	—	50,732	16,404
Gelatin sheets .... lb.	407,040	18,873	7,525
Glycerin, crude .... lb.	20,250	284	—
Gums, dry, dextrin, sandarac, mastic ..... cwt.	9,980	15,101	2,546
Insecticides, sheep-washes, disinfectants, n.e.i.	—	52,534	39,844
Malt-extract (non-spirituous) .... lb.	117,014	2,678	2,620
Castor oil .... gal.	380,293	45,373	1,206
Essential oils	—	38,093	20,543
Linseed oil .... gal.	1,032,118	105,309	101,459
Olive oil .... ,,	28,746	6,506	263
Bismuth ore .... cwt.	17	14	—
Copper sulphate .... cwt.	7,930	8,960	6,527
Potash, crude pearl-ash and caustic potash... cwt.	4,044	4,627	2,988
Mercury .... lb.	173,488	17,139	4,218
Saccharin .... ,,	3,977	1,359	332
Saltpetre .... cwt.	8,112	9,053	4,943
Shellac .... ,,	1,183	11,945	404
Soap, toilet .... lb.	891,117	65,840	26,616
Do. n.e.i. .... ,,	1,147,486	13,642	13,307
Spirits—			
Collodion .... gal.	898	358	131
Methylated .... ,,	105	13	11
Essences, tinctures and extracts........... ,,	37,480	48,463	25,309
Sulphur .... cwt.	269,704	62,335	1,028
Turpentine .... gal.	314,630	61,868	2,004
Wax—			
Bees' .... lb.	13,725	787	404
Vegetable .... ,,	80,021	2,681	966
Paraffin .... ,,	6,363,946	76,345	150

Germany; *Trade of* —— *in* 1905 *and* 1906. Chem. Ind., Sept., 1907. [T.R.]

THE following tables show the imports into and exports from Germany of various chemical products during 1905 and 1906:—

	1905.		1906.	
	Tons.	1000 Mk.	Tons.	1000 Mk.
Caustic potash—				
Imports..........	24	7	44	13
Exports..........	22,246	7,786	21,772	7,620
To U.K.	3,397	1,189	3,824	1,338
Ammonium sulphate				
Imports	48,005	12,001	35,366	8,841
From U.K.	26,813	6,703	16,283	4,070
Exports	27,589	6,897	37,288	9,322
White lead—				
Imports..........	2,488	896	2,342	957
Exports	16,478	5,273	14,022	5,348
To U.K.	10,118	3,238	9,117	3,450
Calcium carbide—				
Imports..........	17,256	3,710	22,819	5,000
Exports	709	163	545	142
Quinine and its salts—				
Imports	6	156	6	140
Exports..........	140	4,493	178	4,921
To U.K.	17	528	24	661
Cinchona bark—				
Imports	2,594	3,373	3,454	4,391
Exports	83	207	134	333
Potassium chloride—				
Imports..........	223	32	181	26
Exports..........	156,434	22,120	171,994	24,884
To U.K.	15,560	2,220	12,679	1,837
Potassium cyanide—				
Imports..........	3	4	3	4
Exports..........	4,005	5,206	5,049	7,411
Glycerin, pure—				
Imports..........	713	678	670	579
Exports..........	3,513	3,337	2,336	2,040
Glycerin, crude—				
Imports..........	4,952	3,467	3,542	2,180
Exports..........	584	409	2,140	1,299
Gum lac, shellac—				
Imports..........	4,104	15,596	4,279	17,013
From U.K.	941	3,577	743	3,098
From India	2,776	10,548	3,046	11,281
Exports..........	958	3,926	1,274	5,510
Indigo—				
Imports..........	199	1,202	113	829
Exports..........	11,165	25,721	12,730	31,575
To U.K.	1,561	2,498	1,454	2,580
Iodine—				
Imports..........	377	12,821	297	5,767
From U.K.	56	1,911	54	1,133
Exports..........	27	942	46	971
Calcium acetate—				
Imports..........	20,510	4,512	20,362	4,820
Exports..........	168	37	190	45
Phosphate of lime—				
Imports..........	501,048	25,052	531,195	31,277
Exports..........	3,720	197	5,484	353
Mercury—				
Imports..........	729	3,135	698	3,110
Exports..........	48	211	20	92
Sodium nitrate—				
Imports..........	540,916	110,888	593,218	124,837
Exports..........	20,531	4,311	22,099	4,720
Potassium nitrate—				
Imports..........	2,156	927	1,918	856
Exports..........	12,140	5,220	11,564	5,162
To U.K.	3,797	1,633	3,840	1,715
Soda, calcined—				
Imports..........	143	12	189	16
Exports..........	46,768	3,975	41,598	3,535
Thomas slag—				
Imports..........	198,763	4,671	193,895	4,556
Exports..........	270,905	7,585	354,116	9,915

Switzerland; *Trade of* —— *in* 1906. Chem. Ind., July 1, 1906. [T.R.]

THE following table shews the imports and exports of various products in Switzerland in double centners (double centner, dz., = 100 kilos.) :—

	Imports.	Exports.
	dz.	dz.
Alkaloids	67	90
Chemical and pharmaceutical preparations	812	1,124
Colophony	24,071	123
Copal, dammar resin, and shellac......	2,059	—
Oil of turpentine	15,098	240
Caustic alkalis	42,793	464
Calcium carbide	2,219	144,384
Chlorates, perchlorates, and persulphates	544	16,725
Chloride of lime	12,328	9,332
Sodium chromate, ferrocyanide, sulphate, sulphide	27,399	14,035
Hydrochloric acid.....................	66,823	4,242
Sulphuric and sulphurous acids........	94,064	3,157
Soda, calcined	131,797	—
Copper sulphate	18,833	661
Acetic acid, lactic acid, wood spirit, acetone, &c..........................	9,622	16
Tannin extracts	15,211	8,908
Methyl alcohol, collodion, organic halogen compounds, phosgene, &c............	5,132	550
Coal tar derivatives	15,170	331
Benzene	85,478	—
Aniline	5,438	17
Aniline compounds.....................	12,580	941
Benzoyl chloride, nitrobenzene, naphthol, &c.	10,906	1,685
Spirit and denatured alcohol..........	76,841	13
Glue..................................	3,682	4,013
Gelatin, fish-glue	827	1,766
Starch, &c.	30,318	8

	Imports.	Exports.
	dz.	dz.
Logwood extract, &c.	4,186	4,792
Aniline dyestuffs	4,338	59,972
Zinc white, lithopone, &c.	13,663	63
Varnishes, lacquers, &c.	5,633	219
Linseed oil	15,499	106
Olive oil, olein, &c.	15,659	597
Liquid fats and oils, n.o.d.	30,428	171
Cocoanut oil, palm oil, &c.	29,992	21
Tallow, &c.	17,139	1,814
Petroleum	654,499	—
Solvent naphtha, &c.	19,176	790
Paraffin and ceresin	5,927	11
Rosin oil	83,358	773
Stearin, degras	7,313	1,661
Soaps	17,023	773

New Book.

TARIFF PROPOSALS OF AUSTRALIA AND NEW ZEALAND; NEW ——. Supplement to the Board of Trade Journal, Sept. 19th and 26th respectively. Price 3d. each.

THE text of the new tariff proposals of the Australian Commonwealth and of New Zealand are given side by side with the rates of duty previously in force. The Australian tariff came into force provisionally on Aug. 8th last, and that of New Zealand, on July 16th.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

20,677. Jäger. Process and apparatus for filtering. Sept. 17.

20,697. De Ferranti. Conducting gaseous endothermic reactions.* Sept. 17.

20,886. Grimwade and Roberts. Gas-fired ovens and kilns. Sept. 20.

21,010. Boult (Blair). Reverberatory furnaces.* Sept. 21.

21,204. Bennis, Bennis, and Scott-King. Separating granular material from the containing liquid. Sept. 24.

21,315. Lines. Material for withstanding extreme and sudden changes of temperature. Sept. 26.

21,346. Petersen. Packing material for reaction chambers and the like. [Ger. Appl., Sept. 27, 1906.]* Sept. 26.

21,427. Welsh and Duffy. *See under* III.

COMPLETE SPECIFICATIONS ACCEPTED.

15,974 (1906). Shaw. Apparatus for distilling water, evaporating syrups, &c. Sept. 25.

21,321 (1906). Fritz. *See under* II.

21,337 (1906). Zeitlin. Production of high vacua. Oct. 2.

23,606 (1906). Grossmann. Apparatus for evaporating at less than atmospheric pressure. Oct. 2.

121 (1907). Russell. Apparatus for washing and sterilising filtering pulp, &c. Oct. 2.

7709 (1907). Martini and Hüneke. Storage and transference of inflammable liquids. Sept. 25.

12,258 (1907). Neff and Brandes. Treatment of liquids. Sept. 25.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

20,647 to 20,649. Hartenstein. Manufacture of carbide.* Sept. 17.

20,652 to 20,654. Hartenstein. Manufacture of carbide.* Sept. 17.

20,685. Vignon. Manufacture of gas for lighting or heating. [Fr. Appl., Nov. 12, 1906.]* Sept. 17.

20,957. Kennedy. Bituminous coal gas producers. Sept. 21.

21,078. Rider. Apparatus for making fuel gas from mineral carbonates and carbonaceous material.* Sept. 23.

21,124. Marconnet. Gas producing apparatus. [Fr. Appl., Oct. 8, 1906.]* Sept. 23.

21,132. Paterson. Coal gas plant. Sept. 24.

21,224. British Thomson-Houston Co. (General Electric Co.). *See under* VII.

21,466. Yates and Kershaw. Suction gas plant. Sept. 27.

21,491. Armstrong. Suction gas producers. Sept. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

14,365 (1906). Parker. Fuel. Oct. 2.

20,484 (1906). Mason's Gas Power Co., Hollis, and Wright. Power gas producers. Sept. 25.

21,321 (1906). Fritz. Reducing power consumption in repeated creations of vacua, applicable in producing peat fuel. Sept. 25.

21,513 (1906). British Thomson-Houston Co. (Gen. Electric Co.). Manufacture of electric lamp filaments from tungsten. Oct. 2.

25,469 (1906). Green. Gas purifiers. Oct. 2.

26,819 (1906). Thwaite. Generating combustible gas. Sept. 25.

566 (1907). Farnsworth. Production of carburetted air. Oct. 2.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

21,060. McMullen. Refining crude petroleum and other hydrocarbons.* Sept. 23.

21,427. Welsh and Duffy. Distilling tar and other liquids or substances.* Sept. 27.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

21,109. Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of colouring matters of the gallocyanine series. Sept. 23.

21,366. Fiechter. Producing diazo compounds capable of uniting by means of amidosulphonic acids. Sept. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

22,872 (1906). Imray. (Meister, Lucius, und Brüning). Manufacture of concentrated liquid dyestuffs or easily liquefiable pastes from sulphurised dyestuffs. Sept. 25.

29,750 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds of the anthracene series. Oct. 2.

1946 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of 4-nitro-2-chlorodiphenylamine and its derivatives. Oct. 2.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

20,839. Römer, Seel, and Färberei A. Römer. Dyeing textile goods in hanks and pieces with alizarin dyes. Sept. 19.

21,038. Dawson. Wool washing and scouring machines. Sept. 23.

21,405. Courtauld and Co., and Wilson. Manufacture of threads, filaments, strips, or films of cellulose. Sept. 26.

Complete Specifications Accepted.

21,592 (1906). Sharp, and Sharp and Sons, Ltd. Apparatus for producing watered effects on textile fabrics. Oct. 2.

25,971 (1906). Ransford (Cassella und Co.). Manufacture of multicoloured fabrics. Sept. 25.

89A (1907). Haddan (Lumière et fils). Apparatus for making collodion filaments, artificial silk, &c. Sept. 25.

4015 (1907). Müller. Manufacture of artificial threads. Sept. 25.

6724 (1907). Fussgänger. Steaming textile fabrics. Sept. 25.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

20,580. Meister, Lucius, und Brüning. Manufacture of stable hydrosulphites. [Ger. Appl., Sept. 26, 1906.]* Sept. 16.

20,613. Duvieusart. Manufacture of hydrochlorate of ammonia, and sulphite and hyposulphite of sodium.* Sept. 16.

20,679. Meyzonnier. Manufacture of chrome alum.* Sept. 17.

20,798. Koehne. Producing high-pressure ammonia vapours.* Sept. 19.

20,868. Fischer. Manufacture of hydrogen peroxide. [Ger. Appl., Oct. 20, 1906.]* Sept. 19.

20,906. Queisser. Making hydrogen peroxide stable in admixture with other substances.* Sept. 20.

20,955. Kennedy. Converting ammonia sulphite solution into ammonia sulphate solution and free sulphur. Sept. 21.

21,147. Cottrell. Manufacture of sulphuric acid.* Sept. 24.

21,211. Szek. Ozonising apparatus. Sept. 24.

21,215. Bredig and Fraenkel. Production of cyanides, cyanamides, and nitrides from nitrogen and carbides.* Sept. 24.

21,224. British Thomson-Houston Co. (Gen. Electric Co.). Manufacture of boron and of electric incandescing bodies therefrom. Sept. 24.

21,475. Basset. *See under* XI.

Complete Specifications Accepted.

16,351 (1906). Lang and Smith. Producing hydro-oxygen gas. Oct. 2.

23,165 (1906). Sarason and Haller. Generating oxygen. Oct. 2.

23,835 (1906). Hutton and Smith. Manufacture of hydrocyanic acid and its salts. Sept. 25.

26,808 (1906). Frank. Production of pure hydrogen. Sept. 25.

4478 (1907). Schmatolla. Vertical kilns for burning limestone, &c. Sept. 25.

4728 (1907). Weinmann. Charge of calcium carbide. Oct. 2.

9553 (1907). Efford and Dabner. Lime kilns. Oct. 2.

11,559 (1907). Petersen. Preventing the denitrating action in the Gay-Lussac absorption apparatus. Sept. 25.

12,213 (1907). Eschelmann, and Ges. der Tentelewschen Chem. Fabr. Purifying the gases from pyrites burners. Oct. 2.

13,989 (1907). Häusser. Producing oxide of nitrogen by explosions. Sept. 25.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

20,964. Grimwade and Brookfield. Gas-fired potters' ovens or kilns. Sept. 21.

20,975. Oppermann. Manufacture of sheet glass.* Sept. 21.

Complete Specification Accepted.

27,564 (1906). Desgraz and Schmidt. Working gaseous fuel furnaces for treating glass, steel, &c. Sept. 25.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Complete Specifications Accepted.

22,390 (1906). Gramiccia. Fireproof building materials. Oct. 2.

24,529 (1906). Wood and Murphy. Dust laying compositions. Oct. 2.

27,747 (1906). Czigler and Eotvös. Kilns for burning bricks, lime, &c. Sept. 25.

2460 (1907). Brookes (Asbestos Wood Co.). Manufacture of compositions of a refractory character. Oct. 2.

X.—METALLURGY.

Applications.

20,622. Craig and Craig. Apparatus for washing and separating or concentrating ores, minerals, and the like. Sept. 17.

20,683. Cowper-Coles. Recovery of metals from ores, residues, &c. Sept. 17.

20,920. Burt (Currie). Magnetic ore separator. Sept. 20.

21,063. Sutton, Steele, and Steele. Dry concentration of ores. [U.S. Appl., Sept. 22, 1906.]* Sept. 23.

21,066 and 21,067. Moeller (Rosalt). Extraction of metals from ores by a wet process. Sept. 23.

21,355. Crawford. Manufacture of steel alloys. Sept. 26.

21,356 and 21,357. Crawford. Steel and other metal alloys. Sept. 26.

21,401. Steinhart and Vogel. Treatment of materials containing tin. Sept. 26.

21,428. Thomlinson. Consolidating flue dust or pulverised materials containing iron and manganese. Sept. 27.

21,455. Reinecke. Utilising foundry wastes.* Sept. 27.

21,513. Nettell and Down. Treatment of ores containing sulphides of lead, zinc, copper, and silver. Sept. 28.

Complete Specifications Accepted.

27,564 (1906). Desgraz and Schmidt. *See under* VIII.

21,440 (1906). MacIvor and Fradd. Treatment of zinc residues. Oct. 2.

21,672 (1906). Sulman. Separation of zinc from its ores or compounds. Oct. 2.

3507 (1907). Mitchell and Vigo. Soldering compounds. Oct. 2.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

20,650. Hartenstein. Electric furnaces.* Sept. 17.

21,475. Basset. Electric battery, also applicable for the manufacture of sulphuric acid. [Fr. Appl., Oct. 2, 1906.]* Sept. 27.

Complete Specifications Accepted.

13,965 (1906). De Ferranti. Electric furnaces. Sept. 25.

14,395 (1906). Marter. Insulating composition. Oct. 2.

21,667 (1906). British Thomson-Houston Co. (General Electric Co.). Treating refractory materials by the electric arc. Sept. 25.

3631 (1907). Jungner. Iron electrodes for accumulators with alkaline electrolyte. Oct. 2.

3711 (1907). Jungner. Electro-active cement-like substances of iron and nickel hydrates for forming electrodes. Oct. 2.

3834 (1907). Jungner. Production of electrodes of magnetic metals by electrolytic oxidation. Oct. 2.

5657 (1907). Petersson. Charging electric furnaces to produce carbide from lime and carbon. Sept. 25.

11,917 (1907). Rochling, Schoenawa, and Rodenhauser. Electrodes for resistance furnaces. Oct. 2.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

20,916. Schou. Manufacture of soap. Sept. 20.

21,043. Robb, Mullen, and Garnett. Cleansing material. Sept. 23.

21,189. McKerrow. Candles. Sept. 24.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Application.

20,990. Merz. Preparation of colours for painting and printing. [Ger. Appl., Sept. 24, 1906.]* Sept. 21.

Complete Specification Accepted.

6755 (1907). Plönnis. Waterproof paints. Oct. 2.

(*B.*)—Resins, Varnishes.

Application.

21,489. Lake (Rutgerswerke A.-G.). Extraction of resins or the like.* Sept. 27.

Complete Specification Accepted.

6843 (1907). Lake (Lingner). Manufacture of solid condensation products from copaiba balsam. Oct. 2.

(*C.*)—India-Rubber.

Applications.

20,695. Gottschalk. Manufacture of indiarubber. Sept. 17.

20,732. Gottschalk. Manufacture of isoprene. Sept. 18.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Complete Specifications Accepted.

20,548 (1906). Helbronner and Vallee. Treatment of ossein. Sept. 25.

5438 (1907). Stewart. Manufacture of tanning extracts. Oct. 2.

XV.—MANURES, &c.

Application.

20,575. Pohl. Manufacture of artificial manure preferably from alumina and silicic acid.* Sept. 16.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

20,865. Topf. Kiln for drying malt. [Ger. Appl., Oct. 22, 1906.]* Sept. 19.

Complete Specifications Accepted.

21,326 (1906). Hellwig. Fittings for mash tuns. Sept. 25.

25,691 (1906). Davis. Apparatus for use in brewing Sept. 25.

8372 (1907). Mertens. Chilling and carbonating beer. Oct. 2.

8800 (1907). Adlam. Apparatus for malting. Sept. 25.

15,259 (1907). Bonnard. Treatment of preserved musts or fruit juices. Oct. 2.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

20,713. Willis. Production of animal albumen or blood serum from animal blood. Sept. 18.

21,397. Thum. Refining coffee beans. [Ger. Appl., Oct. 2, 1906.]* Sept. 26.

Complete Specification Accepted.

21,139 (1906). Michaëly. Manufacture of food for animals. Oct. 2.

(*B.*)—Sanitation; Water Purification.

Applications.

21,533. Adams. Sewage purification plant. Sept. 28.

21,566. Thomson, and Oxychlorides, Ltd. Apparatus for treating sewage. Sept. 28.

COMPLETE SPECIFICATION ACCEPTED.

28,585 (1906). Boult (Bohon). Purification of sewage. Sept. 25.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

COMPLETE SPECIFICATIONS ACCEPTED.

21,171 (1906). Goldsmith, and British Xylonite Co. Manufacture of camphor. Sept. 25.

21,180 (1906). Goldsmith, and British Xylonite Co. Manufacture of camphene. Sept. 25.

942 (1907). Daege, Knoll, and Knoll. Compounds suitable for use in medicine. Sept. 25.

2565 (1907). Boult (Miersch). Obtaining aromatic sulphonic acids and their alkali salts from sulphonating mixtures. Sept. 25.

9725 (1907). Houghton. Production of monobasic organic peroxides. Sept. 25.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATIONS.

20,641. Morgan. Adhesive coating for photographic printing papers. Sept. 17.

20,740. Gateau. Photographic emulsion for pigment printing. Sept. 18.

COMPLETE SPECIFICATION ACCEPTED.

21,189 (1906). Thornton. Self-developing photographic films. Sept. 25.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

20,931. Himalaya. Manufacture of explosives.* Sept. 20.

21,116. Haddan (Lehmann). Explosive oil.* Sept. 23.

21,117. Haddan (Lehmann). Manufacture of explosive oils containing nitroglycerine.* Sept. 23.

COMPLETE SPECIFICATION ACCEPTED.

1357 (1907). Haffner. Igniting mass for matches. Oct. 2.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

COMPLETE SPECIFICATION ACCEPTED.

21,342 (1906). Ridsdale. Methods of chemical analysis. Sept. 25.

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No. 20, Vol. XXVI. OCTOBER 31, 1907. No. 20, Vol. XXVI.

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Obituary.

GEORGE ARCHBOLD.

George Archbold, M.D., Ph.D., an original member of this Society, was born at Spittal on Tweed. He was apprenticed to a local chemist, and afterwards completed his studies in London and Berlin. Devoting himself then to industrial chemistry, he first took charge of a vinegar works at Norwich, and afterwards went to Norway, where he set up a factory, under government auspices, for the industrial treatment of seaweed. Removing in 1880 to the United States, he became consulting chemist to the Government Navy Yard, where he remained for some years, during which he thoroughly reorganised the works. On leaving the government service he became identified with Kingsford's starch works at Oswego, where he shortened the period of manufacture and at the same time improved the quality of the product. He also, about the same time, patented an improvement in Mitscherlich's process for making sulphite pulp (Ber. **16**, 350; this J., 1883, 295). During the Russo-Japanese war, he was employed by the Russian Government to set up works for the manufacture of nitro-starch, on which subject he was still engaged at the time of his death. He died at New York on Sept. 16 of cancer on the liver after two years of intense suffering.

His contributions to the Society's Journal were:—Two papers on the manufacture of maize starch (this J., 1887, 80; and 1902, 4), and Cassava as a competitor of maize in the production of starch (this J., 1903, 68).

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Retort for distilling by means or with the aid of open steam. J. Grossmann, Manchester. Eng. Pat. 19,922, Sept. 7, 1906.

A horizontal cylindrical retort provided with charging and discharging openings and with a vapour-outlet, is provided with a central hollow shaft passing through stuffing-boxes at either end and rotated by gearing from without. Hollow, perforated scrapers are attached to the shaft in such a way that they scrape the interior surface of the retort, and other scrapers project from the side of the retort to scrape the shaft. Steam is supplied to one end of the hollow shaft through a stuffing-box and blows out of the hollow scrapers against the side of the retort.
—W. H. C.

Measuring fluids; Apparatus for ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 23,966, Oct. 27, 1906.

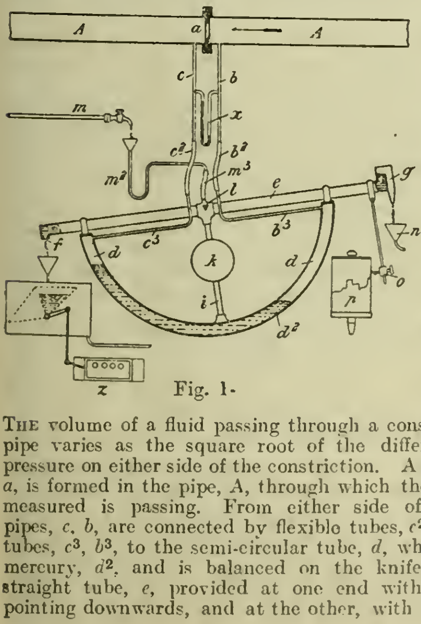


Fig. 1.

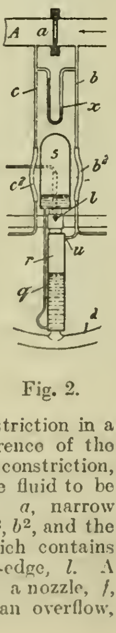


Fig. 2.

The volume of a fluid passing through a constriction in a pipe varies as the square root of the difference of the pressure on either side of the constriction. A constriction, *a*, is formed in the pipe, A, through which the fluid to be measured is passing. From either side of *a*, narrow pipes, *c*, *b*, are connected by flexible tubes, c^2, b^2, and the tubes, c^3, b^3, to the semi-circular tube, *d*, which contains mercury, d^2, and is balanced on the knife-edge, *l*. A straight tube, *e*, provided at one end with a nozzle, *f*, pointing downwards, and at the other, with an overflow, *g*, is kept full of water which enters from the tap, *m*, through the tube, m^2, and the flexible pipe, m^3. When no fluid is passing through the main, A, the pressures on both sides of the constriction, *a*, are equal, and the tube, *e*, remains in such a position that the nozzle, *f*, is above the level of the overflow, *g*, and no water runs out of the former. When however a fluid is passing through the main, the pressures on either side of *a*, are unequal and are transmitted to the tube, *d*, which tilts, and some of the water flows out of the nozzle, *f*. The amount of water is measured by the tipping apparatus and as the tilting of *c*, is proportional to the difference of pressure, which depends on the rate of flow of the fluid through A, the number, indicating the quantity of water, registered by the counter, *z*, is a measure of the amount of fluid passing through the main, A. The relation between these two quantities must be determined by experiment. If desired, the movement of the balance can be recorded on the drum, *p*, by the pen, *o*. If the pressure of the fluid in the main alters, the centre of gravity of the balance must be adjusted by moving the sliding weight, *k*, on the rod, *i*. The apparatus can be made self-adjusting as shown in Fig. 2, where two chambers, *r*, and *s*, are provided and partly filled with mercury. They are connected together by the tube, *q*, and the lower vessel, *r*, is also connected to the main, A, by the tubes, *u*, b^2, *b*, so that if the pressure in A increases, mercury is forced up into the vessel, *s*, and *vice-versa*, and the centre of gravity of the balance adjusted. The gauge, *x*, serves to indicate at any moment the difference of pressure.—W. H. C.

Measuring the flow of vapours, gases, and liquids; Process for ——. Badische Anilin und Soda Fabrik. Fr. Pat. 378,273, May 30, 1907. Under Int. Conv., June 16, 1906.

See Eng. Pat. 23,966 of 1906; preceding.—T. F. B.

Furnaces. H. H. Lake, London. From E. M. Feuerheerd, Hamburg, Germany. Eng. Pat. 2477, Jan. 31, 1907.

Powdered coal and air are fed into a chamber in which a number of concentric, perforated, rotating drums are arranged. A small space is left between the walls of the chamber and the drums, and the lower inclined walls project beneath the drums. The current of air and coal dust passes partly around and partly into and through the drums and issues from the chamber as a perfect dust cloud, which is led to the furnace.—W. H. C.

Separating liquids from gases or vapours by means of hollow tubes arranged transversely to the direction of flow; Apparatus for ——. K. Brunner and O. Bühring, Mannheim, Germany. Eng. Pat. 2909, Feb. 5, 1907.

See Fr. Pat. 374,300 of 1907; this J., 1907, 752.—T. F. B.

Inflammable liquids; Storage and transference of ——. C. Martini and H. Hüneke, Hannover. Eng. Pat. 4589, Feb. 25, 1907.

The closed tank containing the liquid is fitted with pipes in the same manner as a monte-jus or wash-bottle, and the air- or blowing-pipe is connected to a reservoir containing an inert gas. When the tank is being filled with liquid, the gas escapes to the reservoir, from which it is withdrawn by a pump and delivered into the tank to force out the liquid when the tank is required to be emptied. The same gas is used over and over again, any loss due to leakage being made good by the admission of fresh gas from a pressure-bottle or any other suitable source. —W. H. C.

Drying-stove for agglomerated combustibles or other materials. J. P. Serve. Fr. Pat. 377,477, May 3, 1907.

The materials to be dried are supported on horizontal, or inclined open-work trays or grids above a furnace in a brick chamber. Perforated brick arches are arranged above and below the grids to allow the products of combustion to pass through the materials and to escape along with the vapours driven off. Steam may be introduced into the space above the upper arch, through ports in the side of the chamber, to prevent the ignition of the vapours.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Patents.

Washing of coal and other minerals; Apparatus for the ——. J. Shaw, Kirby Moorside, Yorks. Eng. Pat. 20,305, Sept. 12, 1906.

The patent relates to improvements in the apparatus described in Eng. Pat. 13,018 of 1905 (this J., 1906, 463). The bulk of the coal is separated by a preliminary washing, and a residue from this washing, constant in quantity, is treated as previously described, thus enabling a constant water-supply to be used. The material to be washed is delivered at the upper end of an inclined trough fixed over the lower part of the conveyor and is carried downwards by water from a nozzle to a dam over which most of the washed coal is carried. The dirt with a part of the coal is carried upwards by the conveyor in practically constant quantity, through the space below the fixed trough, and is washed on the upper part of the conveyor as previously described (*loc. cit.*). The coal thus separated and carried downwards is guided by a hinged tray resting on the conveyor on to the trough in which the preliminary washing takes place.—A. T. L.

Drying peat and other materials; Construction of cylinders for ——. E. K. Carmichael and J. R. Sharman, Edinburgh. Eng. Pat. 25,913, Nov. 16, 1906.

This is a development of the invention described in Eng. Pat. 17,096, of 1903 (this J., 1904, 897). The material is fed into the central tube which is connected by radial, valved boxes to tapered tubes which fit on the ends of the outer drying tubes. At the discharge end each tube has a cylindrical sheet metal extension in which a slot is cut in such a manner that the contents are only discharged when the tube is in its lowest position.—W. H. C.

Drying stove for agglomerated combustibles or other materials. J. P. Serve. Fr. Pat. 377,477, May 3, 1907. *See* I.

Briquettes formed by an agglomerant soluble in water and rendered resistant to atmospheric influences by heat; Facilitating the penetration of heat into the interior of ——. B. Wagner. Fr. Pat. 377,557, May 7, 1907.

The briquettes are formed with a number of holes extending through them for the purpose of allowing the heat to act on the interior as well as the exterior.—W. H. C.

Coke; Manufacture of —— and ovens and apparatus therefor. J. Armstrong, London. Eng. Pat. 21,486, Sept. 28, 1906.

The coke-oven, which is circular, oval, or octagonal in plan, is constructed of such a height that sufficient pressure will be exerted by the superincumbent mass of coal to produce hard metallurgical coke. Heat is applied to the central mass of coal by means of an annular series of vertical, gas-fired heating flues, built up of grooved and tongued hollow blocks which interlock with each other, forming the inner lining of the oven. These blocks are enclosed in a body of brick-work or other masonry, having vertical air flues, a pair of these being provided for each heating flue. The arrangement is such that air enters at the lower end of the outer flue, flows up through it to near the top of the structure, passes down the inner air flue to the base of the heating flue, where it meets the gas supply, and the burning mixture flows up the heating flue to the common chimney flue at the top.—H. B.

Fuel. T. Parker, London. U.S. Pat. 865,724, Sept. 10, 1907.

Coal is heated in a closed retort, under moderate pressure and to a temperature of about 800° F., so long as illuminating gas continues to be evolved and until the mass is practically free from tarry matter, so that the product will be hard, homogeneous and capable of withstanding stacking, handling and carriage. The mass is then cooled by the introduction of steam and removed from the retort.—W. H. C.

Gas furnace; Regenerative ——. G. Hatton, Brierley Hill. U.S. Pat. 867,038, Sept. 24, 1907.

See Eng. Pat. 29,610 of 1904; this J., 1906, 10.—T. F. B.

Boiler flue waste gases; Treatment of —— and their subsequent utilization by renewal of combustion. R. Ling and W. Henry, Middlesbrough-on-Tees. Eng. Pat. 20,085, Sept. 10, 1906.

The invention consists in an improved apparatus by which flue-gases may be drawn from the main flue of two or more boilers and scrubbed and purified prior to their utilisation by re-ignition in the furnace of another boiler. The apparatus comprises two fans rotating in opposite directions, which may be readily removed from their casing for cleaning, a scrubber packed with wetted coke or wood, and a purifier which may be charged with sawdust or with lime.—A. T. L.

Gases; Apparatus for automatically analysing mixed ——, and recording the percentage therein of one of the gases. W. S. Hubbard. Eng. Pat. 19,513, Sept. 1, 1906. *See* XXIII.

Fire-damp and other gases; Apparatus for detecting and recording ——. E. A. D. Santa and E. Spelmans. Eng. Pat. 10,342, May 3, 1907. *See* XXIII.

Producer gas; Manufacture of —— and generators therefor. J. E. Dowson, London. Eng. Pat. 21,258, Sept. 25, 1906.

Atomised water, *i.e.*, water in a very fine state of division, together with a small proportion of air or exhaust gases, is passed directly into the fire, and the usual vaporiser or separate boiler is dispensed with. The generator may be of the suction or pressure type. Water and air or exhaust gases are led from a receiver to a nozzle at the base of the generator and the atomised water passes through the grate. Additional air is admitted in the usual manner. An atomising nozzle is also described which is supplied with compressed air or exhaust gases from any convenient source and draws water from a feed-tank which is preferably at a higher level but may be level with or below the nozzle.—A. T. L.

Gas generators. H. E. L. F. J. S. de Vilar, Paris. Eng. Pat. 4911, Feb. 28, 1907.

See Fr. Pat. 371,268 of 1906; this J., 1907, 310.—T. F. B.

Gas generators. J. G. L. Bormann, Charlottenburg, Germany. Eng. Pat. 10,226, May 2, 1907.

The generator is of the down-draught type with water-sealed ashpit, the air being admitted centrally at the top and the steam passing from a chamber below the grate through the lower part of the fuel to the gas-outlet, which is immediately above the grate. The improvements relate mainly to the gas-outlet which is of large area and has extensive water-cooled surfaces to avoid choking by ashes, coke-dust, and clinker. An annular boiler at the level of the grate forms the lower part of the generator shaft, and the gas-outlet is in the form of a broad slit communicating with the base of the generator and dividing the boiler into two concentric ring-shaped parts connected by water-ways, the outer part overhanging the inner and projecting into the generator shaft. The roof of the boiler slopes upwards to a steam-collecting chamber around which the gas passes before entering the main. A heavy valve in the feeding hopper is used for ramming down the fuel.—A. T. L.

Gas [illuminating]; Obtaining —— from peat. J. E. Smith, Clinton, Iowa, Assignor to National Peat Products and Chemical Co., S. Dakota. U.S. Pat. 865,537, Sept. 10, 1907.

Gas distilled from fresh dried peat is purified by passing it through dry peat, the latter being afterwards distilled with the fresh peat.—A. T. L.

Gas; Manufacture of illuminating and heating ——. G. W. Ziegler, Los Angeles, Cal. U.S. Pat. 865,624, Sept. 10, 1907.

Air is carburetted by bubbling through light oils, and the carburetted air is then enriched by passing through heavier oils or through a mixture of heavy oil and coal-tar. —A. T. L.

Gas-producer. M. V. B. Smith, New York. U.S. Pat. 865,954, Sept. 10, 1907.

The lower part of the producer is cylindrical, and the furnace chamber above the tuyères is of inverted conical shape. A central abutment rising from the bottom of the ash-pit terminates in a cone at the level of the tuyères which are directed tangentially to it. The producer is surmounted by a dome having a central feeding hopper, a number of vertical uptakes around the hopper, and poking-holes between the uptakes.—A. T. L.

Gas generator. H. Rehmann. Fr. Pat. 377,731, May 11, 1907.

The generator is provided with a rotary, water-sealed ash-pit and grate, the latter being excentrically disposed and having the form of two or more conical bodies, beneath which the blast and steam supplies are delivered. The refractory lining of the combustion chamber is constructed with several vertical channels, communicating at both top and bottom with the interior of the chamber, whereby the volatile matters expelled from the freshly-charged fuel are led down into the incandescent zone. Scraping devices are provided for preventing the adhesion of clinker to the walls, for feeding the ashes over the grate into the ash-pit, and for keeping loose the fuel in the lower part of the charging hopper.—H. B.

Gas-purifier; Centrifugal ——. F. V. Matton, Riverton, N.J., Assignor to Camden Iron Works, Camden, N.J, U.S. Pat. 866,375, Sept. 17, 1907.

This centrifugal gas-purifier comprises a number of fans mounted on a rotating shaft. The fans are inclosed in a casing, which is divided by a partition or partitions into two or more chambers, each of which is occupied by a fan. Communication is maintained between the chambers, by a central opening in the partition. Each fan consists of a central plate, to the sides of which vanes are attached, the vanes on one side being shorter than those on the other side. In the upper part of the partition, is a vertical passage communicating with a supply-pipe, whereby water or other liquid may be discharged across the central opening through which communication is established between the chambers.—W. C. H.

Gas; Process and apparatus for purifying ——. H. Riché. Fr. Pat. 377,628, May 10, 1907.

The apparatus, which is designed for the treatment of washed gas, to remove water vesicles, etc., from it, consists of one or more horizontal chambers through which the gas is passed, each chamber containing a series of vertical, perforated metal plates, spaced apart and kept in position by means of wooden frames. The gas, on flowing through the perforations, is subjected to a frictional purification, the intensity of the frictional action being varied as desired by raising or lowering the level of a stationary body of water in the lower part of each chamber; by this means the number of perforations available for the passage of the gas is varied.—H. B.

Gas washer. E. Bardot. Fr. Pat. 377,818, May 14, 1907.

Upon a horizontal rotary shaft are fixed a circular brush, constructed of radially disposed bristles, and a drum of perforated sheet metal, filled with crushed coke. These rotate within a horizontal cylindrical casing, through which the gas to be purified flows and which is filled with water to a little above the level of the shaft. The gas is thus forced to pass through the upper parts of the rotary brush and drum, which are continuously wetted and cleansed as they move through the water. The inner end of the rotary shaft is fitted with an Archimedean screw, which sets up a circulation of the water by forcing it out through the back of the casing into two external pipes, that deliver it into the casing again at the front; these two pipes are provided on the exterior with numerous radial ribs, acting as radiators to facilitate the atmospheric cooling of the water during its passage from the back to the front of the apparatus.—H. B.

Mantles; Immersion baths [stiffening fluid] for incandescent ——. W. P. Thompson, Liverpool. From R. Eisenmann, Berlin. Eng. Pat. 15,536, July 5, 1907.

As a substitute for the camphor usually employed, in the collodion with which incandescent mantles are stiffened, there are used the following substances:—compound esters, aldehydes, and nitro-compounds of aromatic substances (*e.g.*, ethyl oxalate, ethyl stearate; benzaldehyde, heliotropin; nitrobenzene, *o*-nitrotoluene), and certain ketones (acetophenone), substituted amides (acetanilide), and mixtures of these substances.—H. B.

Incandescent lamps with wolfram incandescent bodies; Manufacture of ——. Cons. f. Elektrochem. Ind., Nürnberg, Germany. Eng. Pat. 3938, Feb. 16, 1907. Under Int. Conv., Feb. 21, 1906.

See Fr. Pat. 374,659 of 1907; this J., 1907, 863.—T. F. B.

Filaments for incandescent electric lamps. H. H. Lake, London. From Parker Clark Electric Co., New York. Eng. Pat. 7637, March 30, 1907.

See Fr. Pat. 376,412 of 1907; this J., 1907, 1002.—T. F. B.

Niobium and tantalum; Preparation of —— and application of these metals to the manufacture of filaments for incandescence lamps. G. C. Bouhard. Fr. Pat. 377,931, April 30, 1907. *See* XI*B*.

Filaments for incandescence electric lamps; Manufacture of —— from tungsten or tungsten alloy. Siemens und Halske A.-G. Fr. Pat. 377,846, May 15, 1907. Under Int. Conv., May 19, 1906.

An oxide of tungsten which is a conductor of electricity at the ordinary temperature is mixed into a paste with metallic tungsten powder and ammonium tungstate; the paste is then dried and pulverised. To prepare filaments from the powder thus obtained, it is moistened with water, moulded into the desired forms, and heated until reduced to metallic tungsten by means of an electric current in an atmosphere of hydrogen.—H. B.

Filaments for incandescence electric lamps: Metallic —— and their process of manufacture. Glühlampen-Fab. Union, Albrecht und Bahr. Fr. Pat. 378,022, May 22, 1907.

Threads of celluloid or nitrocellulose are exposed to the vapours of chloride or oxychloride of tungsten or molybdenum, whilst heated to a high temperature in an exhausted vessel. A mixture of carbon dioxide and hydrogen is preferably introduced into the vessel at the same time. The filaments so produced are now impregnated with "a solution of chloride of silver in hot water" or with the fused chloride, and finally are again exposed to the vapours of the chloride or oxychloride of tungsten or molybdenum, with simultaneous introduction of hydrogen and passage of an electric current.—H. B.

Air-free space [exhausting lamp bulbs]; Process for producing an ——. P. Friedrich. Fr. Pat. 377,719, May 11, 1907. Under Int. Conv., Aug. 29, 1906.

In order to remove the last traces of air from incandescence lamp bulbs, after exhaustion has been carried as far as possible by means of pumps, there is introduced into the bulbs a small quantity of the vapour of an organic compound such as fluorene, anthracene or phenanthrene, which in presence of the incandescent filaments is capable of combining with the oxygen present, the organic compound used having so high a boiling point that, after condensation of the vapour, it remains as a non-volatile deposit inside the lamps at the highest temperature attained during use. Preferably the organic substance to be employed is introduced into a tubular prolongation of the bulb to be exhausted, and after the air has been pumped out, the compound is volatilised by heat, whilst a current is passed through the lamp.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Phenol : Action of sulphuric acid on ——. J. Obermiller. Ber., 1907, **40**, 3623—3647.

The author has investigated the products of the action of sulphuric acid on phenol, and especially the conditions underlying the formation of the *o*- or *p*-sulphonic acid respectively. For the separation of these two acids, use was made of the different solubilities of their mono-barium salts (sulphonic acid salts) and of their mono- and di-magnesium salts. Experiments showed that the proportion of phenol-*o*-sulphonic acid in the reaction-product is greatest when the total yield of sulphonated compounds is least, *i.e.*, at a low temperature and with as weak sulphuric acid as possible. If the reaction-product be heated to 100°—110° C., the ortho acid is converted into the para-compound, but the author is unable to confirm Kekulé's statement that the same transformation takes place on boiling the aqueous solution of the ortho-acid. By using a larger excess of sulphuric acid in the sulphonation process, phenol-2·4-disulphonic acid is also formed. Evidence was obtained in the course of the experiments of the formation of another disulphonic acid and of a third monosulphonic acid, but these acids were not isolated. A ready means of distinguishing between mono- and poly-sulphonic acids of phenol is afforded by the colour-reaction with ferric chloride, which is violet with the mono-acids, and red with the poly-sulphonic acids. In order to obtain the largest yield of phenol-*o*-sulphonic acid (2 parts of *o*-acid to 3 parts of *p*-acid, with a total yield of 95 per cent.), 200 grms. of phenol are melted, and mixed, at 35—40° C., with 100 grms. of sulphuric acid monohydrate (100 per cent. H_2SO_4), then cooled to about 20° C., and 200 grms. more of sulphuric acid added. After standing for 6—8 hours at this temperature, and stirring, the mass is poured into at least 1·5 litres of water, most of the excess of sulphuric acid precipitated by lead carbonate, and after filtering, the *o*- and *p*-sulphonic acids separated by a series of precipitations and crystallisations of the barium and magnesium salts. The mono-barium salt (sulphonic acid salt) and the dimagnesium salt of the *o*-acid are less soluble than those of the *p*-acid, whilst the reverse is the case with the monomagnesium salts of the two acids.

It is also shown that "aseptol" which is sold as a 33 per cent. aqueous solution of phenol-*o*-sulphonic acid, is really a solution of the impure para-acid containing about 6 per cent. of the *o*-acid.—A. S.

Benzoic acid from coal tar ; Product obtained during the manufacture of ——. G. Goldschmiedt. Monatsh. Chem., 1907, **28**, 1091—1097.

In the manufacture of benzoic acid from the carbolic oil fraction obtained from the distillation of coal tar (this J., 1899, 755), the oil is first treated with caustic soda lye. It is then agitated, and steam is passed in for several hours. In this way an alkaline liquid containing sodium benzoate remains behind; on treating this with acid, benzoic acid separates and is then distilled. After most of the benzoic acid has been distilled off, a distillate boiling at over 200° C. is obtained. This distillate is treated with a 15 per cent. solution of sodium hydroxide. The product obtained contains small quantities of free phenols, benzoic acid, and cumarone, but consists chiefly of the benzoic ester of 1.3.4.-xylenol. 1.3.4.-Xylenol is thrown down with the benzoic acid during its manufacture from the coal tar oil, and in the subsequent distillation, the excess of acid present produces the esterification.—C. E. F.

Naphthenes ; Qualitative reaction for ——. K. V. Charitschkow. *See* XXIII.

Patent.

Pyroligneous products ; Process and apparatus for obtaining directly ——. Pagès-Camus et Cie. First Addition, dated July 5, 1906, to Fr. Pat. 375,314, May 10, 1906 (this J., 1907, 920.)

The products of distillation of wood are first passed through a tar separator and then through a series of tubular condensers which may, if desired, be provided with separators. The tubes of each condenser are surrounded by a bath of liquid which boils at a predetermined temperature. The temperatures are arranged so that the different products are condensed and collected separately.—W. H. C.

IV.—COLOURING MATTERS AND DYESTUFFS.

Mordant dyestuffs. R. Möhlau. Chem.-Zeit., 1907, **31**, 940.

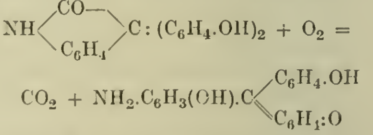
A dyestuff is capable of dyeing mordants when it contains a hydroxyl group in a neighbouring position to the chromophore. 1.4.5.-Trihydroxyanthraquinone and 1.4.5.8.-tetrahydroxyanthraquinone do not at first appear to be as good mordant dyestuffs as quinizarin, but this anomaly is due to the insolubility of these compounds in water. The dyestuffs mentioned act as good mordant dyestuffs if pyridine is used as a solvent, especially on chromium, bismuth and iron mordants.—C. E. F.

Azo-compounds ; Influence of hydroxyl ions on the formation of ——. G. Heller. Chem.-Zeit., 1907, **31**, 923.

Whilst phenoldisazobenzene and phenolazobenzene are the products of the decomposition of benzenediazonium-chloride by means of sodium hydroxide, phenoltrisazobenzene is formed if anthranil, phenol or quinoline are present in addition to some sodium hydroxide. The presence of pyridine or diethylamine does not favour the formation of phenoltrisazobenzene. When the sodium hydroxide is too concentrated (greater than *N*/2), there is no formation of phenoltrisazobenzene.—C. E. F.

Phenol-isatins ; Oxidation of ——. C. Liebermann and N. Danaila. Ber., 1907, **40**, 3588—3597.

When phenol-isatin is oxidised with potassium ferricyanide in alkaline solution, *o*-aminoaurine is formed, to which the name "Isatin-red" is given.



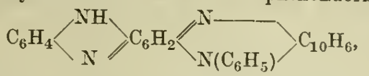
$$NH\left<\begin{matrix}CO—\\C_6H_4\end{matrix}\right>C:(C_6H_4.OH)_2 + O_2 =$$

$$CO_2 + NH_2.C_6H_3(OH).C\left<\begin{matrix}C_6H_4.OH\\C_6H_4:O\end{matrix}\right.$$

Similar dyestuffs are obtained from phenolmono- and di-chloro- or bromo-isatin. They are all amorphous, orange powders, insoluble in water or benzene, but readily soluble in cold alcohol or glacial acetic acid. Their solutions in alkalis or concentrated sulphuric acid are redder than those given by aurine. The dyestuffs have no technical value.—J. C. C.

Safranones ; Action of hydroxylamine on ——. O. Fischer and F. Römer. Ber., 1907, **40**, 3406—3411.

The aminoisorosindone produced by the action of hydroxylamine on isorosindone, which was formerly regarded as the symmetrical compound (this J., 1906, 1213), is now shown to be asymmetric, for the methoxy-isorosindone derived from it is not identical with the methyl ether of naphthosafranol. A further proof is afforded by the fact that *o*-aminoisorosindone condenses with *o*-phenylenediamine to form a naphthofluorindone,

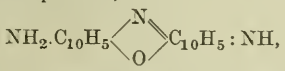


$$C_6H_4\left\langle\begin{matrix}NH\\N\end{matrix}\right\rangle C_6H_2\left\langle\begin{matrix}N\text{———}\\N(C_6H_5)\end{matrix}\right\rangle C_{10}H_6,$$

which is very sparingly soluble in the ordinary solvents, but dissolves readily in glacial acetic acid with a pure blue colour. The phenyl-derivative, obtained by condensing *o*-aminoisorosindone with *o*-aminodiphenylamine, dyes from an acetic acid solution in bluish-green shades which are comparatively fast to light. The authors find that the amino-group is introduced into the safranones only when both ortho positions with respect to the quinone-oxygen atom are free.—J. C. C.

Oxazine dyestuffs. R. Nietzki and V. Becker. Ber. 1907, **40**, 3397—3400.

The dihydrochloride of 1 : 4-diamino-2-naphthol (obtained by reducing the azo-compound from diazosulphanilic acid and 1-amino-2-naphthol) (20 grms.) is suspended in alcohol (250 c.c.) and heated to boiling. Sodium acetate (20 grms.) is now added, and the mixture boiled for half an hour, a current of air being passed through during the process. A sparingly soluble blue dyestuff separates out, which has the composition,

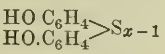


$$NH_2.C_{10}H_5\left\langle\begin{matrix}N\\O\end{matrix}\right\rangle C_{10}H_5 : NH,$$

and is therefore diaminonaphthoxazone, the simplest Nile Blue of the naphthalene series. It is very sparingly soluble in the usual organic solvents and dyes tannin-mordanted cotton, but the colour is easily turned red by alkalis. The disulphonic acid of this dyestuff is obtained by heating 1 : 4-diamino-2-naphthol-6-sulphonic acid with water and weak alkalis. It is sparingly soluble in water, and dyes wool blue from an acid bath.—J. C. C.

Sulphide dyestuffs ; Constitution and synthesis of —— from diphenylamine derivatives. R. Möhlau. Chem.-Zeit., 1907, **31**, 936—937.

According as sodium polysulphide acts on nitrohydroxydiphenylamine or aminohydroxydiphenylamine derivatives, black dyestuffs (such as Immedial Black) or blue dyestuffs (such as Immedial Pure Blue) are obtained (this J., 1904, 782). The author seeks to show what function is played by the sulphur in such compounds. By heating phenol with sodium polysulphide at 100—115° C., until there is no further evolution of sulphuretted hydrogen, the following reaction takes place :—$2C_6H_6O + S_x = C_{12}H_{10}O_2S_{x-1} + H_2S$, where x depends on the amount of sulphur in the polysulphide used but is not greater than 8. The substances formed are yellow amorphous powders, insoluble in water, soluble in pyridine, phenol, and alkali hydroxides and carbonates. They give sulphur dyestuffs when oxidised along with dialkyl-*p*-phenylenediamine-thiosulphonic acid, and are probably *o*-dihydroxydiphenyl-polysulphides,



$$\begin{matrix}HO\ C_6H_4\\HO.C_6H_4\end{matrix}\!>\!S_{x-1}$$

—C. E. F.

Nyctanthes Arbor-tristis ; New colouring matter from ——. E. G. Hill and A. P. Sirkar. Chem. Soc. Trans., 1907, **91**, 1501—1505.

Nyctanthes Arbor-tristis (Urdu, *harsinghar*), a large shrub belonging to the N. O., *Oleaceæ*, grows abundantly in the sub-Himalayan districts. A solution obtained by boiling the flowers with water, and straining, is used for dyeing cotton. When used in conjunction with alum and lime-juice, it gives a bright yellow colour. It is employed chiefly in combination with turmeric and safflower, and sometimes with indigo and *Butea frondosa.* The colouring matter was isolated by treating the aqueous extract of the flowers with about 1 per cent. of hydrochloric acid, and warming gently for several hours. The precipitate was filtered off, boiled with alcohol, again filtered, and the filtrate heated gently with about 1 per cent. of hydrochloric acid. The red colouring matter thus precipitated was filtered off, washed with alcohol and water, and purified by crystallisation from pyridine or phenylhydrazine. It melts at 225°—230° C., is practically insoluble in water, very sparingly soluble in ether, benzene, alcohol and light petroleum, moderately so in toluene, and easily soluble in pyridine and phenylhydrazine. It dissolves in alkalis to a yellow solution, from which the red substance is reprecipitated by acids. Analyses of the new substance, for which the name, *nyctanthin*, is proposed. and of its acetyl derivative, point to the formula, $C_{20}H_{26}O_3.OH$. Mannitol was also isolated from the alcoholic extract of the flowers.—A. S.

Fluorescence phenomena of 2-methyl-3-aminoquinoline and 2-methyl-3-amino-4-hydroxyquinoline. Use of 2-methyl-3-aminoquinoline as an indicator. O. Stark. Ber., 1907, **40**, 3434.

The relationship between fluorescence and dissociation is indicated by the fact that fluorescence is more pronounced in dilute than in strong solutions. Further evidence in support of this view is that pure aqueous solutions of 2-methyl-3-aminoquinoline and 2-methyl-3-amino-4-hydroxyquinoline do not fluoresce in any stage of dilution, the free compounds not undergoing dissociation. In the case of 2-methyl-3-aminoquinoline, fluorescence only occurs in acid solutions, so that this compound forms dissociable salts only with acids. With 2-methyl-3-amino-4-hydroxyquinoline, on the other hand, fluorescence takes place both in acid and alkaline solution, which indicates the formation of dissociable salts with both acids and alkalis. Excellent results may be obtained with 2-methyl-3-aminoquinoline as an indicator, especially as a substitute for methyl orange in the titration of ammonia. About 10 drops of a solution of 0·5 grm. in 10 c.c. of alcohol are added to about 500 c.c. of the liquid to be titrated. In each case the excess of free acid should be titrated, and the end-point of the reaction is shown by the disappearance of the blue fluorescence. One drop of $N/10$ alkali solution in excess is sufficient to produce this result.—C. A. M.

Agglutination from the physical standpoint. IV. The flocculation of aniline dyestuffs. O. Teague and B. H. Buxton. Z. physik. Chem., 1907, **60**, 469—488.

The following dyestuffs were experimented upon : Eosine, Alizarin Red, Alkali Blue, Aniline Blue (soluble), Congo Red, and Azo Blue on the one hand, and Methylene Blue, Safranine, Bismarck Brown, Night Blue, Neutral Red, Chrysoidine and Nile Blue on the other. The authors find that :—(1) When the flocculation of solutions of dyestuffs is effected by means of an electrolyte, there is no point, on increasing the concentration of the latter, at which flocculation does not take place, such as has been observed in experiments on other substances. (2) When, however, a solution of an acid dyestuff is treated with one of a basic dyestuff, such a point is always observed. Thus, complete precipitation takes place when the proportions are 2 parts of Azo Blue to 1 part of Neutral Red, or 3 parts of Night Blue to 2 parts of Eosine, or equal parts of the latter and Bismarck Brown. (3) Dyestuffs show great differences in their colloidal properties, but the colloidal condition does not appear to depend solely on the size of the molecule. (4) Dyestuffs behave with agar-agar or filter paper exactly as they do towards cotton. (5) Dyestuffs can be diffused through agar-agar by an electric current ; acid dyestuffs travel towards the anode and basic ones to the cathode. The rate is slower or quicker according as to whether the medium is dyed or not. (6) In mixtures of two dyestuffs such as are mentioned in (2), even when flocculation does not take place, the dyestuffs are still combined together, although in some cases incompletely.—J. C. C.

Agglutination from the physical standpoint. V. The phenomenon of the fore-zone. O. Teague and B. H. Buxton. Z. physik. Chem., 1907, **60**, 489—506.

An optimum concentration exists for the flocculation of mixtures such as are described in the preceding abstract, and therefore if one constituent is present in greater concentration than is required for this point, the precipitate is dissolved. This state is called the fore-zone (" Vorzone "). In mixtures of Azo Blue and Neutral Red, for example, a very slight excess of the former, but a large excess of the latter is required to redissolve the precipitate, and the authors find that this difference is due to the colloidal states of the dyestuffs. The "zone" of optimum concentration is very narrow for a mixture of two highly colloidal dyestuffs, the slightest excess of either serving to dissolve the precipitate. When a highly colloidal dyestuff is precipitated by one only slightly so, a very small excess of the former, but a large excess of the latter is required for re-solution. In the case of two slightly colloidal dyestuffs, the precipitation is incomplete, and a large excess of either dyestuff is necessary for re-solution. The existence of the fore-zone or its extent is not influenced by the constitution or by the electric charge of a dyestuff.—J. C. C.

Colouring matters; Effect of —— on some of the digestive enzymes. H. W. Houghton. *See* XVIIIA.

Indian indigo industry. Oil, Paint, and Drug Rep., Sept. 23, 1907. [T.R.]

The year 1906–07 has brought some encouragement to indigo planters. The results obtained from the Java-Natal seed have left no doubt as to its superiority, and a larger area has been sown with it for the coming season. In Bihar the first crop was destroyed by floods, but the quality of the later product was exceptionally good. Prices both in Calcutta and London consequently hardened about 12 per cent. One element of strength in the recent demand for indigo has been the activity of iron and machinery trades and the large consumption of indigo-dyed clothing commonly worn in engineering shops. The following statement shows the exports of indigo in 1906–07, and the five previous years:—The total ten years ago was 189,500 cwts., with a value of Rs. 4.37 crores*, and that was about 19 per cent. below the value for the previous year. 1901–02, 89,750 cwts., Rs. 1,85,22,554; 1902–03, 65,377 cwts., Rs. 1,20,56,819; 1903–04, 60,410 cwts., Rs. 1,07,62,026; 1904–05, 49,252 cwts., Rs. 83,46,073; 1905–06, 31,186 cwts., Rs. 58,63,777; 1906–07, 35,102 cwts., Rs. 70,04,773. The exports to the United Kingdom improved by some 2·5 per cent. to 7,942 cwts., and the Continent of Europe increased its demand very slightly to 7,063 cwts. Egypt still retains the first place, but with a reduced total of 9,195 cwts., and the purchases for the United States fell off from 1,530 to 1,258 cwts. Japan and Persia are the two countries that have shown a marked recovery in the past year. In place of 242 cwts. in 1905–06, Japan took 1,600 cwts. with a value of Rs. 2.93 lakhs; and Persia in place of 1,676 cwts. took 2,422 cwts. with a value of Rs. 4.3 lakhs. These mark quantitative increases of 661 per cent. and 44·5 per cent. on the year; but it must be remembered that in 1905–06, the Persian figures showed a decline of nearly 56 per cent., while the exports to Japan five years ago amounted to 5,710 cwts. The effect of the year's results are indicated by an increase of 18 per cent. in the area placed under the crop for the current season. In Madras the total area is now only 1 per cent. below the average of the five years ending 1904–05, but the total shortage in Bengal, Madras, the United Provinces and the Punjab is 38 per cent. The total yield in these four provinces was estimated in December, 1906, at 60,700 cwts., and it is understood that the return has been fully up to expectation. (See also this J., 1907, 15.)

Patents.

2-Amino-5-naphthol-7-sulphonic acid; Manufacture of arylated derivatives of ——, and arylated derivatives produced thereby. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 19,962, Sept. 7, 1906.

When 2-amino-5-naphthol-7-sulphonic acid is heated with the hydrochloride or equivalent halogen salt of a primary aromatic base, together with the free base, ammonia is eliminated, and the amino group of the naphtholsulphonic acid becomes arylated. The temperature at which the reaction takes place is stated to be between 100° and 200° C.—T. F. B.

Triphenylmethane dyestuff and process of making same. W. Herzberg, Berlin, and O. Scharfenberg, Schöneberg, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 866,359, Sept. 17, 1907.

See Fr. Pat. 369,696 of 1906; this J., 1907, 194.—T. F. B.

p-Amino-p′-oxy-[hydroxy-]diphenylamine; Method of production of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 377,866, May 16, 1907.

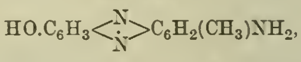
An aqueous solution of *p*-phenylenediamine and phenol is oxidised by means of a solution of sodium hypochlorite in presence of a small quantity of a copper salt, and the resulting indophenol is reduced by sodium sulphide. The yield of *p*-amino-*p*′-hydroxy diphenylamine is stated to be almost quantitative.—J. C. C.

Anthracene derivatives; Manufacture of new ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,429, Nov. 1, 1906.

o-Diaminoanthraquinones, one of the amino groups of which is substituted with an aryl group, may be condensed with aldehydes, the compounds formed being probably azines. When sulphonated, sulphonic acids are obtained, the salts of which are soluble in water and dye wool from acid baths in fast blue to green shades. 10 parts of a 40 per cent. solution of formaldehyde are added to a mixture, heated to 100° C., of 10 parts of 1-*p*-tolylamino-2-aminoanthraquinone and 100 parts of glacial acetic acid; the dyestuff separates from the mixture on cooling, and is purified and sulphonated in the usual manner.—T. F. B.

Sulphur dyestuff; Reddish-brown ——. F. Lehmann, Vohwinkel, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 866,939, Sept. 24, 1907.

Aminohydroxytoluphenazine,



$$HO.C_6H_3\overset{N}{\underset{N}{<>}}C_6H_2(CH_3)NH_2,$$

when melted with sulphur and an alkali sulphide at 135° C., yields a dark brown powder which dyes unmordanted cotton from a sodium sulphide bath in very fast reddish-brown shades. These remain brown on treatment with copper salts.—J. C. C.

Sulphide colours [dyestuffs]; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 3279, Feb. 9, 1907.

By heating a mixture of *m*-toluylenediamine and *p*-phenylenediamine with sulphur, a compound is obtained which, on heating with concentrated alkali or alkali sulphide solutions until soluble in water, is converted into sulphide dyestuffs, dyeing cotton fast "yellow-olive" shades from sulphide baths. The intermediate compound may also be produced by heating the thiotoluylenediamine (obtained from *m*-toluylenediamine and sulphur) with *p*-phenylenediamine.—T. F. B.

Colouring matters for dyeing wool; Manufacture of new ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 17,610, Aug. 1, 1907.

Dyestuffs which dye wool blue shades fast to washing and light, are obtained by heating α-naphthylamine-4.6.8-trisulphonic acid with an alkaline solution of sulphur or with an alkali sulphide, thiosulphate, or hydrosulphite, and oxidising the product by air or other oxidising agent. A solution of 100 grms. of sulphur in 4 kilos. of 50 per cent. caustic soda solution is heated to 150° C., and 1·35 kilos. of the naphthylaminesulphonic acid added; the temperature is then kept at 165° to 170° C. until the melt has become a thin liquid, when it is poured into water and acidified; when it is cool, the sulphur and excess of naphthylaminesulphonic acid are filtered off, and oxidation is completed by blowing air through the solution.—T. F. B.

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* Crore = 10,000,000 rupees.

Thio-indigo dyestuffs; Process of preparation of ——. Kalle und Co. Fr. Pat. 378,406, June 1, 1907. Under Int. Conv., Mar. 5, 1907.

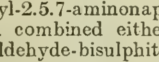
Dyestuffs belonging to the thio-indigo group are obtained by condensing equimolecular proportions of α-hydroxythionaphthene or its halogen derivatives and α-isatin chloride or its halogen derivatives in presence of benzene or other solvents. The dyestuffs produce bright reddish-blue shades on wool or cotton.—J. C. C.

Substantive [*azo*] *dyestuffs fast to acids; Process of making ——.* Farbwerke vorm. Meister, Lucius, und Brüning. First Addition, dated April 25, 1907, to Fr. Pat. 376,868, April 18, 1907. (See Eng. Pat. 9548 of 1907; this J., 1907, 960.)

Dyestuffs obtained by combining diazo compounds with *m*- or *p*-aminobenzoyl-2.5.7-aminonaphtholsulphonic acids are diazotised, and combined either with the addition product of formaldehyde-bisulphite and 2.5.7-aminonaphtholsulphonic acid, or with the urea derivative of this acid, obtained by its interaction with potassium cyanate. The dyestuffs dye cotton brilliant red shades. —T. F. B.

Dyestuffs; Process for the manufacture of brown vat ——. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 377,540, May 6, 1907. Under Int. Conv., Feb. 23, 1907.

Naphthylthioglycol-*o*-carboxylic acids are obtained from 1 : 2- or 2 : 1-naphthylaminesulphonic acids in the following way:—1-Naphthylamine-2-sulphonic acid is converted by the diazo reaction into the corresponding cyanonaphthalenesulphonic acid, which is heated with phosphorus pentachloride and phosphorus oxychloride, whereby the cyanonaphthalenesulphonic chloride is produced. This is reduced to the cyanothionaphthol, $CN.C_{10}H_6.SH$, by dilute sulphuric acid and zinc, and treated with sodium chloroacetate in caustic alkaline solution. From the product, naphthyl-2-thioglycol-1-carboxylic acid is obtained by repeated crystallisation from water. It separates in white needles melting at 93° C. This acid is converted into the dyestuff: (1), by heating it with alkalis or glacial acetic acid to form hydroxythiophenethrenecarboxylic acid,



$$\begin{array}{l}C_{10}H_6.C.OH\\ \;|\qquad\;\;\|\\ S\text{———}C.CO_2H\end{array}$$

or, by heating the alkaline solution of the latter, hydroxythiophenethrene, both of which are transformed into the dyestuff by oxidation with potassium ferricyanide in alkaline solution; or (2), by heating it with nitrobenzene, sulphur, sodium bisulphite or sodium thiosulphate. 2-Naphthylamine-1-sulphonic acid yields corresponding products by the same series of reactions. The dyestuffs produced give fast brown shades on cotton and wool when dyed from the vat.—J. C. C.

Dyestuffs; Production of finely-divided ——. Badische Anilin und Soda Fabrik. Fr. Pat. 377,533, May 6, 1907. Under Int. Conv., April 4, 1907.

Solutions of dyestuffs, or of their leuco- or hydro-derivatives, are forced through an atomiser into a large chamber, whereby they are converted into extremely fine drops, and in this condition are brought into contact with the precipitating or oxidising agent; this may be air or steam or an oxidising solution in a similarly finely-divided state, and is forced into the chamber so that it passes horizontally above the opening of the pipe delivering the dyestuff, etc. Special reference is made to the precipitation of indigo from a solution of phenylglycine-*o*-carboxylic acid, whereby the finely-divided state of the dyestuff renders it more easily attacked by reducing agents.—J. C. C.

Anthracene derivatives and dyestuffs [*benzanthrones*] *and their application in dyeing and printing; Production of a series of ——.* Badische Anilin und Soda Fabrik. Tenth Addition, dated May 10, 1907, to Fr. Pat. 349,531, Dec. 21, 1904. Under Int. Conv., April 18, 1907.

Amino derivatives of benzanthrone or of benzanthronequinoline (see this J., 1905, 726) are converted, by heating with copper salts, into condensation products, probably azines, which possess the property of dyeing, from the vat, fast shades varying from yellow to brown or red-brown. The new dyestuffs are very slightly soluble in organic solvents.—T. F. B.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Dyestuffs on vegetable fibres; Identification of ——. A. G. Green, H. Yeoman, J. R. Jones, F. G. C. Stephens, and G. A. Haley. J. Soc. Dyers and Col., 1907, 23, 252—255.

The method differs in many respects from that used for the identification of dyestuffs on animal fibres (this J., 1905, 1034), mainly owing to the difference between the affinity of dyestuffs for animal and vegetable fibres respectively, and the effect of mordants on the properties of the dyestuffs. The dyed fibre is boiled with caustic soda solution to remove any tannin mordant, the alkali solution being saturated with sodium chloride to prevent it from stripping the dyestuffs. Basic dyestuffs are left in the form of free colour bases, which can be easily stripped by boiling with dilute acetic, or preferably, formic acid. Some mordant dyestuffs, such as Turkey Red, are partially decomposed by the saline alkali solution, and the formic acid extract will then not have the colour of the dyed fibre. If the colour is appreciably stripped, therefore, a solution of tannin is added to the acid extract, when a coloured precipitate is produced if basic dyestuffs are present. In the reduction test with hydrosulphite, it is best, in the case of basic and acid dyestuffs, to transfer the dyestuffs to wool, and carry out the tests with hydrosulphite and persulphate on this fibre. This transference to wool affords a means of distinguishing the dyestuffs of the Gallocyanine series and the "Chrome" dyestuffs of the Rosaniline series from basic dyestuffs, since the former are not transferred to wool by the method used. With colours other than acid and basic dyestuffs, the reduction and oxidation tests are performed on the cotton fibre itself, and in order to accelerate the reduction, a small quantity of anthraquinone is added to the hydrosulphite solution. Sulphide colours are identified by the stannous chloride test (this J., 1907, 467), but "Salt colours" must be first removed, as some of these also evolve hydrogen sulphide in the test.

Reagents.—Dilute ammonia (1 : 100); dilute caustic soda (10 grms. in 100 c.c. of water); saline caustic soda (10 c.c. of 35—40 per cent. caustic soda solution to 100 c.c. of a saturated solution of sodium chloride); weak formic acid (1 c.c. of 90 per cent. acid to 100 c.c. of water); dilute hydrochloric acid (5 c.c. of 30 per cent. acid to 100 c.c. of water); soap solution (10 grms. in 300 c.c. of water); tannin solution (10 grms. and 10 grms. of sodium acetate in 100 c.c. of water); a solution of bleaching powder at 5° T.; Hydrosulphite A (a 10 per cent. solution of Hydrosulphite NF or of Hyraldite, or a 5 per cent. solution of Hydrosulphite NF conc. or of Rongalite); Hydrosulphite B. (200 c.c. of hydrosulphite A slightly acidified by addition of 1 c.c. of glacial acetic acid); hydrosulphite X (50 grms. of Rongalite in 125 c.c. of hot water, mixed with 1 grm. of anthraquinone ground with a little of the Rongalite solution, and the whole heated at 90° C. for 1—2 mins., diluted to 500 c.c. and acidified with 1·5 c.c. of glacial acetic acid); a cold saturated solution of potassium persulphate or a 2 per cent. solution of ammonium persulphate; a solution of 100 grms. of stannous chloride, 100 c.c. of 30 per cent. hydrochloric acid, and 50 c.c. of water.

Procedure.—The reactions are performed in test-tubes with pieces of material about ½—¾ in. square, which are covered with 1½—2 ins. of the reagent. In the case of cotton and wool or cotton and silk unions, the weft is separated from the cotton warp, and both are tested. *Stripping test for acid dyestuffs.*—As a few "salt dyestuffs" are partially stripped by weak ammonia, a small piece of white cotton is introduced with the reagent, when if the dyestuff is an acid one, the cotton is either not tinted or becomes white on boiling a second time with weak

TABLE I.—YELLOW and ORANGE COLOURS.

<table>
<tr><td colspan="20">Boil with Weak ammonia (1:100)</td></tr>
<tr><td colspan="3">The colour is stripped. Boil with acidified water and small piece of white wool</td><td colspan="17">The Colour is not stripped. Boil for half minute with Saline caustic soda, rinse and boil twice with Weak formic acid (1:100)</td></tr>
<tr><td rowspan="5">Colour not transferred to the wool and Sn present in ash</td><td colspan="2">Colour is transferred to the wool:—Acid dyestuff. Boil wool with Hydrosulphite B</td><td colspan="4">The colour is completely destroyed both by alkaline and acid solutions and the fibre is [illegible]. Treat original fibre with cold ammonium sulphide</td><td colspan="3">The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution:—Basic dyestuff. Transfer to wool and boil with Hydrosulphite B</td><td colspan="10">The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X</td></tr>
<tr><td rowspan="4">Not decolourised:—Pyrone or Quinoline group.</td><td rowspan="4">Permanently decolourised:—Azo group.</td><td rowspan="4">Fibre blackened: Cr present in ash</td><td colspan="3">Fibre is not blackened. Boil with Hydrosulphite A</td><td colspan="2">Wool is not decolourised. Boil cotton with hydrochloric acid (1:20)</td><td rowspan="4">Wool is permanently Decolourised:—Azo group.</td><td colspan="4">Decolourised and colour not restored by air or persulphate:—Azo dyestuff (including Stilbene group). Boil with soap solution and white mercerised cotton</td><td colspan="6">The colour is unaffected or changed in shade (becoming yellower, browner or blue). Apply lead acetate test</td></tr>
<tr><td colspan="2">Not decolourised. Test for Al in ash</td><td rowspan="3">De-colourised</td><td rowspan="3">De-colourised</td><td rowspan="3">Not decolourised. The conc. H_2SO_4, and alcoholic solutions are fluorescent:—Acridine group.</td><td colspan="2">White cotton is stained:—Salt Colour. Test ash for Cr and Cu</td><td colspan="2">White cotton is not stained. Boil with pyridine</td><td rowspan="3">H_2S is evolved. After reduction with Hydrosulphite the original colour is rapidly restored by air:—Sulphide dyestuff.</td><td colspan="5">No H_2S is evolved. Boil with soap solution and white mercerised cotton.</td></tr>
<tr><td rowspan="2">Al present</td><td rowspan="2">Al absent.</td><td rowspan="2">No Cr or Cu present:—Salt Azo dyestuff untreated</td><td rowspan="2">Cr or Cu present:—Salt Azo dyestuff after-treated.</td><td rowspan="2">Colour is stripped:—Insoluble Azo Colour.</td><td rowspan="2">Colour is not stripped. Cr present in ash:—Azo Mordant Colour.</td><td colspan="2">The white cotton is stained:—Thiazol Salt dyestuff.</td><td colspan="3">The white cotton is not stained:—Mordant or Vat dyestuff.</td></tr>
<tr><td>The colour after reduct'n with hydrosulphite can be diazotised and developed red with betanaphthol</td><td>The colour after reduction cannot be diazotised and developed</td><td>The reduced colour is yellow or brownish yellow. Al or Cr in ash</td><td>The reduced colour is brown, restored to orange by persulphate.</td><td>The reduced colour is blue, restored to yellow on exposure to air</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr>
<tr><td>PERSIAN BERRIES ON TIN MORDANT</td><td>QUINOLINE YELLOW, EOSINE ORANGE</td><td>INDIAN YELLOW, ORANGE IV G, &c.</td><td>CHROME YELLOW OR CHROME ORANGE (LEAD CHROMATE)</td><td>ALIZARINE YELLOW A</td><td>THIOFLAVINE T</td><td>FLAVINDULINE.</td><td>AURAMINE</td><td>PHOSPHINE, BENZOFLAVINE, ACRIDINE YELLOW, ACRIDINE ORANGE, &c.</td><td>CHRYSOIDINE, TANNIN ORANGE, JANUS YELLOW &c.</td><td>CHRYSOPHENINE, CHRYSAMINE, TOLUYLENE YELLOW AND ORANGE, STILBENE YELLOWS AND ORANGES, BENZO, CONGO, DIAMINE, AND DIANIL YELLOWS AND ORANGES, PYRAMINE ORANGE, &c.</td><td>THE PRECEDING, COPPERED OR CHROMED.</td><td>METANITRANILINE ORANGE OR NITROTOLUIDINE ORANGE (FORMED ON FIBRE).</td><td>CHROME ORANGE, ALIZARINE YELLOW R, GG, &c., DIAMOND FLAVINE, FLAVAZOL, &c.</td><td>IMMEDIAL, KATIGENE, PYROGENE, THIOGENE, SULPHUR, &c., YELLOWS AND ORANGES.</td><td>PRIMULINE DEVELOPED WITH PHENOL OR WITH RESORCINOL. COTTON YELLOW G & R, ORIOL YELLOW, DIANIL YELLOW, &c</td><td>CHLOROPHENINE, CHLORAMINE YELLOW, DIAMINE FAST YELLOW B, FF AND C, CLAYTON YELLOW, THIAZOL YELLOW, THIOFLAVINE S, &c. PRIMULINE DEVELOPED WITH HYPOCHLORITE.</td><td>PERSIAN BERRIES ON AL OR CR MORDANTS</td><td>ALIZARINE ORANGE ON AL MORDANT</td><td>FLAVANTHRENE.</td></tr>
</table>

NOTES

1 Brilliant Yellow is largely stripped by weak Ammonia, but if white cotton is present it will be stained

2 Sulphide Yellows of the thiazol class, such as Katigene Yellow 2G, Pyrogene Yellow, &c. stain white cotton slightly when boiled in soap

3 Diamond Flavine, if not fully fixed, may stain cotton from a soap solution.

TABLE II.—RED COLOURS.

<table>
<tr><td colspan="15">Boil with Weak ammonia (1:100).</td></tr>
<tr><td colspan="2" rowspan="4">The colour is stripped:—Acid dyestuff. Transfer to wool and boil with Hydrosulphite B.</td><td colspan="13">The colour is not stripped. Boil for half minute with Saline caustic soda, rinse, and boil twice for one minute with Weak formic acid (1:100)</td></tr>
<tr><td colspan="4" rowspan="3">The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution:—Basic dyestuff (on tannin or other mordant). Transfer to wool and boil with Hydrosulphite A.</td><td colspan="9">The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.</td></tr>
<tr><td colspan="4">Decolourised and colour not restored by air or by persulphate:—Azo group. Boil with soap solution and white mercerised cotton.</td><td colspan="2" rowspan="2">Decolourised. Colour returns on exposure to air:—Azine or Thioindigo group. Apply lead acetate test</td><td rowspan="4">Colour changed to greenish yellow which can be diazotised and developed red with betanaphthol:—Primuline Azo Colour.</td><td colspan="2" rowspan="2">Colour unaffected or changed in shade (becomes browner, &c.):—Anthracene group. Boil with 90 per cent. formic acid.</td></tr>
<tr><td colspan="2">The white cotton is stained:—Salt dyestuff. Test ash for Cr and Cu.</td><td colspan="2">The white cotton is not stained. Boil with pyridine.</td></tr>
<tr><td rowspan="2">Not decolourised:—Pyrone group.</td><td rowspan="2">Decolourised. Colour not restored by air or persulphate:—Azo group.</td><td rowspan="2">Wool not decolourised:—Pyrone group.</td><td rowspan="2">Wool decolourised. Colour returns on exposure to air:—Azine group.</td><td rowspan="2">Wool decolourised. Colour does not return on exposure to air but is restored by persulphate:—Triphenylmethane group.</td><td rowspan="2">Wool decolourised. Colour not restored by air or by persulphate:—Azo group.</td><td rowspan="2">No Cr or Cu present:—Azo Salt dyestuff.</td><td rowspan="2">Cr or Cu present:—Azo Salt dyestuff after-treated.</td><td rowspan="2">The colour is stripped:—Insoluble Azo Colour.</td><td rowspan="2">The colour is not stripped. Cr in ash:—Mordant Azo dyestuff.</td><td rowspan="2">H_2S is evolved:—Sulphide dyestuff.</td><td rowspan="2">No H_2S evolved. Red vapours formed on heating fibre in dry test-tube.</td><td>Colour is stripped. Test ash for mordant.</td><td>Colour not much affected. Test ash for Cr.</td></tr>
<tr><td>Al present</td><td>Cr present.</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
<tr><td>EOSINES, PHLOXINE, ERYTHROSINE, ROSE BENGAL, &c.</td><td>CROCEIN SCARLETS, BRILLIANT CROCEINES, FAST REDS, &c.</td><td>RHODAMINES, RHODINES, IRISAMINE, ACRIDINE REDS, &c.</td><td>SAFRANINES, RHODULINE REDS AND PINK, AZINE SCARLET, INDULINE SCARLET, NEUTRAL RED, &c.</td><td>MAGENTA, FUCHSINE, ISORUBINE, CERISE, GRENADINE, &c.</td><td>JANUS RED.</td><td>BENZOPURPURINE, DIAMINE SCARLETS, DIAMINE REDS, BENZO FAST SCARLETS, DIAZO BRILLIANT SCARLET, ROSANTHRENES, SAMBESI RED, ERICA, DIAMINE ROSE, GERANINE, ROSOPHENINE, &c.</td><td>DIAMINE FAST RED F, &c.</td><td>PARANITRANILINE RED, ALPHA-NAPHTHYLAMINE BORDEAUX, CHLORANISIDINE PINK, NITROANISIDINE PINK.</td><td>CHROME RED, BRILLIANT CHROME RED, CHROME BORDEAUX, &c.</td><td>THIOGENE RUBINE, &c.</td><td>THIO INDIGO RED, THIO INDIGO SCARLET.</td><td>PRIMULINE DEVELOPED WITH BETANAPHTHOL OR WITH R-SALT.</td><td>TURKEY RED, ALIZARINE RED, ALIZARINE PINK, ALIZARINE MAROON.</td><td>ALIZARINE, PURPURINES OR ALIZARINE MAROON ON CR MORDANT.</td></tr>
</table>

NOTES.

Janus Claret Red does not transfer to wool very easily

TABLE III.—PURPLE and VIOLET COLOURS.

Boil with Weak ammonia (1:100).																		
The colour is stripped:—**Acid dyestuff.** The colour transferred to wool is decolourised by Hydrosulphite A and restored by persulphate:—**Triphenylmethane group.**		The colour is not stripped. Boil for half minute with Saline caustic soda, rinse, and boil twice for one minute with Weak formic acid (1:100).																
		The colour is completely or largely stripped giving a coloured acid extract, which is precipitated by Tannin solution:—**Basic dyestuff** (on tannin or other mordant) or **Basic mordant dyestuff.** Boil with Saline caustic soda, rinse well, and boil with small piece of white wool and plain water.						The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.										
		The wool is dyed:—**Basic dyestuff.** Boil wool with Hydrosulphite A				The wool is not dyed. Cr is present in ash:—**Basic Mordant dyestuff.** Boil cotton with Hydrosulphite X.		Decolourised and colour not restored by air or persulphate:—**Azo group or Alizarine on Iron** (decolourised slowly). Boil with soap solution and white mercerised cotton.					Decolourised. Colour is restored on exposure to air:—**Azine, Oxazine, or Thiazine group.** Apply lead acetate test.		The colour is unaffected or changed in shade:—**Pyrone or Anthracene group** (also one or two **Sulphide dyestuffs**).			
								The white cotton is stained:—**Salt dyestuff.** Test ash for Cr and Cu.		The white cotton is not stained. Boil with hydrochloric acid (1:20).						The colour is changed to brown. Apply lead acetate test.		
											The colour is not stripped. Boil with pyridine.						No H_2S is evolved. Test ash for Al and Cr.	
The ammoniacal solution is colourless, but becomes blue on acidifying.	The ammoniacal solution is violet.	Not decolourised:—**Pyrone group.**	Decolourised. Colour returns on exposure to air:—**Azine (oxazine or thiazine) group.**	Decolourised. Colour does not return in air, but is restored by persulphate:—**Triphenylmethane group.**	Decolourised. Colour is not restored by air or persulphate:—**Azo group.**	Decolourised. Colour returns on exposure to air:—**Oxazine group.**	Decolourised only slowly. Colour does not return in air, but is restored by persulphate.—**Triphenylmethane group.**	No Cr or Cu present:—**Azo Salt dyestuff.**	Cr or Cu present:—**Azo Salt dyestuff after-treated.**	Colour destroyed, giving yellow solution. Fe present in ash:—**Alizarine on Fe mordant.**	The colour is stripped:—**Insoluble Azo Colour.**	The colour is not stripped. Cr present in ash:—**Mordant Azo dyestuff.**	H_2S is evolved:—**Sulphide dyestuff.**	No H_2S is evolved. Cr is present in ash:—**Mordant Oxazine dyestuff** (not falling in group 7).	The colour is unaffected. Al or Cr present in ash:—**Pyrone or Anthracene Mordant Colour.**	H_2S is evolved:—**Sulphide dyestuff.**	Al or Cr present:—**Anthracene Mordant dyestuff.**	Al and Cr absent. **Anthracene Vat dyestuff.**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18	17	18	19
RED SHADES OF SOLUBLE AND ALKALI BLUES.	ACID VIOLETS, FORMYL VIOLETS, &c.	ANISOLINE.	METHYLENE VIOLET, RHODULINE VIOLET, IRIS VIOLET, NEUTRAL VIOLET, TANNIN HELIOTROPE, &c.	METHYL VIOLETS, ETHYL VIOLET, BENZYL VIOLET, CRYSTAL VIOLET, &c.	JANUS CLARET RED, &c.	GALLOCYANINE, GALLAMINE BLUE, PRUNE, &c.	CHROME VIOLET.	VIOLETS OF THE DIAMINE, BENZO, CONGO, HESSIAN, COLUMBIA, CHLORAZOL, CHLORANTINE, DIANIL, OXAMINE, AND ROSANTHRENE SERIES.	THE PRECEDING COPPERED OR CHROMED	ALIZARINE PURPLE.	BENZIDINE PUCE.	CHROME BORDEAUX, CHROME PRUNE, &c.	THIOGENE VIOLET, KATIGENE VIOLET, &c.	GALLAMINE BLUE, GALLOCYANINE, &c	GALLEIN, ALIZARINE VIOLET, ALIZARINE CLARET, ALIZARINE CYCLAMINE, ALIZARINE ON CR MORDANT.	THIOGENE DARK RED, &c.	ALIZARINE CYANINE 3R, ALIZARINE BORDEAUX.	VIOLANTHRENE.

NOTES

Alizarine on chromium becomes rather browner on reduction with Hydrosulphite X.

TABLE IV.—BLUE COLOURS.

Boil with Weak ammonia (1:100).																	
The colour is stripped:—**Acid dyestuff** (or Prussian Blue).		The colour is not stripped. Boil for half minute with Saline caustic soda, rinse, and boil twice with Weak formic acid (1:100).															
		The colour is completely or largely stripped, giving a coloured acid extract, which is precipitated by Tannin solution:—**Basic dyestuff** (on tannin or other mordant) or **Basic Mordant dyestuff.** Boil with Saline caustic soda, rinse well, and boil with small piece of white wool and plain water.					The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.										
		The wool is dyed:—**Basic dyestuff.** Boil wool with Hydrosulphite A.			The wool is not dyed. Cr present in ash:—**Basic Mordant dyestuff.** Boil cotton with Hydrosulphite X.		Decolourised and colour not restored by air or persulphate:—**Azo group.** Boil with soap solution and white mercerised cotton.			Decolourised. Colour is restored on exposure to air:—**Azine, Oxazine, Thiazine or Indigo group.** Heat fibre carefully in dry test-tube.				Colour unaffected or changed in shade (becoming darker, browner, &c.):—**Anthracene Mordant or Anthracene Vat dyestuff** (also **Ultramarine**). Boil with 90 per cent. formic acid.			
							The white cotton is stained:—**Salt dyestuff.** Test ash for Cr and Cu.				No coloured vapour. Apply lead acetate test.			The colour is stripped. Al in ash. Apply lead acetate test.		The colour is not much affected. Test ash for Cr.	
The extract is colourless, but becomes blue on acidification. Transferred to wool, the blue is decolourised by Hydrosulphite A, and restored by persulphate. **Triphenylmethane group.**	The extract is colourless and remains so on acidification. $FeCl_3$ gives a blue precipitate.	Decolourised. Colour returns on exposure to air:—**Azine, Oxazine, or Thiazine group.**	Colour changes to red just before being decolourised. Colour returns violet or blue:—**Safranine Azo dyestuff.**	Decolourised. Colour does not return on exposure to air, but is restored by persulphate:—**Triphenylmethane group.**	Decolourised. Colour returns on exposure to air:—**Oxazine group.**	Decolourised slowly. Colour restored only by persulphate.—**Triphenylmethane group.**	No Cr or Cu present:—**Azo Salt dyestuff.**	Cr or Cu present:—**Azo Salt dyestuff after-treated.**	The white cotton is not stained. Colour is stripped by boiling pyridine:—**Insoluble Azo colour.**	Violet vapours evolved.	H_2S is evolved—**Sulphide Dyestuff.**	No H_2S evolved. Cr in ash:—**Mordant Thiazine or Oxazine** (not falling in group 6).	Colour changed to greenish-yellow, which can be diazotised and developed red with betanaphthol. **Primuline Azo colour.**	H_2S evolved.	No H_2S evolved:—**Alizarine dyestuff on Al.**	Cr present in ash:—**Alizarine dyestuff on Cr.**	Cr absent:—**Anthracene Vat dyestuff.**
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ALKALI OR SOLUBLE BLUES.	PRUSSIAN BLUE.	METHYLENE BLUE, NEW METHYLENE BLUE, NILE BLUE, CAPRI BLUE, INDAZINE, BASLE BLUE, METAPHENYLENE BLUE, MELDOLA'S BLUE, FAST BLUE, CRESYL BLUE, RHODULINE BLUE, NITROSO BLUE, &c.	INDOINE BLUE, JANUS BLUE, NAPHTHINDONE BLUE, DIAZINE BLUE, &c.	VICTORIA BLUE, NIGHT BLUE, TURQUOISE BLUE, SETOCYANINE, &c.	GALLOCYANINE, CELESTINE BLUE, PRUNE, &c.	CHROME BLUE.	BLUES OF THE DIAMINE, BENZO, CONGO, COLUMBIA, CHLORAZOL, DIANIL, OXAMINE, CHICAGO, &c., SERIES.	THE PRECEDING COPPERED OR CHROMED.	DIANISIDINE BLUE.	INDIGO.	BLUES OF THE IMMEDIAL, KATIGENE, THIOGENE, PYROGENE, SULPHUR, &c., SERIES.	BRILLIANT ALIZARINE BLUE, DELPHINE BLUE, GALLOPHENINE, &c.	PRIMULINE DEVELOPED WITH NAPHTHYLAMINE ETHER.	ULTRAMARINE.	ALIZARINE CYANINES OR ANTHRACENE BLUES ON AL MORDANT.	ALIZARINE BLUE, ALIZARINE CYANINES OR ANTHRACENE BLUES ON CR MORDANT.	INDANTHRENE, CYANANTHRENE.

NOTES.

Alkali Blue dyed on a tannin and tin mordant is only partly stripped by weak ammonia, the solution being colourless.

TABLE V. GREEN COLOURS.

Boil with Weak ammonia (1 : 100).																		
The colour is stripped:— Acid dyestuff. Transferred to wool [illegible] decolourised by Hydrosulphite A and restored by persulphate:— Triphenylmethane group.	The colour is not stripped. Boil for half minute with Saline caustic soda, rinse and boil twice with Weak formic acid.																	
	The colour is [illegible] giving a coloured acid extract which is precipitated by Tannin solution [illegible] dyestuff [illegible] or Basic Mordant dyestuff. Boil with Saline caustic soda, rinse well and [illegible] plain water.				The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.													
	The wool is stained:— Basic dyestuff. Boil wool with Hydrosulphite A.			The wool is not stained. Cr in ash. [illegible] Hydrosulphite X, the colour not returning in air but restored by persulphate:— Triphenylmethane group	Decolourised and colour not restored by air or persulphate:— Azo or Nitroso group. Boil with soap solution and white mercerised cotton.				Decolourised. Colour returns on exposure to air:— Azine, Oxazine, or Thiazine group. Apply lead acetate test.		The colour is changed to greenish yellow which can be diazotised and developed red with beta naphthol:— Primuline Azo group.	The colour is unaffected or changed to red, brown, blue, &c. Test ash for Cr and Ni.						
					The white cotton is stained:— Salt dyestuff. Test ash for Cr and Cu.		The white cotton is not stained. Boil with hydrochloric acid (1 : 10).					The ash contains Cr or Ni:— Anthracene Mordant dyestuff.				No Cr or Ni present in ash:— Anthracene Vat dyestuff.		
	Decolourised [illegible] on exposure:— Azine, Oxazine, or Thiazine group	[illegible] green on exposure to air:— Safranine Azo group.	Decolourised [illegible] on exposure to air but is restored by persulphate:— Triphenylmethane group		Cr and Cu absent:— Azo Salt dyestuff.	Cr or Cu present:— Azo Salt dyestuff after-treated.	Colour destroyed. Fe is present in the ash:— Nitroso group.	Not decolourised. Cr is present in the ash:— Mordant Azo dyestuff.	H_2S is evolved:— Sulphide dyestuff.	No H_2S is evolved:— Mordant Oxazine (or Thiazine).		Reduced colour is brownish red. Green restored by persulphate but not by air. Boiling HCl (1 : 20) gives bright green solution.	Reduced colour is brown. Green shade returns on exposure to air. Boil with hydrochloric acid (1 : 20).			Reduced colour is brownish olive. H_2S evolved on applying lead acetate test.	Reduced colour is dark maroon. Green shade restored by air.	Reduced colour is blue. Green shade restored by air.
													Colour unaffected. Solution colourless. Cr in ash.	Colour of fibre becomes grey, solution red. Ni in ash.	Colour of fibre rather paler, solution brownish yellow.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ACID GREENS.	FAST GREEN M, METHYLENE GREEN, AZINE GREEN, CAPRI GREEN	JANUS GREEN, DIAZINE GREEN, &c.	BRILLIANT GREEN, MALACHITE GREEN, METHYL GREEN, VICTORIA GREEN, SETOGLAUCINE, &c.	CHROME GREEN	DIAMINE GREEN, BENZO GREEN, COLUMBIA GREEN, CHLORAMINE GREEN, &c.	THE PRECEDING COPPERED OR CHROMED.	RUSSIAN GREEN, FAST GREEN O, STEAM GREEN, ALSACE GREEN, GAMBINES, DIOXINE, &c.	DIAMOND GREEN, &c.	GREENS OF THE IMMEDIAL, KATIGENE, THIOGENE, PYROGENE, SULPHUR, AND THIONOL SERIES.	GALLANILIC GREEN, INDALIZARINE, &c.	PRIMULINE DEVELOPED WITH AMIDODIPHENYLAMINE.	ALIZARINE VIRIDINE, BRILLIANT ALIZARINE VIRIDINE.	ALIZARINE GREEN S ON CR MORDANT.	ALIZARINE GREEN S ON NI MG MORDANT.	COERULEINE, ANTHRACENE GREEN.	OLIVANTHRENE.	VIRIDANTHRENE.	ALGOLE GREEN, INDANTHRENE IN ADMIXTURE WITH FLAVANTHRENE.

NOTES

Greens of the nitroso group (Gambines, &c.) may become black on reduction if the Hydrosulphite X is insufficiently acid (formation of Fe S).

TABLE VI.—BROWN COLOURS.

Boil with Weak ammonia (1 : 100).													
The colour is stripped:— Acid dyestuff. Transferred to wool it is permanently decolourised by Hydrosulphite A:— Azo group.	The colour is not stripped. Boil for half minute with Saline caustic soda, rinse, and boil twice with Weak formic acid (1 : 100).												
	The colour is stripped giving acid extract which is precipitated by Tannin solution:— Basic dyestuff. The dyestuff transferred to wool is permanently decolourised by Hydrosulphite A:— Azo group.	The colour is not stripped or the acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.											
		Decolourised and colour not restored on exposure to air or by persulphate:— Azo group and Mineral Colours. Boil with soap solution and white mercerised cotton.						The shade is changed to greenish yellow which can be diazotised and developed red with betanaphthol:— Primuline Azo Colour.	Unaltered or changed in shade, becoming darker, paler, yellower, &c. Apply lead acetate test.				
		The white cotton is stained:— Salt dyestuff. Test ash for Cr and Cu.		The white cotton is not stained. Boil with pyridine.					H_2S is evolved — Sulphide dyestuff.	No H_2S is evolved. Test ash for Cr and Cu.			
		Cr and Cu absent:— Azo Salt dyestuff.	Cr or Cu present:— Azo Salt dyestuff aftertreated.	The colour is stripped:— Insoluble Azo Colour. Test ash for Cu.		The colour is not stripped:— Mineral Colour. Treat with sodium bisulphite in the cold.				Cr or Cu (or both) present:— Mordant dyestuff. Boil with HCl (1 : 20).			Cr and Cu absent:— Anthracene Vat dyestuff, &c.
				Cu absent	Cu present.	Decolourised	Not decolourised.			Completely stripped.	Not stripped or only slightly. Boil with dilute caustic soda (10%).		
											Fibre and solution dull violet.	Solution brown, fibre unaffected.	
1	2	3	4	6	6	7	8	9	10	11	12	13	14
FAST BROWN, NAPHTHYLAMINE BROWN, ACID BROWN, &c.	BISMARCK BROWN, JANUS BROWN, &c.	BROWNS OF THE DIAMINE, BENZO, CONGO, DIANIL, COLUMBIA, HESSIAN, OXAMINE AND TOLUYLENE SERIES.	THE PRECEDING COPPERED OR CHROMED.	PARA BROWN (CHRYSOIDINE AND PARANITRANILINE), BENZIDINE OR TOLIDINE BROWN.	PARANITRANILINE CUTCH (PARA RED COPPERED).	MANGANESE BRONZE.	IRON BUFF, KHAKI (OXIDES OF CR AND FE).	PRIMULINE DEVELOPED WITH METAPHENYLENE DIAMINE. TERRA-COTTA, &c.	IMMEDIAL CUTCH, CROSS DYE BROWN, KATIGENE BROWNS, PYROGENE BROWNS, THIOGENE BROWNS, &c.	ANTHRAGALLOL, ANTHRACENE BROWN, ALIZARINE BROWN.	ALIZARINE ORANGE ON CR MORDANT, ALIZARINE OR PURPURINE ON CR.	CUTCH.	FUSCANTHRENE, PARAMINE BROWN (p-PHENYLENE DIAMINE OXIDISED ON FIBRE).

NOTES.

Iron Buff and Khaki may become black on reduction if the Hydrosulphite X is insufficiently acid (formation of Fe S).

TABLE VII.—BLACK and GREY COLOURS.

Boil with Weak ammonia (1:100).													
The colour is stripped :— Acid dyestuff. The dyestuff transferred to wool and boiled with Hydrosulphite A is permanently decolourised :— Azo Group.	The colour is not stripped. Boil with Dilute hydrochloric acid (1:20).												
	The colour is stripped			The colour is not stripped (or only sligbtly). Boil for one minute with Saline caustic soda, rinse, and boil with Dilute hydrochloric acid (1:20).									
				The colour is largely stripped and the acid extract is precipitated by Tannin solution :—Basic dyestuff. Transfer to wool (see note) and boil with Hydrosulphite A		The colour is not stripped or acid extract is not precipitated by Tannin solution. Reduce with Hydrosulphite X.							
						Decolourised and colour not restored by air or persulphate :—Azo group. Boil with soap solution and white mercerised cotton.			The colour is unaffected or changed in shade (becoming brown, maroon, &c.).				
						The white cotton is stained, Test ash or Cr and Cu.		The white cotton is not stained. Colour is stripped by boiling pyridine. Insoluble Azo colour.	The reduced colour is brown but is rapidly restored to black on exposure to air :— Azine, Oxazine, or Thiazine group. Apply lead acetate test.		The reduced colour is brown. Only slowly and imperfectly restored to black by air but at once by persulphate. Cr present in ash :— Naphthalene Mordant dyestuff.	Colour not changed by reduction (or very slightly) :— Anthraecene group. Test ash for Cr.	
	Fibre and solution colourless.	Solution orange. Fe in ash	Solution red. Cr in ash.	Decolourised Colour returns on exposure to air :— Azine, Oxazine, or Thiazine Group,	Colour becomes red just before being decolourised. Violet or violet blue colour returns in air :— Safranine Azo group.	Cr and Cu absent :— Azo Salt dyestuff.	Cr or Cu present :— Azo Salt dyestuff aftertreated.		H_2S is evolved. Fibre becomes colourless or pale buff on boiling with bleaching powder solution (5° Tw.)—Sulphide dyestuff.	No H_2S is evolved. Fibre becomes reddish brown on boiling with bleaching powder solution (5° Tw.):— An Oxidation Black.		Cr present :— Anthraecene Mordant dyestuff.	Cr absent :— Anthracene Vat dyestuff.
1.	2	3	4	5	6	7	8	9	10.	11.	12.	13.	14.
NAPHTHOL BLACKS, NAPHTHYLAMINE BLACKS, PALATINE BLACK, &c.	TANNATE OF IRON	LOGWOOD BLACK ON IRON MORDANT	LOGWOOD BLACK ON CHROME MORDANT, NOIR REDUIT	METHYLENE GREY, NEW METHYLENE GREY, NEW FAST GREY, NIGRISINE, &c.	JANUS BLACK, JANUS GREY, DIAZINE GREY	BLACKS OF THE DIAMINE, OXYDIAMINE, BENZO, COLUMBIA, DIANIL, PLUTO, &c., SERIES, ALSO DIAMINOGEN, DIAZO BLACKS, &c (DEVELOPED OR COUPLED).	THE PRECEDING COPPERED OR CHROMED.	AZOPHOR BLACK, &c	BLACKS OF THE IMMEDIAL, KATIGENE, CROSS DYE, PYROGENE, THIOGENE, THIONOL, PYRROL, SULPHUR, &c., SERIES.	AGED ANILINE BLACK, PRUSSIATE BLACK, ONE BATH ANILINE BLACK, STEAM ANILINE BLACK, DIPHENYL BLACK.	NAPHTHAZARINE S, ALIZARINE BLACK S, ALIZARINE BLUE BLACK SW, NAPHTHOMELANE.	ALIZARINE CYANINE BLACK, ALIZARINE BLUE BLACK B.	MELANTHRENE.

NOTES.

Chrome Black (By) becomes light brown on reduction with Hydrosulphite X, and persulphates change the colour to dark brown but not to black

ammonia. *Transference of basic dyestuffs to wool.*—The tannin mordant is first removed, and the pattern is washed well, and boiled for 1—2 mins. with a piece of white wool (half the size of the cotton or less) in water. One or two drops of weak formic acid may be added if the colour does not develop on the wool. In a few cases (*e.g.*, with basic greys), the colour must be extracted with dilute hydrochloric acid, and the solution carefully neutralised with ammonia before introducing the wool. *Transference of acid dyestuffs to wool.*—The pattern is boiled with a small piece of wool and weak formic acid. *Tannin test for basic dyestuffs.*—A few drops of tannin solution are shaken with the formic acid extract of the colour. Some dyestuffs, *e.g.*, Rhodamines, Gallocyanines, and Chrome colours of the Rosaniline series are only slowly precipitated. *Bleeding test for "salt dyestuffs."*—The pattern is boiled with soap solution or a 5 per cent. solution of sodium carbonate and a piece of white mercerised cotton for 5 mins. *Lead acetate test for sulphide dyestuffs.*—In carrying out this test (this J., 1907, 467), the test-tubes must be thoroughly cleaned, as when they have been previously used for hydrosulphite reductions, an invisible deposit of sulphur is left upon their walls, which gives rise to evolution of hydrogen sulphide on boiling with stannous chloride.

The reactions given by the different dyestuffs are shown in the tables.—A. S.

Cellulose ; Bleaching of ——. C. G. Schwalbe. *See* XIX.

Hydrocelluloses. C. G. Schwalbe. *See* XIX.

PATENTS.

Textile fibre and paper pulp ; Production of ——. V. A. de Perini, Rio de Janeiro, Brazil. Eng. Pat. 20,005, Sept. 8, 1906.

SEE U.S. Pat. 831,521 of 1906 ; this J., 1906, 1040.—T.F.B.

Collodion filaments, artificial silk, horsehair, and the like ; Apparatus for the manufacture of ——. H. J. Haddan, London. From Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 89A, Jan. 1, 1907.

SEE Fr. Pat. 361,960 of 1905 ; this J., 1907, 197.—T. F. B.

Artificial silk filaments from nitrocellulose ; Process for the manufacture of ——. C. Bottler, Assignor to Kunstfäden Ges.m.b.H., Jülich, Germany. U.S. Pat. 866,768, Sept. 24, 1907.

SEE Fr. Pat. 371,544 of 1906 ; this J., 1907, 468.—T. F. B.

Artificial silk ; Apparatus for spinning ——. Soc. Française de la Viscose. Fr. Pat. 377,424, July 10, 1906.

THE viscose, contained in a closed reservoir, is forced by means of compressed air through a number of spinnerets which are immersed in a coagulating bath. The filaments thus formed are passed through a bath of dilute sulphuric acid (7 per cent.) at 70° C., then through water, and finally through a bath containing a mixture of soap solution, oil, and sodium carbonate. During their passage through the various baths, the filaments are supported by rollers having peripheral velocities which are exactly equal to the velocity with which the threads are moving. These rollers are grooved in a longitudinal direction in order to prevent the filaments from sticking to them. The end of each roller is also provided with a number of wooden studs, arranged round the circumference, in order to assist the workman to manipulate the filaments. After being submitted to the soaping operation, the filaments are dried by guiding them several times over the surface of a large drying drum.—P. F. C.

Artificial silk ; Apparatus for manufacturing threads of ——. H. Diamanti and H. Champin. Fr. Pat. 377,494, July 11, 1906.

THE threads of artificial silk are led into a metallic drying chest by means of an endless band of cloth. They are then delivered on to the uppermost of a series of moving tables, which are so arranged that when the material has traversed the width of the drying chest, it is automatically dropped from one table to the next lower one. After leaving the drying chest, the threads are wound separately.—P. F. C.

Artificial wool from jute, cotton, ramie and other vegetable fibres; Process for preparing ——. J. Schmitt. Fr. Pat. 377,979, May 21, 1907.

MILK of lime is prepared by treating 250 grms. of quicklime with a litre of water, adding 100 grms. of calcined sodium carbonate, and heating the mixture to the boil. The vegetable fibres are first immersed in the boiling solution for fifteen minutes and then allowed to steep in the hot liquor for another hour. The material is next washed, treated with dilute sulphuric acid (1° B.), and finally washed and dried.—P. F. C.

Copper salts from alkaline liquors; Removing ——. R. Linkmeyer, Brussels. U.S. Pat. 866,371, Sept. 17, 1907.

SEE Fr. Pat. 353,187 of 1905; this J., 1905, 1011.—T. F. B.

Vapours of alcohol and ether contained in air [of artificial silk factories]; Recovery and revivification of ——. A. de Chardonnet. Fr. Pat. 377,673, July 17, 1906.

THE air containing the vapours is passed through a series of towers or chambers into which amyl alcohol or other high-boiling alcohols are sprayed. The vapours are absorbed by the alcohol which is passed through the series of towers in the opposite direction to the air, the weak solution obtained in the last tower of the series being sprayed into the next and so on. The alcohol or ether is recovered from the strong solution obtained in the first tower, by distillation either conducted at the atmospheric pressure by heat, or in the cold under reduced pressure. The residue left in the still is used over again. In the manufacture of artificial silk, the alcohol and ether which are given off at different stages in the process are either recovered separately or are allowed to mix and the alcohol recovered first by passing the air through a similar train of apparatus into which water, or water containing a little alcohol or calcium chloride is sprayed.—W. H. C.

Dye jigger. W. Peters, Düsseldorf, Germany. U.S. Pat. 866,058, Sept. 17, 1907.

SEE Fr. Pat. 376,146 of 1907; this J., 1907, 1006.—T. F. B.

Threads or fibres wound on bobbins; Machine for treating —— *with solutions.* T. Robatel, J. Buffaud et Cie. Fr. Pat. 374,861, Feb. 20, 1907.

THE apparatus comprises a number of fixed annular tanks placed one above the other and disposed concentrically around a central, vertical hollow shaft. Just above each tank is a horizontal wheel fixed to the vertical shaft, and from the rims of these wheels, spindles project, on which the bobbins are held loosely so that they can rotate freely by contact with rails laid on the bottoms of the tanks. The central shaft is also provided with series of radiating pipes, each set of which opens into a circular pipe just above each of the wheels carrying the bobbins. From these circular pipes, short perforated pipes project, from which liquid is sprayed on to the bobbins. The annular tanks are not fixed horizontally, but slope gently downwards in the form of one turn of a helix, the highest and lowest points being adjacent, so that the liquid in the tanks moves forward continuously. In working the apparatus, the central shaft is slowly rotated, and the bobbins are thus carried round, partially immersed in the liquid in the tanks, which liquid flows continuously in the opposite direction. The bobbins are preferably made with fluted surfaces to enable the liquid to readily penetrate the material wound upon them.—A. S.

Fabrics; Decoration of ——. Soc. Lyonnaise de Teinture, Impression, Appret et Gaufrage. First Addition, dated July 18, 1906, to Fr. Pat. 377,216, July 3, 1906 (this J., 1907, 1046).

ACCORDING to the main patent, the fabrics were treated with reserves and then dyed, and powdered dyestuffs applied to the parts reserved white. According to the present addition, powdered dyestuffs are applied to the dyed ground around the reserve, thus producing shaded effects about the main design. The result is one and the same whether the design be reserved before dyeing or produced by discharging the dyed ground. The effect may be altered by "dusting" once more, after the removal of the reserve or after discharging.—F. M.

Discharge effects in textile printing; Process for producing ——. H. Dydynski. Fr. Pat. 378,373, May 31, 1907.

SEE Eng. Pat. 11,154 of 1906; this J., 1907, 682.—T. F. B.

Watered effects on textile fabrics; Apparatus for producing ——. J. Sharp and S. H. Sharp and Sons, Leeds. Eng. Pat. 21,591, Sept. 29, 1906.

Two rollers are supported in a heavy frame, upon bearings which may be moved further apart or closer together, to permit of the pressure upon the fabric being varied. The lower roller is plain and made of metal, wood, paper, or cotton, but the upper one is of metal and is engraved, in a manner suited to the material to be treated, with checks, lines, or designs in bold relief. The top roller is heated, and the fabric before being treated is damped or sprayed.—F. M.

Silk-like effects on textile fabrics; Method of producing ——. J. Sharp and S. H. Sharp and Sons, Leeds. Eng. Pat. 7382, Mar. 27, 1907.

THE fabric is passed in a damp condition between two rollers, one or both of which may be heated. Reference is especially made to the production of silky effects upon moreens, moirettes, poplins, and the like, and for this purpose one roller is plain and the other carries the desired design, suitably engraved in lines which run in a direction at right angles to that of the rib of the fabric.—F. M.

Silk-like effects on textile fabrics; Apparatus for producing ——. J. Sharp and S. H. Sharp and Sons, Leeds. Eng. Pat. 7,749, April 2, 1907.

IN an embossing machine two rollers are mounted in open bearings. The bottom roller is plain but the upper one is engraved with lines parallel to the axis when moreens are to be treated, or circumferentially for moirettes. The engraving need not be continuous but may form any suitable design. The rollers are mounted upon hollow axes and may be heated by means of gas flames when desired.—F. M.

Silky effects; Process for obtaining ——. Englische Wollenwaaren Manufactur (vorm. Oldroyd and Blakeley). First Addition, dated April 24, 1907, to Fr. Pat. 333,835, July 15, 1903 (this J., 1904, 17).

MATERIALS which possess suitable surfaces, such as textile fabrics and paper, are treated with a solution or emulsion of some waxy, fatty, or resinous substance and then dried. The surface is next coated with a solution of cellulose or one of its derivatives, a solution of viscose giving particularly good results. If desired, this cellulose solution may contain some pigment in suspension. The material may finally be submitted to the pressure of an engraved roller. The finish thus obtained is said to be water-resistant. It is also claimed to be unaffected by such gums and pastes as are used for bookbinding.—P. F. C.

Silky effects; Process for obtaining ——. Englische Wollenwaaren Manufactur (vorm. Oldroyd and Blakeley). Second Addition, dated April 25, 1907, to Fr. Pat. 333,835, July 15, 1903. (See preceding abstract.)

INSTEAD of using viscose for obtaining a silky effect on surfaces, it is found that better results are obtained by using a compound of viscose with some metal of the magnesium series. The zinc compound is most suitable. It is prepared by adding a solution of a zinc salt to neutral or slightly acid viscose, and then dissolving the precipitate which is formed, in a weak alkaline solution.—P. F. C.

Fabric opaque to Röntgen rays; Process for rendering ——. W. Meisel, Breslau, Germany. Eng. Pat. 22,796, Oct. 15, 1906.

SEE Fr. Pat. 370,635 of 1906; this J., 1907, 253.—T. F. B.

Size for yarns, warps, and cloth. J. Clare, Lytham. Eng. Pat. 27,904, Dec. 7, 1906.

THE size consists of sucrate of lime, calcium or magnesium chloride, and flour or starch. A small quantity of salicylic acid is added as a preservative, and China clay for heavy sizing.—T. F. B.

Waterproof or impermeable and washable fabric for hangings or decorative purposes. E. Mérou, Paris. Eng. Pat. 1383, Jan. 18, 1907. Under Int. Conv., Feb. 6, 1906.

A waterproof, washable fabric is prepared by applying to the back of the material a waterproof composition prepared by mixing together an alkaline-earth pigment (calcium carbonate or zinc white), linseed oil and a siccative. The treated material is dried for 12—24 hours at 160° C. and is then ready for use, or it may be decorated on the face with a design in oil or may be varnished with a spirit varnish.—F. M.

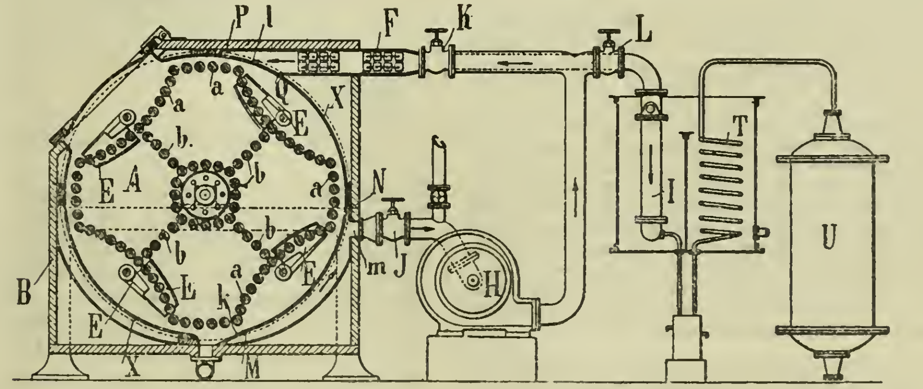
Drying fibrous material; Machinery for ——. J. Fielden, Rochdale. Eng. Pat. 23,594, Oct. 24, 1906.

Loose, fibrous or other materials are placed in the wet state at the top of a cylindrical tube, coiled spirally round a vertical axis. They are caused to descend by giving the apparatus slight rotatory movements in opposite directions alternately, while the moisture is removed from them by a current of heated or dry air which enters the apparatus at the bottom and makes its escape at the top. The materials may conveniently be conveyed to the apparatus by means of a pneumatic apparatus, such as is described in Eng. Pat. 23,607 of 1903 (this J., 1904, 1145).—E. B.

Drying machine for yarn. F. Haas. Fr. Pat. 377,445, April 20, 1907. Under Int. Conv., Feb. 1, 1907.

This apparatus consists of a number of drying stoves and heating chambers which are arranged alternately. By means of an aspirating device which is fixed to each drying stove, a current of air is first drawn through the heating chamber and then through the corresponding drying stove in which the wet material is hung. The machine is also provided with a separate cooling chamber in which the dried material is exposed to a current of cool and suitably humidified air.—P. F. C.

Dry-cleaning; Process and apparatus for —— with recovery of the solvents. R. Sparmberg. Fr. Pat. 377,949, May 17, 1907.



This apparatus comprises a washing drum, A, contained in a wooden casing, B. The walls of the drum consist of a number of circular bars or tubes, *a*, which are so arranged as to leave a small space between them, through which the solvent can enter the drum. The drum is also divided into compartments by similar walls, *b*, each compartment being provided with a door, E, through which the material to be treated can be introduced. The wooden casing, B, is provided with a double envelope, X, made of metal, which is arranged so that the drum, A, can just work in it. One part, M N, of this double envelope serves as an air-outlet conduit, the air being drawn into it through a number of holes, *k*, from the washing drum by means of the fan, H. Another section, P Q, serves as an air-inlet conduit, the air passing into the drum through the holes, *l*. An opening, *m*, in the outer wall of the double envelope is connected to a fan, H, which is itself in connection with a condenser, I, and a heating device, F. A second condenser, T, which is connected to the first one, can be used for condensing the vapours which issue from the retort, U, in which the impure solvents are distilled. By adjusting the various stopcocks, J, K and L, one can either pass a current of warm air through the apparatus to remove all traces of the solvent from the material, or cool the air and condense the vapours it contains.—P. F. C.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Colours on wood, fast to light; Production of —— by means of alizarin dyestuffs. W. Zimmermann. Ger. Pat. 183,004, Aug. 4, 1906.

The wood is impregnated with a solution containing free acid, a metallic salt, and a soluble alizarin dyestuff, preferably in the form of its bisulphite compound, and is then subjected to the action of an alkali, *e.g.*, ammonia gas, in order to induce the formation of a lake from the metallic salt and the dyestuff.—A. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Tetrathionates; Action of alkalis on ——. A. Gutmann. Ber., 1907, **40**, 3614—3622.

The author studied the action of dilute solutions of the hydroxides of sodium, potassium, calcium, strontium, and barium, and also of a concentrated solution of sodium hydroxide on sodium tetrathionate. He finds that with dilute solutions of sodium and potassium hydroxides and with the solutions of the alkaline-earth hydroxides, the reaction proceeds according to the equation: $2Na_2S_4O_6 + 6NaOH = 3Na_2S_2O_3 + 2Na_2SO_3 + 3H_2O$. When concentrated sodium hydroxide solution (1 : 1) is used, some sulphide is formed together with thiosulphate and sulphite, but no sulphate.—A. S.

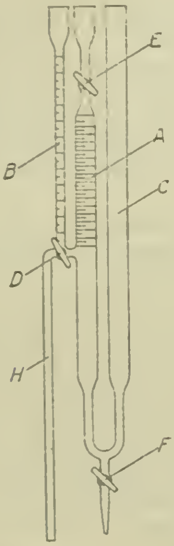
Lead compounds; Solubility of —— in water. M. Pleissner. Arbb. Kais. Gesundh.-Amt., 1907, **26**, 384—443. Chem. Zentr., 1907, **2**, 1055—1056.

The author determined the solubility of lead oxide and hydroxide and normal and basic carbonates, sulphates, and chlorides of lead, in water at 18° C. Alkalis and barium hydroxide precipitate lead oxide, PbO, from cold, and hydrated lead oxide from hot solutions of lead salts. The oxide forms greyish-yellow scales, which have a metallic lustre, and yield a greenish-yellow powder. The same greenish-yellow oxide is produced by the action on metallic lead of water rich in dissolved oxygen; water poor in oxygen, produces hydrated oxides. The solubility of lead oxide increases with its degree of hydration. The only hydrate definitely identified was $3PbO,H_2O$. The basic salts examined were prepared in most cases by the interaction of the normal salts with lead hydroxide, $Pb(OH)_2$, and water. The results of the solubility determinations were as follow, the figures representing mgrm.-mols. of lead per litre. PbO, 0·31; $3PbO,H_2O$, 0·45; $PbCO_3$, 0·0002*; $2PbCO_3,Pb(OH)_2$, 0·0002*; $PbSO_4$, 0·126; $PbSO_4,PbO$, 0·050; $3PbO,PbSO_4,H_2O$, 0·106; $PbCl_2$, 33·6; $PbCl_2,Pb(OH)_2$, 0·38; and $3PbO,PbCl_2,H_2O$, 0·10. The values marked with an asterisk were obtained by calculation.—A. S.

Iodine; Determination of —— in crude and sublimed iodine. H. Cormimbœuf. *See XXIII.*

Monochloramine. F. Raschig. *See XX.*

Hydrogen peroxide; Gasometric method for the determination of ——. W. B. Dehn. J. Amer. Chem. Soc., 1907, **29**, 1315—1319.



THE method is based on the following reaction: $H_2O_2 + NaBrO = NaBr + H_2O + O_2$. The apparatus is shown in the figure. The tap, E, is opened, and D and F are closed, and a solution of sodium hypobromite of sp. gr. 1·25 is run in at the top of C until it fills the tubes, A and C, to a point above the tap, E. The tap, E, is now closed and F is opened until the level of the solution in C falls to the constricted portion. The tube, B, is rinsed with some of the hydrogen peroxide to be determined, and is then filled with the same, a measured quantity of which is next passed from B to C through D. An immediate evolution of oxygen occurs, and after admitting most of the hypobromite solution above E, the columns of liquid in A and C are brought to the same level, and the volume of oxygen read. For very accurate work it is necessary to take into account the vapour pressure of the hypobromite solution.—A. S.

Carbon dioxide in electrolytic chlorine, bleaching powder, and bleaching liquors; Determination of ——. P. Philosophoff. Chem.-Zeit., 1907, **31**, 959—960.

THE method proposed for the determination of carbonates in bleaching powder or bleaching liquors is a combination of somewhat modified existing methods; it serves also for the estimation of carbon dioxide in electrolytic chlorine. The sample is decomposed by hydrochloric acid in a small flask connected with a Bunte gas burette, the flask and burette having been previously rendered vacuous by a water pump. Towards the end of the reaction all gas is driven out of the liquid by warming the flask and adding 3 c.c. of three per cent. hydrogen peroxide solution, after which the residue of gas is transferred to the burette by filling the flask with water. The chlorine is absorbed by shaking the contents of the burette with mercury, which, for this purpose, is allowed to flow in from the levelling tube. To obtain a sharper meniscus, the reduction in volume is conveniently read after running into the burette 1—2 c.c. of a saturated solution of sodium chloride. Carbon dioxide is then absorbed by a concentrated solution of potassium hydroxide in the usual way.—F. SODN.

Fluorspar production of the United States. [T.R.] *See* VIII.

PATENTS.

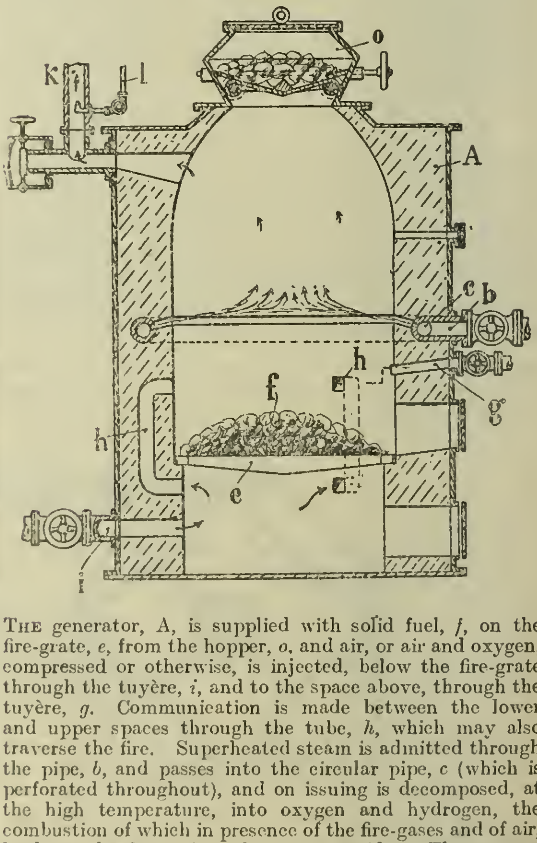
Nitric acid; Process for obtaining highly concentrated ——. G. H. Gontard and F. W. S. Valentiner, Leipzig-Plagwitz, Germany. Eng. Pat. 4254, Feb. 20, 1907.

SEE Fr. Pat. 374,902 of 1907; this J., 1907, 872.—T. F. B.

Gay-Lussac absorption apparatus; Process for the prevention of the denitrating action in the ——. H. Petersen, Wilmersdorf, Germany. Eng. Pat. 11,559, May 17, 1907.

SEE Fr. Pat. 377,567 of 1907; this J., 1907, 1046.—T. F. B.

Oxygen compounds [nitrogen oxides, sulphuric acid]; Process and apparatus for producing —— at high temperatures. O. Bender. Fr. Pat. 377,442, April 12, 1907.



THE generator, A, is supplied with solid fuel, *f*, on the fire-grate, *e*, from the hopper, *o*, and air, or air and oxygen, compressed or otherwise, is injected, below the fire-grate through the tuyère, *i*, and to the space above, through the tuyère, *g*. Communication is made between the lower and upper spaces through the tube, *h*, which may also traverse the fire. Superheated steam is admitted through the pipe, *b*, and passes into the circular pipe, *c* (which is perforated throughout), and on issuing is decomposed, at the high temperature, into oxygen and hydrogen, the combustion of which in presence of the fire-gases and of air, leads to the formation of nitrogen oxides. The gaseous products are withdrawn through the pipe, *k*, into which a steam jet, *l*, passes, the steam sufficiently cooling the gases to permit of collection of the nitrogen oxides formed. In case the generator is applied in the manufacture of sulphuric acid, either sulphur is mingled with the fuel, or sulphur dioxide is admitted to the furnace, and under the conditions described, sulphuric acid is formed together with nitrogen oxides, which latter aid in the further production of the acid. The heating of the furnace may be reinforced, if desired, by the use of the electric arc.
—E. S.

Kilns for burning limestone and other substances; Vertical ——. E. Schmatolla, Berlin. Eng. Pat. 4478, Feb. 23, 1907.

SEE Second Addition to Fr. Pat. 352,549 of 1905; this J., 1907, 1047.—T. F. B.

Alumino-silicates or artificial zeolites; Manufacture of hydrated ——. R. Gans, Pankow, Germany. Eng. Pat. 8232, April 9, 1907. Under Int. Conv., July 3, 1906.

An alumina mineral, alumino-silicate, or aluminate is fused with an alkali or alkali carbonate together with such a quantity of an inorganic salt, preferably a borate, that on extracting the reaction-product with water, the residue consists solely of crystalline hydrated alumino-silicates. Special claim is made for the product obtained by melting together kaolin (2·5—3 parts), an alkali carbonate (5—6 parts), and borax (1·5—2·4 parts), and subsequently extracting the mass with water. (See also Eng. Pat. 3494 of 1907.)—A. S.

Bleaching powder chamber. M. Mauran, Niagara Falls, N.Y., Assignor to Castner Electrolytic Alkali Co., Va. U.S. Pat. 865,651, Sept. 10, 1907.

The chamber has the usual top and walls, but is provided with a floor having a heat conducting and impervious surface. The floor rests on a layer of moisture-proof material, such as asphalt, and beneath this is a "monolithic slab," provided with passages through which a cooling medium may be circulated for controlling the heat within the chamber.—B. N.

Copper sulphate; Method of obtaining pure ——. R. Conedera, Massa Marittima, Italy. U.S. Pat. 866,625, Sept. 24, 1907.

See Fr. Pat. 362,342 of 1906; this J., 1906, 697.—T. F. B.

Hydrosulphites free from water and perfectly stable; Manufacture of ——. Badische Anilin und Soda Fabrik. First Addition, dated May 6, 1907 (Under Int. Conv., Nov. 14, 1906) to Fr. Pat. 354,273, May 13, 1905. (See Eng. Pat. 8816 of 1905; this J., 1905, 673.)

The hydrated hydrosulphite, in the form of a paste or concentrated solution, is allowed to fall continuously, in small quantities, on to a surface (*e.g.*, an endless band or rotating drum) heated to above 100° C., in order that the water may be evaporated as rapidly as possible. The operation may be conducted at the ordinary pressure or under diminished pressure, and the hydrosulphite paste or solution may be mixed with indifferent substances, such as a solution of gum, starch, molasses, etc.—A. S.

Tricalcium phosphate; Enrichment of ——. J. Gathy. Fr. Pat. 377,749, May 13, 1907. Under Int. Conv., June 5, 1906.

The calcium phosphate is heated sufficiently to decompose the calcium carbonate associated with it. The cooled mass is hydrated, and levigated with a strong solution of calcium chloride, which dissolves out the lime. The solution is submitted to the action of carbon dioxide which causes separation of calcium carbonate, leaving the calcium chloride solution fit for re-use. The process may be modified by digesting the roasted crude calcium phosphate with a boiling solution of calcium chloride, in which case, it is stated, calcium oxychloride crystallises out and may be sold as such, or it may be decomposed by treatment with water.—E. S.

Hydrogen; Method of producing pure ——. A. Frank, Charlottenburg, Germany. Eng. Pat. 26,808, Nov. 26, 1906. Under Int. Conv., Nov. 28, 1905.

See Fr. Pat. 371,814 of 1906; this J., 1907, 408.—T. F. B.

Arsenic; Effecting the removal of —— *from liquids and gases.* G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 974, Jan. 14, 1907.

See Fr. Pat. 376,931 of 1907; this J., 1907, 1047.—T. F. B.

Graphite; Application of —— *to the decolorisation or modification of coloured or saline solutions.* L. H. Dejust. Fr. Pat. 377,716, May 11, 1907.

Graphite or plumbago is substituted for animal charcoal or the like, in the decolorisation and defecation of coloured syrupy, saline, or other liquids. The absorbent character and, hence, the activity of the graphite may be enhanced by suitable mechanical or chemical treatment.—E. S.

Chromite deposits in the United States. U.S. Geol. Survey, 1906. [T.R.]

Although the demand for chromite for use in the manufacture of chromium salts for pigments is chiefly supplied by importations, efforts are being made to develop deposits of this mineral in the United States, and the production in 1906 exceeded the output of any year since 1902, amounting to 107 long tons, valued at $1,800. The whole quantity was mined by two operators in California and was used within that State. High-water mark in this industry was reached in 1894, when the output amounted to 3,680 tons, valued at $53,231. It declined rapidly during the succeeding two years, and the industry came to a standstill in 1897. Production was again resumed in 1900, but since that time not more than 400 tons has been mined in any one year.

Chromite is widely distributed both in the south-eastern and the western parts of the United States, where it is usually associated with basic igneous rocks, but there are few localities where it occurs in sufficient quantities to constitute an ore of chromium. In the States along the Atlantic slope no deposits of chrome ore are worked on a commercial scale, though it is probable that with the extension of railroad transportation some of the deposits will be exploited. The only active chromite mines in the United States are in California, where there has been a small production for many years.

Chromium is imported into the United States both as crude ore and in various manufactured products. The following figures show the imports during the past few years of chromate and bichromate of potash, chromic acid and chrome yellow and chrome ore:—

Potassium chromate and *bichromate*:—1903, 41,229 lb.; 1904, 26,053 lb.; 1905, 59,650 lb.; 1906, 30,098 lb. *Chromic acid* and *chrome yellow*:—1902, 90,817 lb.; 1903, 285,014 lb.; 1904, 209,224 lb.; 1905, 158,402 lb.; 1906, 144,666 lb. *Chrome ore*:—1901, 20,112 long tons; 1902, 39,570 tons; 1903, 22,932 tons; 1904, 24,227 tons; 1905, 54,434 tons; 1906, 43,441 tons.

The production of chromite in Canada has increased rapidly in the last few years, having risen from 900 tons, valued at $13,000 in 1902, to 8,750 tons, valued at $92,100 in 1906. The prices of the Canadian product are somewhat lower than those in the United States, and it is to be expected that any surplus produced in the Dominion will find its way into the United States.

Talc and soapstone in the United States. U.S. Geol. Survey, 1906. [T.R.]

An important increase in the production of talc and soapstone during 1906 is recorded in the annual report of the United States Geological Survey. More than one-half the production of the year was of the fibrous variety of talc, which after being ground was used in the manufacture of paints, paper filling, wall plasters, etc. The production of talc and soapstone during 1906 amounted to 120,644 short tons, valued at $1,431,556, as compared with 96,634 tons, valued at $1,082,062 in 1905. This increase is distributed over nearly all the States of the Atlantic slope, North Carolina alone showing a decreased production.

Nearly all the talc and soapstone quarries are operated or controlled by the manufacturers, and only a small part of the output is sold in the crude state. The production is classified in the following four groups: rough or crude, sawn into slabs, manufactured articles, and ground. The following table shows the production of 1906 classified according to the condition in which it was marketed:—

Condition in which marketed.	Quantity (short tons).	Value.
Rough	15,211	$40,337
Sawn into slabs	4,980	83,563
Manufactured articles	23,575	631,342
Ground	76,878	676,314
Totals	120,644	1,431,556

Talc and soapstone are found in nearly all the Atlantic slope States, and in many of them the deposits are so favourably located as regards transportation and markets as to make their development profitable. During 1906 such quarries were operated in Georgia, North Carolina, Virginia, Maryland, Pennsylvania, New York, New Jersey, Rhode Island, Massachusetts and Vermont. New York, which was formerly the largest producer of talc in the United States, was this year succeeded by Virginia, whose product represents about 41 per cent. of the total value.

VIII.—GLASS, POTTERY, AND ENAMELS.

Fluorspar production of the United States. U.S. Geol. Survey, 1907. [T.R.]

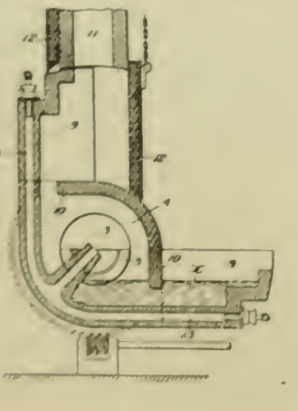
There was a heavy decline in the production of fluorspar in the United States in 1906 as compared with 1905. The total quantity of fluorspar marketed during the year was 40,796 net tons, valued at 244,025 dols., as compared with 57,385 tons, valued at 362,488 dols. in 1905. The reduced output is doubtless due largely to over-production in 1905, the surplus stock of which was sold the following year. It is the custom of some producers to carry a reserve stock equal to about one year's production. There was, therefore, a large quantity on hand, unsold, at the close of 1906. Production is confined to five States, viz., Arizona, Colorado, Illinois, Kentucky, and Tennessee.

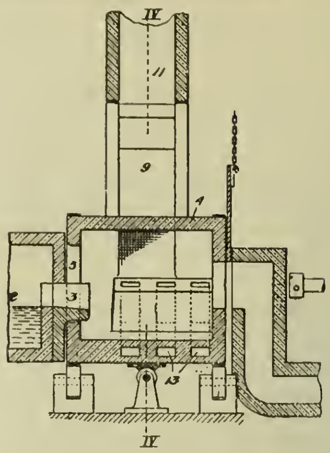
The three principal classes of consumers of fluorspar are smelters and metallurgists, makers of opalescent glass and enamelled ware, and makers of hydrofluoric acid. The lower grades only are used in metallurgy and smelting. Fluorspar is a more efficient flux than limestone, especially when used with refractory ores, but the proportion in which it can be used is limited, as its favourable effects do not increase indefinitely with the quantity employed. In blast furnaces it is used in the production of ferromanganese and ferrosilicon; in basic open-hearth steel furnaces, to give increased fluidity to the slag, and to reduce the phosphorus and sulphur content. The lowest grade of fluorspar is used in iron and brass foundries, where it both helps to make the metal more fluid, and assists in removing impurities. It is also used in extracting aluminium from bauxite, in smelting gold ores, and in refining copper and lead bullion.

PATENTS.

Glass; Apparatus for use in the manufacture of ——. R. S. Pease, Allegheny, Pa. Eng. Pat. 9575, April 24, 1907.

A tank, 2, containing molten glass, delivers by means of a spout, 3, into the mouth, 5, of a cylindrical partly rotatable vessel, 4, provided with the laterally placed filling and drawing chambers, 9, 9. Through the port, 13, air and gas are supplied to the vessel, 4, so as to maintain the heat in its interior, the burnt gases escaping in either position of the vessel through the fixed flue, 11, the gap between which and the wall, 10, of the vessel is filled by one of the slides, 12, which can be raised or lowered.





This bridge wall, 10, dips considerably below the normal level, *x*, of the molten glass in 9, so as to free the glass in flowing outward from the central vessel into the lateral chambers from air-bubbles and light impurities. The vessel, 4, can swing sufficiently far below the flue, 11, to enable the glass to be poured out of 9 into a pot or on to a table; or else the glass may be drawn from the chamber 9.—A. G. L.

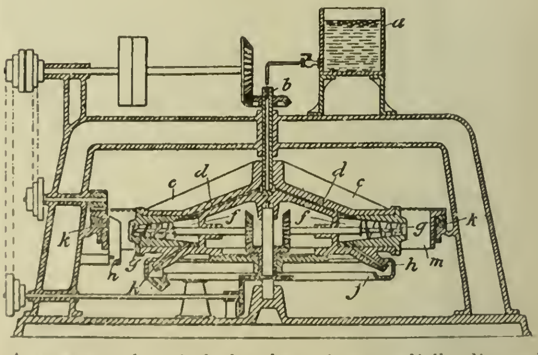
Mirrors; Process for the preparation of ——. Chem. Fabr. von Heyden, A.-G. Ger. Pat. 178,520, July 26, 1905.

The article to be coated is covered with a paste of extremely finely-divided mercury, obtained in the wet way by the reduction of mercury compounds. The pastes obtained by the reduction of mercury salts in presence of alkalis and proteid bodies, are specially suitable.—A. S.

Kilns for pottery, porcelain, bricks and the like. W. F. Murray, Stevenston, N.B. Eng. Pat. 24,272, Oct. 31, 1906.

To prevent the drawing of air through fissures and cracks in the walls of gas-fired chamber kilns, the air necessary for combustion is supplied under pressure sufficient to obviate such leakage from without.—O. R.

Separating apparatus; Centrifugal —— [for potters' slip]. P. Spengler, Merzig on the Saar, Germany, and E. Sommerschuh, Rakonitz, Austria. Eng. Pat. 18,147, Aug. 10, 1907.



A number of conical chambers, *f*, are radially disposed on a rotating disc, or cone, *c*, actuated by gearing as shown. The apparatus is specially intended for separating water from "slip," and the latter is fed from the tank, *a*, into the hollow shaft, *b*, and passes by the channels, *d*, to the conical chambers, *f*. When starting the machine, the outer ends of the chambers, *f*, are stopped up, the disc is rotated, and "slip" is run in from *a*, but the screws, *g*, are not worked. A solid plug of paste is formed in the ends of the chambers, *f*, and the water escapes by the channels, *h*, into the gutter, *i*. After a time the apparatus is stopped, the stoppers removed from the ends of the chambers, the screws, *g*, are thrown into gear, and the apparatus started again. "Dry" paste is then continuously forced out of the open ends of the chambers, *f*, by the screws, *g*, and the water escapes as before. The paste is thrown against the ring, *m*, revolved by the rollers, *k*, and is continuously removed by the scraper, *n*.—W. H. C.

Decorations on porcelain; Process for the preparation of matt, coloured ——. Galluba und Hofmann. Ger. Pat. 179,562, Feb. 9, 1905.

The different colours are laid on in the liquid condition, and covered with a colourless glaze, and the goods are burnt. They are next coated with another colourless, easily fusible glaze, burnt at a relatively low temperature, and then etched with weak acid.—A. S.

Pottery; Process for the manufacture of —— from mixtures of pottery-masses and glass. H. Eisenlohr. Ger. Pats. 182,107, and 182,108, June 14, 1905.

A hard glass of low melting point, but containing a high percentage of silica, is mixed with a non-plastic clay or with quartz, then formed into the desired shapes with plastic clay as binding material, and burnt. It is stated that glass prepared from quartz, alkalis, alkaline-earths, and aluminous materials, and containing at least 75 per cent. of silica, with about 8 per cent. of alumina, is as hard and resistant as felspar, but has a much lower melting point. When used as described above, it yields on burning at 1200° C., a sintered and transparent ware, which is claimed to be very resistant to sudden changes of temperature and to the action of chemicals. In Pat. 182,108, the use, in the process described, of a glass containing 75 per cent. of silica and about 10 per cent. of alumina is claimed. —A. S.

Enamelling and annealing; Process of —— and ovens employed therefor. O. Zahn, Berlin. Eng. Pat. 27,048, Nov. 28, 1906. Under Int. Conv., Nov. 28, 1905.

The working chamber in which the enamelling is carried out is first heated internally by means of hot gases on their way to the chimney. These gases are then shut off by means of dampers, and passed through flues located in the walls of the working chamber. In order to prevent accidental entry of the gases into the working chamber through the dampers not fitting properly, means are inserted between the ports to the chamber and the chimney, which draw the gases from the former into the latter; or else an over-pressure of some indifferent gas may be created in the chamber.—A. G. L.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Corundum; Artificial ——. O. Hönigschmid. Monatsh. Chem., 1907, 28, 1107—1111.

It is stated that a method for preparing boron in a crystalline form, as given by Kühne (Chem. Centr., 1904, 1, 64), does not give crystalline but amorphous boron: at the same time, however, there are produced crystals of artificial corundum. The process is carried out by mixing 100 grms. of powdered fused borax, 100 grms. of aluminium powder, and 125 grms. of flowers of sulphur, and igniting these with the assistance of a mixture of barium peroxide and powdered magnesium. The products are: (1), aluminium sulphide; (2), particles of fused aluminium; (3), crystals of alumina (artificial corundum); (4), brown amorphous boron: (5), small quantities of crystallised aluminium borides. To separate these, the sulphide is decomposed by dilute ammonia, and the aluminium hydroxide removed by cold, dilute hydrochloric acid; the aluminium is next picked out, and the crystals of alumina are separated from the boron by washing, and by treatment with concentrated nitric acid which dissolves the boron.—C. E. F.

Patents.

Kilns for burning bricks, lime, and like materials. P. Czigler, Komitat Féjer, and J. Eotvös, Komitat Veszprem, Hungary. Eng. Pat. 27,747, Dec. 5, 1906.

See Fr. Pat. 373,000 of 1906; this J., 1907, 612.—T. F. B.

Solid forms [of silicon carbide]; Process for the manufacture of ——. G. Egly, Assignor to Gebr. Siemens und Co., Charlottenburg, Germany. U.S. Pat. 866,444, Sept. 17, 1907.

See Eng. Pat. 26,384 of 1905; this J., 1906, 428.—T. F. B.

Impregnating wood or other substances; Apparatus for ——. B. Kuckuck, Wannsee, Assignor to Hülsberg und Co., m.b.H., Charlottenburg, Germany. U.S. Pat. 866,487, Sept. 17, 1907.

See Ger. Pat. 185,531, following.—T. F. B.

Impregnating wood and the like, in closed vessels, with tar oils or other inflammable substances; Process and apparatus for avoiding the danger of fire in ——. Hülsberg und Co. G.m.b.H. Ger. Pat. 185,531, Oct. 8, 1905.

The air used for forcing the impregnating liquid into the pores of the wood, is previously freed from the greater part of its oxygen by passing it through a coke-oven. The pipe leading the air to the coke-oven is branched so that part of the air is delivered above and part below the coke, and in this way a predetermined portion of the oxygen can be converted into carbon dioxide.—A. S.

Tiles and similar moulded objects made of cement; Method of colouring ——. P. de Jorge. Fr. Pat. 378,034, July 27, 1906.

The tile, of cement and sand, is, whilst in the mould and still plastic, covered with a paint consisting partly of substances impervious to water, and partly of substances capable of uniting with the body of the tile, *e.g.*, a mixture of 100 parts of white cement (plaster), 10 of the colouring matter, 0·98 of stearine, 0·048 of potassium carbonate, and 0·04 of colophony. By superimposing two such mixtures in different colours by means of perforated zinc sheets, a coloured design may be given to the tile. The tile is sprinkled with water, allowed to remain in the mould another two days, and then taken out and allowed to harden for about 60 days.—A. G. L.

Cement [from blast-furnace slag]; Manufacture of ——. The Collos Portland Cement Co., Ltd., London. From H. Colloseus, Berlin. Eng. Pat. 1646, Jan. 22, 1907.

A solution of a salt of an alkali metal (preferably sodium or potassium sulphate) is injected into a stream of molten blast-furnace slag, with the result that the water is instantly vaporised, and the slag, intimately mixed with the salt, falls to the ground in a fine powder ready for immediate grinding into cement. The amount of salt required to be incorporated varies in inverse proportion to the basicity of the slag, the approximate amounts of salt necessary for slags carrying 50, 45, and 40 per cent. of lime, being 0·5, 2 to 3, and 4 to 5 per cent. respectively. A suitable apparatus for carrying out the process is described in Eng. Pat. 14,329 of 1905 (see Fr. Pat. 356,379 of 1905; this J., 1906, 26).—O. R.

Cement [from blast-furnace slag]; Manufacture of ——. The Collos Portland Cement Co., Ltd., London. From H. Colloseus, Berlin. Eng. Pat. 1647, Jan. 22, 1907.

A solution of a salt of one of the metals of the iron group, preferably ferric chloride or ferrous sulphate, is injected into a stream of molten blast-furnace slag under conditions similar to those described in Eng. Pat. 1646 (see preceding abstract). The quantity of solution injected should be such that about 0·6 per cent. of the dry salt is retained by slags containing 50 per cent. of lime, 1 per cent. of the salt by slags containing 45 per cent. of lime, and from 1·5 to 10 per cent. of the salt by slags containing 40 per cent. of lime and less. The inclusion of iron compounds is said to render slag cement truly hydraulic and specially stable towards sea-water.—O. R.

Portland cement, and process for making the same. R. K. Meade, Nazareth, Pa. U.S. Pat. 866,376, Sept. 17, 1907.

A mixture of argillaceous material and magnesian limestone, containing from 3 to 20 per cent. of magnesia, is heated to incipient vitrification and incorporated with a

chloride, such as calcium chloride, in an amount proportioned to the quantity of magnesia in the mixture.
—W. C. H.

Cement; Process for preventing the expansion of ——. Edelmann and Wallin. Ger. Pat. 180,177, Sept. 24, 1905.

THE claim is for the addition of up to 5 per cent. of kieselguhr to the cement, whereby it is stated a product of constant volume is obtained, whilst the tensile- and crushing-strengths are increased by 25 and 15 per cent. respectively.—A. S.

Cement; Process for the preparation of a powder, hardening rapidly with water, from ——. B. Hövermann. Ger. Pat. 174,840, Nov. 1, 1905.

THE powder consists of a mixture of cement, alkali carbonate, aluminium sulphate, and white lead.—A. S.

X.—METALLURGY.

Mercury production in 1906. Ch. of Comm. J., Oct., 1907. [T.R.]

THE following table shows the average prices during the last five years for mercury in flasks of 75 English pounds weight on the London metal market:—

	1902			1903			1904			1905			1906		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Highest ...	8	17	6	8	15	0	8	5	0	7	15	0	7	7	6
Lowest ...	8	14	6	8	5	0	7	14	0	7	1	0	6	17	0

The countries producing mercury are Austria, Italy, Mexico, Russia, Spain and the United States, all of which produce for export, with the exception of Mexico, which imports mercury for the amalgamation process for extracting silver. The falling off in the production is shown in the following table, the figures representing metric tons:—

	1901	1902	1903	1904	1905	1906*
Austria-Hungary ...	558	566	567	581	564	419
Italy	278	259	314	357	370	268
Mexico	128	191	188	190	190	—
Russia	368	416	362	332	318	82
Spain	754	1,425	914	1,020	800	1,481†
United States......	1,031	1,208	1,288	1,192	1,043	211
Total	3,117	4,055	3,633	3,672	3,285	—

* Eleven months. † Complete year.

Metallurgy of iron; Application of the laws of physical chemistry in the ——. H. von Jüptner. Iron and Steel Inst., September, 1907. [Advance proof.]

THE author gives a preliminary account of the conclusions which have been established as to the conditions of equilibrium in reversible reactions dependent upon temperature, showing how equilibrium is dependent upon the dissociation-pressures of the various substances concerned. He then applies these principles to the reactions going on in the blast-furnace, and points out the conditions under which the reduction of iron oxides is effected by carbon monoxide and by carbon respectively, as also those under which the reaction: $2CO = CO_2 + C$, with resulting deposition of carbon, can occur.—J. T. D.

Iron; Heat content of ——. P. Oberhoffer and J. W. Richards. Metallurgie, June 22, July 8 and 22, 1907. Electrochem. and Met. Ind., 1907, **5**, 366.

OBERHOFFER determined the specific heat at temperatures between 250° and 1500° C. of a sample of soft steel containing 0·06 per cent. of carbon, 0·005 per cent. of silicon, 0·005 per cent. of phosphorus, 0·019 per cent. of sulphur, and 0·05 per cent. of manganese. Cooling curves of the iron showed arrests in the speed of cooling culminating at 860° C., 750° and 680° C. The results are shown in the following table, the figures for temperatures above 1500° C. being estimated values by Richards, the latent heat of fusion of the iron being taken as 69—70 calories, and the specific heat of liquid iron as 0·20.

°C.	Grm.-cals. per grm.	°C.	Grm.-cals. per grm.	°C.	Grm.-cals. per grm.
250	30·5	900	152·8	1500	250·0
300	37·7	950	160·4	1550	258·3
350	45·0	1000	167·8	1600	266·7
400	52·2	1050	175·4	1600	336·0
450	60·3	1100	183·0	1650	346·0
500	68·3	1150	191·7	1700	356·0
550	76·7	1200	200·0	1750	366·0
600	85·0	1250	208·3	1800	376·0
650	95·1	1300	261·1	1850	386·0
700	111·8	1350	224·2	1900	396·0
750	125·6	1400	233·1	1950	406·0
800	135·8	1450	241·4	2000	416·0
850	144·4	—	—	—	—

—A. S.

Steels; Hardened ——. P. Longmuir. Iron and Steel Inst., Sept., 1907. [Advance proof.]

THE examination of specimens of hardened steels which had proved satisfactory in actual work, showed that these had a uniform structure free from any pronounced pattern, the constitution being essentially that described by Arnold and McWilliam (this J., 1902, 861). Steels which had been spoiled in the hardening process, on the other hand, exhibited a pronounced structure, with more or less crystalline patterns, which were different in different parts of the same section; in many cases, characteristic martensitic, austenitic, or troostitic appearances were observed. The conclusion that a uniform, not very pronounced structure is characteristic of properly hardened steels, was supported by the results of laboratory tests on steels quenched from different temperatures.—A. S.

Cast-irons; Special ——, *particularly high-carbon ferro-nickels.* L. Guillet. Compt. rend., 1907, **145**, 552—553.

QUANTITIES of nickel ranging from 1 to 50 per cent. were added to a white cast iron and from 1 to 12 per cent. to a grey cast iron, and the resulting alloys were examined micrographically. It was found that nickel favours the formation of graphite, and in view of results previously obtained, the conclusion is drawn that those elements which dissolve in iron (nickel, aluminium, silicon) favour the separation of graphite, whilst those which form a double carbide with cementite (manganese, chromium) retard this separation. On adding increasing quantities of nickel to cast iron, the pearlite first disappears, and sorbite is formed. Then (at 2 per cent. of nickel) the cementite acquires, in part at least, the acicular form, which is rarely observed in ordinary cast iron, and (at 6 per cent. of nickel) γ-iron and needles of troosto-sorbite make their appearance, the sorbite disappearing. As the quantity of nickel increases further, the proportions of γ-iron and of troosto-sorbite increase and decrease respectively, until with about 25 per cent. of nickel, only γ-iron and graphite are present. On adding manganese to cast iron, there is no formation of γ-iron, but sorbite makes its appearance. The special cementite (double carbide) which is formed, increases in quantity, and is less readily attacked by sodium picrate solution (etching reagent) as the content of manganese becomes higher.—A. S.

Tin oxide; Separation of —— *from wolfram.* A. Treloar and G. Johnson. Inst. Min. and Metall., October, 1907. [Advance proof.]

IN the treatment of tin-wolfram ores by a magnetic separator, the resulting "tinny-wolfram" contains 28 per cent. of tin oxide and only 61 per cent. of wolfram. It is found that a large proportion of this tin can be extracted by heating the ore with dilute sulphuric acid and then again passing through the magnetic separator. For example a sample (1 cwt.) of the ore was heated with sulphuric acid (1 in 20) for 4—5 days, then washed, dried, and passed through a Wetherill magnetic separator, when it yielded 20 per cent of tin oxide, 73 per cent. of wolfram, 6·5 per cent. of tinny wolfram, and 0·5 per cent. of iron oxide.
—A. S.

Tin-cobalt alloys. F. Ducelliez. Compt. rend., 1907, **145**, 502.

The author has extended his study of tin-cobalt alloys (see this J., 1907, 1011) to those containing from 57—66 per cent. of tin. Three alloys were examined containing respectively, 59·72, 61·15, and 64·83 per cent. of tin. The first two on repeated treatment with 15 per cent. hydrochloric acid, left residues having a composition approaching that of the compound, Co_3Sn_2. On treatment with concentrated nitric acid, they left residues containing about 64 per cent. of tin. The alloy containing 64·83 per cent. of tin left a residue of the compound, CoSn, on treatment with concentrated nitric acid, but its composition was not appreciably altered by the action of hydrochloric acid. The three alloys thus appear to be mixtures of the compounds, Co_3Sn_2 and CoSn; they are all brittle and non-magnetic.—A. S.

Silicides of molybdenum, tungsten and tantalum. O. Hönigschmid. Monatsh. Chem., 1907, **28**, 1017—1028.

The silicides of molybdenum, tungsten and tantalum were prepared by the aluminium reduction method (this J., 1906, 812) in a similar manner to the silicides of zirconium and titanium. They have the formula, MSi_2, where M stands for any one of these metals. The reaction mixture consists of 90 grms. of quartz sand, 100 grms. of aluminium powder, 125 grms. of flowers of sulphur, and 10, 20 or 15 grms. of the oxide of molybdenum, tungsten or tantalum respectively. The silicides are crystalline and possess metallic lustre. They are scarcely attacked by mineral acids, except by a mixture of nitric and hydrofluoric acids.—C. E. F.

Patents.

Iron and steel; Manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 13,979, June 17, 1907.

The patent relates to a process of treating iron or steel to render it extremely hard on the surface, but tough and elastic in the inner portion. It consists in incorporating the molten iron with a small proportion (say 1 per cent.) of vanadium, preferably added in the form of ferro-vanadium, ferro-nickel-vanadium or ferro-chrome-vanadium, and then subjecting the metal to a process of cementation by means of a mixture of carbon and vanadium oxide, *e.g.*, 60 per cent. of the former to 40 per cent. of the latter.—A. S.

[Alloy] Magnetic composition and method of making the same. R. A. Hadfield, Sheffield. Re-issue No. 12,691, Sept. 3, 1907, of U.S. Pat. 745,829, Dec. 1, 1903.

A material of high permeability and low hysteresis action is made by alloying iron with 1—5 per cent. of silicon. The alloy is heated to 900°—1100° C., allowed to cool, reheated to 700°—850° C. and allowed to cool slowly.
—O. F. H.

Slimes and other substances; Apparatus for treating —— with air and other fluids. W. H. N. Goschen, London. From B. Solis, Mazatlan, Mexico. Eng. Pat. 13,275, June 8, 1906.

The apparatus is intended specially for the agitation, by means of compressed air, of a mixture of auro-argentiferous or auriferous ore with cyanide solution. It consists essentially of an arrangement of apparatus whereby compressed air is introduced into the mixture of ore and cyanide solution through nozzle-distributors so suspended from and arranged upon a tubular frame structure, that the air issuing from the nozzles causes a part or parts of the frame to rotate with respect to the remainder, and, also, by means of gearing, to rotate the whole frame. In this way the nozzles themselves travel in epicyclic paths, and the air is brought into effective contact with all parts of the mixture of ore and solution.—A. S.

Alluvial gold deposits; Hydraulic apparatus for the treatment of ——. L. A. Pottereau. Fr. Pat. 377,456, April 25, 1907.

Each amalgamating table is covered with a network of cells, square or otherwise (riffles). The water supplied to the table is given a certain force by dropping from openings in a number of pipes placed at a certain height above, and crosswise to, the table. These pipes are fed from longitudinal pipes joining their ends, and the whole system of pipes is given a reciprocating motion along the table, the fresh material being supplied to the cells after the latter have been filled with water. The gangue is caused to move from cell to cell and finally off the table.—A. G. L.

Waste liquor from galvanising iron; Utilisation of ——, *and apparatus thereto.* G. F. Thomson, Bedford. Eng. Pat. 20,057, Sept. 10, 1906.

The waste liquor is treated with the requisite quantity of magnesite, and the mixture heated in closed rotating iron drums or tubes, similar to tube-mills, containing flint stones or iron balls. The carbon dioxide produced in the reaction is collected, and the slush or mud from the tubes is passed through filter-presses in order to recover iron oxide and magnesium chloride solution.
—A. S.

Cement [from blast-furnace slag]; Manufacture of ——. The Collos Portland Cement Co., Ltd. From H. Colloseus. Eng. Pats. 1646 and 1647, Jan. 22, 1907. *See* IX.

Rust; Method of avoiding the formation of —— in tinned iron tanks or vessels. Aktieselskabet Burmeister and Wain's Maskin-og Skibsbyggeri and N. C. Nielsen, Copenhagen. Eng. Pat. 11,821, May 21, 1907.

Pieces of a tinned or untinned metal or alloy, *e.g.*, zinc, which is more electro-positive than iron, are soldered on to the inner surface of the tinned iron tank, for instance in recesses of suitable size, whereby it is stated, the electric current generated by the liquid coming into contact with the two metals—the iron and the more electro-positive metal—prevents or impedes the combination of oxygen with the iron.—A. S.

Agglomerated body [blast-furnace dust, etc.]. W. Schumacher, Osnabrück, Germany, Assignor to E. Thalmann, New York. U.S. Pat. 864,804, Sept. 3, 1907.

Blast-furnace dust or the like is bound into a coherent body by an intimate mixture of calcium silicate and a very small proportion of silica in the form of exceedingly small jagged particles.—O. F. H.

Ores; Method of separating the metallic and rocky constituents of ——. D. H. Norris, New York. U.S. Pat. 864,856, Sept. 3, 1907.

The crushed ore mixed with oil and water, or with water only, is introduced into the upper end of a cylindrical receptacle, into which water containing air in solution is forced at the lower end. Minute bubbles of air are formed, which attach themselves to the metallic particles carrying them to the top, whilst the waste sinks to the bottom.—O. F. H.

Minerals; Apparatus for extracting —— from ore. O. A. Ellis, San Francisco, Cal. U.S. Pat. 865,027, Sept. 3, 1907.

The ore and a chemical solution flow from a hopper into the upper end of a long inclined open shoot or launder, provided with riffles. At the lower end of the launder is a precipitating box, connected by a movable shoot, to one or other of a series of filtering vats. Means are provided for passing an electric current through the precipitating box. The mixture of ore and solution flows down the launder, through the precipitating box, into one or other of the filtering vats. From the latter the solution drains into a reservoir, whence it is pumped back to the hopper.—O. F. H.

Roasting ores and separating by-products therefrom; Apparatus for ——. A. D. Lee, Brookline, Mass. U.S. Pat. 865,309, Sept. 3, 1907.

A chamber closed at the sides and at the bottom, is heated by gas admitted by a number of inlets immediately above the bottom of the chamber, and air or steam, or a mixture of air and steam is forced into the chamber through passages surrounding the gas inlets. The ore is fed into the chamber by hoppers in the roof, in which is also an outlet for the gases, communicating with scrubbers and a gasometer. Means are provided for heating the gas passing to the chamber.—O. F. H.

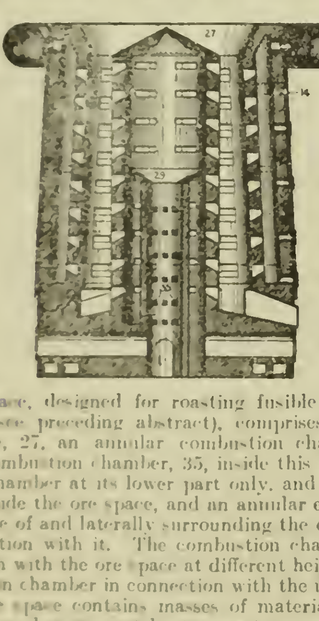
Smelting ores and converting matte; Process of ——. A. M. Day, Bingham Canyon, Utah. U.S. Pat. 865,333, Sept. 3, 1907.

The ore is placed in a furnace or converter, and covered with a molten substance containing sufficient heat to start the fusion of the charge. Air is supplied to the charge at or near the melting level as fusion progresses downwards, and at the same time powdered silica or siliceous material "in a fluent form" is injected by an air blast through separate tuyères.—O. F. H.

Fusible ores; Process of roasting ——. A. G. Davis, Washington, D.C. U.S. Pat. 866,580, Sept. 17, 1907.

The fusible sulphide ore, rich in sulphur, is allowed to fall slowly down a narrow vertical chamber, in which it is met by two currents of gas. The first consists of non-oxidising products of combustion at a temperature sufficiently high to distil off a portion of the sulphur from the ore, which then, no longer fusible, meets a current of hot oxidising gases.—A. G. L.

Fusible ores; Apparatus for roasting ——. A. G. Davis, Schenectady, N.Y. U.S. Pat. 866,581, Sept. 17, 1907.



The furnace, designed for roasting fusible ores rich in sulphur (see preceding abstract), comprises an annular ore space, 27, an annular combustion chamber, 29, a central combustion chamber, 35, inside this annular combustion chamber at its lower part only, and for its whole length inside the ore space, and an annular exit chamber, 14, outside of and laterally surrounding the ore space and in connection with it. The combustion chambers are in connection with the ore space at different heights, and the combustion chamber in connection with the upper portion of the ore space contains masses of material capable of absorbing and giving out heat so as to equalise the temperature in the upper portion of the ore space.—A. G. L.

Ores; Process for treating mixed sulphide ——. G. de Bechi and R. W. Ricker. Fr. Pat. 378,304, April 10, 1907. Under Int. Conv., April 20, 1906.

See Eng. Pat. 9339 of 1906; this J., 1907, 618.—T. F. B.

Minerals; Process for concentrating —— *by means of an intermittent current of liquid.* F. G. Buendia. Fr. Pat. 377,791, May 13, 1907. Under Int. Conv., May 23, 1906.

The mineral is concentrated by the action of a current of water to which regulated pulsations are given by means of two perforated metal discs. One of these discs is stationary, the other revolves, so that the current of water is interrupted whenever the holes in the two discs do not coincide. —A. G. L.

Tin ores, ashes, slags, or stanniferous waste of any kind; Reverberatory furnace and process for the treatment of ——. H. Mennicke. Fr. Pat. 378,075, May 24, 1907.

This furnace has its hearth inclined towards the middle, where there is a cavity in masonry of suitable dimensions. The metal and slag accumulate and separate in this cavity. It is claimed that all loss of metal is avoided. The furnace is only tapped after the treatment of at least four charges. —R. L.

Furnace and process for the extraction of metals or alloys from ores, ashes, residues or waste containing tin, lead, antimony, copper, bismuth and arsenic. H. Mennicke. Fr. Pat. 378,077, May 24, 1907.

This furnace is composed of a number of funnels, mounted one above the other inside a gas producer near its wall. The top of the furnace penetrates the cover of the producer and forms a hopper into which the ore or material to be treated is charged. The bottom funnel leads into a collecting trough having a tapping passage through the wall of the producer. The pressure and heat of the reducing gases in the producer effect the continuous fusion of the contents of the furnace without the employment of a special heating and reducing fuel. The formation of slag and consequent loss of metal is avoided. The producer gas does not suffer any appreciable alteration in its composition and may be afterwards utilised in the ordinary manner.—R. L.

Tin ores, ashes, stanniferous waste and similar materials containing sulphur; Furnace and process for the roasting of ——. H. Mennicke. Fr. Pat. 378,079, May 24, 1907.

The bottom of the trough-like furnace consists of three steps or shelves, the lowest being near the fire-bridge. The ore is charged on to the highest shelf and moved towards the lower ones, access being allowed through openings in the side walls. The fire-gases travel in the opposite direction. By this means a gradual heating of the material is ensured and the dust is prevented from being carried away with the gases. It is stated that in a furnace of 6 metres length and 1·5 metres width, 5 tons of ore can be roasted in 24 hours so that the product contains only 0·1 per cent. of sulphur.—R. L.

Tin; Process and apparatus for condensing and precipitating metallic vapours, dust, etc., containing ——. H. Mennicke. Fr. Pat. 378,080, May 24, 1907.

Frames over which fine wire gauze is stretched are placed in the flues, transversely to the flow of gases, at a suitable distance from each other. The top bar of the frame is formed of a perforated pipe through which water or a dilute alkaline solution of sodium sulphide drips, forming a film on the wire netting. This film condenses the vapours and retains all solid particles, the latter being at the same time continually washed down by the liquid and collected in a trough into which the base of the frame extends and which is provided with an overflow pipe. —R. L.

Tin and its salts and compounds; Process for the production of —— *from stanniferous slags and other similar materials.* H. Mennicke. Fr. Pat. 378,081, May 24, 1907.

In the extraction of tin or its compounds from stanniferous residues, powdered basic slag or other similar materials containing phosphoric acid together with lime, iron, and sodium are added in the usual smelting process. This is said to increase the yield of metallic tin and avoid oxidation.—R. L.

Tin; Furnace and process for the extraction of —— *from residues, pastes and precipitates containing it.* H. Mennicke. Fr. Pat. 378,082, May 24, 1907.

Spongy material containing tin together with iron, sulphur, silica, and alkali, is placed in inclined rotating retorts and reduced and melted without access of air by the action of producer gas which also serves to heat the retorts. These are kept at a temperature which prevents the formation of slag and consequently loss of tin. The inclined position and the rotating movement of the retorts causes the fine particles to unite to metallic globules which are subsequently fused together.—R. L.

Tin; Process for the extraction of pure —— and of lead compounds from spongy tin and lead from electrolytic recovery processes. H. Mennicke. Fr. Pat. 378,083, May 24, 1907.

The materials containing tin and lead are mixed with alkaline-earth oxides or carbonates, placed in rotary retorts and heated to incandescence. A current of air or oxygen is passed through, and after oxidation, carbon dioxide or substances generating carbon dioxide are introduced. Stannates and plumbates are formed, and separated from the lime by washing. The lime is returned to the process; the stannate and plumbate are dissolved in hydrochloric acid and treated by any known method. —R. L.

Volatile heavy metals; Process for obtaining compounds of —— soluble with difficulty. C. Luckow. Ger. Pat. 179,305, Dec. 11, 1903.

The metals are distilled in a vacuum, and the vapours are absorbed in water or suitable aqueous solutions. By this method there is no possibility of injury to the workpeople from the metal fumes, the whole of the operations being carried out in closed vessels.—A. S.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Platinum; Decomposition of ——. T. Gross. Chem.-Zeit., 1907, 31, 975.

It is stated that when molten potassium carbonate is very strongly heated in a platinum vessel and subjected to an alternating current, between platinum electrodes, for many hours, with the occasional addition of a little potassium nitrate, the electrodes are attacked and become coated with needle-shaped crystals of the colour of graphite. At the same time the vessel and electrodes lose weight, and, on extracting the melt with water, a brown powder, free from potassium and carbon, is obtained. The crystals and brown powder yield solutions which are precipitated by sulphuretted hydrogen, but they, and the other products of electrolysis, appear to contain no platinum. Experiments in which molten potassium hydroxide and a mixture of nitric and sulphuric acids respectively replace potassium carbonate, give confirmatory results. It would appear, therefore, that platinum is chemically decomposed by such treatment.—F. Sodn.

Carbon dioxide in electrolytic chlorine, bleaching powder, and bleaching liquors; Determination of ——. P. Philosophoff. *See* XXIII.

PATENTS.

Electric furnaces; Method of charging —— for producing carbide from lime and carbon. A. Petersson, Alby, Sweden. Eng. Pat. 5657, March 8, 1907.

See Fr. Pat. 370,911 of 1906; this J., 1907, 327.—T. F. B.

Furnaces; Electric ——. S. Z. de Ferranti. Fr. Pats. 378,482 and 378,483, June 5, 1907. Under Int. Conv., June 18, 1906.

See Eng. Pats. 13,949 and 13,949A of 1906; this J., 1907, 878.—T. F. B.

Insulating material and method of producing the same. C. L. Norton, Manchester, Mass., Assignor to Asbestos Wood Co., Me. U.S. Pat. 865,606, Sept. 10, 1907.

A porous body, composed of asbestos fibre containing magnesium hydroxide, is heated and impregnated with a liquefiable oxidisable hydrocarbon, such as ozokerite, and the latter is allowed to harden by association with the magnesium hydroxide.—B. N.

Filaments for incandescence electric lamps; Manufacture of —— from tungsten or tungsten alloy. Siemens und Halske A.-G. Fr. Pat. 377,846, May 15, 1907. *See* II.

Filaments for incandescence electric lamps; Metallic —— and their process of manufacture. Glühlampen-Fabr. Union, Albrecht und Bahr. Fr. Pat. 378,022, May 22, 1907. *See* II.

Nitrous compounds; [Electrical] Production of ——. C. P. Steinmetz, Schenectady, N.Y., Assignor to General Electric Co., N.Y. U.S. Pat. 865,618, Sept. 10, 1907.

An electric arc of minimum volume and maximum length is established in a suitable apparatus, and a rotating magnetic flux is passed through it at right angles to the axis of the arc. The latter is deflected and rotated magnetically, and a current of air is passed through the space of rotation.—B. N.

Glycollic acid; [Electrolytic] Process for making ——. F. Reinhold. Fr. Pat. 378,276, May 30, 1907.

Glycollic acid can be obtained by the electrolytic reduction of oxalic acid in acid solution, using a lead cathode and a diaphragm. It is necessary to use a moderately strong acid solution, to prevent ionisation of the oxalic acid. For example, the solution may contain seven parts of oxalic acid and 11 parts of 30 per cent. sulphuric acid solution in 33 parts of water; the anolyte may consist of 30 per cent. sulphuric acid. The current density may vary, it is stated, from 25 to 250 ampères per sq. metre of cathode surface.—T. F. B.

(*B.*)—ELECTRO-METALLURGY.

PATENTS.

Metal wire, strip or the like; Electrolytic manufacture of ——. S. O. Cowper-Coles, London. Eng. Pat. 27,099, Nov. 28, 1906.

In the manufacture of metal strip or wire by the method described in Eng. Pat. 21,568, of 1904 (this J., 1905, 976), a sharp fin or burr is produced on two sides of the strip. This is removed by passing the strip, as it is unwound from the mandrel, through an acid bath, the strip forming the anode and another metal the cathode. The strip may be coated with a "resist," leaving only the fins or burrs exposed to the acid, and a powerful current is passed through the strip and the bath.—B. N.

Ores; [Electrical] Process of smelting refractory ——, and producing low-carbon ferro-alloys. E. F. Price, Niagara Falls, N.Y. U.S. Pat. 865,609, Sept. 10, 1907.

Low-carbon ferro-alloys, such as ferro-chromium, are produced by smelting a charge containing ferro-silicon with an oxidised compound of a metal, such as chromium, and a basic flux. An electric current is passed through the charge, acting as a resistance conductor, the current density being increased to a point where reduction is effected. The slag and alloy are withdrawn from the furnace at different levels, and the charge mixture is supplied as required.—B. N.

Fused salts; Electrolysis of ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. U.S. Pat. 865,648, Sept. 10, 1907.

Magnesium-calcium alloy is produced by the electrolysis of a fused mixture of calcium chloride and magnesium fluoride. The latter has a higher decomposition voltage than the former compound, and the electrolysis is regulated so that the secondary reaction between the more electro-positive metal, calcium, and the magnesium fluoride is only partially complete, so that the desired alloy is obtained.—B. N.

Nickel films; Process of making —— [electrolytically]. T. A. Edison, Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 865,687, Sept. 10, 1907.

A film of copper is deposited chemically on a suitable cathode, and alternating films of copper and nickel are then deposited electrolytically. The composite sheet is stripped from the cathode, cut into long strips or filaments, and these are subjected to the action of an ammoniacal solution of copper sulphate, in order to dissolve the copper. The "resulting filamentary filaments" are dried, and reduced to pieces of the desired size.—B. N.

Metallic films or flakes ; Process of making —— [electrolytically] ; T. A. Edison, Assignor to Edison Storage Battery Co., West Orange, N.J. U.S. Pat. 865,688, Sept. 10, 1907.

The process is similar to that described in U.S. Pat. 865,687 (see preceding abstract), but in addition, the process of making films of cobalt is claimed, and it is mentioned that a film of a metal, such as cobalt, may be first deposited electrolytically, this being then dissolved and replaced by a deposit of copper by immersing the cathode and film in a solution of copper sulphate.—B. N.

Tantalum : Process for producing technically pure ductile ——. M. von Pirani, Wilmersdorf, Assignor to Siemens und Halske A.-G., Berlin. U.S. Pat. 866,385, Sept. 17, 1907.

See Fr. Pat. 367,293 of 1906 ; this J., 1906, 1102.—T. F. B.

Niobium and tantalum ; Preparation of ——, and application of these metals to the manufacture of filaments for incandescence lamps. G. C. Bouhard. Fr. Pat. 377,931, April 30, 1907.

To 100 grms. of potassium columbate (niobate) or tantalate dissolved in 3 litres of water sulphuric acid is added until no further precipitate is formed. The precipitate is filtered off after some hours, washed, mixed with 1 litre of water heated to 70°—80° C., and dissolved by adding a hot solution (1 : 5) of oxalic acid. The excess of oxalic acid is neutralised with ammonia, and, after cooling, sufficient hydrochloric or sulphuric acid is added to form 3 per cent. of the liquid. This solution is then electrolysed, using a current at 2 volts and 0·1—0·3 ampère. The anode is of carbon or platinum, and is of rectangular form ; the cathode consists preferably of a series of horizontal wires of carbon or platinum. The deposited metal is removed from the bath when it has attained a thickness of 3 or 4 mm., and is drawn as usual into wire, 0·04—0·05 mm. in diameter, which is used for lamp filaments.—A. G. L.

Manganese silicide ; Process of producing ——. E. F. Price, Niagara Falls, N.Y., Assignor to Electro-Metallurgical Co., West Virginia. U.S. Pat. 866,597, Sept. 17, 1907.

An electric arc is established within a charge of compounds of manganese and of silicon, and carbon ; the zone of reduction is surrounded by a considerable body of the charge, and the minimum potential difference necessary for reduction is maintained between the electrodes. The product is withdrawn and further charge added, as required.—A. G. L.

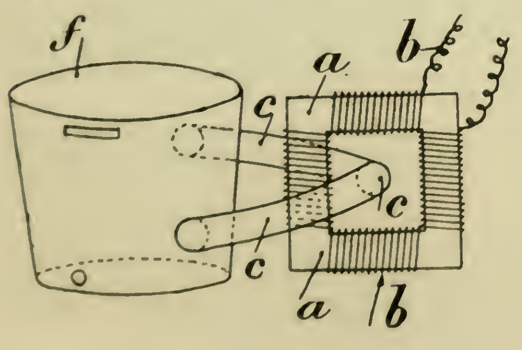
Electroplating apparatus. L. Potthoff, Flushing, N.Y. U.S. Pat. 866,959, Sept. 24, 1907.

See Fr. Pat. 377,049 of 1907 ; this J., 1907, 1056.—T. F. B.

Copper from its ores ; Electrometallurgical process for extracting ——. L. Jumau, Paris. U.S. Pat. 867,046, Sept. 24, 1907.

See Fr. Pat. 359,913 of 1905 ; this J., 1906, 485.—T. F. B.

Furnace ; Electric induction ——. Schneider et Cie. Second Addition, dated July 24, 1906, to Fr. Pat. 339,010, Sept. 2, 1903.



The inclined tube, *c*, and the vessel, *f*, contain metal in fusion which forms the secondary circuit, the tube passing within the core, *a*, which is covered as completely as possible with the primary winding, *b*, in order to avoid magnetic leakage. Both the tube and vessel are of refractory material, and are provided with envelopes of a metal which is a bad conductor of electricity and non-magnetic. The metallic envelope of the tube is made in two parts, which are attached to each other, and to the envelope of the vessel, by insulating joints.—B. N.

Alloys [of alkaline-earth metals] by electrolysis ; Production of ——. The Virginia Laboratory Co. Fr. Pat. 376,889, April 18, 1907. Under Int. Conv., April 24, 1906.

The process is similar to that described in U.S. Pat. 864,928 of 1907 (this J. 1907, 1056), but in addition it is stated that the metal collects at the surface of the electrolyte within a ring, which is cooled by circulating water, and underneath a movable protecting cover in contact with the electrolyte. This cover preferably consists of a mass of the metal which is being produced, the upper portion of the mass being cooled and maintained in a solid state, whilst the lower portion in contact with the electrolyte is kept soft, so that the globules of metal will adhere to the under surface. The metal is gradually raised from the electrolyte as the thickness of the mass increases.—B. N.

Alloys [of alkaline-earth metals] by electrolysis ; Production of ——. The Virginia Laboratory Co. Fr. Pat. 377,042, April 20, 1907. Under Int. Conv., April 25, 1906.

See U.S. Pat. 864,928 of 1907, this J., 1907, 1056.—B. N.

Tin ; Process and apparatus for the recovery of —— and the production of tin oxide from bath liquors in electrolytic detinning processes. H. Mennicke. Fr. Pat. 378,078, May 24, 1907.

The alkaline electrolyte saturated with tin from electrolytic detinning processes is treated, in a scrubber filled with suitable packing material, with the exhaust gases from a gas-engine. The liquor becomes saturated with carbon dioxide and tin oxide is precipitated and settles down in the lower part of the apparatus. The tin oxide is separated, dried and roasted.—R. L.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Olive oil ; Influence of oxygen, nitrogen, sunlight and darkness on the iodine- and saponification values of ——, and on the production of rancidity. L. A. Ryan and J. Marshall. Amer J. Pharm., 1907, 79, 308—315.

Exposure to oxygen causes a diminution of the iodine value, and an increase in the saponification value of olive oil, whilst the rancidity is accentuated, and the colour becomes lighter. Unsterilised oil, when exposed to diffused sunlight, acquires a slightly higher iodine value and lower saponification value than sterilised oil under similar conditions. Sterilised oil kept in darkness acquires a slightly higher iodine value and lower saponification value than when kept in diffused sunlight. Exposure to nitrogen does not affect the iodine value of either sterilised or unsterilised oil, but there is an increase in the saponification value of sterilised oil, probably due to heating in the process of sterilisation. No rancidity was observed in oils which had been exposed to nitrogen. The experiments confirm the conclusions of Winckel that exposure to oxygen is an active cause of rancidity. Light and moisture, in the absence of oxygen have no influence on rancidity. The fact that no rancidity appears in either sterilised or unsterilised oils when exposed to nitrogen, excludes the possibility of enzymic action.—J. O. B.

Lard ; Detection of foreign fats in ——. A. Leys. J. Pharm. Chim., 1907, 26, 289—300.

The author's mercuric acetate reagent (this J., 1907, 436) may be employed for the detection of foreign fats in lard, the method being based upon a determination of the m. pt. of the solid glycerides which separate from the solution.

About 2 grms. of the fat are mixed with 40 grms. of mercuric oxide and 50 c.c. of glacial acetic acid melting at about 15° C., and the liquid slowly heated to the boiling point under a reflux condenser, and boiled for 5 minutes. The flask is then set aside for 2 or 3 hours to allow the mercurous acetate to separate completely, after which its contents are heated to 50° C. and mixed with 50 c.c. of absolute alcohol (to reduce the solubility of the glycerides). The next day the liquid is filtered from the mercurous acetate and separated glycerides, the flask and filter washed with 100 c.c. of absolute alcohol, and the precipitate dried on the filter in a current of air. The glycerides are then dissolved in 50 c.c. of hot benzene added little by little, the solution evaporated on the water-bath, and the residue allowed to stand for 12 hours at 10° to 15° C. The glycerides are weighed and their melting point determined. Their iodine value is then only 0·6 to 0·7. The melting point is practically a constant for each kind of animal fat from whatever part of the animal it is taken. The value varies somewhat, however, with butter-fat, and also with vegetable oils according to their variety and origin. The following results were obtained with samples of fat, each of which was derived from a different source:—Beef fat (4 samples), 55·8° to 56·2° C.; calves' fat (2), 53° to 53·4° C.; mutton fat (1), 57·6; horse fat (1), 53° C.; oleomargarine (1), 52·6° C.; pigs' fat (5), 60·6° to 60·8° C.; cows' butter fat (6), 48° to 50·6° C.; cacao butter (14), 55·8° to 58·8° C.; cotton oil "stearine" (1), 55·8° C.; and cocoanut oil, no deposit. Lard mixed with an equal volume of cottonseed oil yielded solid glycerides which melted at the same temperature (60·6° C.) as the original sample, but the addition of 10 per cent. of beef fat to a lard lowered the melting point of the deposit to 56° C. In the author's opinion any sample of lard which yields solid glycerides melting below 60° C. may be regarded as undoubtedly adulterated with foreign fat.
—C. A. M.

PATENTS.

Grease; Method of making a conserving mixture of ——. S. Fenger, Nakskov, Denmark. Eng. Pat. 13,382, June 10, 1907. Under Int. Conv., June 16, 1906.

A MIXTURE of animal fats is melted and treated with from 0·025 to 0·05 per cent. of potassium or sodium hydroxide. After being kept in a molten condition for 24 hours, the mixture is neutralised with hydrochloric acid, and a quantity of melted vegetable fats is added. When the mixture has been partially cooled, from 1·5 to 2·5 per cent. of a soap, prepared from butter and sodium hydroxide, is added, and the whole mass is cooled to a temperature of from 4° to 5° C. It keeps for several months without becoming rancid.—W. P. S.

Emulsion of oil and the like. O. A. H. H. Kösters, Hemelingen, Germany. U.S. Pat. 867,141, Sept. 24, 1907.

SEE Eng. Pat. 4688 of 1906: this J., 1906, 767.—T. F. B.

Liquids [oils, sugar juice, etc.]; Process for purifying —— *[by treatment with zinc and plumbago].* T. Macherski and E. Koperski. Fr. Pat. 377,700, May 11, 1907.

THE liquid is heated with about 1 per cent. of its weight of a mixture consisting of equal parts of zinc dust and powdered plumbago, and is then filtered. A small quantity of sand may also be added, and the plumbago can be, to a certain extent, replaced by powdered animal charcoal.—W. P. S.

Vegetable oils; Process of treating ——. Van de Kerckhove. Fr. Pat. 378,248, May 30, 1907. Under Int. Conv., July 10, 1906.

SEE Eng. Pat. 21,172 of 1906; this J., 1907, 211.—T. F. B.

Soap; Process of making white ——. Verein. Chem. Werke A.-G. Fr. Pat. 377,720, May 11, 1907. Under Int. Conv., Aug. 11, 1906.

SOAP prepared from oils which have colour, such as cottonseed oil, palm oil, etc., is bleached by the addition of about 0·5 per cent. of alkali persulphate, percarbonate, or perborate, during, or after, the saponifying process.
—W. P. S.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

PATENTS.

Hops; Utilisation of spent ——. C. Sureties. Eng. Pat. 21,250, Sept. 25, 1906. *See* XVII.

Paint, varnish, and the like; Liquid for dissolving coatings of ——. C. A. Reihl and A. H. Waters, London. Eng. Pat. 27,092, Nov. 28, 1906.

THE liquid, which is used for removing old coats of paint from painted surfaces, consists of arachidic or palmitic acid, 18 to 25 parts; benzene, 35 to 42 parts; and methyl alcohol or amyl acetate, 40 parts, by weight. The fatty acids obtained from castor, walnut, candle nut, beech nut, linseed, rape seed, sunflower seed, olive, or wood oils may be employed instead of arachidic or palmitic acids.—W. P. S.

Paint; Process for the manufacture of ——. J. H. Lebon. First Addition, dated July 31, 1906, to Fr. Pat. 350,171, Sept. 13, 1904.

THE paint prepared by the process described in the main patent (this J., 1905, 1244) is mixed with certain pigments capable of modifying, in either direction, its heat-conductivity or its light- or heat-absorbing power.—A. S.

Lithopone; Rendering —— *resistant to light and air.* C. R. Steinau. Fr. Pat. 377,429, Mar. 30, 1907. Under Int. Conv., Sep. 17, 1906.

THE lithopone is treated with from 0·5 to 5 per cent. of its weight of an alkali nitrite and the same quantity of either magnesium carbonate, zinc carbonate, or metallic oxides. The materials may be mixed in a moist condition at the ordinary temperature, or be heated by steam, or simply ground together in a dry state. Alkali nitrite alone may be employed in the process. (Compare this J., 1907, 264.)
—W. P. S.

Lakes [from azo dyestuffs]; Production of coloured ——. Badische Anilin und Soda Fabrik. Fr. Pat. 378,274, May 30, 1907. Under Int. Conv., June 11, 1906.

SEE U.S. Pat. 863,396 of 1907; this J., 1907, 1020.—T.F.B.

Paints for buildings; Process for the manufacture of ——. Lőrincz Festékgyár (Topp) Betéti Társaság. Fr. Pat. 378,363, May 31, 1907.

IT is stated that oils and fats are rendered miscible with water by the addition of glycerin. Based on this, a paint vehicle is prepared by mixing together mineral oil (40), oil of turpentine (30), crude alcohol (8), ceresin (5), paraffin wax (5), tallow (1), wax (8), and glycerin (1 part). For the preparation of a matt paint, 12 parts of the above vehicle are mixed with 40 parts of slaked lime, 2 parts of ferrous sulphate, 2 parts of an insecticide, 5 parts of a colouring matter, and 44 parts of water. Paints of varying degrees of brilliancy may be prepared by mixing the matt paint with suitable proportions of an oil-paint or an enamel-paint.—A. S.

(*B.*)—RESINS, VARNISHES.

PATENT.

Wurtzilite or elaterite; Process for producing fusible soluble products of ——. W. F. Doerflinger and L. H. Buck, Niagara Falls, Assignors to M. Stine, New York, and E. F. C. Young, Jersey City, N.J. U.S. Pat. 864,836, Sep. 3, 1907.

WURTZILITE is heated with a fusible resinous substance to a temperature of about 350° C., in the absence of air. When a homogeneous liquid has been obtained, the mixture is cooled, and dissolved in turpentine and linseed oil to form a coating material.—W. P. S.

(C.)—INDIA-RUBBER, &c.

Murac. K. Bing and P. Alexander. Gummi-Zeit., 1907, 21, 1259—1260.

Murac is obtained from the latex of a species of the *Sapotaceæ*, and is described as possessing properties resembling those of rubber, gutta-percha, and balata. The sample examined was a pale reddish-brown, finely porous mass, and had a sp. gr. of 0·94. At ordinary temperatures it had little "elasticity," and when warmed to about 50° C. became soft and plastic. The sample had the following composition:—Water (and aromatic substances volatile at 100° C.), 12·3; mineral matter (ash), 4·3; organic impurities, 5·5; resins, 37·8, (of which 6·0 was saponifiable by alcoholic sodium hydroxide); gutta-like substance, α-murae (Schneider process), 23·1, β- and γ-murae, 17·0 per cent.—E. W. L.

Patents.

Vulcanising; Impts. in ——. W. R. Ormandy, Warrington, and Harvey Frost and Co., Ltd., London. Eng. Pat. 22,105, Oct. 6, 1906.

The patent relates specially to the vulcanisation of rubber tyres, etc., by processes in which a finely-divided substance is used in contact with the article to be vulcanised, and the improvements consist essentially in the employment of a finely-divided metallic substance, such as small shot, as a heat-carrying and pressure-transmitting substance. —A. S.

Gum or caoutchouc; Artificial —— *and methods of producing the same.* Z. Olsson, Upsala, Sweden. Eng. Pat. 20,404, Sept. 13, 1906.

See Fr. Pat. 369,717 of 1906; this J., 1907, 330.—T. F. B.

Plastic substance applicable as a rubber substitute. B. Sauton. Fr. Pat. 378,465, Aug. 10, 1906.

See Eng. Pat. 27,616 of 1906; this J., 1907, 1021.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Disinfection of hides imported into the United States. Board of Trade J., Oct. 3, 1907. [T.R.]

A Circular has been issued by the Treasury Department at Washington stating that hides taken from cattle at abattoirs in Great Britain, Norway, and Sweden, at which Government inspection is maintained, will be admitted without the production of certificates of disinfection therefor, provided the same are accompanied by a certificate issued by the official Government inspector stationed at the abattoir at which such hides are taken, showing that the animals from which they were taken were healthy at the time of slaughter, and that such hides are free from infection or disease, and also by an affidavit from the owner or shipper showing that such certificates refer to the identical hides imported. The hides of cattle exported from the United States to Great Britain and slaughtered separately in this country will also be admitted without requiring the production of certificates of disinfection therefor. (See this J., 1907, 978.)

Patents.

Hides and skins; Process for tanning ——. A. Weinschenk, Mainz, Germany. Eng. Pat. 4605, Feb. 25, 1907.

Although the naphthols are only weak tanning agents, per se, they may advantageously be used if the hides are first prepared with an aldehyde. Aldehydes of the aliphatic and aromatic series, such as formaldehyde, acetaldehyde, resorcyl-aldehyde, pyrogallol-aldehyde, may be used. The hides may be also first saturated with naphthol, and then, in the presence of an additional quantity of the reagent, treated with the aldehyde; or the naphthol and aldehyde may be made into a paste with water and gradually added to the prepared hides, suspended in water at a temperature of 30° to 35° C. and kept constantly moving.—S. R. T.

Skins; Process of treating ——. A. Granville, Assignor to The Fur-Wool Co., Ltd., London. U.S. Pat. 866,458, Sept. 17, 1907.

See Eng. Pat. 16,887 of 1905; this J., 1906, 897.—T. F. B.

Hides, previously fitted upon moulds or frames; Tanning of ——. H. Boulanger. Fr. Pat. 378,103, May 24, 1907.

Skins of any kind, with the hair on or off, are fixed upon moulds or frames and tanned. However bent, the fibres of the skin set during tanning, and leather of a permanent shape is obtained.—S. R. T.

Leather; Process for treating the surface of —— *in order to render it capable of taking up colour.* H. Neumann. Ger. Pat. 178,016, Sept. 10, 1903.

Zinc dust is spread over the surface of the leather, which is then treated with an alkali sulphite solution, rinsed, and exposed to the air or immersed in a weak acid solution to destroy the yellow coloration produced by the sulphite. It is then washed, treated with a hot, concentrated solution of alkali sulphite, and again washed.—A. S.

Glue and gelatine; Process and apparatus for obtaining —— *from glue-materials in the form of powder or grits.* O. Schneider, München-Gern, Germany. Eng. Pat. 19,848, Sept. 6, 1906.

Claim is made for an apparatus which prevents caking during the extraction of glue from bones, fleshings, etc. The apparatus consists essentially of two horizontal cylindrical pipes with semi-circular ends heated by means of a steam-jacket, and provided with manholes for charging and discharging. By means of a propeller the mixture of water and pulverised glue material is driven through the pipes in a horizontal circulating current, whirling in vertical planes, the process being advantageously carried out under a vacuum. The process may be varied by alternately spreading out the glue materials in thin layers on sieves and exposing them to the action of steam, and subjecting them to the above process of lixiviation. —S. R. T.

Ossein; Treatment of ——. A. Helbronner and E. A. Vallee, Paris. Eng. Pat. 20,548, Sept. 15, 1906. Under Int. Conv., Sept. 26, 1905.

See Fr. Pat. 361,796 of 1905; this J., 1906, 1227.—T. F. B.

XV.—MANURES, &c.

Phosphoric acid; Determination of —— *volumetrically.* W. D. Richardson. *See* XXIII.

Patents.

Nitrogen-gathering bacteria; Process of growing and distributing ——. G. H. Earp-Thomas, Toronto, Canada. U.S. Pat. 865,965, Sep. 10, 1907.

The process consists in inoculating a seed with a culture composed of a mixture of nitrogen-gathering bacteria, planting the seed in a sterilised medium contained in a closed vessel, allowing the plant to grow in the said vessel, and at the same time supplying it with water and air through a suitable air-filter in the side of the vessel. A nodule is then removed from the plant and used for inoculating a medium contained in a distributing receptacle; the medium thus inoculated is covered, after the culture has developed, by a "liquid," and the receptacle is closed. (See also Eng. Pat. 15,949 of 1906; this J., 1907, 979.)—W. P. S

Peat and peat-bogs; Method of treatment of ——. A. Müntz and A. C. Girard. Fr. Pat. 377,711, July 18, 1906.

The object of the invention is to obtain the nitrogen of the peat in the form of ammonia, with a view to preparing ammonium salts for use in agriculture or industry, and to transform these salts into nitrated products with the aid of nitrifying ferments. The dried, coarsely-ground peat is distilled with the aid of superheated steam, whereby most of the nitrogen is obtained in the form of ammonia, with production also of water-gas, and of tar, pyroligneous substances, etc. The condensed ammoniacal liquors, containing most of the ammonia in the form of carbonate, are concentrated by distillation, and then caused to react with sodium chloride and carbon dioxide, in a suitable apparatus, to obtain sodium bicarbonate and ammonium chloride. The sodium bicarbonate separates and is filtered off, dried, and calcined, any ammonia being recovered, and the carbon dioxide utilised in the preceding operation. The mother-liquors are distilled to recover ammonium carbonate, then concentrated at 100° C. until the bulk of the sodium chloride separates, and from the residual solution, ammonium chloride can be obtained by crystallisation in a condition suitable for use in agriculture. The ammoniacal liquors from the distillation of the peat may also be utilised for the manufacture of nitrated products by the use of nitrifying organisms. Peat, divided into pieces to allow of free circulation of air, is impregnated with a thin paste of calcium carbonate containing small quantities of phosphates and other substances necessary for the growth of the micro-organisms, and is then piled up on a cement floor, and inoculated with a preparation of the nitrifying ferments. The dilute ammoniacal liquor is passed over a number of such heaps in succession or repeatedly over the same heap, with addition, as required, of ammonia, until it becomes sufficiently concentrated in nitrated products. Or, ammoniacal liquor may be added gradually so as to keep the mass of peat in a moist condition, whereby nitrated products are formed in the heap, and may be recovered by lixiviation. In either case the process is carried out in the dark, under cover, and at a temperature of about 30° C. It is stated that nitric acid free from chlorine compounds, and hence specially suited for the manufacture of explosives, may be obtained from the nitrated products (calcium nitrate) prepared in this manner.—A. S.

Manure, or materials for industrial use; Process of manufacturing ——. A. E. Vasseux. Fr. Pat. 377,703, May 11, 1907.

ORGANIC by-products such as nitrogenous liquors and matters, the waste of sugar factories or distilleries, or wool-washing liquors, etc., are concentrated, with or without addition of lime, at a temperature not exceeding 180° C. The resulting mass is dried, and the product is ground with water, with addition of acids, such as pyroligneous acid, or acid salts, or of substances containing tannin, alum, or other astringent. By filtration, a solution containing potassium and sodium salts, etc., (which may be set to crystallise) is obtained, and a residue of nitrogenous organic matters, which may be dried for application as a manure.—E. S.

Animal and faecal matters; Apparatus and process for treating —— by means of sulphuric acid. J. Brossard. Fr. Pat. 378,055, May 23, 1907.

THE animal matter, such as bones and meat, or faeces, is heated with one-half of its weight of sulphuric acid (53° B.) for 3 hours in a closed vessel, the movable lid of the latter being rendered gas-tight by means of a water-lute. The gases formed during the heating are conducted through a pipe leading from the top of the vessel to a second vessel containing water. After skimming off the oily layer from the treated material, the latter is run into a tank where it is mixed with ground phosphate in the proportion of 2 parts of phosphate to 3 parts of material, a quantity of sodium carbonate equal to one-tenth of the weight of the bones, etc., being also added. The mixture is then dried in a double-walled oven, devised with the object of economising the fuel needed, and the dry product is used as a manure.—W. P. S.

Manure from atmospheric nitrogen; Process for making a ——. L. Roth. Fr. Pat. 378,390, June 1, 1907.

SEE Eng. Pat. 12,741 of 1907; this J., 1907, 1022.—T. F. B.

XVI.—SUGAR, STARCH, GUM, &c.

Sugar juices and molasses; Treatment of —— with calcium aluminium silicates, and the quality and properties of the syrups thus obtained, with special reference to the solubility and crystallising power of the sucrose contained therein. H. Claassen. Z. Ver. Deut. Zuckerind., 1907, 931—946 (see this J., 1907, 215).

THE author has made experiments on the filtration of molasses and massecuite through calcium-aluminium silicate (known commercially as "Calcium-Permutit"), in order to determine the practicability of the process. The molasses were diluted with an equal volume of water and the massecuite was made up to a solution of 40° Brix. Quantities of these solutions, equivalent to 4 kilos. of undiluted molasses and 2 kilos. of undiluted massecuite, were filtered through 2 kilos. and ½ kilo. respectively, of the double silicate. In each case, the height of the filtering layer was 50 cm., and the liquids filtered through in about 1—1¼ hours. The temperature of the solution which had passed through the filter was 65° C. The following results were obtained from the investigation of the filtrates:—In the process of filtration adopted by the author, about half of the alkali (potash and some soda) is replaced by an equivalent quantity of lime, with the result that the ash-content is decreased and the purity coefficient correspondingly increased. The silicate treatment has, however, no other action; in particular, the quantity of organic non-sugar is not reduced. As a result of the replacement of potassium by calcium salts, the syrups are much more viscous, especially at low temperatures, after filtration than before; owing to the fact that they froth very readily, the filtered juices and syrups are very difficult to boil, and evaporation ceases when they still contain a relatively large quantity of water. The sucrose is decidedly less soluble in the filtered syrup than in the original syrup or molasses; hence the concentration of filtered syrups need not be carried so far as in the case of unfiltered syrups; special care must be taken that a strong supersaturation at low temperatures is avoided, otherwise the high viscosity of the syrup will prevent crystallisation. The increase in solubility of the sucrose with rising temperature is not much more rapid in the case of filtered solutions than in the case of pure sucrose solutions; since also, the viscosity of the filtered syrups decreases very rapidly with increasing temperature, such syrups crystallise best at comparatively high temperatures. The slight increase in the yield of sugar obtained by filtration through calcium-aluminium silicate would not, in the author's opinion, cover the cost of this process; moreover, under practical conditions, the increase in yield might not be obtained owing to the difficulty of boiling the syrup and maintaining the conditions requisite for crystallisation. At present, also, it seems very doubtful whether it would be profitable to work up the potassium salts present in the liquor obtained by treating the exhausted silicate with calcium chloride.—L. E.

Reducing sugars; Determination of ——, with special reference to dextrose and laevulose. L. Pellet. Bull. Assoc. Chim. Sucr., 1907, **25**, 125—127.

THE author recommends the use of invert sugar solutions for standardising copper solutions and for determining the reducing powers of various sugars. The analysis of a mixture of two reducing sugars may be effected by determining the polarisation of the mixture and the reducing sugar-content calculated as invert sugar. The amounts, x and y, of the reducing sugars may then be obtained from the equations:

$$p\,x + p'\,y = \mathrm{P} \quad (1)$$
$$r\,x + r'\,y = \mathrm{R} \quad (2)$$

in which p and p' are the ratios of the rotations of the two reducing sugars to that of sucrose, r and r' are the ratios of the reducing powers of the two reducing sugars to that of invert sugar, P is the polarisation of the mixture (referred to 100 grms.), and R is the reducing sugar content of the mixture calculated in terms of invert sugar. The author gives the following table of ratios of the rotation of lævulose to that of sucrose at various temperatures and concentrations :—

° C.	Concentration.						
	1 %	2 %	3 %	4 %	5 %	10 %	25 %
15	1·384	1·385	1·387	1·389	1·390	1·398	1·442
20	1·341	1·343	1·345	1·346	1·348	1·356	1·380
25	1·299	1·301	1·303	1·304	1·306	1·314	1·338
30	1·257	1·259	1·261	1·262	1·264	1·272	1·296

In the case of a mixture containing sucrose, dextrose and levulose, the sucrose must of course be determined first (Clerget) : in such a case, P in equation (1) would be the difference between the total polarisation and that due to the sucrose. (See also this J., 1906, 446.)—L. E.

Reducing sugars ; Detection and determination of ——. S. R. Benedict. J. of Biol. Chem., 1907, **3**, 101—117.

If a 1 per cent. solution of dextrose be boiled, for about 1 minute, with a 10 per cent. solution of potassium hydroxide, and the resulting liquid cooled to room temperature, the sugar loses its reducing power, whereas lactose after a similar treatment, will reduce even cold Fehling's solution. On the contrary, both of the liquids obtained on boiling dextrose or lactose solution with sodium carbonate, reduce Fehling's solution in the cold. Lactose may consequently be detected in presence of dextrose by boiling strongly for one minute, 5 c.c. of a 0·5—1 per cent. solution of the sugar with half the quantity of a 10 per cent. solution of potassium hydroxide. The liquid after cooling, will give immediately a considerable precipitate with Fehling's solution if lactose be present. The author uses the following reagents, which are stated to be capable of detecting 0·00005 per cent. of dextrose in solution. A. 69·3 grms. of copper sulphate crystals dissolved in water and made up to 1 litre. B. 346 grms. of Rochelle salt and 200 grms. of anhydrous sodium carbonate dissolved in water and made up to 1 litre. Immediately before use, equal parts of the two solutions are mixed together, and the whole is diluted with an equal volume of water.

Sugar products ; Comparative studies of the results obtained with various cane —— defecated and decolorised with neutral lead acetate and with bleaching powder. J. Zamaron and J. S. Gongora. Bull. Assoc. Chim. Sucr., 1907, **25**, 127—132.

The authors have compared the influence of neutral lead acetate and of bleaching powder on the polarisation of cane juices and massecuites at various stages of manufacture. In all cases, the polarisations of the solutions treated with neutral lead acetate were lower than those obtained with bleaching powder, and the differences increased with the amount of reducing substances. In the case of the samples of cane juices taken at various stages of manufacture, the average difference between the two polarisations was found to range between 1·00 and 1·56 per 100 parts of sugar ; with the massecuites of the first, second, and third jets, the average differences were found to be 1·315, 1·986, and 6·51 respectively. With some cane products treated with bleaching powder, filtration is sometimes very slow and the filtrate somewhat turbid ; in such cases, the author recommends the addition of 1—2 c.c. of neutral lead acetate to the solution previously treated with bleaching powder ; experiments have shown that the results obtained are identical with those obtained when bleaching powder alone is used.—L. E.

Molasses ; Influence of sodium bisulphite on the proportion of ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1907, **25**, 87—92.

As a remedy for the evolution of gas in the diffusion battery, sodium bisulphite is sometimes used. The author has made experiments on the effect of this salt on the yield and quality of the sugar ; his chief conclusions are as follows.—Sodium bisulphite, added to a syrup of pure sugar, either increases the loss of sugar in the crystallisation (owing to the retention of water by the salt), or crystallises with the sugar, thereby lowering the value of the latter. It is difficult to determine the loss of sugar in the form of molasses, and hence it is difficult to ascertain the effect of sodium bisulphite on the amount of this loss. Since the bisulphite added to the diffusion juice, and the sulphurous acid employed in sulphitation, undergo oxidation to a considerable extent, experiments on the action of bisulphite on the crystallisation of the sugar, should be performed with a mixture of sodium sulphite and sulphate (about equal parts). Of course addition of sodium bisulphite to the diffusion juice lessens the value of the saline matter in the molasses.—L. E.

Molasses ; Quantity of —— produced per 100 kilos. of canes or beetroots. H. Pellet. Bull. Assoc. Chim. Sucr., 1907, **25**, 93—97.

A study of the manufacture of sugar in Egypt, has led the author to conclude that for a given factory, using a given process, the quantity of molasses produced per 100 parts of canes does not vary much in spite of a decided variation in the purity of the juices and manufactured products. The author also quotes some experiments made by F. Sachs on Belgian and Dutch massecuites, and some experiments made by himself in French sugar factories, which show that the loss of sugar in the form of molasses is fairly constant in spite of considerable variations in the sugar-content of the beetroots. The author points out, however, that sugar cane grown on irrigated soil contains more mineral matter than that grown under natural conditions, and the same is true of beetroots. Again, the amount of sugar lost in the form of molasses varies from one year to another, even with the same method of working. Hence, in determining the influence of a substance such as sodium bisulphite on the loss of sugar, numerous experiments must be made. (See preceding abstract.)—L. E.

Molasses ; Precipitation of lævulose by basic lead acetate in presence of the foreign organic and mineral substances contained in cane and beetroot ——. H. Pellet. Bull. Assoc. Chim. Sucr., 1907, **25**, 102—105.

Previous experiments have shown : (1). that basic lead acetate affects the polarisation of lævulose, the normal polarisation being restored by addition of acetic acid; (2), in the case of cane juice and molasses, basic lead acetate causes a precipitation of the lævulose and, to a less extent, of the dextrose (see this J., 1896, 831 ; 1897, 1038.). B. Minz has stated, however, that these sugars are not precipitated by basic lead acetate, and that, if, in certain cases, reducing substances are precipitated, they are substances other than dextrose or lævulose. The author has now made further experiments which confirm his earlier results. Basic lead acetate was found to lessen the reducing sugar-content of a sample of cane molasses by 25 per cent. in the maximum, and of an artificial beetroot molasses (prepared by adding dextrose and lævulose to the non-sugar of beetroot molasses freed from reducing substances) by 8·1 per cent. The author points out that in some of his experiments, Minz used comparatively pure Russian sugar which had been stored for a long time, and had thus undergone a partial conversion into invert sugar ; the absence of non-sugar would account for the non-precipitation of reducing sugars. Minz's experiments with colonial sugars containing non-sugar, confirmed the author's experiments. The author also points out that variations in the amount of reducing sugars precipitated, are due to variations in the nature and amount of the non-sugar in molasses from various sources.—L. E.

Molasses ; Influence of non-sugar of beetroot —— on the Brix readings according to the dilution. Experiments with various vinasses from distillery and sugar refinery molasses. H. Pellet. Bull. Assoc. Chim. Sucr., 1907, **25**, 107—112.

In determining the dry substance-content of molasses, owing to the fact that the solution-density of the non-sugar differs from that of the sugar, it is necessary, as a general rule, to multiply the Brix degrees corresponding to the non-sugar by 0·9. The author has made experiments to determine if this factor remains constant with varying degrees of dilution. Distillery vinasse and molasses freed from sugar were employed. In both cases it was found that only a slight variation in the factor was caused by diluting the solutions five times. Thus, the apparent purities of a sample of molasses, obtained by using the two factors were 62·1 and 62·4 respectively. Since, in practice, the range of dilution is much less than the above, and the non-sugar only averages about 37 per cent. of the total dry matter, the error introduced by assuming that the factor is constant, is negligible.—L. E.

Starches; Specific gravities of various ——. E. Parow, Ellrodt, und F. Neumann. Z. Spiritusind., 1907, **30**, 432.

The mean results obtained are given in the following table:—

Starch from:	Sp. gr. of anhydrous starch in:		Sp. gr. of hydrated starch in:			
			Water.		Toluene.	
	Water.	Toluene.	Per cent. of water in the starch.	sp.gr.	Per cent. of water in the starch.	sp. gr.
Potatoes	1·648	1·513	18·72 19·35 20·14	1·463 1·436 1·453	15·03	1·361
Wheat	1·629	1·502	13·38 13·80 14·60	1·515 1·496 1·492	13·90	1·365
Maize	1·623	1·499	11·06 12·88 14·36	1·522 1·504 1·490	12·60	1·378
Rice	1·620	1·504	11·92 13·10 14·14	1·514 1·500 1·501	14·03	1·360

—T. H. P.

Sugar production of France in 1906–7. Board of Trade J., Oct. 3. 1907. [T. R.]

The "Journal Officiel" of 13th September contains statistics of the production of sugar in France during the period 1st September, 1906 to 31st August, 1907, from which it appears that the number of sugar factories in France was 273, as against 292 in 1905–6, the total amount of sugar despatched from the factories (expressed in terms of refined sugar) being 752,733 metric tons, as compared with 1,044,197 tons in 1905–6. The raw material supplied to the factories amounted to 65,004,263 hectolitres in 1906–7, as compared with 97,904,142 hectolitres in 1905–6.

Sugars; Oxidation of —— by cupric acetic acid mixtures. A. P. Mathews and Hugh McGuigan. Proc. Soc. Exp. Biol. Med., March 10, 1907.

The addition of acetic acid to cupric acetate diminishes its speed of oxidation so that one sugar after another ceases to be oxidised at a rapid rate as more acid is added. The amount of acid necessary to add, to check oxidation to any rate, depends on the concentration of the acetate; the more concentrated the acetate the more acid is required. The results showed that according to the amount of acid necessary to check oxidation, the sugars are arranged: Lævulose (most), galactose, dextrose, maltose, lactose. Solutions of different concentrations of acetate were prepared which would just fail to oxidise lævulose to a visible reduction of cuprous oxide on one minute's boiling. Similar solutions were prepared for the different sugars. Each of these solutions for any given sugar of 1 per cent. concentration had the same speed of oxidation. The cupric ions in these solutions were measured by the E.M.F. developed between the solution and a plate of copper. The hydrogen ions were determined by inversion tests. From these figures the result appeared that in all solutions oxidising with the same speed, the decomposition of the cupric oxide in the solution was a constant. For the different sugars the following decomposition potentials were obtained in those solutions just not oxidising to a visible extent on one minute's boiling:—Lævulose, 0·583 volts; galactose, 0·562 volts; dextrose, 0·558 volts; maltose, 0·532 volts; lactose, 0·519 volts. The constancy of the decomposition potentials shows that for the same rate of oxidation of any single sugar by different concentrations of cupric acetate, the product of the concentration of the cupric ions and the oxygen ions is a constant. The fact that for the same rate of oxidation in the different sugars this product varies, shows that the percentage of dissolution into reactive products in the different sugars, varies, and in fact the lævulose dissociates most, then galactose, dextrose, maltose and lactose in a diminishing order. Preliminary observations indicate that for the same rate of oxidation, the product of CuO × dissociated sugar molecules, is a constant. The oxidising potential of all cupric solutions is a constant; these solutions differ only in their rate of oxidation. Acid cupric sulphate is reduced by dextrose, lævulose, &c., but at a very slow rate. The constancy depends on the constant ionic potential of the cupric ions regardless of their concentration, *i.e.*, 668 volts. The superior speed of action of a Fehling's solution over a cupric acetate solution is due to the enormously greater concentration of oxygen ions (hydroxyl ions) in the solution, and also to the fact that the dissociation of the sugar molecule into active particles is enormously greater in an alkaline than an acid medium. These facts show why it is that the sugars are oxidised and fermented by the tissues, by moulds, and bacteria, at different rates. A cupric acetate acetic acid mixture of proper concentration will show the same selective action toward lævulose that many bacteria show and oxidise the lævulose almost completely before the dextrose is attacked.

Patents.

Sucrate of lime; Apparatus for making ——. E. Morrison, Fort Collins, Colo., Assignor to The American Sugar Refining Co., Jersey City, N.J. U.S. Pat. 865,793, Sept. 10, 1907.

The apparatus consists of a tank provided with a cooling chamber, a well, and a mixing chamber situated above the cooling chamber, with a propeller for circulating the molasses solution through the well and cooling chamber. (See U.S. Pat. 861,893 of 1907; this J., 1907, 1023.) The walls of the well are solid and extend above the top of the cooling chamber, and the top of the well is covered by a perforated cap.—W. P. S.

Liquids [oils, sugar juice, etc.]; Process for purifying —— *[by treatment with zinc and plumbago].* T. Macherski and E. Koperski. Fr. Pat. 377,700, May 11, 1907. *See* XII.

Xanthates of certain carbohydrates; Manufacture of ——. C. F. Cross and J. F. Briggs, London. Eng. Pat. 20,638, Sept. 17, 1906.

See Fr. Pat. 370,505 of 1906; this J., 1907, 267.—T. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt; Germinative capacity of ——. D. P. Hoyer. Woch. f. Brau., 1907, **24**, 515—516.

Referring to the observations of Sautner (this J., 1907, 982) on the germinative capacity of malt, the author states that he has studied the question for some years. He cannot confirm the statement that the growth of mould during the test is an indication that the malt has been cured at a temperature below 65° C. He found that high-cured malts with little or no germinative capacity became mouldy far more readily than vigorously germinating malts of the Pilsen type. The tendency to mouldiness depends probably not so much on the curing temperature as on the treatment afterwards. In order to prevent mouldiness, the malts were steeped in a 1 per cent. solution of sodium carbonate at 35° C. and were afterwards moistened with a 0·5 per cent. solution of the same. Germination was carried out in sterilised flannel wrappers which were laid on glass plates in a sterilised cupboard at the ordinary temperature. The tests were conducted for 8—10 days. A large number of results are summarised in the following table:—

Colour of laboratory wort (Berlin scale).	Number of samples.	Germinative capacity:	
		Maximum.	Mean.
		per cent.	per cent.
0·15—0·2	50	74·6	18·2
0·25—0·3	36	57·2	10·17
0·35—0·4	28	25·4	2·3
0·45—0·6	50	6·0	1·1
0·65—0·8	75	5·6	0·9
0·85—1·0	44	4·2	0·8
Over 1·0	17	2·0	0·3

With Munich malts (over 0·4° colour) abnormally high results indicate either irregularities of temperature on the kiln or blending with pale malts. In the case of low-dried malts, the result depends on the time of kilning as well as on the temperature. Scotch malts which are cured very slowly have a germinative capacity higher than that of malts which are cured rapidly to the same degree of colour. Storage in closed bottles generally raises the germinative capacity of the samples.—J. F. B.

Yeast; The physiological condition of ——. H. Lange. Woch. f. Brau., 1907, **24**, 417—421, 433—436, 445—449, 457—463, 474—476, 489—491, 505—515, 521—524.

The physiological condition of yeast is determined by the proportions and activity of its constituent enzymes. These are subject to variations, according to the temperature during storage and active fermentation, the aëration, the nutrition, and the presence of certain stimulating substances. By the above-named influences acting in a favourable direction, the fermentative work done by a given number of cells in a given time may be increased many times over. Bottom-fermentation yeasts are generally more amenable to changes, both favourable and unfavourable than top-fermentation yeasts. The author estimated the quantitative relations of the zymase by determining the fermentative power by Hayduck's method. In certain cases also, the zymase contents were measured by determining the activity of the cell juices expressed from the yeast. During storage of pressed yeast, the zymase contents increase up to a maximum point and then decrease; this maximum point and the period in which it is reached depend on the temperature. The changes are slower and the maximum point is higher, the lower the temperature of storage. When the zymase contents are already high, very little increase takes place at low temperatures, whilst the decrease at high temperatures is more rapid. When a yeast which has lost a large portion of its zymase by storage at high temperatures, is transferred to a chamber at 6° C., the amount of zymase gradually increases again and may become higher than it was originally. This recovery does not take place if decomposition has gone too far. When the yeast is stored under water, the increase of zymase at low temperature takes place more slowly than when the yeast is stored in the pressed state. Old yeast is less subject to an increase of zymase at low temperatures than a fresh yeast; the same rule holds good for all stimulating influences. Yeast which has to be transported in hot weather should not be taken directly from a very cold store, as, owing to the sudden change, the decomposition will be very rapid. The only relationship which exists between the zymase and the glycogen contents is that both rapidly decrease at high temperatures; at low temperatures of storage, the glycogen steadily decreases, whilst the zymase increases. Free exposure of the pressed yeast to air at low temperatures stimulates the production of zymase to a remarkable degree; the degree of stimulation produced by air is inversely proportional to the store of zymase already present. At higher temperatures the stimulating influence of air is very small. With active yeast the highest fermentative efficiency is observed at the period of the most active budding. After budding has ceased, the quantity of zymase decreases, the nutrition being exhausted. Of the other enzymes of the yeast, the invertase is affected by temperature during storage, in a similar manner to the zymase, but the peptase (really a tryptic enzyme) increases under all conditions. Flocculent yeast is poor in peptase; as the latter increases, the yeast under its action loses its power of "breaking"; softening and liquefaction are the extreme effects. The author has studied the stimulating influence on the production of zymase of a large number of organic and inorganic substances in the presence of sucrose and under conditions which precluded reproduction of the cells. The powerful stimulants included nitrogenous compounds, especially ammonium salts, amides of organic acids and peptones, potassium and magnesium phosphates, chlorides and sulphates, and the bitter principle of hops. Weakly stimulating substances included the lower organic acids of the fatty and aromatic series, a few hydroxy-acids and inorganic salts, and small quantities of monohydric alcohols and phenols. On studying the behaviour of yeast in presence of aqueous solutions of the various stimulants without sugar, it was found that in yeasts poor in zymase, both the quantity of zymase and the yeast substance increased, whereas in the case of yeasts rich in zymase, only the quantity of zymase increased. The addition of the raw grain or green malt of rye, oats, maize, barley and wheat flour, or of aqueous extracts of the same to yeast in presence of a 10 per cent. solution of sucrose, caused an extraordinary increase in the zymase contents (*e.g.* an increase of 2—3 fold in 2 hours), due partly to the soluble phosphates. All the above statements as regards stimulation of the zymase production refer to the top-fermentation distillery yeasts only. On the bottom-fermentation beer yeasts the same stimulants either produced little effect or, as in the case of peptone, caused a considerable decrease in the zymase contents. Moreover, with the beer yeasts, whilst maize and oat grists were stimulating, those of barley, wheat and especially rye had a powerful destructive effect on the zymase. Even the distillery yeasts were adversely affected by large amounts of rye flour. These cereals contain a protein yeast poison, which causes a complete alteration of the form and contents of the cells and kills over 95 per cent. of the cells in a few minutes. The malted grains are slightly less poisonous and aqueous extracts considerably less. The presence of suitable nutrients, such as beer wort or yeast extract, entirely prevents this poisonous action of the cereals. Distillery yeast is slightly affected by egg albumin, brewery yeast is more sensitive; milk, on the other hand has a stimulating influence.—J. F. B.

Yeast; Nutrition of ——. C. H. Field. J. Inst. Brewing, 1907, **13**, 584—586.

When an auxiliary yeast food is necessary it should be specially selected according to the particular race which it is desired to cultivate. For instance, a food suitable for distillery yeast can be made by digesting protein matter with acid at a blood heat, whereas for brewery yeast, the protein must be digested under pressure. When the yeast is properly fed, the beer may remain perfectly good even when the yeast is contaminated with acid-forming bacteria. A good food for brewers' yeast may be made by "peptonising" malt combs or bean flour. It is necessary to secure an ample amount of assimilable nitrogenous matter in the wort in order to produce a healthy yeast, which, in presence of sufficient carbohydrate matter of the right sort, will so purge the wort that the beer contains a minimum quantity of putrescible matter. Too high a ratio of sugar to nitrogenous nutrient leads to an increase in the number of yeast cells, accompanied, however, by degeneration of the yeast. Aëration at the beginning of the fermentation is beneficial up to the time of the formation of the yeasty head. In a particular case cited by the author, it was found that frequent changes of yeast in a brewery were necessitated by the excessive accumulation of nitrogenous matter which was not of a sufficiently assimilable character, combined with insufficient aëration. The washing of yeast with water at 34°—38° F., as practised on the Continent, is advantageous, since it eliminates the weak cells, bacteria, etc.; further, the storage of yeast at these low temperatures is also recommended. For the production of stable beers the nutrition and condition of the yeast is almost of greater importance than the attenuation, since a weak yeast may disperse its contents into the beer and cause instability.—J. F. B.

Alcohol-oxydases [*Acetifying enzymes*]; *Studies on* ——. F. Rothenbach and W. Hoffmann. Deut. Essigind., 1907, 11, 41; Z. ges. Brauw., 1907, 30, 497.

The authors have made active preparations of oxygenase from acetifying bacteria by treating the cultures with acetone in order to kill the cells. Their studies were made on the wine-vinegar bacterium β-R, recently isolated by Henneberg. Since this species only forms films of extreme thinness, the material available was very small. In most of the cultures, after the first film had been removed, the bacterium β-R reverted to its other modification, *B. xylinoides*, which forms tough films; in these cases the second crop was not taken. The "Aceton-dauer" preparations obtained were tested in a suitable solution of alcohol through which air was aspirated for three days. The acetic acid produced was then determined by distillation. It is believed that the activity of the oxygenase is seriously impaired by the action of the acetone. The authors made experiments to ascertain whether the activity could be increased by the presence of a small quantity of hydrogen peroxide, as Bach had found in the case of other oxydases, but so far the results have been negative.—J. F B.

Volatile acids in fermentation media: musts, wines, beers, etc.; Determination of —— *under reduced pressure.* Roos and W. Mestrezat. Bull. Assoc. Chim. Sucr., 1907, 25. 41—49.

In determining the acidity of wines, etc., by distillation under ordinary pressure, the fixed acids are liable to undergo some alteration during heating. The authors propose the following modification of the method which not only obviates this difficulty but is also more rapid in execution. The apparatus includes a flask (of about 200 c.c. capacity), the bulbed neck of which is provided with an exit tube leading to a vacuum pump. The flask is closed with a rubber stopper through which passes the stem of a tap-funnel. Twenty c.c. of the wine are run from the funnel into the flask (in which a few fragments of pumice have been placed), the flask being heated by a boiling water-bath. The action of the pump is controlled at first by compressing the rubber connection between the thumb and forefinger and subsequently with a screw-clip. When the contents of the flask have been reduced to 2—3 c.c., 20 c.c. of water are run in, the distillation being continued until the volume is reduced to 5—6 c.c. A second addition of 20 c.c. of water is then made, the volume being finally reduced to about 10 c.c. The fixed acid in the residue is then determined by titration with $N/10$ sodium hydroxide in presence of phenolphthalein. A determination of the total acidity of the decarbonated wine gives, by difference, the volatile acidity. If several flasks are connected with one pump, a number of analyses may be effected simultaneously. The method is especially advantageous in the case of wines containing lactic acid. Provided that the volume of the residue in the successive distillations, is not reduced to less than 5 c.c., there is no danger of this acid being volatilised. In the analysis of musts by this method, decomposition of the lævulose and caramelisation of the residue are avoided. In the case of liquids, such as beer, which are liable to froth, a fragment of paraffin wax should be added. To decarbonate the sample before determining the total acidity, it should be run in a thin stream into a vacuous flask; it is not necessary to do this more than once, and the concentration of the liquid caused by the operation is negligible.—L. E.

Glycerol; Determination of —— *in wine and beer.* F. Zetzsche. Chem.-Zeit., 1907, 31, 924.

The author considers, that for the determination of glycerol, esterification methods are the best, and he prefers the benzoate method to the acetin method. The variable results hitherto obtained with the benzoate method are due to a partial saponification of the ester, but it is possible to obtain satisfactory results by using only a small quantity of the reaction-mixture. Further improvements suggested are the agitation of the liquid during the esterification, and separation of the ester from the mother-liquor by extracting with a mixture of ether and petroleum ether. The ester formed is the tribenzoate melting at 69—71° C.—C. E. F.

Patents.

Malt; Method and apparatus for drying green ——. J. Elsner and C. Guttwein, Berlin. Eng. Pat. 1959, Jan. 25, 1907. Under Int. Conv., May 9, 1906.

The character and quality of the malt depend very largely on the rate of the removal of the moisture from the green malt at definite temperatures. According to this invention the drying floor of the kiln has the form of a trough which is mounted on a weighing machine. The weight of the charge of malt is determined at the time of loading the kiln, and the percentage of moisture is ascertained. The regulation of the temperature and draught is then conducted on a definite plan according to the indications of the weighing machine.—J. F. B.

Malting process. H. Heuser and T. Brain. Fr. Pat. 378,249, May 30, 1907.

See U.S. Pat. 856,637 of 1907; this J., 1907, 835.—T. F. B.

Hops; Utilisation of spent ——. C. Sureties, London. Eng. Pat. 21,250, Sept. 25, 1906.

Spent hops are dried and then threshed in order to separate the seeds from the leaves. The seeds are reduced to a flaky powder, which is brewed in the usual manner for making ale, stout, vinegar, etc., or for the extraction of lupuline and anodyne. The leaves may be used for cattle food or for the manufacture of charcoal powder, or bleached for making paper pulp.—J. F. B.

Brewing; Apparatus for use in ——. C. B. Davis, New York. Eng. Pat. 25,691, Nov. 14, 1906. Under Int. Conv., Nov. 15, 1905.

See U.S. Pat. 846,187 of 1907; this J., 1907, 545.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Lactic acid; Kinds of ——, *produced by lactic acid bacteria.* Heinemann. J. Biol. Chem., 1907, 2, 603—612.

There is a lack of agreement in the results of experiments of various workers on the kind of lactic acid formed in milk that has undergone natural souring. The author seeks to ascertain the causes of these discrepancies, with the following results: 1. Milk naturally souring at room temperature contains chiefly *d*-acid, whilst milk souring at 37° C. contains chiefly *r*-acid with *l*-acid in excess, if allowed to stand several days. 2. *Streptococcus lacticus* and *Str. pyogenes* produce the same kind of lactic acid (*d*-acid.) *B. aërogenes* from milk (*B. acidi lactici*) and the ordinary laboratory strain of *B.* (*lactis*) *aërogenes* (Escherich) produce the same kind of lactic acid (*l*-acid). 3. The lactic acid produced in milk naturally souring, varies: (*a*) According to the relative numbers of *Str. lacticus* and *B. aërogenes* present. The higher the number of *B. aërogenes*, the more *l*-acid is produced. (*b*) According to the temperature at which the fermentation takes place other conditions being uniform. At 37° C. relatively more *l*-acid is formed than at room temperature. (*c*) According to the length of time the fermentation has lasted. The longer the time, the more *l*-acid is formed. 4. In "certified" milk, *d*-acid only was present at room temperature for nine days, while both *d*-acid and *l*-acid were present in milk of poorer quality after 1—4 days. At 37° C., *l*-acid was apparent after six days in "certified" milk and on the second day in other milk. It seems as if the excess of *d*-acid persists longer in purer milk. 5. Racemic lactic acid is the result of the formation of *d*-acid and *l*-acid by at least two different species of micro-organisms. Racemic acid is not known to be the product of one species only. 6. Since it is known that *B. aërogenes* forms other acids in addition to lactic acid, often in appreciable amounts, while *Str. lacticus* produces almost pure *d*-acid, the presence of *d*-acid may be taken as indicating desirable conditions for dairy work, because this shows the absence of the fermentation products of *B. aërogenes*, that is, volatile acids, gas and ethyl alcohol.

Vegetable curdling ferments ; Sodium chloride as a sensitiser for ——. C. Gerber and S. Ledebt. Compt. rend., 1907, **145**, 577—580.

The behaviour of sodium chloride towards vegetable rennet is similar to that of calcium salts towards animal rennet. Thus, in small proportions, it accelerates the coagulation of milk by rennets of vegetable origin and even induces the phenomenon when the rennet alone is unable to do so. In large proportions, however, sodium chloride retards the coagulation of raw milk by these enzymes. —T. H. P.

Casein ; Combining power of —— with certain acids. J. H. Long. J. Amer. Chem. Soc., 1907, **29**, 1334—1342.

At the ordinary temperature, 1 grm. of casein combines with nearly 7 c.c. of $N/_{10}$ hydrochloric, hydrobromic, hydriodic, sulphuric, and acetic acids, respectively, and also with appreciable quantities of tartaric, phosphoric, oxalic and other acids. The acid-fixing power of casein is thus somewhat less than its base-fixing power, 1 grm. combining with 9 c.c. of $N/_{10}$ solutions of hydroxides or carbonates of sodium, potassium, lithium or ammonium respectively. At higher temperatures, *e.g.*, in the evaporation of weak acid solutions with casein, larger quantities of acid are combined, *viz.*, about four times as much hydrochloric acid, and still larger quantities of hydrobromic and hydriodic acids. This is due, in part at least, to the hydrolysis of the casein at the higher temperature, the decomposition-products themselves combining with acid.—A. S.

Colouring matters ; Effect of —— on some of the digestive enzymes. H. W. Houghton. J. Amer. Chem. Soc., 1907, **29**, 1351—1357.

The author examined the effects of annatto, saffron, turmeric, cochineal, Bismarck brown, and "croceine scarlet B" at dilutions ranging from 1 : 100 to 1 : 1600, on the peptic digestion of fibrin, casein, and egg albumin. Annato had no effect on the digestion of fibrin, but retarded that of albumin and casein. Saffron retarded the digestion of all three substances when used at concentrations ranging from 1 : 100 to 1 : 400. Turmeric had no effect on the digestion of fibrin when used in proportions of 1 : 800 or smaller, but in all cases retarded the digestion of casein and albumin. Cochineal and Bismarck brown retard the digestion of albumin at all the concentrations tried, and also that of fibrin and casein when used in proportions of from 1 : 100 to 1 : 400. "Croceine scarlet B" inhibits the digestion of fibrin at all the concentrations tried, whilst it retards the digestion of casein and albumin when used in proportions of from 1 : 300 to 1 : 1600, and entirely prevents it at a concentration of from 1 : 100 to 1 : 200.

Experiments showed that annatto and "oil yellow" accelerate the hydrolysis of butter fat by lipase.—A. S.

Lard ; Detection of foreign fats in ——. A. Leys. *See* XXIII.

Patents.

Butter, lard, cream, and the like ; Substitutes for ——. R. B. Ransford, London. From A. L. Lallemand, Montreal, Canada. Eng. Pat. 19,321, Aug. 29, 1906.

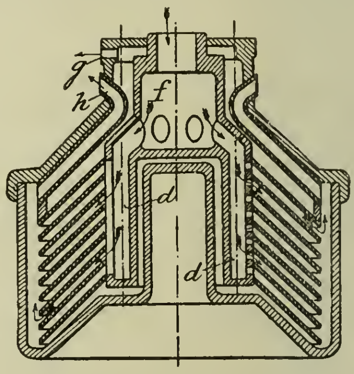
See Fr. Pat. 370,193 of 1906 ; this J., 1907, 272.—W. P. S.

Hops ; Utilisation of spent ——. C. Sureties. Eng. Pat. 21,250, Sept. 25, 1906. *See* XVII.

Milk, dissolved caseine, and other liquids and semi-liquids, Method and apparatus for evaporating the watery parts of ——. S. P. Rasmussen, London. Eng. Pat. 25,750, Nov. 14, 1906.

The apparatus consists of a vacuum pan in the form of a vertical cylinder provided with a steam-jacket and terminating in a lower conical part which is also provided with a separate steam- or water-jacket. The upper part of the pan is in connection with a condenser and an exhaust pump. A central shaft, capable of being slowly rotated, is fitted in the pan ; the upper part of this shaft is hollow for receiving the supply of milk, which then passes through a small horizontal pipe to a vertical pipe situated close to the inner wall of the pan. This vertical pipe is fixed by means of brackets to the central shaft, and has an adjustable slit throughout its length, so that the milk is thrown on the wall of the pan in the form of a thin layer. A scraper or knife is fixed in front of this vertical pipe for the purpose of removing the dry, or semi-dry, film of milk from the wall of the pan. The powder falls on to an umbrella-shaped disc fitted on the lower part of the central shaft, from which it is removed by means of a fixed scraper ; it falls into the lower part of the pan, where it is more completely dried and is then withdrawn through a manhole. An overflow gutter is provided at the bottom of the pan, to collect any excess of undried milk. The pan is fitted with the necessary vacuum gauge, thermometer, etc. The temperature during the drying operation is maintained at from 50° to 60° C.—W. P. S.

[*Milk*] *Separators ; Centrifugal ——.* B. A. O. Prollius, Copenhagen, Denmark. Eng. Pat. 2596, Feb. 1, 1907.



The whole-milk is fed into the chamber, *f*, and passes as shown by the arrows into a number of slotted vertical tubes, *d*, arranged symmetrically round the axis of the machine. These tubes are closed at the bottom and are so arranged that the milk occupies only the outer half of each tube, leaving an empty space behind in order to prevent any separated cream from lodging in them and causing a block. The cream finally escapes at *g*, and the skim-milk at *h*.—W. H. C.

Milk powder ; Process and apparatus for the manufacture of —— and products of the same. E. Passburg. Fr. Pat. 378,051, May 23, 1907.

The milk is introduced into a horizontal casing in which is mounted a revolving cylinder heated internally by means of steam. The casing is connected with a vacuum pump and the thin layer of milk is removed by means of a scraper from the revolving cylinder before it is completely dried. The partially dried milk falls into a separate vessel, in which it is submitted to a slow final drying. Means are provided for preventing the milk becoming over-heated, pipes through which cold water circulates, or a cold water jacket, being fitted at the bottom of the casing for this purpose. The apparatus may be used for drying mixtures of milk and cocoa, coffee, etc.—W. P. S.

(B.)—SANITATION ; WATER PURIFICATION.

Water treatment ; Some reactions during ——. E. Bartow and J. M. Lindgren. J. Amer. Chem. Soc., 1907, **29**, 1293—1305.

The authors find that in the treatment of water with lime, the reactions proceed mainly in regular order, the lime acting in succession on the carbon dioxide, calcium bicarbonate, sodium bicarbonate, and magnesium bicarbonate. During the first and second stages, from 70—80 per cent. of the calcium bicarbonate, or about 50 per cent. of the alkaline-earth bicarbonates are removed, whilst for the removal of only a small percentage more, nearly double the amount of lime is required. Neither lime nor sodium carbonate alone will effect a maximum separation of incrusting constituents from waters containing sulphates; of the two, sodium carbonate is the more efficient.—A. S.

Lead compounds; Solubility of —— in water. M. Pleissner. *See* VII.

Patents.

Sewage; Purification of ——. A. J. Boult, London. From E. Bohon, Paris. Eng. Pat. 28,585, Dec. 14, 1906.

See Fr. Pat. 372,544 of 1906; this J., 1907, 547.—T. F. B.

Liquids [*water, etc.*]; *Apparatus for sterilising —— by means of ozone.* H. J. Wessels de Frise. Fr. Pat. 377,597, May 8, 1907.

The water, or other liquid, is introduced into the lower part of a vertical cylindrical vessel, through a pipe piercing the wall and extending downwards in the form of a trumpet. Ozonised air is injected into this trumpet-shaped part, and the mixture of water and ozonised air rises gradually in the vessel. A diaphragm, or plate, is situated across the vessel at about one-half the height of the latter, and is perforated by a few small holes so that the passage of the water is somewhat obstructed and a slight pressure is formed. At a little distance above and below this diaphragm are placed other perforated plates with the object of mixing the ozonised air with the water. The treated water is drawn off from the top of the vessel, a separate escape-pipe being provided for the discharge of the excess of ozonised air.—W. P. S.

Animal and faecal matters; Apparatus and process for treating —— by means of sulphuric acid. J. Brossard. Fr. Pat. 378,055, May 23, 1907. *See* XV.

(*C.*)—DISINFECTANTS.

Patent.

Acetate of copper and calcium [*insecticide*]; *Manufacture of a double ——.* I. C. Ponthus. First Addition, dated March 11, 1907, to Fr. Pat. 357,414, Aug. 31, 1905 (this J., 1906, 87).

To the double acetate of copper and calcium described in the main patent, a modified formula is now assigned, *viz.*, $9[Ca(C_2H_3O_2)_2,Cu(C_2H_3O_2)_2,5H_2O],CuO(OH_2),H_2O$. A hot concentrated solution of copper acetate is added to a concentrated solution of calcium acetate, the latter being in slight excess. The acetic acid evolved during the formation of the double salt, and during the succeeding concentration of its solution, and of the mother-liquors, is condensed.—E. S.

XIX.—PAPER, PASTEBOARD, &c.

Cellulose; Bleaching of ——. C. G. Schwalbe. Chem.-Zeit., 1907, 31, 940—941.

Contrary to what has formerly been supposed, the author finds that when cellulose is bleached by hypochlorites, either in acid or alkaline solution, the amount of chlorine which combines with the substance of the fibre is quite negligible. In the case of sulphite-cellulose there is however a small quantity of chlorine absorbed. The use of bleaching powder produces a much larger absorption of salts by the fibre than sodium hypochlorite; the absorption is not so great in acid as in alkaline solution. The velocity of the bleaching process is dependent on the amount of salts present in the bleaching solution, being less, the greater the amount of salts present. For this reason, electrolytically prepared sodium hypochlorite is to be preferred to that made from sodium hydroxide and chlorine, as the former contains less alkali: it is also preferable to bleaching powder. The bleaching of sulphite-cellulose is best carried out at about 40° C. The hypochlorite solution gradually decomposes into chlorate at this temperature, but at a rate much slower than that at which the bleaching process goes on. The bleaching of sulphite-cellulose (this J., 1904, 948) cannot usually be carried out in acid solution owing to the formation of hydrocelluloses and oxycelluloses. As however these substances have a much greater reducing action on Fehling's solution than sulphite-cellulose, the progress of the bleaching in acid solution may be controlled by testing from time to time.—C. E. F.

Hydrocelluloses. C. G. Schwalbe. Chem.-Zeit., 1907, 31, 937.

Cotton cellulose is hydrated by the action of concentrated alkalis and acids; there is no difference between the product of the reaction and cellulose itself in so far as their reducing action on Fehling's solution is concerned. Dilute acids hydrolyse cellulose to hydrocelluloses which have a much greater reducing power than cellulose. Vegetable parchment and Chardonnet silk are both able to reduce Fehling's solution though not so much as the hydrocelluloses. Parchment owes its reducing power to the production of a small quantity of hydrocelluloses, formed whilst the concentrated acid is being washed out during the process of preparation. The reducing action of Chardonnet silk is due to the production of oxycelluloses by the nitric acid employed in its preparation. These oxycelluloses are distinguished from the hydrocelluloses by being much more strongly coloured by basic dyestuffs. Mercerised cotton, Pauly silk and viscose silk have scarcely any reducing action on Fehling's solution.—C. E. F.

Patents.

Hops; Utilisation of spent ——. C. Sureties. Eng. Pat. 21,250, Sept. 25, 1906. *See* XVII

Pulp and paper; Manufacture of ——. J. M. Dohan, Darlington, Pa. U.S. Pat. 865,168, Sept. 3, 1907.

All the water and solid matters discharged from fibrous material in forming the web of paper, are collected, and the solid matters are deposited by causing the water to flow against baffle-plates. The water is drawn off and further clarified, and the "clarified water and the solids separated therefrom are returned by different courses for separate incorporation in the treatment of the fibrous material."—W. P. S.

Celluloid uninflammable and incombustible; Process for rendering ——. P. Marino, London. Eng. Pat. 5891, March 11, 1907.

See Fr. Pat. 376,399 of 1907; this J., 1907, 989.—T. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cinchonine; Action of nitric acid on ——. P. Rabe and E. Ackermann. Ber., 1907, 40, 2016—2017.

By heating 50 grms. of cinchonine, free from cinchotine, with eight times the quantity of nitric acid (sp. gr. 1·3) to about 100°—110° C. for 48 hours, a new base was formed, which was isolated by diluting the reaction-product with half its volume of ice-water, and precipitating by ammonia. The new compound, $C_{19}H_{20}N_4O_6$, is insoluble in water, ether and ligroïn, almost insoluble in benzene, chloroform, and cold alcohol, and soluble with difficulty in boiling alcohol, from which it separates in small white, woolly needles, that melt at about 238° C. with decomposition. It is a di-acid base, which is only slowly attacked by potassium permanganate, but yields cinchonic acid on oxidation with chromic acid. The hydrochloride of the new base, $C_{19}H_{20}N_4O_6$, 2HCl, crystallises from alcohol in small white prismatic needles, which melt, with decomposition, at about 238° C.—A. S.

Cocaine; A base occurring in the alkaloids accompanying ——. C. Liebermann. Ber., 1907, **40**, 3602—3603.

In working up large quantities (13 kilos.) of the alkaloids occurring in crude cocaine, a small quantity (20 grms.) of a base was obtained by extracting the residues from the purification of ecgonine with benzene, saturating the remaining liquid with ammonia and extracting with ether. This was identified as the ethyl ester of anhydroecgonine.
—J. C. C.

Aporeine, and other constituents of Papaver dubium. V. Pavesi. Gazz. Chim. ital., 1907, 37 [1].

The milky juice of *Papaver dubium* contains the alkaloid, *aporeine*, which is distinct from the base *rhoeadine* found in *P. rhoeas*. The dried plant is extracted with 95 per cent. alcohol, and the evaporation-residue of the extract is treated with aqueous acetic or tartaric acid, filtered, and alkali added to the filtrate until no further precipitate is formed. The aqueous liquid is then rendered alkaline with sodium carbonate, and extracted with ether, or a mixture of ether and light petroleum spirit. On evaporating the extract, the impure base is obtained as a resinoid green residue, which becomes brown, and less soluble in ether, on exposure to the air. This is purified by conversion into the hydrochloride, $C_{18}H_{16}NO_2.HCl$, which forms silvery nacreous scales or tablets. When heated in dry carbon dioxide, it sublimes between 220—240° C. without melting. In the air, it turns greenish-black at 215° C. with decomposition. The free base is almost colourless, shows a bluish fluorescence, is readily soluble in most organic solvents, but sparingly soluble in water. The alcoholic solution is alkaline to litmus. It gives crystalline salts, from the aqueous solution of which it is liberated by alkali carbonates, forming an emulsion. With formaldehyde solution, it gives, at first, a bright blue colour, becoming darker and finally olive-black; this reaction is characteristic. If a solution of aporeine hydrochloride be exposed to sunlight for 14 days, and then shaken with ether, the latter removes a body exhibiting a blue fluorescence; on evaporating the ether a crystalline residue of white needles is obtained, which has been named *aporegenine*. It gives colour reactions differing from those of aporeine. From the mother-liquor of the first crystallisation of aporeine hydrochloride, another body, *aporeidine*, m. pt. 124—125° C., has been isolated. Aporeine is poisonous, but aporeidine is non-toxic.—J. O. B.

Nierembergia hippomanica; New toxic alkaloid in ——. P. Lavenir and J. Sanchez. J. Pharm. Chim., 1907, **26**, 220—222.

Nierembergia hippomanica, N.O., *Solanaceæ* ("Chuschu") is a poisonous plant growing in Argentina, which has caused damage to grazing stock. It was examined in 1875 by Echegaray who claimed to have isolated from it a glucoside, hippomanin. The authors are unable to confirm this, but find that the toxic principle is an alkaloid, *nierembergine*. Besides this, the plant contains two resins and a colouring matter. The base was isolated as sulphate: this salt, and the free alkaloid, are amorphous and soluble in water. The solutions of the base resemble those of saponin in their property of frothing when shaken.
—J. O. B.

Hydroxycaffeine. E. Starkenstein. Pharm.-Zeit., 1907, **52**, 585.

Hydroxycaffeine, or 1.3.7.-trimethyluric acid, has powerful diuretic properties, especially in the form of the hydroxycaffeine-sodium benzoate compound. It is obtained by the action of alcoholic potassium hydroxide on chlorocaffeine, the ethoxycaffeine thus obtained being boiled with hydrochloric acid. It crystallises from solution in hot water in fine, felted needles, m. pt. 345° C. with sublimation. It is soluble in hot water, acids, alkali carbonates, and sodium benzoate solutions, but only sparingly soluble in alcohol, ether, and chloroform.
—J. O. B.

Eriodictyon glutinosum; Chemistry of ——. G. Mossler. Monatsh. Chem., 1907, **28**, 1029—1039.

The author has made a further study of eriodictyonone, $C_{16}H_{14}O_6$ (this J., 1907, 275), which is identical with the homo-eriodictyol of Power and Tutin (this J., 1906, 1065, and 1907, 635). It is optically active, having a molecular rotation of $(\alpha^{20°}_D) = -28{\cdot}21°$. Three of the four hydroxyl groups it contains can be methylated and are phenolic hydroxyl groups. With phenylhydrazine in acetic acid solution, it gives a phenylhydrazone, which is a yellow crystalline substance (m.p., 184—186° C.). By heating eriodictyonone with hydrochloric acid to 120° C. for several hours, catechol and homo-catechol are formed.
—C. E. F.

Alkaloidal extracts; Simple method for the assay of ——. M. H. Webster. Amer. J. Pharm., 1907, **79**, 301—307.

Fluid extracts.—Ten c.c. are gradually added to 85 c.c. of cold absolute alcohol in which 1·5 grms. of tartaric acid have been previously dissolved, and sufficient absolute alcohol is added to make 100 c.c. 50 c.c. of the filtered solution are evaporated to dryness on the water-bath, the cold dry residue is extracted with 10 c.c. of *N*/2 sulphuric acid, the liquid filtered through a cotton plug into a separator, and the insoluble portion washed with two successive 5 c.c. of water. The filtrate and washings are treated with 20 c.c. of a mixture of 16 c.c. of chloroform and 4 c.c. of ether, and shaken with 4 c.c., or a sufficient quantity of a 20 per cent. solution of potassium hydroxide. After separating, the ether-chloroform extract is washed twice with 15 c.c. of water, and the alkaline liquid is shaken with fresh portions of ether-chloroform until no more alkaloid is removed. The mixed ether-chloroform extracts are treated with excess of *N*/50 or *N*/100 sulphuric acid, shaken, and after separation, the free acid in the aqueous portion is titrated with *N*/50 sodium hydroxide solution, using cochineal or iodeosin indicator.

Solid extracts.—Two grms. are dissolved in 10 c.c. of 50 per cent. alcohol and the solution treated as described above.—J. O. B.

Tannothymal. O. Baumgarten. Pharm. Zentralh, 1907, **48**, 558.

This compound, introduced for medicinal use, is a condensation product of tannin, thymol and formaldehyde (tannin-thymolmethane). Thymol in alcoholic solution is mixed with an aqueous solution of tannin, and well shaken with 2 to 3 times the calculated quantity of 40 per cent. formaldehyde solution. The mixture is poured into 20 times the quantity of strong sulphuric acid, and after standing for a while, it is diluted with water. The precipitate of tannothymal which forms, is filtered off, washed and dried. It is a whitish powder, m. pt. 235° C., soluble in alcohol and in alkaline solutions.
—J. O. B.

Monochloramine [and preparation of hydrazine]. F. Raschig. Chem.-Zeit., 1907, **31**, 926—927.

By the interaction of dilute solutions of molecular proportions of sodium hypochlorite and ammonia, monochloramine is produced smoothly and quantitatively: $NaOCl + NH_3 = NH_2Cl + NaOH$. If the resulting solution, after addition of zinc chloride to retain any excess of ammonia, be distilled in a vacuum at 40° C., a strong aqueous solution of monochloramine is obtained, which has a very injurious action on the eyes and skin. The compound is very unstable, the rate of decomposition increasing with the concentration of the solution. In presence of alkalis it yields, nearly quantitatively, ammonia and nitrogen: $3NH_2Cl + 3KOH = NH_3 + N_2 + 3KCl + 3H_2O$, and as the reaction-product from hypochlorite and ammonia always contains alkali, the monochloramine gradually decomposes according to the equation given. With ammonia, the amine decomposes according to the equation: (1) $3NH_2Cl + 2NH_3 = N_2 + 3NH_4Cl$, but a small quantity of hydrazine is also formed: (2) $NH_2Cl + NH_3 = N_2H_4,HCl$. The yield of hydrazine can be somewhat increased by adding to the hypochlorite an excess of ammonia larger than that required for the formation of monochloramine and for its decomposition according to equation (2), and also by boiling the solution immediately after mixing the hypochlorite and ammonia. The yields, however, vary considerably, and this was found to be due to the susceptibility of reaction (1) to catalytic influences. Proceeding from the author's view (Z. angew. Chem., 1906, **19**, 1748, 2083), that catalytic effects are due to alteration in the form of the reacting molecules, the influence on the reaction of substances capable of causing an alteration of the viscosity of the solution, was examined. It was found that substances, *e.g.*, acetone, which lower the viscosity, accelerate considerably reaction (1), whilst, on the other hand, substances which increase the viscosity, such as sugar, starch, dextrin, etc., even when only a small quantity is used, retard reaction (1), so that yields of 40—50 per cent. of the theoretical quantity of hydrazine can be obtained. Still better yields are obtained in presence of albumin, casein, and, especially, animal glue. Indeed in presence of a small quantity of animal glue, the reaction affords a practicable process for the preparation of hydrazine from cheap raw materials, since by using 50 times the calculated quantity of ammonia, a yield of 75—80 per cent. of the theoretical amount of hydrazine can be obtained by the action of hypochlorite.—A. S.

Silver ammonio-nitrate ; Crystalline ——. N. Castoro. Gazz. Chim. ital., 1907, **37** [1], 310—312.

SILVER ammonio-nitrate may be obtained in the form of white acicular crystals having the composition, $Ag(NH_3)_2NO_3$ by the following process. A strong aqueous solution of 5 grms. of silver nitrate in 4 to 5 c.c. of water is treated with strong solution of ammonia until the precipitate at first formed is almost re-dissolved, and a faintly opalescent liquid is obtained. This is filtered and 120 c.c. of absolute alcohol are added, when the salt separates in the crystalline state. These crystals are quickly reduced on exposure to air, becoming brown from liberation of metallic silver ; but they may be kept for some days unaltered under alcohol. If ether be used as the precipitant instead of alcohol, the salt separates in an amorphous condition.—J. O. B.

PATENTS.

Sulphonic acids and their alkali salts ; Process for obtaining aromatic —— from sulphonating mixtures containing sulphuric acid. A. J. Boult, London. From W. Miersch, Niedersedlitz, Saxony. Eng. Pat. 2565, Feb. 1, 1907.

SEE Fr. Pat. 373,338 of 1907 ; this J., 1907, 680.—T. F. B.

Peroxides ; Process of forming monobasic organic ——. A. C. Houghton, Syracuse, N.Y., U.S.A. Eng. Pat. 9725, April 26, 1907.

SEE U.S. Pat. 851,752 of 1907 ; this J., 1907, 637.—T. F. B.

Hydroxy-amino-acid esters ; Process for preparing ——. Soc. Anon. des Etabl. Poulenc frères, and E. Fourneau. Fr. Pat. 378,325, Aug. 7, 1906.

BY the action of ammonia or amines on dihalogenated dimethylhydroxyacetic acid, $(Cl.CH_2)_2 : C(OH)COOH$, and subsequently esterifying the products with alcohols, esters of the type, $(NXX'.CH_2)_2.C(OH)COOR$, are obtained : these in turn may be used as alcohols to prepare esters, which are stated to be of great technical value. The preparation of the following substances is described in detail :—Tetramethyldiaminomethylhydroxyacetic acid and its ethyl ester ; tetramethyldiaminodimethylbenzoyloxyacetic acid ethyl ester.—T. F. B.

Succinylsalicylic acid or its derivatives ; Process of preparing ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 378,220, May 29, 1907. Under Int. Conv., Dec. 6, 1906.

SUCCINYLSALICYLIC acid or its derivatives are obtained by the action of succinyl chloride or bromide on salicylic acid, hydroxytoluic acids, etc. The condensation is carried out in presence of dimethylaniline, quinoline, or other base which will unite with the halogen acid liberated. The products are slightly soluble in water, alcohol, and glacial acetic acid.—T. F. B.

Glycollic acid ; [*Electrolytic*] *Process for making* ——. F. Reinhold. Fr. Pat. 378,276, May 30, 1907. *See* XIA.

1-*Phenyl*-2.3-*dimethyl*-4-*sulphamino*-5-*pyrazolone and its salts ; Process for obtaining* ——. E. Scheitlin. Fr. Pat. 378,486, June 5, 1907. Under Int. Conv., Feb. 13, 1907.

THE nitroso group of 1-phenyl-2.3-dimethyl-4-nitroso-5-pyrazolone is converted into a sulphamino group by heating with sodium bisulphite solution, thus, $R.NO + 2NaHSO_3 = NaHSO_4 + R.NH.SO_3Na$. The sulphamino-compound is sparingly soluble in water and alcohol, and insoluble in most organic solvents : it is converted by acids into the corresponding aminopyrazolone sulphate. With dilute alkalis it forms alkali salts, readily soluble in water.

—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photography in colours on autochrome plates. C. Gravier. Bull. Soc. Franc. Phot., 1907, **23**, 415—417.

THE author states that the last five operations hitherto necessary for obtaining colour photographs on Lumière's "autochrome" plates (see this J., 1905, 104, 152, and 1906, 867), *viz.*, the second development, oxidation, intensification, clarifying, and fixing, can be superseded by a single treatment. The exposed plate is developed and treated with a solution of permanganate and sulphuric acid as directed by the makers, washed, and placed in a solution of sodium bisulphite (2 c.c. of the commercial solution to 100 c.c. of water) until a clear image is obtained, when it is washed for one minute, dried, and varnished.

—T. F. B.

PATENTS.

Colour photography ; The bleach-out process of ——. J. H. Smith, Zürich, Switzerland, and W. Merckens, Mülhausen, Germany. Eng. Pat. 2461, Jan. 31, 1907. Under Int. Conv., Feb. 2, 1906.

COMPOSITE films for use in the "bleach-out" process of colour photography are made to consist of a layer of nitrocellulose (or other cellulose derivative, such as the acetate) containing the basic dyestuffs, and a layer of gelatin, glue, isinglass, casein, etc., containing the acid dyestuffs. The films may also consist of a nitrocellulose layer containing three basic dyestuffs on a gelatin base, or of a gelatin film containing three acid dyestuffs supported on nitrocellulose. The following example is given :—A 3 per cent. collodion is added to an alcoholic solution of auramine, erythrosin, and methylene blue until a drop of the mixture, placed on a gelatin-coated surface, dries to a neutral grey colour. An alcoholic solution of anethol or other sensitiser or a mixture of sensitisers is added, and the emulsion is coated on gelatin-covered paper ; when dry, the erythrosin has passed into the gelatin, the two basic dyestuffs remaining in the nitrocellulose layer ; the paper requires sensitising with hydrogen peroxide, as the sensitisers first used remain in the nitrocellulose.—T. F. B.

Coloured photographs ; Process for the production of ——. J. H. Smith, Zürich, and W. Merckens, Mülhausen, Germany. Eng. Pat. 7217, March 26, 1907. Under Int. Conv., April 6, 1906.

SEE Fr Pat. 376,062 of 1907 ; this J., 1907, 1029.—T. F. B.

Silver phosphate emulsion ; Process for preparing a ——. Y. Schwartz. Fr. Pat. 378,305, April 16, 1907.

A SILVER phosphate emulsion of great rapidity, for photographic purposes, is prepared by adding a large excess of alkali phosphate, preferably disodium phosphate, to a solution of silver nitrate and gelatin, and then adding potassium chlorate and citric acid, and, if necessary, chrome alum. About twice the quantity of phosphate necessary for converting the silver nitrate into phosphate should be employed. An aqueous solution of metol is said to be the best developer for this emulsion. (Compare Fr. Pat. 320,451 of 1902 ; this J., 1903, 44.)—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Explosives in Brazil. Ch. of Comm. J., October, 1907. [T.R.]

The use of powder for war and sporting purposes is rather limited in Brazil, but the use of dynamite is rapidly increasing. The imports in 1905 and 1906 were as follows: Powder, £11,277 and £8752; dynamite and other explosives, £27,997 and £35,751, respectively. The powder comes from the United Kingdom and Germany, while the dynamite and other explosives, in the order of their value, come from the United Kingdom, Germany, France and Belgium. There are considerable difficulties in carrying on the trade in Brazil. The duty, together with special dock and other charges, is about as follows, per pound: On dynamite, 9d.; on powder, 1s. 3d. The regulations require storage under isolating conditions. In Rio de Janeiro this means securing an island in the bay, hiring a man to guard and care for the goods, special boat service for the transportation of the goods, etc.

Patent.

Powders for guns or cannon; Manufacture of —— which do not produce flame at the muzzle. C. Duttenhofer. Second Addition, dated May 22, 1907, to Fr. Pat. 364,413, March 19, 1906.

See Eng. Pat. 791 of 1907; this J., 1907, 840.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Patents.

Gases; Apparatus for automatically analysing mixed ——, and recording the percentage therein of one of the gases. W. S. Hubbard, Leicester. Eng. Pat. 19,513, Sept. 1, 1906.

The patent relates to an automatic apparatus by which a quantity of the mixed gases is measured, then passed over or through an absorbing solution, and afterwards again measured, the percentage of the absorbed constituent being recorded on a diagram.—A. S.

Fire-damp and other gases; Apparatus for detecting and recording ——. E. A. D. Santa, Ixelles-Brussels, and E. Spelmans, Anderlues, Belgium. Eng. Pat. 10,342, May 3, 1907. Under Int. Conv., May 7, 1906.

The method employed is based upon the fact that the size and intensity of a flame of *e.g.*, benzine, varies with its environment, becoming longer and hotter as the percentage of fire-damp in the air increases, and becoming smaller when carbon dioxide is present. The flame is surmounted by a short chimney of refractory material, connected with a thermo-pile, the outer current-circuit of which passes through a galvanometer, so that any alteration of temperature caused by variation of the flame, is recorded.—A. S.

INORGANIC—QUANTITATIVE.

Phosphoric acid; Determination of —— volumetrically. W. D. Richardson. J. Amer. Chem. Soc., 1907, **29**, 1314—1315.

It is found that the discrepancy between the results obtained in the determination of phosphoric acid in "acid phosphate" by Pemberton's volumetric method (this J., 1894, 176, 667; 1895, 511) and by the gravimetric method of the A.O.A.C. (Amer. Assoc. of Agric. Chemists) is due to the presence of sulphates. The following modification is recommended for the determination of phosphoric acid in fertilisers, especially when sulphates are present. Two grms. of the sample are digested by boiling with 30 c.c. of concentrated nitric acid and 5 c.c. of concentrated hydrochloric acid, then 10 c.c. of water are added, and the whole boiled for 5 minutes. From 25 to 30 c.c. of a 10 per cent. solution of barium chloride are next added, the liquid is cooled, made up to 250 c.c., filtered through a dry paper, and after rejecting the first portion of the filtrate, 25 c.c. are treated according to the A.O.A.C. modification of Pemberton's method.—A. S.

Carbon dioxide in electrolytic chlorine, bleaching powder and bleaching liquors; Determination of ——. P. Philosophoff. *See* VII.

Hydrogen peroxide; Gasometric method for the determination of ——. W. B. Dehn. *See* VII.

Fluorescence phenomena of 2-methyl-3-aminoquinoline and 2-methyl-3-amino-4-hydroxyquinoline. Use of 2-methyl-3-aminoquinoline as an indicator. O. Stark. *See* IV.

Iodine; Determination of —— in crude and sublimed iodine. H. Cormimbœuf. Ann. Chim. anal. appl., 1907, **12**, 307—308.

Three grms. of the sample are treated with 20 to 25 c.c. of water, 1 grm. of iron filings is gradually added, and the mixture is agitated until a colourless or pale green liquid is obtained. This is filtered, made up to 250 c.c. by washing the insoluble residue with distilled water, and 50 c.c. of the solution are treated with 0·5—1·0 grm. of pure dry sodium carbonate, previously dissolved in a little water. The iron is precipitated, and a faintly alkaline solution obtained. The latter is made up to 100 c.c., and exactly 50 c.c. are filtered off, rendered acid with nitric acid, and treated with one-fourth of its volume of solution of ammonia, any precipitate formed being filtered off. The iodine is then precipitated by means of silver nitrate in the usual manner.—J. O. B.

ORGANIC—QUALITATIVE.

Lard; Detection of foreign fats in ——. A. Leys. *See* XII.

Methyl lactate; Detection of ——. T. Takahashi. Bull Coll. Agric., Tokyo Imp. Univ., 1907, **7**, 565—566.

The method described by the author (this J., 1905, 692) for the detection and determination of fusel oil, will also serve for the detection of methyl lactate, a bluish-green layer being produced. The coloration appears above the purple-blue (fusel oil) layer, when both substances are present.—A. S.

Dyestuffs on vegetable fibres; Identification of ——. A. G. Green, H. Yeoman, J. R. Jones, F. G. C. Stephens, and G. A. Haley. *See* V.

ORGANIC—QUANTITATIVE.

Reducing sugars; Determination of —— with special reference to dextrose and laevulose. L. Pellet. *See* XVI.

Reducing sugars; Detection and determination of ——. S. R. Benedict. *See* XVI.

Volatile acids in fermentation media: musts, wines, beers, etc.; Determination of —— under reduced pressure. Roos and W. Mestrezat. *See* XVII.

Glycerol; Determination of —— in wine and beer. F. Zetzsche. *See* XVII.

Alkaloidal extracts; Simple method for the assay of ——. M. H. Webster. *See* XX.

Patent.

Butter; Process of determining the percentage of water in ——. G. E. Patrick. U.S. Pat. 864,913, Sept. 3, 1907. *See* XVIIIA.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Action of light ; Laws of the —— on glucosides, enzymes, toxins and anti-bodies. G. Dreyer and O. Hanssen. Compt. rend., 1907, **145**, 564—566.

By studying the action of the light of a Bang lamp, fitted with cooled silver electrodes, on solutions of saponin and cyclamin ; rennet, trypsin and papayotin ; the toxins, ricin and abrin, and the immuno-serum, coli-agglutinin, the authors find that all these substances are weakened by light. The weakening, which is due principally to the ultra-violet rays absorbed by the glass, proceeds according to the formula representing the course of monomolecular reactions. The two glucosides examined are hydrolysed by strong illumination, which has also the power of coagulating protein solutions. For substances which, when subjected to prolonged illumination, become turbid owing to the coagulation of proteins, the weakening follows the course of a monomolecular reaction, allowance being made for the diminution in the transparency of the solution.
—T. H. P.

New Books.

Organic Chemistry for Advanced Students. By Julius B. Cohen, Ph.D., Professor of Organic Chemistry in the University of Leeds. Edward Arnold, 41 and 43, Maddox Street, Bond Street, London, W. 1907. Price 21s. net.

As stated in the preface—" these essays have been prepared from notes of lectures delivered to senior students, and are intended only for those who have completed an elementary course of organic chemistry." The work contains 610 pages of subject matter, with an alphabetical index both of subjects and authors, etc., completing 632 pages. The sections of organic chemistry covered in the text, are as follows :—I. Historical introduction. II. Isomerism and stereoisomerism. III. Stereochemistry of unsaturated and cyclic compounds. IV. Stereochemistry of nitrogen. V. Isomeric change. VI. Steric hindrance. VII. Condensation. VIII. The carbohydrates. IX. Fermentation and enzyme action. X. The purine group. XI. The proteïns. XII. The benzene theory. XIII. The terpenes and camphors. XIV. The alkaloids.

A Scheme for the Detection of the more common Classes of Carbon Compounds. By Frank E. Weston, B.Sc., Lecturer in Chemistry at the Polytechnic, Regent Street. 2nd Edition. Longmans, Green and Co., 39, Paternoster Row, London. 1907. Price 2s. 6d. New York, Bombay, and Calcutta.

8vo volume, containing 95 pages of subject matter, with five illustrations. The Scheme comprises subject matter subdivided as follows:—I—V. Preliminary observations. VI. Carbon and hydrogen only present. VII. Carbon, hydrogen, and halogen present. VIII. Carbon, hydrogen, oxygen, and halogen present. IX. Carbon, hydrogen, and oxygen present. X. Carbon, hydrogen, and nitrogen present. XI. Carbon, hydrogen, nitrogen, and oxygen present. XII. Carbon, hydrogen, and sulphur present. XIII. Carbon, hydrogen, sulphur, and oxygen present. XIV. Carbon, hydrogen, sulphur, and nitrogen present. XV. Carbon, hydrogen, sulphur, oxygen, and nitrogen, or halogen present. XVI. Special reactions. XVII. Solubility of organic substances in water.

Practical Test-Book of Chemistry. By John Dabney Palmer, M.A., M.D. John Wiley and Sons. New York, U.S. America. Chapman and Hall, Limited, London. 1907. Price 4s. 6d. net.

Small 8vo volume, containing 186 pages of subject matter, and an alphabetical index. The work is divided into two parts, the first part containing " Specific Tests," the second, " Tests for Purity." The specific tests, are methods for distinguishing individual substances such as phenol, phenacetin, nicotine, or quinine sulphate, etc. ; the tests for purity, for distinguishing and identifying commercial individual substances, such as beeswax, asphaltum, lampblack, or glycerin, etc.

The Electric Furnace in Iron and Steel Production. By John B. C. Kershaw. The " Electrician " Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, London. E.C. 1907. Price 3s. 6d. The D. Van Nostrand Co., 23, Murray Street, New York. Z. P. Maruya and Co., 14, Nihonbashi Tori Sanchome, Tokyo, Japan. Higginbotham and Co., Madras. George Robertson and Co., Melbourne, Sydney, Adelaide, and Brisbane.

8vo volume, containing 68 pages of subject matter, with 24 illustrations. The text is classified according to the following scheme :—I. Historical introduction. II. The Héroult furnace and process. III. The Keller furnace and process. IV. The Kjellin furnace and process. V. The Stassano furnace and process. VI. Miscellaneous furnaces and processes (Conley, Galbraith, Gin, Girod, Harmet, Hiorth, Ruthenberg). VII. Yields and costs. VIII. British and American patents. IX. The Colby furnace and process.

Nature's Hygiene and Sanitary Chemistry : Containing also a Special Account of the Chemical and Hygienic Characters of Eucalyptus, Pine and Camphor Forests, and some Industries connected therewith. By C. T. Kingzett. Fifth Edition. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, London. 1907. Price 10s.

Demy 8vo volume, containing 514 pages of subject matter and an alphabetical index. The subject matter is divided into two parts, and these are classified as follows :—Part I. I. Introductory. Constitution of matter, etc. II. Constituents of the atmosphere. Water. Peroxide of hydrogen, etc. III. Chemistry and hygiene of the atmosphere. Ventilation, etc. IV. Oxidation. Physiological combustion. Natural decay. Putrefaction. Sanitary bearings of these processes. V. Rain water. Spring-water. Sea water. Water supply. Sewage contamination. Water purification, etc. VI. Excreta. Sewage, etc. VII. Infectious and contagious diseases. Chemical and germ theories. Preventing infection. VIII. Bacteriological studies. Disease and its chemistry. IX. The scientific basis of disinfection. Disinfectants and their standardization. X. Measures of disinfection to be observed in sickness, and infectious disease. XI. Alimentation and foods. Part II. XII. Malarial fever and its causes. Eucalyptus globulus and its sanitary properties, etc. XIII. Essential oils and their oxidation in nature, the laboratory, and the factory. XIV. Properties of the individual and collective products of the oxidation of essential oils, considered as antiseptics, disinfectants, oxidants, and germicides. XV. Eucalyptus, pine, and camphor forests ; extent, distribution, and hygienic influences. Industries connected with them.

Taschenbuch für die anorganisch-chemische Grossindustrie. Herausgegeben von Prof. Dr. G. Lunge und Privatdoz. Dr. E. Berl. Vierte umgearbeitete Auflage des Taschenbuches für die Soda-, Pottasche-, und Ammoniakfabrikation. Julius Springer's Verlag, Monbijouplatz 3, Berlin, N. 1907. Preis M.7.

This, the fourth edition of the " Pocketbook," contains 288 pages of subject matter and tables, and 11 pages of alphabetical index, with 33 blank pages for written notes and addenda. The text is illustrated with fifteen engravings. A number of additions have been made, and more especially under the subjects of boiler feed-water, gas manufacture, calcium carbide and acetylene, crude materials and manufactured products of the manure and cement industries, and of the industry of alumina preparations. The subject matter is arranged under the following heads :—General data and tabulated matter. Special. I. Fuels, etc. Steam boilers. II. Sulphuric acid manufacture. III. Saltcake and hydrochloric acid manufacture. IV. Bleaching powder, etc. V. Alkali manufacture. VI. Sulphur recovery from the Leblanc alkali waste. VII. Nitric acid manufacture. VIII. Potash industry. IX. Ammonia industry. X. Illuminating gas manufacture. XI. Calcium carbide and acetylene. XII. Investigation of the crude materials and products of the manure manufacture. XIII. Alumina preparations. XIV. Cement industry. XV. Preparing normal volumetric solutions. XVI. Preparation of average samples. XVII. Comparison of the various hydrometer scales.

PRACTICAL CHEMISTRY FOR ARMY AND MATRICULATION CANDIDATES AND FOR USE IN SCHOOLS. By GEOFFREY MARTIN, Ph.D., Lecturer and Demonstrator in Chemistry, University College, Nottingham. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London. 1907. Price 2s.

SMALL 8vo volume, containing 138 pages of subject matter with 74 illustrations and the alphabetical index. The subject is subdivided as follows:—I. Apparatus. II. Preparation of gases and liquids. III. Simple quantitative experiments. IV. Analytical operations. V. Solubility. VI. Water of crystallisation. VII. Neutralisation of acids by bases, and preparation of simple salts. VIII. Volumetric analysis. IX. Chemical equivalents. X. Observation of reactions. XI. Melting and boiling points. Appendixes I., II., and III. Symbols and atomic weights. Weights and measures. Hints on regulating work in practical chemistry classes.

THE CHEMICAL TRADE DIRECTORY. Third Edition. Davis Bros., 265, Strand, London, W.C. Price 10s.

THE Directory consists of 327 large 8vo pages of subject matter divided into two parts. Part 1 contains an alphabetised list of names of chemical manufacturers, merchants, brokers, and agents, and makers of chemical plant, shewing the chief products made or dealt with by each; Part 2 consists of a classified list of chemical products, plant, &c., with the names and addresses of the makers.

BOARD OF AGRICULTURE AND FISHERIES. REPORT ON THE SECOND INTERNATIONAL DAIRY CONGRESS HELD AT PARIS IN OCTOBER, 1905. Including the text of the Resolutions adopted, and a detailed account of the Proceedings relating to International Co-operation for the Prevention of Butter Adulteration; with an Appendix. Darling and Son, Ltd., 34—40, Bacon Street, London, E. 1907. Price 6d. Wyman and Sons, Ltd., Fetter Lane, E.C., and 32, Abingdon Street, Westminster, S.W. Oliver and Boyd, Edinburgh. E. Ponsonby, 116, Grafton Street, Dublin.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

APPLICATIONS.

21,993. Moore. Regenerative gas furnaces. Oct. 5.
22,095. Eschelmann and others. *See under VII.*
22,408. Seard. Evaporating apparatus.* Oct. 8.

COMPLETE SPECIFICATIONS ACCEPTED.

25,449 (1906). Hebb. Apparatus for cooling liquids. Oct. 6.

25,727 (1906). Greis. Furnaces. Oct. 16.

26,732 (1906). Weekes. Kilns. Oct. 16.

27,064 (1906). Symonds. Apparatus for measuring and recording the temperature of furnaces, &c. Oct. 16.

5189 (1907). Leuschner. Apparatus for mixing liquids and gases. Oct. 16.

13,585 (1907). Wolff. Liquid filters. Oct. 9.

14,097 (1907). Meurs-Gerken. Separation of one or more vapours from mixtures of vapour and gas. Oct. 16.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

21,593. Fabry. Coke ovens. Sept. 30.

21,601. Wegelin. Manufacture of soot.* Sept. 30

21,682. Bowmer. Suction gas producers. Oct. 1.

21,808. Sheldon. Coking or distilling coal for making coke and gas. [U.S. Appl., Oct. 2, 1906.]* Oct. 2

21,838. Mason's Gas Power Co., and Wright. Gas producers. Oct. 3.

21,920. Hense. Liquid combustibles. Oct. 4.

22,036. Lake (Michaud and Delasson). Manufacture of filaments for illuminating and heating purposes.* Oct. 5.

22,274. Johnson. Apparatus for making coal gas. Oct. 9.

22,293. Wirtz. Furnaces for calcining coal. Oct. 9.

22,561. Hense. Liquid combustible. Oct. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

19,398 (1906). British Thomson-Houston Co. (General Electric Co.). Refractory conductors for electric lamps, furnaces, &c. Oct. 9.

20,281 (1906). Robertson and Graham. Manufacture of artificial fuel. Oct. 16.

21,505 and 21,509 (1906). British Thomson-Houston Co. (General Electric Co.). Manufacture of electric conductors of refractory metals. Oct. 9.

21,510 (1906). British Thomson-Houston Co. (General Electric Co.). Electrodes for arc lamps. Oct. 9.

22,028 (1906). Harris. Compositions for use in producing gas from garbage, &c. Oct. 9.

29,291 (1906). Duncan and Hardie. Manufacture and purification of illuminating gas. Oct. 16.

13,986 (1907). Haddan (Bergmann Elektricitäts-Werke A.-G.). Manufacture of metallic filaments for electric glow lamps. Oct. 16.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

APPLICATIONS.

21,742. Paterson. Manufacture of vulcanised bitumen. Oct. 1.

21,743. Cooper and Shattock. Manufacture of non-inflammable benzine and the like. Oct. 1.

22,031. Castano. Utilising crude bitumen for heating, &c.* Oct. 5.

22,298. Gutensohn. Treatment of tar. Oct. 9.

COMPLETE SPECIFICATIONS ACCEPTED.

27,629 (1906). Lake (Rütgerswerke A.-G.). Production of oils for use in explosion motors, &c. Oct. 9.

9180 (1907). Hellsing. Deodorising and desulphurising mineral oils. Oct. 16.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATION.

21,668. Ransford (Cassella und Co.). Manufacture of disazo dyes. Sept. 30.

COMPLETE SPECIFICATIONS ACCEPTED.

2766 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of diphenylamine and derivatives thereof. Oct. 9.

5841 (1907). Newton (Bayer und Co.). Manufacture of the monosulphonic acids of *p*-diaminoanthrarufin and of *p*-diaminochrysazin. Oct. 16.

6105 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of bromo derivatives of indigo. Oct. 16.

6106 (1907), Imray (Soc. Chem. Ind. in Basle). Manufacture of vat dyestuffs. Oct. 16.

11,609 (1907). Johnson (Kalle und Co.). Manufacture of colouring matters of the thioindigo group. Oct. 9.

17,521 (1907). Wolffenstein and Boeters. Manufacture of nitro compounds. Oct. 16.

19,002 and 19,003 (1907). Durand, Huguenin, et Cie. Manufacture of new gallocyanines. Oct. 9.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

21,609. Rothwell-Jackson. Machines for bleaching, dyeing, and otherwise treating fabrics in the open state. Sept. 30.

22,092. Bronnert and Fremery. Manufacture of cellulose products from solutions of cellulose in cuprammonia.* Oct. 7.

22,347. Hanitzsch. Apparatus for spraying fluid on textiles, paper, &c.* Oct. 10.

22,371. Morison. Composition for preserving and waterproofing fabrics, wood, &c.* Oct. 10.

Complete Specification Accepted.

13,518 (1907). Ratignier and Pervilhac. Manufacture of artificial fabrics. Oct. 9.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

21,725. Meurer. Manufacture of metal sulphates from metal sulphides. [Ger. Appl., Oct. 19, 1906.]* Oct. 1.

21,786. Frank and Voigt. Manufacture of nitrogen compounds with the aid of carbides. Oct. 2.

21,892. Hird. Production of ammonia from ammoniacal liquor. Oct. 4.

22,095. Eschelmann, Harmuth, and Ges. der Tentelew'schen Chem. Fabr. Apparatus for absorbing gases, especially sulphuric anhydride.* Oct. 7.

22,201. Spitzer. Manufacture of nitrogen oxides. [Ger. Appl., Oct. 12, 1906.]* Oct. 8.

22,434. Tucker. Massive boron carbide and process of making the same.* Oct. 11.

Complete Specifications Accepted.

21,780 (1906). Mewes. Liquefying air and winning oxygen. Oct. 9.

21,787 (1906). Simm and Simm. Production of zinc oxide. Oct. 9.

25,547 (1906). Williams and Fenner. Saturators for ammonium sulphate manufacture. Oct. 9.

28,581 (1906). Strohbach. Manufacture of soda alum, potash alum, and ammonia alum free from iron. Oct. 9.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

22,094. Imray (Window Glass Machine Co.). Apparatus for melting and drawing glass.* Oct. 7.

Complete Specification Accepted.

14,587 (1907). Menzel. Apparatus for drawing plate glass. Oct. 9.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

21,637. Lockwood. Manufacture of artificial stone, plaster, cement, and the like. Sept. 30.

22,179. Collins. Manufacture of imitation marble, stone, and the like. Oct. 8.

22,371. Morison. *See under* V.

Complete Specifications Accepted.

25,417 (1906). Boult (Cöln-Müsener Bergwerks Akt.-Ver.). Hardening moulded articles of ground slag. Oct. 9.

25,857 (1906). Brooks. Hydrating and cooling cement. Oct. 9.

1381 (1907). Miller. Manufacture of tar concrete or artificial asphalt. Oct. 16.

6623 (1907). Oltmanns. Material for and process of making building blocks. Oct. 16.

X.—METALLURGY.

Applications.

21,595. King's Norton Metal Co., Smith, and Brownsdon. Treatment of copper ores and residues containing copper.* Sept. 30.

21,638. Martin. Treatment of iron or steel to prevent rust or erosion.* Sept. 30.

21,961. Von Zelewski. Mechanical roasting furnace. [Ger. Appl., Oct. 13, 1906.]* Oct. 4.

22,135. Hodgkinson. Removal of phosphorus from pig iron, ferromanganese, and like metals or alloys. Oct. 8.

22,283. Côte and Pierron. *See under* XI.

22,522. Brayshaw. Furnaces for hardening high speed steel.* Oct. 12.

22,523. Meek. Magnetic separators for separating metals from refuse. Oct. 12.

Complete Specifications Accepted.

21,876 (1906). Ruthenberg. Reduction of ores. Oct. 9.

22,162 (1906). MacIvor and Fradd. Extraction of tin from ores or oxide. Oct. 16.

22,264 (1906). James (Hobson). Gold alloys. Oct. 16.

22,534 (1906). Sulman. Separation of zinc from ores or compounds. Oct. 16.

22,799 (1906). Simpson. Hardening or tempering iron or steel articles. Oct. 16.

23,293 (1906). Galbraith. Manufacture of steel by the Bessemer or pneumatic process. Oct. 9.

23,384 (1906). Harvey. Portable crucible furnaces. Oct. 9.

24,234 (1906). British Thomson-Houston Co. (General Electric Co.). Purification of tantalum. Oct. 16.

25,530 (1906). Stanley. Extraction of precious metal from ores. Oct. 9.

28,182 (1906). Churchward. Annealing and heat treating steel alloys. Oct. 9.

5656 (1907). Petersson. Carrying out metallurgical reduction and melting processes. Oct. 16.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

26,212A, B, and C (1906). Cowper-Coles. Anodes for electrodeposition. Oct. 11.

3000A. Boult (Elektricitäts A.-G. vorm. Schuckert und Co.). Electrolytic apparatus. Oct. 8.

21,834. Heys (Sierau). Electrolytic processes and appliances. Oct. 3.

21,911. Szek and Joly. Compounds for electrical insulation, varnishes, paints, &c. Oct. 4.

22,202. British Thomson-Houston Co. (General Electric Co.). Insulating material. Oct. 8.

22,283. Côte and Pierron. Electric furnace for the continuous extraction of zinc from its ores. Oct. 9.

22,311. Cowper-Coles. Electrodeposition of iron. Oct. 9.

22,312. Cowper-Coles. Manufacture of iron articles by electrodeposition. Oct. 9.

22,543. Cowper-Coles. Anodes for electrodeposition.* Oct. 12.

22,547. Bourcoud. Electrical heating and apparatus therefor. Oct. 12.

Complete Specifications Accepted.

19,398 (1906). British Thomson-Houston Co. (General Electric Co.). *See under* II.

21,290 (1906). Johnson and Tilley. Insulating composition for conduits containing electric cables. Oct. 9.

22,002 (1906). Wheatley and Lark. Deposition of white metallic alloys by electrolysis. Oct. 16.

24,985 (1906). Cowper-Coles. Electrodeposition of metals. Oct. 16.

7320 (1907). Salpetersäure-Ind. Ges. Arc furnaces for the electrical treatment of gases. Oct. 16.

8560 (1907). Marshall. Electroplating solution. Oct. 16.

9637 (1907). Chem. Fabr. Buckau. Increasing the durability of carbon and graphite electrodes in aqueous solutions. Oct. 16.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

21,658. Wood. Distillation of glycerine.* Sept. 30.

Complete Specifications Accepted.

23,534 (1906). Thompson (Bottaro). Production of fatty acids. Oct. 16.

27,701 (1906). Bacon. Manufacture of soap powder. Oct. 16.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

Applications.

21,772. Heinemann. Manufacture of india-rubber. Oct. 2.

21,911. Szek and Joly. *See under* XI.

21,967. Collins. Rubber substitutes. Oct. 5.

Complete Specifications Accepted.

22,023 (1906). Cowper-Coles. Manufacture of white lead. Oct. 9.

25,735 (1906). Alexander. Manufacture of aqueous solutions of caoutchouc. Oct. 16.

28,984 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of red colour lakes. Oct. 16.

4379 (1907). Simpson. Waterproof writing ink. Oct. 16.

4717 (1907). Bloxam (Raffin. Réun. de Caoutchouc). Process for refining crude caoutchouc. Oct. 16.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Applications.

21,906. Feldmann and Feldmann. Manufacture of many-coloured varnished leather.* Oct. 4.

22,207. Engländer. Production of a tanning material. Oct. 8.

22,382. Neufeld. Manufacture of elastic chromated glue masses.* Oct. 10.

Complete Specification Accepted.

4049 (1907). Johnson (Badische Anilin und Soda Fabrik). Bleaching glue. Oct. 9.

XV.—MANURES, &c.

Application.

22,180. Fraser-Hewett and Watchurst. Fertilising compounds.* Oct. 8.

XVII.—BREWING, WINES, SPIRITS, &c.

Application.

21,941. Heymann. Preparation of green and dry malt.* Oct. 4.

Complete Specifications Accepted.

5224 (1907). Rombaut and Rombaut. Beer fermenting. Oct. 9.

9444 (1907). Watt. Distilling fermented liquors. Oct. 9.

9695 (1907). Suzuki. Apparatus for brewing soy. Oct. 9.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

21,733. Andersson and Lindblad. Producing a drink from apple juice. [Swed. Appl., Nov. 1, 1906.]* Oct. 2.

21,912. Marti. Preparation of artificial butter.* Oct. 4.

22,195. Finkler. Rendering the nutrient constituents of grain, pulse, &c., accessible to digestion. Oct. 8.

Complete Specifications Accepted.

23,236 (1906). Bertels. Strengthening food. Oct. 16.

1041 (1907). De Crignis. Treatment of grain for use as a foodstuff. Oct. 16.

9015 (1907). Mitscherlich. Manufacture of margarine. Oct. 9.

(*B.*)—Sanitation; Water Purification.

Complete Specification Accepted.

22,028 (1906). Harris. *See under* II.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

21,880. Self-Developing Plate Co., Ltd., and Bolas. Manufacture of celluloid.* Oct. 3.

22,092. Bronnert and Fremery. *See under* V.

22,347. Hanitzsch. *See under* V.

22,532. Davidson. Manufacture of paper. Oct. 12.

Complete Specifications Accepted.

24,067 (1906). Newton (Bayer und Co.). Manufacture of cellulose derivatives. Oct. 16.

8369 (1907). Knoll, Knoll, and Daege. Manufacture of cellulose derivatives and their solutions. Oct. 16.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

21,946. Friedl, Weizmann, and Clayton Aniline Co. Manufacture of camphor. Oct. 4.

22,038. Guy. Substance for use as a bacterial medium. Oct. 5.

22,129. Chem. Fabr. von Heyden. Manufacture of isobornyl esters. [Ger. Appl., Oct. 26, 1906.]* Oct. 7.

Complete Specifications Accepted.

17,773 (1906). Rouxeville. Treatment of terpenes. Oct. 16.

4613 (1907). McDougall and McDougall. Manufacture of tartaric acid. Oct. 16.

5842 (1907). Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Oct. 9.

14,550 (1907). Verley, Urbain, and Feige. Oxidising borneol or isoborneol to camphor. Oct. 9.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

21,768. Adams and Watson. Colour-sensitive plates or screens for photographic purposes. Oct. 2.

22,218. Smith. Toning reagents and processes for toning photographic prints. Oct. 8.

22,239. Hunt. Material for direct colour photography. Oct. 9.

22,244. Lees. Treatment of films of photographic negatives and the like. Oct. 9.

Complete Specifications Accepted.

1928 (1907). Hans. Producing photographs on metal, glass, porcelain, &c. Oct. 16.

6098 (1907). Szczepanik. Production of photographs in natural colours. Oct. 9.

9855 (1907). Schwartz. Production of an emulsion of phosphate of silver. Oct. 9.

XXII.—EXPLOSIVES, MATCHES, &c.

Complete Specification Accepted.

28,053 (1906). King's Norton Metal Co., Bayliss, Smith, and Brownsdon. Preparation of explosives. Oct. 9.

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New England Section.

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MR. HENRY HOWARD IN THE CHAIR.

THE QUANTITATIVE DETERMINATION OF ARSENIC BY THE GUTZEIT METHOD.

BY CHARLES ROBERT SANGER AND OTIS FISHER BLACK.*

Several attempts have been made to apply the so-called Gutzeit reactions to the quantitative determination of arsenic, especially in England since the epidemic in 1900 of arsenical poisoning from beer. Kelynack and Kirkby (1) suggested that an approximate valuation of the amount of arsenic in a sample of beer may be made by comparing the stain produced on mercuric chloride paper by the arsenical hydrogen from a given portion of the sample, with that produced by a definite quantity of a standard solution of arsenic. Bird (2) made a careful study of the conditions under which the arsenical stain on mercuric chloride paper may be best obtained and identified, with special reference to the interference of the hydrides of sulphur, phosphorus, and antimony. Although his work is extremely suggestive of a quantitative application, he himself considers that the test is only approximately quantitative, in that the stain obtained from a given amount of substance, say beer, may be shown to be greater or less than the stain representing a fixed limit of arsenic for that amount. He also regards it as a true negative test. Treadwell and Comment (3) compared the stain obtained from the action of arsine on silver nitrate paper with a series of stains from definite quantities of a standard solution of arsenic. The method, applied by these authors to the detection of arsenic in mineral waters, is said to have given good results.

Dowzard (4), after describing a modification of the Gutzeit test which allows the detection of minute traces of arsenic in a small volume of solution, suggested the preparation of a standard set of stains, which should be kept in a tightly stoppered bottle in a dark place. Thomson (5) attempted to make the reaction quantitative by passing the arsenical hydrogen through a tube in which was hung a cotton thread or a paper, saturated with mercuric chloride solution, which, from the intensity of the stain produced upon it, should show the amount of arsenic present. Thomson states, however, that his results were inconclusive. Goode and Perkin (6) made a series of experiments to ascertain if the Gutzeit test could be made quantitative and if a set of standards could be prepared which should be at least as permanent as the standard mirrors of the Berzelius-Marsh process. Stains were made as usual on paper treated with mercuric chloride, but the impossibility of making them permanent led to their abandonment for quantitative purposes, except that a given stain might be matched with freshly prepared standards. Langmuir (7), in order to detect the presence of undecomposed arsine in the Marsh test, placed in the end of the exit tube a slip of paper moistened with a saturated solution of mercuric chloride. It apparently did not occur to him that this might also be used quantitatively, but he seems to have employed the ordinary colour stains successfully in the approximate determination of arsenic in glycerin.

Aside from the above-quoted authors, there are doubtless many who have been able to use the Gutzeit reactions as a means of approximate analysis, but we have not met with a careful study of the conditions under which the reactions may be employed quantitatively with any degree of accuracy.

The chief difficulty in differentiating between stains caused by various amounts of arsine on either silver nitrate or mercuric chloride paper, lies in the fact that the action is partly over the surface and partly within the fibre of the paper. Further, a single layer of paper is not always sufficient to retain all the arsenic evolved, and stains from equal amounts of arsine may not always be of the same density. These difficulties disappear almost entirely if one allows the arsenical hydrogen to act not against, but along a surface. The principle, therefore, of the modification we suggest in order to make the Gutzeit reactions more accurately quantitative, is to allow the arsine to pass over a strip of paper impregnated with mercuric chloride, and to compare the band of colour thus obtained with a series of bands prepared from known amounts of a standard solution of arsenic. We think that the failure of Thomson to get good results was merely due to unsuitable conditions. Our experience has not only confirmed the conclusion which has been reached by most of those who have investigated the Gutzeit reactions—that the use of mercuric chloride is preferable to that of silver nitrate from a qualitative standpoint, but it has also shown that the former reagent is better suited to the quantitative analysis.

A careful study of the conditions of the reaction, following the principle stated above and made for the most part without knowledge of the work of the above quoted authors, has shown that the reaction can be made the basis of a simple and fairly accurate quantitative method, with no more than ordinary analytical precautions.

THE METHOD.

Sensitised mercuric chloride paper.—For this purpose we used at first a smooth filter paper of close texture, but we have recently employed to greater advantage a cold pressed drawing paper made by Whatman. The latter not only gives better colour results, but also, on account of its greater strength, withstands better any subsequent treatment for development or identification of the colour. A square metre of this paper weighs about 160 grms. (4¼ ounces per square yard). It is cut into strips having a uniform width of 4 mm., and we use for this purpose a carefully made brass rule of exactly this width. The cutting may be done with a sharp knife, but more accurately and in large quantity by the machine which should be accessible at any printing office. The strips, which must be clean and free from dust, are sensitized by drawing them repeatedly through a five per cent. solution of recrystallized mercuric chloride until they are thoroughly soaked. They are then placed to dry on a horizontal rack of glass rods or tubing, and, when dry, are at once cut into short lengths of 7 cm., discarding the ends by which the strips were held during the immersion. A bundle of these strips is placed in a stoppered tube or bottle containing calcium chloride covered by cottonwool, and is kept in the dark until needed.

The reduction apparatus.—(See Figure.)—This consists of a glass bottle of 30 c.c. capacity, closed by a pure rubber stopper with two holes. Through one of these holes passes a small thistle tube, about 15 cm. long, reaching to the bottom of the bottle and constricted at its lower end to an opening of about 1 mm. The other hole carries an exit tube, bent first at a right angle, then back again in the same plane in the form of a ⊂. To this is fastened by means of a rubber stopper a short bulb tube about 12 mm. in diameter, terminating in a longer tube which has a bore of slightly over 4 mm. The bulb of this tube (deposition tube) is loosely filled with clean absorbent cotton which has been kept over sulphuric acid to ensure uniform dryness. Instead of the bulb tube, the rubber stopper of the exit tube may carry a short piece of glass tubing of about 12 mm. diameter, in which is placed the absorbent cotton, and to which, by means of another rubber stopper, is attached the deposition tube.

The simplicity and compactness of this apparatus allow a number of determinations to be carried on at the same

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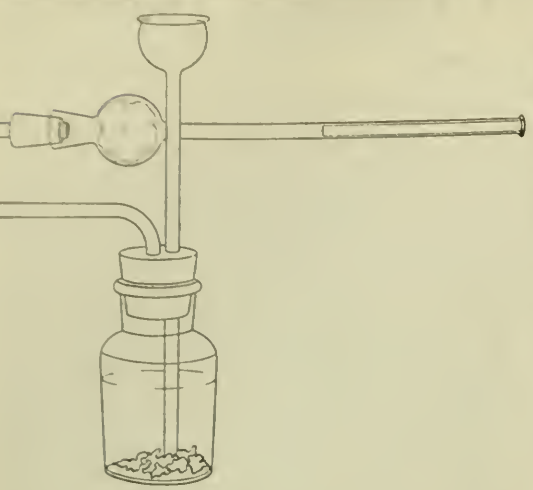
* Taken as read.



time by the use of several pieces. It is important, however, that the bottles be of the same size, and it is also advisable to have the rest of the apparatus of as nearly definite size as possible.

Reagents.—We have used zinc and hydrochloric acid in preference to zinc and sulphuric acid, as the action goes on more regularly and without the addition of a sensitizer. The probability of formation of hydrogen sulphide is also less. The zinc, known as Bertha spelter, is from New Jersey zinc ore, and has been proved by exhaustive tests to be free from arsenic. It contains not over 0·019 per cent. of lead and not more than 0·013 per cent. of iron. The hydrochloric acid contained not over 0·02 mgrm. of arsenious oxide per litre. The dilution employed, one part of acid to six of water, is equivalent to a normality of about 1·5. The quantity of diluted acid used in the analysis would not contain over 0·00004 mgrm. of arsenious oxide, an amount beyond the practical limit of the delicacy of the method (8). No evidence of sulphur, phosphorus, antimony, or arsenic has been obtained from these reagents when used in long continued blank tests.

Procedure.—Three grms. of carefully and uniformly granulated zinc are placed in the bottle, and a strip of sensitized paper is slipped into the deposition tube to a definite distance, the paper being wholly within the tube. 15 c.c. of diluted acid are then added through the thistle tube, and the evolution of hydrogen is allowed to continue for at least ten minutes. At the end of this time the rate of flow of the gas has become as regular as possible, and the atmosphere in the deposition tube has a nearly definite degree of saturation with aqueous vapour. On these two conditions depends chiefly the uniformity of colour bands from equal amounts of arsenic. In this time, also, the absence of arsenic in reagents and apparatus is assured, in the great majority of cases, by the non-appearance of colour on the sensitized paper, but the blank test may be as long continued as circumstances demand. The solution to be tested is then introduced, either wholly or in aliquot part, which may be determined by weghing or measuring. In the former case, we use a side-neck test tube of about 30 c.c. capacity, and weigh to the second decimal place. Unless the amount of arsenic be exceedingly small, it is not necessary to add the whole of the solution, but in that case the volume must be obviously not over 15 c.c., on account of the capacity of the bottle. After introduction of the solution, the colour appears upon the paper in a few minutes, and the deposit reaches its maximum within thirty minutes. The band of colour thus obtained is then compared with a set of standard bands. From the amount of arsenic as estimated from the comparison and the amount of solution from which the band was obtained, the calculation of the arsenic in the entire solution is simple.

Standard colour bands.—A standard solution is made by dissolving one grm. of re-sublimed arsenious oxide in a small quantity of sodium hydroxide solution free from arsenic, acidifying with sulphuric acid, and making up to one litre with recently boiled water. Of this solution (I.) 10 c.c. are diluted to a litre with freshly boiled water, giving a solution (II.) which contains 0·01 mgrm. or 10 micromgrms. (mmg.) of arsenious oxide per cubic centimetre. In testing the delicacy of the method we have also prepared solutions containing 1 mmg. (III.) and 0·1 mmg. (IV.) per cubic centimetre.

From definite portions of solution II., measured from a burette, a series of colour bands is made by the above procedure, using a fresh charge of zinc and acid for each portion. Plate I. shows in colours the actual size of the set of bands made by us, corresponding to the following amounts of arsenious oxide in micromgrms. :—2, 5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70. The colour in the lowest values is a lemon yellow, shading from this to an orange yellow, and through orange yellow to reddish brown in the higher values.

Preservation and development of the colour bands.—The rapid fading of the stains has been a serious obstacle to the use of the Gutzeit reaction for a quantitative method, and it very soon became evident to us that some means of preserving the colour bands must be found before the method could be considered an entirely practical one. It was clear that the chief factors in the change of colour were light and moisture, the latter being by far the more important. Concerning the mechanism of the reactions, either for the formation of the colour or for its decomposition with water, the work of those who have investigated the reactions was not sufficient to guide us. The early work of Rose (9) on the action of arsine on excess of mercuric chloride in solution showed that a yellowish brown precipitate was formed having the empirical formula $AsHg_3Cl_3$. This he considered to be made up of mercurous chloride and a compound of mercury and arsenic, to which the formula As_2Hg_3 might be given. Mayençon and Bergeret (10) consider the compound to be a mixture of arsenic and mercurous chloride. Franceschi (11), apparently without knowledge of Rose's work, passed arsine through an aqueous solution of mercuric chloride. The liquid became at first a light yellow, then red, and there was precipitated a substance at first yellow, but with excess of gas a dark red, "of the colour of Spanish tobacco." For this compound Franceschi assumes from the analysis and properties the formula $AsHHg_2Cl_2$, which he writes: $HAs:(HgCl)_2$. Lohmann (12), who does not mention the results of Franceschi, finds the reaction to run in a similar manner. But the red product decomposed with water, becoming black, and with such rapidity that an analysis was impossible except through the decomposition products. From this the formula $AsHg_3Cl_3$ was assigned. Lohmann considers that the reaction is always $3HgCl_2 + AsH_3 = AsHg_3Cl_3 + 3HCl$, whether the precipitation is complete or not, and that the decomposition of the product depends (*a*) on the presence of mercuric chloride, in which case arsenic and mercurous chloride are the products, or (*b*) on absence of mercuric chloride, in which case mercury, arsenious acid, and hydrochloric acid are the products.

Partheil and Amort (13) note the formula given by Franceschi, but evidently assume that it was for the yellow body (if such indeed exists) and not for the red, which was clearly indicated from Franceschi's paper. On this assumption, and from Lohmann's work, they consider that the following is the reaction for the formation of the yellow body: $2HgCl_2 + AsH_3 = AsHHg_2Cl_2 + 2HCl$, and for the red, that given by Lohmann (above). These reactions were given by Franceschi and by Lohmann respectively, but both of these authors were dealing with the red body. Partheil and Amort further consider these bodies to have the following structure, respectively: $HAs:(HgCl)_2$ and $As(HgCl)_3$.

Passing excess of arsine through the solution in which the red body is suspended, Partheil and Amort obtain a black precipitate to which they give the formula As_2Hg_3, and this derives support from the reactions with alkyl iodides described by these authors in a succeeding paper (14). The investigation is given somewhat more fully in a later paper by Partheil (15). On partial precipitation of a mercuric chloride solution by arsine, a yellow body was obtained, to which, from a single analysis of an evidently impure substance, the formula AsH_2HgCl was assigned. From this experiment and from the results of Franceschi and of Lohmann, Partheil considers that there should be added to the two substances given above a third, with the structure, $H_2As.HgCl$. While the evidence appears to show that the hydrogen of arsine is replaced by the mercurous chloride group to a greater or less extent, the formula for the red substance does not seem to us to have been conclusively proved, and the reactions of decomposition are decidedly in doubt. Nothing has been brought forward to show definitely the relation of the yellow compound or compounds, if such exist, to the red. Lack of time prevents us at present from studying the reaction quantitatively, but it is hoped that the investigation may be taken up later by one of us. Nevertheless the following qualitative reactions have made it possible to treat the bands of colour so that they may be kept for a considerable time, either in their original form or by means of a *quasi*-development and fixation.

The removal of the relatively large excess of mercuric chloride from the paper by treatment with absolute ether or alcohol did not offer a solution of the difficulty, as the colours faded rapidly even when kept in the dark and over sulphuric acid. The colour is quickly bleached by boiling with water, as is well known. Cold water acts more slowly, the colour not being completely changed until after a day or two, and then not bleached but converted to a dull grey. Bird (16) and also Goode and Perkin (17) have observed the action of hydrochloric acid upon the original colour, which is thereby considerably changed. Goode and Perkin also note the action of ammonia upon the original colour, but do not find the action of service in preparing standards.

From the evident effect of even a slight amount of moisture we were led to adopt the suggestion of Panzer (18), as applied to the standard Marsh mirrors, for the preservation of our standards. A clean, dry, glass tube, about 5 mm. in diameter, is sealed at one end, at which is placed a small quantity of phosphorus pentoxide covered by a bit of dry cottonwool. The strip is then inserted, coloured end down, and fastened by a drop of Canada balsam, and the tube is sealed. The set of standards prepared in this way can be used for several months, although the brilliancy of the colour is lost after a few weeks.

The colour band may be developed by treatment with rather concentrated hydrochloric acid, of a normality of about 6 (one part acid to one of water). This is done in a small test tube, at a temperature not exceeding 60° C. and for not over two minutes, else, with this concentration of acid, the paper is likely to become disintegrated. The strip is then thoroughly washed with running water and dried. The colour on the wet strip is a brilliant dark red in the higher values, while the smaller amounts show a deeper yellow than in the initial set. The length of the bands is considerably greater than that of the original. On drying, the colour becomes duller. These bands must also be sealed as above with phosphorus pentoxide, and are somewhat more permanent than the initial set. Plate II. represents the set obtained by development of the initial set with hydrochloric acid. If the original colour band is treated for a few minutes with normal ammonia solution, a dense black colour is produced, of slightly greater length than the original. This colour is far more permanent than the others, but it is nevertheless necessary to seal the dry strips in glass, using fresh, powdered quicklime instead of phosphorus pentoxide. Plate III. shows the set obtained by development of the initial set with ammonia.

GENERAL PRECAUTIONS.

As far as concerns the reduction of the arsenic, no other precautions are necessary than those which must be observed in the proper conduct of the Berzelius-Marsh method when applied to small amounts. The solution to be reduced should contain no interfering organic matter, nor any metals which prevent or retard the formation of arsine. Sulphur in any form reducible to hydrogen sulphide should be absent. It is well known that small amounts of hydrogen sulphide interfere with the Gutzeit reactions, and it is the custom of most analysts to pass the arsenical hydrogen over paper or cottonwool containing lead acetate, or even through a lead solution, before it reaches the mercuric chloride. As we have been careful to eliminate the sulphur before testing, we have not found this necessary, except in certain cases, when, with a sufficiently long deposition tube, it is very simple to insert a strip of paper saturated with normal lead acetate and dried. Phosphites and hypophosphites will also have been oxidized before introduction of the solution, and there is little danger in ordinary work from small amounts of phosphine which might result from the accidental presence of reducible compounds of phosphorus. Antimony should of course be absent, but very small amounts of stibine do not interfere with the recognition, though they may prevent the estimation of arsenic. Free nitric acid must be avoided. Arsenates require especial treatment, as will be discussed below.

SPECIAL PRECAUTIONS.

In order to be certain of uniformity in length and colour of the bands from the same amount of solution, the following points must be observed:—

1. The reduction bottles must be of equal capacity, and the deposition tubes of equal bore.

2. The amount of zinc must be the same always, and the granulation must be uniform.

3. The volume and concentration of the acid must be definite.

4. The absorbent cotton must be perfectly clean and reasonably dry, and is therefore best stored in a desiccator before use. The amount used should be approximately the same in all cases, packed in the bulb tube to about the same density.

5. The sensitized paper must be acted upon by a gas in which the moisture is as nearly constant as possible. For this reason the paper cannot be allowed to become moist, nor can the gas be dried. In the first case the band is short and imperfectly shaded; in the second it is scattered along the whole length of the strip, or even partially escapes the paper. This we have shown by attaching a hard glass tube with capillary, in which, on heating, a mirror of arsenic was obtained. Conversely, under carefully regulated conditions, no evidence of escaping arsenic was found, either by the use of a hot tube or by the introduction of a second strip of sensitized paper.

6. After ten or twelve runs with the same bottle, the atmosphere of the deposition tube becomes too moist and the bands are consequently too short. It is then necessary to replace the cotton. In order to get a sufficient degree of saturation in the next run, the evolution of hydrogen must go on for a longer time than usual before adding the test solution, say for an hour. This preliminary saturation may be also conveniently secured by leaving zinc and acid in the apparatus over night.

By observation of the above precautions we have obtained fairly regular and uniform bands of colour from equal amounts of arsenic, using apparatus of definite size, reagents of definite concentration, carefully sensitized paper, and by passing the arsenical gas over the paper in a condition of moisture which is as carefully regulated as possible. Without these precautions, which involve no great care, the method will not give satisfactory quantitative results.

ANALYTICAL DATA.

The method, as far as it concerns the determination of arsenic in a solution properly prepared for reduction, was tested by the analyses of the following solutions containing varying amounts of arsenic, which, with the exception of Nos. 5, 8, 7 and 9, were unknown to the analyst. In analysis No. 9 the arsenic was present as arsenic acid. In Nos. 5, 8, 7 and 9, the comparison was made with standards which had been kept over three months, and the reading of the bands was confirmed by the standards obtained by development of the initial bands with ammonia.

TABLE 1.

No. of Analysis.	Arsenious oxide taken.	Total weight diluted solution.	Weight diluted solution taken for analysis.	Reading of band.	Arsenious oxide found.	Arsenious oxide found, mean.	Per cent. arsenious oxide found.
	mgrm.	grm.	grm.	mgrm.	mgrm.	mgrm.	
6	0·05	21·21	5·75	0·009	0·033		
			6·05	0·012	0·043	0·038	76
8	0·10	24·13	5·74	0·024	0·100		
			7·16	0·027	0·091	0·096	96
2	0·25	24·95	3·5	0·037	0·26		
			2·7	0·025	0·23	0·25	100
1	0·50	26·11	1·0	0·018	0·47		
			1·3	0·025	0·50	0·49	98
7	1·00	25·02	0·39	0·014	0·90		
			0·76	0·028	0·92	0·91	91
9	1·00	23·76	0·35	0·013	0·88		
			0·48	0·022	1·09	0·99	99
3	1·50	23·88	0·47	0·027	1·37		
			0·47	0·027	1·37	1·37	92
4	2·00	25·51	0·66	0·055	2·15		
			0·51	0·035	1·75	1·95	98
5	2·50	27·04	0·19	0·015	2·13		
			0·34	0·028	2·24	2·19	88
				Average percentage			93

We do not claim for the method, under ordinary circumstances, a greater accuracy than from five to ten per cent.

ANALYTICAL NOTES.

Sensitized Paper.—We have found that the prepared paper, if kept dry and away from the light, does not lose its sensitiveness to a great extent after several months. On long keeping there is apparently a very slight reduction to mercurous chloride, since an old paper, after treatment with hydrochloric acid and washing, gives a slight darkening with ammonia or auric chloride (for this test, see below). Although this change does not greatly influence the result, it is better not to use paper which has been kept too long.

Contrary to Goode and Perkin (19), we have found no advantage in using mercuric bromide instead of the chloride. Neither the aqueous solution of the former, which is, in addition, too dilute, nor the alcoholic solution gives a paper of greater sensitiveness than that prepared from the chloride. The alcoholic solution of the chloride, since it evaporates more rapidly, leaves a less even surface of the salt upon the paper than is obtained by the slower evaporation of the aqueous solution.

Apparatus.—In case it is necessary to examine larger quantities of solution for arsenic, a larger reduction bottle will naturally suggest itself. In this case, slight variations from the procedure may be found necessary, and the absolute delicacy of the method may be somewhat less.

We have found no sign of arsenical contamination from the rubber stoppers used in the apparatus, and we have therefore not lessened the simplicity of the apparatus by making it entirely of glass. The stoppers are boiled with dilute alkali and washed before use.

Although we have not tried it for ourselves, it would seem obvious that the electrolytic reduction of the solution could be employed if desired.

Reagents.—From the delicacy of the method, as discussed below, the zinc used by us is evidently highly sensitive. Indeed, the amount of iron present, to which metal, from the work of Chapman and Law (20), Parsons and Stewart (21), and others, may be attributed the insensitiveness of most samples of zinc, is about one-seventh of the amount in a zinc which Chapman and Law show to be sufficiently sensitive in the Marsh process.

We have also, in this connection, studied the effect of the presence of other metals on the sensitiveness of the zinc. The retention of arsenic by the addition of platinic chloride or cupric sulphate, confirmed by one of us (22) several years ago, is well known. With a bright platinum foil in contact with our zinc, and using either sulphuric or hydrochloric acid, we have never noticed any loss of arsenic in the Marsh procedure. Similarly, there is no diminution in the delicacy of our method when platinum foil is used. The use of zinc carefully covered with copper, after the procedure of Lockemann (23), makes no difference whatever in the results, nor does the addition of tin or lead salts to the solution during the reduction. The zinc is granulated by pouring the metal, melted in a porcelain casserole, from a height of six feet through a hot porcelain sieve into two feet of cold water.

The estimation of the arsenic in the hydrochloric acid was made on samples of 100 c.c. in two ways. The acid was distilled to half its volume, a treatment which we have shown in the following paper (24) to be sufficient to expel all the arsenic. The distillate was collected in 35 c.c. nitric acid and evaporated with a small amount of sulphuric acid. Again, the acid was allowed to drop slowly into hot nitric acid, and the mixture was then evaporated. Several residues obtained by both of these procedures from lots of 100 c.c. gave closely agreeing results, both from the reading of the Marsh mirrors and the Gutzeit colour bands. The mean of all determinations was 0·002 mgrm. for 100 c.c., or 0·02 mgrm. per litre. This acid was shipped in carboy, and we have not observed any increase of arsenic in the acid on standing, such as might result from the action upon the glass if the latter contained arsenic. It is better, however, that such acid should be shipped, or at least stored, whether concentrated or dilute, in ceresine bottles.

We have noticed that the nitric acid from the carboy, which gave no test for arsenic, took up traces from the storage bottle on long standing. We have therefore stored the nitric acid in ceresine. A slight, but unimportant amount of paraffin is taken up. 50 c.c. lots of this acid, evaporated with a small quantity of sulphuric acid, gave residues which showed no traces of arsenic. It must be borne in mind that a nitric acid residue contains the arsenic as arsenic acid, and that the procedure must accordingly be modified as explained below.

The second sample of hydrochloric acid, referred to in the footnote above, was shipped in ceresine, and the diluted acid is also kept in ceresine. Two 100 c.c. lots of this acid were dropped into nitric acid and evaporated with sulphuric acid. The residues were reduced with sulphurous acid free from arsenic, and gave colour bands equal to 0·3 and 0·5 mmg. of arsenious oxide respectively. This is equivalent to 0·004 mgrm. of arsenious oxide per litre.

Procedure.—At the end of a run, a slight annular sublimate is often observed on the inside of the deposition tube where the colour band is in contact with the glass. With very small amounts of arsenic this sublimate is white, but is ordinarily slightly coloured. It is probably due to transference of mercuric chloride, either through volatilization or capillary action, and a slight colour reaction may take place on the deposit. The amount is without influence on the result, but the tube should be cleaned with dry cotton before being used again.

The temperature during reduction should not be allowed to rise very much, as the moisture equilibrium in the deposition tube is disturbed from the excess of moisture carried over. For this reason the procedure of Bird (25), which consists in heating the liquid under reduction to the boiling point, is not adapted to this method.

We have found no advantage in using very large amounts of zinc, as recommended by many, especially in the Marsh process, nor do we think it necessary that the zinc should be entirely dissolved.

Standard Bands.—We have long noticed that solutions of the dilution of 0·01 mgrm. per c.c. undergo a change on standing, with the result that a given volume will not yield the same depth of band as when first prepared, or, in the Marsh process, the same intensity of mirror. In more dilute solutions the change is very rapid, and solution IV., containing 0·1 mmg. per c.c. is of no value as a standard in a day or two. The use of boiled water for dilution greatly retards the change, which would lead to the conjecture that the reaction might be one of oxidation, with formation of arsenic acid, which, as shown below, does not give the same depth of colour in a given time as its equivalent of arsenious acid. Yet the treatment of an old solution with sulphurous acid does not increase the amount of arsenic from a given portion of it, as far as we have been able to determine. Solution IV. (0·1 mmg.) should be freshly prepared before use; solution II. (10 mmg.) will hold its strength for a few weeks, and solution I. (1 mgrm.) should not be used if it has stood for a very long time.

The deposit of colour is, of course, on both sides of the paper. If the strip exactly bisects the tube and the flow of hydrogen is the same in both segments, the intensity of colour should be the same on each side of the strip. It often happens that there is a slight difference and in consequence the band may appear on one side greater than the standard, on the other less. The set of standards is also a series of mean, though not greatly varying colour densities, and when viewed from one side or the other may not seem regularly graded. The set should be mounted in such a way that both sides of the strip can be examined, and the mean density of the test band should be compared with the mean density of the standard. The judgment is greatly assisted by treating the band or its duplicate with hydrochloric acid or ammonia solution (particularly the latter), and comparing the result with the corresponding standards.

Treatment of the Bands.—Whatever may be the constitution of the red compound, it is probable that the reaction is only complete in the presence of an excess of hydrochloric acid. As previously mentioned, the colour fades completely on treatment with hot water. Cold water brings about a gradual fading, but this is succeeded by a secondary reaction in which a grey substance is formed. This action of water was further studied by treatment with sodium acetate. A set of standard bands was immersed in half-normal sodium acetate for two hours in the cold. The red colour gave place to a uniformly graded light yellow with a tinge of orange. The set, after pressing between filter paper, was then sealed while still moist. In 24 hours the yellow had changed to a dull white, with no colour except in the higher values. On the next day there was a change to a faint grey, becoming darker on further standing.

The black colour with ammonia suggests the presence of mercurous chloride, but it is not clear whether a decomposition into mercurous chloride takes place before the black colour is formed. If the red band is treated with hydrochloric acid, washed, and then placed in ammonia, the colour is not an intense black, but rather greyish in tone.

Another reaction of interest is that with auric chloride. If the band, after treatment with hydrochloric acid, is placed in a small test tube with a few drops of hundredth normal auric chloride, and allowed to stand for five or ten minutes, a beautiful purple colour results. The reaction is characteristic for larger amounts of arsenic.

The reactions of the formation, development and decomposition of the colour bands are susceptible of various interpretations, but, as we have said before, a quantitative study is necessary before expressing an opinion, not only as to the constitution of the red body and the mechanism of its formation and decomposition, but also on the existence of intermediate yellow compounds.

Bird has applied Bettendorff's reaction to the stains, substantially as follows: The disc of paper containing the colour is extracted with one or two c.c. of warm, concentrated hydrochloric acid; the extract is oxidised by a few drops of bromine in hydrochloric acid, and treated in a small test tube with an equal volume of 30 per cent. stannous chloride. On warming, the pinkish-brown colour appears.

INTERFERENCE OF THE HYDRIDES OF SULPHUR, PHOSPHORUS, AND ANTIMONY.

There is considerable confusion in the statements of various authors as to the colour stains from these gases on mercuric chloride paper, and even Bird's more careful study is open to the common criticism that the descriptions are not given with reference to known amounts of the hydrides. In determining to what extent these substances interfere in our method, we have at first ascertained by trial how much of the particular hydride will give a comparable band on the mercuric chloride paper under the same conditions, particularly in the same time. We then studied the effect of a given treatment upon each colour band, and afterward compared the effect of each reagent upon the four approximately equivalent bands.

Hydrogen Sulphide.—In a freshly prepared solution of sulphurous acid, which gave no test for arsenic, the amount of sulphur was determined by titration with iodine. A solution was made containing 1 mgrm. of sulphur per c.c., and from this, in turn, a second containing 0·01 mgrm. Of this solution, amounts corresponding to 10, 30, 50 and 70 mmg. of sulphur were added to separate reduction bottles, and the action continued for 30 minutes. Bands of a pale yellow were obtained, slightly darker in shade than those from phosphine. The respective lengths corresponded to those from 2, 25, 30 and 40 mmg. of arsenious oxide. Fresh strips of paper were now substituted, and each experiment was continued for thirty minutes longer. No additional band was obtained from the first; from the others the values were approximately 1, 5 and 10 mmg. This shows that under the same conditions and in equal time the band from 50 mmg. of sulphur will be of about the same length as that from 30 mmg. of arsenious oxide, and further, that the reduction of the sulphurous acid is not completed in 30 minutes, like the arsenic, but requires a longer time.

The colour of the sulphur band is somewhat brightened by hydrochloric acid (6 *N*) but not essentially changed, nor was the length increased. Auric chloride produced a dirty light brown. Ammonia on the original band gave also a light brown colour.

Phosphine.—A sample of sodium hypophosphite, containing no arsenic, was shown by analysis to contain 28·94 per cent. of oxidisable phosphorus (theory, 29·23). Of this a solution was made containing 1 mgrm. of phosphorus per c.c., from which two others were prepared having 0·1 and 0·01 mgrm. to the c.c. Of the last solution, 10, 30, 50 and 70 mmg. were reduced for 30 minutes in separate bottles. From 10 mmg. no colour was obtained; from 30 mmg. a very faint indication, and from 50 and 70 mmg. bands corresponding in length to only about 2 and 10 mmg. of arsenious oxide respectively. After continuing the action for 30 minutes longer, with fresh strips, there was again no colour on the first, a faint indication on the second, and about 1 and 10 mmg. on the third and fourth. It was evident that the reduction was very slow. Next were taken 100, 300 and 500 mmg. After 30 minutes the length of the first band corresponded to about 2 mmg. of arsenious oxide, the second, 30, and the third, 50, showing that not over one-tenth of the phosphorus had been reduced in the given time. On opening the bottles, the odour of phosphine was strong.

To obtain a band from the hypophosphite equal to that from 30 mmg. arsenious oxide in the standard time, an amount equivalent to 200 or 300 mmg. of phosphorus is necessary. The colour of the bands was a bright yellow, somewhat resembling that from hydrogen sulphide. Hydrochloric acid makes the band a bright lemon yellow, but without increasing its length. The yellow turns slowly brown when exposed to light. Auric chloride acts very slowly, giving at first a characteristic brownish-red, which changes to purple. Ammonia acts more slowly than on the arsenic band, giving a less intense black.

Stibine.—The solutions used were made from a sample of pure tartar emetic, which had been shown to be free from arsenic. They contained respectively 1·0, 0·1 and 0·01 mgrm. of antimonious oxide per c.c. Volumes corresponding to 10, 30, 50 and 70 mmg. of the oxide were added to separate bottles, and the reduction carried on for 30 minutes. No colour was obtained in any case. Hydrochloric acid did not develop. Auric chloride brought out slowly a purple colour, duller finally than that of a similarly treated arsenic band. Ammonia quickly turned the band black, and a comparison with the arsenic ammonia standards showed amounts equal to about 20 to 40 per cent. of the arsenic values. On further reduction for 30 minutes, with fresh strips, there was no additional deposit on the paper which could be developed by ammonia. Continuing the experiments, it was found necessary to add 100 mmg. of antimonious oxide before any visible band was obtained, and 200 mmg. before the band appeared to be of the same length as that from 30 mmg. of arsenious oxide. The colour was a faint grey when first visible; darker with increasing amounts. The development with hydrochloric acid and auric chloride or with ammonia showed, of course, that the paper had been originally affected over a much greater length than was then visible.

These results agree with those obtained by Franceschi (26) who found by the action of stibine on mercuric chloride a white body to which he gave the formula, $SbHHg_2Cl_2$, analogous to the formula assigned by him to the red arsenic compound. Dowzard (27), also, was unable to obtain a stain on mercuric chloride paper from 0·01 to 0·1 mgrm. of tartar emetic, while from 0·2 mgrm. he got a faint blackish brown colour; a result which is essentially confirmed by our experiments.

Comparative Effect of Reagents.—From the necessary amounts of each substance, as shown by the above trials, approximately equal colour bands were prepared from arsine, stibine, phosphine and hydrogen sulphide, with a reduction of 30 minutes' duration. Each set of four was then treated with various reagents and the effects compared.

Initial band.—The arsenic band appears in a few minutes and is nearly complete before the others begin to form. The deposit is characteristic and unmistakeable. The phosphorus and sulphur bands are a uniform pale yellow, rather difficult to distinguish from each other. The antimony band is a faint grey.

Exposure to air.—On standing over night in rather moist, warm air, the arsenic band was slightly bleached, the others unchanged. On longer exposure, the phosphorus band was turned slightly brown on the upper side, and the sulphur band became slightly dark on the upper edge. Heating to 105° had no additional effect on any of the bands.

Cold water.—The initial set was placed in cold water. After 15 minutes the antimony band was bleached completely, the phosphorus became paler, while the arsenic and sulphur were unchanged. After 14 hours the arsenic was considerably bleached, but was still orange red, while the phosphorus had become a very faint yellow and the sulphur was unchanged.

Hot water.—The set was boiled with water for one minute. The arsenic and antimony bands were changed to a greyish-white, the phosphorus was bleached to a faint yellow, while the sulphur was unchanged. On standing, the sulphur band became light brown.

Hydrochloric acid.—The set was warmed to 60° with hydrochloric acid (6 N) for one minute and thoroughly washed. The arsenic band was lengthened and became the usual brilliant red. The antimony was turned slightly grey. The phosphorus became a brilliant lemon yellow, and the sulphur was also brightened, but not so strikingly. On drying, the colours became duller, and on the upper end of the sulphur band was a fringe of dark grey.

Auric chloride.—The dried set from the last treatment was immersed in auric chloride (N/100) for five minutes. The arsenic band became at once a brilliant purple; the antimony changed more slowly. The phosphorus slowly turned a characteristic red-brown, then to purple, and the final colours of these three bands differed chiefly in intensity. The sulphur band had only a slight brownish tinge.

Ammonia.—The set was placed in normal ammonia solution for five minutes. The arsenic band became at once a brilliant black; the antimony also quickly, but the band was longer and duller in shade. The phosphorus turned slowly black, and was not equal finally to the other two in intensity. The sulphur band was not blackened, but changed slightly to a pale brown, somewhat darker on drying.

From these results it will be seen that if we have a colour band from pure material, within or above the range of the 4 mm. arsenic standards, the differentiation of arsenic from antimony, phosphorus, and sulphur is perfectly simple. With smaller amounts, or especially with mere traces, there can be no confusion with antimony, since stibine gives no yellow colour on the paper. With sulphur, while the small initial band might be mistaken for arsenic, the treatment with hot water, ammonia, and auric chloride will easily identify it. But with phosphorus there is likely to be a doubt if the 2 mm. band (28) is very small, since the amount and length of the colour do not permit the same comparison as in the larger bands. As we have shown, however, that even as much as 0·1 mgrm. of phosphorus gives very little colour in 30 minutes of reduction, and as this is a quantity which can be easily oxidised in the preparation of the solution for analysis, we should have little to fear from smaller amounts than 0·1 mgrm. Such amounts might be considered quite accidental.

Effect of Hydrogen Sulphide, Phosphine or Stibine on the Arsenic Band.—Very different is it, however, when the arsenic solution also gives by reduction as much of any one of these gases as would alone yield a band equal to the arsenic band in length. This is shown by the following experiments.

Hydrogen sulphide.—Amounts of the respective solutions, equal to 30 mmg. of arsenious oxide and 50 mmg. of sulphur were added together to a bottle and reduced for 30 minutes. Instead of the short, well-defined band of the arsenic, a band nearly three quarters of the length of the strip was formed, of a reddish yellow colour. Hydrochloric acid turned it slightly redder, but the appearance was not definitely characteristic of arsenic. On another similar band, ammonia brought out splotches of black on a red ground. The arsenic had evidently acted as an accelerator in the reduction of the sulphurous acid, and the resulting band was due to a mixture of the arsenic and sulphur compounds, spread over a greater surface.

Phosphine.—Solutions containing 30 mmg. of arsenious oxide and 200 mmg. of phosphorus were added to a bottle and reduced for 30 minutes. The band was longer than the corresponding band of arsenic, but with the characteristic appearance of the latter,—well shaded, except that it was somewhat lighter at the top. Hydrochloric acid converted the colour to the well-marked red of arsenic and the length agreed with the hydrochloric acid standard for 30 mmg. Auric chloride acted more slowly than with arsenic alone, giving a slight brownish red at first and finally a somewhat lighter purple than the pure arsenic colour. There was apparently little increase in evolution of phosphine in the presence of the arsenic, and the arsenic compound in the mixed band was not appreciably obscured.

Stibine.—Solutions containing 30 mmg. of arsenious oxide and 70 mmg. of antimonious oxide were reduced together for 30 minutes. The resulting band was pale red in colour. and over twice as long as the band from 30 mmg. of arsenious oxide. Hydrochloric acid gave a colour not essentially different, which faded on drying to a rather dirty brownish red. The evolution of the two hydrides was apparently more rapid than either alone, and the mixed band was longer than from either amount.

It is evident from the above results that if we have with the arsenic an amount of hydrogen sulphide even below that required to give a band of the same length as the arsenic, the latter will be so altered as to make its quantitative estimation impossible and its detection doubtful. But, as unavoidable amounts of hydrogen sulphide would be held back completely by lead acetate paper, we should have no difficulty in estimating the arsenic if the solution had not been properly oxidised before testing. Even if the solution contains considerable amounts of reducible sulphur, the lead acetate paper will protect the mercuric chloride strip. We have also little to fear from phosphine, since we should not put a solution into the reduction bottle until the phosphorus had been oxidised as completely as possible. Accidental amounts of phosphine would not affect the quantitative estimation of the arsenic. We have not thought it necessary, for this reason, to verify the statement of Dowzard (29) that phosphine is held back by cuprous chloride in hydrochloric acid solution, nor have we sought any other reagent which could be adapted to this purpose under the conditions of our method.

In the presence of stibine, arsenic may be qualitatively recognised, but not quantitatively determined, when the amount of antimony is enough to give, if alone, an ammonia band equal to that of the arsenic. But we should not test a solution without getting rid of any antimony it might contain, and the methods for that purpose are satisfactory. Slight traces of antimony would not affect the determination. If the arsenic is accompanied by any two or all three of the substances in question, cases which we think would seldom arise. their influence on the determination of the arsenic could be predicated from the foregoing investigation.

To sum up, then, we think that small amounts of arsenic can be determined by our method without danger of interference from sulphur, phosphorus, and antimony, provided the solution to be tested is freed as carefully as possible from these substances, and the additional precaution is taken to place a strip of lead acetate paper in front of the test paper.

From the comparative rarity of the hydrides of selenium and tellurium, and the unlikelihood of their occurrence in ordinary practice, we have made no study of their action on mercuric chloride paper. One would suppose from analogy, also, that the reactions in small amount would be similar to that of hydrogen sulphide. We note in this connection that Rosenheim (30) states that hydrogen selenide has no influence on the Gutzeit test, unless in large quantity, if lead acetate paper is used.

The results of the above experiments are tabulated for comparison as follows :—

THE PROCEDURE IN PRESENCE OF ARSENATES.

It is well known that the reduction of an arsenate solution to arsine goes on more slowly than that of an arsenite. This is provided for in the Marsh procedure by continuing the reduction for a longer time when arsenic acid is present, fully an hour, or, if small amounts are present, still longer. The deposition of the mirror being in a comparatively small compass, its size and appearance are not appreciably changed, within the range of the standards, by the slower accumulation of the arsenic particles. In the Gutzeit procedure the case is different for two reasons. The formation of the colour bands is over a greater surface, and the standard set is based on the deposition of the colour in a short time, which, in turn, depends upon a comparatively quick reduction of the arsenious acid. Not only will some arsenic escape reduction during this time, if arsenic acid is present, but the slower congregation of the particles will result in a shorter band. Hence, from a given amount of arsenic as arsenate, the reading of the colour after 30 minutes is invariably low. The subsequent reduction may be studied fractionally for 60 to 90 minutes. with successive strips, although the colours from the last fractions may only be shown by the 2 mm. strips (see below). The proportion of colour within 30 minutes has been shown by us from repeated trials to be reasonably definite. It is rarely over 50 per cent. of the standards, rarely under 40 per cent., and the bands formed are somewhat denser in appearance. This implies that the band from an arsenate, though shorter, contains more arsenical substance than a band of the same length from an equivalent amount of arsenite, and this is borne out by the fact that the subsequent colour estimations from the continued reduction do not apparently carry the total percentage of arsenic to more than 80.

There are two ways of approximately estimating the value of the colour bands derived from arsenates. We may either make a series of standards from known amounts of arsenic as arsenic acid, with which the test band from an arsenate may be compared, or we may multiply the reading of the ordinary standards by 2 or 2·5. Either of these alternatives will answer, the latter being simpler—though both are obviously inexact—if one's object is only to get a rough idea of the amount of arsenic present. The estimation can be made, however, within the ordinary limits of the method, if the arsenate is converted to arsenite before reduction to arsine. Before arriving at the procedure finally adopted, we studied the effect on the reduction of an increase of temperature and also that of various catalysers. A solution containing 10 mmg. of arsenious oxide as arsenic acid was prepared by evaporating 10 c.c. of solution I. repeatedly with nitric acid. and making up to one litre. The bottles were heated during the reduction in an air bath in such a way that all above the necks protruded. At 60° C., the bands obtained from 3 c.c. of the arsenate solution after 30 minutes of reduction were only about 43 per cent. of the standard for 30 mmg. of arsenious oxide. Parallel trials with 3 c.c. of the arsenite solution gave bands of the

TABLE 2.—*Reactions of colour bands within the range of the arsenic standards from approximately equivalent amounts of arsine, stibine, phosphine and hydrogen sulphide.*

Element.	Amounts taken for reduction.	Initial Band.	Action of Air.	Cold Water.	Hot Water.	Hydrochloric Acid.	Auric Chloride.	Ammonia.
As	30 mmg. (As_2O_3)	Orange yellow to red	Slightly faded	Considerably bleached	Grayish White	Dark red	Bright purple	Dense black
Sb	200 mmg. (Sb_2O_3)	Faint grey	Unchanged	Bleached	Greyish White	Greyish	Dull purple	Dull black
P	200 mmg. (P)	Pale yellow	Pale brown where exposed to light	Considerably bleached	Faint yellow	Bright lemon yellow	Red brown to Purple	Grey black
S...........	50 mmg. (S)	Dull yellow	Unchanged	Unchanged	Unchanged. On standing. light brown	Brighter yellow	Slightly Brown	Pale Brown

standard length. Another experiment at 90° C. gave no better results. The bands from the arsenate solution were not over 50 per cent. of the standard, while the parallel arsenite reductions gave shorter bands than at ordinary temperature, owing to the larger amount of moisture carried over. That a reduction at the boiling point would cause a practically complete conversion to arsine, as claimed by Bird, seems improbable, while the moisture equilibrium would be so disturbed as to invalidate the procedure.

Returning to the reduction at ordinary temperature, it was found that no increased effect was produced within the standard time by the addition of stannous chloride or potassium iodide. Platinum in contact with the zinc, even when the acid was more concentrated, was of no service, and the use of copper-covered zinc did not help. An appreciable increase, but not a complete reduction was effected by sesquisulphate of titanium. It was evident that the use of a catalytic agent did not solve the problem with such small amounts of arsenic, and we were therefore forced to a reduction of the arsenate to arsenite before testing. For this purpose we found sulphurous acid the simplest substance, since comparatively little is needed, no excess of reagent need be left in solution, and it can easily be prepared free from arsenic. The solution, made from pure copper and pure sulphuric acid, was saturated at 0° C. The solution gave no test for arsenic when tested in quantities larger than would be used in an analysis. The tests were made after boiling out the sulphur dioxide from the samples. We tested the efficacy of the sulphurous acid as follows: Four portions of the arsenic acid solution, corresponding to 10, 20, 30 and 40 mmg. of arsenious oxide, were evaporated in small glass dishes with 6 c.c. of the sulphurous acid until the excess of sulphur dioxide was apparently expelled. On adding the residues to the reduction bottles, the colour bands came up quickly as in the case of arsenites, and in 30 minutes all the bands were equal to the corresponding standards in length and intensity of colour. Subsequent trials conducted similarly confirmed these results. The precaution was taken to use the lead acetate paper, on which in some cases there was a slight deposit of the sulphide (31).

In practice, when the solution contains an arsenate, or when the substance has been oxidised, say by nitric acid, one may add a sufficient quantity of sulphurous acid to the entire solution or to the aliquot portion taken for reduction. In analysis No. 9, Table I., we followed the latter plan, adding 10 c.c. of sulphurous acid in two parts, the second after partial evaporation. The excess of sulphur dioxide is then expelled, but the evaporation must not be carried too far, as chlorides, if present, would cause a loss of arsenic. In testing the residues the lead acetate paper should be used.

THE DELICACY OF THE METHOD.

For most practical purposes, the set of standards from 2 to 70 mmg. is sufficient. Amounts of arsenic between 2·0 and 0·5 mmg. can be approximated by the 4 mm. strip, but in studying the limit of delicacy we have allowed the action to take place within a smaller compass. The ordinary strip is cut in two and these pieces are again divided lengthwise, giving a piece 2 mm. wide and 35 mm. long. This is inserted in a tube of slightly more than 2 mm. diameter, which is fitted into the usual deposition tube by a washer of rubber tubing. With these small strips a series of standards may be made from 10 mmg. down. The yellow colour appears definitely, though of course slightly, from 0·5 mmg. Treated with hydrochloric acid, ammonia, or hydrochloric acid and auric chloride, the indication is much sharper, and from this amount up to 10 mmg. the gradation of the 2 mm. standards is well marked. From 0·3 mmg. the yellow colour is exceedingly faint, but development with the reagents brings it out. At 0·2 mmg. the formation of yellow is no longer seen, but treatment with hydrochloric acid gives a faint but definite colour, which under the glass is seen to be greater than the effect produced by 0·1 mmg. Development with ammonia or auric chloride is also definite. From 0·08 mmg. a faint fringe of colour is visible under the glass after treatment with hydrochloric acid, and the indication is even sharper with ammonia or auric chloride. From 0·05 mmg. no results were obtained. These tests were made on two solutions, prepared at different times.

Between 0·05 and 0·08 mmg. is clearly the limit at which we have been able to detect any arsenic by the mercuric chloride paper under the conditions of our method. It is safe to set this limit at 0·08 mmg. (0·00008 mgrm.) of arsenious oxide, which is equivalent to 0·00006 mgrm. of metallic arsenic, or one seventeen-thousandth of a milligram. In the above tests, on quantities under 10 mmg., the hydrochloric acid containing 0·004 mgrm. of arsenious oxide per litre was used. This, in 15 c.c. of the diluted acid, assured a quantity of arsenic far below the above limit, while blank tests of over an hour's duration gave negative results The deposits from these small amounts were formed within 30 minutes and each reduction was continued 30 minutes longer.

Although the method is a very delicate one, as shown by the above tests, we are far from claiming that 0·08 mmg. of arsenious oxide can be recognised by it with certainty under the varying conditions of analytical practice. We are not as much concerned with the absolute delicacy, however, as with the amount which may be considered a practical limit, the recognition of which is definite under all conditions, and which, when obtained from an aliquot portion of a solution, may safely be used as a factor in the quantitative determination of the arsenic. In this particular we agree fully with Chapman and Law (32), who have expressed the opinion that in the Marsh method, 5 mmg. should be taken as a practical limit, and that one's efforts should be directed toward recognizing this amount with certainty. We consider, therefore, that 1 mmg. (0·001 mg.) of arsenious oxide may be set as the practical limit of our method, although less than one-tenth of this amount may be recognized under favourable conditions. The colour produced on the large or small strip by 1 mmg. need not be confused with that from hydrogen sulphide, stibine, or phosphine, if these are unavoidably present, while the more minute traces of colour, though not easily confounded with those from the first two, are similar in appearance to that from the last. We have found by trial that 0·1 mmg. of arsenious oxide, if present as arsenate, can be recognised after reduction with sulphurous acid.

Previous estimates of the delicacy of the Gutzeit test have not been under 0·1 mmg., as far as we know, with the exception of that made by Dowzard (33), who states that one fifteen-thousandth to one twenty-thousandth of a milligram can be recognized by the modification described by him. This figure is practically the same as ours.

THE USE OF THE METHOD.

The method naturally suggests comparison with the Marsh test in its present accepted form. In the modification described by one of us in 1891(34), in which a standard set of mirrors was employed for the first time, the absolute limit of delicacy was placed at 1 mmg. of arsenious oxide. The most important improvement in procedure which has been made of late years is the cooling of the capillary tube, described by Gautier (35), Thomson (36), Lockemann (37), and others. By this means, the scattering of the deposit of arsenic is prevented, and the mirror takes a more compact and hence more easily identifiable form. In spite of this advantage, we have not been able, as yet, to reach the absolute limit of delicacy in the Marsh process, which is set by Thomson at 0·4 mmg. of arsenious oxide, and by Lockemann and others at 0·1 mmg. arsenic. We cannot think that this failure is due to insensitiveness of the zinc, but to other reasons not yet discovered. Sanger and Gibson (38) have shown, for example, that the nature of the antimony mirror depends upon the kind of glass tubing used, and they suggest that a greater or less oxidation of the stibine may take place in the accidental presence of air, if the glass contains a catalysing agent. If this were true, it is easy to imagine a slight retention of the arsenic from the

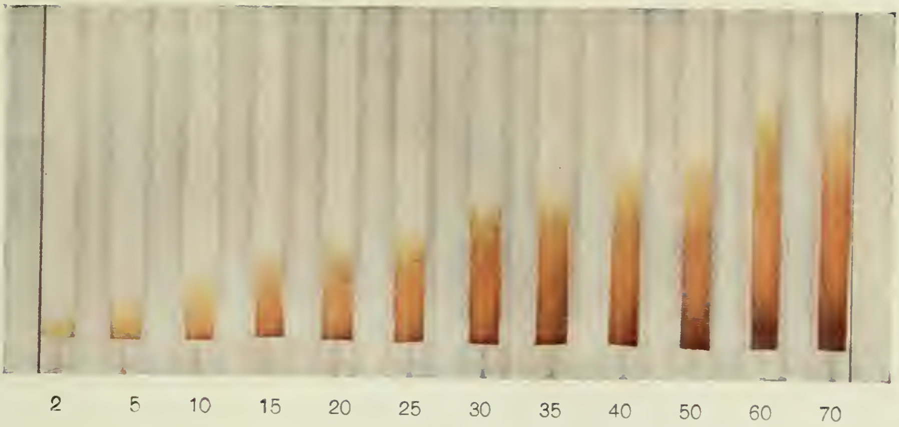


PLATE 1.

Standard Arsenic Bands in Micromilligrams of As$_2$O$_3$
Initial.

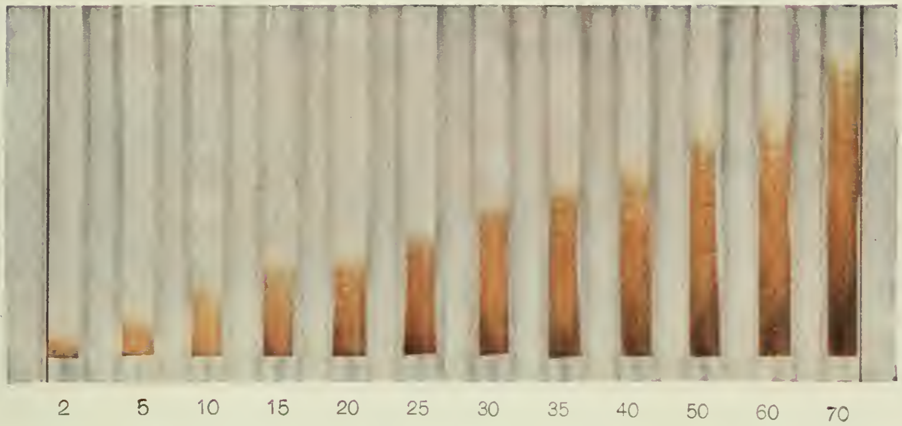


PLATE 2.

Standard Arsenic Bands in Micromilligrams of As$_2$O$_3$
Hydrochloric Acid Development.

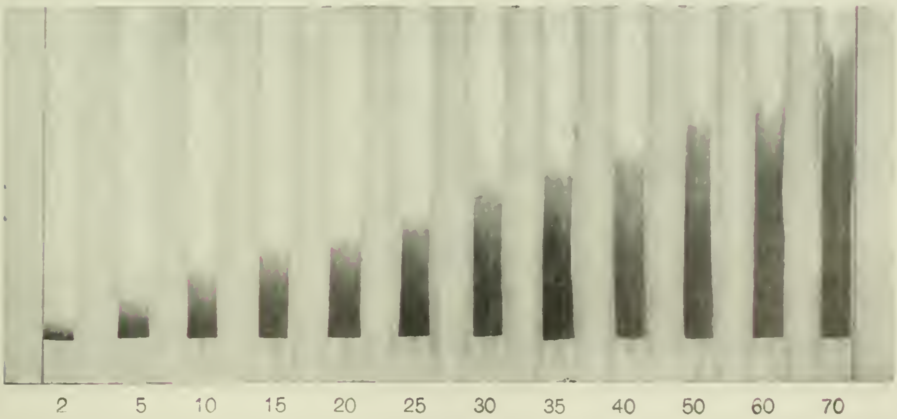


PLATE 3.

Standard Arsenic Bands in Micromilligrams of As$_2$O$_3$
Ammonia Development

same cause, since the oxide formed would be fixed by the base of the glass. This point will be soon investigated in this laboratory.

Not only, as far as our experience goes, has the Gutzeit method proved to be more sensitive than the Marsh, but we think it will be found so by others. In certain lines of work, in which the sample may be tested directly or quickly freed from interfering substances, the Gutzeit in the form proposed by us may be preferable to the Marsh, particularly when the routine analysis of a large number of samples is concerned. In toxicological or legal work, it will serve as a valuable adjunct to the Marsh method, since the exhibits from both methods can be presented and will corroborate each other, qualitatively or quantitatively. Though not convertible, like the Marsh mirror, to a definite and obvious compound of arsenic, yet the colour band can be easily differentiated from the effect produced by other substances on mercuric chloride.

We have not studied the application of the method to the analysis of many products, though we have used it successfully for the determination of arsenic in wall paper, in the urine, and in certain salts. Its usefulness will depend upon its adaptability to the needs of the analyst, and it may be modified to meet his conditions. For instance, in the examination of beer, if the analyst must add the sample to the reduction bottle without previous treatment, there should be adequate provision for the retention of hydrogen sulphide, the prevention of frothing, etc. We are not at all sanguine of the success of the method, however, unless the test solution has had adequate treatment before reduction.

During the study of the interference of sulphur, phosphorus, and antimony, as given above, the possibility of quantitatively determining small amounts of these substances by this method, particularly of antimony, suggested itself. We desire to note also that the principle of allowing the gas to be tested to act along the surface of the reacting substance has a useful application in other cases, notably in the determination of fluorine, and we are at present engaged in developing a method for the estimation of small amounts of that substance according to this principle.

In conclusion it gives us pleasure to acknowledge our indebtedness to the C. M. Warren Fund of Harvard University for material assistance in the preparation of the coloured plates used in this article.

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(1) Arsenical Poisoning in Beer Drinkers, p. 88. Ballière. Tindall and Cox, London, 1901.

(2) Analyst, 26, 181 (1901).

(3) Treadwell, Kurzes Lehrbuch der Analytischen Chemie, Bd. II., 138 (1902).

(4) Chem. News, 86, 3 (1902).

(5) Royal Commission on Arsenical Poisoning, Final Report, Vol. II., p. 58. Eyre and Spottiswoode (London), 1903.

(6) This J., 25, 507 (1906).

(7) J. Amer. Chem. Soc., 21, 133 (1899).

(8) We are also indebted to the Baker and Adamson Company for a preparation of hydrochloric acid containing a still smaller quantity of arsenic, the use of which will be later explained in the discussion of the absolute delicacy of the method.

(9) Pogg. Ann., 51, 423 (1840).

(10) Comptes Rend., 79, 118 (1874).

(11) L'Orosi, 13, 289 (1890).

(12) Pharm. Zeitung, 36, 748 and 756 (1891).

(13) Ber., 31, 594 (1898).

(14) *Ibid.*, 31, 596.

(15) Archiv. Pharm., 237, 121 (1899).

(16) *Loc. cit.*

(17) *Loc. cit.*

(18) Zentralbl., 74, (1), 821 (1903).

(19) *Loc. cit.*

(20) Analyst, 31, 3 (1906).

(21) J. Amer. Chem. Soc., 24, 1005 (1902).

(22). Proc. Amer. Acad., 26, 24 (1891); Amer. Chem. J., 13, 431 (1891).

(23) Zeits. angew. Chem., 18, 416 (1905).

(24) Proc. Amer. Acad., 43, 327 (1907); Zeits. anorg. Chem., 16; see following paper.

(25) *Loc. cit.*

(26) L'Orosi, 13, 397 (1890).

(27) J. Chem. Soc., 79, 715 (1901).

(28) For the use of the 2 mm. band, see below.

(29) *Loc. cit.*

(30) Chem. News, 83, 277 (1901).

(31) We have found that the lead acetate paper is more sensitive to hydrogen sulphide than the mercuric chloride.

(32) Zeits. angew. Chem., 20. 67 (1907).

(33) *Loc. prim. cit.*

(34) *Loc. cit.*

(35) Bull. Soc. Chim., 27, 1030 (1902).

(36) Chem. News, 88, 228 (1903); also, 94, 156 and 166 (1906).

(37) *Loc. cit.*

(38) Proc. Amer. Acad., 52, 719 (1907); this J., 26, 585 (1907); Zeits. anorg. Chem., 55, 205 (1907).

Meeting held at Boston on Friday, March 1, 1907.

MR. HENRY HOWARD IN THE CHAIR.

THE DETERMINATION OF ARSENIC IN URINE.

BY CHARLES ROBERT SANGER AND OTIS FISHER BLACK.*

Some years ago, one of us had occasion to make a number of analyses of urine in cases of suspected chronic arsenical poisoning (1). In looking up the literature of the subject at that time, it was found that the analysis of the urine in case of chronic arsenical poisoning had been comparatively rare. In the twenty-three cases cited by Sanger in which the urine had been examined, and the methods of analysis described, the latter were generally open to adverse criticism. They were usually tedious, and often involved the use of many reagents, thereby adding to the possibility of introduction of arsenic. The amounts of arsenic found, in the absence at that time of any method for the determination of small quantities, could only be judged from the descriptions of the mirrors, but probably did not exceed 1 mgrm. of arsenious oxide per litre, and in many cases must have been less than 0·1 mgrm. In the only analysis found in which quantitative results were given, the amount was stated to have been 16·8 mgrms. in 1700 c.c., but the method of analysis was not given, hence this case was not included in the twenty-three above mentioned.

The method used by Sanger for the treatment of the urine was based on that proposed by Gautier (2) for the general treatment of animal tissue. To a measured volume of urine was added about one-tenth the volume of concentrated nitric acid, and the whole was evaporated over a free flame. As the mass neared dryness the flame was lowered, and more acid was added, if necessary, in order to avoid carbonisation at the end. Deflagration often ensued, but it was thought that loss of arsenic should not be feared in presence of excess of nitric acid. To destroy the organic matter completely, the residue from evaporation was transferred to a smaller dish, treated with sulphuric acid, and heated for some time with addition of nitric acid until a clear, white, partly melted mass was obtained. The residue, free from nitric acid, was diluted with water and introduced into the Marsh flask. The amount of arsenic was determined by Sanger's (3) modification of the Berzelius-Marsh method.

In the twenty cases of suspected arsenical poisoning referred to above, thirty-one samples of urine were examined by this method, and in no instance was the amount of arsenic (as arsenious oxide) greater than 0·07 mgrm. per litre. The analytical precautions were such as to preclude the introduction of arsenic from any outside source. Prior to these analyses, but one instance had been found in which a method for the quantitative estimation of arsenic in urine had been described. Hubbard (4), in studying the elimination of arsenic by the kidneys, added the urine directly to the Marsh flask, and determined the weight of the mirror according to the gravimetric Berzelius-Marsh method, first applied by Gautier (5), and afterward elaborated by Chittenden and Donaldson (6) and others. While the amounts of arsenic found by Hubbard (varying from 0·35 to 1·12 mgrm. per litre) were undoubtedly a close approximation, the method cannot be applied to minimal amounts with certainty, on account of the impossibility of accurately weighing small mirrors, and the effect of the pressure of organic matter on their deposition.

The treatment described above has been used by several analysts (7) in the determination of arsenic in urine. Unfortunately it was not accurately tested by the analysis of urines containing known amounts of arsenic, partly on account of lack of time, partly through acceptance of the Gautier method. The assumption that all of the arsenic present was accounted for was probably incorrect, as our present work will show.

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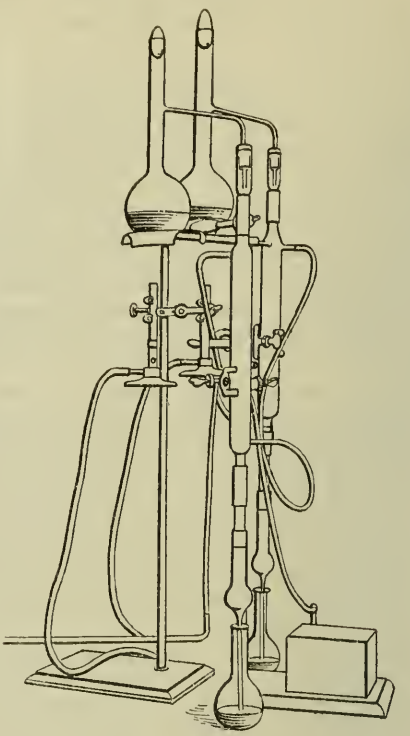
* Taken as read.

The method is a troublesome one, requiring much time for evaporation and the destruction of the organic matter, as care must be taken to have the latter entirely eliminated, since the accurate determination of the arsenic is impossible in its presence. The use of large quantities of nitric acid is unpleasant and may introduce error. These considerations, together with the much more important one of possible loss of arsenic, have led us to substitute for the destruction of the organic matter with nitric acid a distillation of the arsenic from the evaporated urine by means of hydrochloric acid. The distillation of arsenic from organic matter by hydrochloric acid, first used successfully by Schneider (8) and Fyffe (9), is a common procedure, and needs no explanation. We have not been able, however, to find any instance of its application to the analysis of urine. The only serious objection is the difficulty of obtaining hydrochloric acid with a negligible amount of arsenic. Fortunately such an acid is obtainable at low cost in this country (10), and one does not have to resort to the troublesome methods of purification, which to some are prohibitive of the use of hydrochloric acid in arsenic work. Not only is the distillation method more accurate, but it will also be shown that, in point of time for the entire operation, the advantage is greatly in its favour, particularly, as we have said before, if the careful elimination of the organic matter is made a pre-requisite to the introduction of the solution into the Marsh flask.

THE METHOD.

Apparatus.—For distillation, a 300 c.c. round bottom flask is used, with a neck about 20 cm. long. The side tube, which is about half-way up the neck, is 20 cm. in length, and is bent downward in the middle at an obtuse angle, so that it passes into an upright condenser parallel to the neck of the boiling flask, which is closed by a short glass tube sealed off at each end, over which is slipped a short piece of rubber tubing. A glass-stoppered boiling flask could advantageously be used. The cooling tube is 50 cm. long, with a jacket of 35 cm. The side tube of the flask passes through a rubber stopper in the neck of the condenser, and as far into the cooling tube as possible. The condensing tube passes at the bottom through a rubber stopper, over which is slipped a wide tube 15 cm. long, similar to a calcium chloride tube, having a bulb of about 25 c.c. capacity near the lower end, which terminates in a tube of ordinary bore. To this end is fused a tube of equal diameter, about 15 cm. long. The arrangement is practically a pipette-shaped adapter, similar to that used in ammonia distillation, and is intended to prevent the rise of distillate into the condenser in case of back pressure. The distilling apparatus is conveniently set up in duplicate mounted on two stands (see figure), and is placed in the hood under a strong draught.

Distillation.—200 c.c. of urine are evaporated in a porcelain dish over a low flame or on the steam bath, to about 35 c.c., cooled, and introduced into the flask, which is then connected with the condenser. Under the adapter is placed a small flask containing 25 c.c. of concentrated nitric acid, which should just cover the end of the adapter. There are then added through a long funnel tube 100 c.c. of cool, concentrated hydrochloric acid, in which the amount of arsenic is as small as possible and accurately determined. The stopper of the flask is at once inserted. Distillation is begun with a low flame and is continued at such a rate that the volume of the liquid in the flask is reduced to about one-half in the course of 30 to 40 minutes. Repeated trials have shown that all the arsenic, in the quantities for which this method is intended, goes over by this operation, whether the arsenic is present as arsenious or arsenic acid. As by far the greater part of the arsenic goes over with the gaseous hydrochloric acid and meets the concentrated nitric acid, no loss is to be feared from the dilution of the nitric acid by the acid distillate. Comparatively little organic matter is distilled, and this is entirely destroyed by the subsequent procedure.



Treatment of the distillate.—To the distillate are added 25 c.c. of concentrated nitric acid, in order to decompose completely during evaporation any excess of hydrochloric acid and thus guard against loss of arsenic. The mixture is then evaporated to a small bulk, 3 to 5 c.c. of concentrated sulphuric acid are added, and the evaporation continued until the nitric acid is expelled. To destroy the slight amount of organic matter which usually remains, a few drops of nitric acid are added, and the heating is continued until only the small residue of sulphuric acid is left, which must be colourless. The residue is then diluted with water to a measured volume of about 25 c.c., or, if preferred, to a quantity which is weighed in a side-neck test tube to the second decimal place.

Determination of the arsenic.—The subsequent procedure, as in the paper above referred to, follows closely the method of Sanger (11) for determining small amounts of arsenic, except that the capillary tube should be cooled at the deposition point of the mirror, as advised by Gautier (12), Thomson (13), Lockemann (14), and others. An aliquot portion of the ultimate solution, accurately measured or weighed, is introduced into the Marsh flask, the entire apparatus having been in action for a sufficient time to show absence of arsenic. This time varies according to the importance of the test in hand, but should not be less than 20 minutes. If, after the addition of the solution, a mirror does not make its appearance in the capillary tube within ten minutes, a larger portion or the whole of the solution is added. After the appearance of the mirror, the heating of the tube is continued for a sufficient time to ensure the complete deposition of the arsenic, which usually occurs within an hour. During this time the flow of hydrogen is regulated by the constant generator, so that the height of the flame at the end of the heated tube is about 1 mm., the regular deposition of the mirror being dependent on this condition. The mirror obtained is compared with a set of standards, which is prepared as explained in the paper referred to. From the amount of solution used and the volume of urine taken, the quantity of arsenic per litre is calculated. Should the mirror exceed in size the standard of

0·06 mgrm., it may be necessary to obtain another mirror from a smaller portion of the solution or from a smaller volume of urine, since the reading of mirrors above 0·06 mgrm. is not accurate.

The determination of the amount of arsenic in the solution may also be made by the modification of the Gutzeit method described by us in the preceding paper (15). In this case, owing to the size of reduction flask used, the volume of the solution should not exceed 20 c.c., of which an aliquot part or all may be taken. This method consists briefly in allowing the arsenical hydrogen to pass through a tube containing a strip of paper saturated with a five per cent. solution of mercuric chloride and dried. The resulting band of colour is compared with a set of standard bands.

Reagents.—The zinc used is "Bertha spelter"; the amount taken is from 5 to 10 grms. We have used it in a rather finely granulated form in the reduction bottle, reserving the larger pieces for the constant generator. As the metal is too pure to generate hydrogen with sufficient rapidity from sulphuric acid, we place in the reduction bottle a thin disc of platinum foil nearly as large as the bottom of the bottle. With this the evolution of the hydrogen is most regular. That the platinum does not cause arsenic to be held back, we have assured ourselves by obtaining mirrors of equal size and same appearance as those formed without the disc. The deposition of platinum on the zinc by use of platinic chloride is, however, not allowable, as one of us has shown (16), and cupric sulphate is equally inadmissible. The formation of a coating of copper on our zinc, after the procedure of Lockemann (17), does not add to its sensitiveness, nor does the addition of tin or lead salts to the solution during reduction. In the constant generator, the zinc is sensitized, according to the suggestion of Gooch (18), by treatment with a solution of cupric sulphate, but we take the precaution to pass the hydrogen from the generator through a ten per cent. solution of cupric sulphate in order to retain any hydrogen sulphide which may be formed. The sulphuric acid showed no trace of arsenic when tested in greater quantity and for a longer time than in a single determination. In the constant generator it is used at a dilution of 1 to 8; in the reduction bottle somewhat more dilute (1·5 normal).

Two grades of hydrochloric acid (19) have been used: the ordinary chemically pure acid (A) which was found by repeated trials to contain 0·4 mgrm. of arsenious oxide per litre, and a second (B) in which we have determined by careful analysis an amount equal to 0·02 mgrm. per litre.

The nitric acid is an ordinary, chemically pure acid, tested in large quantity after evaporation with sulphuric acid, and found to be entirely free from arsenic, both by the Marsh and Gutzeit tests.

Utensils.—All glass and porcelain vessels were new, and, after freedom from arsenic was assured by blank tests, were reserved for this purpose alone.

ANALYTICAL RESULTS.

Blank tests.—1. 100 c.c. of hydrochloric acid (A) were diluted with 35 c.c. of water and distilled into 25 c.c. of nitric acid. From the evaporated distillate a mirror was obtained equal to 0·04 mgrm. of arsenic (20). Amount per litre, 0·4 mgrm.

2. 100 c.c. of acid (A) were added, drop by drop, to 50 c.c. of hot nitric acid in a porcelain dish. The mixture evaporated with sulphuric acid gave a mirror equal to 0·04 mgrm. of arsenic. Amount per litre, 0·4 mgrm.

3. 100 c.c. of hydrochloric acid (B) were diluted with 35 c.c. of water and distilled into 25 c.c. of nitric acid. The evaporated distillate gave a mirror which was judged to be about 0·003 mgrm. of arsenic.

4. 200 c.c. of acid (B) were added, drop by drop, to 100 c.c. of hot nitric acid and the resulting mixture was evaporated with sulphuric acid until the nitric acid was expelled. From this was obtained a mirror which was read as 0·002 mgrm. of arsenic.

From analyses 3 and 4 it was evident that there was a trace of arsenic in the acid (B), probably about 0·002 mgrm. in 100 c.c., or 0·02 mgrm. per litre.

5. 300 c.c. of urine were evaporated to 30 c.c. and distilled with 100 c.c. of hydrochloric acid (A) into 25 c.c. of nitric acid. One half of the solution from the evaporated distillate gave a mirror equal to 0·02 mgrm. of arsenic; the other half a colour band (Gutzeit) equal to 0·02 mgrm. The amount of arsenic per litre is therefore 0·4 mgrm., which confirms the results of analyses 1 and 2, and the test shows the urine to be free from arsenic.

6. 200 c.c. of urine were evaporated to 30 c.c., and distilled with 100 c.c. of acid (B) into 25 c.c. of nitric acid. The distillate, evaporated with a little more nitric acid, gave a mirror, which, as nearly as could be judged, was equal to 0·002 mgrm. This confirms, within the limits of reading, the results of analyses 3 and 4, and enables us to fix the correction for 100 c.c. of this acid at 0·002 mgrm. This has been since confirmed by the analysis of the acid by the Gutzeit method. The correction is only appreciable, as will be seen from Series B, below, when the entire solution gives a very low mirror, and entirely disappears when the mirror, even if a low one, is obtained from a small part of the solution (see Series C).

The third grade of hydrochloric acid (C), which will hereafter be used in all urine work in this laboratory, was tested as in analyses 2 and 4. After reduction of the residues from two lots of 100 c.c. with sulphurous acid, colour bands were obtained equal to 0·3 and 0·5 micromilligrams of arsenic. This is equivalent to 0·004 mgrm. of arsenic per litre. The correction for 100 c.c. of this acid, 0·0004 mgrm., would be practically inappreciable under ordinary conditions of the Marsh procedure, even if the mirror was obtained from the entire solution.

Analyses.—For use in the subsequent analytical work, a solution of arsenious acid was made as follows: One grm. of pure arsenious oxide, twice resublimed, was dissolved in a small amount of sodium hydroxide solution free from arsenic. After acidification with sulphuric acid, this solution was made up to a litre. Of this, 10 c.c. were diluted to a litre, giving a solution containing 0·01 mgrm. of arsenious oxide per c.c.

7. 150 c.c. of urine, to which had been added 0·025 mgrm. of arsenic, were evaporated to 25 c.c. and distilled with 100 c.c. of hydrochloric acid containing 0·035 mgrm. of arsenic. The total amount was 0·06 mgrm. 25 c.c. of distillate were collected in 25 c.c. of nitric acid and from this was obtained a mirror equal to 0·06 mgrm. 50 c.c. more of the distillate were collected in 15 c.c. of nitric acid and from this no mirror was found.

8. By the same procedure as in analysis 7, and also with 150 c.c. of urine, 25 c.c. of distillate gave 0·06 mgrm. of arsenic, equal to the amount taken. 50 c.c. of additional distillate gave no mirror.

9. With 200 c.c. of urine and the same amount of arsenic, the same procedure gave 25 c.c. of distillate containing 0·06 mgrm. of arsenic, and 50 c.c. of additional distillate yielded no further mirror.

The results of analyses 7, 8 and 9 show that by distilling one-half the contents of the flask, according to the method above described, all the arsenic passes over.

The following series shows that by the former method of destroying the organic matter by evaporation with nitric acid a very large error is made:—

SERIES A.—*Nitric acid method.*

No. of Analysis.	Volume of Urine taken.	Arsenious oxide added.	Arsenious oxide recovered.	Per cent. recovered.
	c.c.	mg.	mg.	
10	500	25·0	6·0	24
11	500	2·5	0·44	18
12	300	0·3	0·00	0
13	100	0·5	0·00	0

In analyses 10 and 11, actual deflagration took place; in Nos. 12 and 13 the residues were blackened.

The following series shows the results of a preliminary trial of the distillation treatment :—

SERIES B.—*Distillation method.*

No. of Analysis.	Volume urine taken.	Arsenious oxide added.	Arsenious oxide in 100 c.c. HCl.	Total arsenious oxide taken.	Arsenious oxide recovered.	Per cent. recovered.
	c.c.	mg.	mg.	mg.	mg.	
16	200	0·10	0·04	0·14	0·14	100
17	,,	0·15	,,	0·19	0·16	80
18	,,	0·05	,,	0·09	0·09	100
19	,,	0·15	,,	0·19	0·16	80
20	,,	0·20	,,	0·24	0·24	100
			Average per cent. recovered, Nos. 16 to 20			92
38	,,	0·07	0·002	0·072	0·077	107
37	,,	0·06	,,	0·062	0·06	97
36	,,	0·04	,,	0·042	0·04	95
35	,,	0·03	,,	0·032	0·03	94
34	,,	0·02	,,	0·022	0·02	91
33	,,	0·01	,,	0·012	0·01	83
			Average per cent. recovered, Nos. 38 to 33			95

Series B shows that by the distillation method very small amounts of arsenic can be recovered with practical completeness. As a more severe test of the method, 0·01 mgrm. of arsenic was added to a litre of urine, and the analysis carried out as usual, using acid B (Analysis 39). A mirror was obtained fully equal to the standard for 0·01 mgrm.

Even with the correction for this acid, we thus recover from 80 to 100 per cent. of the amount of arsenic taken, which shows that, considering the amount of organic matter involved and the hydrochloric acid used, the method is a delicate one. By the use of an acid of such purity as that of grade C, it will be possible to eliminate entirely the correction for arsenic in the acid, even if the amount of arsenic in the entire test solution is as low as 0·01 mgrm., since the correction is only four per cent. of this quantity, which is well within the limit of accuracy of the method itself. With larger amounts than 0·01 mgrm. the correction for this acid is of course of even less account.

Presence of arsenates in the urine.—The compound in which arsenic occurs in the urine has never to our knowledge been thoroughly investigated. To determine accurately the condition of such small amounts as would ordinarily occur would be a matter of considerable difficulty. Schmidt and Bredtschneider (21) claim to have found arsenic acid and no arsenious acid when arsenic was ingested as the trioxide. Selmi (22) states that he found in the urine of a dog poisoned by arsenic a volatile compound of the element. The reference gives no analytical details, and the original is not accessible to us. It is not improbable, however, from the analogy to phosphorus, that arsenic finds its way into the urine as an arsenate. If this be the case, the question will perhaps be asked if small amounts of arsenate, when distilled with hydrochloric acid, would be recovered in the distillate, or would require a preliminary reduction before distillation.

Mayerhofer (23) has shown that if arsenic acid is distilled with a sufficiently large quantity of hydrochloric acid, it is converted to arsenic trichloride, chlorine being given off, since the pentachloride does not exist under ordinary conditions. In our method, the concentration of the hydrochloric acid in 100 c.c. of its solution would be so great compared with that of the arsenate that a complete conversion to trichloride might be predicted. That this is the case is shown by the following analyses, in which the arsenic acid used was prepared by evaporating a measured quantity of arsenious acid solution to dryness with nitric acid before adding to the urine.

SERIES C.—*Distillation method in presence of arsenates.*

No. of Analysis.	Volume Urine taken.	As_2O_3 added, as arsenic acid.	As_2O_3 in 100 c.c. hydrochloric acid.	Total As_2O taken.	As_2O_3 recovered.	Per cent. recovered.
	c.c.	mgrm.	mgrm.	mgrm.	mgrm.	
40	200	0·25	0·002	0·252	0·25	99·2
41	,,	0·50	,,	0·502	0·50	99·6

Analyses of urine.—The method was finally tested by the analysis of six samples of urine to which varying amounts of arsenic had been added by one of us, the amounts not being known to the analyst.

SERIES D.—*Distillation method.*

No. of Analyses.	As_2O_3 per litre.	Volume Urine taken.	As_2O_3 present in volume taken.	Total As_2O_3 in volume taken.	As_2O_3 found in volume taken.	Corrected (correction, 0·04 mg.).	As_2O_3 found per litre.	Per cent. found.
	mgrm.	c.c.	mgrm.	mgrm.	mgrm.	mgrm.	mgrm.	
21	0·5	200	0·10	0·14	0·15	0·11	0·55	110
22	2·0	,,	0·40	0·44	0·38	0·34	1·70	85
23	1·0	,,	0·20	0·24	0·23	0·19	0·95	95
24	1·5	,,	0·30	0·34	0·33	0·29	1·45	97
25	0·8	,,	0·16	0·20	0·17	0·13	0·65	81
26	1·2	,,	0·24	0·28	0·28	0·24	1·20	100
				Average per cent. found				95

To show the calculation of the analysis, one example will suffice :—

No. of Analysis.	Volume urine taken.	Volume of solution used.	Volume of solution taken.	Reading of mirror.	Reading of mirror, average.
	c.c.	c.c.	c.c.	mgrm.	mgrm.
26	200	50	5	(a) 0·025 (b) 0·030	0·028
			Amount in solution taken, 10 × 0·028 =		0·28 mg.
			Less correction for hydrochloric acid =		0·24 „
			Amount per litre urine, 5 × 0·24 =		1·2 „

Comparison of methods.—In order to compare more fairly the distillation method with the method of evaporation, the latter was slightly modified to secure the most favourable conditions for the recovery of the arsenic. 200 c.c. of urine were evaporated to about 50 c.c., and then treated with 25 c.c. of concentrated nitric acid and 5 c.c. of sulphuric acid. Evaporation was continued until the fumes of sulphuric acid appeared, which left a dark residue containing a large amount of organic matter. By successive additions of small amounts of nitric acid and heating, this residue was oxidised after a very long time, so that it appeared nearly colourless. The diluted residue was then added to the reduction bottle. A series of analyses was made by this method in which the amounts of arsenic were not known to the analyst.

Series E.—*Nitric acid method, modified.*

No. of Analysis.	Arsenious oxide, per litre.	Volume Urine taken.	Arsenious oxide present in volume taken.	Arsenious oxide found in volume taken (Corrected).	Arsenious oxide found per litre.	Per cent. found.
	mgrm.	c.c.	mgrm.	mgrm.	mgrm.	
27	0·8	200	0·16	0·13	0·65	81
28	1·0	„	0·20	0·08	0·40	40
29	0·5	„	0·10	0·10	0·50	100
30	2·0	„	0·40	0·24	1·20	60
31	1·2	„	0·24	0·12	0·60	50
32	1·5	„	0·30	0·18	0·90	60
				Average per cent. found		65

From comparison of Series D and E, it will be seen that the distillation method is more accurate than the evaporation method, even if the latter is carefully conducted so that the loss from carbonisation is avoided as far as possible. But the time needed for a proper treatment with nitric acid by the latter method is very great, and the manipulation uncleanly. The entire preparation of the solution for testing, in the distillation method, does not consume more than three-fifths of the time required in the other, and the procedure is much cleaner.

USE OF THE METHOD.

We have not studied the question of how small an amount of arsenic can be recovered from the urine by this method, but have been content to show that very small amounts, even as little as 0·01 mgrm. per litre, can be detected and estimated with reasonable accuracy (Series A and Analysis No. 39). For the examination of abnormal urine,—in studying the elimination of arsenic through the kidneys, for instance,—it would be seldom necessary to consider a quantity smaller than 0·01 mgrm., although the delicacy of the Marsh and Gutzeit methods permits a fairly exact estimation of much smaller amounts. If the question of the occurrence of arsenic in normal urine is to be investigated,—and we hope that opportunity for such an important study may be found at some future time in this laboratory,—the delicacy of the methods is secondary in importance to that of the source and manner of collection of the urine. The absolute delicacy of the Marsh method is claimed by Thomson (24) to be 0·0004 mgrm. of arsenious oxide, by Lockemann (25) and others, 0·0001 mgrm. of arsenic, and we have been able to recognize by our modification of the Gutzeit method as little as 0·00008 mgrm. of arsenious oxide. But until it is shown that a urine has had absolutely no arsenical contamination, such extreme delicacy is apt to be misleading.

The use of the method in the analysis of other liquids containing organic matter suggests itself, for example in the more exact determination of arsenic in beer. Although the distillation of small quantities of arsenic from animal tissue with hydrochloric acid has been rejected by Lockemann (25) and others, either on account of the amount of arsenic in commercial " pure " acid, or the difficulty of purifying the acid, yet we believe that the distillation of organic matter with acid of only 0·004 mgrm. arsenic to the litre would not introduce a serious error into an investigation of the normal occurrence of arsenic in the organs of man.

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(1) Proc. Amer. Acad., 29, 148 (1894).

(2) Ann. Chim. Phys., 8, 384 (1876); Bull. Soc. Chim., 24, 250 (1875).

(3) Proc. Amer. Acad., 26, 24 (1891); Amer. Chem. J., 13, 431 (1891).

(4) Physician and Surgeon, Ann Arbor, Mich., 4, 348 (1882); Contr. Chem. Lab. Univ. Mich., I., Part I. (1882).

(5) *Loc. cit.*

(6) Amer. Chem. J., 2, 235 (1881).

(7) Putnam-Worcester, Bost. Med. Surg. J., 124, 623 (1891); Wood, *Ibid.*, 128, 414 (1893); and others.

(8) Pogg. Ann., 85, 433 (1851).

(9) J. prakt. Chem., 55, 103 (1852).

(10) Baker and Adamson Chemical Company, Easton, Pa.

(11) *Loc. cit.*

(12) Bull. Soc. Chim., [2], 27. 1030 (1902).

(13) Chem. News, 88, 228 (1903).

(14) Zeits. angew. Chem., 18, 416 (1905).

(15) Proc. Amer. Acad., 43, 297 (1907); Zeits. anorg. Chem., 56 (1907); see preceding paper.

(16) *Loc. cit.*, p. 39.

(17) *Loc. cit.*

(18) Amer. J. Science, [3], 48, 292 (1894).

(19) A third grade (C) has been obtained from the same source since the completion of the analytical work on this paper. In this acid, which is of exceptional purity, the amount of arsenic is not over 0·004 mgrm. per litre.

(20) In these analyses, "arsenic," unless otherwise specified, means arsenious oxide.

(21) Moleschott's Untersuchungen, 6. 146 (1859).

(22) Mem. d. Accad. d. Scienze, Bologna, [4] 1. 299 (1882); ref., Gazz. Chim. Ital., 12, 558 (1882).

(23) Ann. Chem. Pharm., 158. 326 (1871).

(24) *Loc. cit.*

(25) *Loc. cit.*

Journal and Patent Literature.

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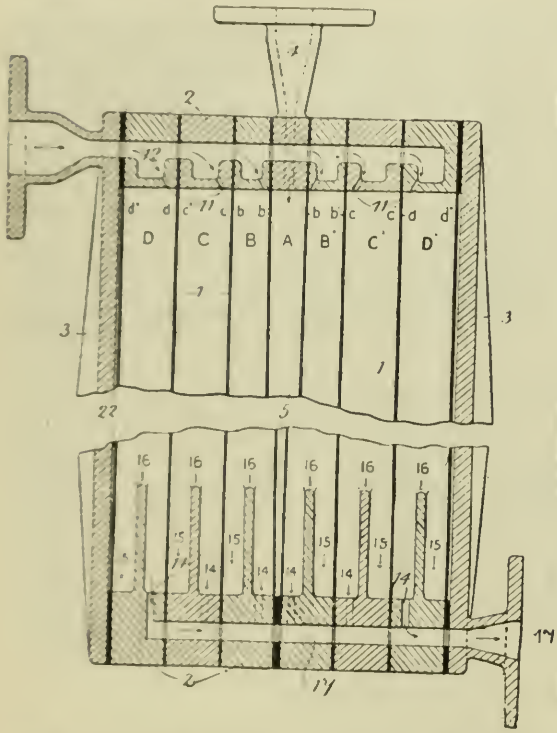
I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Distillation of water, evaporation of syrups, and like purposes; Apparatus suitable for ——. E. Shaw, London. Eng. Pat. 15,974, July 14, 1906.



The apparatus is constructed in a similar manner to a filter-press and consists of copper plates, 1, separated by frames, 2, the whole being clamped together by bolts between the end plates, 3. The liquid to be evaporated enters through the pipe, 13, into the chamber, 12, from which it is delivered to the chambers, B, B′, C, C′, etc., by the inclined channels, 11. Steam enters through the pipe, 4, into the middle chamber, A, and evaporates the film of liquid flowing down the surfaces, b, b, of the chambers, B, B′, which form the first effect of the apparatus. The concentrated liquid flowing down the surfaces, b, b, leaves the bottom of the chamber through the channels, 14, which are connected by a channel similar to 17, to the receiver in which the least degree of vacuum is maintained. The vapour given off in the chambers, B, B′, passes across to and is condensed on the surfaces, b', b', at the same time serving to evaporate the film of liquid flowing down the surfaces, c, c, of the chambers, C, C′, which form the second effect. The condensed liquid flowing down the faces, b', b', is prevented from mixing with the concentrated liquid by the vertical partitions, 16, and flows away by separate channels, 15. Each corresponding pair of chambers, C, C′, D, D′, etc., of which there may be any convenient number, form second, third, etc., effects, being connected to receivers under successively greater vacuum. The liquid to be evaporated flows down the surfaces, b, c, d, and the vapours are condensed on the surfaces, b', c', d'. The condensation in all the chambers except the ones at each end is effected by the liquid to be evaporated, and that in the latter by cooling water which flows through the space, 22, between the end copper plates and the end-pieces, 3.—W. H. C.

Evaporating at less than atmospheric pressure; Apparatus for ——. J. Grossmann, Manchester. Eng. Pat. 23,606, Oct. 24, 1906.

The apparatus is similar to that described in Eng. Pat. 19,922 of 1906 (this J., 1907, 1077), but the stirrers have no perforations and the exhaust steam escapes from the other end of the shaft. It is provided with a tube placed below and parallel with the tubular retort with which it communicates by a slot extending the full length of the tube. An archimedian screw working in this tube continuously discharges the separated solid matter.—W. H. C.

Evaporation of liquids; Process for the ——. Lübecker Apparatebau Ges.m.b.H. Fr. Pat. 378,513, June 6, 1907.

The liquid to be evaporated or distilled is pumped under pressure through the tubes of a vertical tubular heater. The latter is divided into two parts by a vertical partition, and the liquid passes down the tubes in the first half and up those in the second half. It is heated to a temperature insufficient to cause its complete volatilisation, by steam or hot gas which enters the upper portion of the space surrounding the tubes in the second half of the apparatus and escapes from the bottom of the first half. From the chamber above the tubes in the second half of the heater, the hot liquid is forced upwards through a nozzle or sprayer into a still or chamber placed above the heater and maintained at a lower pressure. It impinges against a baffle-plate, and the more volatile portion is converted into vapour and passes to the condenser. The less volatile portion collects in the chamber and is withdrawn from the bottom to be passed through a second similar apparatus at a higher pressure and temperature.—W. H. C.

Reducing the consumption of power in repeated creations of vacua; Method of —— *applicable in the production of peat-fuel.* F. Fritz, London. Eng. Pat. 21,321, Sept. 26, 1906.

When it is necessary that the vacuum in a chamber should be destroyed, it is proposed to connect it to another similar chamber in which a vacuum is desired to be produced instead of to the air. In this way the vacuum is not wasted but serves to produce a preliminary partial vacuum in the next chamber. The invention is applied to the treatment of peat to be used for the production of fuel, the cells in the vegetable fibres being split up by subjecting the peat to the action of a vacuum.—W. H. C.

Vacua; Mechanical production of high ——. J. Zeitlin, London. Eng. Pat. 21,337, Sept. 26, 1906.

See Fr. Pat. 378,414 of 1907; following.—T. F. B.

Vacua; Production of high ——. J. Zeitlin. Fr. Pat. 378,414, June 3, 1907.

The difficulty of obtaining a high vacuum with single- or multiple-stage air-pumps, owing to air leaking in at the valves and stuffing-boxes, is due to the great difference of pressure between the interior of the cylinders and the air. This difficulty is overcome by enclosing the pump or pumps, together with the motor for driving them, in a chamber from which the air has been exhausted by an auxiliary pump which may be placed within or without the chamber. The suction and delivery pipes and the wires carrying the current to the electric motor pass air-tight through the walls of the chamber, which is made in two parts held together by the vacuum. As the difference of pressure is by this means reduced, the leakage of air through the valves and stuffing-boxes is avoided, and a very high vacuum can be obtained.—W. H. C.

Washing and sterilising filtering pulp and the like materials; Apparatus for ——. H. C. Russell, London. Eng. Pat. 121, Jan. 2, 1907.

A PERFORATED drum, provided with blades inclined to its horizontal axis, is fitted so that it can be rotated in the lower portion of a tank into which the pulp is put. A row of spikes project from the side of the tank adjacent to the drum, and the pulp or other material to be washed is guided on to the drum by a curved plate fixed above it. The upper part of the tank is provided with a perforated drum for discharging scum and dirty water as described in Eng. Pat. 15,388 of 1906.—W. H. C.

Inflammable liquids; Storage and transference of ——. C. Martini and H. Huneke, Hannover, Germany. Eng. Pat. 7709, April 2, 1907.

THE liquid is removed from the closed reservoir in which it is stored by a suitable pump. The reservoir is connected to a supply of compressed non-inflammable gas, *e.g.*, carbon dioxide, by a pipe and a reducing-valve, so that the gas under a low pressure only replaces the liquid as it is withdrawn by the pump. When the tank is being filled with liquid, the gas is allowed to escape.—W. H. C.

Treating liquids and apparatus therefor; Method of ——. C. Neff and A. Brandes, Hanover, Germany. Eng. Pat. 12,258, May 27, 1907.

THE liquid is caused to trickle over sheets of aluminium or other metal which is exposed to the light. It is stated that water treated in this way acquires special properties which render it suitable for rapidly cleansing clothes and other purposes.—W. H. C.

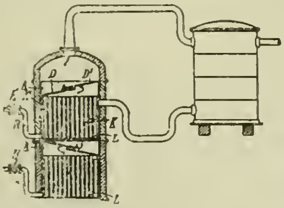
Filter-press. B. F. Arendt and R. H. Moore, Spreckels, Cal., Assignors to American Sugar Refining Co., Jersey City, N.J. U.S. Pat. 863,894, Aug. 20, 1907.

THE press is built up of grooved filter-plates and distance plates or frames, arranged alternately and tightened up in the usual manner. Each plate has four lugs or ears, one at each corner. The lugs have holes in them which form channels extending the whole length of the press when it is assembled. The channel in the upper right-hand corner communicates with the distance plates and serves to feed the press. The two lower channels alternately communicate with the grooved surfaces of alternate filter-plates and serve to conduct away both the filtrate and the washings. The upper left-hand lugs have two openings so as to form two separate channels alternately communicating with the grooved faces of alternate filter-plates. The filter-plates are covered with cloths and the joints between the lugs are made good with cloths in the ordinary way. When the cakes are being washed, the wash-water is first sent through one of the two adjacent upper channels and passes through the cakes in one direction and away by the lower channel which communicates with the next plate. After a time the washing is stopped and the water sent through the other channel so that it passes through the cake in the opposite direction and away by the other lower channel. It is stated that very thorough extraction of the cakes is in this way attained and that the blocking of the pores of the filter-cloths is avoided.—W. H. C.

Filter-press. B. Berkovits and V. A. Kridlo. Fr. Pat. 378,312, May 3, 1907.

THE press has two longitudinal parallel filter-chambers formed on either side of a central vertical plate by a series of pairs of grooved outer plates, whose lower edges are hinged to the lower part of the central plate. When the press is at work, the side plates are turned on their hinges until they are vertical and parallel with the central plate. A U-shaped filter-cloth is arranged between the central and side plates, and the latter are maintained in position by thumb- or wing-screws. The liquid to be filtered is delivered into the interior of the press at both ends and at the centre, and the clear liquid passes through the cloth and down the grooves in the plates into a gutter placed below. When it is necessary to empty the press, the side plates are lowered into the horizontal position to give access to the interior and allow of the removal of the sludge. A coil may be arranged within the body of the central plate so that the filtration may be carried out at any desired temperature.—W. H. C.

Rectifying and dephlegmating vapour mixtures; Apparatus for ——. J. J. Ponomarew, Terskaja Oblast, Russia. U.S. Pat. 865,933, Sept. 10, 1907.

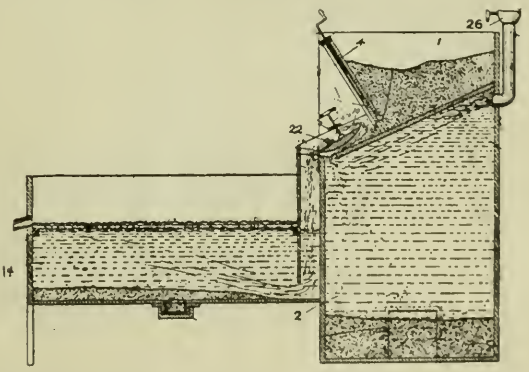


A RECTIFYING column is constructed of a number of superposed chambers, A, separated by tube-plates, L. Two of such chambers are shown in the figure. Each chamber has a number of vertical tubes, K. open above and below, the lower ends of which pass through the tube-plate. Each chamber has an overflow pipe, K¹, and a "swan-neck," R, provided with a valve, H. Above the tubes in each chamber, two inclined, overlapping, baffle-partitions, D, D¹, are arranged as shown, the lower one, D, having an opening at its lowest point which is above the overflow-pipe, K¹.—W. H. C.

Rectifying apparatus for spirit, petroleum and other volatile bodies. Comp. Industrielle des Pétroles. Fr. Pat. 378,695, June 11, 1907.

THE vapours pass upwards from the still by a wide pipe into a vertical cylinder filled with coke or other suitable packing, and provided with a swan-neck attached to a condenser. The cylinder is surrounded by a jacket, and a current of gas or liquid, previously heated to an appropriate temperature, is circulated through the jacket and serves to condense the less volatile portions of the vapour coming from the still. These drain back to the still and the more volatile portion of the vapour after repeated contact with the returning condensed liquid, passes on to the swan-neck and condenser.—W. H. C.

Separating finely-divided material; Apparatus for ——. A. J. Cook, San Rafael, Cal. U.S. Pat. 866,626, Sept. 24, 1907.



THE materials to be separated are fed into the channel, 1, and pass under the lower edge of the adjustable partition, 4. A current of water enters the vessel, 2, through the pipe, 26, and passes under the adjustable partition, 10, carrying the lighter particles with it into the tank, 14. The heavier particles collect at the bottom of the tank, 2. A riffle-plate, 22, is provided on the upper side of the partition, 10, to keep back any large particles carried forward by the water.—W. H. C.

Dehydrating apparatus. E. W. Cooke, New York, Assignor to The Cokel Co. U.S. Pat. 867,246, Oct. 1, 1907.

SEE Eng. Pat. 14,854 of 1905; this J., 1905, 1319.—T. F. B.

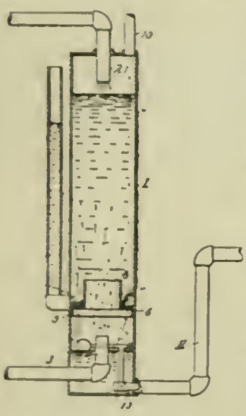
Drying the interior of vats; Means for ——. J. H. Beckman, Seattle, Wash. U.S. Pat. 867,548, Oct. 1, 1907.

Air under pressure is injected into a heated funnel which is connected to a pipe passing through an aperture in the side of the vat near the bottom. Within the vat the air-pipe is connected to a rotating air-distributor from which the warm air is discharged through perforated arms into the vat.—W. H. C.

Drying machines: Rotary cylinder for ——. W. M. Cummer. Fr. Pat. 378,572, May 14, 1907.

See U.S. Pat. 857,161 of 1907; this J., 1907, 814.—T. F. B.

Treating gases with liquids and liquids with gases; Apparatus for ——. C. S. Bradley, New York. U.S. Pat. 867,553, Oct. 1, 1907.



A vertical chamber, 1, is divided by a perforated horizontal partition, 6, into two parts. The liquid to be treated is fed into the upper chamber through the pipe, 21, and compressed gas is delivered into the lower chamber through the pipe, 3. The partition has the form shown at 6, 8, 9, and the gas passes upwards through the vertical extension, 8, into and through the liquid, which passes down into the lower chamber through the annular perforated portion, 6, 9, of the partition. The excess of gas escapes through the pipe, 10, and the treated liquid flows away through the pipe, 11, 13.—W. H. C.

Vapours of alcohol and ether contained in air [in artificial silk works, etc.]; Recuperation and recovery of ——. A. Chardonnet. First Addition, dated July 27, 1906, to Fr. Pat. 377,673, July 17, 1906 (this J., 1907, 1088).

This addition claims the application of the process described in the original patent, to the recovery of acetone vapours.—P. F. C.

Reaction chambers; Materials for filling ——. H. Petersen. Fr. Pat. 378,454, June 4, 1907. Under Int. Conv., Aug. 4, 1906.

Fig. 1.

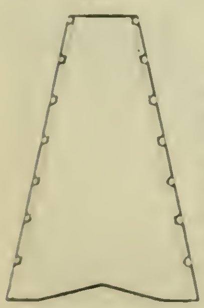
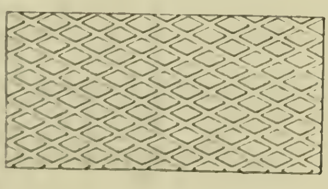


Fig. 2.



The chambers are filled with prismatic bodies having the cross-section shown in Fig. 1, and also having their inclined faces covered with a network of grooves as shown in Fig. 2. The pieces are packed in the chambers in a similar way to chequer brickwork and may be placed with either their larger, or smaller parallel faces uppermost.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Irish peat industries; Report upon the ——. *Part I.* H. Ryan. Economic Proc. Roy. Dublin Soc., 1907, 1, [10], 371—420.

The subject is treated under the following headings :—*Section I. Irish bogs and the methods employed for their reclamation.* 1. Preliminary. 2. Attempts to utilise the Irish peat supply. 3. Assistance given towards development of peat industries by various States. 4. Origin of peat. 5. Peat-forming plants. 6. Process of peat formation. 7. Age of peat. 8. Classification of bogs and of peat. 9. Distribution of peat. 10. Distribution of bogs in Ireland. 11. Composition of peat. 12. Drainage of Irish bogs. 13. Utilisation of surface of bog. 14. Peat as manure. 15. Utilisation of water in bog canals. 16. Utilisation of cut-away bog. *Section II. Peat-fibre industries.* 1. Percentage of fibre in peat. 2. Utilisation of peat fibre. 3. Peat litter. 4. Manufacture of peat-moss litter. 5. Turf-mould mills. 6. Sifting the divided peat. 7. Baling the divided peat. 8. Peat litter bales. 9. Peat litter for farmers. 10. Plan and cost of peat-moss litter factory. 11. Peat-moss litter in stalls. 12. Testing peat-moss litter. 13. Irish peat-moss litter factories. 14. Peat paper. 15. The Celbridge peat paper factory. 16. Building materials from peat. 17. Brown dye from peat. 18. Tanning material from peat. 19. Turf-wool. 20. Foodstuff from turf fibre. 21. Preparation of alcohol from turf.—T. F. B.

Hydrogen; Influence of the impurities in —— *on the durability of the envelopes of balloons.* R. Namias. L. Ind. Chimica, 1907, 7, 257—258. Chem. Zentr., 1907, 2, 1460—1461.

The author examined the envelope of a balloon which burst at the International Exhibition at Milan in 1906. A number of spots were visible on the envelope, and at these places, the material could be easily torn, whereas at other parts, it showed great resistance to tearing. These spots were found to have been caused by phosphoric and arsenic acids, produced by oxidation from arseniuretted and phosphoretted hydrogen contained in the hydrogen gas. The presence of these impurities is due to the use of impure materials in the preparation of the hydrogen, and the author recommends that the preparation of the gas for filling balloons should be under strict chemical control.—A. S.

Methane; Detection and rapid determination of —— *[by combustion].* N. Gréhant. Compt. rend., 1907, **145**, 625—626.

Experiments are recorded showing that mixtures of a few per cent. of methane with air have to be passed hundreds of times over a red-hot wire before combustion is complete, but that if 20 c.c. of electrolytic gas are added to 50 c.c. of the mixture, a single explosion suffices. By the latter method an examination of air containing fire-damp accurate enough for ordinary purposes can be carried out in 10 minutes.—W. A. C.

Patents.

Fuel. T. Parker, London. Eng. Pat. 14,365, June 22, 1906.

See U.S. Pat. 865,724 of 1907; this J., 1907, 1078.—T. F. B.

Reducing the consumption of power in repeated creations of vacua; Method of —— *applicable to the production of peat fuel.* F. Fritz. Eng. Pat. 21,321, Sept. 26, 1906. *See* I.

Fuel; Artificial ——, *and method of making the same.* D. Drawbaugh, Eberlys Mill, and B. E. Gamble, Bowmansdale, Assignors to The Drawbaugh Artificial Fuel Co., Harrisburg, Pa. U.S. Pat. 867,915, Oct. 8, 1907.

See Fr. Pat. 375,336 of 1907; this J., 1907, 956.—T. F. B.

Briquettes [from paper-makers' waste]; Compressed —— *for fire-lighters, heating, &c., and process for their manufacture.* Comp. Française des Crocidolites. Fr. Pat. 378,169, May 25, 1907.

Incombustible fibrous waste from paper works is treated with zinc chloride and dried in the air. It is then mixed with 15 or 20 per cent. of coke dust and about 8 per cent. of sodium silicate, and after moulding and drying, the briquettes are saturated with petroleum and coated with a thin layer of boiled linseed oil and again dried.
—W. H. C.

Compound alcohol to replace mineral spirit for all kinds of explosion motors. A. M. A. Mabille. Fr. Pat. 378,518, June 6, 1907.

The claim is for the use of an alcoholic solution of phosphorus as a motor fuel. The phosphorus is dissolved in the alcohol by the aid of a mixture of carbon bisulphide and benzine.—W. H. C.

Hydro-oxygen gas; Method of producing —— and apparatus therefor. A. Lang and H. F. Smith, Philadelphia, U.S.A. Eng. Pat. 16,351, July 19, 1906.

See U.S. Pats. 833,346 and 833,399 of 1906; this J., 1906, 1083.—T. F. B.

Power-gas producers. Mason's Gas Power Co., Ltd., A. Hollis, and T. Wright, Manchester. Eng. Pat. 20,484, Sept. 15, 1906.

Gas-outlet openings are provided in the wall of the producer at intervals all the way round, at a level below the surface of the fuel, the gas passing out into an annular belt-like chamber on the exterior, from which it passes to the scrubbing plant. For convenience of access to the openings in the producer wall, a corresponding series of ports, closed normally by cover-plates, is provided in the annular chamber.—H. B.

Generating combustible gas; Method of ——, and apparatus therefor. B. H. Thwaite, London. Eng. Pat. 26,819, Nov. 26, 1906.

Two producers are arranged side by side, with a communicating flue at a point about one-third of the height of the fuel column in each; or a single producer may be used, divided into two compartments by a partition wall having an archway opening at the level stated. The gas-outlet pipes from both combustion chambers communicate with a single outlet main, fitted with a butterfly-valve by means of which the two outlet pipes can be shut off alternately. A blast of air is admitted at the base of both chambers continuously. The plant is so operated that, when one chamber is freshly charged with fuel, its gas-outlet is shut off by means of the valve, and the tarry, dusty gases are compelled to flow into the adjoining chamber, passing upwards through two-thirds of the column of incandescent fuel therein. The reversals of the butterfly-valve correspond with the alternate chargings of fuel.—H. B.

Coal and other carbonaceous materials; Distillation of ——. T. Parker. Fr. Pat. 378,621, June 8, 1907. Under Int. Conv., Jan. 25, 1907.

A coke-oven of the bee-hive, cupola, or longitudinal type, which is designed for the production of partly-carbonised fuel in the manner described in an earlier French patent of Dec. 27, 1906, is provided at various points with tuyères for the admission of air, steam, and gas, under pressure, to enable the temperature of the charge to be regulated at various points independently. —H. B.

Calcium carbide; Improved charge of ——, and method or process for making the same. G. Weinmann, Zürich. Eng. Pat. 4728, Feb. 26, 1907.

Powdered calcium carbide is mixed with tarry matter (1—6 per cent.) and the mixture is compressed into pellets of globular or like form.—H. B.

Gas purifiers. H. Green, Preston. Eng. Pat. 25,469, Nov. 12, 1906.

The top of a purifier, of the kind in which a removable cover has to be fastened down gas-tight with the aid of a compressible (rubber) gasket, is, according to this specification, provided with a temporary water-seal round the cover at the time of making the joint, whereby any leakage of gas would be revealed, and the gasket need not be compressed more than is necessary to render the joint effective.—H.B.

Calorific value of gases and gaseous mixtures for gas-engines, furnaces, etc.; Continuous process of determining the ——. A. F. Adam. Fr. Pat. 378,508, June 5, 1907.

The process consists in drawing off continuously, or at very close intervals, small quantities of the gaseous mixture fed to the gas-engine, furnace, etc., and burning the same in a burner which heats a thermo-couple connected to a galvanometer, the indications of the latter varying with the calorific value of the mixture.—H. B.

Filaments for lighting and heating by gas or by electricity in the open air; Process and apparatus for the continuous manufacture of ——. G. Michaud and E. Delasson. Fr. Pat. 378,665, June 10, 1907.

Alumina, magnesia, lime or silica, either alone or mixed together, are made into a paste with brown soap, along with oxides of thorium, cerium, or the like; the paste is extruded into threads, which are passed down through an infusible tube (made of carborundum) arranged close to two electric arcs; and the calcined, vitrified filament, on emerging from the tube, is cut into suitable lengths, which are used for making incandescence bodies for gas-lighting. If the filament is to be used for electric lighting in the open air, it is provided with a conducting core of carbon, the pipe from which the original thread is extruded having two concentric openings, the outer one delivering the oxide paste mentioned above, whilst the other delivers a paste composed of sugar-charcoal and brown soap. —H. B.

Refractory conductors for electric lamps, furnaces or other apparatus. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 19,398, Aug. 30, 1906.

Pure graphite, which may be prepared by heating in an electric furnace the lampblack obtained from volatile hydrocarbons, is ground, sifted, and mixed with a carbonaceous binding agent such as glucose, caramel solution, or waxes, to form a plastic mixture. This is squirted or otherwise formed into filaments which are heated to 400° C. to carbonise the binder. The filaments are next packed in powdered graphite and heated in an electric furnace to 3000—4000° C., or they may be graphitised in the vacuum furnace described in Eng. Pat. 20,809 of 1904 (this J., 1905, 976). The filaments are finally mounted on wires and heated in a vacuum by means of a current.—A. T. L.

Electric conductors of refractory metal for use as incandescing bodies in electric lamps and other apparatus. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 21,505, Sept. 28, 1906.

Filaments are made of tungsten, or other metals ordinarily obtained in the non-ductile form, by heating a thread formed from the oxide and a carbonaceous binder, in a reducing atmosphere under diminished pressure. A suitable mixture consists of 39·8 parts of tungsten trioxide, 1·2 parts of glucose, 1 part of starch, and 3 parts of glycerin. This mixture is squirted, and the threads wound on a form and baked in a muffle at 150° C. for 10 minutes to dry and stiffen them. The filaments, mounted on a graphite form covered with pure tungsten, are next carbonised at 300° C. for 10 minutes in a muffle, and then placed in a graphite crucible and fired in the furnace described in Eng. Pat. 20,809 of 1904 (this J., 1905, 976) in an atmosphere of hydrogen at 20 mm. pressure. The temperature is brought rapidly above that at which carbon reduces tungsten oxide, and is kept at about 1200° C. for half-an-hour. The hydrogen is then pumped out, and the temperature kept at about 2200° C. for an hour. The filaments may be mounted directly in the lamps, or they may first be shrunk by heating *in vacuo* or in an inert gas by means of a current. The filaments appear to be free from carbon; the consumption is stated to be 0·3 watt per candle.—A. T. L.

Electric conductors of refractory metals; Manufacture of ——. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 21,509, Sept. 28, 1906.

Conductors of tungsten or other refractory metal, suitable for lamps, furnaces, and the like, are made by a process, which is an improvement on that described in Eng. Pat. 12,163 of 1902 (this J., 1903, 691) for vanadium, tantalum, and niobium. The tungsten is mixed with glucose and sufficient tungsten trioxide to oxidise all the carbon present, and the mixture squirted or pressed into shape, and heated in a vacuum furnace to about 1300° C., the exact temperature depending on the composition and previous treatment of the mixture. The metallic bodies obtained may be machined without disintegrating, and are finally hardened and strengthened by heating above 1600° C. in an electric furnace. They may be obtained hard enough to resist filing and drilling.—A. T. L.

Electrodes for arc lamps and methods of making the same. The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y. Eng. Pat. 21,510, Sept. 28, 1906.

A small proportion of sodium fluoride is added to electrodes for flame arcs, such as those described in Eng. Pats. 7298, 7299, and 14,196 of 1904 (this J., 1905, 491 and 611). In the case of a magnetite electrode, 0·25 per cent. of sodium fluoride is added. The effect is to steady the arc; pitting of the electrode and wandering of the arc are prevented. If too much fluoride be added, the arc lifts intermittingly, causing variation in the light.
—A. T. L.

Tungsten: Process and apparatus for the treatment of metallic ——, and for the manufacture of electric lamp filaments therefrom. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 21,513, Sept. 28, 1906.

It has been found that tungsten becomes so ductile when heated that it may be worked into any desired form. To utilise this property, ordinary non-coherent tungsten powder is first consolidated by, for example, compressing it into rods, subjecting these to heat in a vacuum, and compressing them at a red heat; or by mixing it with tungstic oxide and a binding material, forming the mixture into rods, heating the latter *in vacuo* at about 1000° C., and then heating them by means of an electric current for several hours to near the melting point. The consolidated metal can then be worked at a dull red heat into any desired form, preferably in a vacuum or inert atmosphere to minimise oxidation. For drawing it into thin filaments, a suitable apparatus consists of a closed chamber, containing a die and provided with means for passing an electric current through the portion of tungsten being operated upon.—H. B.

Electric incandescent lamps having metal filaments; Impts. in and in the manufacture of ——. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 21,669, Oct. 1, 1906.

In making a lamp with a filament of refractory metal, which is produced by heating a thread composed of a mixture of the metal and a vaporisable inorganic binder, the thread is pasted to the leading-in wires and loop-supports by means of a paste composed of a mixture of refractory metal and a vaporisable inorganic binder. Preferably the thread and paste are composed of the same metal and binding ingredients.—H. B.

Metallic incandescing bodies for electric lamps; Manufacture of ——. The British Thomson-Houston Co., Ltd., London. From the Allgem. Elektricitäts-Ges., Berlin. Eng Pat. 24,236, Oct. 30, 1906.

Water-gas, previously freed from carbon dioxide, is used, in place of hydrogen or a hydrogen-nitrogen mixture, for treating filaments in a reducing atmosphere. The conductivity of carbon monoxide is considerably less than that of hydrogen, so that the required temperature is obtained with less current.—A. T. L.

Electrodes for arc lamps and method of making the same. W. S. Weedon, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 867,456, Oct. 1, 1907.

See Eng. Pat. 26,921 of 1904; this J., 1905, 491.—T. F. B.

Filaments employed in incandescence electric lamps; Machine for calcining ——. J. M. Canello. Fr. Pat. 378,641, June 8, 1907. Under Int. Conv., Aug. 27, 1906.

The thread of cotton or nitrocellulose, previously impregnated with nitrates of the rare earths, passes from a bobbin downwards between two rubber-covered rollers, and then moves forwards alternately behind and before a series of rotating, grooved, pipe-clay cylinders, without any other traction than its own weight and the movement of the cylinders. During its passage it is led over the chimney of a gas burner, where the calcination is begun. It is then led through the oxy-hydrogen flame to complete the calcination.—H. B.

Photometer for testing the luminous power of electric lamps. G. Bartel. Eng. Pat. 13,062, June 5, 1907. *See* XXIII.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum, Galician; Chemical composition of ——. R. Zaloziecki and J. Hausmann. Z. angew. Chem., 1907, 20, 1761—1767.

The lower fractions (b.p. up to 150° C.) of the crude oils are very rich in aromatic hydrocarbons, in which respect they resemble Roumanian oil, and form with the latter a group differing from Russian, American, German and Indian oils. Up to the present the authors have not established any connection between the aromatic hydrocarbons and the other constituents, except that the former seem to vary directly with the amount of paraffin present. The Pagorzany, Boryslaw, and Wankowa oils, which are richest in paraffin, also yield the largest proportion of nitro-products, but, owing to the varying yield of the several fractions by the different crude oils, the figures have merely a relative value.—C. S.

Petroleum in Roumania. Board of Trade J., Oct. 24, 1907. [T.R.]

H.M. Minister at Bucharest has forwarded the following memorandum on the development of the petroleum industry in Roumania:—

From 1882 till 1897 the production of petroleum increased from 19,000 to 79,000 tons, while from 1898 to 1906 it rose from 106,470 to 887,554 tons, and the first six months of the current year show a total of 555,482 tons. Roumania thus now comes fourth on the list of petroleum-producing countries after the United States, Russia, and the Dutch Indies. This rapid development has gradually attracted foreign capital, the amount of which is now close upon £7,750,000. The exploitation of petroleum is at present confined to the four districts of Prahova, Dambovitza, Buzeu and Bacau. The fields of the Prahova valley supply 95 per cent. of the total, but there are other petroliferous regions as yet unexplored, the greater part of which belong to the State. At the end of 1906 there were 451 sounds and 591 hand-wells at work, the production of the former representing 92 per cent. of the total. The depths at which the oil is reached vary from 500 to 1,800 feet, but about 900 feet is the average. The average monthly production of a sound is estimated at 150·8 metric tons, and that of a hand-well at 9·9 metric tons. The transport from the oil-fields to the refineries is carried on by means of tank waggons or pipe lines, of which there are at present 22½ miles. The road and rail communications with the oil fields are insufficient, and one of the projects of the Government is to double the railway line leading to Campina (Prahova). In various stations and at the ports on the Danube, reservoirs capable of holding 100,000 tons have been erected for storing the oil. In Constantza, the principal outlet to the sea, special reservoirs have also been constructed, fitted with the latest appliances for shipping the oil, &c. When the works now in progress are completed, it is calculated that 100,000 tons can be shipped annually from that port. There are a number of refineries, capable of producing together 3,300 tons a day. The principal products derived from Roumanian petroleum are benzine, lamp oil, lubricating oil, paraffin and "Pacura," made of the residues, and now used on nearly all Roumanian railways and steamers instead of wood and coal as heretofore. The export of oils, which in 1897 amounted only to 21,387 tons, of a value of £42,764, rose in 1906 to 321,119 tons, worth £1,045,553; the increase is largely due to illuminating oil and benzine.

Petroleum products : U.S. Customs decision. [T.R.]

Free entry was claimed on an importation of paraffin wax produced in Scotland from petroleum, on the ground that the country of production does not impose a duty upon like products from the United States. On the authority of United States vs. Downing (T. D. 27,025), which was followed by the Board in Bergeresch's case, G. A. 6405 (T. D. 27,507), the protest was sustained and the collector directed to reliquidate the entry accordingly.

Asphaltum and bituminous rock ; Production of —— in the United States. U.S. Geol. Survey, 1906. [T.R.]

The production of asphaltum in the United States in 1906 amounted to 138,059 short tons, valued at $1,290,340, as against 115,265 short tons, valued at $758,153, in 1905. The production of the several varieties in 1906 is shown in the following table, the quantities being short tons :—

	Quantity.	Value.
Bituminous sandstone	24,085	$70,686
Mastic	2,543	24,158
Hard and refined, or gum	24,178	341,106
Liquid or maltha	9,900	86,750
Wurtzilite and Gilsonite	12,947	159,960
Grahamite	1,952	16,432
Oil asphaltum....................	62,454	591,248
	138,059	$1,290,340

The great increase in the production of hard and refined asphaltum in 1906 over that of 1905, which amounted to only 3036 short tons, is due chiefly to the new refinery development in Texas, although the production of this variety in California in 1906 (8178 short tons) is 100 per cent. in advance of the total for 1905. In the production of oil asphaltum California stands almost alone, producing 62,361 short tons of the total quantity, and showing a substantial increase over the production for 1905. A very small output is reported from Texas. About two-thirds of the asphaltum imported into the United States comes from Trinidad.

Patents.

Saturators used in the manufacture of sulphate of ammonia. P. E. Williams, Leytonstone, and R. L. Fenner, London. Eng. Pat. 25,547, Nov. 13, 1906.

A distributing pipe, conveying steam, ammonia, etc., is fixed externally to the saturator and communicates with it by means of a number of symmetrically placed, short connecting pipes. In this way the sulphate is formed equally throughout all parts of the acid liquor, and incrustations are avoided.—O. R.

Ammonia ; Transformation of the nitrogen of peat into ——. M. L. Gaillot and P. Brisset. First Addition, dated May 21, 1907, to Fr. Pat. 375,972, March 15, 1907. *See* XV.

Hydrocarbons ; Transformation of ——. E. A. L. Rouxeville. First Addition, dated Aug. 4, 1906, to Fr. Pat. 356,716, Aug. 7, 1905 (this J., 1906, 83).

The addition relates to the use of various polymerising reagents in the principal process and to methods of treating and separating the products obtained.—W. H. C.

Rectifying apparatus for spirit, petroleum, and other volatile bodies. Comp. Industrielle des Pétroles. Fr. Pat. 378,695, June 11, 1907. *See* I.

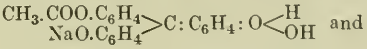
IV.—COLOURING MATTERS AND DYESTUFFS.

Amines and para-diazoimides ; Interactions of ——. G. T. Morgan and F. G. Micklethwait. Chem. Soc. Trans., 1907, **91**, 1512—1518.

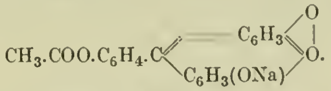
It is found that certain aminoazo-compounds can be produced directly by the action of para-diazoimides on the more reactive amines. The reaction does not take place with aniline and its homologues and alkyl derivatives, nor with dialkylnaphthylamines, but proceeds quantitatively with the naphthylamines and the more reactive meta-diamines, such as 2 : 4-tolylenediamine, and also, though less readily, with monoalkylnaphthylamines. The production of a number of aminoazo-compounds in this way is described. In several instances where interaction could not be effected, the aminoazo compound could be obtained by combining the base, generally a tertiary amine, with the corresponding diazonium chloride instead of the diazoimide, the operation being carried out in aqueous solution, and sodium acetate, or an alkali, or excess of the amine being added to neutralise the hydrochloric acid liberated in the reaction.—A. S.

Phenol- and quinol-phthaleins ; Constitution of the salts of ——. A. G. Green and P. E. King. Ber., 1907, **40**, 3724—3734.

The scarlet compound previously described as the methyl ester of phenolphthalein (see this J., 1906, 749) was actually the chloride of the ester. The free ester, when quite neutral, is much more stable than the chloride. It was obtained by passing dry hydrochloric acid gas through a mixture of a solution of 4 grms. of phenolphthalein in 30—40 c.c. of methyl alcohol and 50 grms. of 100 per cent. sulphuric acid, and heating under a reflux condenser for 1 hour. The deep red solution was allowed to stand overnight and then dropped slowly into an excess of an ice-cold solution of ammonia. The dark red precipitate was collected, washed with ammonia solution, dried in the exsiccator, and triturated two or three times with anhydrous ether, whereby it acquired a deep yellow colour, and some phenolphthalein separated. On evaporating the ether solution, the ester was obtained as a bright orange-red, vitreous substance, which, in the exsiccator, was transformed into orange-coloured prismatic needles. On treating its alcoholic solution with hydrochloric acid, a scarlet coloration is produced, owing to the formation of the hydrochloride, but on standing, the ester is hydrolysed, with formation of phenolphthalein, and the colour gradually disappears. The ester dissolves without decomposition in alkalis, with a violet-red coloration, but is gradually hydrolysed on allowing the solution to stand. Quinolphthalein methyl ester behaves in a similar manner towards alkalis. The coloured alkali salts of the two esters are represented by the following formulæ :—

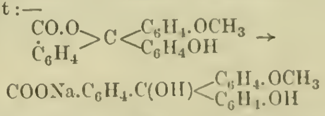


$$\begin{matrix}CH_3.COO.C_6H_4\\NaO.C_6H_4\end{matrix}\!\!>\!C:C_6H_4:O\!<\!\!\begin{matrix}H\\OH\end{matrix}\quad\text{and}$$



In the coloured alkali salts of the phthaleins themselves, the methyl groups would be replaced by alkali metal. This view of their constitution is in accord with the fact that the ester salts are not affected by alcohol or excess of alkali, whereas the salts of the phthaleins become colourless. Owing to its stability in presence of alcohol and excess of alkali, the methyl ester is a much better indicator than phenolphthalein itself in alkalimetry, especially when, *e.g.*, in soap analysis, titration is effected in alcoholic solution.

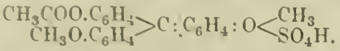
The authors prepared the lactoid mono- and dimethyl esters of phenolphthalein and quinolphthalein, and find, contrary to Meyer and Spengler (Ber., 1905, **38**, 1328), that these do not form coloured salts with alkalis. The pure lactoid monomethyl ester of phenolphthalein melts at 148°—149° C., and then solidifies to a vitreous mass, which on again heating, melts at 80° C. By the action of alkalis, it is probably converted directly into the colourless carbinol salt :—



$$\begin{matrix}CO.O\\\dot{C}_6H_4\end{matrix}\!\!>\!C\!<\!\!\begin{matrix}C_6H_4.OCH_3\\C_6H_4OH\end{matrix}\rightarrow$$

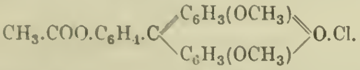
$$COONa.C_6H_4.C(OH)\!<\!\!\begin{matrix}C_6H_4.OCH_3\\C_6H_4.OH\end{matrix}$$

The lactoid monomethyl ester of quinolphthalein melts at 107°—109° C. Monomethylphenolphthalein methyl ester, the chlorides of monomethylquinolphthalein and its methyl ester, and the quinonoid methyl esters of dimethylphenolphthalein and dimethylquinolphthalein were also prepared, the two last-named in the form of salts. The sulphate of dimethylphenolphthalein methyl ester.



$$\begin{matrix}CH_3COO.C_6H_4\\CH_3O.C_6H_4\end{matrix}\!\!>C:C_6H_4:O\!<\!\!\begin{matrix}CH_3\\SO_4H.\end{matrix}$$

is decomposed slowly by cold water, rapidly by alcohol and alkalis, with separation of the lactoid dimethyl ester. The chloride of dimethylquinolphthalein methyl ester is easily soluble in water, and is more stable than the phenolphthalein derivative. This is best expiained by the assumption that it is an oxonium salt of orthoquinonoid structure,

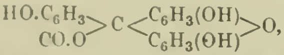


$$CH_3.COO.C_6H_4.C\!\!\begin{matrix}\nearrow C_6H_3(OCH_3)\searrow\\ \searrow C_6H_3(OCH_3)\nearrow\end{matrix}\!\!O.Cl.$$

The study of these compounds has confirmed the view that there is a strict parallelism between the esters and salts of phenolphthalein and quinolphthalein, and those of fluorescein.—A. S.

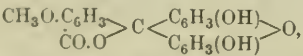
Fluoresceins and eosins from 4-hydroxyphthalic, 4-methoxyphthalic, and hemipinic acids. A. Friedl, C. Weizmann, and M. Wyler. Chem. Soc. Trans., 1907, **91**, 1584—1588.

HYDROXYFLUORESCEIN,



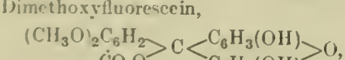
$$\begin{matrix}HO.C_6H_3\\CO.O\end{matrix}\!\!>C<\!\!\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}\!\!>O,$$

prepared by the interaction of resorcinol and 4-hydroxyphthalic acid, was obtained as a red powder, which melts at about 350° C. and dissolves in alkalis to slightly fluorescent, orange-yellow solutions, and in sulphuric acid to a canary-yellow, fluorescent solution. The corresponding hydroxyeosine is orange-coloured, and melts indefinitely at 200° C. Its red alkaline solutions show very little fluorescence. It dyes chrome-mordanted wool a bluer shade than does eosine. Methoxyfluorescein,



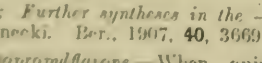
$$\begin{matrix}CH_3O.C_6H_3\\CO.O\end{matrix}\!\!>C<\!\!\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}\!\!>O,$$

from 4-methoxyphthalic anhydride and resorcinol, is a red powder, which melts at about 300° C.; its yellow alkaline solutions are intensely fluorescent, but its solutions in acetic and sulphuric acids and in alcohol are pale yellow and only slightly fluorescent. Methoxyeosine, an orange-red powder melting indefinitely above 200° C., dissolves in sulphuric acid to a yellow solution, and to red, intensely fluorescent solutions in alkalis. It dyes chrome-mordanted wool a yellower shade than does eosine. Dimethoxyfluorescein,



$$\begin{matrix}(CH_3O)_2C_6H_2\\CO.O\end{matrix}\!\!>C<\!\!\begin{matrix}C_6H_3(OH)\\C_6H_3(OH)\end{matrix}\!\!>O,$$

from hemipinic anhydride and resorcinol, is a yellowish-brown powder melting indefinitely at 280° C. Its yellowish-brown alkaline solutions are only moderately fluorescent. Dimethoxyeosine forms a red powder which decomposes at 250° C. It gives a slightly fluorescent, red solution in alkalis, and a yellow solution in sulphuric acid. It dyes chrome-mordanted wool a yellower shade than does eosine. *a*-Naphtholresorcinolphthalein anhydride,



$$\begin{matrix}C_6H_4\\CO.O\end{matrix}\!\!>C<\!\!\begin{matrix}C_6H_3(OH)\\C_{10}H_6-\end{matrix}\!\!>O,$$

was prepared from resorcinol and hydroxynaphthoylbenzoic acid in presence of sulphuric acid. It shows a strong resemblance to hydroxyfluorescein in some of its properties, and especially in its fluorescence, and it appears therefore that the elimination of a hydroxy-group from fluorescein itself has merely the same effect as the introduction of a hydroxy-group into the phthalic acid nucleus of fluorescein.—A. S.

Flavone series; Further syntheses in the ——. St. von Kostanecki. Ber., 1907, **40**, 3669—3677.

2-Hydroxy-4′-isopropylflavone.—When quinacetophenone monomethyl ether is treated with cuminol in the presence of alcohol and a 50 per cent. solution of sodium hydroxide, 2-methoxy-4′-isopropylflavanone is obtained, which crystallises from alcohol in leaflets, m.pt. 90° C., and forms an *a*-bromine derivative separating from glacial acetic acid in white needles, m. pt. 125°—127° C. Debromination of the latter with potassium hydroxide in alcoholic solution leads to the formation of 2-methoxy-4′-isopropylflavone, which crystallises from alcohol in white leaflets, m. pt. 135° C., and furnishes 2-hydroxy-4′-isopropylflavone, when boiled with hydriodic acid. The latter compound separates from alcohol in light yellow spear-shaped crystals, m. pt. 182°—183° C. It gives with concentrated sulphuric acid a yellowish solution with bluish-green fluorescence, and with dilute sodium hydroxide a yellow solution. *3-Hydroxy-4′-isopropylflavonol.*—The condensation of paeonol with cuminol gives rise to the formation of 2′-hydroxy-4′-methoxy-4-isopropylchalkone, which crystallises from alcohol in yellow leaflets, m. pt. 104° C., and yields a yellow solution with concentrated sulphuric acid. For its conversion into 3-methoxy-4′-isopropylflavanone, its alcoholic solution is boiled with dilute hydrochloric acid. The resulting product forms colourless prisms, m. pt. 75° C., and yields the corresponding flavonol when boiled in alcoholic solution with amyl nitrite and hydrochloric acid. The latter crystallises in yellow, glistening leaflets, m. pt. 201° C., and furnishes 3-hydroxy-4′-isopropylflavonol when demethylated with hydriodic acid. It separates from alcohol in almost colourless leaflets, m. pt. 243° C., dissolves in dilute sodium hydroxide solution with a greenish-yellow colour and green fluorescence, and dyes yellow on an alumina mordant. *3.4-Dihydroxy-4′-isopropylflavonol.*—When gallacetophenone dimethyl ether is treated with cuminol in the presence of alcohol and a 50 per cent. solution of sodium hydroxide, 2-hydroxy-3′.4′-dimethoxy-4-isopropylchalkone is obtained, which crystallises from alcohol in yellow leaflets, m. pt. 114° C., and furnishes 3.4-dimethoxy-4′-isopropylflavanone on prolonged boiling with hydrochloric acid in alcoholic solution. This crystallises from ether and alcohol in white granular crystals, m. pt. 92° C. Its *a*-isonitroso-derivative dyes yellow on a cobalt mordant, and furnishes 3.4-dimethoxy-4′-isopropylflavonol, when treated with mineral acids. The latter compound crystallises from alcohol in pale yellow needles, m. pt. 162° C., and dyes light yellow on an alumina mordant. Demethylation with hydriodic acid leads to the formation of 3.4-dihydroxy-4′-isopropylflavonol, which crystallises from alcohol in silvery leaflets, m. pt. 265° C. It is readily soluble in dilute sodium hydroxide solution with an orange colour, and dyes yellow on an alumina mordant. *4′-Isopropyl-a-naphthoflavonol.*—On treating 2-aceto-1-naphthol with cuminol, 2-cuminalaceto-1-naphthol is obtained, crystallising from alcohol in orange-red prisms, m. pt. 98° C., and yielding a red solution with concentrated sulphuric acid. The acetyl derivative separates from alcohol in pale yellow prisms, m. pt. 88°—89° C. For the conversion of the naphthol into 4′-isopropyl-*a*-naphthoflavanone, its alcoholic solution is boiled with hydrochloric acid. The product crystallises from alcohol in colourless prisms, m. pt. 134°—135° C., and furnishes the corresponding flavonol, when subjected to the action of amyl nitrite and hydrochloric acid. The latter separates from alcohol in pale yellow needles, m. pt. 211°—212° C. —D. B.

Titanium trichloride in volumetric analysis. E. Knecht and E. Hibbert. *See* XXIII.

PATENTS.

Sulphurised dyestuffs; Manufacture of concentrated liquid dyestuffs or easily liquefiable pastes from ——. O. Imray, London. From Farbw. vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 22,872, Oct. 16, 1906.

THE press-cake, containing about 25 per cent. of the isolated sulphurised dyestuff, is mixed with sodium sulphide, with or without the further addition of water. The dyestuff goes into solution and the mixture is evaporated in a vacuum or under diminished pressure, until the desired consistency is obtained.—F. M.

Anthracene series; Manufacture of compounds [dyestuffs] of the ——. J. Y. Johnson, London. From the Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 29,750, Dec. 31, 1906.

By treating 1-acetylaminoanthraquinone, or one of its halogen derivatives, with an acid chloride, such as phosphorus oxychloride, new compounds are obtained which can be converted into dyestuffs by heating them either alone, or in the presence of some suitable condensing agent. The above-mentioned new compounds possess weak basic properties and are much less soluble in organic solvents than the acetylaminoanthraquinone compounds from which they are prepared. Their solutions in sulphuric acid have a red colour.—P. F. C.

4-Nitro-2-chlorodiphenylamine and its derivatives; Manufacture of ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 1946, Jan. 25, 1907.

See Fr. Pat. 373,885 of 1907; this J., 1907, 756.—T. F. B.

Diphenylamine; Manufacture of —— and of derivatives thereof. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 2766, Feb. 4, 1907.

See Fr. Pat. 374,385 of 1907; this J., 1907, 756.—T. F. B.

Colouring matters of the thioindigo group; Manufacture of ——. G. W. Johnson, London. From Kalle und Co., Biebrich on Rhine, Germany. Eng. Pat. 11,609, May 17, 1907.

See Fr. Pat. 378,406 of 1907; this J., 1907, 1083.—T. F. B.

Vat dyestuffs; Halogenated —— dyeing like indigo. Soc. pour l'Ind. Chim. à Bâle. First Addition, dated Mar. 23, 1907 (Under Int. Conv., Feb. 25, 1907), to Fr. Pat. 372,627, Dec. 17, 1906. (See U.S. Pats. 848,354–6 of 1907; this J., 1907, 466—467.)

By condensing indoxyl with isatine, indirubine is obtained which dyes cotton in an alkaline vat in pale lilac shades which are, however, not fast even to washing. It is now found that the introduction of halogens into the indirubine molecule alters the properties of the dyestuff most markedly, so that cotton is dyed in the vat in heliotrope and violet shades which are strong and bright and of good fastness. Bromine is the halogen best suited to the purpose, and the substitution may be carried out as follows:—3 parts of indirubine, 30 parts of nitrobenzene, and 3·6 parts of bromine are well mixed and the mixture allowed to stand for 24 hours at the ordinary temperature; it is then heated in an oil-bath at 130—140° C. for 3—4 hours and after cooling, it is filtered, washed with alcohol, and the residue dried. The product dissolves in fuming sulphuric acid with a violet colour, changing to reddish-violet on dilution with water; this sulphonic acid derivative dyes wool in bright lilac shades. The new dyestuff when treated with alkaline reducing agents dissolves with a clear yellow colour, and unmordanted cotton is dyed in the vat in clear violet shades, fast to washing and chlorine. Among the interesting dyestuffs prepared in this way are those derived from Thioindigo Red; with 5 parts of thioindigo, 50 parts of nitrobenzene and 16—18 parts of bromine, a product is obtained giving a vat of a clear yellow colour, in which unmordanted cotton is dyed reddish-bordeaux, the shades being fast to washing, light, and chlorine.—F. M.

Indophenols; Manufacture of condensation products similar to ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 378,655, June 8, 1907.

Quinonechlorimides and quinonedichlordiimides react (in the dry state or in paste form) with phenols or aromatic amines, with or without the assistance of a condensing agent, and yield products very similar to the indophenols. These products may be obtained directly in the dry, solid form and are more stable than indophenols obtained by the usual methods. The condensation takes place when the chlorimides are ground together with the phenols or amines (heat being generated), but in the case of the dichlordiimides, it is sometimes necessary to apply gentle heat, to assist the reaction. Diluents such as common salt or sodium sulphate may be added to the mixture, as well as mild condensing agents such as sodium carbonate, oxalic acid, etc. The compounds obtained are reduced to leuco bodies by treatment with sodium sulphide, and may serve as starting points in the manufacture of sulphide dyestuffs. *Example.*—Powder and mix well 100 parts of α-naphthol, 72 parts of calcined sodium carbonate and 330 parts of common salt. Then add, little by little, 100 parts of quinonechlorimide and grind in a ball-mill until all the quinonechlorimide has been brought into reaction. The inorganic salts are removed by washing with water. The residue dissolves in caustic soda solution with a deep blue colour; in alcohol it gives a cerise-red and in concentrated sulphuric acid a deep olive-green coloured solution.—F. M.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Diazo-solutions; Neutralisation of acid ——. F. Erban and A. Mebus. Chem.-Zeit., 1907, **31**, 1011—1014. (See also this J., 1907, 819,866.)

The authors record the colour changes produced in various diazo-solutions containing: (1), hydrochloric, and (2), sulphuric acid by titration with sodium carbonate and sodium hydroxide, using methyl orange as indicator. In each case to 0·1 grm.-mol. of base, was used 0·107 grm.-mol. of sodium nitrite and 0·4 grm.-equivalent of acid. It was found that with many bases a change in the colour of the methyl orange took place even when more than one equivalent of free acid was present. A distinct change of colour or a turbidity before complete neutralisation of the last equivalent of acid was shown by the diazo-sulphates of the following amines:—

Amine.	Equiv. of alkali used.	Amine.	Equiv. of alkali used.
p-Chloroaniline .	1·4—1·5	Nitrophenetidine	1·7
p-Aminophenol .	1·63	*p*-Toluidine......	1·39
o-Nitroaniline...	1·35—1·63	*o*-Nitro-*p*-toluidine	1·44—1·6
m- ,,	1·4—1·5	*p*- ,, *o*- ,,	1·3
p- ,,	1·4—1·5		

The authors recommend that, in practice, only such quantities of alkali should be used for neutralisation as will not produce these changes, namely, less than the above amounts (to two equivalents of free acid present in the diazo solution), the rest of the free acid being neutralised, when necessary, by sodium acetate.—J. C. C.

Cotton yarn; Method of preparing —— to cause it to resist direct-dyeing cotton colours. J. B. Fothergill. J. Soc. Dyers and Col., 1907, **23**, 251—252.

If cotton yarn be heavily mordanted with tannate of tin (*e.g.*, in successive baths of a 3 per cent. solution of tannic acid, and a 2 per cent. solution of stannous chloride at 30° C.), and then woven along with untreated yarn, so-called "melange" or woven effects can be obtained by dyeing the mixed fabric with direct-dyeing cotton colours, which leave the mordanted yarn practically unaffected. By dyeing first with a basic dyestuff, and then after washing, and, if necessary, a light soaping, with a direct-dyeing dyestuff, "shot" effects are produced, the tannate of tin acting as a mordant for basic dyestuffs. Or, yarn which has been already dyed with basic or other dyestuffs unaffected by weak "tin salt" solutions, *e.g.*, Paranitraniline Red and α-Naphthylamine Bordeaux, may be prepared with the tannate of tin, then woven with unprepared yarn, and dyed with direct-dyeing colours. Although the white obtained is not quite perfect, the process seems specially adapted to flannelette styles where quiet effects are desired.—A. S.

Patents.

Artificial threads; Manufacture of ——. O. Müller, Cologne, Germany. Eng. Pat. 4015, Feb. 18, 1907.

Threads obtained by forcing cellulose solutions through fine orifices into precipitating liquids, are liable to stick together when wound directly upon smooth spools or bobbins, owing to the incomplete removal of the solvent. This drawback is obviated when the threads are cross-wound upon a bobbin which is longitudinally grooved or corrugated, for they are only in contact then, where they cross each other, and a porous reel is produced which is easily penetrated by the washing liquors, the grooved spool permitting these to flow away and ensuring as complete a washing of the threads in the interior of the reel, as of those near the periphery.—F. M.

Denitration of artificial silk on bobbins; Process for the ——. H. Diamanti, P. Loisif and H. Champin. Fr. Pat. 378,143, July 31, 1906.

Bobbins of artificial silk are arranged vertically in a wooden frame which can be inserted as a whole inside an airtight vat. This vat, which may be made of wood or stoneware, is provided with means for placing it in communication with a tank containing the denitrating solution, and also with an exhausting apparatus. A number of vats are worked in series, each being connected to its immediate neighbours. The vats are first exhausted, and the denitrating solution then circulated through the whole series, care being taken that the fresh solution always comes in contact with bobbins which have already been almost completely denitrated.—P. F. C.

Vapours of alcohol and ether contained in air [in artificial silk works, etc.]; Recuperation and recovery of ——. A. Chardonnet. First Addition, dated July 27, 1906, to Fr. Pat. 377,673, July 17, 1906. *See* I.

Cotton; Electrolytic bleaching of ——. A. A. Vogelsang, Dresden, Germany, Assignor to The British Hosiery and Electrolytic Bleaching Co., Ltd., London. U.S. Pat. 867,452, Oct. 1, 1907.

See Eng. Pat. 4017 of 1901; this J., 1902, 612.—T. F. B.

Cotton and ramie slubbing; Process for mercerising and dyeing ——. E. Steiner. Second Addition, dated Mar. 20, 1907, to Fr. Pat. 364,965, April 5, 1906 (this J. 1906, 1042).

In order to obtain a more brilliant effect, the slubbing is twisted before mercerising it.—P. F. C.

Bobbins of slubbing or yarn having supple cores; Process for the preparation of —— *for the purpose of dyeing and other analogous operations.* Soc. Anon. de Teint. et d'Impress. "G. G. Pue" (Anciens Etablis. "Gaydet, Grulos, Pneumatique"). First Addition, dated May 22, 1907, to Fr. Pat. 375,291, Feb. 28, 1907 (this J., 1907, 922).

In order to facilitate the packing of the material inside the dyeing vessel, a metallic tube, preferably perforated, is introduced into the supple core of each wound bobbin. By means of a suitable framework, which is inserted through these tubes, the bobbins are then arranged in columns inside the dyeing vessel. If desired, instead of having a separate tube for each bobbin, a number of bobbins may all be mounted on one long tubular axis.—P. F. C.

Multi-coloured fabrics; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort a/Main, Germany. Eng. Pat. 25,971, Nov. 16, 1906.

Mixed cotton and wool goods are treated with formaldehyde or tannin, or a mixture of the two, and then dyed in a cold or lukewarm bath with sulphide dyestuffs. If preferred, the wool yarn may be treated with formaldehyde or tannin before being woven with the cotton, and the piece afterwards dyed as above. The impregnation with these compounds prevents the absorption of the dyestuff by the wool, the effect of the alkaline solution upon which is minimised by adding glucose or glue to the bath, and giving only a short passage at a temperature of 20—30° C. The cotton being thus dyed, the goods are squeezed and rinsed, and the wool is dyed with acid dyestuffs.—F. M.

Pattern piece goods; Process for producing ——. W. Klingberg, Winterthur, Switzerland. Eng. Pat. 9845, April 27, 1907.

This process consists in coating the pattern threads, before they are woven into the fabric, "with an insulating layer of the protective paste used in calico-printing." After the fabric has been dyed, the insulated threads, which do not take up the colour, are freed from their coating by means of a dilute acid bath.—P. F. C.

Watered effects upon textile fabrics; Apparatus for producing ——. J. Sharp, and S. H. Sharp and Sons, Leeds. Eng. Pat. 21,592, Sept. 29, 1906.

The fabric is subjected to the combined action of pressure and heat, whilst in a damp state, between suitably prepared surfaces. For this purpose a pair of superposed co-acting rollers is mounted in an embossing machine, the surface of the upper roller being cut away so as to leave the desired design in bold relief, whilst the surface of the lower roller is engraved with lines running circumferentially or lengthwise according to the nature of the effect which it is desired to obtain. Either or both of the rollers may be made hollow and heated by gas or steam. The material is exposed to a spraying or damping device whilst passing through the rollers or previous thereto. —P. F. C.

Printing machine; Plate —— *for cloth, threads or paper.* J. Forest et Cie. Fr. Pat. 378,684, June 11, 1907.

The bed of the machine is of wood or metal and above it is a frame carrying the printing blocks; these are in duplicate and are moved from side to side in an arc of a circle by means of levers, fixed at one end, and actuated by a rod working from a radial arm of a wheel, which is in gear with the rollers that draw the material forward. Whilst one printing block is in contact with the material, the corresponding one is taking up colour, from a colour-box let into the bed of the machine. The material is drawn forward over a drying table by rollers, which are so geared that it travels a definite distance during the alternations of the printing blocks, but remains at rest whilst the impression is being received.—F. M.

Steaming textile fabrics; Method of and apparatus for ——. V. Fussgänger, Hoechst a/Main, Germany. Eng. Pat. 6724, Mar. 20, 1907. Under Int. Conv., Mar. 30, 1906.

In the usual form of steamer some little time elapses before the air is completely driven out and the atmosphere of steam is evenly distributed throughout the interior. According to the present invention the interior of the steamer is divided into compartments, by partitions which leave spaces at the top and bottom alternately, the rollers guiding the cloth being placed opposite the free ends of the partitions. By introducing the steam at the point of entry (or of exit) of the cloth, it travels around the partitions and all air is rapidly removed; the cloth enters an air-free steam atmosphere, the effect of which is to reduce the time usually required for steaming printed goods, and the steam is so well utilised that there is a distinct saving in the amount required. The amount of reducing agents in discharge pastes may also be diminished.—F. M.

Finishing soaps; Process for preparing ——. E. Agostini. First Addition, dated Aug. 8, 1906, to Fr. Pat. 361,772, Sept. 16, 1905 (this J., 1906, 1160).

The original patent claims the use as a finishing preparation of mixtures of fats and hydrocarbons with such insoluble soaps as are obtained by the action of fatty acids on aluminium hydroxide. According to the present addition, such finishing preparations are greatly improved by the addition of sizing substances such as animal glue. —P. F. C.

Drying apparatus provided with a recuperating device. P. Turlur. Fr. Pat. 378,247, May 30, 1907.

The material, on entering the machine, is exposed to jets of hot air which are discharged through conical apertures in the walls of a hot air chest, and then travels over a drying drum. It next again traverses the length of the machine, passes over a second drum, and finally travels along the drying chamber for a third time. Whilst the material is in the machine it is constantly exposed to hot air, which is either produced by steam pipes or discharged from hot air chests. The machine is provided with two chimneys for the removal of the moist air. Through one is led the hot air which has been discharged on to the material during the first part of its passage through the drying chamber, and has thereby become saturated with moisture. The second chimney is used for the withdrawal of air, which has been discharged on to the material during the latter part of its journey and is thus comparatively dry. The first chimney is provided with a heat-exchanger composed of two concentric metal tubes, the moist air being led through the inner tube, wherein the steam condenses and warms a current of air which is being forced through the outer tube. Either or both of the two currents of dry warm air thus obtained, may then be mixed with the comparatively dry air which ascends the second chimney and again forced into the hot air chests.—P. F. C.

Treating liquids and apparatus therefor; Method of ——. C. Neff and A. Brandes. Eng. Pat. 12,258, May 27, 1907. *See* I.

Cleaning and disinfecting agent [*for textiles*]; *Manufacture of a liquid* ——. Soc. dite " Centaur " Chem. Techn. Fabr. von. Max Brückner. Fr. Pat. 378,559, May 3, 1907. *See* XVIII*C*.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patent.

Wall papers; Printing of —— *in a single operation.* H. Bürmann. Fr. Pat. 378,680, June 10, 1907.

The usual process of printing demands two operations at least, the printing of the ground and, after drying, the printing of the design. By printing the ground with an oil colour from a smooth roller and using a size or paste colour for the design, the latter may be printed on the undried ground without fear of the colours being blurred or mixing. The oil colour may be let down with oil of turpentine if desired, and the paste colour with glycerin, without affecting their non-miscibility.—F. M.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Salt and bromine in the United States; Production of ——. U.S. Geol. Survey, 1906. [T.R.]

In 1906 the quantity of salt produced in the United States was 3,944,133 short tons, valued at $6,658,350. In 1905 the production was 3,635,257 short tons, valued at $6,095,922. The small average price for 1906, as for 1905, is accounted for by the increase in the quantity of brine used in chemical work without concentration into salt, the average value of the dry salt obtained from this brine being, according to the principal producers, about 5 cents a barrel.

The bromine produced in the United States in 1906 was derived from brine obtained at Midland, Mount Pleasant, and St. Louis, Mich.; Pomeroy, Ohio; Allegheny City, Pa., and Hartford and Malden, W. Va. These four States produced brine containing an equivalent of 1,283,250 pounds of bromine recovered as potassium bromide, valued at $165,204. In 1905 the production was 1,192,758 pounds, valued at $178,914.

The average price per pound in 1906 was 12·8 cents, in 1905, 15 cents. Michigan furnished the greater part of this output, the production from the other States being nearly all by-products from salt works.

The gradual decrease in the value of bromine is accounted for by the imports from Germany. A large quantity of the United States product was exported as the bromides of potassium, sodium, and ammonium.

Sulphur; Combustion of —— *in air and oxygen.* H. Kastle and J. S. McHargue. Amer. Chem. J., 1907, **38**, 465—475.

When sulphur is burnt in oxygen at atmospheric pressure, about 2·76 per cent. is converted into sulphur trioxide. When burnt in air, about 2½ times as much—say 7 per cent.—of the sulphur forms trioxide. The humidity of the gas, and the presence in it of carbon dioxide, appear to have little influence on the proportion of sulphur trioxide formed, whether air or oxygen be used; but the proportion of nitrogen present does affect the yield of trioxide considerably, and it would seem that the nitrogen acts as a carrier of oxygen to the sulphur dioxide, doubtless through becoming oxidised itself in the first instance.
—J. T. D.

Caustic lime; Determination of ——. E. H. Croghan. J. Chem., Metall., and Min. Soc., S. Africa, 1907, **8**, 37—42.

The author analysed 8 white limes and 1 blue lime by the gravimetric method and also determined the caustic lime by the sugar method and by Sutton's " acid " method. He found that the " acid " method gave results only slightly higher than the sugar method for the white limes, but in the case of the blue lime, the large amount of magnesia present caused the " acid " method to give far too high a value, contrary to Sutton's statement that magnesia does not interfere with the method; on the other hand, he found the statement that calcium carbonate is without influence to be correct. In all cases the gravimetric method gave very high results, especially for the blue lime, unless allowance was made for the impurities present, which combine (apparently) with lime to form the compounds, $CaCO_3$, $CaSO_4$, $Ca_3Al_2O_6$ and Ca_4SiO_6. Deducting this combined lime, the error varied from +2·23 to − 1·64 for the white limes, and amounted to − 5·81 per cent. (on the lime) for the blue lime. The author believes the sugar method to be the best.

In the discussion on the paper, McArthur Johnston questioned the existence in the samples of silicates and aluminates of lime. He also prefers the sugar method and does not think that lime suffers much deterioration on keeping. He samples by crushing 10 bags of lime from each truck in a small room with little access of air, bottling off a sample on the spot in an air-tight jar, and mixing this sample further in the jar.—A. G. L.

Aluminium powder; Action of —— *on silica and boric anhydride.* F. E. Weston and H. R. Ellis. Trans. Faraday Soc., Oct. 29, 1907. [Advance proof.]

The authors confirm Goldschmidt's statement that boric anhydride and silica are reduced by aluminium to boron and silicon respectively; but the boron is difficult to isolate and the method is not to be recommended. In the proportion, Al_2 to B_2O_3, reaction occurs with the production of alumina, boron, and borides of aluminium, which last predominate, but in the proportion, Al_2 to $2B_2O_3$, the chief product is boron. The readiness with which the reaction proceeds depends on the proportions used and the fineness of the powders. Kieselguhr and precipitated silica, in the proportion, 8Al to $3SiO_2$, can be made to react in the cold by means of a fuse of magnesium ribbon and barium peroxide: in the case of sand, preliminary heating to redness is required. The presence of the reduced element may, in each case, be shown by the formation of its chloride, when the product is heated in a stream of chlorine.—F. Sodn.

Phosphoric acid; Quantitative volatilisation of —— from its salts in a current of chlorine containing carbon tetrachloride. P. Jannasch and W. Jilke. *See* XXIII.

Patents.

Gases from pyrites burners; Purifying —— [for use in the manufacture of sulphuric acid by the contact process]. G. Eschellmann and Ges. der Tentelewschen Chem. Fabr., St. Petersburg. Eng. Pat. 12,213, May 27, 1907.

The gases are led through a dust chamber having many compartments, thence into cooling apparatus, in which the greater part of the acid mist condenses and is continuously run off, and are then caused to pass in an upward direction through a coke-filter, the grains of which decrease in size from bottom to top, and subsequently in a downward direction through a fine-grained "finishing" coke-filter. The gases are finally washed with a weak solution of an alkali hydroxide, or with a weak milk of an alkaline-earth, and are dried in the usual manner. (See also Eng. Pats. 15,948 of 1898, and 3327 of 1901; this J., 1899, 831, and 1902, 407.)—E. S.

Sulphuric acid; Manufacture of —— [by contact process]; and apparatus for separating sulphuric acid. F. G. Cottrell, Berkeley, Cal., Assignor to H. E. Miller, Oakland, Cal. U.S. Pats. 866,843 and 866,844, Sept. 24, 1907.

In the manufacture of sulphuric acid by the contact process, the gases coming from the contact mass are mixed with aqueous vapour, the humidity and temperature being so adjusted that practically the whole of the sulphur trioxide is converted into liquid particles of sulphuric acid. The liquid particles of acid are then separated from the gases by passing the mixture into a rotating shell within which are several concentric spaced cylinders, forming "a series of functionally operative annular channels." A liquid seal guards the fitting of the non-rotating inlet and delivery pipes, which communicate with the annular channels, and means are provided for drawing off the acid which separates in the latter.—E. S.

Oxide of nitrogen: Method of producing —— by means of explosion. F. Hausser, Kaiserslautern, Bavaria. Eng. Pat. 13,989, June 17, 1907. Under Int. Conv., July 2, 1906.

This is a process for producing oxides of nitrogen, by means of explosions, from a compressed mixture of nitrogen, oxygen and a suitable combustible gas or vapour. The compressed explosive mixture is passed adiabatically into a shell or explosion vessel for combustion, in order to reduce the number of explosions as compared with the number of revolutions of the compressor, and the mixture is afterwards chilled to such a temperature that the oxide of nitrogen produced during the explosion is not materially decomposed. The chilling is effected either by injecting a suitable cooling medium, such as water, air, steam or the like into the shell, or by exhausting the mixture from the shell and passing it into a cooled receptacle. During the explosion in the shell, and the exhaustion of the exploded mixture from it, the compressor runs idle, and only takes up the conveyance of gases into the shell after the exhaust valve of the shell is closed.—W. C. H.

Hydrocyanic acid and its salts; Process for the manufacture of ——. R. S. Hutton, Manchester, and E. W. Smith, Mottram, Cheshire. Eng. Pat. 23,835, Oct. 26, 1906.

A mixture of gases containing hydrogen and nitrogen is passed over the surface of, or through, a mass of carbon, maintained at a temperature of at least 1700° C. by means of an electric current, "but considerably below the temperature of the positive crater of the electric arc." The hydrocyanic acid produced may be absorbed by alkali, or transformed according to any of its known reactions, and the residual or uncombined gases may either be brought again into contact with the heated carbon, or utilised for other purposes.—W. C. H.

Lime kilns. W. J. Efford, Wouldham, and E. H. Dabner, Burham, Kent. Eng. Pat. 9553, April 24, 1907.

The kiln has at one end a chalk-feeding hopper and shoot, and at the other end, a fuel-supplying hopper and shoot. A flue round its crown communicates with its interior, and opens at opposite ends into two flues, common to a range of kilns, and opening into an uptake, each of the kilns having a vertical flue opening at its lower end into the ash-pit, and at its upper end into a flue communicating with one of the two flues which are common to the range, all the flues and openings being provided with dampers whereby the heated gases from a burning kiln or several burning kilns can be passed into one or more drying kilns. —E. S.

Saturators used in the manufacture of sulphate of ammonia. P. E. Williams and R. L. Fenner. Eng. Pat. 25,547, Nov. 13, 1906. *See* III.

Ammonium chloride; Manufacture of —— by reaction between sodium chloride and ammonium sulphate in hot aqueous solution. E. Naumann. Fr. Pat. 378,445, June 4, 1907.

Instead of using molecular proportions of the two salts, an excess of sodium chloride is employed; this excess dissolves, and displaces some of the dissolved sodium sulphate, so that on cooling, ammonium chloride free from sodium sulphate crystallises out. The concentration of the solution is adjusted so that the hot final liquid contains less than 75 parts of ammonium chloride to every 100 parts of water. *Example.*—80 parts of ammonium sulphate are dissolved in 100 parts of water at 70° C., or above, and 15 parts of sodium chloride are added with agitation. After digestion for an hour or two, the hot liquor is decanted from any residue, and set to cool, when ammonium chloride, free from sulphate, crystallises, and is separated. To the mother liquor ammonium sulphate is added, and the process is repeated with further addition of sodium chloride, including any residue of the first operation.—E. S.

Sodium alum, potassium alum, or ammonium alum free from iron and in small crystals; Manufacture of ——. E. Strohbach, Niedersedlitz-Dresden, Germany. Eng. Pat. 28,581, Dec. 14, 1906.

See Fr. Pat. 372,809 of 1906; this J., 1907, 527.—T. F. B.

Alkali peroxide boxes; Method of producing ——. W. P. Thompson, London. From Königswarter and Ebell, Linden, Germany. Eng. Pat. 9458, April 23, 1907.

A box for the reception of alkali peroxide is formed of stearine, or other material, which is not attacked by the peroxide at ordinary temperatures, is impermeable to moisture, and may form in presence of water with an alkali peroxide, a soap or washing liquid. When filled, the box is covered by a stearine stopper. When placed in hot water, the stearine slowly melts, giving access of water to the peroxide. The stearine may be replaced by paraffin-wax, wax, or other similar material, having a melting point not exceeding 100° C., and the box may be enclosed in a soap block; or a hollow in the latter may be internally lined with stearine or the like, for receiving the alkali peroxide, a soap stopper coated on its underside with stearine being used for hermetically closing the box. (Compare Eng. Pat. 19,809 of 1905, and U.S. Pat. 818,695, of 1906; this J., 1906, 32 and 486.)—E. S.

Aluminate of soda; Process for desilicating —— in the manufacture of alumina. Cie. des Prod. Chim. d'Alais et de la Camargue. Fr. Pat. 378,539, Aug. 13, 1906.

See Eng. Pat. 27,290 of 1906; this J., 1907, 202.—T. F. B.

Aluminium nitrides; Method of producing ——. O. Serpek, Madulein, Switzerland. U.S. Pat. 867,615, Oct. 8, 1907.

See Fr. Pat. 367,124 of 1906; this J., 1906, 1096.—T. F. B.

Air; Process of liquefying —— *and winning oxygen.* R. Mewes, Berlin. Eng. Pat. 21,780, Oct. 2, 1906. Under Int. Conv., Oct. 3, 1905.

See Fr. Pat. 358,236 of 1905; this J., 1906, 180.—T. F. B.

Separation of gases from their mixtures and particularly the separation of the constituents of atmospheric air. Soc. l'Air Liquide and R. J. Lévy, Paris. Eng. Pat. 3302, Feb. 9, 1907.

See Fr. Pat. 376,854 of 1906; this J., 1907, 1047.—T. F. B.

Oxygen; Processes of generating —— *for effervescing baths and other purposes.* L. Sarason, Hirschgarten, and S. Haller, Grünau, Germany. Eng. Pat. 23,165, Oct. 19, 1906.

See Fr. Pat. 372,233 of 1906; this J., 1907, 527.—T. F. B.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Gaseous fuel furnaces for treating glass, steel, and other substances, and for other similar purposes; Method of working ——. A. Desgraz and P. Schmidt, Hannover, Germany. Eng. Pat. 27,564, Dec. 4, 1906.

Nozzles are arranged for introducing regulated mixtures of air and gas into the furnaces in a horizontal direction, and by a suitable arrangement of channels leading from the air- and gas-supply mains, similarly regulated mixtures of air and gas can be admitted to the furnaces in a vertical direction.—W. C. H.

Aluminium oxide [for ceramic articles]; Process for the manufacture and treatment of compositions containing ——. C. F. Boehringer und Söhne. First Addition, dated May 6, 1907, to Fr. Pat. 377,964, July 25, 1906 (this J., 1907, 1049).

Instead of melting together alumina and oxides of other metals or of metalloids, the alumina may be fused alone, granulated, and mixed, in the solid state, with the other oxides. The mixture is then moulded into the desired shapes, dried, and burnt in the usual manner, when, it is stated, combination takes place between the alumina and the other oxides.—A. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Patents.

Building materials; Fireproof —— *manufactured from an artificial conglomerate.* C. Gramiccia, Rome. Eng. Pat. 22,390, Oct. 10, 1906.

See Fr. Pat. 366,879 of 1906; this J., 1906, 1098.—T. F. B.

Moulded articles made from ground or divided slag; Method of hardening ——. A. J. Boult, London. From Cöln-Müsener Bergwerks Akt.-Ver., Creuzthal, Germany. Eng. Pat. 25,417, Nov. 10, 1906.

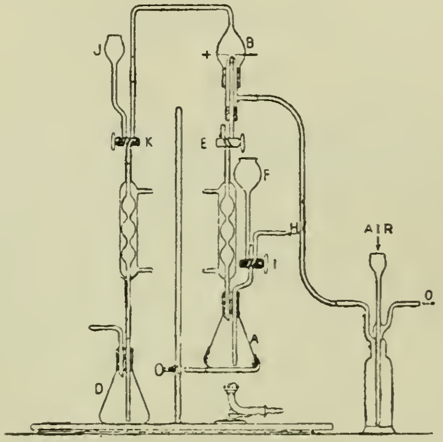
See Addition of Nov. 19, 1906, to Fr. Pat. 362,808 of 1906; this J., 1907, 612.—T. F. B.

X.—METALLURGY.

Steel; Crystallisation and structure of ——. A. Bajkow. J. Russ. Phys.-Chem. Ges., 1907, **39**, 399—410. Chem. Zentr., 1907, **2**, 1461—1462.

In the blow-holes in the interior of cast steel, octahedral crystals are frequently found, and have been believed to consist of pure ferrite. Three specimens of such crystals examined by the author contained:—(1). Carbon, 0·78; manganese, 1·06; and silicon, 0·26 per cent. (2). Carbon, 0·54; manganese, 0·89; and sulphur, 0·17 per cent. (3). Carbon, 0·98; manganese, 0·78; and sulphur, 0·08 per cent. Micrographic examination showed that all three specimens contained inclusions of slag, which were, in general, uniformly distributed in crystals belonging to the regular system. Each fragment of slag was enclosed by an envelope of ferrite, and the latter by one of pearlite, whence it is inferred that the slag is the primary product of crystallisation. Examination of a large number of specimens of cast steel, showed that slag is a normal structural element of the same, and in the author's opinion, these slag inclusions consist of manganese sulphide, MnS. —A. S.

Sulphur in iron, steel, etc.; Determination of ——. E. Jaboulay. Rev. gen. Chim. pure et appl., 1907, **10**. 193—195.



The principle of the method consists in burning in a mixture of air and oxygen, the sulphurous gases evolved on treating the metal with acid, oxidising the resulting sulphur dioxide to sulphuric acid by means of hydrogen peroxide, and either titrating the unused excess of peroxide, or precipitating the sulphuric acid as barium sulphate. The hydrogen peroxide solution employed is prepared from a 12-volume solution containing 20 c.c. of nitric acid per litre, by diluting it until it will decolorise about an equal volume of a solution containing 0·9875 grm. of potassium permanganate per litre (1 c.c. of which corresponds to 0·0005 grm. of sulphur); from 10 to 50 c.c. are used according to the sulphur-content of the metal under examination. The apparatus used is shown in the figure. Five grms. of the metal are placed in A, and a current of hydrogen is passed through for 5 minutes, E being open to the air. The absorption-liquid (hydrogen peroxide diluted with water to 100 c.c.) is then placed in D, 100 c.c. of dilute hydrochloric acid (1 part of acid of 22° B. to 1 part of water) are poured into F, and the apparatus is connected with a pump, whereby a mixture of oxygen and air is drawn through the bulb, B. A series of sparks is now caused to pass across B by means of sealed-in wires, and hydrogen is again passed through the apparatus, and becomes ignited in B. The acid is now allowed to run from F into A, and then I is again connected with the hydrogen-supply. The pressure of the hydrogen is so regulated that the size of the flame in B remains constant, and of a bright yellow colour. When the decomposition of the metal is complete, the liquid in A is boiled for 5 minutes, the flame in B is extinguished by turning the tap, E, the condenser above D, is rinsed with water from the funnel, J, and then the excess of hydrogen peroxide is titrated with permanganate, after addition of 5 c.c. of nitric acid of sp. gr. 1·20. A quantity of peroxide equal to that used in the determination, is also titrated with permanganate, and from the difference between the two titrations, the percentage of sulphur is calculated.—A. S.

Manganese in steel ; Volumetric determination of ——. L. Sacerdoti. L'Ind. Chimica, 1907, **7**, 258—259. Chem. Zentr., 1907, **2**, 1448.

THE author has modified and simplified Deshay's method, based upon the conversion of the manganese into permanganate, so that the determination can be carried out in 20 minutes. 0·2 grm. of steel cuttings is boiled with 45 c.c. of nitric acid of sp. gr. 1·18, until the evolution of nitrous fumes ceases, then 40 c.c. of hot water are added, and the whole is again heated to boiling and 1·5—2 grms. of lead dioxide added. After a further heating for exactly 2 minutes, with vigorous agitation, the solution is cooled rapidly, diluted with water to 100 c.c., and filtered through asbestos. 50 c.c. of the filtrate are diluted with 50 c.c. of water and titrated with sodium arsenite solution (0·2 grm. of arsenious oxide and 0·5 grm. of sodium bicarbonate per litre), which has been standardised against a steel of known manganese-content.—A. S.

Iron and chromium ; Alloys of ——. W. Treitschke and G. Tamman. Z. anorg. Chem., 1907, **55**, 402—411.

THE curves showing the interdependence of the composition and crystallisation temperatures of the iron-chromium alloys are explained by assuming the formation of a compound, X, of relatively small speed of formation, a ternary system having to be considered, of which the components are iron, chromium, and this compound. The metals each form a continuous series of mixed crystals with X, and the halting points on the cooling curves correspond to the separation of these and of a ternary eutectic. Micrographic results are in accordance with this view. The alloys with 10—90 per cent. of chromium contain two structural elements, of which the secondary is less readily attacked by acids and is harder than the primary. In accordance with the requirements of the thermal diagram, it is found that alloys prepared by the alumino-thermic method show a homogeneous polyhedral structure, but by reheating at 1700° C., their structure becomes that of alloys of the same composition, which have been prepared by melting together the two metals, the ternary mixed crystals splitting into others of different composition. Equilibrium is nearly established between iron, chromium, and their compound, X, at temperatures between 1700° and 2500° C. in 5—10 minutes, and by cooling fairly quickly, crystallisation is completed as in a ternary system. The structure and properties of the chrome steels depend, therefore, not only on the percentage of chromium present, but also on the temperature to which the alloys have been heated in the liquid state, if they have been cooled fairly quickly to the crystallisation temperature. For instance, the alumino-thermic alloys containing 0—80 per cent. of chromium affect a delicate magnetic needle, but the alloys obtained by direct melting have a marked effect up to 90 per cent. of chromium.—F. SODN.

Iron and molybdenum ; Alloys of ——. Lautsch and G. Tamman. Z. anorg. Chem., 1907, **55**, 386—401. (Compare this J., 1906, 429).

A STUDY of the alloys of iron and molybdenum, formed at 1800° C., shows that the thermal diagram does not correspond with the normal behaviour of a binary system, but the abnormality can be explained by supposing that a compound, X, (of molybdenum and iron), constitutes one of the components of a ternary system, the other components being these metals themselves. The speeds of formation and decomposition of this compound, X, during crystallisation are assumed to be small in comparison with the speed of the concentration changes in the melt. Iron and molybdenum form mixed crystals, except between the limits 30—70 per cent. of the latter metal, but they do not form mixed crystals with X. Three groups of alloys may be distinguished between 0 and 60 per cent. of molybdenum:—(1) 0—27 per cent. The primary crystallisation gives mixed crystals, rich in iron, and later, the compound, X, also crystallises, the proportion of X increasing with the rise in the percentage of molybdenum, as is seen by micrographic examination. (2) 27—42·5 per cent. Primary mixed crystals, rich in iron, are followed by a secondary and tertiary crystallisation (the eutectic). (3) 42·5—60 per cent. Mixed crystals, rich in molybdenum, appear first. That the "inner" composition of the alloy is dependent on the temperature to which it has been subjected, the quantity of X increasing with the temperature, is proved by preparing these alloys by the alumino-thermic method (this J., 1906, 1100), which gives a temperature of at least 2300° C. From alloys prepared thus and containing 20—60 per cent. of molybdenum, the compound, X, separates as the primary crystals. In general properties, also, the two series of alloys differ. For instance with a high percentage of molybdenum, these affect a magnetic needle less than the corresponding alloys prepared by direct melting of the metals at 1800°. But by 10 minutes' heating at 1500° the structure of the alloy containing 32·7 per cent. of molybdenum, prepared by the alumino-thermic method, becomes similar to that of the alloy prepared directly.—F. SODN.

Iron group elements ; Melting points of the —— *by a new radiation method.* G. K. Burgess. Bull. Bureau of Standards, U.S.A., 1907, **3**, 345—355.

THE melting points of metals of the iron group were determined in an atmosphere of hydrogen, a Holborn-Kurlbaum optical pyrometer being used for measuring the temperature, and the results being estimated with the aid of the data on the monochromatic radiation from platinum (see following abstract). The results were as follows, the purities of the metals being given in brackets: Iron (99·95), 1505°; chromium (98—99), 1489°; cobalt (99·95), 1464°; nickel (99·95), 1435°; and manganese (98—99), 1207° C. The melting points of cobalt and nickel are probably correct within 5° C., and those of iron, chromium, and manganese, within 10° C.—A. S.

Palladium and platinum ; Radiation from and melting points of ——. C. W. Waidner and G. K. Burgess. Bull. Bureau of Standards, 1907, **3**, 163—208. [Reprint No. 55.]

THE melting points of platinum and palladium were determined by several different methods, in particular by the application of Wien's equation giving the relation between the absolute temperature of a black body and the intensity of any monochromatic radiation. The observations on the monochromatic radiation from strips of the two metals, using red, green, and blue light, gave results in very close agreement when applied to the determination of the melting points, the figures also agreeing with the more exact optical measurements made on the melting points of the metals when the latter were heated in an iridium tube-furnace, which approximates a black body. The values finally adopted, after making requisite corrections, are 1546° C. for the melting point of palladium and 1753° C. for that of platinum. The values of the melting points as determined by the usual thermoelectric method are about 45° lower than those obtained by the two optical methods.—A. S.

Platinum ; Crystallised ——. F. Limmer. Chem.-Zeit., 1907, **31**, 1025.

THE formation of crystals of platinum on heating potassium-platinum chloride, first observed by Jacquelain (J. prakt. Chem., 1841, 22, 22), has been studied by the author. On reducing potassium-platinum chloride with cuprous chloride, evaporating the filtrate from the potassium-platinous chloride, igniting the residue for an hour in a porcelain crucible, and taking up the mass with dilute hydrochloric acid, the platinum was obtained in crystals instead of in the spongy condition as expected. Platinum black and platinum chloride ignited in the same way yielded only spongy platinum. Potassium-platinum chloride heated alone gave small octahedral crystals, and the size of these was not increased by using a mixture of potassium chloride and platinum chloride. Spongy platinum heated with potassium chloride remained practically unaltered, but when heated with cuprous chloride, it was partially converted into larger octahedra, whilst the remainder was transformed into highly crystalline flakes. Crystals obtained with the aid of cuprous chloride are characterised by a remarkable capacity for reflecting light. In the author's opinion the cuprous chloride plays a definite part in the formation of crystals. The fact that the ignition of platinum chloride and ammonium-platinum chloride does not yield well-defined crystalline platinum may be attributed to the rapid decomposition of these compounds. When cuprous chloride and spongy platinum are heated together, particles of platinum may be noticed floating about and apparently these subsequently unite.—C. A. M.

Cyanide process ; Assisting the solution of gold in the —— by compressed air. A. F. Crosse. J. Chem., Metall. and Min. Soc. S. Africa, 1907, **8**, 36.

Air supplied by a " trompe " (water-blast) is used to lift ore-pulp up a pipe placed in the centre of a conical vat containing the cyanide solution. About 2 feet above the surface of the liquid this pipe terminates, and the ore falls into an outer pipe from which four pipes, having their orifices arranged tangentially so as to give it a circular motion, discharge it into the cyanide solution. A similar method is also used for clean sand free from slimes. The method yields 92 per cent. of the gold in 24 hours (including the time required for washing) from tailings containing 6·2 dwt.—A. G. L.

Gold ores ; Laboratory tests of chlorination of ——. A. L. Sweetser. Bi-Monthly Bull. Amer. Inst. Min. Eng., 1907, 747—755.

The paper describes chlorination tests on a roasted, partially-roasted and unroasted gold ore respectively, the fineness of the sample, time of chlorination, and quantity of bleaching powder and sulphuric acid used being varied.—O. F. H.

Vanadium ; The present source and uses of ——. J. Kent Smith. Bi-Monthly Bull. Amer. Inst. Min. Eng., 1907, 727—732.

Until the recent opening-up of a large deposit of vanadium sulphide ore in S. America, the most important source of vanadium was Spanish lead ores containing, as mined, only 4—5 per cent. of vanadic oxide. The South American ore, which is easily mined, contains about 40 per cent. of vanadium sulphide, and when calcined, nearly 60 per cent. of vanadic oxide. (See this J., 1906, 291.)—O. F. H.

Copper and bismuth ; Alloys of ——. K. Jeriomin. Z. anorg. Chem., 1907, **55**, 412—414.

An examination of the cooling curves shows that copper forms no compound with bismuth and that there is no evidence of the formation of mixed crystals. The eutectic point corresponds to an alloy containing very little copper : much less than 2·8 per cent. The presence of a little copper oxide in the alloy completely alters the form of the curve connecting the crystallisation temperatures.
—F. Sodn.

Zinc and cadmium ; Alloys of ——. G. Hindrichs. Z. anorg. Chem., 1907, **55**, 415—418.

A study of the cooling curves and microscopic structure of the zinc-cadmium alloys shows that at all concentrations, pure zinc and pure cadmium crystallise from the melts. Neither compounds, nor mixed crystals are formed, in spite of the fact that the metals, in the liquid state, are miscible in all proportions. The eutectic concentration is found to be 82·6 per cent. of cadmium, and eutectic crystallisation occurs at 270° C.—F. Sodn.

Antimony and lead ; Alloys of ——. W. Gontermann. Z. anorg. Chem., 1907, **55**, 419—425.

Antimony and lead, as liquids, mix in all proportions. Pure lead and antimony separate from these melts on cooling, and prolonged heating at high or low temperatures has no effect on the behaviour of the alloys. Thermal analysis furnishes no evidence of the formation of mixed crystals or of a compound.—F. Sodn.

Alloys ; Potential and nature of metallic ——. N. Puschin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 353—399. Chem. Zentr., 1907, **2**, 1314—1319. (See this J., 1907, 826.)

The author has continued his study of alloys on the lines previously indicated. Tin-bismuth alloys consist of a mechanical mixture of two solid components (tin and bismuth). Zinc-cadmium alloys also consist of mixtures of the two metals, with the exception of those containing up to 7 atoms per cent. of zinc, which are composed of mixed crystals. *Brass group of alloys.*—For alloys of copper and zinc, the potential-curve consists of five distinct parts, corresponding to the solid phases, Zn, Zn_6Cu, Zn_2Cu, ZnCu, $ZnCu_2$, Cu, of which the following pairs form solid solutions : Cu and $ZnCu_2$, $ZnCu_2$ and ZnCu, ZnCu and Zn_2Cu, Zn_2Cu and Zn_6Cu. Shepherd's view that copper forms no compounds with zinc, but six types of different solid solutions is untenable. Alloys of silver and zinc resemble those of copper and zinc in their great diversity of colour, structure and hardness. Those with up to 30 atoms per cent. of silver have the colour of pure zinc ; they show a distinct crystalline structure and a coarse-grained fracture, and are very brittle. The alloy with 39 atoms per cent. of silver shows a white, glistening, conchoidal fracture ; that with 50 atoms per cent. has a fine rose-colour ; and that with 63 atoms per cent. of silver is bright yellow, tough, and malleable. The alloys are more resistant to air and water than brass, and appear well suited for technical application. The potential-curve comprises five horizontal portions, indicating the existence of the compounds, Zn_6Ag, Zn_4Ag, Zn_2Ag, and $ZnAg_2$. The alloys of zinc with gold are analogous in many respects to the zinc-silver alloys. The potential-curve indicates the existence of the compounds, Zn_6Au, Zn_2Au, and ZnAu, of which Zn_6Au and Zn, and probably also ZnAu and Zn_2Au form mixed crystals. The alloys of cadmium and copper are of the same type as the brasses, showing a similar diversity of colour, structure, and hardness. The potential-curve indicates the existence of a single compound, Cd_2Cu, which forms solid solutions with cadmium, but of limited concentration from the side of the compound, Cd_2Cu. Copper, also, is capable of dissolving the compound, Cd_2Cu, to a solid solution. *Bronzes.*—The potential-curve of alloys of copper and tin indicates the existence of the compounds, $SnCu_3$ and $SnCu_2$. Tin-silver alloys possess the characteristic physical properties of bronzes ; in general, they are very hard, and many of them are also brittle. The potential-curve indicates the existence of the compounds, $SnAg_3$ and $SnAg_5$ ($SnAg_6$?). Ternary alloys of tin, copper, and silver are very easily fusible. Their potential in the cell : $Sn/N/_1H_2SO_1/SnCu_xAg_y$, remains at 0 so long as less than three atoms of copper and zinc together are present for each atom of tin, but as soon as this limit is reached, the potential rises suddenly to about 480 millivolts. This behaviour indicates that the copper in the compound, $SnCu_3$, can be gradually replaced by silver without any change in the electro-motive character of the compound. Alloys of tin and gold resemble the copper-

and silver-bronzes in their physical properties. The potential-curve indicates the existence of the compounds, Sn_2Au and SnAu.—A. S.

Mineral production of the United Kingdom in 1906. Mines and Quarries, General Report and Statistics, Part III. [T.R.]

The following table shows the quantity and value of the minerals produced in the United Kingdom in 1906, as compared with 1905:—

Mineral.	1905. Quantity.	1905. Value at the Mines and Quarries.	1906. Quantity.	1906. Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shale	7,131	1,609	9,454	1,978
Arsenical pyrites	641	155*	640	952
Arsenic	1,528	7,493	1,599	22,313
Barytes	29,063	29,618	35,745	35,282
Bauxite	7,300	1,825	6,654	2,728
Bog ore	3,205	801	5,425	1,356
Chalk	4,535,584	196,480	4,749,310	203,224
Chert and flint	70,677	14,433	68,209	14,803
Clay and shale	15,134,754	1,763,008	15,291,352	1,768,023
Coal	236,128,936	82,038,553	251,067,628	91,529,266
Copper ore	6,903	21,796	7,478	26,466
Copper precipitate	250	10,900	280	12,800
Fluorspar	39,446	19,557	41,849	20,023
Gold ore	15,981	17,787	17,384	5,343
Gravel and sand	2,241,620	170,205	2,366,985	177,996
Gypsum	255,508	82,342†	225,027	74,563
Igneous rocks	5,956,900	1,288,344	6,165,750	1,223,611
Iron ore	14,590,703‡	3,482,184	15,500,406§	4,085,428
Iron pyrites	12,186	4,789	11,140	4,953
Lead ore	27,649	244,752	30,795	341,405
Limestone (other than chalk)	12,501,780	1,410,526	12,758,588	1,368,375
Manganese ore	14,474	11,634	22,762	22,983
Mica	11,640	3,858	11,384	4,530
Ochre, umber, &c.	16,237	15,462	14,210	14,641
Oil shale	2,496,785	593,334	2,546,522	657,928
Petroleum	46	69	10	15
Salt	1,889,910	556,437	1,965,151	595,984
Sandstone	5,640,684	1,634,357	5,261,150	1,504,889
Silver ore	14	306	cwt. 12	42
Slate	514,524	1,466,916	492,663	1,232,321
Sulphate of strontia	14,294	13,936	14,112	13,758
Tin ore (dressed)	7,201	574,183	7,153	713,184
Uranium ore	103	‖	11	‖
Wolfram ore	172	11,357	271	19,775
Zinc ore	23,909	139,806	22,824	142,054
Total values	—	95,828,812†	—	105,842,992

* Value of 141 tons only.

† Corrected figures.

‡ Exclusive of 443 tons of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, &c."

§ Exclusive of 436 tons of micaceous iron ore, used for paint, and placed under the heading "Ochre, umber, &c."

‖ Value not yet ascertained.

The quantity of coal exported was 55,599,771 tons, an increase of more than 8,000,000 tons on the exports for 1905. France received nearly 9,500,000 tons, Germany and Italy each over 7,500,000 tons, Sweden over 3,500,000 tons, and Russia, Spain, Denmark, the Netherlands, Egypt and Argentina each over 2,000,000 tons. Adding the 2,598,194 tons exported in the form of coke and patent fuel, and the 18,590,213 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 76,788,178 tons. The amount of coal remaining for home consumption was 174,279,450 tons, or 3·992 tons per head of the population. 20,694,641 tons were used in the blast furnaces for the manufacture of pig-iron, as against 19,255,555 tons in the previous year, 35,402,677 tons were used in the manufacture of coke, and 1,399,542 tons in the manufacture of briquettes. 19,296,526 tons of coke were obtained in 1906, valued at 12,549,116*l.*, and 29,728 coking ovens were in use during the year. 1,513,220 tons of briquettes, valued at 899,046*l.*, were produced.

The output of iron ore yielded 5,040,360 tons of iron, or nearly one-half of the total quantity of pig-iron made in the country. 7,823,084 tons of iron ore were imported during the year, over 76 per cent. of which came from Spain.

Mineral production of South Australia in 1906. Bd. of Trade J., Oct. 31, 1907. [T.R.]

The output and value of the various metals and minerals produced in South Australia during the years 1905 and 1906 are as follows:—

—	1905. Quantity.	1905. Value.	1906. Quantity.	1906. Value.
		£		£
Copper .... cwt.	130,959	426,511	164,160*	718,609*
Lead .... ,,	1,040	369	1,000	550
Copper ore ... tons	2,563	28,434	†	†
Gold .... oz.	10,983	45,853	13,961	58,453
Ironstone ..... tons	84,483	48,577	75,226	33,852
Limestone..... ,,	44,498	4,791	31,940	4,791
Salt .... ,,	32,500	13,000	55,000	27,500
Other metals and minerals	—	1,261	—	1,263
Total	—	568,796	—	845,018

* Including copper ore. † Included in copper.

Mineral production of Western Australia. Bd. of Trade J., Oct. 31, 1907. [T.R.]

The quantity and value of the minerals raised during 1906, as compared with 1905, were as follows:—

		1905.		1906.	
		Quantity.	Value.	Quantity.	Value.
			£		£
Black tin (raised)	Statute tons	1,079	86,840	1,495	57,644
Coal (raised)	,,	127,364	55,312	149,755	57,998
Copper ore (raised)	,,	2,389	16,266	7,430	50,337
Gold (export and mint) ...	Fine ozs.	1,955,316	8,305,654	1,794,547	7,622,749
Ironstone (raised)	Statute tons	3,213	1,285	1,280	512
Limestone (raised)	,,	9,145	1,220	9,472	1,691
Pig lead (exported)	,,	2,730	34,471	2,681	44,460
Silver (exported)..........	Fine ozs.	359,744	44,278	282,145	37,612
Tantalite (raised)	Statute tons	73	10,515	15	2,644
Total values		—	8,555,841	—	7,975,647

Lead and zinc smelting and refining in the United States. U.S. Census Bureau. [T.R.]

The general statistics of the lead smelting industry for the census years 1900 and 1905 are presented in the following table:—

	1905.	1900.
Number of establishments	32	39
Capital	$63,822,810	$72,148,933
Salaried officials, clerks, etc.	524	425
Wage-earners	7,573	8,319
Total wages	$5,374,691	$5,088,684
Miscellaneous expenses	$897,876	$1,166,210
Cost of materials used	$168,958,076	$144,195,163
Value of products	$185,826,839	$175,466,304

The total production of refined lead as reported at the census of 1905 is 391,530 tons. The following table shows the production of refined lead in the United States for the years 1900 to 1904, both inclusive:—

Year.	Desilverized lead.	Soft lead.
	Tons.	Tons.
1904....................	315,284	89,169
1903....................	295,074	83,444
1902....................	303,011	74,050
1901....................	323,790	57,898
1900....................	329,658	48,021

The principal products of the lead smelting and refining industry consisted of 783,060,836 lb. of lead, valued at $30,357,901; of 2,574,549 oz. of gold, valued at $52,994,436, and of 72,592,987 oz. of silver, valued at $41,425,114. As compared with the corresponding figures for 1900, those for 1905 show an increase in quantity of 33·2 per cent. for lead, of 2·4 per cent. for gold, and of 3·1 per cent. for silver. In value lead increased 20·6 per cent. and gold 1·9 per cent., but silver decreased 1·7 per cent. That the development of the precious metals did not keep pace with that of lead is not due to a decrease in the precious metal values of the argentiferous lead ores treated, but results from the large increase in the quantity of dry gold and silver ores treated by the copper smelters.

The vigorous growth of the zinc smelting industry noted at the census of 1900 has continued, and the production of spelter, including sheet zinc, at the census of 1905 reached a total of 186,990 tons, as compared with 131,546 tons for 1900, 58,860 tons for 1890 and 23,239 tons for 1880.

The general statistics for the zinc smelting industry are set forth as follows:—

	1905.	1900.
Number of establishments	31	31
Capital	$23,701,586	$14,141,810
Salaried officials, clerks, etc.	354	208
Wage-earners	6,528	4,869
Total wages	$3,856,466	$2,355,921
Miscellaneous expenses	$1,326,621	$399,472
Cost of materials used	$17.028,418	$13,286,058
Value of products	$24,791,299	$18,188,498

The products of the industry in 1900 and 1905 were as follows:—

		1905.	1900.
Total value		$24,791,299	$18,188,498
Spelter	Pounds	325,287,010	227,646.314
	Value	$16,379,383	$12,348,036
Sheet zinc	Pounds	48,692,068	35,445,374
	Value	$2,831,476	$2,495,380
Zinc oxide	Pounds	117,485,861	75,114,904
	Value	$4,330,394	$2,718,700
Sulphuric acid	Pounds	154.609,036	117.655,214
	Value	$576,060	$424,670
All other products		$673,986	$201,712

PATENTS.

Steel alloys; Annealing and heat treating ——. J. Churchward, New York. Eng. Pat. 28,182, Dec. 11. 1906.

See U.S. Pat. 855,756 of 1907; this J., 1907, 1012.—T.F.B.

Gaseous fuel furnaces for treating glass, steel, and other substances and for other similar purposes; Method of working ——. A. Desgraz and P. Schmidt. Eng. Pat. 27,564, Dec. 4, 1906. *See* VIII.

Armour plates; Manufacture of ——. Marrel Frères Second Addition, dated May 22, 1907, to Fr. Pat. 366,532, May 23, 1906 (this J., 1906, 1051; 1907, 259)..

The process described in the original patent is carried out with steel containing 3 to 5 per cent. of nickel, 0·4 to 0·8 of chromium, and 0·18 to 0·30 of carbon (instead of only 3 to 4 per cent. of nickel).—A. G. L.

Cementation [of steel or iron]; Composition for ——. H. L. Martinet. Fr. Pat. 378,531, June 6, 1907.

The composition consists of a mixture of 60 per cent. of old boot-leather, carbonised in a closed vessel; 20 of soot from hard wood (oak or beech); 15 of charcoal of the same wood; and 5 of sea-salt, not washed. The charcoal may be replaced by shavings of the same wood, and the sea-salt by ammonium chloride or potassium bichromate or cyanide.—A. G. L.

Steel coated with copper; Manufacture of plates, sheets and leaves of ——. J. C. Fell, London. From Soc. Internat. de Metallurgie Nouvelle, Paris. Eng. Pat. 8242, April 9, 1907.

Bundles of sheets of the copper alloy, with which the coating is to be effected, are prepared as follows: Electrolytic copper is melted with 0·005 to 1 per cent. of tin, aluminium, nickel or zinc, or with several of these metals, and cast into ingots, having a diameter of 150 mm. and a length of 450 mm., which are finished in the lathe. Suitable alloys are: Copper, 99; zinc, 0·35; and aluminium, 0·65 per cent.; or, copper, 99; tin, 0·2; nickel, 0·35; zinc, 0·3; and aluminium, 0·15 per cent. The ingots are heated and hammered into flat plates 250 mm. in width, which are again heated and rolled to a thickness of 5 to 10 mm. The bands obtained are cut into lengths of 70 cm., heated, cleaned with sand, and rolled hot crosswise down to 0·5 mm. The plates obtained are heated, cleaned and made into bundles of 10 or 15 sheets, between which, for special purposes, sheets of tin, aluminium, zinc or nickel may also be inserted. The bundles are then cut to a size of 60 × 40 cm., rolled crosswise to a thickness of 6 to 3 mm., and cut to a size of 20 × 40 cm. The edges of the sheets in each bundle are then soldered with tin to prevent displacement, etc.

The steel to be coated consists of ingots of special soft steel, 20 by 40 by 5 or 6 cm. After cleaning and grinding the faces of these ingots, twelve of which are treated together, they are freed from grease, and given a galvanic deposit of copper, and then a deposit of tin. Six of these steel ingots, each sandwiched between two of the bundles of copper alloy sheets prepared as above, outside which again are placed steel plates, 45 × 45 cm. by 0·5 mm., to prevent welding together, are then placed between two counter-plates, 50 × 50 × 3 cm., provided with 8 lugs through which pass bolts screwing the whole together. Between the ingots and the bolts are placed 4 steel partitions to protect the ingots from the action of the fire. Six of these composite bundles, representing 1440 kilos., are then heated together, and compressed hydraulically whilst hot. After removing the counter-plates, the ingots are placed in an annealing furnace and rolled in a single operation from a thickness of 50 or 60 mm. to 15 or 10 mm. The bands obtained are cut into sizes of 700 × 200 mm. and cleaned.—A. G. L.

Analysis; Methods of chemical ——. [Phosphorus in steel.] C. H. Ridsdale. Eng. Pat. 21,342, Sept. 26, 1906. *See* XXIII.

Zinc residues; Treatment of ——. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 21,440, Sept. 27, 1906.

The zinc residues, containing zinc in the metallic and combined states, are treated with a solution of calcium chloride, and sulphuric acid is added. The solution of zinc chloride obtained is filtered and treated with dry lime or milk of lime in a tube-mill or other gently grinding agitator. The zinc oxide precipitated is filtered off and washed.—A. G. L.

Zinc; Separation of —— from its ores or compounds. H. L. Sulman, London. Eng. Pat. 21,672, Oct. 1, 1906.

The ore is roasted to convert the zinc into oxide, and treated with an aqueous solution of sulphur dioxide. From the solution of zinc bisulphite obtained, the zinc is precipitated in the cold, by agitation with zinc oxide, in the form of zinc sulphite. This compound is calcined so as to regenerate sulphur dioxide, which is used again, and to form zinc oxide. The last traces of zinc may be precipitated from the bisulphite solution by the addition of lime or of an alkali.—A. G. L.

Soldering compounds; Manufacture of ——. W. R. Mitchell, Philadelphia, and J. B. Vigo, New York. Eng. Pat. 3507, Feb. 12, 1907.

See Fr. Pat. 375,756 of 1907; this J., 1907, 929.—T. F. B.

Bullet and shot; Self-lubricating ——. B. L. Williams, Lowell, Mass. U.S. Pat. 862,778, Aug. 6, 1907.

The bullets or shot are made from metal obtained by melting 80 parts of lead and adding 1 part of mercury, to which 2 parts of antimony and 3 of tin may be added as a hardening material.—A. G. L.

Ores; Method of sintering ——. J. Scott, Pittsburg, Pa. U.S. Pat. 865,658, Sept. 10, 1907.

The finely-divided ore or flue-dust is allowed to fall in a shower through an open shaft-furnace having a down-draught and heated by a series of rows of flames. The partially fused ore is compressed, and passes out at the bottom of the furnace into a "water-bosh."—O. F. H.

Ores; [Apparatus for] Sintering ——. J. Scott, Pittsburg, Pa. U.S. Pat. 865,659, Sept. 10, 1907. (See preceding abstract).

The apparatus consists of an open shaft-furnace heated at different levels by rows of burners, and a preheating chamber similarly heated, and forming a continuation of the upper part of the shaft-furnace. The ore is fed in a shower into the preheating chamber, from which it falls through the shaft-furnace into a "water-bosh," whence it is discharged in the sintered condition by a conveyer. Means are provided for retarding the progress of the ore through the preheating chamber.—O. F. H.

Pickling process. M. Hernsheim and C. E. Bonwell, Mannington, W. Va. U.S. Pat. 865,700, Sept. 10, 1907.

Iron or steel articles are pickled by heating to a temperature not exceeding the boiling point of water in a bath of a solution of citric acid and an alkali such as caustic soda. —O. F. H.

Ore-separator. J. A. Haralson, Mexico City. U.S. Pat. 867,360, Oct. 1, 1907.

The apparatus comprises a retort for generating gas; a gasometer for storing the gas; a generator containing water and the material which has passed through the retort; means for supplying gas from the retort to the generator and agitating the solution in it; a series of mixers; means for supplying metalliferous solution and the gas from the generator to the mixers in determined quantities, and a series of separators receiving the solution impregnated with the gas from the mixers, to effect separation of the metal by precipitation. Each separator is in communication with the next mixer by means of a pipe rising from the separator and having a filter at its lower end.—A. G. L.

Minerals and slags rich in silica; Treatment of —— and recovery of metal [iron, manganese] in the furnace. J. de Moya. Fr. Pat. 378,140, July 31, 1906.

A mixture of equal parts of sodium chloride and calcium sulphate is added to the usual charge of a blast-furnace in the proportion of 8 kilos. per ton of charge; and through the tap-hole for the slag, 3 kilos. of a mixture of 90 parts of sodium chloride and 10 of saltpetre, placed in a cylinder of sheet-iron, are dispersed through the charge by blows from a hammer. The calcium sulphate is designed to combine with the silica and to liberate iron and manganese. —A. G. L.

Minerals and slags rich in silica; Treatment of ——, and precipitation of the metal in a furnace. J. de Moya. First Addition, dated Dec. 7, 1906, to Fr. Pat. 378,140, July 31, 1906 (preceding).

The blast furnace is charged as usual, with the addition, per ton of slag or mineral used, of 12 kilos. of a mixture of 5 parts of sodium chloride and 25 parts of calcium sulphate (gypsum). Before casting the metal, a further addition is made, through the tuyères, of a cylinder containing, for each ton of charge, 3 kilos. of a mixture of 80 parts of sodium chloride, 10 of potassium nitrate, and 10 of borax.—A. G. L.

[*Thermite process.*] *Metals, metalloids, and their alloys; Preparation of* ——. K. A. Kühne. First Addition, dated May 4, 1907, to Fr. Pat. 364,329, March 17, 1906 (this J., 1906, 890 and 1101).

THE place of the chlorates and perchlorates in the thermite mixtures, as described in the principal patent, is taken by superoxides of barium, lead or sodium, or by persulphates, to which fluorspar, lime or other substances may be added to obtain a very liquid slag.—A. G. L.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

"*Overvoltage*"; *Explanation of the action of* ——. I. F. Kaufler. Z. Elektrochem., 1907, 13, 633—637.

THE energetic reduction and oxidation which occur respectively at the cathode and anode with such metals as exhibit an abnormally high potential difference, the so-called "overvoltage," has sometimes been explained by supposing the hydrogen and oxygen at these electrodes to be set free under great pressure. The author as a result of a careful series of experiments, considers that the effect must be attributed rather to a local heating of the electrode. An electrode which exhibits "overvoltage" can be shown also to be the seat of a heating effect. Moreover platinum electrodes, which as a rule are free from marked "overvoltage," if heated by a suitable device, can be employed for such reductions and oxidations as otherwise only occur with metals exhibiting "overvoltage." Since with increasing temperature of the electrode, the potential difference at the electrode falls, the effect appears to be a purely thermal one.
—R. S. H.

Electro-analysis; New results in ——. T. P. McCutcheon, jun. J. Amer. Chem. Soc., 1907, 29, 1445—1455.

THE author has extended Hildebrand's work on the electrolytic determination of anions by means of a mercury cathode and a rotating silver anode (this J., 1907, 644), and has also tried the effect of anodes of other metals than silver. Anodes of lead, cadmium, bismuth, zinc, and iron were tried, but without satisfactory results: in some cases an insoluble precipitate was formed, but not in a sufficiently adherent form, whilst in others, for example, an iron anode with a soluble ferrocyanide, the free acid, corresponding to the salt being electrolysed, was formed. A number of different metallic chlorides were then electrolysed, according to Hildebrand's method, and it was found that the metals could be divided into two classes according to the behaviour of the amalgams formed. The amalgams of lithium, sodium, potassium, calcium (with a sufficiently high E.M.F.), strontium, and barium decompose in the outer (cathode) compound with formation of the corresponding hydroxides. The amalgams of magnesium, aluminium, and the heavy metals in general, decompose in the inner (anode) compartment, with formation of hydroxides (see McCutcheon and Smith, following). By making use of this difference in the behaviour of certain metals, it was found possible to separate electrolytically barium and calcium from magnesium; sodium, lithium, barium, and strontium from uranium; and barium from thorium, cerium, lanthanum, and neodymium. In the case of the alkali metals, the alkali hydroxide formed in the outer compartment was titrated directly with standard acid, whilst in the case of the alkaline-earth metals, a slight excess of acid was added to the cathode liquid before electrolysis, and afterwards, the excess of acid titrated. In some cases it is advisable to add a drop of acid to the inner compartment from time to time. When an insoluble hydroxide is formed in the inner compartment the anode is removed after the electrolysis is complete, the liquid and precipitate siphoned off, and the inner compartment washed well with water. The contents of the cathode compartment are then poured into a beaker and well stirred, before performing the titration.—A. S.

Halides of the alkaline-earth metals; Electrolysis of the ——. H. S. Lukens and E. F. Smith. J. Amer. Chem. Soc., 1907, 29, 1455—1460.

IN the electrolysis of calcium chloride with the aid of a mercury cathode and a rotating silver anode, it was found that in presence of magnesium, calcium and magnesium hydroxides separate in the inner compartment, no trace of calcium passing into the outer compartment, as when pure calcium chloride is electrolysed. In presence of magnesium, therefore, calcium may be separated electrolytically from alkali metals and from barium and strontium. (See preceding abstract.)—A. S.

Metallic chloride solutions; Electrolysis of —— *with the use of rotating silver anode and mercury cathode.* T. P. McCutcheon, jun., and E. F. Smith. J. Amer. Chem. Soc., 1907, 29, 1460—1464.

SOLUTIONS of metallic chlorides (50 c.c., containing about 0·1 grm. of metal) were electrolysed, using an E.M.F. of 8 volts, with the anode making about 200 revolutions per minute. Experiments were made with cerous, lanthanum, neodymium, praseodymium, yttrium, ferric, aluminium, chromium, cobaltous, manganese, glucinum (niobium), cadmium, stannous, zinc, nickel, copper, stannic, thorium, zirconium, titanium and uranium chlorides, and it was found that in the case of chlorides derived from sesquioxides, stable colloidal hydroxide solutions are formed in the inner (anode) compartment, whilst with chlorides of the dioxide and monoxide types, such colloidal solutions are either not formed or are very unstable.—A. S.

PATENTS.

Furnaces; Electric ——. S. Z. de Ferranti, Grindleford, Derby. Eng. Pat. 13,965, June 18, 1906.

AIR is passed through a multi-stage compressor, provided with intermediate coolers, and then enters a chamber, wherein it is subjected to the action of an electric arc, preferably rotated by means of a coil arranged concentrically with one or more of the electrodes. The gases formed by combination of the nitrogen and oxygen, are next rapidly cooled by expansion in a nozzle, the kinetic energy generated thereby being abstracted by a high-speed wheel system. The exhaust gases pass into a vacuum receiver, which is connected with a vacuum pump, provided with coolers, or the gases may be brought into contact with cooling sprays.—B. N.

Electric furnace. J. T. Marshall, Metuchen, N.J., Assignor to General Electric Co., New York. U.S. Pat. 867,519, Oct. 1, 1907.

THE electric furnace comprises a box-like structure; a filling of loose refractory material; a number of carbon tubes extending across the box and covered by the filling; metal sockets in the walls of the box for holding the ends of the tubes; a carriage movable along the top of the box; levers carrying terminals pivoted on the box, the terminals engaging with the sockets, and connected with the secondary coils of a transformer; and a screw shaft uniting the levers and simultaneously ensuring good electrical connection between the terminals and the tubes.—A. G. L.

Insulating composition [*from spent tan*]; *Manufacture of an* ——, *and articles resembling vulcanite.* C. Marter, London. Eng. Pat. 14,395, June 23, 1906.

POWDERED spent tan, such as the bark of oak, chestnut, sumach, myrabolans, etc., is heated with 25 to 33 per cent. of powdered sulphur, the resulting black powder being ground and heated in a suitable mould, if necessary under pressure. Before introducing it into the mould, a solution of rubber or an equivalent substance may be mixed with the powder, dried and heated for the purpose of producing a superior composition.—B. N.

Rubber substitute [*Insulating composition*]; *Hard* ——, *and process for making the same.* C. Marter, Fondon. U.S. Pat. 867,737, Oct. 8, 1907.

SEE Eng. Pat. 14,395 of 1906; preceding.—T. F. B.

Compositions of matters of a refractory character, and adapted for electrical insulation and other uses ; Manufacture of ——. A. G. Brookes, London. From Asbestos Wood Co., Portland, U.S.A. Eng. Pat. 2460, Jan. 31, 1907.

SEE Fr. Pat. 374,489 of 1907 ; this J., 1907, 925.—T. F. B.

Eng. Pats. 21,505 ; 21,509 ; 21,510 ; 21,513 ; 21,669 ; 24,236, all of 1906. Also Fr. Pats. 378,641 and 378,665, of 1907. *See* II.

Vacuum [*in mercury vapour lamps*] : *Method of creating a* ——. P. C. Hewitt, Assignor to The Cooper Hewitt Electric Co., New York, N.Y. U.S. Pat. 862,333, Aug. 6, 1907.

THE vessel (a mercury vapour lamp for example) containing a negative electrode of liquid conducting material and a solid electrode, which is capable of being wetted by the liquid, and is in contact with but in a different plane from the latter, is first exhausted as far as possible by an ordinary air-pump and then sealed. By inclining the vessel or in any other suitable manner, the liquid is caused to wet the solid and to so render it capable of localising the entrance of the current into the negative electrode and also of absorbing any residual gas left in the vessel.—W. H. C.

Batteries ; Lead-peroxide-zinc storage ——. R. Ziegenberg, Berlin. Eng. Pat. 20,327, Sept. 12, 1906.

DURING the discharge of the battery, the electrolyte of dilute sulphuric acid is converted into an acidulated solution of zinc sulphate. The used electrolyte is evaporated in a vacuum vessel, constructed of acid- and fire-resisting materials, which is connected with a vacuum pump. Water and sulphuric acid are separated and are used for forming the new electrolyte for the following discharge. A portion of the zinc sulphate remaining in the vacuum vessel is used in the charging bath, and the remainder is converted into zinc oxide by further heating, the latter being used for neutralising the sulphuric acid in the charging bath. The sulphur dioxide evolved during the formation of zinc oxide is converted into sulphuric acid.—B. N.

Batteries ; Secondary ——. R. Ziegenberg, Berlin. Eng. Pat. 14,756, June 26, 1907. Under Int. Conv., Aug. 10, 1906.

THE liquid (a sulphuric acid solution of zinc sulphate) produced during the discharge of lead-zinc accumulators, is evaporated in an acid- and fire-resisting boiler, connected to a vacuum pump, and the residue is heated, in order to obtain as final products, water, sulphuric acid, and zinc oxide. The acid is used for the fresh discharge of the battery, and the zinc oxide for the removal and enrichment of the charging bath.—A. S.

Batteries ; Secondary ——. R. Ziegenberg, Berlin. Eng. Pat. 14,762, June 26, 1907. Under Int. Conv., Aug. 11, 1906.

DURING the charging of lead-zinc accumulators, a bath of a dilute solution of zinc sulphate, containing also a trace of free sulphuric acid, which exerts a favourable influence on the zinc deposit, is used. Metallic zinc is placed in the bath, but is not connected in the circuit, or zinc compounds, such as the oxide or hydroxide, may be used, for the purpose of neutralising the sulphuric acid formed by the decomposition of the zinc sulphate, and thus maintaining the strength of the solution. The temperature of the bath may be raised, by means of tubes through which steam or a hot liquid circulates, for facilitating the solution of the metal. The bath may be enriched in a separate vessel, communicating with the charging vessel, the liquid being caused to circulate, the formation of gas bubbles on the zinc electrodes being thus avoided.—B. N.

Electrodes for accumulators ; Iron —— *with alkaline electrolyte, and method for manufacturing same.* E. W. Jungner, Kneippbaden, Sweden. Eng. Pat. 3631, Feb. 13, 1907. Under Int. Conv., Feb. 14, 1906.

THIN iron plates are smeared over with a solution of an ammonium salt, to which has been added a copper salt, and are then exposed to the air. The plate is dried, and covered with a solution of sulphur in carbon bisulphide, these operations being repeated until a layer of rust of the desired thickness is produced. A number of these plates are used as negative electrodes in accumulators with an alkaline electrolyte, thin plates or nets of nickel, having their surfaces electrolytically oxidised, being used as the positive electrodes. The plates of the different electrodes are placed alternately, and separated by thin plates of a porous insulating material, such as asbestos. —B. N.

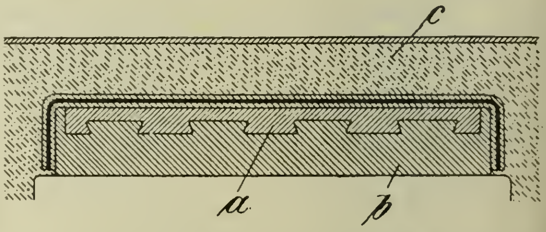
Electro-active cement-like substances of iron and nickel hydrates for forming electrodes ; Method of producing ——, *and accumulators constructed with such electrodes.* E. W. Jungner, Kneippbaden, Sweden. Eng. Pat. 3711, Feb. 14, 1907. Under Int. Conv., Feb. 15, 1906.

SEE Fr. Pat. 374,597 of 1907 ; this J., 1907, 877.—T. F. B.

Electrodes of magnetic metals ; Production of —— *by means of electrolytic oxidation ; electrodes produced in this manner, and accumulators provided with such electrodes.* E. W. Jungner, Kneippbaden, Sweden. Eng. Pat. 3834, Feb. 15, 1907. Under Int. Conv., Feb. 16, 1906.

SEE Fr. Pat. 374,598 of 1907 ; this J., 1907, 877.—T. F. B.

Electrodes for resistance furnaces. H. Röchling, J. Schoenawa and W. Rodenhauser, Völklingen-on-Saar, Germany. Eng. Pat. 11,917, May 22, 1907.



THE electrode, which is let into the furnace wall, consists of two parts ; *b*, a slab, consisting of alkaline-earths, rare earths or their compounds, and a carbonaceous residue, preferably of large section and as thin as possible, and a difficultly fusible plate, *a*, embedded between the slab, *b*, and the furnace wall, *c*. The slab, *b*, is in direct contact with the metal bath ; and the face of the plate, *a*, facing the slab, *b*, is provided with "suitably profiled channels for enlarging the current transfer surface and facilitating the firm adherence of the slab." When the furnace is erected, the material of the furnace wall, *c*, is separated from the electrode slab, *b*, and the plate, *a*, by the interposition of a fire-resisting electrically insulating layer. —B. N.

Electrode. J. W. Stubbs, Middlewich, Assignor to The General Electrolytic Parent Co. U.S. Pat. 867,319, Oct. 1, 1907.

SEE Fr. Pat. 376,548 of 1907 ; this J., 1907, 1015.—T. F. B.

Zinc oxide ; [*Electrical*] *Manufacture of* ——. W. and H. Simm. Eng. Pat. 21,787, Oct. 3, 1906. *See* XIIIA.

White lead ; Manufacture of —— [*electrolytically*]. S. O. Cowper-Coles. Eng. Pat. 22,023, Oct. 5, 1905. *See* XIIIA.

[*Lead oxide.*] *Electrolytic process and product.* C. P. Townsend, Washington, D.C., Assignor to E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 867,320, Oct. 1, 1907.

AN electric current is passed through a solution of the acetate of an alkali metal, using a lead anode and a diaphragm ; the cathode product is returned to the anode region at such a rate as to produce lead oxide by the reaction between the lead acetate and the alkali plumbite produced. The lead oxide obtained consists of yellow crystalline plates having opposite re-entrant angles ; it is darkened by exposure to light, and is readily hydrated. —A. G. L.

Lead pigment and similar compounds. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 867,436, Oct. 1, 1907. (See preceding abstract.)

An electric current is passed from a lead anode through an electrolyte from which lead is deposited at the cathode. This cathode is then used as anode in another electrolyte, with formation of the desired lead compound, which is heated to an elevated temperature with a reagent. The compound of lead obtained, is claimed to possess "peculiar properties."—A. G. L.

(*B.*)—ELECTRO-METALLURGY.

Metals; Electrical resistance of —— at very high and very low temperatures. G. Niccolai. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, I., 757—766, 906—909, II., 185—191. Chem. Zentr., 1907, 2, 283—284, 514, 1395.

Wires of about 0·5 mm. diam. and about 8 m. long, were wound upon glass tubes, insulated by means of asbestos, and either heated electrically from inside the tube, or cooled in a Dewar vessel. The temperature at the two ends of the coil of wire was measured thermo-electrically. For pure silver wire of 0·46 mm. diam., the following values for the electrical resistance ($R_{1}^{8}10^{9}$) were obtained, a correction being made for the expansion of the metal. At – 189·0° C., 417; – 100·2°, 913; +0·2°, 1507; +101·0°, 2104; +200°, 2687; +300·2°, 3259; and at +400·6° C., 3800. With nickel and iron, the variation in the electrical resistance at different temperatures is very large and increases as the temperature rises; the resistance is very low at – 273° C. In the case of copper, the resistance becomes equal to 0 even before the absolute zero (– 273° C.) is reached. The ratio of the resistance at +400° C. to that at – 189° C. is >26 for nickel, >16 for iron, greater than 12 for copper, 12 for aluminium, and 7 for platinum. The resistance-curves of different metals intersect: *e.g.*, copper and silver have the same resistance at – 70° C.; at lower temperatures, silver, and at higher, copper, is the better conductor. At 25° C. platinum and iron have the same resistance; at lower temperatures, iron is a slightly better conductor than platinum, whilst at higher temperatures, platinum is a much better conductor than iron. Alloys give resistance-curves quite different from those of the components. Manganin shows a slight maximum at +50° C. (38,855 as against 38,258 at +400° C., and 37,937 at – 189° C.). The ratio of the resistance at 400° C. to that at – 189° C. is shown in the following table:—

Nickel	26·192	New Silver. (" Neusilber ")..	1·183
Iron	16·338	Rheotan	1·142
Copper	13·543	Nickelin	1·114
Silver..........	9·002	Constantan	1·052
Gold	8·601	Manganin	1·008
18-Carat gold ..	2·196		

Change of structure has a considerable influence on the resistance: pieces of 18-carat gold wire, which were tested immediately after being drawn, and after heating four times and twelve times respectively to about 400° C., differed considerably in their resistance at first, but gave identical values after several re-heatings.—A. S.

Nickel; Thermo-electricity of ——. Influence of metallic impurities. H. Pécheux. Compt. rend., 1907, **145**, 591—593.

In employing thermo-couples constituted of nickel and copper wires, a marked difference in behaviour is noticeable according to the purity of the nickel employed. The presence of copper increases the fusibility of nickel, whereas iron appears to render it more refractory; carbon influences greatly the hardness of the metal, carbon-free metal being quite soft. After calibrating a series of nickel-copper couples by comparison with mercury thermometers and a platinium-iridium couple, and employing them subsequently for temperature measurements, it was found that they gave measurements which were comparable with one another, but comparison with a platinium-iridium couple was much less concordant and depended upon slow heating. Annealing up to 640° C. for a long period seemed to greatly increase the constancy of these couples and rendered them more suitable for technical pyrometry. The simultaneous occurrence of copper and cobalt in nickel gives rise to inconstancy and also affects the resistivity of the metal.—R. S. H.

Gold; Passivity of ——. A. Coehn and C. L. Jacobsen. Z. anorg. Chem., 1907, **55**, 321—355.

By the electrolysis of a solution of potassium aurocyanide ($KAuCy_2$), gold is deposited quantitatively as a monad, but from a solution of gold chloride ($AuCl_3$), aurous as well as auric ions appear to separate, and more readily at higher than at lower potentials, the weight of gold deposited being greater than that calculated. An anode of gold in a solution of auric chloride at sufficiently low potentials dissolves quantitatively as a tervalent ion, but at higher potentials becomes more or less passive. When passivity is once established, activity is not immediately regained by a return to a lower potential within the active range, a kind of hysteresis being exhibited. The introduction of more chlorine ions, as by the addition of hydrochloric acid, raises the value of the critical potential, below which passivity does not occur. In potassium cyanide solution, gold dissolves at the anode as a univalent ion Passivity develops in commercial potassium cyanide at a small concentration, a brown colour, due to paracyanogen, being noticed in the solution, but in pure potassium cyanide, a much higher concentration is necessary. The presence of the sodium salt in the commercial substance is responsible for this difference and the cause of passivity appears to be the formation of an invisible protective coating of sodium aurocyanide on the anode, this salt being much less soluble than that of potassium (a fact which explains the superior efficiency of potassium cyanide over sodium cyanide for the purpose of gold extraction). A similar result is noticed in the case of nickel, which dissolves quantitatively in a solution of potassium cyanide (this J., 1904, 667), but is rendered passive, it is now found, in the presence of sodium cyanide. The author would extend this explanation of passivity to all known instances of the phenomenon. When, in the neighbourhood of the anode, the solubility product of the ions of the protecting substance is reached (hastened in this case by the presence of more sodium ions), the protective coating is formed, rendering the anode passive. The property of sodium ions of causing passivity may be utilised analytically for the detection of sodium in the presence of much potassium.
—F. Soddy.

Nickel-plating baths; Reactions in ——. A. Brochet. Compt. rend., 1907, **145**, 627—628.

For a neutral nickel-plating bath the author recommends nickel chloride in presence of ammonium chloride and boric acid. In sulphate baths the anodes tend to become partially passive, which leads to acidity of the electrolyte and disengagement of hydrogen at the cathode. On the other hand, the tendency of chloride baths to deposit hydroxide at the cathode is corrected by an addition of boric acid.—W. A. C.

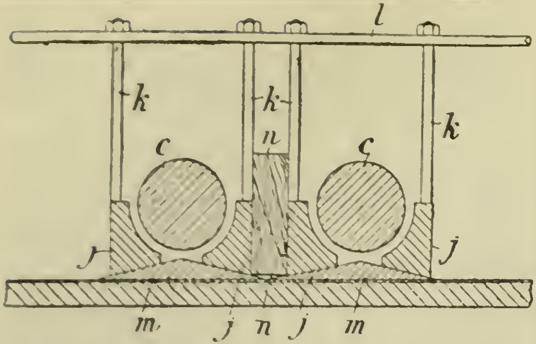
Zinc; Deposition of —— electrolytically from aqueous solutions of zinc fluosilicate. R. Goldschmidt. Rev. d'Electrochim. et d'Electromet., 1907, 1, 276—277.

The author as the result of numerous experiments on the electrolytic deposition of zinc from an electrolyte consisting of a solution of hydrofluosilicic acid of 20° B., exactly neutralised with zinc carbonate, found that dense, adherent deposits of a bright grey colour, free from the least sponginess, can be obtained by using a rotating cathode and adding some very fine sand to the electrolyte.
—A. S.

Patents.

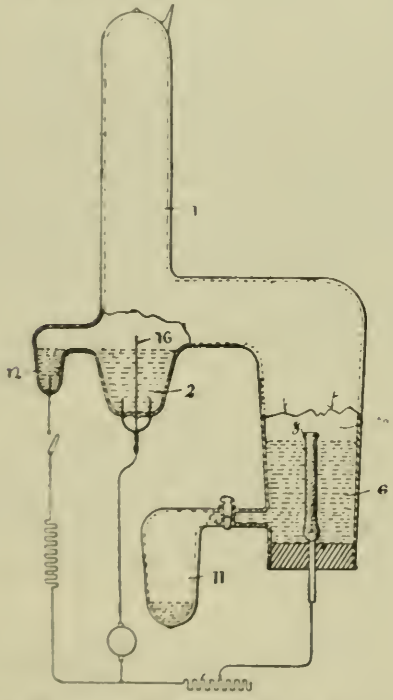
Iron tubes; Manufacture of —— by electro-deposition. S. O. Cowper-Coles, London. Eng. Pat. 21,081, Sept. 22, 1906.

The cathodes, *c*, in the form of iron rollers, are slowly rotated in the vat by means of pawls, the latter engaging with ratchet teeth on the ends of the rollers. The pawls are mounted on a common reciprocating rod, and are jointed, so that any one or more of them may be thrown



out of gear without stopping the remainder. The cast iron anodes, *j*, are connected by rods, *k*, to a common bar, *l*. As the anodes dissolve away, the wedges, *n*, are driven in, thus causing the anodes to rise on the inclined wooden blocks, *m*, and approach the cathodes, the rods, *k*, sliding laterally in slots in the bar, *l*.—B. N.

Refractory materials [*tantalum, etc.*]; *Treatment of* ——, *by means of the electric arc, and apparatus therefor.* The British Thomson-Houston Co., Ltd., London. From the General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 21,667, Oct. 1, 1906.



The cathode consists of a mercury bath, 2, through which a platinum wire projects into a vacuum vessel, 1. The anode consists of a rod, 8, which is moulded out of the powdered metal to be treated, and is surrounded by a considerable body of mercury, 6. An auxiliary mercury anode, 12, is provided for starting the vapour arc, and after the anode, 12, is cut out of the circuit, the rod, 8, carries practically the whole of the current, and the metal is gradually melted and obtained free from volatile impurities. The mercury is run from 6 into 11 as the rod melts, so as to maintain the level of mercury just below the end of the rod. A modification is described in which the cathode is suspended in a silica cup, an anode of dropping mercury being provided for starting the arc. In this case the anode bath, 6, forms the upper part of a barometric column, the upper level of which may be regulated by running off mercury from the trough.—B. N.

Ores; Methods of and apparatus for [*electrically*] *reducing* ——. M. Ruthenburg, Lockport, N.Y., U.S.A. Eng. Pat. 21,876, Oct. 3, 1906.

SEE Fr. Pat. 370,300 of 1906; this J., 1907, 262.—T. F. B.

Ferruginous sands; Reduction of ——. J. J. W. H. van der Toorn, The Hague, Holland. Eng. Pat. 598, Jan. 9, 1907.

FERRUGINOUS sand is mixed with pulverised limestone and carbon, and heated to about 1900° C. in an electric furnace, preferably of the resistance type. It is claimed that the iron is of good quality and free from titanium.—O. F. H.

Metal from deposits; Separating ——. I. Kitsee, Philadelphia, Pa. U.S. Pat. 865,711, Sept. 10, 1907.

A MIXTURE of conducting and non-conducting particles is fed on to a revolving drum the surface of which is formed by the non-conducting covering of electrodes connected to a circuit carrying a high-tension current. —O. F. H.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Palm fruits; Comparison of —— *from various districts.* E. Drabble. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 126—129.

THE essentials of the comparison between the fruits of *Elaeis guineensis*, Jacq., from the various districts named are shown in the following table. For convenience, the term "pericarp" is taken to include only the outer oily fibrous coat and not the stony shell.

Ratio of:	New Calabar.	Old Calabar.	Lagos.	Dixcove.	Warri.	Benin.
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Pericarp to whole fruit	—	38·76	24·65	30·89	23·36	35·67
Pericarp fat ,, ,,	—	29·02	14·38	20·94	14·01	24·86
Pericarp fat to whole pericarp	—	74·88	58·33	67·8	60·0	69·69
Kernel to kernel and shell	20·4	22·81	25·0	31·06	23·17	20·17
Kernel oil to kernel and shell	5·2	4·7	5·0	12·42	4·81	5·04
Kernel oil to kernel	25·0	20·58	20·0	35·0	21·05	25·0
Average volume of fruit in c.c.	—	7·2	4·0	5·2	6·7	7·5

It is important that the fruits shall have thoroughly ripened before they are gathered, as the maximum yield of oil is only obtained from the mature fruits. In the samples examined, many of the fruits were not ripe, and the oil yield was no doubt affected thereby.—E. W. L.

Fat from Lophira alata seeds; Analysis of ——. E. S. Edie. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 124.

THE seeds formed about 66 per cent. of the total fruit, and the ethereal extract from them amounted to 31·8 per cent. of the seeds. The extract was separated into: (*a*), a dark brown brittle mass, apparently of resinous nature; and (*b*), a white fat, containing, when purified by means of chloroform, free acid equivalent to 1·5 c.c. of $N/10$ potassium hydroxide per grm. of fat. The saponification value of the fat is 195, the iodine value 75·3; the free acids from the lead soaps insoluble in ether had the neutralisation value 195 and iodine value 22·5, whilst those from the soluble lead soaps had the neutralisation value 196 and iodine value 134·5.—E. W. L.

Myristica Angolensis; [*Fat of* ——.] E. Drabble. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 131—132.

THROUGHOUT the endosperm of the seeds of *Myristica Angolensis*—known as "Acoomoo" seed in Southern Nigeria—there are present, in the thin-walled cells, large masses of fat. This has been expressed from a small quantity of the seeds and was valued at £11 per ton for soap-making purposes.—E. W. L.

Sesamé oil; Influence of rancidity on Baudouin's test for ——. A. Lauffs and J. Huismann. Chem.-Zeit., 1907, **31**, 1023—1025.

Kreis (this J., 1899, 1158) applied Bishop's reaction to the detection of rancidity in fats, using for the purpose fresh sesamé oil which gave no coloration with hydrochloric acid. The authors have confirmed this observation upon a large number of samples of sesamé oil, the acid layer in each case assuming a rose coloration after the disappearance of the green and violet colorations. In one instance, however, Bishop's reaction was not obtained, notwithstanding the obvious presence of rancidity. Since this sesamé oil also gave no coloration with furfural and hydrochloric acid, the authors concluded that it was either abnormal and contained no sesamin, or that that substance had been so altered in the process of rancidity that it could no longer take part in a condensation reaction. From this fact they also infer that the active agents in Bishop's and Baudouin's reactions are identical. When rancid cocoanut oil was treated with concentrated hydrochloric acid with the object of causing the aldehydic bodies to form condensation products among themselves, it was found that the rancid fat could no longer prevent sesamé oil from assuming the characteristic coloration in the Baudouin test. The addition of cottonseed oil also has a promoting influence on the reaction, since it prevents the condensation between the sesamin and the aldehydic products of rancidity. This observation has a practical application in the examination of butter and margarine, in which there may be sufficient rancidity to interfere with the test for sesamé oil without being otherwise perceptible. In such cases it is recommended to add an equal quantity of cottonseed oil to the fat, and if a dyestuff giving a red coloration with hydrochloric acid be present, the mixture should be treated with hydrochloric acid of sp. gr. 1·125 (or of sp. gr. 1·19 when the weaker acid will not extract all the dyestuff), and then tested with the prescribed amount of furfural solution. In the presence of sesamé oil the colour should be rendered more intense.—C. A. M.

Animal fats; Detection of some —— when mixed with other animal fats. E. Polenske. Arbb. Kais. Gesundh.-Amt, 1907, **26**, 444—463. Chem. Zentr., 1907, **2**, 1120—1122.

It has been found that the difference of temperature between the melting point and solidifying point ("difference number") is not the same for different fats, but is fairly constant for an individual fat. In carrying out the determinations, 20—25 c.c. of the clear filtered fat are first heated for $\frac{1}{2}$ hour in a glycerin bath at 102°—103° C., whilst passing through it a slow, carefully dried current of carbon dioxide. It is then introduced into a U-shaped capillary tube having a diam. of 1·4—1·5 mm., and made of easily fusible glass, about 1 mm. thick. The column of fat in the tube has a total length of about 2 cm., and should stand at the same height in both limbs. Before making the determinations, the tube, with the fat, is kept for 22—24 hours in direct contact with ice in a closed box. For each determination, two carefully cleaned capillary tubes are used, fastened to an Anschütz thermometer, graduated in $\frac{1}{5}$° from 10° to 80° C. The heating bath consists of a mixture of 200 c.c. of glycerol and 100 c.c. of water in a beaker of 350 c.c. capacity; it has an initial temperature of 20° C., and the heating is so regulated that the temperature rises 2° per minute until within about 5° of the m. pt. of the fat, and then $\frac{3}{4}$° per minute. The m. pt. is taken as the temperature at which the fat appears perfectly clear, capillaries containing a light-coloured clear oil being used for control purposes. The observations are made by transmitted light against a dark background about 15 cm. distant, and the mean of six determinations is taken. For the determination of the solidifying point, an apparatus is used resembling that of Beckmann for determining the depression of the freezing point. It consists of a cooling vessel, 20 cm. high, in an opening in the cover of which rests the air-jacket consisting of a glass tube, 15 cm. high, 5 cm. diam. and 1 mm. thick. In the centre of this air-jacket is fixed the tube containing the fat, which is 17 cm. high and 1·8 cm. diam., and has, about 1 cm. above its flat bottom, two horizontal blackened scratches, 2 mm. long, 0·5 mm. wide, and separated by 0·25 mm. A third black mark is provided 2·7 cm. above the bottom, and 2 mm. above this mark, the tube has a globular enlargement of 2·5 cm. diam. The thermometer used is graduated in $\frac{1}{5}$° between 10° and 50° and in $\frac{1}{10}$° between 50° and 70° C., and is of such a size that when the bulb is between the two parallel marks and the upper mark, the scale up to 50° C. must be visible below the cork and not project above the surface of the water-bath. The fat is stirred by means of a nickel wire stirrer driven at 180—200 revolutions per minute. The fat, which has been previously heated to about 15° above its melting point, is introduced into the tube up to the upper mark. The solidifying point is taken as the temperature at which the two adjacent, horizontal marks on the rear wall of the tube can no longer be separately distinguished, but appear to shade off one into the other. The test is then repeated, and if the two results do not differ by more than 0·2°, these two determinations are sufficient; otherwise, the mean of three or four determinations is taken. For beef-tallow and lard the difference numbers were found to be 12·8—14·7 and 19—21 respectively, and the method allows of the detection of 15 per cent. of tallow in lard. Lard having a difference number lower than 18·5 must be regarded as adulterated with tallow or other fats having lower difference numbers. For pure goose-fat, 17 was found to be upper limit of the difference number. Pure butter-fat has a difference number varying from 11·8 to 14·3, and butter should be regarded as adulterated if the difference number of the butter-fat is above 14·6 or if that of a mixture of 75 parts of the butter-fat and 25 parts of beef-tallow is higher than 15. (The beef-tallow used should melt at 49—49·7° C. and have a difference number of 14·4—14·6.) Besides lard the only other fat examined by the author having a difference number as high as 20, is shea butter, a vegetable fat produced in Togo by boiling the seeds of *Bassia Parkii* with water. This fat gave the following results on analysis:—Free acids, 46·37; refractometer reading at 40°, 54; Reichert-Meissl value, 1·9; butter value (this J., 1904, 387), 0·43; iodine value, 49·0; m. pt., 45° C.; solidifying pt., 25° C.; difference number, 20; resinous unsaponifiable matter, 4·7 per cent. Mixtures of butter with 10 and 20 per cent. of shea butter gave difference numbers of 15·4 and 17·1 respectively.—A. S.

Drying vegetable oils; Oxidation of ——. S. Fokin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 609—615. Chem. Zentr., 1907, **2**, 1365.

The author studied the effect of a number of metals, which may be grouped as follows, according to their activity in accelerating the oxidation:—(1), cobalt, manganese, chromium, nickel (iron, platinum, palladium); (2), lead, calcium, barium; (3), bismuth, mercury, uranium, copper, zinc. The active agent is stated to be the oxygen of the highest peroxide of the metal. The velocity of the oxidation process increases proportionally to the cubic root of the concentration of the catalyser, and between $\frac{1}{2}$ and 20 atmospheres, the absorption of oxygen is proportional to the pressure. The reaction-velocity increases with temperature according to Spring's rule. Polymerisation, which occurs conjointly with oxidation, is observed most readily in the case of olive oil. It is stated that oils of less decided drying properties, *e.g.*, hemp-seed, sunflower, and poppy oils, may be used instead of linseed oil in the preparation of boiled oils.—A. S.

Hydrides; Rôle of metallic —— in reduction processes. [Reduction of unsaturated fatty acids]. S. Fokin. J. Russ. Phys.-Chem. Ges., 1907, **39**, 607—609. Chem. Zentr., 1907, **2**, 1324. (See this J., 1906, 935.)

The reduction of erucic acid proceeds readily in alcoholic but not in acetone solutions. Mesaconic and itaconic acids yield methylsuccinic acid on electrolytic reduction. The liquid fatty acids of croton oil give stearic acid on reduction, or if they are previously treated with bromine in carbon tetrachloride solution, tetrabromostearic acid. Croton oil does not give the elaidin test, owing to the presence of acids more unsaturated than those of the oleic series: on oxidising the liquid fatty acids of the oil with alkaline permanganate, tetrahydroxystearic acid is produced. By the action of excess of cobalt hydride at 270° C., under atmospheric pressure, oleic acid is reduced to stearic acid to the extent of 26—28 per cent., whilst in a sealed tube, the reduction proceeds to the extent of 60 per cent. If an ethereal solution of oleic acid be treated with palladium black, and a current of hydrogen led through, stearic acid can be detected after ½ hour; with platinum black under similar conditions, 24 per cent. of stearic acid is obtained after ½ hour, 84·5 per cent. after 3½ hours, and 90 per cent. after 5 hours. Oleic acid is also reduced by nickel and cobalt (prepared from the oxides), in presence of hydrogen, at temperatures of 45°—184° C. and 98°—250° C. respectively.—A. S.

Phytosterol; Notes on ——. A. Windaus and A. Hauth. Ber., 1907, **40**, 3681—3686.

In a previous communication (this J., 1907, 69) it was shown that the crude phytosterol from the fat of Calabar beans could be resolved into the two constituents, stigmasterol, $C_{30}H_{50}O$ (or $C_{30}H_{48}O$), and a phytosterol, $C_{27}H_{46}O$ (or $C_{27}H_{44}O$), melting at 136° to 137° C. Further details of this phytosterol are now given. It was prepared by acetylating the crude phytosterol from the fat, brominating the mixed esters, filtering off the stigmasteryl acetate tetrabromide, and separating the phytosterol from the filtrate. The purified product (m. pt. 136° to 137° C.) was proved to be identical with an actual sample of Burian's sitosterol (*Monats. f. Chem.*, 1897, 18, 551), and in the authors' opinion most of the phytosterols of m. pt. about 135° C. hitherto described consist entirely, or for the most part, of sitosterol. Incidentally it is mentioned that the phytosterol from linseed oil does not yield a compound forming a sparingly soluble tetrabromide. In this respect it shows a marked difference from the phytosterol of rape oil, which contains about 20 per cent. of a substance of the nature of stigmasterol. When the phytosterol from Calabar bean fat was dissolved in amyl alcohol, and the solution boiled for 8 hours with metallic sodium, added little by little, the derivative finally obtained crystallised from acetone in blunt needles (or in rectangular plates if the crystallisation was very slow), melting at 175° C. It was nearly insoluble in cold alcohol and petroleum spirit, but dissolved readily in chloroform, benzene, and ether. The air-dried substance, which contained no water of crystallisation, had the composition $C_{27}H_{48}O$, and was termed "dihydrophytosterol"; it was still unsaturated. The same derivative was also given by linseed oil phytosterol and Burian's sitosterol. It formed a "dihydrophytosteryl" chloride (m. pt. 114°—115° C.) which dissolved readily in chloroform and ether, with difficulty in acetone, and with great difficulty in methyl alcohol, and was also unsaturated. A compound termed "dihydrophytostene," $C_{27}H_{48}$, was prepared from this chloride by reduction with sodium and amyl alcohol. It crystallised in brilliant rectangular plates melting at 80° to 81° C., and was unsaturated. It might be inferred that "dihydrophytosterol" is an isomeride of phytosterol, the transformation being effected by ready-formed sodium amylate, and the nascent hydrogen being without action. Experiments with sodium amylate disproved this, however, a derivative melting at 146° to 147° C., and having the composition, $C_{27}H_{46}O$, being obtained. This compound, "pseudophytosterol" was distinct from phytosterol and "dihydrophytosterol," and was not an intermediate product, since it was not acted upon by metallic sodium and amyl alcohol. It no longer gave the colour reactions of cholesterol bodies, and was unsaturated, though it absorbed bromine more slowly than did phytosterol. The authors therefore conclude that "dihydrophytosterol" is actually a reduction compound of phytosterol, and that that alcohol must contain at least two unsaturated bonds. In this respect it differs from cholesterol, which yields the same saturated compound (α-cholestanol, cyclocholesterol) whether treated with metallic sodium and amyl alcohol or with sodium amylate (this J., 1907, 782). The formation of "dihydrophytosterol" may be used as an identification-test of phytosterol. In connection with this comparison between cholesterol and phytosterol it is pointed out that hippocoprosterol (probably formed by the bacterial reduction of phytosterol) contains at least 4 atoms of hydrogen more than phytosterol, whilst coprosterol, the intestinal reduction product of cholesterol, contains only 2 atoms of hydrogen more than cholesterol.—C. A. M.

Soap in Ceylon. Bd. of Trade J., Oct. 24, 1907. [T.R.]

The Report of the Ceylon Customs Administration for 1906 states that German manufacturers are competing successfully with English in toilet soaps, the imports from that country having increased from Rs. 22,000 in 1905 to Rs. 25,000 in 1906. During the same period the exports from Great Britain rose from Rs. 212,000 to Rs. 217,000, and though this increase is proportionately less than that of Germany, it must be noted that the United Kingdom sends to Ceylon 84 per cent. of the toilet soap imported. The increase in the quantity of soap imported into Ceylon is very great. Ten years ago Rs. 189,000 worth (toilet and bar) was imported, while in 1906 the total value amounted to Rs. 423,000. In addition to the soap imported, oils and soap berries are freely used. There is a great demand for cheap scented soap, and of this the German manufacturers make a speciality.

Patents.

Margarine; Manufacture of ——. S. Mitscherlich. Eng. Pat. 9015, April 18, 1907. *See* XVIII*A*.

Cocoanut oil; Process for transforming —— *into an alimentary fat having a nutty flavour and the consistency of lard.* P. D. Massimi. First Addition, dated May 23, 1907, to Fr. Pat. 373,996, April 4, 1906. *See* XVIII*A*.

Fatty compounds; Process for making a mixture of —— *which can be preserved.* S. Fenger. Fr. Pat. 378,377, May 31, 1907.

See Eng. Pat. 13,382 of 1907; this J., 1907, 1099.—T.F.B.

Fats, oils, resins, waxes and analogous substances; Method of bleaching ——. Vereinigte Chem. Werke Akt.-Ges. Fr. Pat. 378,515, June 6, 1907.

The crude substance is treated, preferably with the aid of heat, with an organic peroxide such as benzoyl peroxide in the proportion of, say, 0·2 per cent. Such peroxides are soluble in oils, fats, resins, etc., and effect decolorisation without the formation of a deposit or the emulsions often produced by ordinary aqueous solutions of bleaching agents.—C. A. M.

Alkali peroxide boxes; Method of producing ——. W. P. Thompson. From Königswarter and Ebell. Eng. Pat. 9458, April 23, 1907. *See* VII.

Finishing soaps; Process for preparing ——. E. Agostini. First Addition, dated Aug. 8, 1906, to Fr. Pat. 361,772, Sept. 16, 1905. *See* V.

Soap; Manufacture of ——. J. Crosfield and Sons, Ltd. Fr. Pat. 378,528, June 6, 1907.

Soap is prepared from soft oils or fats hardened by saturating the unsaturated fatty acids or glycerides with hydrogen in the presence of a finely-divided metal to act as a catalysing agent. The product is much harder than soap made from the untreated oil, and may be used as a lubricant, etc.—C. A. M.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Patents.

Zinc oxide; Manufacture [Electrical] of ——. W. and H. Simm, Prescot, Lancs. Eng. Pat. 21,787, Oct. 3, 1906.

Zinc ores, or substances containing zinc in an impure form, are roasted with free access of air in an electric furnace which is constructed on the top of a truck. Two carbon slabs, which form the sides of the furnace, serve also as electrodes and are connected by a layer of powdered charcoal before starting the furnace, which is operated by an alternating current. The furnace is fitted with a hood, which is carried by a permanent support, in such a manner that its lower edge covers the top of the furnace and leaves a short space above it for the supply of air. The hood carries a flue provided with a damper, and a charging hopper communicating with the flue through a valve. A condensing chamber communicates with the hood by means of the flue, and is provided with a fan for creating a draught from the furnace through the flue, and with baffle-screens facing the fan. These screens are arranged on the Venetian blind principle and may conveniently consist of flat wooden bars, frames covered with muslin, or the like.—O. R.

White lead; Manufacture of —— [*electrolytically*]. S. O. Cowper-Coles, London. Eng. Pat. 22,023, Oct. 5, 1906.

Grids, plates, or sheets of lead are placed, either in series or in parallel, in a cell containing ammonium nitrate solution as electrolyte. An electric current is passed through the cell, the voltage employed varying between 0·3 and 0·8, and the current-density being about 9 ampères per sq. ft. of single electrode surface. The temperature of the bath is about 45° C., and the current is reversed every 10 minutes to prevent the deposition of spongy lead upon the cathodes. When the solution has become charged with lead, it is conveyed into a separate vessel, where a current of carbon dioxide is passed through it at a temperature of about 37° C. The lead is thereby precipitated in the form of white lead, and the solution, after filtering, is returned to the electrolytic cell. An almost theoretical yield of white lead, free from spongy or metallic lead, is thus obtained.—O. R.

[*Lead oxide.*] *Electrolytic process and product.* C. P. Townsend, Assignor to E. A. Sperry. U.S. Pat. 867,320, Oct. 1, 1907. *See* XI*A*.

Lead pigment and similar compounds. E. A. Sperry. U.S. Pat. 867,436, Oct. 1, 1907. *See* XI*A*.

Paints; Waterproof ——. R. Plönnis, Berlin. Eng. Pat. 6755, March 20, 1907. Under Int. Conv., May 2, 1906.

See U.S. Pat. 858,536 of 1907; this J., 1907, 881.—T. F. B.

Carbon-black; Process of making ——. A. D. Purtle and J. E. Rowland, Salem, W. Va. U. S. Pat. 866,883, Sept. 24, 1907.

A hydrocarbon gas is continuously introduced under pressure into a retort heated to 800° C., so as to deposit carbon in a flocculent state on the walls of the retort. This carbon is removed from time to time while still in the flocculent state, without interrupting the heating. —A. G. L.

Bauxites and aluminous minerals; Utilisation of —— *and transformation into pigments with concurrent production of valuable by-products.* N. A. Lecesne. Fr. Pat. 378,323, Aug. 6, 1906.

To prepare a red aluminous pigment, 1000 kilos. of powdered ferruginous bauxite, with about one kilo. of aluminium filings, are mechanically agitated with sufficient water to form a paste, to which about 7 kilos. of caustic soda are added, in order to produce hydrogen, the temperature being meanwhile maintained at near 100° C. The product is then mixed, at this temperature, with 70 kilos. of colophony partially saponified by lime, and 10 kilos. of oleic acid, in order to produce an aluminium soap. The mixture is dried, and powdered. An aluminous pigment of a green or blue colour is obtained by adding 1000 kilos. of ferruginous bauxite powder, previously treated with nascent hydrogen as described above, and then dried, to 1000 kilos. of sulphuric acid (50—52° B.), and heating to about 150° C. for 72 hours. The mixture is then cooled to 100° C., small portions of water are added sufficient to produce a liquid paste, and then 500 litres of a ten per cent. solution of ammonia, and 100 kilos. of finely-powdered chalk. Potassium ferrocyanide is then added according to the tint required, and the mass filter-pressed, dried, and ground. To obtain a white pigment, hydrated alumina, obtained from bauxite by described processes, and then partially dehydrated, is incorporated with a fatty acid, and then with zinc white which has also been mixed with a fatty acid, in order to produce a double soap of aluminium and zinc, soluble in oils, and insoluble in water, which when dried at a low temperature, and ground, is applicable as a pigment. A mastic for luting is obtained by incorporating aluminium oxide, more or less hydrated, with oil or with a zinc soap or the like, and with or without iron ferrocyanide. Other by-products and applications are described.—E. S.

Metals; Paints for ——. P. H. Guérin. First Addition, dated May 10, 1907, to Fr. Pat. 374,053, Jan. 29, 1907 (this J., 1907, 831).

Claim is made for the use of salicylic acid, either pure or in combination with alumina, lime, magnesia, etc., in the compositions described in the main patent.—O. F. H.

Painting cement; Substance for ——. G. L. Daniel. Fr. Pat. 378,357, May 27, 1907.

The dry cement is twice coated with a saturated solution of iron sulphate in water. After drying, the oil-paint is applied as usual.—A. G. L.

(*B.*)—RESINS, VARNISHES.

Finnish turpentine oil (pine oil); Examination of the first runnings of ——. O. Aschan. Z. angew. Chem., 1907, 20, 1811—1816.

The author has investigated the fraction of Finnish oil of turpentine which boils below 154° C. A large quantity of this oil can be obtained from the forests of Finland, but hitherto there has been an objection to its use in the paint and varnish industry owing to its strong colour and smell. The following substances have been isolated from the oil and identified:—(*a*), Simple aldehydes; (*b*), furan and some of its homologues; (*c*), benzene hydrocarbons; (*d*), aliphatic diketones, such as diacetyl; (*e*), methyl isobutyrate and some other esters; (*f*), furfural; (*g*), unsaturated substances, probably hydrocarbons and alkylated quinones. It is believed that the esters, benzene hydrocarbons, and furan cannot account for the colour or smell of the turpentine, but that these characteristics are due to some or all of the other substances, *viz.*, the aldehydes, the diketones and the unsaturated bodies, and especially the quinone-like substances. In order to get rid of these substances, the oil of turpentine should be treated in the first instance with sulphuric acid to remove the furan and diketones. The sulphuric acid must not be too concentrated, or it will act also on the turpentine. The oil is next treated with sodium bisulphite in order to get rid of the aldehydes and quinones, and then with sodium hydroxide to neutralise the acid present and to condense any remaining diketones.—C. E. F.

Colophony; Composition of American ——. P. Levy. Ber., 1907, 40, 3658—3660 (See also this J., 1906, 1057).

Further experiments are described in support of the author's suggestion that the hydrocarbon, abietin, $C_{19}H_{28}$, produced by the distillation *in vacuo* of the chloride of abietic acid is identical with the compound obtained by Krämer and Spilker to which the incorrect formula, $C_{18}H_{28}$, was assigned (Ber., 1899, 32, 2953). Crude rosin oil obtained by the rapid distillation of American colophony was distilled *in vacuo*, and the light-yellow distillate, boiling at 190° to 205° C. under a pressure of 14·5 mm., redistilled over metallic sodium. The product, which now boiled at 200° to 202° C. under a pressure of 14·5 mm., was a thick colourless liquid, which did not alter on standing for a long time. Its composition corresponded with the formula, $C_{19}H_{28}$, and it behaved exactly like abietin on treatment with organic solvents, and, like it, formed no picrate with picric acid solution. The author's observations also show that abietic acid is not acted upon by reducing agents. With hydrobromic acid in glacial acetic acid, it forms an addition compound which differs from abietic acid mainly in its greater solubility in ordinary solvents. Analyses of the addition compound have confirmed the view of Fahrion (this J., 1902, 127) and of Koritschoner that two double bonds are present in abietic acid.—C. A. M.

Tamarind resin ("*Jutahycica*"). E. S. Edie. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 120.

The resin was pale-coloured and moderately brittle, and contained a considerable amount of bark and fibre. From these and other insoluble impurities it may be freed by boiling with dilute (about 5 per cent.) sodium carbonate solution, separating the impurities by centrifugal action and subsequently precipitating the resin acids by means of dilute sulphuric acid. 98 per cent. of the original resin is thus obtained as a white powder. The resin yields about 0·25 per cent. of ash, and the saponification value of both crude and purified samples is 136. It is soluble to a large extent in alcohol, ether, oil of turpentine and other organic solvents. It appears to be suitable for application as an adhesive, and also as a varnish.—E. W. L.

Funtumia elastica [*caoutchouc*]; *Influence of the method of coagulation on the physical and chemical properties of* ——. P. Schidrowitz and F. Kaye. India Rubber J., 1907, 34, 377.

A sample of *Funtumia elastica* latex was coagulated in various ways and the rubbers obtained were tested, with the results given in the following table. No. 1 was coagulated by heating to 75° C. and was washed with warm water before pressing. No. 2 was boiled, pressed lightly, and boiled with fresh water. No. 4 was treated with ammonium oxalate (when no coagulation took place), diluted, and warmed with calcium chloride. No. 6 was coagulated with acetone. No. 7 was simply diluted with five parts of water, when the caoutchouc "creamed" out. No. 9 was diluted with five parts of 10 per cent. calcium chloride solution (when no creaming occurred) and eventually coagulated by warming with ammonium oxalate. No. 11 was treated as No. 2 and then extracted with a resin solvent. No. X. was coagulated by exactly neutralising the somewhat acid latex with alkali. The coagulated rubbers were pressed and dried *in vacuo* at 40° C.

	No. 1.	No. 2.	No. 4.	No. 6.	No. 7.	No. 9.	No. 11.	No. X.
Yield of rubber, calculated to dry resin-free article ..	47	47	—	47	46	51	43	about 40
Nitrogen in extracted and dried rubber	1·03	0·92	0·78	0·95	0·56	—	1·12	—
Moisture (after partial drying)	7·90	11·51	10·64	7·91	12·64	1·20	0·46	—
Resin, referred to original rubber....................	6·77	6·16	5·60	6·19	6·56	5·20	1·74	—
Resin, referred to dry rubber	7·34	7·82	6·27	6·67	7·50	5·30	1·74	—
Caoutchouc	84·9	80·6	77·6	85·4	80·9	91·9	94·3	—
Dirt and insoluble	0·64	1·73	6·16	0·43	—	1·76	3·54	—
Moist* tensile strength, in grms. per sq. mm.	120	190	150	117	190	—	—	—
Dry* tensile strength	—	293	392	217	290	220	364	384
Moist* elongation	6·0	4·25	4·4	3·8	5·6	—	—	—
Dry* elongation	—	5·0	6·0	5·5	6·4	4	6·6	4·8
Resiliency (dry*)	—	66	57	80	94	54	100	—

The figures in the first seven horizontal columns denote percentages.

* The "moist" tensile strengths were determined on the rubber as analysed; the "dry" tensile strengths on rubber which had been dried (until quite clear) *in vacuo* at 40° C.

Under "resiliency" the authors understand the original length of the test-piece expressed as a percentage of its length at the breaking strain, measured 24 hours after the test.—W. A. C.

Drying vegetable oils; Oxidation of ——. S. Fokin. *See* XII.

Patents.

Fats, oils, resins, waxes, and analogous substances; Method of bleaching ——. Ver. Chem. Werke A.-G., Fr. Pat. 378,515, June 6, 1907. *See* XII.

Corn (maize) cobs; Utilisation of ——. J. Prégent. Fr. Pat. 378,322, Aug. 6, 1906.

The cobs are reduced to a granular or powdered condition, and the substance is then useful as a substitute for cork in packing fruit, etc., and in the manufacture of linoleum. When mixed with silicates, chalk, cement, and gelatin, the powdered substance may be pressed in moulds of any desired shape.—W. P. S.

(C.)—INDIA-RUBBER, &c.

Rubber-bearing tree of Tonkin; A newly-discovered ——. Dubard and Eberhardt. Compt. rend., 1907, **145**, 631—633.

The only native rubber tree hitherto found in Tonkin, where it occurs in considerable numbers, is of the order *Moraceæ* and is identified by the authors as a *Bleekrodea* (Blume) and named by them *B. tonkinensis*. Other members of the same genus are found in Borneo and in Madagascar. Its latex is as rich in rubber as that of Hevea, and the quality of the product is stated to be equal to that of the best Para.—W. A. C.

Lease of Government rubber plantation in Burma. Bd. of Trade J., Oct. 24, 1907. [T.R.]

The lease of the Government rubber plantation at Mergui, Tenasserim, Lower Burma, is offered for sale for a period of 30 years with the right to renewal for a further period of 20 years. The area to be leased is planted with rubber and is estimated to cover 1,897 acres, on which, it is believed, some 340,000 rubber trees (*Hevea Braziliensis*) are now alive. Of these trees some 3,000 are over six years old, and of these more than 3000 are over 2 feet in girth. A memorandum giving full particulars and a copy of the agreement the purchaser will be expected to enter into, can be obtained on application to the Chief Conservator of Forests, Burma.

Patents.

Vulcanised rubber; Process of reclaiming scrap or waste ——. O. A. Wheeler, Austin, Ill., Assignor to F. W. Garlick, C. I. Bear, and W. A. Vail, Chicago, Ill. U.S. Pats. 866,758 and 866,759, Sept. 24, 1907.

The old rubber stock, finely divided and freed from fibre and other foreign matter, is forced through a narrow pipe or passage, where, air being excluded, a stream of heated fluid such as superheated steam, without oxidising the particles of rubber, quickly heats them to the point of plasticity and coherence. Passing on, the plastic mass is quickly cooled and formed into sheets.—S. R. T.

Gums; Process of recovery, devulcanisation and agglomeration of ——. E. A. L. Rouxeville. Fr. Pat. 378,251, Aug. 4, 1906.

Use is made of the similar nature and properties of natural gums and the terpene hydrocarbons and derivatives to substitute the latter for, or mix them with the gums in various preparations, in proportion and kind according to the product desired. In particular the mixture of hydrocarbons (cymene, terebene, camphene, etc.) described in Fr. Pat. 356,716 of 1905 (this J., 1906, 83) may be employed, the rubber being finely divided, intimately mixed with the hydrocarbons, and beated at 140° C. The resulting material is practically a new gum and can be vulcanised in the usual way. From such a mixture the sulphur may be extracted by maceration with carbon bisulphide, followed by hot strong sodium carbonate. The latter produces an emulsion which may be cleared with alum or a weak acid, any loading or inert matter introduced in manufacture being at the same time precipitated. Or, the hydrocarbon mixture may be dissolved out with acetone, in which the natural gums are insoluble.—S. R. T.

Rubber; Plastic substitute for ——. B. Sauton. First Addition, dated Oct. 15, 1906, to Fr. Pat. 378,465, Aug. 10, 1906. (See Eng. Pat. 27,616 of 1906; this J., 1907, 1100.)

To the plastic composition of glycerin and gelatin, claimed in the principal patent, textile materials, preferably as short fibres, are added while the mass is still liquid, thus preventing tension of the elastic material without diminishing its compressibility.—S. R. T.

Elastic material similar to rubber, and process of manufacturing the same. L. Roland. Second Addition, dated May 22, 1907, to Fr. Pat. 364,075, Mar. 13, 1906 (this J., 1906, 895; 1907, 539).

In making an elastic material from glycerin, gelatin, chromic acid, and sugar by the process described in the main patent (*loc. cit.*), an increase of tensile strength is said to be obtained by adding at the frothing stage, a solution of caoutchouc, or such oils as rape oil and linseed oil, which thicken when heated and produce a brown finish on vulcanising.—S. R. T.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Chrome leather; Neutralisation of ——. P. Kauschke. Collegium, 1907, 354—355, 357—365.

Complete neutralisation is readily obtained by means of sodium carbonate, but its employment alone is likely to cause damage, owing to the liberation of carbonic acid in the skin fibres. Sodium phosphate is better and also preferable to borax, since less is required and less free acid is liberated. It is also easier to detect and titrate in the liquors than the liberated boric acid. The two may be advantageously combined, and as the result of experiments, the author recommends the following process of neutralisation. 100 kilos. of the leather are worked in a drum for half an hour with a solution of 2·25 kilos. of sodium phosphate in 100 litres of water at a temperature of 25° C. The liquor is then drawn off and the leather worked for a further quarter of an hour in a solution of sodium bicarbonate (50 grms. per litre) at the same temperature.—S. R. T.

Patents.

Tanning extracts [with waste sulphite-cellulose lyes]; Manufacture of ——, *and tanning.* D. Stewart. Eng. Pat. 5438, Mar. 6, 1907.

Tanning materials are extracted with filtered waste paper pulp sulphite liquors, the ash of which does not contain more than 6 per cent. of iron. The extract is allowed to stand in a settling tank and the clear liquor concentrated. Oxalic or other suitable acid may be added to increase the bleaching effect of the sulphites.—S. R. T.

Skins; Depilation and soaking process for ——. J. Morel and P. Savigny. Fr. Pat. 378,425, Aug. 9, 1906.

Sulphuretted compounds of antimony (such as sulphoantimonates and sulphoantimonites of the sulphides of the alkalis and alkaline-earths) either alone or mixed are employed. Soft skins are treated with a solution (1 to 10 per cent.) of sulphoantimonate of sodium sulphide, stronger solutions being used for hard skins. The time of contact varies with the nature of the skin and the concentration of the solution.—S. R. T.

Skins; Apparatus for tanning ——. P. Pons and A. Boglio. Fr. Pat. 378,613, Aug. 16, 1906.

The apparatus consists of a series of connected vats in which the skins are suspended, without touching, and through which the tanning liquor circulates, entering at one end of the series and leaving at the other. A trough is provided alongside the vats, so that any one of the latter can be thrown out of action without interrupting the work of the others. The circulation of the tanning liquor is maintained by means of a pump which transfers the liquor from a cistern at the end of the series to one placed at a higher level at the beginning.—S. R. T.

Leather, varnished and multi-coloured; Manufacture of ——. Gebr. Feldmann and H. Feldmann. Fr. Pat. 378,643, June 8, 1907.

Leather, prepared in the usual manner, is covered with an opaque colour, obtained by mixing a colouring matter with a lacquer, and then dried. The surface is then completely covered with a second colour of a similar nature. While still moist, the colour of the projections of the grain is then removed by rubbing, after which the leather is re-dried and if desirable, re-varnished.—S. R. T.

Insulating composition [from spent tan]; Manufacture of an ——, *and articles resembling vulcanite.* C. Marter. Eng. Pat. 14,395, June 23, 1906. *See* XIA.

XV.—MANURES, &c.

Calcium cyanamide and other nitrogenous manures; Experiments with ——. Volhard. Biedermann's Centr., 1907, 36, 653—661.

The writer has collated the conclusions recorded by several observers as the result of their experiments regarding the manurial value of calcium cyanamide. H. Immendorf (Mitt. deutschen Landw., 1907, [9], 93) finds that calcium cyanamide is quite unsuitable, and even injurious, for use with acid humus and light sandy soils. For all other soils, particularly those rich in lime and well supplied with farm-yard manure, the use of calcium cyanamide is advantageous. The substance should be ploughed into the soil 3 or 4 days before the seed is sown; it must not be used as a top dressing. H. Schmöger (Mitt. deutschen Landw., 1907 [10], 103) observed that oats and potatoes grew well on soil manured with calcium cyanamide, no injurious effect being noticed. The cyanamide appeared to have nearly the same manurial value as ammonium sulphate, but neither were as efficient as sodium nitrate (Chili saltpetre). F. Mach (Fühling's Landw. Zeit., 1906, [24], 830) in his first experiments found that calcium cyanamide was only about 40 per cent. as valuable as sodium nitrate, but later experiments gave the same value for both of these manures. B. Schulze (Fühling's Landw. Zeit., 1907, [5], 145) concludes from his experiments that nitric nitrogen is most readily taken up by plants; then comes ammoniacal nitrogen, and lastly cyanamide nitrogen. Plants, however, appear to differ in their power of absorbing nitrogen from these manures. He also finds that a top dressing of cyanamide is injurious to plants. W. Schneidewind (Landw. Wochenschr. Sachsen, 1907, [9], 87) states that calcium cyanamide is almost as good a manure for potatoes as sodium nitrate. M. Gerlach (Landw. Centralbl., 1907, [4]) found that cyanamide is either converted by soil bacteria into urea and ammonia, and later into nitric acid, or is changed by chemical action into dicyandiamide; the latter substance has no value as a manure and is injurious to plants. Von

Feilitzen (Landw. Presse, 1907) has studied the values of calcium cyanamide and Norwegian calcium nitrate. The former when applied to sandy or clay soils was almost as good a manure as ammonium salts for cultivating oats, barley, wheat, and potatoes, but it is inferior to manures containing nitric nitrogen. Cyanamide was practically valueless when added to decomposed peaty soils. Other experiments showed that, on account of its purity, calcium nitrate frequently gave better results than Chili saltpetre; its only objection is that it is extremely deliquescent. (See also this J., 1907, 478 and 1059.)—W. P. S.

Tobacco; Relation of the composition of the leaf to the burning qualities of —— W. W. Garner. Bureau of Plant Industry, U.S. Dept. of Agric. Bull. No. 105, 1907.

By the term "burning qualities" is understood, in general, the fire-holding capacity of the tobacco, *i.e.*, the length of time it will continue to burn, the evenness and completeness of the burning, and the character (colour and firmness or cohesiveness) of the ash. It is found that the fire-holding capacity depends chiefly on the content of potassium salts of organic acids. Lime does not greatly affect the fire-holding capacity, but is an essential factor in the production of a good ash. A large proportion of magnesia has an injurious effect on the fire-holding capacity of the tobacco. Chlorine and sulphates are also harmful, but the former is seldom present in sufficient quantity to do much injury, and the effect of sulphuric acid is less marked when it is present only as potassium sulphate. The organic constituents of tobacco have little influence, with the exception of the so-called tarry acids and the proteids, which are generally believed to injuriously affect the burning qualities. It would appear, therefore, that in order to improve the burning qualities of tobacco, efforts should be made, by breeding, by improved methods of production, and by the use of fertilisers, to obtain: (1), A relatively high content of potassium combined with citric and malic acids, with a minimum amount of inorganic salts, especially chlorides and sulphates; (2), a moderate content of lime; (3), a comparatively small percentage of magnesia; and (4), a low content of organic nitrogenous compounds. Potassium carbonate would be an ideal potash fertiliser for tobacco, but for its high cost and its strong alkaline reaction. Potassium silicate, which is free from this latter objectionable property, would be a valuable fertiliser if its potassium could be rendered available. Magnesia should only be applied in the form of magnesium carbonate. The proportion of organic nitrogenous constituents is greatest in tobacco of rank growth, produced, *e.g.*, by the use of excessive quantities of nitrogenous fertilisers, especially during the later stages of growth. The percentage of proteids decreases rapidly during the ripening process, and the tobacco should therefore not be harvested until the leaf is well matured.—A. S.

Patents.

Peat and peat-bogs; Process for treating —— [*Nitre beds*]. A. Müntz and A. C. Girard. First Addition, dated April 23, 1907, to Fr. Pat. 377,711, July 18, 1906 (this J., 1907, 1100).

The peat, incorporated with chalk, a little calcium phosphate, and a sufficiency of water, is made into a stack and sown with material from an active nitre bed. Ammonium sulphate is added, and the temperature maintained at about 27° C., until nitrification is complete (about 1 month). After washing out the calcium nitrate, the bed may be reconstructed. If the peat is not too earthy, the process can be made continuous by forming a series of specially constructed beds, each on a foundation of cinders. The nitrifiable solution is fed on automatically at intervals, and is allowed to increase in strength and quantity each day, reaching at the end of the month 1000 litres (7·5 grms. of ammonium sulphate per litre) per cb. m. of peat per 24 hours. The calcium nitrate solution drains from each bed into a corresponding reservoir, where it is treated with more ammonium sulphate, and the precipitated calcium sulphate allowed to settle, the clear liquid being transferred to an upper reservoir feeding the beds. More chalk is added as required.—F. Sodn.

Ammonia; Transformation of the nitrogen of peat into ——. M. L. Gaillot and P. Brisset. First Addition, dated May 21, 1907, to Fr. Pat. 375,792, Mar. 15, 1907 (this J., 1907, 925).

A special kiln is described for combustion of the peat. The material passes from a hopper into the distillation chamber, the bottom of which consists of a grate, through which the hot coke is mechanically shaken into a lower chamber supplied with air, where it is incinerated, before passing into the ash-pit below. The hot and dry ammoniacal gases from the incineration chamber are led into the absorption tower near the base, the moist tarry gases from the distillation chamber being made to enter at a higher level. A series of perforated shelves, each of which can be turned on its axis, is provided in the tower, and by this means solid absorbents, such as peat saturated with sulphuric acid, may pass down the tower from shelf to shelf, and meet the ascending gases. A claim is made for the production of these nitrogenous manures, such as enriched peat.—F. Sodn.

XVI.—SUGAR, STARCH, GUM, &c.

Starch; Action of nitric acid on ——. A. Doroschewski and A. Rakowski. J. Russ. Phys.-Chem. Ges., 1907, 39, 427—439. Chem. Zentr., 1907, 2, 1325—1326.

The authors studied the effect of 0·2-, 0·4-, and 0·6-normal solutions of nitric acid on the hydrolysis of starch (5 grms. per 100 c.c. of liquid), the mixtures being heated in sealed tubes at 98° C. The progress of the hydrolysis was followed by polarimetric observations, and it was found that the velocity-constant, calculated for a unimolecular reaction, increased regularly up to a certain limit, which is characteristic for reactions with intermediate stages. The final stage of the hydrolysis is a unimolecular reaction. The time required for the complete hydrolysis of the starch is inversely proportional to the concentration of the acid, being 20 hours for 0·2-N acid, 10 hours for 0·4-N, and 5 hours for 0·6-N acid. The factor for the calculation of dextrose into starch is 0·907 according to the authors' results, the theoretical factor being 0·900. The hydrolysis proceeds most evenly with 0·2—0·4-N nitric acid, but for analytical purposes, 0·6-N acid can be used without any appreciable error. With acid of greater concentration, oxidation occurs. From the reaction-products the authors prepared four osazones, of which one is dextrosazone, and another a monosazone (hexosazone) melting at 214° C.—A. S.

Cassava; its content of hydrocyanic acid and starch, and other properties. C. C. Moore. U.S. Dept. Agric. (Bureau of Chemistry), Bull. No. 106, 1907.

An account is given of the study of different varieties of cassava, more especially with regard to their content of hydrocyanic acid and of starch. For the determination of the hydrocyanic acid, the fresh tuber was pulped, and 540 grms. of the pulp heated gently in an enamelled iron retort until the hydrocyanic acid was completely expelled. The evolved vapours were absorbed in potassium hydroxide solution, which was subsequently treated with excess of sulphuric acid and distilled, the liberated hydrocyanic acid being absorbed in water containing about 5 c.c. of $N/10$ potassium hydroxide solution, and the cyanide titrated with $N/10$ silver nitrate solution while the distillation was proceeding. In a large number of varieties examined, the percentage of starch (on the dry substance) ranged from 40 to 82, whilst the content of hydrocyanic acid varied between 0·002 per cent. in the common Florida variety, known as "Florida Sweet," and 0·03 per cent. in the most common bitter variety, known as "White Top"; there was no marked line of distinction between the sweet and bitter varieties with respect to the content of hydrocyanic acid. The greater proportion of the hydrocyanic acid appears to be present in the peel and bark of the tuber, a peeled root of an extreme bitter variety of cassava containing no more hydrocyanic acid than a whole root of an extreme sweet variety. In accord with this statement, it is found that the smaller the root, the higher is the relative content of hydrocyanic acid, the proportion of peel being higher in a small root. There appears to be no relation between the percentages of starch and of hydrocyanic acid. Field experiments tended to corroborate the general belief that all varieties of cassava grown in Florida eventually become sweet, *i.e.*, contain a very low percentage of hydrocyanic acid. The most desirable forms of tubers are the cylindrical and the oval. When the cassava is intended for the manufacture of starch, it is recommended that the tubers be ground to meal and dried in the air. It is stated that, under favourable conditions, a fine white meal can be obtained in this way, which can be kept without deterioration. If a long time is required for drying, the meal becomes discoloured, but this is not objectionable if the cassava be subsequently used for stock feeding or for the manufacture of industrial alcohol.—A. S.

Patents.

Beetroot juice ; Process for the extraction of ——, by diffusion and pressure. H. Steckhan. Fr. Pat. 378,172, May 27, 1907.

The beetroot slices are moved through a number of diffusion tanks by means of screw conveyors, the movement of the slices being in the opposite direction to that of the extracting liquid. The tanks are placed in steps, each one being higher than the preceding one, and the slices are raised from one tank to the next by a screw which at the same time compresses them, so that most of the juice is removed before the slices fall into the next higher tank.—W. P. S.

Beetroot juice ; Process and apparatus for extracting ——, by diffusion. K. Philipp. Fr. Pat. 378,175, May 27, 1907. Under Int. Conv., May 28, 1906.

The beetroots are pulped, and allowed to fall into a vertical cylindrical vessel where they are mixed with juice drawn from a second vessel. The pulp and juice are pumped from the first vessel into the bottom of the second, the latter being supplied with water from an upper reservoir. The pulp leaves the top of the second cylinder, and is conducted to presses where the juice is removed and returned directly, or indirectly, to the second vessel. The concentrated juice drawn from the bottom of the second vessel is heated before being mixed with the freshly introduced beetroot in the first vessel. The end of the pipe leading from the second to the first vessel is covered with a sieve, another sieve being placed before the outlet provided in the first vessel, for the fully concentrated juice.—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt analysis ; Unified method of commercial ——. Woch. f. Brau., 1907, 24, 533—534.

The brewing research stations at Berlin, Hohenheim, Munich, Nürnberg, Weihenstephan, Vienna, and Zürich have adopted a uniform scheme for the commercial analysis of malt, the details of which are described. Samples from bulk must be taken from different parts and samples from sacks must be taken from 10 per cent. of the packages ; all samples are then to be averaged and stored in air-tight bottles. For analysis, 500 grms. are to be sent, reference samples being retained for two months. Before analysis, only coarse impurities may be removed and the fact is to be noted ; foreign seeds and dust must be left in. For chemical analysis, 55 grms. are passed twice through a rapid grinding mill which produces 85 per cent. of meal in the first passage, and 4 grms. of the meal are weighed out at once for the determination of moisture. This portion is dried for 2—4 hours at a temperature of 104°—105° C. For mashing, 50 grms. of the meal are weighed out into a tared beaker and covered with 200 c.c. of water at 45°—47° C., the mash being stirred mechanically ; after half an hour at 45° C., the temperature is raised during 25 minutes to 70° C., then 100 c.c. of water at 70° C. are added. The first test for saccharification is made 10 minutes after arriving at 70° C. and is repeated, if necessary, at intervals of 5 minutes. After 1 hour at 70° C., the mash is quickly cooled to 17° C. and its weight is made up to 450 grms. with water. The wort is filtered off through a dry filter, and it is noted whether it runs quickly or slowly. The density is determined at 17·5° C. by the pyknometer, and the extract is calculated by Balling's tables ; differences of 0·8 per cent. of extract are allowable. The colour of the laboratory wort is compared with $N/10$ iodine solution or alternatively with Brand's colour bottles. The mechanical analysis includes determinations of the hectolitre weight by the German official grain balance, the result being reported without corrections, the weight per 1,000 corns corrected to dry substance, mealiness of endosperm by means of a farinatome, with statement of percentages of mealy, white, yellow and brown corns. The acrospire development is not recorded.—J. F. B.

Aspergillus oryzae ; Formation of acid by ——. K. Saito. Bot. Mag., 1907, 21, 6 ; Z. ges. Brauw., 1907, 30, 520.

From rice liquefied by means of *Aspergillus oryzae*, the author has separated a crystalline acid which is apparently *s*-resorcylcarboxylic acid. The same acid is formed by this organism from dextrose, maltose, sucrose, galactose or glycerol, but not from mannitol. In nutrient media, the carbonaceous and nitrogenous constituents of which consist only of protein, Witte's peptone, or asparagine, an alkaline reaction is obtained with this organism and the above acid cannot be detected.—T. H. P.

Acetic bacteria ; Increase of the oxidising action of —— by ferrous and manganous salts. F. Rothenbach and W. Hoffmann. Deut. Essigind., 1907, 11, 125 ; Z. ges. Brauw., 1907, 30, 519—520.

When grown in alcoholic liquids containing 0·1 grm. of manganous or ferrous sulphate [per 100 c.c.], cultures of *B. ascendens*, *B. rancens*, *B. aceti* and *B. Kützingianum*, which have been gradually acclimatised to the above proportions of these salts, produce more acetic acid than when no manganous or ferrous salt is present.—T. H. P.

Wines ; Determination of the principal acids in ——, in presence of alcohol and glycerol. A. Heiduschka and G. Quincke. Arch. Pharm., 1907, 245, 458—461.

A scheme is proposed for the determination of acetic, lactic, tartaric, malic and succinic acids together, in presence of glycerol and alcohol. Fifty c.c. of the liquid are neutralised with barium hydroxide and evaporated to 15 c.c., care being taken that the solution remains neutral. The residue is washed into a measuring cylinder, and alcohol is added until the liquid contains 80 per cent. by volume. The precipitate is filtered off and washed with alcohol of the same strength. The filtrate contains barium acetate and lactate together with the glycerol. The alcohol is evaporated and the glycerol is distilled off under vacuum from a portion of the solution. This glycerol is determined in the distillate by oxidation by potassium bichromate according to Hehner's method. The original solution is oxidised in a similar manner, and the lactic acid is calculated from the difference between the two results. The insoluble barium salts are decomposed by 20 c.c. of dilute sulphuric acid, and the solution is made up to 100 c.c. with alcohol and filtered. To 80 c.c. of the filtrate are added 0·5 c.c. of a 20 per cent. solution of potassium acetate, 15 grms. of powdered potassium chloride, and 2 c.c. of glacial acetic acid ; after 12 hours the separated potassium bitartrate is filtered off and titrated in the usual way. The alcohol is removed from the filtrate and the malic acid is determined by titration of the hot solution with permanganate in presence of sulphuric acid. The succinic acid is not oxidised by permanganate and is extracted by ether from the residue after evaporation with sand. The acetic acid and the alcohol are determined by known methods, with the exception that the liquid is neutralised before distilling off the alcohol, and the latter is determined by oxidation in the same way as the glycerol.—J. F. B.

Patents.

Malting; Apparatus for ——. E. G. Adlam, Bristol. Eng. Pat. 8800, April 16, 1907.

The apparatus consists of a number of grain containers, arranged in vertical series, each having an endless travelling web which acts as a conveyor for the grain. At one end of the apparatus is an elevator, so arranged, that the grain is carried from one container to the one next above it, and so round and round the apparatus, being meanwhile subjected to aeration. The elevator consists of a number of cups, hung so that the grain is discharged at an angle at given points; the cups after discharging return to a normal position, this movement being effected by cranked arms, rollers, and roller guides.—W. P. S.

Beer fermenting and apparatus employed therein. C. and E. Rombaut, Mont St. Amand lez Gand, Belgium. Eng. Pat. 5224, March 4, 1907.

See Fr. Pat. 375,321 of 1907; this J., 1907, 939.—T. F. B.

Beer; Chilling and carbonating [apparatus for] ——. L. Mertens, Willebroeck, Belgium. Eng. Pat. 8372, April 10, 1907.

The apparatus consists of two or more cylindrical vessels entirely submerged in a brine tank, this tank being provided with coils (preferably wound round the cylinders) through which a cooling gas is circulated. The beer is admitted to the cylinders through suitable pipes, carbon dioxide being introduced through a second set of pipes. The beer and gas are thoroughly mixed by means of screw propellors fitted in the cylinders and operated from the outside of the latter. A screw propellor is also provided for stirring the brine. The cooling and carbonating may be carried out in one cylinder while the treated beer is being drawn off from the other cylinder. —W. P. S.

Soy; Apparatus for brewing ——. T. Suzuki, Sunamura, Japan. Eng. Pat. 9995, April 30, 1907.

See Fr. Pat. 377,294 of 1907; this J., 1907, 1062.—T.F.B.

Brewing; Process of ——. H. Breker. Fr. Pat. 378,154, May 25, 1907.

The wort, after saccharification, is boiled and then cooled to a temperature just below 69° C. An extract of malt rich in peptase is now added in order to peptonise the proteins present, the liquid being afterwards filtered at a suitable temperature. The cooling of the boiled wort may be effected by the addition of cold water.—W. P. S.

Pitch substitute [for brewers] and process for making the same. K. Rücker, Assignor to Deuts. Conservierungs-Ges. f. Nahrungs- und Genussmittel Berlin. U.S. Pat. 867,757, Oct. 8, 1907.

See Fr. Pat. 371,270 of 1906; this J.. 1907, 336.—T.F.B.

Musts or fruit juices; Treatment of preserved ——. C. Bonnard, Paris. Eng. Pat. 15,259, July 2, 1907. Under Int. Conv., July 3, 1906.

See Fr. Pat. 367,703 of 1906; this J., 1906, 1168.—T.F.B.

Distilling fermented liquors; Process of ——. J. N. Watt, San Jose, Cal., U.S.A. Eng. Pat. 9444, April 23, 1907.

See U.S. Pat. 851,718 of 1907; this J., 1907, 630.—T.F.B.

Rectifying apparatus for spirit, petroleum, and other volatile bodies. Comp. Industrielle des Pétroles. Fr. Pat. 378,605, June 11, 1907. *See* I.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Cassava: its content of hydrocyanic acid and of starch, and other properties. C. C. Moore. *See* XVI.

Condensed milk; The causes of "blowing" in tins of ——. G. H. Pethybridge. Economic Proc. Roy. Dublin Soc., 1906, 1, [7], 306—320.

Condensed milk contains large numbers of small yeasts or torulæ, which are capable of causing the "blowing" of milk in the tins. Unlike the other micro-organisms in milk, these small yeasts are not inhibited in their activity by increasing concentration of cane sugar; on the contrary, they are capable of fermenting saturated solutions of cane sugar in milk. They do not appear to be introduced into the milk with the cane sugar, since they have been traced back to the sources of the milk supply in some cases. Owing to the darkening in colour of the milk when subjected to high temperatures, it is not practicable to destroy these yeasts by heat. The only method by which to ensure freedom from "blowing," appears to be a careful supervision of the milk supply. —T. F. B.

Protein derivatives; A new solvent for ——. I. Ostromysslensky. *See* XXIV.

Sesamé oil; Influence of rancidity on Baudouin's test for ——. A. Lauffs and J. Huismann. *See* XII.

Animal fats; Detection of some —— *when mixed with other animal fats.* E. Polenske. *See* XII.

Patents.

Margarine; Manufacture of ——. S. Mitscherlich, Bremen, Germany. Eng. Pat. 9015, Apr. 18, 1907. Under Int. Conv., Apr. 19, 1906.

To improve the flavour of margarine, especially with a view to causing it to brown, foam, and give off a butter-like fragrance when used for cooking, from 2 to 5 per cent. of certain substances are added to it in a churn or otherwise. Such substances are milk extracts, meat extracts, and extracts of certain fungi such as yeast.—O. R.

Cocoanut oil; Process for transforming —— *into an alimentary fat having a nutty flavour and the consistency of lard.* P. D. Massimi. First Addition, dated May 23, 1907, to Fr. Pat. 373,996, Apr. 4, 1906.

The process described in the original specification may be applied to other fats besides cocoanut oil, and the first operation may be omitted if a nutty flavour be not desired in the product. The fats may be chopped or sliced to destroy their brittle properties and to give them the consistency of lard. The finely-divided fat may afterwards be homogenised in a suitable apparatus.—W. P. S.

Yolk of egg emulsion; Process of preparing a —— *for use in margarine, etc.* Riegel's Nahrungsmittel-Werke, G.m.b.H. Fr. Pat. 378,281, May 30, 1907.

Commercial yolk of egg is thoroughly mixed with a concentrated salt solution to which has been added previously, 0·5 per cent. of lactic acid and a quantity of sugar equal to one-half of the weight of salt present.—W. P. S.

(*B.*)—SANITATION; WATER PURIFICATION.

Patents.

Garbage, sewage, or paper pulp; Pressing or straining apparatus for treating [removing oil from] ——. C. S. Wheelwright, Bristol, R.I., U.S.A. Eng. Pat. 8924, April 17, 1907.

The apparatus consists of a horizontal water-tight cylinder provided with a screw conveyor which fits closely to its sides, and an adjustable knife projecting through a water- and air-tight frame on the upper side of the cylinder, and operating, together with the edge of the screw, upon the material. The material is fed into the cylinder at one end through a wide pipe provided with valve with a knife edge for cutting off the supply of material. The cylinder is surrounded with a water-tight jacket and double perforated plates let into the under side of the cylinder allow the liquid portion of the material to be drawn into the jacket, where it falls into conical receptacles connected with an exhaust pump. The perforated plates are adjustable as is also a dead-plate placed between them. Cam-shaped fins are provided in recesses at the top of the cylinder, which, by following the convolutions of the screw, impart frictional resistance to the garbage or other material in the cylinder. Presser-fingers are placed in an extension of the cylinder beyond the conveyor in order to squeeze the material. The exit end of the cylinder is fitted with a valve operated by steam power; when the pressure of the material in the cylinder exceeds that of the steam on the other side of the valve (say 40 lb.), the latter is forced back, and by means of a clutch, teeth fixed on the valve are caused to operate on the material passing through the cylinder. —W. P. S.

Water-purifying [*softening*] *apparatus.* O. L. Stump, J. Reidenbaugh, and E. D. Packard, Assignors to The Marion Incline Filter and Heater Co., Marion, Ohio. U.S. Pat. 861,551, July 30, 1907.

On the outside of a tank, in which water is treated with soda-ash solution, are fixed a number of glass tubes similar to the ordinary water-gauge tubes of a boiler. The tubes connect, top and bottom, with the water in the tank at different levels, the connecting tubes being provided with cocks. A cup, containing phenolphthalein solution, is placed at the top of each tube. The method of using the apparatus is as follows:—A sample of the water is allowed to flow into one of the tubes, and a drop or two of the phenolphthalein solution is admitted from the cup, a needle-valve being provided for this purpose. If the water in the tube colours the phenolphthalein red, too much soda-ash solution has been admitted to the water in the tank; if a red coloration is not obtained, too little has been added, and the supply is then regulated so that a sample of the water exhibits a faint pink coloration, showing that only a very small excess of the soda-ash solution is present. Discharge cocks are provided at the bottom of the tubes.—W. P. S.

(*C.*)—DISINFECTANTS.

Patent.

Cleansing and disinfecting agent [*for textiles*]; *Manufacture of a liquid* ——. Soc. dite "Centaur" Chem. Techn. Fabrik von Max Brückner. Fr. Pat. 378,559, May 3, 1907. Under Int. Conv., June 26, 1906.

Claim is made for a cleansing and disinfecting agent consisting of an aqueous solution of potassium carbonate, ammonium carbonate, sodium diborate, soluble glass, liquid soap and a harmless disinfectant. Linen, &c., treated with this preparation is cleansed without mechanical friction. A mixture of formaldehyde with glycerin, liquid soap, carbon tetrachloride and turpentine oil is specially mentioned as yielding a readily emulsifiable fluid, the disinfecting action of which is promoted by heat. An addition of a carbonate which gives off carbon dioxide when boiled in the solution also adds to the disinfecting power.—C. A. M.

XIX.—PAPER, PASTEBOARD, &c.

Paper and pulp in Burma; Manufacture of ——. R. W. Sindall. Report to Indian Govt., Rangoon, March, 1906.

The author reports the results of a full investigation of the qualities and supplies of prospective paper-making plants in Burma. The major portion of the work is devoted to bamboo, several species of which are available in industrial quantities. A small pulp mill, producing 60 tons of unbleached pulp per week, would consume 25,000 stems of large bamboos or 41,000 stems of small bamboos weekly. The cost of such pulp is calculated to be about £5 10s. per ton on the spot, or £7 10s. delivered in Europe. Stems of less than one year's growth yield a pulp of excellent quality which is easily bleached to a good white colour. In the case of older stems, it will probably be necessary to cut out the knots (about 10 per cent. of the stems) in order to obtain a satisfactory pulp under economical conditions. The older stems require considerably more caustic soda for the manufacture of pulp than the young stems, and greater difficulty is experienced in bleaching. The Burmese woods do not offer favourable prospects for the manufacture of paper pulp in competition with those varieties already on the market. Rice straw and "Kaing" grass, on the other hand, are available in large quantities and would repay further investigation.—J. F. B.

Cellulose; Action of cold solutions of sodium hydroxide on ——. W. Vieweg. Ber., 1907, **40**, 3876—3883.

Cellulose was treated at the ordinary temperature with solutions of sodium hydroxide of increasing concentrations, and the diminution in the concentration of the surrounding liquid was determined in each case. The curve expressing the percentages of sodium hydroxide taken up by the cellulose as the concentrations were increased, shows two perfectly horizontal portions in its rise, corresponding with points where further increase in the concentration caused no increase in the percentage taken up by the cellulose. The first of these points, comprising concentrations from 16 to 24 grms. of sodium hydroxide per 100 c.c., corresponds with a removal of 13 per cent. of caustic soda on the cellulose, a molecular ratio of $(C_6H_{10}O_5)_2$,NaOH. The second horizontal portion, beginning at a concentration of 35 grms. per 100 c.c. and upwards, corresponds with 24 per cent. of caustic soda on the cellulose, a molecular ratio of $(C_6H_{10}O_5)_2$2NaOH. Treatment of cellulose with sodium hydroxide produces a permanent alteration, which may be measured by the determination of the percentage absorption of sodium hydroxide by the purified cellulose when placed in a 2 per cent. solution of the alkali. This percentage absorption is called the "degree of mercerisation"; it increases in proportion with the concentration of the caustic soda with which the cellulose was first treated, but becomes constant when the cellulose has been "mercerised." Alkali-cellulose is formulated as a definite compound, $C_{12}H_{19}O_{10}$.Na, which is capable of combining with more sodium hydroxide until the compound, $C_{12}H_{19}O_{10}$Na.NaOH, is produced. Up to the mercerisation point (16 grms. of sodium hydroxide per 100 c.c.) the degree of benzoylation of the cellulose attained by the Schotten-Baumann reaction, is exactly proportional to the sodium hydroxide combining, but in all cases one molecule of sodium hydroxide is equivalent to two benzoyl groups. The author explains the mechanism of the benzoylation of cellulose by assuming that, of the three hydroxyl groups of the cellulose, one must be combined with sodium hydroxide, whilst the other two react with the benzoyl residue.—J. F. B.

Cellulose, hydrocellulose, and oxycellulose; The higher nitrates of ——. E. B rl and R. Klaye. Z. Ges. Schiess-und Sprengstoffwesen, 1907, 2, 381—387.

The authors have, in the first instance, prepared samples of hydrocellulose and oxycellulose by the many varying methods which have been recorded. A complete analytical study of these compounds has been made, and they have been compared with each other and also with pure cellulose in the following respects: (1) Colour-fixing capacity towards methylene blue. (2) Coloration with iodine and sulphuric acid. (3) Coloration with iodine and zinc chloride. (4) Reduction of Fehling's solution. (5) Microscopic appearance. The colour-fixing power is stated in terms of mgrms. of methylene blue fixed per grm. of substance. It was least (3·7 mgrms.) in the case of pure cellulose, and greatest (9·5 mgrms.) in the case of oxycellulose prepared by means of potassium chlorate. The coloration with iodine and sulphuric acid was blue in all cases, with the exception of the oxycelluloses prepared with calcium permanganate (light-brown), with nitric acid (yellowish), and with potassium chlorate (yellowish brown). A blue coloration was obtained in all cases with iodine and zinc chloride. The relative reduction values obtained with Fehling's solution were lowest (1) with the oxycelluloses obtained by means of bromine and potassium chlorate, and highest (7) in the case of pure cellulose and the oxycellulose prepared with potassium permanganate. The microscopic appearance varied very considerably in all cases. The products were then nitrated at 19° C.—20° C.

for 24 hours in an acid of the composition: H_2SO_4 (46·22 per cent.), HNO_3 (42·03), N_2O_4 (0·25), and H_2O (11·50 per cent.). The proportion of acid to material was 50 to 1. The nitrates were washed with cold and then hot water for a prolonged period and eventually dried in a vacuum desiccator at 33°—40° C. over phosphorus pentoxide. A complete analysis was made in a special combustion tube and the nitrogen determined both by the nitrometer and by Dumas' method. The viscosity was determined in a Cochius viscometer with a two per cent. acetone solution. The following table contains the results of the experiments:—

Nitrated Compound.	N per cent. (Nitrometer).	N per cent. (Dumas).	Solubility in Ether-Alcohol.	Fixation of Methylene Blue. Mgrms. per grm.	Viscosity (relative).
Cellulose	13·5	13·32	1·8	0·6	10.000
Hydrocellulose	13·23	13·36	12·15	2·4	65·7
H_2O_2 Hydralcellulose	13·07	—	22·5	2·4	8·13
$KMnO_4$ Oxycellulose	13·31	—	18·0	1·6	5·15
Br: Oxycellulose	12·92	13·29	15·5	3·5	9·06
$Ca(MnO_4)_2$ Oxycellulose	13·25	—	20·5	3·3	11·10
HNO_3 Oxycellulose	12·87	13·28	34·0	5·0	7·94
$KClO_4$ Oxycellulose	13·04	—	18·0	3·0	7·2

From consideration of the data obtained, the authors adopt for cellulose the formula, $C_{24}H_{40}O_{20}$. Experiment showed that the nitration of oxycellulose is complete in 24 hours. Prolonged immersion up to 144 hours does not increase the nitrogen content. The following conclusions are drawn. Under similar conditions the highest nitrates are obtained with pure cellulose. Cellulose, oxycellulose and hydrocellulose are dyed more readily by methylene blue than the corresponding nitrates, and the nitrates of oxycellulose and hydrocellulose more easily than cellulose nitrate itself. Increase of nitrogen in cellulose nitrate increases the viscosity in acetone solution, and the viscosity of the nitrates of oxycellulose and hydrocellulose is very much less than that of the corresponding cellulose nitrate solutions.—G. W. McD.

Patents.

Garbage, sewage, or paper pulp; Pressing or straining apparatus for treating [removing oil from] ——. C. S. Wheelwright. Eng. Pat. 8924, April 17, 1904. *See* XVIII*B*.

Half-stuff from peat; Apparatus for making ——. O. P. Beck. Fr. Pat. 378,642, June 8, 1907.

See Eng. Pat. 27,125 of 1906; this J., 1907, 889.—T. F. B.

Half-stuff from peat; Process and apparatus for the production of ——. O. P. Beck. Fr. Pat. 378,676, June 10, 1907.

See Eng. Pat. 27,126 of 1906; this J., 1907, 889.—T. F. B.

Tanning extracts [with waste sulphite-cellulose lyes]; Manufacture of ——, and tanning. D. Stewart. Eng. Pat. 5438, Mar. 6, 1907. *See* XIV.

Briquettes [from paper-makers' waste]; Compressed —— for fire-lighters, heating, etc., and process for their manufacture. Comp. Française des Crocidolites. Fr. Pat. 378,169, May 25, 1907. *See* II.

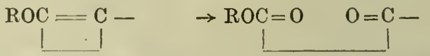
XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Cinchona alkaloids. VII. A new oxidation product of cinchonine. P. Rabe. Ber., 1907, **40**, 3655—3658.

Under certain circumstances, the oxidation of cinchonine with chromic acid produces a new base, $C_{19}H_{20}ON_2$. This base is a ketone, showing that cinchonine is a secondary alcohol as previously stated (this J., 1907, 944). Cinchonine was dissolved in acetic or sulphuric acid, and chromic acid solution slowly added, the temperature not being allowed to rise too high. The excess of acid was neutralised with sodium hydroxide and the base extracted with ether. It is soluble in most organic solvents, but insoluble in water. It crystallises from dilute alcohol in well-formed faintly yellow prisms melting at 126°—127° C., and with $[\alpha]_D = +68{\cdot}8°$ at 20° C. in ethyl alcohol. It turns litmus blue and is slightly soluble in alkalis. The hydrochloride, B.HCl, forms white needles melting at 245°—247° C. The monomethiodide forms small crystals, which are almost colourless and melt at 232°—233° C. The base on oxidation with chromic acid by Skraup's method yields cinchoninic acid and meroquinene. The base forms a solid oxime.—F. Shdn.

Thebaïne; Action of ozone upon ——. R. Pschorr and H. Einbeck. Ber., 1907, **40**, 3652—3654.

Thebaïne, in common with some other morphine alkaloids, is rapidly oxidised by ozone. In the case of thebaïne, the principal product is *a-thebaïzone*, $C_{19}H_{21}O_5N$, which is precipitated from its solution in hydrochloric acid by sodium carbonate, but is re-dissolved on the addition of sodium hydroxide. The ethereal solution, on concentrating, deposits flattened needles or leaflets melting at 125°—126° C. (corr.). This substance contains two methoxyl groups. It forms a semicarbazone, $C_{20}H_{24}N_4O_5$, melting at 202° C. (corr.). When α-thebaïzone is dissolved in sodium hydroxide, one methyl group is split off, with the formation of an acid. It therefore has the constitution, $C_{15}H_{15}NO(COOCH_3)(OCH_3)(CO)$. The mechanism of the reaction is thus indicated:—



$$\mathrm{ROC{=\!=}C—} \rightarrow \mathrm{ROC{=}O \quad O{=}C—}$$

This is in agreement with the constitution of thebaïne as known at present. α-Thebaïzone can be converted into an isomeride, β-thebaïzone.—F. Shdn.

Allopseudocodeïne; A new isomeride of codeïne. L. Knorr, H. Hörlein, and C. Grimme. Ber., 1907, **40**, 3844—3851.

In the course of the preparation of pure isocodeïne from the crude products of the hydrolysis of bromocodide by Schryver and Lees' method, the authors have isolated a new base, isomeric with codeïne, to which they give the name allopseudocodeïne. This base is an oil with the specific rotatory power, $[\alpha]_D = -228°$; its hydriodide melts at 280°—285° C.; its methiodide melts at about 215° C., and has $[\alpha]_D = -142°$. It yields pseudocodeïnone on oxidation, and is therefore an optical isomeride of pseudocodeïne, the isomerism consisting in the relative disposal of the hydrogen and hydroxyl groups in the position 8. This observation makes it probable that codeïne and isocodeïne are an optically isomeric pair.
—J. F. B.

Desoxycodeïne and desoxydihydrocodeïne. L. Knorr and R. Waentig. Ber., 1907, **40**, 3860—3868.

Desoxycodeine is best prepared by the reduction of bromocodide or chlorocodide by means of zinc dust and alcohol without the presence of acid. The product obtained by reduction with sodium and alcohol is not desoxycodeïne but desoxydihydrocodeïne. The two bodies give series of derivatives which are very similar in crystalline form and melting points, but the derivatives of the former are all dextro-rotatory, whilst those of the latter are all lævo-rotatory. These bodies are both phenolic bases; they show a difference when converted into their methine bases by complete methylation; the methine base from desoxycodeïne is unstable, whilst that from desoxydihydrocodeïne is relatively stable.—J. F. B.

Isoconiine ; A note on ——. A. Ladenburg. Ber., 1907, **40**, 3734—3736.

In the synthesis of coniine from allylpyridine, small quantities of allylpiperidine can, according to Löffler, be formed. To avoid this, another method of synthesis has been devised. Methylpicolylalkine (see this J., 1906, 826) was heated with hydriodic acid and red phosphorus, and reduced with zinc dust. In this way propylpyridine was obtained, boiling at 167·5°—170° C. This was reduced to propylpiperidine by means of sodium and alcohol. The bitartrate was recrystallised several times and the base set free. The synthetic coniine obtained by this method had $[\alpha]_D = 17{\cdot}85°$, and the author looks upon it as stereoisomeric with *d*-coniine, which has $[\alpha]_D = 15{\cdot}6°$. It is therefore pure isoconiine and contains no allylpiperidine, as shewn by its stability towards acid permanganate. The isoconiine obtained from methylpicolylalkine and hydrochloric acid (*loc. cit.*) has $[\alpha]_D = 19{\cdot}2°$, and apparently contains traces of allylpiperidine. The author considers that the synthetic coniine, which he prepared by the reduction of pure allylpyridine, is free from allylpiperidine (Ber., 1894, **27**, 3066).—F. Shdn.

Plant alkaloids ; Some new ——. A. Pictet and G. Court. Ber., 1907, **40**, 3771—3783.

The authors consider that the degradation of the complex nitrogenous substances of plants (*e.g.*, albumin, chlorophyll, etc.) takes place in two stages. In the first place relatively simple basic products are formed. These, in the second stage, condense with other substances to form other compounds, with which they occur in the plant. These intermediate degradation products are termed "protoalkaloids." In support of this idea, the authors have digested several plants with sodium carbonate solution, and distilled the resulting solution with steam, the distillate being evaporated after neutralising with dilute hydrochloric acid. In the case of tobacco, the liquor obtained by macerating the leaves with water was concentrated, made alkaline with sodium hydroxide, and distilled. The crude nicotine obtained in this way was fractionated. Pyrrolidine and N-methylpyrroline were identified in the first fractions. Nicotine after boiling for 7 hours with 20 per cent. sodium hydroxide solution, gave no fraction boiling below 240° C., nor did it appear to have undergone any change. Pepper, the fruit of *Piper nigrum* L., gave a volatile base, C_5H_9N or $C_5H_{11}N$, in very small amount. The gold salt, $B,HCl,AuCl_3$, crystallises from dilute hydrochloric acid in yellow leaflets or matted needles, melting at 182° C. The picrolonate melts at 217° C. after crystallising from water. The platinum salt, $(B,HCl)_2,PtCl_4$, is insoluble in alcohol, and melts at 203° C. This base is possibly N-methylpyrroline or one of the unknown C-methylpyrrolines. The leaves of the carrot yielded two volatile bases. The more easily volatile was identified as pyrrolidine. The other base proved to be new, and is styled *daucine*. It boils at 240°—250° C., and is a colourless oily liquid, with a smell resembling that of nicotine. It is soluble in water, alcohol and ether, is alkaline to litmus, and has the composition, $C_{11}H_{18}N_2$, with $[\alpha]_D = +7{\cdot}74°$. From its reactions it does not appear to be a pyrrol base. From the seeds of the carrot a small amount of a pyrrol base was obtained, giving an insoluble gold salt decomposing at 172°—175° C. Parsley leaves gave a crystalline hydrochloride of a pyrrol base, of which the picrolonate formed fine needles melting at 210° C. Coca leaves gave a pyrrol base, which did not yield any crystalline salts, thus being distinct from hygrine. The authors look upon these simple pyrrol bases as the first degradation products of chlorophyll or albumin, which then condense to form more complicated alkaloids as nicotine, piperine, or daucine.—F. Shdn.

Columba root ; Alkaloids of ——. K. Feist. Apoth.-Zeit., 1907, **22**, 823—824. Chem. Zentr., 1907, 2, 1424—1425. (See this J., 1906, 906, 1115.)

Columbamine, $C_{17}H_9N(OCH_3)_4OH$, is the methyl ether of jateorrhizine, $C_{17}H_9N(OCH_3)_3(OH)_2$. The third alkaloid of columba root, palmatine, behaves as though it were the methyl ether of columbamine, but the composition of its iodide is $C_{17}H_{10}NO_2(OCH_3)_4I$. Columbamine is present in the root as nitrate, and jateorrhizine as chloride. All three alkaloids resemble berberine in many of their properties, and on oxidation of their methyl derivatives with permanganate, yield products similar to those obtained from berberine and corydaline under similar conditions.—A. S.

Solanaceous base ; A new ——. R. Willstätter and W. Heubner. Ber., 1907, **40**, 3869—3875.

Besides hyoscyamine and the alkaloids which accompany it, a new base has been isolated from *Hyoscyamus muticus*. This base, $C_8H_{20}N_2$, is optically inactive and has the sp. gr. 0·7941 at 15° C. It is miscible in all proportions with water, alcohol, and ether. It is easily volatile with steam, and boils without decomposition at 169° C. (corr.). It is non-poisonous. The hydrochloride, $B,2HCl$, crystallises from alcohol and melts at 273° C. The dipicrate crystallises from water in long thin needles, melting at 198° C. The chloroplatinate, B,H_2PtCl_6, melts at 234° C., and the aurichloride, $B,2HAuCl_4$, decomposes at 206°—207° C. The dimethiodide, $C_4H_8[N(CH_3)_3I]_2$, forms hygroscopic leaflets and needles, melting at 305°—308° C. with decomposition. On distilling the ammonium base, butadiene was produced. The constitution of the new base was determined by preparing 1.4-diaminobutane by the reduction of succinaldoxime. The base was then fully methylated to form hexamethyltetramethylenediammonium chloride, $(CH_2)_4[N(CH_3)_3]_2Cl_2$. On dry distillation this substance yields N-methylpyrrolidine. Hexamethyltetramethylenediammonium chloride prepared in this way, was found to be identical with that obtained from the new base, which has therefore the constitution, $N(CH_3)_2.CH_2.CH_2.CH_2.CH_2.N(CH_3)_2$.
—F. Shdn.

Herabol-myrrh ; Investigation of ——. O. von. Friedrichs. Arch. Pharm., 1907, **245**, 427—457.

Herabol-myrrh consists of a mixture of a resin, an essential oil, a gum and an oxydase. The yield of *essential oil* was 8·8 per cent. ; its characters were : sp. gr. at 15° C. = 1·011, $n_D^{20°} = 1{\cdot}5359$, $[\alpha]_D = -73{\cdot}86°$; acid value, 6·15 ; saponification value, 47·60. It contained free formic and acetic acids and a non-volatile, crystalline acid, m. pt. 150° C. Appreciable quantities of *m*-cresol, cuminol and cinnamic aldehyde were isolated. After saponification, a monobasic acid, $C_{17}H_{22}O_5$, m. pt. 236° C., to which the name of *myrrholic acid* was given, was obtained. On fractional distillation of the residue, a new tricyclic sesquiterpene, *herabolene*, was obtained ; its hydrochloride melts at 98°—99° C. This essential oil yielded no terpene, but pinene was isolated from a commercial specimen. The fraction of the *resin* soluble in light petroleum yielded acetic acid on destructive distillation. The portion, insoluble in petroleum but soluble in ether, contained three free acids, α-, β- and γ-*commiphoric acids*, the first two having the formula, $C_{14}H_{18}O_4$, and the last being isomeric with myrrholic acid. On saponification, another acid, *commiphorinic acid*, $C_{28}H_{36}O_8$, was liberated from an ester ; the residue yielded a monatomic *alcohol*, $C_{14}H_{22}O_2$. This portion of the resin contained two dihydric phenols, α- and β-*herabomyrrhols*, having the formulæ, $C_{18}H_{26}O_5$ and $C_{20}H_{26}O_6$, respectively. It also contained the resene, *heraboresene*, $C_{42}H_{56}O_8$, containing one methoxyl group. The portion insoluble in ether contained two acids, α- and β-*herabomyrrhololic acids*, $C_{15}H_{22}O_7$ and $C_{25}H_{32}O_6$, respectively, both monobasic. The *gum*, which is dextro-rotatory, appears to contain galactose and arabinose groups.
—J. F. B.

Lippia scaberrima ("*Beukess boss*") *: Chemical examination of* ——. F. B. Power and F. Tutin. Archiv Pharm., 1907, **245**, 337—350.

Lippia scaberrima, Sonder, N.O. *Verbenaceæ*, is a native of Orange River Colony, where it has a local reputation as a medicinal remedy. Besides resins and other amorphous constituents it has been found to contain the following substances :—(1), About 0·25 per cent. of an aromatic *essential oil*, sp. gr. 0·9500 at 15° C. ; $\alpha_D =$

+7° 36′; (2), *heptacosane*, $C_{27}H_{56}$; (3), *hentriacontane*, $C_{31}H_{61}$: (4), a small amount of a *paraffin*, m. pt. 80° C.; (5), *phytosterol*, $C_{27}H_{46}O$, m. pt. 134° C.; (6), *unsaturated alcohols*, probably with the general formula, $C_nH_{2n-4}O$, and containing one double linkage; (7), free *formic* and *butyric acids*; (8), *esters* of *formic*, *valeric*, *butyric*, *arachidic*, *linolic*, and other *acids*; (9), about 0·05 per cent. of a new colourless monohydric alcohol, *lippianol*, $C_{25}H_{36}O_4$, m. pt. 300—308° C., with decomposition, $[a]_D = +64·9°$; crystallising in needles from alcohol or ethyl acetate; (10), *two yellow crystalline substances*, present in very small quantity, both melting at about 267° C., also a trace of *another crystalline substance*, m. pt. 123° C.; (11), a *glucosidal substance*, not isolated; and (12), *glucose*, chiefly in the optically inactive condition. The methyl ether of lippianol, $C_{25}H_{35}O_3.OCH_3$, forms colourless needles, m. pt., about 260° C. with decomposition.—J. O. B.

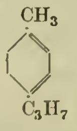
Kus-kus root; Report on ——. E. Drabble. Quart. J. Inst. Comm. Research in Tropics (Liverpool Univ.), 1907, 2, 130.

Kus-kus root is the rhizome of *Andropogon squarrosus* L.f., a marsh plant of the Gramineæ growing in India, the Philippines, and the Mascarenes, and cultivated in Jamaica. The ethereal oil contained in the rhizome and adventitious roots—"*Oleum aether. Vetiveriæ*"—is used in perfumery. The yield of oil obtained by steam distillation from the roots, previously macerated in water, is from 0·4 to 0·9 per cent. The oil is soluble in 80 per cent. alcohol and has a sp. gr. of 1·02—1·03. It is very thick and tenacious, and varies in colour from green to straw-yellow, yellowish-brown and dark brown.—E. W. L.

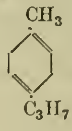
Terpenes and essential oils. 86th communication. Compounds of the terpinene series. O. Wallach and F. Boedecker. Annalen, 1907, **356**, 197—226.

The authors give further details respecting work on terpinene recently published (see this J., 1906, 1171, and 1907, 221). Terpinene monohydrochloride, $C_{10}H_{17}Cl$, was prepared by passing dry hydrochloric acid gas into a well-dried solution of terpinene or sabinene in carbon bisulphide. With hydrochloric acid in acetic acid, the monohydrochloride yields terpinene bihydrochloride melting at 52° C. The monohydrochloride boils at 87°—92° C. at 12 mm., has sp. gr. 0·982, and $n_D = 1·4824$ at 20° C. As it is unsaturated, it is derived from the hydrocarbon by the breaking of the intracyclic ring (this J., 1907, 221). Terpinene-terpine (m.pt. 137° C.) can be obtained more easily than from terpinene bihydrochloride by shaking sabinene, thujene, or terpinenol (active or inactive) with dilute sulphuric acid. It appears that terpinenol is an intermediate product of the conversion of sabinene into terpine. Pure terpinene-terpine is optically inactive. It can be sublimed in fine white leaflets, and is always deposited in this form from solvents. It can be separated from *cis*-terpine hydrate, m.pt. 117° C., by means of its greater solubility in ethyl acetate. Terpinene-terpine is easily volatile with steam. This terpine was mixed with a saturated solution of oxalic acid, and steam distilled. On fractionation, terpinene-cineol, $C_{10}H_{18}O$, and terpinenol were separated. The cineol was purified by shaking with permanganate solution at 0° C. and drying; it then boiled at 172°—173° C., had the sp. gr. 0·897, and $n_D = 1·4485$, and could not be made to solidify. On treatment with gaseous hydrobromic acid in light petroleum, an unstable solid separated, but terpinene bihydrobromide melting at 58°—59° C. was obtained from the mother liquors. When bromine is added to the solution of this cineol in light petroleum, a bright red crystalline precipitate is produced, which, on oxidation with permanganate, gives products quite different to those obtained from cineol. Water can be removed from terpinene-terpine so as to give theoretically four unsaturated alcohols, $C_{10}H_{17}OH$. These are:—Δ^1-*p*-menthenol-(4) or terpinenol-(4); Δ^4-*p*-menthenol-(1) or terpinenol-(1); methene-(1)-menthanol-(4); γ-terpineol. The optically active alcohol, $C_{10}H_{17}OH$, of cardamom and majoram oils is terpinenol-(4), since on oxidation with permanganate, a trihydroxyterpane is produced, which, when treated with hydrochloric acid, loses water and passes into carvenone (semicarbazone, m.pt. 203° C.). The trihydroxyterpane (from majoram or cardamom oil) was oxidised at 0° C. with alkaline permanganate. After standing for several hours and filtering, the filtrate was evaporated to complete dryness in a current of carbon dioxide. The potassium salts of two isomeric acids, $C_{10}H_{18}O_6$, were obtained. The free acids were separated by crystallising from water, acid (*a*) melting at 205°—206° C., acid (*b*) melting at 188°—189° C. Both acids on distillation lose two molecules of water to form a dilactone, $C_{10}H_{14}O_4$; the lactone from acid (*a*) melts at 63°—64° C., that from acid (*b*) at 72°—73° C. The formation of these lactones can be used to detect terpinenol even in the presence of α-terpineol. The high-melting acid is probably the active modification, and the low-melting acid the inactive modification of the same compound. When sabinene (see above) is shaken with dilute sulphuric acid, besides terpine (m.pt. 137° C.), terpinenol-(4) is produced. This boils at 209°—212° C., has the sp. gr. 0·9265, $n_D = 1·4785$ at 19° C., and $a_D = +25° 4′$ in a 100 mm. tube. It gave a trihydroxyterpane melting at 114°—115° C. after crystallising from chloroform, and with $[a]_D = +21° 21′$. On distillation with hydrochloric acid, it yielded carvenone. Further oxidation with permanganate gave the acid (*a*) and the lactone, m. pt. 63°—64° C. The inactive terpinenol obtained by treating terpinene bihydrochloride (m.pt. 52° C.) with alkali, yielded the lactone melting at 72° C., and the corresponding acid (*b*), $C_{10}H_{18}O_6$, melting at 188°—189° C. By this means it was shown that the terpinenol obtained from terpine by oxalic acid (see above) was a mixture of terpinenol-(1), and terpinenol-(4). Commercial terpineol was freed from α- and β-terpineol by freezing, and the lowest-boiling fraction shaken with dilute sulphuric acid for several days in order to completely hydrate the α- and β-terpineols. *Cis*-terpine hydrate, and terpinene-terpine were produced, showing the presence of terpinenol in the original oil. There was also left an alcohol boiling at 208°—210° C., with sp. gr. 0·9265, and $n_D = 1·4781$ at 18° C. On oxidation, an optically inactive glycerol, m.pt. 120° C., was produced, which on further oxidation yielded the acid melting at 188° C., and the lactone melting at 72° C. On boiling the glycerol with hydrochloric acid it does not yield carvenone, but a ketone the semicarbazone of which melts above 220° C. Terpinene nitrosite was reduced at 0° C. in acetic acid with zinc dust. Carvenone was produced, giving a semicarbazone, m.pt. 202° C., and a ketone regenerated therefrom boiling at 231°—233° C. This gave an oxamino-oxime melting at 161°—162·5° C. When carvenone from the nitrosite is converted into the ordinary oxime, the product melts at 78°—79° C. The oxime prepared by warming the correctly melting oxamino-oxime with dilute sulphuric acid, melts at 84° C. or 86° C. The low-melting oxime gives a benzoyl compound melting at 69° C. however. Terpinene nitrosite on shaking with alkali yields a product melting at 163°—164° C., which yields carvenone on reduction. A better yield of carvenone is obtained by the reduction of terpinenenitrolpiperidide, m.pt. 154° C. The following formulæ are put forward for terpinene, of which formula II. is considered most probably correct by the authors:—

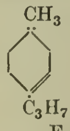
I.



II.



III.

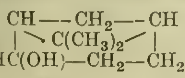


—F. Shdn.

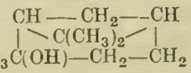
Terpenes and essential oils. 87th communication. Nopinone. O. Wallach and A. Blumann. Annalen, 1907, **356**, 227—249.

Pinene, recently distilled from oil of turpentine, was oxidised with permanganate in the presence of sodium hydroxide. The unchanged pinene was removed by steam distillation, the residue filtered and evaporated to a small bulk in a current of carbon dioxide. On cooling, crystals of sodium nopinate crystallised out. As nopinic acid is an oxidation product of β-pinene, this process can be used to recognise the latter in oil of turpentine.

The amount obtained was about 2·5 to 5 per cent. of the oil taken. American oil of turpentine yielded more acid than the French variety. Both dextro-rotatory American oil and lævo-rotatory French oil yielded nopinic acid, melting at 126° C., and with $[\alpha]_D = -15{\cdot}60°$ to $-15{\cdot}64°$ in ether. The free acid was obtained by treating the sodium salt with sulphuric acid, extracting with ether, and crystallising from benzene. Sodium nopinate was dissolved in water, and potassium permanganate added, followed by dilute sulphuric acid in such proportion that the liquid remained neutral. The nopinone was removed by steam distillation and extraction with ether. Pure nopinone boils at 209° C. and is easily solidified by a freezing mixture. It has sp. gr. 0·981, $n_D = 1{\cdot}4787$ at 20° C., and $[\alpha]_D = +18{\cdot}47°$ to $+18{\cdot}48°$. In alcohol it has $[\alpha]_D = +37{\cdot}27°$ to $+38{\cdot}04°$, and in benzene $[\alpha]_D = +10{\cdot}79°$ to $+11{\cdot}02°$. It shows a great tendency to condense with itself. When the alcoholic solution of nopinone is saturated with hydrochloric acid gas, a compound, $C_{18}H_{29}OCl_3$, separates, melting at 148° C. By boiling in solution, or with sodium ethoxide, the trichloride loses one molecule of hydrochloric acid, forming a more soluble bichloride, $C_{18}H_{28}OCl_2$, melting at 125°—126° C. In alcohol this takes up hydrochloric acid to form the trichloride. The ease with which the trichloride can be formed, makes it useful for the recognition of nopinone. On boiling with dilute sulphuric acid, nopinone forms Δ-2-isopropylhexenone, identical with that obtained by the oxidation of β-phellandrene. Nopinone was reduced in moist ethereal solution with sodium, when two isomeric alcohols, $C_9H_{16}O$, were produced. α-Nopinol boils at 204°—205° C., and crystallises from methyl alcohol in long white needles, smelling of camphor, melting at 102° C., and having $[\alpha]_D = -5{\cdot}32°$ in ether. The urethane melts at 131°—132° C. The other isomeride, β-nopinol, does not solidify. It has $[\alpha]_D = -15{\cdot}03°$ in ether, and forms a urethane melting at 95°—96° C. On reducing nopinone in alcohol with sodium, a pinakone, $C_{18}H_{30}O_2$, is formed, boiling at 195° to 200° C. at 11 mm., and melting at 106°—107° C. when crystallised from ether. On warming β-nopinone with zinc chloride, nopinonene, C_9H_{14}, is produced boiling at 157°—160° C. Nopinone was treated with methyl-magnesium iodide, thereby producing homonopinol, $C_{10}H_{17}OH$ (methyl-(1)-nopinol or pinene hydrate). This substance crystallises from dilute methyl alcohol in matted needles melting at 58°—59° C., and boiling at 204°—205° C. It is stable towards permanganate and has $[\alpha]_D = -4{\cdot}99°$ in ether. The four-atom ring in pinene hydrate is very labile, and is easily ruptured by acids. When pinene hydrate is shaken with dilute sulphuric acid, or with a solution of oxalic acid, *cis*-terpine hydrate, melting at 117° C. is produced. When it is warmed with formic acid, terpinene, terpinolene, and possibly dipentene are produced. When treated in ice-cold acetic acid solution with gaseous hydrochloric acid, pinene hydrate yields dipentene dihydrochloride, m.pt. 48°—49° C. Homonopinol was dissolved in light petroleum and treated with phosphorus pentachloride, when pinene monochloride, $C_{10}H_{17}Cl$, was produced. This boils between 95° and 105° C. at 13 mm. with the loss of some hydrochloric acid. This chloride is entirely different from that obtained by the action of hydrochloric acid upon dry pinene. This result shows that the addition of one molecule of hydrochloric acid to dry pinene brings about the rupture of the four-atom ring, leaving the ethylene linking intact. When the chlorine compound obtained from homonopinol was treated with gaseous hydrochloric acid in acetic acid, dipentene dihydrochloride was produced. This on treatment with aniline gave dipentene. The following formulæ are given :—



Nopinol



Homonopinol.

—F. SHDN.

Sesquiterpenes. I. Caryophyllene. E. Deussen and A. Lewinsohn. Annalen, 1907, **356**, 1—23.

THE present paper deals with the characterisation of caryophyllene and certain of its nitrogen derivatives. The derivatives were obtained from oil of cloves (from the flower stems) which had $\alpha_D = -8{\cdot}81°$ to $-8{\cdot}96°$, and sp. gr. at 15° C., 0·9067—0·910. On treatment with ethyl nitrite and hydrochloric acid, a bluish coloured nitrosochloride was obtained, the melting points of different preparations varying between 158° and 162° C. On recrystallising from ethyl acetate and chloroform, α-caryophyllene nitrosochloride, $C_{15}H_{24}ONCl$, was obtained. This is a stable substance, forming glistening crystals melting at 177° C. when gently heated. It is not changed by boiling alcohol and is practically inactive, having $\alpha = -0{\cdot}23$ to $0{\cdot}5°$. From the mother liquors two substances were separated : (1), β-caryophyllene nitrosochloride, $C_{15}H_{24}ONCl$, which forms glassy crystals, melting at 159° C., and with $\alpha_D = -98{\cdot}07°$ in benzene ; (2), a new substance, $C_{15}H_{23}NO_2$, which crystallises from alcohol in long prismatic needles, melting at 162·5—163·5° C., and with $\alpha_D = +217{\cdot}2°$ in benzene ; it decolorises bromine, and does not react with benzylamine. The α- and β-caryophyllene nitrosochlorides were termed the β- and α-compounds respectively by Schreiner and Kremers (Pharm. Archives, 2, 293). α-Caryophyllenenitrolbenzylamine, $C_{15}H_{24}(NO)NHC_6H_5$, melts at 126°—128° C. ; the hydrochloride crystallises from dilute alcohol in glistening leaflets, melts at 195° C., and is optically inactive. β-Caryophyllenenitrolbenzylamine crystallises from chloroform and alcohol in long, silky, colourless needles, melting at 172°—173° C., and with $\alpha_D = +217{\cdot}87°$ at 16° C. in chloroform. α-Nitrosocaryophyllene, $C_{15}H_{23}NO$, was prepared by the action of sodium in methyl alcohol upon α-caryophyllene nitrosochloride. After crystallising from alcohol it melts at 116° C. It is optically inactive and decolorises bromine. The blue caryophyllene nitrosite melting at 115° C. was prepared according to the method of Schreiner and Kremers (Pharm. Archives, 2, 283). This nitrosite was dissolved in alcohol at 0° C. and treated with a solution of potassium hydroxide in alcohol. On acidifying with acetic acid, diluting, and extracting with ether, a substance, $C_{15}H_{24}N_2O_3$, was obtained. This crystallises from light petroleum in long, matted needles, which melt at 139°—139·5° C., and have $\alpha_D = +120{\cdot}0°$ in benzene. The substance decolorises bromine. If the liquid after treatment with potassium hydroxide be allowed to stand for several hours before acidifying, a substance, $C_{15}H_{23}NO$, is obtained, which may be regarded as *d*-nitrosocaryophyllene. It crystallises from light petroleum in short prismatic needles, melting at 162°—163° C., and has $\alpha_D = +209{\cdot}2°$ in benzene. The blue nitrosite was boiled with light petroleum, a current of carbon dioxide being passed through at the same time, when a whitish-yellow precipitate separated. This substance, $C_{15}H_{23}N_4O_6$ or $C_{15}H_{23}N_3O_7$, forms soft, silky, minute needles melting at 159° C., and is stable towards bromine. The light petroleum held in solution a nitrosate, $C_{15}H_{23}N_2O_4$ or $C_{15}H_{22}N_2O_4$, which crystallises in rosettes of flat needles, melting at 130·5° C., and decolorising bromine. Both substances are optically inactive. When the blue nitrosite is boiled with alcohol, an oil and some crystals are formed. The latter crystallises in small needles melting at 128° C. The mother-liquors from the preparation of the blue nitrosite yielded a new sesquiterpene, $C_{15}H_{24}$. This boiled at 123°—124° C. at 14·5 mm., had $\alpha_D = -25{\cdot}03°$, sp. gr. 0·8990 at 20° C., and $n_D = 1{\cdot}49617$ at 20° C. It forms a nitrosochloride melting at 122° C. Whether this new sesquiterpene is a constituent of the original oil or not, remains to be proved.—F. SHDN.

Essential oils ; Constituents of ——. *The sesquiterpene cedrene.* F. W. Semmler and A. Hoffmann. Ber., 1907, **40**, 3521—3528.

NATURAL cedrene, obtained from *Juniperus virginiana*, was used in this research, and had the following constants : b.pt., 124—126° C. at 12 mm. ; sp. gr. at 15° C., 0·9354 ; $\alpha_D = -55°$ in a 100 mm. tube : and $n_D = 1{\cdot}50233$. Oxidation of cedrene by permanganate shows it to be a tricyclic sesquiterpene with one ethylenic linkage, the oxidation products being as follows. *Cedrene glycol*, $C_{15}H_{26}O_2$, crystallises from acetone in long prisms, melting at 160° C., boiling at 186°—187° C., at 12 mm., and with the sp. gr. 1·053 at 15° C. *Cedrene keto-aldehyde* or *diketone*,

$C_{15}H_{24}O_2$, boils at 165° C. at 10 mm. and has the sp. gr., 1·055 at 15° C. It forms a disemicarbazone, m. pt. 234° C. *Cedrene keto-acid*, $C_{15}H_{24}O_3$, boils at 215°—222° C. at 11 mm., and forms a semicarbazone melting at 245° C., and an oxime melting at about 60° C. The methyl ester of this acid boils at 160°—165° C. at 8 mm., has the sp. gr., 1·054 at 15° C., $n_D = 1·484$, and forms a semicarbazone melting at 180° C. When this acid was treated with bromine in alkaline solution, a dicarboxylic acid was formed, the methyl ester, $C_{16}H_{26}O_4$, of which boiled at 165°—173° C. at 11 mm., and had $n_D = 1·47936$, and sp. gr. 1·081 at 15 C. Oxidation of cedrene with ozone gave the keto-aldehyde. The sesquiterpene was then oxidised with chromic acid dissolved in acetic acid. The chief product was *cedrone*, $C_{15}H_{22}O$, which is a slightly yellowish oil with a strong smell of cedar-wood. It boils at 147°—150·5° C. at 9 mm., and has the sp. gr., 1·011 at 125° C., $n_D = 1·51202$, and $a_D = -91° 30'$ in a 100 mm. tube. The semicarbazone, by means of which it was purified, melts at 242°—243° C. On reduction with sodium in alcohol, *dihydroisocedrol*, $C_{15}H_{26}O$, was obtained, boiling at 148°—151° C. at 9·5 mm., and with the sp. gr., 1·007 at 18° C., $n_D = 1·51202$, and $a_D = -20° 30'$. The ketone grouping and the ethylenic linkage are thus both reduced. On decomposing the semicarbazone mother-liquors from cedrone, another ketone was obtained. This boiled at 148°—152° C. at 10 mm., and had the sp. gr., 1·005 at 16 mm., and $a_D = -40°$. *Dihydrocedrene*, $C_{15}H_{26}$, was obtained by the reduction of cedrene with hydriodic acid; it boiled at 116°—122° C. at 10 mm., and had the sp. gr. 0·9052 at 15° C., and $n_D = 1·48721$. The different compounds contain the following groupings:—

$C.CH$	$C.CH.OH$	$C.COOH$	$C.CO$
$C.\ddot{C}.CH_3$	$C.\dot{C}(OH)CH_2$	$C.CO.CH_3$	$C{:}\dot{C}.CH_3$
Cedrene	Glycol	Keto-acid	Cedrone

The constants obtained for cedrone do not agree with those of the cedrone, $C_{15}H_{24}O$, obtained in a similar way by Rousset (Bull. Soc. Chim., 1897, [3] **17**, 485).
—F. Shdn.

East Indian sandalwood oil; Specific gravity of ——. H. Löhr. Chem.-Zeit., 1907, **31**, 1040.

The author has frequently obtained sandalwood oil with a sp. gr. below the minimum, 0·975, suggested by Parry and Bennett (this J., 1907, 945). Recently the distillation of 20,000 kilos. of East Indian wood gave an oil having the sp. gr. 0·972 at 15° C., and optical activity, $a = 19·25°$ in a 100 mm. tube; it contained 96 per cent. of santalol, and was completely soluble in 4 parts of 70 per cent. alcohol. (See also this J., 1907, 1028.)—F. Shdn.

Thyme oil, French; Crystalline constituent of ——. J. Schindelmeiser. Apoth.-Zeit., 1907, 22, 853.

In a parcel of French thyme oil, which had stood for some time in a zinc-lined tin, a crystalline deposit was found to have formed. By recrystallisation from water or alcohol, the substance was obtained in odourless, colourless, well-formed, glassy, hard, columnar crystals, m. pt. 169° C.; sparingly soluble in alcohol, chloroform and ethyl acetate, almost insoluble in ether, readily dissolved in hot water, but sparingly in cold; optically inactive; subliming at 80° C. Analysis gave figures agreeing with the formula, $C_{10}H_{18}(OH)_2.H_2O$. When treated with hydrobromic acid in solution in glacial acetic acid, the dihydrobromide, $C_{10}H_{18}.2HBr$, was obtained, m. pt. 68° C. When the original crystals were treated with dilute sulphuric acid, a liquid with a limonene odour, but showing no constant b.pt. was obtained. The substance appears to be a new terpin hydrate, allied to, but distinct from, *trans*-terpin, which has the m. pt. 156°—158° C., and forms a dihydrobromide with the m. pt. 64° C. No known terpin has been recorded with the high m. pt. 169° C. so the substance is either a new constituent of the original oil, or is derived from some undetected adulterant; the oil showed no abnormal characters or constituents.—J. O. B.

Terpin and benzoic acid; New compound of ——. P. Cesario. Boll. Chim. Farm., 13, 495. Apoth.-Zeit., 1907, 22, 686.

A new compound of terpin with benzoic acid has been obtained in the form of acid, rectangular scales, m. pt. 97° C., readily volatilised; insoluble in cold water; soluble (1 : 20) in boiling water, and (6 : 100) in alcohol; sparingly soluble (0·01 : 15) in ether; slightly more soluble (0·1 : 100) in glycerol and in chloroform; insoluble in carbon bisulphide, oil of turpentine, benzine, and light petroleum spirit. It affords no characteristic reactions with mineral acids, nor with ferric chloride.—J. O. B.

Formaldehyde; Some condensation products of ——. J. Breslauer and A. Pictet. Ber., 1907, 40, 3784—3786.

The products described in this paper were obtained in attempting to use formaldehyde as a methylating agent. Phthalimide was heated to 150°—160° C. under pressure with a 40 per cent. solution of formaldehyde. Methylphthalimide was obtained, melting at 132° C., and boiling between 280° and 300° C. Formaldehyde and succinimide gave methylenedisuccinimide melting at 200°—202° C. Formaldehyde and phenol gave a condensation product, which is probably *methyleneglycolmethylphenyl ether*, $C_6H_5.O.CH_2.O.CH_3$. This substance boils between 197° and 200° C., has sp. gr., 1·0814 at 12° C., is insoluble in alkalis, and is volatile with steam. Treated with bromine water it forms a dibromo substitution product, $C_8H_8Br_2O_2$, melting at 112°—113° C. On boiling with dilute nitric acid, it yields picric acid. Its constitution was confirmed by its synthesis from potassium phenate and chloromethyl ether, $CH_3.O.CH_2Cl$. Formaldehyde and a-naphthol gave a dark brown, amorphous powder, $C_{23}H_{16}O_3$, soluble in alcohol, chloroform, and benzene with a red colour, in alkalis with a deep-blue colour. On distillation, a product is obtained, $C_{22}H_{16}O$, forming yellow crystals melting at 79°—80° C., soluble in alkalis and giving a deep-blue colour with ferric chloride.—F. Shdn.

Monazite sand; U.S. production of ——. U.S. Geol. Survey, 1906. [T.R.]

The production of crude monazite sand in the United States during 1906 amounted to about 2,000,000 lb., which averaged about 30 per cent. monazite. The prices paid for crude monazite in the North Carolina and South Carolina mining regions varied from 1½ cents per pound for very low-grade concentrates with small thoria content to 15 or more cents for the better grades. The average price was nearly 8 cents per pound. There were no imports of monazite or other thorium-bearing minerals into the United States during 1906. A considerable quantity of thorium nitrate, however, has been imported during the last five years; the import in 1906 was 40,090 lb., valued at $139,929.

Patents.

Camphor [from isoborneol]; Manufacture of ——. J. N. Goldsmith and The British Xylonite Co., Ltd., Brantham, Suffolk. Eng. Pat. 21,171, Sept. 24, 1906.

Camphor can be prepared by the oxidation of isobornyl ethers. As an oxidising agent, nitric acid diluted with an equal volume of water can be used. The isobornyl ether is floated on this, and the mixture warmed. Dilute sulphuric acid, starch, treacle, or copper filings may be added to the dilute nitric acid to aid the reaction. Instead of nitric acid, a mixture of sodium nitrate and dilute sulphuric acid may be employed.—F. Shdn.

Camphor; Process for oxidising borneol or isoborneol for the manufacture of ——. A. Verley, E. Urbain, and A. Feige, Paris. Eng. Pat. 14,550, June 24, 1907.

Borneol, or isoborneol, is oxidised by means of a chromic acid combination made by decomposing a concentrated solution of sodium bichromate with excess of concentrated sulphuric acid, the proportions being such that there are at least three molecular proportions of sulphuric acid to one of sodium bichromate.—F. Shdn.

Camphene; Manufacture of ——. J. N. Goldsmith and The British Xylonite Co., Ltd., Brantham, Suffolk. Eng. Pat. 21,180, Sept. 24, 1906.

Camphene is made by heating pinene hydrochloride with a salt or salts of naphthol or other phenols in non-aqueous solution. The phenolic salts of the alkaline-earths or the sodium salts of naphthols or cresols may be used in a "dry" state, that is, the pinene hydrochloride may be boiled with the salts in the absence of any solvent, and the camphene distilled off. (See Eng. Pats. 16,429 and 22,810 of 1906; this J., 1906, 909: 1907, 343; and Fr. Pat. 375,897 of 1907; this J., 1907, 947.)—F. Shdn.

Compounds for use in medicine and pharmacy [urea derivatives of α-halogen-isovaleric acid], and process for the manufacture of the same. Knoll und Co., Ludwigshafen, Germany. Eng. Pat. 942, Jan. 14, 1907.

Urea is mixed with α-halogen-isovaleryl chloride or bromide: the mixture becomes warm and combination takes place. The following substances are described. The urea compound of α-bromoisovaleryl crystallises from toluene in leaflets melting at about 149° C. The urea compound of α-chloroisovaleryl crystallises from toluene or water, and melts at about 139° C. The combination takes place in the proportion of one molecule of urea to one molecule of the α-halogen-isovaleryl.
—F. Shdn.

Pharmaceutical compounds [succinylsalicylic acid]; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5842, March 11, 1907.

See Fr. Pat. 378,220 of 1907; this J., 1907, 1109.—T. F. B.

Copaiba balsam; Manufacture of solid condensation products from ——. H. H. Lake, London. From K. A. Lingner, Dresden. Eng. Pat. 6843, Mar. 21, 1907.

Copaiba balsam, dissolved in benzine or other similar solvent, is treated with formaldehyde in the presence of a condensing agent such as hydrochloric acid, after which the acid is neutralised with sodium carbonate, and sufficient caustic alkali added to neutralise the acid constituents present in the balsam. On standing, the liquid separates into two strata, and the lower is drawn off and acidified, when the condensation products are liberated. These are then collected and dried. The product so obtained is free from essential oils, which are a frequent cause of irritation.—S. R. T.

Formic acid; Process of reducing ——. C. Ellis, White Plains, N.Y., and K. P. McElroy, Washington, D.C. U.S. Pat. 867,575, Oct. 8, 1907.

Acids of the monobasic fatty acid series, such as formic acid, can be reduced electrolytically with the formation of aldehydes and alcohols in the presence of a stronger mineral acid as sulphuric acid. A portion of the reduced liquid can be withdrawn, passed through a still to remove the volatile products of reduction and returned to the electrolytic bath.—F. Shdn.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patent.

Emulsion of phosphate of silver; Process for producing an —— *[for photography].* Y. Schwartz, Hannover, Germany. Eng. Pat. 9855, April 27, 1907.

See Fr. Pat. 378,305 of 1907; this J., 1907, 1109.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Cellulose, hydrocellulose, and oxycellulose; The higher nitrates of ——. E. Berl and R. Klaye. *See* XIX.

Patents.

Explosives; Impts. in and in preparation of ——. King's Norton Metal Co., Ltd., T. A. Bayliss, H. M. Smith, and H. W. Brownsdon, London. Eng. Pat. 28,053, Dec. 10, 1906.

The grains or particles of the explosive are coated with a metal, preferably aluminium in fine powder, with or without the addition of a small quantity of oil or vaseline. The coating of metal retards the rate of explosion, thereby improving the ballistic properties of the explosive.
—F. Shdn.

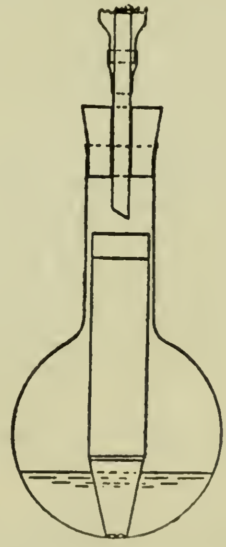
Matches; Ignition mass for ——. G. A. Haffner, Paris. Eng. Pat. 1357, Jan. 18, 1907. Under Int. Conv., Feb. 21, 1906.

Potassium chlorate, powdered glass, and zinc oxide are formed into a paste by stirring with the addition of water, and incorporated with a mixture of potassium bichromate and barium chlorate previously moistened with alcohol or ammonia, and finely ground. After complete cooling and removal of superfluous water by pressing, a cementing substance, preferably glue, combined with amorphous phosphorus is added and the whole is lightly beaten up together.—W. P. S.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, &c.

Extractor for use with small quantities of material. C. L. Jackson and J. E. Zanetti. Am. Chem. J., 1907, 38, 461—464.



The flask (250 c.c. or larger) (see Fig.) contains a wide tube, narrowed at the lower end, in which is the solid to be treated, resting on a perforated porcelain plate covered by a disc of filter-paper, which is at a higher level than the liquid in the flask; another filter-paper covers the solid. There should be a space above the solid of 1—3 cm. in height, to receive the drip from the inverted condenser, and there must be space enough between the tube and the neck of the flask to allow free passage of vapour. The rate of distillation and the adjustment of the filter-papers must be so contrived that the space above the solid is kept full of liquid while a rapid percolation goes on. The extraction is thus effected by hot liquid, and is more rapid and effective than with a Soxhlet extractor, over which the present form has the further advantages that it can be used with much less solvent, is cheaper, less fragile, more compact, and well adapted for use with solvents of high boiling-point.—J. T. D.

Nickel; Thermo-electricity of ——. Influence of metallic impurities. H. Pecheux. *See* XI*B*.

PATENTS.

Photometer for testing the luminous power of electric lamps. G. Bartels, Cologne. Eng. Pat. 13,062, June 5, 1907.

THE photometer consists of a box, at one end of which the lamp to be tested and a standard lamp are placed side by side, whilst at the other end is fixed a screen having in front of it a movable object, such as a vertical rod, by means of which shadows can be cast on the screen by the two lamps. The rod can be moved along a candle-power scale in front of the screen. A current-meter is provided. The photometer box is made in two parts, hinged together so as to be conveniently folded up with the test apparatus fixed in position.—H. B.

Gas; Apparatus for the analysis of ——. J. F. Simmance and J. Abady. Fr. Pat. 378,622, June 8, 1907. Under Int. Conv., Aug. 21, 1906.

SEE Eng. Pat. 18,680 of 1906; this J., 1907, 1067.—T. F. B.

INORGANIC—QUANTITATIVE.

Gold; New method for determining —— by means of sucrose or dextrose. P. Leidler. Z. Chem. u. Ind. Kolloide, 1907, 2, 103.

A MIXTURE of 5 c.c. of auric chloride solution (1 : 100), 10 c.c. of sucrose solution (1 : 1), and 10 c.c. of water, was heated on the water-bath, metallic gold being precipitated after about 10 minutes. Twenty c.c. of water were subsequently added, the heating then being continued for 20 minutes. The precipitate, the coagulation of which was accelerated by repeated agitation, was filtered through a Gooch crucible, washed, first with hot water, then with alcohol and ether, and dried at 140° C. In 10 determinations, the amount of gold obtained ranged between 0·0248 and 0·0255 grm. In control determinations, in which hydrogen peroxide in alkaline solution was used, 0·0254 grm. of gold was obtained. Good results were also obtained by using dextrose instead of sucrose as a reducing agent; lactose, however, was found to be unsuitable owing to the fact that the gold precipitated was too finely divided to be retained by the filter. The method is only applicable to auric chloride and aurichloric acid; in the case of sodium aurichloride, the gold is not obtained quantitatively. The method is not applicable to the determination of silver or platinum.—L. E.

Phosphoric acid; Quantitative volatilisation of —— from its salts in a current of chlorine containing carbon tetrachloride. P. Jannasch and W. Jilke. Ber., 1907, **40**, 3605—3608.

THE method described by Jannasch and Heimann (this J., 1906, 1007) may be simplified by carbonising the sugar mixture with sulphuric acid in a large glass boat in a combustion tube heated in a furnace, and distilling over the phosphoric acid by means of a current of chlorine. Or, the mixing of the phosphate with carbon may be dispensed with if the current of chlorine be charged with carbon tetrachloride vapour. For this purpose the chlorine, after passing through a washing bottle containing sulphuric acid, is made to traverse an Erlenmeyer flask, which is heated in a beaker of water to 85°—95° C., and into which carbon tetrachloride falls drop by drop, the supply being so regulated that about 200 c.c. are consumed in an hour. The phosphate is heated in a platinum boat placed near the centre of the combustion tube, which is about half a metre in length and has an end which is constricted and bent downwards where it is connected with the absorption vessels. The first of these is a flask containing 200 c.c. of water and 50 c.c. of dilute nitric acid, whilst the second, which is a vessel with 10 bulbs, is charged with 50 c.c. of water. About 4½ hours are required for the complete volatilisation of phosphoric acid from ammonium and magnesium phosphates. The liquid in the absorption vessels is then gently heated to expel the carbon tetrachloride, concentrated to a syrup, and filtered, and the phosphoric acid determined by the molybdate method.—C. A. M.

Molybdic acid; Behaviour of —— in the zinc reductor. D. L. Randall. Am. J. Science, 1907, **24**, 313—316.

THE molybdic solution (0·2 to 0·3 grm. of ammonium molybdate dissolved in 10 c.c. of water and acidified by 100 c.c. of sulphuric acid of 2·5 per cent.) is passed through the column of zinc (about 36 cm.) in the reductor, following 100 c.c. and followed by 200 c.c. of the hot dilute acid, and the zinc is finally washed with 100 c.c. of hot water. The liquids leaving the reductor are received in 20—30 c.c. of solution of iron alum (100 grms. of the crystallised salt dissolved in a litre of water) to which 4 c.c. of phosphoric acid have been added. The reduced ferrous salt is then determined by titration with $N/10$ permanganate. Under these circumstances it is found that the molybdenum is reduced exactly to Mo_2O_3. In determining phosphorus, the precipitation of ammonium phosphomolybdate is carried out as usual, the washed precipitate dissolved out of the Gooch crucible by means of dilute ammonia, the solution acidified with sulphuric acid, and passed through the reductor as described above.—J. T. D.

Caustic lime; Determination of ——. E. H. Croghan. *See* VII.

Sulphur in iron, steel, etc.; Determination of ——. E. Jaboulay. *See* X.

Manganese in steel; Volumetric determination of ——. L. Sacerdoti. *See* X.

Electro-analysis; New results in ——. T. P. McCutcheon, jun. *See* XI*A*.

Halides of the alkaline-earth metals; Electrolysis of the ——. H. S. Lukens and E. F. Smith. *See* XI*A*.

Metallic chloride solutions; Electrolysis of —— with the use of rotating silver anode and mercury cathode. T. P. McCutcheon, jun., and E. F. Smith. *See* XI*A*.

Titanium trichloride in volumetric analysis. E. Knecht and E. Hibbert. *See* Org. Quant.

PATENT.

Analysis; Methods of chemical ——. [Phosphorus in steel.] C. H. Ridsdale, Middlesbrough. Eng. Pat. 21,342, Sept. 26, 1906.

THE invention relates to the preparation of weighed or measured quantities of reagents for use in definite chemical operations, the solid substances being put up in the form of tablets and the liquids in measures of the required size. An instance is given in which the determination of phosphorus in steel is described. A weighed portion of the sample is treated with a quantity of a mixture of nitric acid and hydrogen peroxide delivered from a special measure; when the steel is dissolved, a pellet consisting of ammonium nitrate and ammonium chloride is added, the excess of oxygen is removed by boiling, and the phosphoric acid is then precipitated by the addition of ammonium molybdate.—W. P. S.

ORGANIC—QUALITATIVE.

Sesamé oil; Influence of rancidity on Baudouin's test for ——. A. Lauffs and J. Huismann. *See* XII.

Animal fats; Detection of some —— when mixed with other animal fats. E. Polenske. *See* XII.

ORGANIC—QUANTITATIVE.

Combustions; Use of palladium as contact substance in ——. M. Dennstedt. Ber., 1907, **40**, 3677—3681.

A CRITICISM of Jacobsen and Landesen (this J., 1907. 948), and a claim for priority in the use of palladium, which the author has shown to possess no advantage over platinum as a catalyst though superior to copper oxide. Palladium further has the disadvantage that it loses its metallic surface and becomes covered with a greyish-green layer. The use of palladium-asbestos and of asbestos generally is unfavourably criticised on the ground that these materials retain traces of sulphuric acid. The use of a combustion tube of reduced bore at the spot where the contact substance is placed is also condemned.—E. F. A.

Titanium trichloride in volumetric analysis. E. Knecht and E. Hibbert. Ber., 1907, **40**, 3819—3827. (See this J., 1903. 232, 825; 1905, 154, 1192.)

IN the determination of trinitrocresol and trinitroxylenol by reduction with titanium trichloride, accurate results are obtained only by using a large excess of the titanium solution, and boiling for 5 minutes in a current of carbon dioxide. For the determination of nitro-compounds insoluble in water and not easily sulphonated, the substance is dissolved in alcohol, and slowly introduced into a known volume of a hot, standardised solution of titanium trichloride. The whole is then boiled for five minutes, while passing a current of carbon dioxide through, and after cooling, the excess of titanium chloride is titrated with ferric-ammonium sulphate solution. A control determination should always be performed. Thioindigo can be determined in exactly the same manner as indigo (this J., 1905, 1192), being reduced to the leuco compound. For direct-dyeing cotton azo dyestuffs, the indirect method was previously recommended (this J., 1905, 154), but if an addition of Rochelle salt be made, as with basic dyestuffs, they can be titrated directly, except in the case of yellow dyestuffs, such as Chrysophenine. In the titration of ferric iron with titanium trichloride, instead of ascertaining the end-point by spot-tests with potassium thiocyanate, a considerable excess of the latter may be added to the solution, and the titration continued until the colour disappears. The direct determination of ferric iron in this way also allows of a simplification of Mohr's method for the determination of dissolved oxygen in water. For the determination of hydrosulphites (hyposulphites), 0·2 grm. of the sample is introduced directly into 25 c.c. of a solution of Methylene Blue (10 grms. per litre) contained in a flask through which a current of carbon dioxide is led. The hydrosulphite reduces an equivalent quantity of the dyestuff, and after acidifying with acetic acid, the excess of Methylene Blue is titrated with titanium chloride solution.—A. S.

Methane; Detection and rapid determination of ——. N. Grehant. *See* II.

Shellac analysis. H. Endemann. *See* XIII*B*.

Malt analysis; Unified method of commercial ——. *See* XVII.

Wines; Determination of the principal acids in —— in presence of alcohol and glycerol. A. Heiduschka and G. Quincke. *See* XVII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radio-active element; New ——. B. B. Boltwood. Am. J. Science, 1907, **24**, 370—372.

EVIDENCE has been obtained of the existence in uranium minerals of a new radio-active element, emitting both α- and β-radiations, producing no emanation, and resembling thorium in its chemical characters. It is a disintegration-product of uranium, and probably the immediate parent of radium. The author proposes for it the name *ionium*.—J. T. D.

Solvent; Relation between the —— and the substance to be dissolved. I. Ostromysslensky. J. prakt. Chem., 1907. **76**, 264—267.

THREE rules are established for the relationship between the solvent and the substance to be dissolved, which hold almost without exception. (1). A substance dissolves in its homologues. Thus paraffin dissolves in ligroïn; cetyl and myricyl alcohols are soluble in amyl, propyl, ethyl and methyl alcohols; stearic, margaric and palmitic acids are soluble in caprylic, caproic, propionic, acetic and formic acids; and many other instances are given. The solubility of homologues in one another decreases with each increment of CH_2. (2). All position isomerides are soluble in one another, as exemplified by the *o*, *m* and *p*-dinitro-, dibromo-, dichloro-, and dihydroxy-benzenes: the five isomeric chlorodinitrobenzenes dissolve in one another without limit. (3). All polysubstituted compounds of any particular compound dissolve in one another so long as the group replacing hydrogen remains the same. Thus acetic and malonic acids dissolve in one another, phenol, resorcinol, catechol, quinol, phloroglucinol and pyrogallol are mutually soluble; also mono-, di-, and trichloroacetic acid, etc.—E. F. A.

Protein derivatives; A new solvent for ——. I. Ostromysslensky. J. prakt. Chem., 1907, **76**, 267—268. (See preceding abstract.)

THE albumoses and peptones, which according to Fischer's researches contain chains of acid amides, dissolve in formamide and fused acetamide (m. pt. 85° C.) with ease. Egg albumin peptone dissolves to the extent of 30 per cent., whereas the albumin itself is insoluble. The concentrated formamide solutions are of a thick fluid consistence and can be easily filtered: it is hoped to use them to separate inorganic constituents from the albumoses and for cryoscopic purposes.—E. F. A.

Polypeptides; Formation of —— by hydrolysis. E. Fischer and E. Abderhalden. Ber., 1907, **40**, 3544—3562.

THREE dipeptides were isolated from the products of the partial hydrolysis of silk fibroin and elastin, and were characterised as derivatives of glycocol with *d*-alanine, *l*-tyrosine and *l*-leucine respectively. A dipeptide derivative, say of glycocol and alanine, may be either glycylalanine or alanyl-glycine. In order to determine the nature of such combinations, the authors prepare the β-naphthalenesulphonic derivative of the dipeptide and hydrolyse this with dilute hydrochloric acid. The dipeptide linkage is thus broken and the naphthalenesulphonic group remains unaffected. In this way the first of the above dipeptides yielded alanine and naphthalenesulphoglycine; the body is therefore glycyl-*d*-alanine. From the products of hydrolysis of elastin, *d*-alanyl-*l*-leucine has been obtained and characterised; two other dipeptides from the same source are probably derivatives of glycocol and valine and of *d*-alanine and proline respectively. A dipeptide, identified as *l*-leucyl-*d*-glutamic acid, which is an important product of several proteins, has been isolated from the products of hydrolysis of gliadin. The authors have obtained from silk fibroin what appears to be a tetrapeptide, a combination of two glycocol residues with *d*-alanine and *l*-tyrosine. This body, of relatively simple constitution, is precipitated by ammonium sulphate and presents a very close similarity in its reactions to the complicated albumoses; this peculiarity is attributed to the presence of tyrosine groups in the molecule.—J. F. B.

Trade Report.

BRAZIL: PROPOSED NEW TARIFF ON CHEMICAL IMPORTS. *Statement showing present and proposed new rates of Customs Duty (where they differ).* Note:—1000 reis = 1s. 3d.

No. in Proposed Tariff.	Tariff Classification.		Present Duty.	Proposed Duty.
178	Acids—		Reis.	Reis.
	Carbolic (Phenol) pure—liquid or crystals ..	kilo.	400	300
	Sulphuric, impure....	,,	30	40
	Sulphurous, liquid or compressed	,,	200	300
200	Borax crystallised ("cristallzado em-pedra")	,,	300	100
	Borax in powder	,,		300
205	Carbonates and Carburets—			
	Ammonium	,,	400	300
	Calcium (impure)	,,	60	120
	Potassium (impure) (pearlash)	,,	30	20
	Potassium (bicarbonate)	,,	200	400
	Sodium (bicarbonate).	,,	100	400
211	Sodium or Potassium Chlorate	,,	300	150
213	Chlorides and Hypochlorites—			
	Lime (prob. Bleaching Powder)	,,	50	30
	Potash (Eau de Javelle)	,,	300	500
	Soda (Eau de Labarraque)	,,	300	500
	Sodium (common salt, crude)	litre	25	30
215	Potassium or Sodium Chromate	kilo.	150	100
221	Ferrocyanides and Ferricyanides—			
	Iron Prussiate (Prussian Blue)	,,	1800	1200
	Potash Ferrocyanide (yellow)...........	,,	500	300
	Potash Ferricyanide (red)	,,		400
257	Lysol, crealin, cresol and the like	,,	300	500
272	Oxides—			
	Lead (massicot, minium, litharge)	,,	150	100
	Lead (compound or white siccative) ...	,,	400	200
	Iron, industrial	,,	500	30
281	Potassium or sodium perchlorate..............		not specified	400
284	Calcium Phosphate (see note at end)		.	
308	Sulphates—			
	Ammonium sulphate (see note at end) ..	,,	400	100
	Potassium sulphate ..	,,	300	100
	Sodium bisulphate ..	,,	300	100
309	Sodium Hyposulphite—			
	Pure	,,	500	250
	Impure	,,	200	50
	Lead (?)	,,	not specified	500

Note.—Under both tariffs, are exempted from duty the following chemical products, adapted for use as fertilisers and correctives of the soil, such as:—Phosphate and superphosphate of lime; nitrates of potash and soda; sulphates of ammonia, copper, iron, and potash; sulphur; guano; kainite; chloride of potassium; and ant-killing substances (formicides).

New Books.

CHAPTERS ON PAPERMAKING. VOL. III. Comprising a short practical treatise in which boiling, bleaching, loading, colouring, and similar questions are discussed. By CLAYTON BEADLE. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. 1907. Price 5s. net, each volume.

SMALL 8vo volume, containing 129 pages of subject matter, with three illustrations, and an alphabetical index. The following classification is followed in the work: General introduction. I. "Brass" and "steel" beater bars. II. Size and speed of beater rolls. III. Fading of Prussian blue papers. IV. Effect of lowering the breast roll. V. Effect of "loading" on the transparency of papers. VI. "Terra alba" as a loading for paper. VII. Use of alum in tub sizing. VIII. Influence of temperature on bleaching. IX. Use of refining engines. X. Agitation as an auxiliary to bleaching. XI. Heating of "stuff" for the paper machine. XII. Comparative results of quadruple and open effect evaporation. XIII. How to prevent electrification of paper on the machine. XIV. Transparency of papers. XV. The "life" of machine wires. XVI. Edge-runners.

VOL. IV. (Discussions on water supplies and the management of the paper machine and its influence on the qualities of papers.) Contains 150 pages of subject matter, and an alphabetical index. The matter is classified as follows:—General introduction. I. The bulking of papers. II. Special qualities of "art" papers. III. The "ageing" and storage of papers. IV. Use of lime in boiling. V. Controlling the mark of the "dandy." VI. "Machine" and "hand-" cut rags. VII. Froth on paper machine. VIII. Scum spots in paper. IX. Consumption of water in the manufacture of paper. X. Management of suction-boxes. XI. Shrinkage of paper on the machine. XII. Paper that does not shrink or expand. XIII. Production of non-stretchable paper. XIV. Connection between "stretch" and "expansion" of papers. XV. "Stretch" and "breaking strain." XVI. Paper-testing machines.

THE MICROSCOPY OF TECHNICAL PRODUCTS. By Dr. T. F. HANAUSEK, Director of the Gymnasium at Krems on the Danube, etc. Revised by the Author and translated by ANDREW L. WINTON, Ph.D., with the collaboration of K. G. BARBER, Ph.D. First Edition. John Wiley and Sons, New York. 1907. Price 21s. net, or, $5.00. Chapman and Hall, Limited, London.

LARGE 8vo volume, containing 448 pages of subject matter, with 276 illustrations, and an alphabetical index. The subject matter is subdivided and classified according to the following method: PART I. APPARATUS AND METHODS. I. The microscope. II. Microscopic accessories. III. Micro-technique; reagents. PART II. MICROSCOPY OF THE MOST IMPORTANT TYPES OF TECHNICAL RAW MATERIALS. I. Starch-Inulin. II. Vegetable fibres. (*a*) Hairs. (*b*) Fibres of stems (bast fibres, fibro-vascular bundles, etc.). (*c*) Microscopic examination of paper. III. Animal fibres. Mineral fibres. Textiles. IV. Stems and roots. (*a*) Wood of dicotyledons and gymnosperms. (*b*) Monocotyledonous stems. (*c*) Subterranean organs. (*d*) Barks. V. Leaves. VI. Flowers and parts of flowers. VII. Fruits and seeds. (*a*) Kinds of fruits. Morphology. (*b*) The seed. (*c*) Microscopic investigation of typical examples of technical fruits and seeds (such as wheat, barley, oil-cakes, myrobalans, ivory nut, etc.). VIII. Teeth, bone, horn, etc. IX. Microchemical analysis; (*a*) Comparative crystal analysis, (*b*) Individual crystal analysis.

THE PHYSIOLOGY OF ALIMENTATION. By Dr. MARTIN H. FISCHER, Professor of Pathology in the Oakland College of Medicine. First Edition. John Wiley and Sons, New York. 1907. Price 8s. 6d. net, or, $2.00. Chapman and Hall, Limited, London.

SMALL 8vo volume, containing 322 pages of subject matter, with thirty illustrations, and alphabetical indexes of authors and subjects. The text is classified as follows: I. and II. The mechanical phenomena of alimentation. III. The juices poured out upon the food and their chemical constituents. IV. Ferments and fermentation. V., VI., VII., and VIII. Action of the enzymes found in the human alimentary tract. IX. The bacteria of the alimentary tract. X. The regulation of salivary secretion. XI. Regulation of gastric secretion. XII. Regulation of pancreatic secretion. XIII. Regulation of the biliary and the intestinal secretions. The functions of the bile. XIV., XV., XVI., and XVII. The alimentary tract as an absorptive system. (Absorption of water; of salts; of carbohydrates; of fats; and of proteins.) XVIII. The alimentary tract as an excretory system.

Clean Water and How to Get It. By Allen Hazen, Member of the American Society of Civil Engineers, etc. First edition. John Wiley and Sons, 45, East Nineteenth Street, New York. 1907. Price 6s. 6d. net, or $1.50. Chapman and Hall, Limited, London.

8vo volume, containing 174 pages of subject matter, with frontispiece and twenty-five illustrations, and an alphabetical index. The subject matter is classified as follows: I. Impounding reservoir supplies. II. Water supplies from small lakes. III. Supplies from the great lakes. IV. Water supplies from rivers. V. Ground water supplies. VI. Action of water on iron pipes and the effect thereof on the quality of the water. VII. Development of water purification in America. VIII. Nature of the methods of purifying water. IX. Application of the methods of water purification, arranged according to the matters to be removed by the treatment. X. Storage of filtered water. XI. Required sizes of filters and other parts of water works. XII. Pressure under which water is to be delivered. XIII. Use and measurement of water. XIV. Financial aspects. XV. Laying out and construction of works. XVI. Financial management of publicly-owned water works.

Steel Works Analysis. By John Oliver Arnold and F. Ibbotson, respectively Professor and Lecturer in Metallurgy in the University of Sheffield. Third edition. Whittaker and Co., 2, White Hart Street, Paternoster Square, London, and 64 and 66, Fifth Avenue, New York. 1907. Price 10s. 6d.

8vo volume, containing 462 pages of subject matter, with twenty-four illustrations. The subjects and methods of analysis described, are as follows: I. Steel works laboratory, and its appliances. II. Analysis of steel and wrought iron. The determinations include those of carbon by combustion, and by colour; of graphite; of silicon, manganese, sulphur, phosphorus, arsenic, tungsten, chromium, nickel, aluminium, copper, iron, molybdenum, vanadium, titanium, tantalum. Reactions of acids with steel. Time-table summary. II. Analysis of high-speed steels, pig-iron, spiegel and ferro-manganese, ferro-chrome, ferro-silicon, ferro-aluminium, aluminium metal, ferro-tungsten, metallic tungsten, ferro-nickel and metallic nickel, ferro-molybdenum, -vanadium, -titanium, and -tantalum. Analysis of iron ores and manganese ores. Analyses of chrome iron ore, wolfram, scheelite, tantalite, of refractory metals, fuels, slags, boiler water, brass, bronze, and white metals. III. Determination of the specific gravity of steel, of carbide of iron, of the evaporative power of coal, and of nitrogen in steel, &c. Tables of typical analyses, of atomic weights, factors, etc. Calculation of the calorific power and intensity of fuel.

Monographien über angewandte Elektrochemie. XXVIII Band. Die Elektrochemische und Elektrometallurgische Industrie Grossbritanniens, von John B. C. Kershaw. Ins Deutsche übertragen von Dr. Max Huth. Wilhelm Knapp's Verlag, Halle a. S., Germany. 1907. Price M.9.

8vo volume, containing 178 pages of subject matter, and an alphabetical index of authors and inventors. The text is illustrated by eighty-seven engravings and ten tables. The subject matter is subdivided and classified as follows:—I. Historical introduction. II. The aluminium industry. III. Electrolytic chlorine and alkali industry. IV. Calcium carbide and acetylene. V. Electrolytic copper refining. VI. The hypochlorite and chlorate industry. VII. The ozone, oxygen, and hydrogen industries. VIII. The sodium, potassium, and phosphorus industries. IX. Stripping of tin-plate (tinned iron). X. Electrolytic zinc-plating; extraction, and refining of zinc. XI. Other electrochemical industries. ("Silvering"; galvanotyping; and preparation of reflectors and mirrors of special character.)

Eisenhüttenchemie. von Max Orthey. Wilhelm Knapp's Verlag, Halle a. S., Germany. 1907. Price M. 8.

This volume of 8vo size, contains 248 pages of subject matter with thirty-six illustrations, and alphabetical indexes of subjects and names of authors, inventors, etc. The subject matter of this work, chiefly devoted to analytical methods, is classified as follows: I. Methods of preparation for quantitative determination ((*a*) Taking samples; (*b*) Solution; (*c*) Qualitative investigation). II. Quantitative investigation. II. Fluxes, and other additions in smelting. III. Fuels. IV. Iron and Steel. V. Slags. VI. Gases. VII. Fireproof products.

A Course of Practical Organic Chemistry. By T. Slater Price, D.Sc., Ph.D., and Douglas F. Twiss, M.Sc. Longmans, Green, and Co., 39, Paternoster Row, London; New York, Bombay, and Calcutta. 1907. Price 3s. 6d.

This book contains the scheme of work drawn up for the classes in the Birmingham Municipal Technical School with some necessary enlargement. It is of 8vo size, and contains 234 pages of subject matter, with 35 illustrations, and an alphabetical index of subjects. The subject matter is classified as follows: Part I. a. Determination of melting points; boiling points; specific gravity of liquids. Detection of the elements: carbon, hydrogen, halogens, nitrogen, sulphur, phosphorus. b. Preparation of methane. Purification of ethyl alcohol, and spirit determination of a fermented liquor. Tests for formates, acetates, etc., etc. c. Tests for acetone. Preparations from acetone. Tests for chloroform, chloral hydrate, iodoform. d. Monobasic acids, etc. Polybasic acids. Alcohols. Amide of carbonic acid. e. Tests for cyanides, ferrocyanides, and ferricyanides. f. Tests for dextrose, cane sugar, lactose, starch. Preparation of glucosazone. g. Scheme for identifying bodies of foregoing groups. Part II. h. Fractional distillation. Preparation of nitrobenzene; *m*-dinitrobenzene; aniline (and tests), etc. i. Preparations depending on diazotising, etc. j. Further preparations and tests. k. Preparations, including *o*- and *p*-nitrophenol; picric acid; *β*-naphthol, anthraquinone, etc. Tests for naphthalene, anthracene, picric acid, etc. Part III. (i.) Special preparations, including diazoaminobenzene; aminoazobenzene; acetophenone by Friedel and Crafts' reaction, etc. Quinoline by Skraup's reaction. (ii.) Quantitative determination of the principal elements in organic substances. (iii.) Determination of the molecular weight of an organic compound. (iv.) Vapour density determinations, etc. (v.) Special quantitative work. (vi.) Tests for uric acid, pyridine, quinoline, and other bases and alkaloids. (vii.) Scheme for detecting an organic compound.

Mines and Quarries: General Report and Statistics for 1906. Part II.—Labour. [Cd. 3770.] Wyman and Sons, Fetter Lane, London, E.C. Price 8d.

This publication contains a report and statistics relating to persons employed and accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts. According to these statistics the total number of persons employed at mines and at the quarries under the Quarries Act in the United Kingdom and the Isle of Man during the year 1906 was 1,004,092, of whom 912,576 were employed in or about mines, and 91,516 in or about quarries. Compared with the preceding year, there is an increase of 25,052 persons employed at mines. In 1906, 1,190 separate fatal accidents occurred in or about mines and quarries, causing the loss of 1,275 lives, showing an increase of 87 in the number of fatal accidents and a decrease of 29 in the number of lives lost as compared with 1905.

Mines and Quarries: General Report and Statistics for 1906. Part III.—Output. [Cd. 3774.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 5d.

This return, which is prepared annually by the Home Office, contains statistics as to the quantity and value of various minerals raised in the United Kingdom. The value of the mineral output of the United Kingdom in 1906 was 105,842,992*l*., an increase of 10,014,180*l*. as compared with the preceding year.

The Patents and Designs Act, 1907. By J. Roberts and H. Fletcher Moulton. Butterworth and Co., 11 and 12, Bell Yard, Temple Bar, London, W.C. Price 4s.

The volume consists of 119 pages of subject matter, with a 9-page index. After a table of the cases mentioned in the book, there is an introduction, dealing with the jurisdiction and powers of the Comptroller, the Board of Trade, and the Court, and with the procedure incidental to the taking out of patents. Then follows a reprint of the Patents and Designs Act, with notes relative to the interpretation of the various clauses. An appendix gives abstracts of some recent Comptroller's cases, and also a table of corresponding sections of the old and new Acts.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

22,732. Lamort. Recovery filters. [Fr. Appl., Nov. 5, 1906.]* Oct. 15.

23,221. Bebbington and Mathieson. Apparatus for filtering, washing, and drying, applicable for treating sodium bicarbonate, &c. Oct. 21.

23,330. Peat and Bonin. Apparatus for subjecting gases to the action of liquids. Oct. 22.

23,348. Lindskog. Concentrating salts or other substances dissolved in water. Oct. 22.

24,362. Macfarlane and Williamson. Centrifugal drying machines. Oct. 23.

23,588. Plechati. Dewar flasks.* Oct. 25.

23,712. Peritz and Lyld. Retorts.* Oct. 26.

Complete Specifications Accepted.

23,645 (1906). Radford. Regenerative melting furnaces. Oct. 23.

24,135 (1906). Ermen. Preparation of emulsions. Oct. 30.

28,977 (1906). Whitman. Separating liquids from solids or matter held in suspension. Oct. 30.

1463 (1907). Evans (Minimax Consolidated, Ltd.). Condenser. Oct. 23.

1843 (1907). Kestner. Extracting from a liquid gases contained therein. Oct. 23.

5137 (1907). Brocke. Regenerative furnaces. Oct. 23.

13,510 (1907). Sepulchre. Freeing gases from solid or liquid particles. Oct. 23.

13,620 (1907). Siemens. Regenerative gas furnaces. Oct. 23.

19,005 (1907). Reeves and Bramwell. *See under* XVIII*B*.

II.—FUEL, GAS, AND LIGHT.

Applications.

22,682. Hall-Brown. Gas producers. Oct. 15.

22,746 and 22,747. Siemens und Halske A.-G. Manufacture of incandescence filaments for electric light. [Ger. Appls., Oct. 16 and 26, 1906.]* Oct. 15.

22,881. Hall-Brown. Gas producers. Oct. 17.

22,965. Hill and Westwood. Apparatus for making heating and illuminating gas. Oct. 18.

22,989. Hall-Brown. Gas producers. Oct. 18.

23,078. Hall-Brown. Scrubber and cooler for producer gas. Oct. 19.

23,069. Stirling. Producer gas scrubbing or filtering apparatus. Oct. 19.

23,097. Oberbayerische Kokswerke und Fabr. Chem. Prod. Furnace for coking peat, lignite, and wood. [Ger. Appl., Oct. 20, 1906.]* Oct. 19.

23,202. Hansford and Gibbons. Manufacture of gas and coke. Oct. 21.

23,392. Kesson. Apparatus for producing peat fuel. Oct. 23.

23,429. Grote, and Foster Arc Lamp Co. Electrodes for arc lamps.* Oct. 23.

23,512. Schmidt. Gas and steam generators.* Oct. 24.

23,524. Lang. Heating material.* Oct. 24.

23,537. Dewey. Incandescent gas mantles. Oct. 25.

23,679. Whitfield. Power gas producing plant. Oct. 26.

Complete Specifications Accepted.

23,080 (1906). Willis (Salc). Gas generator. Oct. 30.

23,119 (1906). Bourdos, Rotschild, and Sutcliffe. Manufacture of incandescence filaments for electric lamps. Oct. 30.

23,451 (1906). Stevenson. Apparatus for generating steam and combustion products under pressure. Oct. 30.

29,115 (1906). Boult (Bohon). Mixture of gases for combustion purpose. Oct. 30.

342A (1907). Clarke, Chapman and Co., and Robson. Combined gas producer and ammonia generator. Oct. 30.

7857 (1907). Börlin. Production of solid fuel. Oct. 30.

11,716 (1907). Siemens und Halske A.-G. Manufacture of a plastic mass from tungsten compounds. Oct. 23.

12,606 (1907). Cobbett. Hydrocarbon liquid for explosion motors, and for heating and lighting. Oct. 23.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

22,818. Newton (Bayer und Co.). Manufacture of dyestuffs of the phthalein series dyeing on a mordant. Oct. 16.

22,967. Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Oct. 17.

23,026. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 18.

23,182. Newton (Bayer und Co.). Manufacture of a tetrazo dyestuff. Oct. 21.

23,183. Newton (Bayer und Co.). Manufacture of azo dyestuffs. Oct. 21.

23,410. Newton (Bayer und Co.). Manufacture of a dyestuff of the gallocyanine series. Oct. 23.

Complete Specifications Accepted.

27,322 (1906). Ransford (Cassella und Co.). Manufacture of diacetyldiaminophenol derivatives and dyestuffs therefrom. Oct. 30.

28,139 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 30.

28,765 (1906). Newton (Bayer und Co.). Manufacture of anthracene derivatives. Oct. 30.

1472 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. Oct. 30.

1592 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of α-oxythionaphthenes. Oct. 23.

4235 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters of the anthracene series. Oct. 23.

7351 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of monoazo dyestuffs and lakes therefrom. Oct. 30.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

22,702. Hellstern and Vincent. Bleaching by oxygen. Oct. 15.

22,753. Follet and Ditzler. Manufacture of filaments of fibroin, cellulose, &c. [Belg. Appl., Oct. 16, 1906.]* Oct. 15.

22,788. Hunt and Moscrop. Kiers for treating textiles. Oct. 16.

22,830. Trevor and Burrows. Preparing flax, hemp, &c. Oct. 16.

22,987. Rothwell-Jackson. Kiers for bleaching and otherwise treating fabrics, yarns, threads, and fibres. Oct. 18.

23,130. Denison and Preussner. Rendering the finish on textiles permanent.* Oct. 19.

23,255. Levinstein, and Levinstein, Ltd. Treatment of animal fibres. Oct. 22.

23,360. Sutherland. Degumming stalk fibres. Oct. 23.

23,621 and 23,624. Higginson and Arundel. Gassing machines for yarn or thread. Oct. 25.

23,675. Costikyan. Apparatus for printing or dyeing yarns. Oct. 26.

Complete Specifications Accepted.

23,555 and 23,556 (1906). Von Ordody, and Westdeuts. Thomasphosphat-Werke. Production of long fibres from willow bark or other bast-containing material. Oct. 30.

23,761 (1906). Schiefner. Treatment of jute fibres. Oct. 30.

25,248 (1906). Ainley. Machines for washing and scouring textile fabrics. Oct. 30.

1331 (1907). Fitzpatrick (De Perini). Machines for separating fibres from plants. Oct. 23.

7099 (1907). Peters. Dyeing with the jigger. Oct. 30.

9300 (1907). Wilkins. Solution for rendering textiles, &c., resistent to fire. Oct. 23.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Complete Specification Accepted.

27,788 (1906). Bayer, and Passauer Mechanische Papierfabrik. Marbling paper. Oct. 30.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

22,894. Middleton. Re-purifying lime. Oct. 17.

22,968. Tcherniac. Manufacture of sodium cyanide. Oct. 17.

23,040. Raymond. Preparation of hydrogen. Oct. 18.

23,217. Johnson (Verein Chem. Fabr.). Manufacture of reduction products of sodium sulphate in anhydrous pulverulent form.* Oct. 21.

23,221. Bebbington and Mathieson. *See under* I.

23,634. Schröder. Manufacture of aluminic sodic chloride, ferric chloride, and phosphatic fertilisers from aluminic-ferric and calcic-aluminic-ferric phosphates.* Oct. 25.

23,667. Pochin and Richardson. Treatment of the residue or sludge from the production of sulphate of alumina. Oct. 26.

Complete Specifications Accepted.

23,165A (1906). Sarason and Haller. Generating oxygen. Oct. 23.

342A (1907). Clarke, Chapman and Co., and Robson. *See under* II.

4861 (1907). Fromont. Lead chambers for the manufacture of sulphuric acid. Oct. 23.

7149 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of a stable hydrosulphite preparation. Oct. 30.

VIII.—GLASS, POTTERY, AND ENAMELS.

Application.

23,063. Fischer. Production of highly glazed coloured earthenware. Oct. 18.

Complete Specification Accepted.

3769 (1907). Shelley and Forrester. Pottery saggars. Oct. 23.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Application.

23,127. Peters. Kilns for steaming or burning bricks and the like. Oct. 19.

Complete Specifications Accepted.

22,901 (1906). Crotch. Artificial stone. Oct. 23.

23,450 (1906). Kelway-Bamber. Manufacture of Portland and like cements. Oct. 30.

10,532 (1907). Alexander-Katz. Manufacture of artificial stones. Oct. 30.

X.—METALLURGY.

Applications.

22,620. Cowper-Coles. Production of aluminium. Oct. 14.

23,060. De Laval. Extraction of iron. [Swed. Appl., Oct. 20, 1906.]* Oct. 18.

23,366. Hellstern and Vincent. Uses of oxygen in metallurgical processes. Oct. 23.

23,405. Holloway. Treatment of slags from tin-smelting furnaces. Oct. 23.

23,627. Zenzes. Manufacture of steel in the converter. Oct. 25.

Complete Specifications Accepted.

23,449 (1906). Goldschmidt and Goldschmidt. Detinning tin-plate scraps and other tinned waste material. Oct. 30.

23,869 (1906). Bergquist. Apparatus for sintering fine ore. Oct. 30.

29,728 (1906). Schwarz. Concentrating ores. Oct. 23.

530 (1907). Jumau. Obtaining pure copper. Oct. 23.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

22,621. Cowper-Coles Galvanizing Synd., Ltd., and Cowper-Coles. Electro-galvanising. Oct. 14.

22,869. British Thomson-Houston Co. (General Electric Co.). Electric resistance material. Oct. 16.

23,145. Cowper-Coles. Apparatus for purifying electrolytes.* Oct. 19.

23,273. Hargreaves. Electric insulating materials. Oct. 22.

Complete Specifications Accepted.

13,943 (1907). Phillips and Hutchins. Insulation of electric conductors and material therefor. Oct. 30.

18,900 (1907). Pauling. Electric furnaces. Oct. 23.

18,901 (1907). Pauling. Electric furnaces. Oct. 30.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

22,658. Holstein and Petersen. Rectifying mixtures of glyceride of physetoil acid and other unsaturated acids with fatty acids and their glycerides. Oct. 14.

23,146. Berliner. Extraction of fats, oils, and the like.* Oct. 19.

23,622. Philips-Smith. Lubricating compounds. Oct. 25.

Complete Specifications Accepted.

23,768 (1906). Common, and Hull Oil Manufacturing Co. Means for use in emulsifying oils. Oct. 30.

13,042 (1907). Crosfield and Sons, Ltd., and Markel. Manufacture of soap. Oct. 23.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—Pigments, Paints.

Application.

22,653. Gilton and McCann. Ink for use in making carbon papers, &c. Oct. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

7351 (1907). Imray (Meister, Lucius, und Brüning). *See under* IV.

11,803 (1907). Steinau. Rendering lithopone or lithopone white proof against sunlight or atmospheric influences. Oct. 30.

(*B*.)—RESINS, VARNISHES.

APPLICATIONS.

23,328. Grognot. Manufacture of resinous products analogous to natural resins.* Oct. 22.

23,383. Baines. Production of resin. Oct. 23.

(*C*.)—INDIA-RUBBER.

APPLICATIONS.

22,640. Olsson. Manufacture of resilient substances. [Swed. Appl., May 16, 1907.]* Oct. 14.

23,031. Perkin, and Whipp Bros. and Todd, Ltd. Elastic or resilient material. Oct. 18.

COMPLETE SPECIFICATION ACCEPTED.

13,908 (1907). Kempter. Apparatus for washing caoutchouc, guttapercha, &c. Oct. 23.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATIONS.

23,030. Perkin, and Whipp Bros. and Todd, Ltd. Preparation of gelatine. Oct. 18.

23,313. Epstein. Tanneries. Oct. 22.

COMPLETE SPECIFICATIONS ACCEPTED.

26,188 (1906). Howorth (Oesterreich. Pluviusin A.-G.). Imitation of chamois leather. Oct. 23.

8026 (1907). Neufeld. Manufacture of bodies from chromated glue compositions. Oct. 23.

XV.—MANURES, &c.

APPLICATIONS.

23,399. Colburn and Broadbent. Production of manure from animal and vegetable matter. Oct. 23.

23,634. Schröder. *See under* VII.

COMPLETE SPECIFICATION ACCEPTED.

15,922 (1906). Brightmore. Production of fertilisers, filtering materials, &c. Oct. 23.

XVII.—BREWING, WINES, SPIRITS, &c.

APPLICATIONS.

23,266. Littleton. Apparatus for filtering yeast. Oct. 22.

23,544. Combe. Utilising electricity in making grain into malt, and in brewing ales, &c., from hops, grain, or sugar. Oct. 25.

COMPLETE SPECIFICATIONS ACCEPTED.

19,140 (1906). Sleeman. Apparatus for malting grain. Oct. 30.

23,055 (1906). Oxford. Drying yeast and products containing yeast. Oct. 23.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A*.)—FOODS.

APPLICATIONS.

22,944. Stevenson. Preserving foodstuffs. Oct. 17.

23,147. Meyer. Manufacture of sulphur-containing roasted grain products. Oct. 19.

23,511. Richardson. Preservation of food. Oct. 24.

(*B*.)—SANITATION; WATER PURIFICATION.

COMPLETE SPECIFICATIONS ACCEPTED.

15,922 (1906). Brightmore. *See under* XV.

17,325 (1907). Lewicki. Treatment of sewage matter and the like. Oct. 23.

19,005 (1907). Reeves and Bramwell. Apparatus for purifying, decanting, and treating liquids. Oct. 30.

XIX.—PAPER, PASTEBOARD, &c.

APPLICATIONS.

22,734. Sommer. Production of lustreless printing paper.* Oct. 15.

22,753. Follet and Ditzler. *See under* V.

22,840. Mitchell. Decorative treatment of paper and other substances. Oct. 16.

23,666. Pochin and Richardson. Manufacture of size for paper-makers' use. Oct. 26.

COMPLETE SPECIFICATIONS ACCEPTED.

27,788 (1906). Bayer, and Passauer Mechan. Papierfabr. *See under* VI.

28,886 (1906). Bacon. Manufacture of rosin size for paper-making. Oct. 23.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATIONS.

22,627. Newton (Bayer und Co.). Manufacture of pharmaceutical compounds. Oct. 14.

22,699. Clark. Manufacture of camphor. Oct. 15.

22,957. Raschig. Manufacture of hydrazine. [Ger. Appl., Nov. 22, 1906.]* Oct. 17.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

23,615. Clifton and Wells. Colour photography.* Oct. 25.

COMPLETE SPECIFICATION ACCEPTED.

8723 (1907). Urban. Colour photography. Oct. 23.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATION.

23,250. Schaefer. Manufacture of matches. [Ger. Appl., Oct. 22, 1906.]* Oct. 21.

COMPLETE SPECIFICATION ACCEPTED.

25,291 (1906). Haffner. Manufacture of matches. Oct. 23.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

APPLICATIONS.

22,896. Thorp. Apparatus for reporting the percentage of carbonic acid and other gases in gas mixtures. Oct. 17.

22,995. Szczepanik. Colorimeters.* Oct. 18.

23,706. Digby and Biggs. Detection and estimation of impurities or dissolved matter in water or other fluids. Oct. 26.

COMPLETE SPECIFICATION ACCEPTED.

19,768 (1907). Evans-Jackson (Brylmi). Photometers. Oct. 30.

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Official Notice.

THE FRANCO-BRITISH EXHIBITION, 1908.

Considerable progress has been made with the Franco-British Exhibition of 1908 which opens in May next. The site upon which it is being constructed at Shepherd's Bush is 140 acres in extent and is easy of access from all parts of London. Already the buildings which are being erected to house the exhibits have made substantial progress towards completion, and the various lakes and canals have been constructed. No timber is being used in the buildings, which will consist almost wholly of steel and concrete. To each building is assigned a special class of exhibits. In most cases the French exhibits will occupy one-half of the building; but in some cases special buildings are being erected. The French Agriculture Committee have alone taken 40,000 square feet.

A special section will be devoted to the Colonies, who will be better represented than at any previous exhibition. Canada alone has secured an area of 120,000 square ft., Australia 60,000 square ft., and New Zealand and the Crown Colonies are equally well represented. The Indian Government has also made a substantial grant towards the expenses of their section. The French Colonies have secured an area of 275,000 square ft., upon which special buildings are being erected.

British Chemical Industries will form a special group, with the following Committee :—

Alfred Mond, M.P. (Chairman), Eugene V. Barrett, Samuel Barrow, junr., John Brock, Edward A. Brotherton, M.P., Arthur H. Crosfield, Sir James Dewar, F.R.S., Joseph Dixon, Lewis Evans, Oscar Guttmann, Fred Goulding, Charles Percy Gosnell, Walter Hill, Stanley G. Lutwyche, Frederic Holl Morris, Sir W. Vaughan Morgan, Bart., G. Croydon Marks, M.P., Oswald Partington, M.P., S. C. Phillips, W. Pearce, M.P., Dr. J. Gordon Parker, Prof. H. R. Procter, John Pullman, Walter F. Reid, Sir Boverton Redwood, Sir William Ramsay, K.C.B., F.R.S., A. Gordon Salamon, A.R.S.M., Sir John Turney, Thomas Tyrer, John C. Umney, Charles R. Ward.

A novel feature will be the establishment of Commercial Bureaux, in which Exhibitors and visitors will be brought together, so that those taking part in the Exhibition may derive the greatest possible advantage, and those visiting the Exhibition for business purposes will be able to obtain all the information they require at a minimum of time and trouble. Local Committees have been organised throughout the United Kingdom to facilitate the collection of suitable exhibits representing local industries.

Each of the groups is being arranged by a Committee of experts, with the following Chairmen: Education, Sir William Mather; Science, Sir Norman Lockyer; Fine Arts, Sir E. J. Poynter; Liberal Arts, Sir H. E. J. Jerningham; Engineering and Shipping, Sir Wm. H. White; Constructional Engineering, Sir Alexander Binnie, Mechanical Engineering, T. Hurry Riches; Gas Engineering, Henry E. Jones; Electrical Engineering, Dr. R. T. Glazebrook; Mining Engineering, Maurice Deacon; Metallurgical Engineering, Sir Charles McLaren, Bart.; Iron and Steel, Sir Hugh Bell, Bart.; Other Metals, Prof. W. Gowland; Shipbuilding and Marine Engineering, Dr. Francis Elgar; Shipping, James Dixon; Transportation, H. Cosmo Bonsor; Surface Transport, Sir Clifton Robinson; Agriculture, Lord Blyth; Viticulture, Robert A. Yerburgh; Horticulture and Arboriculture, Lt.-Col. D. Prain; Alimentation, the Earl of Bessborough; Decoration and Furnishing, Earl of Plymouth; Textiles, Frank Debenham; Chemical Industries, Alfred Mond; Various Industries, Sir Howard Vincent; Social Economy, H. Percy Harris; Colonial, the Hon. Sir John A. Cockburn; Indian, Sir William Lee-Warner: Ceylon, Sir Thomas Lipton; Woman's Work, the Countess of Jersey (President) and the Duchess of Sutherland (Vice-President): Sports and Physical Culture, Lord Desborough; and Congress and Conference, Lord Weardale.

The movement has been taken up strongly on both sides of the Channel, and it has already been found necessary several times to enlarge the original area. Allotments will shortly take place, so that applications for space should be sent as soon as possible to the Secretary, Franco-British Exhibition, 56, Victoria Street, London, S.W.

London Section.

Meeting held at Burlington House on Monday, Nov. 4, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

The Chairman said that the matter dealt with in the two papers was mainly one of analysis and assay, but it had a very far reaching and indeed an imperial application, for it affected the attempts to maintain one of the great manufactures of the Empire. The extent of this was shown by the returns of land under indigo cultivation, prepared by the Indian Government, since it became aware of the very serious inroads made by synthetic indigo on the markets of the natural product. It appeared, then, from Government returns that for the five years ending 1904–5 the total acreage in India devoted to that cultivation was 755,900, or 11,815 square miles, *i.e.*, about 1/11th of the total area under grain crop in the British Islands. In 1905–6 this had fallen to 330,400, or to less than 44 per cent. of its former area. By 1906–7 it had fallen further to 329,800. Although he had no statistics, he did not doubt that similar changes had taken place in the Dutch colonies and in South America. Meanwhile the production of synthetic indigo was advancing by leaps and bounds. No statistics were available as to the actual quantity made by the foreign factories, but the imports into our own islands might be taken as a fair index. In 1905 synthetic indigo amounting to 32,246 cwt. was imported. In 1906 this increased to 39,042 cwt., an increase of 21 per cent. During the same years the imports of natural indigo were 8201 cwt. and 7641 cwt. respectively, a decrease of 6·8 per cent., so that last year the natural indigo sent here was only one-sixth of the total quantity, and if it were taken, as it should, as of an average content of indigotin of about 45 per cent., it represented but little over one-twelfth, so that within the last few years from a monopoly it only held 8 or 9 per cent. of the market. He believed that natural indigo would for at any rate some years to come occupy a place in the world's market. Much went to primitive peoples who could not change traditional processes easily, and in those markets the synthetic indigo had not yet succeeded in gaining a footing. The indigo planters had therefore a breathing time in which to improve their methods both biologically and chemically. Biologically by increasing the indican content of the plant, as the beetroot grower had improved the sugar content of the beet; chemically by improving the methods of winning the indigo and making the quality constant. Meantime the British manufacturers should begin to make the synthetic dye. All the raw materials were to be obtained here as cheaply as in any country in the world. As to the Patents, for various reasons, one of which was the new Act, they would not prove serious obstacles to those who had the courage to attack the problem in a serious spirit.

THE DETERMINATION OF INDIGOTIN IN INDIGO-YIELDING PLANTS.

BY CYRIL BERGTHEIL AND R. V. BRIGGS.

In a previous paper (this Journal, 1906, 729) we described a method for determining indigotin in indigo-yielding plants, which was shown to give correct results by comparison with those obtained by the employment of the indigo enzyme. This method has since been criticised by Orchardson, Wood, and Bloxam (this Journal, 1907, 4), who proposed two alternative methods; the first, depending on the same principle and giving the same results as that described by us, is claimed to be more expeditious, and the second, founded on an entirely different principle, is said to give considerably higher results than are obtained by the employment of either method. The matter is of considerable importance, since a correct estimate of the efficiency of the process of indigo manufacture depends upon the reliability of the method of determining the indigotin obtainable from the plant, and we have therefore submitted the methods proposed to a careful examination.

The necessary preliminary to any such method must be a reliable means of extracting the whole of the indican from the sample of leaf under examination (only the leaves of the plant come into consideration in this connection, since it is well recognised that the stems, etc., contain no appreciable amount of indican). We have failed to obtain complete extraction by the method proposed by Orchardson, Wood, and Bloxam (*loc. cit.*, p. 7) both with fresh and with dried leaf; in every case in which the method was tried a further amount of indican could be extracted from the leaf with boiling water after the treatment described. We have therefore obtained our extracts with boiling water in the manner recommended by Rawson ("Report on the Cultivation and Manufacture of Indigo," 1904) in the experiments to be described.

Persulphate method.—The modifications of this method as described by us (*loc. cit.*) which are suggested by Orchardson, Wood, and Bloxam are (*a*) A fixed quantity (1 grm.) of ammonium persulphate is added to the plant extract in one instalment. (*b*) The reaction is carried out at 60° C. for one hour. (*c*) The precipitated substance is washed with alkali and water, dried, and weighed, and calculation made on the assumption that it is pure indigotin. Preliminary experiments showed that this last assumption (*c*) is not justified, since the substance obtained in the manner described is never pure indigotin, and the indigotin content varies with the concentration (in indican) of the plant extract dealt with. In three cases in which the method was used precipitates showing indigotin contents of 88 per cent., 82·2 per cent., and 81 per cent., respectively, were obtained. It is also extremely difficult to avoid indigotin being carried through the filter when washing the precipitates with alkali, and such loss cannot be observed owing to the deep colour of the washings. We have therefore dispensed with this washing, and in all cases have collected the precipitates on an asbestos filter, washed with boiling water and alcohol, dried, sulphonated, and determined indigotin by titration with permanganate in the manner described in our previous paper (*loc. cit.*). We have used the fresh leaf of *Indigofera Sumatrana* throughout our experiments in order to avoid complications which may arise owing to the presence of kämpheritrin in working with *Indigofera arrecta*. The following results were obtained from two extracts of fresh leaf by precipitating indigotin in the manner proposed by us and by Orchardson, Wood, and Bloxam respectively:—

Weight of leaf extracted per litre of water.	Volume of extract precipitated.	Percentage of indigotin obtained from the leaf.	
		Authors' method.	Method of Orchardson, Wood, and Bloxam.
100 grms. ...	100 c.c.	0·7725	0·6300
60 grms. ...	200 c.c.	0·5625	0·5083

The new method has thus given low figures in each case. This seemed to be the result which was to have been anticipated, since a fixed amount of persulphate is likely to be either too little to precipitate the whole of the indigotin, or too much, in which case there is liability to destruction of indigotin due to superoxidation, as we have pointed out in criticising Rawson's original method (*loc. cit.*). To confirm this view we have carried out the following series of experiments, in which varying quantities of a stock extract of 200 grms. of leaf in 1 litre of water, representing extracts of leaf of varying indican content, were made up to the same volume (300 c.c.) and the indigotin precipitated in each case by the method of Orchardson, Wood, and Bloxam. The experiments were all carried out in duplicate, which agreed within experimental error :

Volume of stock extract taken.	Percentage of indigotin obtained from leaf.
50 c.c.	0·686
100 c.c.	0·764
150 c.c.	0·825
200 c.c.	0·862
250 c.c.	0·877
300 c.c.	0·833

Thus the results rise to a maximum at the stage at which the amount of persulphate added approaches most nearly to that required for complete oxidation of the indoxyl present, and decline after this point. It is clear, therefore, that no method in which a fixed amount of persulphate is used can give reliable results. Indigo plants are found in practice whose leaves are capable of yielding anything from 0·1 to 1·4 per cent. of indigotin, and it is therefore evident that in any method used for their analysis the amount of persulphate added must be adjustable, otherwise variations such as those shown in the above table are bound to occur in the results.

It is advisable to add as nearly the required amount of persulphate as possible at the beginning of the reaction, both for the purpose of rapidity in analysis and because, in the case of an extract rich in indican, prolonged standing in an acid condition with an insufficiency of persulphate seems to lead to somewhat low and irregular results, but the error introduced in this way hardly exceeds experimental limits (see next table). It is, however, only possible to make a large addition of persulphate at the beginning of the reaction when the amount of indigotin obtainable from the leaf is approximately known, and, even in this case, the later additions must be made with caution. In dealing with leaf of unknown indican content, only small additions (2 c.c. of a 5 per cent. solution) at a time can be made with safety.

There remains the question of temperature. We find that the process may safely be conducted between 45° and 50° C. and would recommend the adoption of this temperature as considerably expediting the process. Probably the reaction can be carried out safely at the temperature employed by Orchardson, Wood, and Bloxam (60° C.) if due regard be had to the cautious addition of the persulphate. We have not tested this point, but would deprecate the employment of a higher temperature than is necessary to render the reaction reasonably rapid, since the risk of superoxidation of indigotin by a small excess of persulphate becomes greater the higher the temperature.

The following table illustrates the points dealt with in the last paragraphs. The solutions used were prepared by extracting 200 grms. of leaf per litre of water.

It is clear from the above table that results agreeing within experimental error are obtained by the authors' method at all concentrations of extract, and that similar results are obtained whether the reaction is carried out at the lower or the higher temperature. The figures are, however, uniformly slightly high and most concordant where a large amount of persulphate is added at the beginning of the reaction at the higher temperature, and there can be no doubt that the results obtained under these conditions are most correct. On the other hand, the method of Orchardson, Wood, and Bloxam does not give corresponding results at any concentration. In every case the figure obtained is low. The method was not tried with the lower concentrations of extract because it was already known from previous experiments that the amount of persulphate added would be in large excess of the requirements, and a correspondingly low result would be obtained. This is borne out by the figures in the above table, which rise to a maximum at a concentration of extract corresponding to 300 c.c. of the stock solution taken in the first case, and 350 c.c. in the second case, and fall after these points. The concentration of the extract used by Orchardson, Wood, and Bloxam with which they obtained concordant results by both methods must therefore have been such that the amount of persulphate added corresponded very nearly with that of the indican present.

Isatin method.—The principle on which this method depends is the hydrolysis of the indican contained in the plant extract by a mineral acid and the precipitation of the indoxyl so obtained in the form of indirubin by the addition of isatin. The reaction is a well-known one, and its application to the analysis of indigo plants was first suggested by Beijerinck (Proc. K. Akad. Wetensch., 1899, 120).

The procedure recommended by Orchardson, Wood, and Bloxam is as follows :—The plant extract is boiled with the addition of 0·1 grm. of isatin in a current of carbon dioxide for ten minutes. 20 c.c. of recently boiled sulphuric acid (containing 10 c.c. of 96 per cent. sulphuric acid) is then added and the whole kept just on the boil for one hour, carbon dioxide passing through during the experiment. The precipitate obtained is filtered off on a tared filter-paper, washed with 1 per cent. caustic soda, hot water, and dilute acetic acid, and finally dried and weighed ; calculation is made on the assumption that the substance so obtained contains 95 per cent. of indirubin. This method seemed open to criticism on the same grounds as those which we have shown to apply to its authors' persulphate method, *viz.* :—(*a*). No provision is made for varying indican content in samples of leaf under analysis, so that in some cases an excess of isatin would be employed and in others a deficit. (*b*). There is considerable risk of indirubin being carried through

Percentage of indigotin found in leaf.

Volume of stock extract taken.		Authors' method.				Method of Orchardson, Wood, and Bloxam.
		at 30—35° C.		at 45—50° C.		
		Additions of 2 c.c. of 5 per cent. persulphate sol.	Addition of persulphate at start within 2 c.c. of required amount.	Additions of 2 c.c. of 5 per cent. persulphate sol.	Addition of persulphate at start within 2 c.c. of required amount.	
Extract A	25 c.c.	0·525	0·525	0·525	0·525	
	50 c.c.	0·528	0·525	0·518	0·525	
	100 c.c.	0·518	0·518	0·518	0·525	
	150 c.c.	0·515	0·515	—	0·520	0·475
	200 c.c.					0·491
	250 c.c.					0·516
	300 c.c.					0·518
	350 c.c.					0·503
Extract B	25 c.c.	0·519	0·519	0·518	0·528	
	100 c.c.	0·510	0·510	0·503	0·528	
	200 c.c.	0·510	0·518	0·503	0·528	0·491
	250 c.c.	—	—	—	—	0·498
	300 c.c.	0·515	0·510	0·510	0·528	0·505
	350 c.c.					0·519
	400 c.c.					0·510
	420 c.c.					0·500

the filter-paper when washing with alkali, and this could not be observed owing to the dark colour of the washings. (c). It is extremely improbable that a precipitate containing a constant |percentage of indirubin would be obtained under all conditions of experiment. To test these points the following series of determinations was carried out with varying volumes of a stock extract of indigo-plant representing 200 grms. of leaf per litre. The procedure adopted was precisely as recommended by Orchardson, Wood, and Bloxam, each experiment was carried out in duplicate, and the purity of the precipitate obtained in each case was determined by titration with titanium chloride as described by Knecht (J. Soc. Dyers and Col., 1905, 292).

Volume of extract taken.	Weight of precipitate obtained.	Percentage of indirubin found in precipitate.	Weight of indirubin obtained.	Percentage of indigotin obtainable from the leaf, calculated from weight of indirubin.
	grm.		grm.	
25 c.c.	0·0665	98·7	0·0656	0·656
	0·0642		0·0633	0·633
50 c.c.	0·1357	92·8	0·1259	0·629
	0·1370		0·1271	0·635
100 c.c.	0·2065	89·7	0·1852	0·463
	0·211	89	0·1878	0·469
150 c.c.	0·243	74·6	0·1813	0·302
	0·241	75·4	0·1817	0·303
200 c.c.	0·279	66·1	0·1844	0·230
	0·2725	66·1	0·1801	0·225

The indigotin obtainable from the leaf used in the preparation of the extract employed in these experiments was determined by precipitating from 200 c.c. by the persulphate method previously described. Duplicate experiments indicated 0·66 per cent. as the amount obtainable. Thus in no case has the isatin method given as high a result. The indirubin content of the precipitates is by no means constant, and the figures obtained do not agree amongst themselves. In the cases in which 25 c.c. and 50 c.c. of extract were taken the amount of isatin used (0·1 grm.) was evidently in excess of the requirements, since this amount is, in accordance with the equation representing the reaction, capable of yielding 0·178 grm. of indirubin, and in each case less than this amount was obtained. In these cases the precipitates obtained were of a comparatively high degree of purity in indirubin, and moderately good end points were obtained in titrating their sulphonic acids with titanium chloride. In the other cases there was evidently a deficit of isatin, with the result that the precipitates were rendered very impure, and the end points in titration were very poor. The impurities could not be removed by Grossmann's method (this J., 1905, 308) which has been recommended by Knecht in the application of his titanium chloride method to commercial indigos. For this reason the results obtained in determining the purity of the precipitates in indirubin in these cases are too high.

The amount of indican present in the case of the largest volume of extract used (200 c.c.) corresponds, according to the analysis of the leaf by the persulphate method, to 0·24 grm. of indigotin, which is less than would be obtained from a 20 grm. sample of leaf capable of yielding 1·3 per cent. of indigotin. Since a smaller sample than 20 grms. of leaf cannot safely be taken in practice, this experiment thus represents a situation which might easily arise in practice.

It is clear, therefore, that this method cannot be applied to the determination of the indigotin obtainable from plant extracts without adaptation to the indican content of the leaf dealt with. The close approach of the results obtained in the above cases where an excess of isatin was present to those obtained by persulphate suggested that the results might be brought into line by working the isatin method with a sufficiently large amount of isatin to provide an excess in each case. The following experiments, in which indirubin was precipitated from a fixed quantity (100 c.c.) of the extract used in the previous set of experiments with gradually increasing quantities of isatin, were carried out on this point.

Weight of isatin used.	Weight of precipitate obtained.	Percentage of indirubin found in precipitate.	Weight of indirubin obtained.	Percentage of indigotin obtainable from the leaf, calculated from weight of indirubin.
grm.	grm.		grm.	
0·15	0·2605	88·3	0·2300	0·575
	0·259	88·7	0·2297	0·574
0·2	0·2745	91·0	0·2498	0·624
	0·275	89·4	0·2458	0·614
0·25	0·2745	90·3	0·2478	0·619
0·3	0·2785	90·0	0·2506	0·626

The indirubin content of the precipitates obtained in these experiments is fairly high in each case, but the results obtained tend to rise with the amount of isatin added, and do not agree sufficiently closely amongst themselves. In no case is so high a result obtained as by the persulphate method.

Conclusion.—Neither of the methods suggested by Orchardson, Wood, and Bloxam for determining the indigotin obtainable from the leaf can therefore be used in practice, both leading to entirely erroneous results unless the exact indican-content of the samples dealt with is previously known and the methods adjusted accordingly. Their conclusion with regard to the isatin method, that it may under certain circumstances indicate a higher indican-content in a given extract than the persulphate method, is not borne out by our experiments; in no instance when due regard has been given to the purity in indirubin of the precipitate obtained, have we found this to be the case. The method of leaf extraction employed by Orchardson, Wood, and Bloxam would, however, be sufficient to account for their conclusion.

ANALYSIS OF INDIGO (PART III.) AND OF THE DRIED LEAVES OF INDIGOFERA ARRECTA AND INDIGOFERA SUMATRANA.

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This is a continuation of previous work, "The Analysis of Indigo," by W. P. Bloxam (this J., 1906, 735), and "Analysis of Indigo," Part II., by Orchardson, Wood, and Bloxam (this J., 1907, 4), on the analysis of indigotin and of commercial indigo, and of the colour-yielding value of the leaves of indigofera. More especially it deals with the tetrasulphonate method and the isatin process which was outlined in the second paper.

Section I.—Tetrasulphonate Process.

Under this heading we shall now deal with:—

(*a*) The preparation of pure indigotin.

(*b*) The actual method of analysis.

Pure Indigotin.—With reference to this point, we feel it necessary, as the result of friendly criticism we have received, to add further details of the process previously described (this J., 1906, 736), and to discuss certain difficulties which occasionally arise in the working of the process. These points, which did not appear important at the time, are now considered to be so, and details are now given to guard against all misapprehension as to the details.

As previously stated, the process is essentially one depending upon sublimation and in which synthetical indigo is employed as the crude material. The operation is conducted in a Jena flask which is carefully evacuated.

The original operations (Bloxam, Chem. Soc. J., Trans., 1905, 982, and this J., 1906, 736), were carried out with a sample of indigo, of date about 1902, of which a large quantity was available, indeed sufficient to meet our requirements until the summer of 1906. A new supply was found to be of a more bulky nature—which we have ascertained is now almost always the case, and is, no doubt, more suitable for dyeing purposes. Such a material, however, is not so suitable for sublimation under the conditions previously described. But this drawback we have readily overcome by wetting the bulky powder with acetic acid and water, evaporating to dryness, drying finally at 150° C., and then grinding. By this means the product is rendered practically identical with the old form, and occupies almost exactly the same space in the sublimation flask, which is an important feature in the process. It is necessary to employ the highest vacuum which the water pump can develop, since it has been shown by A. G. Perkin ("An oxidation product of indigotin," Chem. Soc. Proc., 1906, 138) that limited access of air at the temperature of sublimation converts indigotin into a yellow oxidation product. The presence of this substance accounts, in part, for the green filtrate obtained in the tetrasulphonate process carried out on indigotin produced during conditions of faulty sublimation. The temperature we now employ is 420° C., being higher than that previously recommended; the operation is quicker and the yield slightly better as a result of this modification. In the actual working we prefer to first heat the bath of fusible metal to this temperature and to then lower into it the previously evacuated flask. The flask is adjusted in the bath and covered with a sheet of asbestos cardboard in the fashion previously stated (this J., 1906. 736). We find as a rule that as a result of a satisfactory sublimation a yield of 60 per cent. of crystals is obtained.

It has been suggested that in the earlier paper (*loc. cit.*, 736) no definite mention is made of the exact nature of the solvents employed by us for the final purification of the crystals. We find the best solvent to be boiling glacial acetic acid used so long as a red filtrate is obtained, followed by boiling alcohol. Though we did not feel it necessary in the earlier communication (*loc. cit.*, 736) to give any ultimate analysis of our standard indigotin, this fact has aroused hostile criticism, and we therefore append the following nitrogen estimations of the product, prepared in this manner. Determinations of the nitrogen in pure sublimed indigotin by the combustion process, gave the following figures:—Nitrogen, 10·685, 10·74, and 10·77 per cent. (corresponding to indigotin, 99·98, 100·49, and 100·8 per cent.). Determinations by the Kjeldahl method* gave:—Nitrogen, 10·66, 10·68, 10·72, and 10·67 per cent., corresponding to indigotin contents of 99·74, 99·93, 100·30, and 99·83 per cent. respectively.

To make the matter more complete we also give the values for carbon and hydrogen obtained by combustion:—0·1086 grm. indigotin† (100 per cent.) gave 0·2922 grms. CO_2 and 0·0371 grms. H_2O. $C=73{\cdot}36$; $H=3{\cdot}80$ ($C_{16}H_{10}N_2O_2$ requires $C=73{\cdot}28$; $H=3{\cdot}82$).

Although in the original paper (Bloxam, Chem. Soc. Trans., 1905, 974) stress was laid upon the necessity for a determination of the percentage of nitrogen, more recent work has led to a modification of this opinion. For in work recently published upon the nature of the impurities associated with indigo, especially indigo-brown ("Some constituents of natural indigo," Perkin and Bloxam; Chem. Soc. Trans., 1907, 279), it has been shown that these possess a nitrogen value only slightly inferior to that of indigotin itself. Again the impurities associated with synthetical indigos are also mainly nitrogenous, for we have known cases where an unpurified preparation of this character has given a percentage of nitrogen identical with that of the chemically pure product (10·68 per cent., equivalent to indigotin, 99·93 per cent.; and 10·74 per cent., equivalent to indigotin, 100·49 per cent.). Under these circumstances, it is evident that the mere standardisation of an indigotin by its percentage of nitrogen is not only valueless but misleading.

As the result of very numerous experiments with preparations of synthetical indigo we have found that, in rare cases, certain of these proved unsuitable as sources for the preparation of pure indigotin by sublimation. Taking the precautions previously insisted on (col. 1), an indigotin was obtained of 98·5 per cent. purity, by both the titanium and permanganate methods, and an especial feature was the production on analysis of a green filtrate of the character previously described (*loc. cit.*). The explanation of this difficulty was solved in part by the detection by Mr. A. G. Perkin of a yellow substance present in the original sample of the synthetical indigo employed. This compound, not fully investigated, crystallises in yellow plates, melts at about 200° C., partly sublimes at higher temperatures, and is specially characterised by yielding a beautiful magenta coloration when dissolved in cold concentrated sulphuric acid. Investigation of this substance is proceeding.

Analytical process.—The experience gained by the continued use of the tetrasulphonate method has shown that the sulphonation of indigotin itself and of indigos of a high degree of purity by heating with 20 per cent. fuming acid for 30 minutes is unnecessary—for after 20 minutes' heating with 20 per cent. fuming acid in the water oven (96°—98° C.), we find that tetrasulphonation is complete. On the other hand, with crude indigos, where for sulphonation a 25 per cent. fuming acid is employed, we sulphonate for 35 minutes in the water oven at 96°—98° C. A word of caution is necessary here as to the strength of acid to be employed, for it is essential that the strength should be determined in each case by analysis.

Criticisms advanced as to the losses experienced on salting out with potassium acetate, based on the blue colour of the filtrate obtained, are in reality evidence of the need for this precaution. For it has been clearly pointed out (this J., 1906, 741) that the potassium salt of the disulphonic acid is responsible for this defective working. On the other hand, it is obvious that the same result will be obtained if moisture is introduced, either in the materials or the apparatus employed.

Method of analysis of the fuming sulphuric acid.—The best method for the analysis of the fuming acids required is that devised by Dr. Rudolph Messel and he kindly allows us to give the necessary details. The acid is weighed in a thin glass bulb, of about 3 c.c. capacity, drawn out at each end. The empty bulb is weighed and is then filled with the fuming acid by immersing it in the latter. When sufficient acid has run in the upper end is sealed, the bulb is taken out of the bottle, and carefully washed with a jet of water. It is advisable to let a jet of cold water play on the bulb before and during the sealing of the lower end. This prevents the anhydride from coming too close to the end, and prevents loss. The bulb with its contents is now weighed. The bulb is then placed in a stout stoppered bottle, of say 300 c.c. capacity, or more, which contains already some 100 c.c. of water. The hand of the operator should be placed over the stopper to prevent it being forced out; shaking once strongly should suffice to break the bulb, and the shaking is continued until every trace of sulphuric anhydride fume is absorbed. The liquid is now transferred to a 250 c.c. flask, and the bottle and bulb thoroughly washed with water, care being taken to break with a stout glass rod any pieces of capillary tube which might contain some of the acid. The flask is filled up to the mark and 50 c.c. are withdrawn for titration with $N/2$ sodium hydroxide solution, using litmus as indicator. The liquid is boiled, preferably in a porcelain basin, for five minutes to expel any traces of carbon dioxide, before finishing the titration. The value of the acid is then calculated in the following fashion:—Acid taken = 5·5502 grms.: the 50 c.c. of the diluted acid required on titration 52·05 c.c. $N/2$ alkali solution, hence 250 c.c. of diluted acid = 5·205 grms. of

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[*] Some attention has been given by one of us (Bloxam) to the exact conditions to be observed in applying Kjeldahl's process to the analysis of indigotin, and it is hoped some account of this may be given in a later communication.

[†] The indigotin used in the above-quoted analysis was that of which the purity was shown by the tetrasulphonate process in London and Manchester by Messrs. Wood and Orchardson (*v.* p. 1178).

sulphuric anhydride (total SO_3). Subtracting this value from the total weight of acid taken (5·5502 – 5·205), we obtain 0·3452 grm. as the weight of water present. The weight of sulphuric anhydride to which this weight of water is equivalent is 1·53422 grms. Now the total anhydride value of the acid was shown above to be 5·205 grms., of which 1·53422 grms. is held in combination with water. Therefore the free sulphuric anhydride $= (5{\cdot}205 - 1{\cdot}53422) = 3{\cdot}67078$ grms., and its percentage value $= \frac{3{\cdot}67078 \times 100}{5{\cdot}5502} = 66{\cdot}2$ per cent. It is stated that the fuming acid of about 20 per cent. anhydride of Messrs. Chapman and Messel contains approximately 0·0021 per cent. of iron and 0·001 per cent. of sulphur dioxide, and these impurities may therefore be disregarded.

Preparation of fuming sulphuric acids of values 25 *per cent. and* 20 *per cent. free SO_3 respectively.*—The exact values of the available fuming acids having been determined as previously indicated, it now remains to provide for the preparation of two acids of the definite concentrations above stated. To arrive at this result is a matter of prime importance in the case of the tetrasulphonate process, and possibly to other persons requiring fuming acids of definite strengths. So as only scanty details are to be found in the various books on analytical chemistry, the matter has here been followed out with considerable care by one of us. We hope that by the methods now given the needs in general of operators requiring fuming sulphuric acids of definite strengths may be met.

Case I. General case. To make a fuming sulphuric acid of any strength.—Given two fuming acids, A, containing x per cent. of free SO_3 and B, containing y per cent. of free SO_3. Required C, containing z per cent. of free SO_3. (N.B.—z must lie between x and y.) Then the proportion is

$$\frac{z-y}{x-y} \text{ of A} + \frac{x-z}{x-y} \text{ of B} = 1 \text{ of C.} \quad . \quad . \quad . \quad . \quad (1.)$$

Example (1). Given an acid, A, of 70 per cent. free SO_3 and B, of 18 per cent. free SO_3, it is required to make an acid, C, of strength 20 per cent. free SO_3. Then,

$$\frac{20-18}{70-18} \text{ of A} + \frac{70-20}{70-18} \text{ of B} = 1 \text{ of C},$$

$$\text{i.e., } \frac{2}{52} \text{ of A} + \frac{50}{52} \text{ of B} = 1 \text{ of C.}$$

Hence to make 100 grms. of acid C containing 20 per cent. free SO_3 we require 3·85 grms. of 70 per cent. acid (A) and 96·15 grms. of 18 per cent. acid (B).

Case II. Particular case. To make a fuming sulphuric acid by mixing a fuming acid (of known SO_3 strength) with true sulphuric acid (100 *per cent. H_2SO_4*).* In the above equation (1) the value of $y = o$, and the equation thus becomes :—

$$\frac{z}{x} \text{ of A} + \frac{x-z}{x} \text{ of B} = 1 \text{ of C.}$$

Example (2). Given an acid, A, of 70 per cent. free SO_3, and B, of 100 per cent. H_2SO_4, to make an acid, C, of 25 per cent. free SO_3. Then in order to obtain the required acid we substitute these values $x = 70$, $z = 25$; then $\frac{25}{70}$ of A $+ \frac{45}{70}$ of B $= 1$ of C. To make 100 grms. of 25 per cent. SO_3 acid (C) we shall require $35\frac{5}{7}$ grms. of 70 per cent. SO_3 acid (A) and $64\frac{2}{7}$ grms. of 100 per cent. H_2SO_4 acid (B).

Case III. Particular case. To make a fuming sulphuric acid by mixing a fuming acid (of known SO_3 strength) with ordinary concentrated sulphuric acid (containing 96 *per cent. H_2SO_4).*† An example will show how the quantities are calculated :—

Required 360 grms. of acid containing 25 per cent. SO_3; to be made from an acid containing 40 per cent. SO_3 and concentrated acid (96 per cent. H_2SO_4). Let x = the weight of fuming acid to be taken and y = the weight of conc. sulphuric acid, then $\frac{4y \times 80}{100 \times 18}$ is the weight of sulphuric anhydride necessary to combine with the 4 per cent. of water in the concentrated acid, and we have $\frac{40x}{100} - \frac{8y}{45} = 90$, and $x + y = 360$; whence $x = 266{\cdot}5$, and $y = 93{\cdot}5$. Therefore 266·5 grms. of the 40 per cent. SO_3 acid must be mixed with 93·5 grms. of concentrated sulphuric acid, in order to give 360 grms. of an acid containing 25 per cent. of SO_3.

It is perhaps hardly recognised by chemists in general how slight a trace of moisture will lower considerably the strength of the fuming acid; and, on this account, the precautions to be adopted to prevent access of water during storage or use cannot be too strongly insisted on. It is preferable to purchase the required acid in sealed flasks so that there is no risk of deterioration on keeping. Owing to the kindness of Dr. R. Messel, such acid, in sealed flasks, can now be purchased in London and in Leeds.*

Salting out with potassium acetate.—We have found by further experience of the process that the employment in the analysis of 80 c.c. of the precipitant solution, is preferable, and just as effective as the 100 c.c. previously recommended (this J., 1906, 741), as there is, in this way little risk of the deposition of potassium sulphate, which has the effect of retarding filtration.

Sulphur dioxide in fuming sulphuric acid.—It has been urged, as a defect of the tetrasulphonate process (this J., 1907, 183), that fuming acid contains free sulphur dioxide, and in sufficient quantity to seriously affect the results given by this method when permanganate is used. Though it appeared to us as well known that both ordinary and fuming sulphuric acid though capable of retaining considerable quantities of this gas at the ordinary air temperature (concentrated sulphuric acid absorbs 0·009 part by weight (58 vols.) of sulphur dioxide (Kolb, Dingl. 209, 270). The coefficient of absorption of sulphur dioxide for sulphuric acid (1·841 sp. gr. at 15° C. and 760 mm.) is 28·14 at 17° C., and 28·86 at 16° C., Dunn (Chem. News, 43, 121) has shewn that this was entirely removed from the acid on raising the temperature of the latter to about 100° C. To make certain, however, on this point, ordinary concentrated sulphuric acid, which, as stated above absorbs 28·86 vols. of sulphur dioxide at 16° C., was saturated with the dried gas at the ordinary laboratory temperature. It was then heated for 20 minutes in the water oven under the conditions of sulphonation. After cooling and dilution with water, titration with permanganate proved the absence of dissolved sulphur dioxide. It does not appear to have been evident to our critics that, did the contrary occur, the fact would have proved more fatal to processes where salting out is not adopted.

As previously shown (this J., 1907, 5), indigo-brown with sulphuric acid, at the temperature of the water oven, is oxidised with evolution of sulphur dioxide; and, if this were retained by the acid, it is evident that the subsequent consumption of permanganate would be greatly increased. Experiments made with fuming acid (20 per cent. free SO_3) showed the behaviour with regard to sulphur dioxide to be similar. So this criticism has evidently been advanced without experimental basis. The statement (this J., 1907, 183) as to the loss involved in salting out with potassium acetate, has already been dealt with (p. 1175), and shown to be due to faulty conduct of our process; for, it may be observed that the opinion of others, beside ourselves, who have seen or carried out this operation, is that the separation of the tetrasulphonate is complete (*v.* p. 1178).

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* It seems to be generally accepted that "absolute" sulphuric acid (containing 100 per cent. H_2SO_4) can be made by taking ordinary pure concentrated sulphuric acid (containing 96—98 per cent. H_2SO_4) in a porcelain dish and stirring fuming acid into it until the mixture just begins to fume when one blows upon the surface of the liquid.

† Here the details given are taken, with due acknowledgment, from "The Synthetic Dyestuffs and Intermediate Products," Cain and Thorpe (London: Griffin and Co., 1905) pp., 183, 184.

* London: Baird and Tatlock, 14, Cross Street, Hatton Garden, E.C. Leeds: Reynolds and Branson, 14, Commercial Street.

The factor employed in our calculations for permanganate was adopted only after numerous experiments, both with the di- and tetra-sulphonic acids (this J., 1907, 6), and resulted in our adoption of a figure (1 c.c. of permanganate solution 1/1000 = 0·0022 grm. of indigotin solution, 1/5000) which is in agreement with that adopted by the Badische Anilin und Soda Fabrik, and stated in their *Brochure*, 1900, "Chemistry of pure indigo." That this is correct admits of no doubt, but a contrary statement has appeared (this J., 1907, 183), and we have merely to reiterate our former statements (this J., 1906, 741; and 1907, 6), which were made as the result of carefully conducted experiments.

We have again tested the effect of dilution, employing our pure indgotin converted into the tetrasulphonic acid. The differences in consumption of permanganate observed at the concentrations were as follows:—

Concentration of indigotin soln.	Consumption of permanganate soln. (1/1000).	Indicated per cent. indigotin.
1/5000	9·01 c.c.	100·1
1/10,000	8·97 c.c.	99·6

So it is clear that, although the consumption of permanganate is very slightly decreased, on dilution from 1/5000 concentration to 1/10,000, to dilution cannot be attributed the great diminution of consumption claimed for it.

Purification of indigo by the Badische process.—This process as set forth in the *Brochure* of the B.A.S.F. Co., 1900, was undertaken in order that another source of pure indigotin should be available other than that obtained by the sublimation process. The directions given were carefully followed throughout, though the operations proved to be somewhat tedious. The procedure was as follows:—200 grms. of Indigo B.A.S.F. *rein* (91—92 per cent. indigotin) is worked into a paste in a large mortar with a little 10 per cent. sulphuric acid (chem. pure), transferred to a capacious enamelled iron pan and gently boiled all day with 4—5 litres of the 10 per cent. acid. The mixture is frequently stirred, and the loss of liquid due to evaporation is made good by addition of distilled water. It is allowed to stand overnight, the supernatant liquor (which has a golden yellow colour) siphoned off, and this process was repeated until a colourless filtrate was obtained. This golden yellow filtrate, it was noted, exhibits a large consumption of permanganate solution. Finally the whole is transferred to a large glass funnel fitted with two hardened filter papers.* The pasty mass is carefully removed from the papers and is reduced with alkaline hydrosulphite. For this one part of indigo requires 8 parts of caustic soda solution (25° B.), 20 parts of strong hydrosulphite solution, and 10 parts of water, the whole being kept at 45—50° C. The solution of indigo-white is filtered from insoluble matter, with the aid of the water pump, as rapidly as possible, diluted to twice its volume with water, and air blown through the liquid until oxidation is complete. The "blown out" product is collected and thoroughly washed with hot water till the filtrate is neutral and free from hydrogen sulphide or oxidised sulphur compounds. The indigo is now boiled up with dilute chemically pure hydrochloric acid, as in the first operation, filtered, washed free from acid with boiling water, dried roughly on the water bath, powdered finely, and completely dried in the water oven. The weight of indigo obtained at this stage was 151 grms., a considerable loss of necessity taking place during the reduction process and subsequent filtration. The dry indigo is next boiled out several times with absolute alcohol, employing a reflux condenser, when a red impurity is removed. After drying, the purity of the product was ascertained by the tetrasulphonate method to be 96·5 per cent. indigotin. Two processes are now given in the Brochure for final purification:—(*a*) Crystallisation from phthalic anhydride, and (*b*) crystallisation from glacial acetic acid; the latter was finally adopted.

Crystallisation from boiling glacial acetic acid.—The directions given in the *Brochure* are as follows:—"The product (of 96·5 per cent. indigotin content) is dried at 100° C., and then boiled for 10 minutes with acetic acid and filtered as hot as possible, the crystals which separate from the filtrate are collected, washed with hot absolute alcohol, with ether, and then with diluted chemically pure hydrochloric acid, and, finally, with water. The crystals are dried at 100°—105° C., and are preserved in well stoppered bottles. For filtration use S. and S. hard papers." Following these directions, we were unable to obtain a successful result, as the glacial acetic acid extract after filtration contained but a trace of dissolved indigotin. Finally, by employing a Soxhlet extraction apparatus, in the ordinary manner, and intimately mixing the finely divided indigotin with sand, the colouring matter was slowly dissolved and crystals were deposited from the acetic acid solution. These crystals were collected on hardened filter paper, washed with acetic acid and then with ether, and dried, first at 100° C., and finally at 160° C. Analysis was made by the tetrasulphonate process of the crystals so obtained.

To our gratification the analytical results obtained showed the crystals to be 100 per cent. indigotin value before and after salting out with potassium acetate, the consumption of permanganate being identical before and after this process. We are therefore able to record the successful result attained using the B.A.S.F. procedure, in the case of acetic acid, and under the modifications stated. With the exception of the process of one of us (Bloxam), *i.e.*, that for producing pure indigotin by sublimation, we know of no other method which will yield pure indigotin. It is now interesting to inquire why this firm should advocate so tedious and lengthy a process for the preparation of pure indigotin for use as a standard—if a mere crystallisation from nitrobenzene,* or a treatment with acetic-sulphuric acid (Binz and Kufferath, Annalen, 1902, 196, and later Möhlau and Zimmermann, Zeits., Farben und Textil Chem., 1903, 189) is all that is necessary. It can only be presumed that the chemists of the company were aware, long before even our own experiments were made (Chem. Soc. Trans., 1905, 980) that these last mentioned methods cannot be relied upon to yield a satisfactory product, on which to standardise methods of analysis.

Losses experienced on submitting "Indigo B.A.S.F. rein" to the action of solvents.—In the B.A.S.F. *Brochure* this material is stated to contain exactly 98 per cent. of indigotin. As a result, however, of experiments made by one of us with a sample purchased in India in 1903 (Chem. Soc. Trans., 1905, 977) it was determined that the true percentage of indigotin it contained was only 91·88. The accuracy of this statement was sustained by Möhlau and Zimmermann (Zeits. Farben und Textil Chem., 1903, 189) who found that synthetical indigo contains 3—10 per cent. of a red dyestuff. On the establishment of the tetrasulphonate process (this J., 1906, 735), we were able to separate the indigotin of synthetical indigos from the impurities when filtrates of characteristic colours were obtained—green in the case of the Meister, Lucius, and Brüning, and deep red in the case of the B.A.S.F. products (*loc. cit.*, 741). After removal of the impurities the indigotin value fell to 91—92 per cent. These results are put forward for the reason that, although the makers of synthetical indigo have not denied the truth of the results above given, the statement occurs, as a result of analysis (this J., 1907, 184) that the B.A.S.F. "indigo pure" of 1898 contains 98 per cent. of indigotin. We have, therefore, recently subjected a specimen of "B.A.S.F. rein" (which gave with the tetrasulphonate process 91·5 per cent. of indigotin) to the action of solvents in the following order, the losses in weight being stated:—

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* Hardened filter papers (C. S. and S.) were used exclusively throughout the whole process.

* In a paper by Bloxam (this J., 1906, 25, 736) some doubt was expressed as to the purity of the indigotin obtained by recrystallisation from nitrobenzene. A series of experiments recently concluded showed that the product obtained contained never more than 97—97·5 per cent. indigotin.

	Loss in weight.		Mean loss in weight.
	I.	II.	
	grm.	grm.	per cent.
(I.) 5 grms. on heating 1 hour at 110° C.	0·032	0·034	0·66
(II.) 5 grms. dried as in (I.) treated with boiling glacial acetic acid	0·160	0·167	3·28
(III.) 4 grms. of the indigo, after treatment as in (II.), treated with boiling absolute alcohol	0·020	0·022	0·53
(IV.) 3·5 grms. of the indigo, after treatment as in (III.), extracted with ether ...			
(V.) 3·0 grms. of the indigo, after treatment as in (IV.), treated with boiling toluene	0·024	0·028	0·86
(VI.) 2·5 grms. of the indigo, after treatment as in (V.), treated with boiling dilute hydrochloric acid	0·012	0·015	0·54
Total loss per cent. =			5·87

So B.A.S.F. indigo contains evidently less than 94·2 per cent. of indigotin. Though it was not thus found possible to completely purify the sample, the results are interesting, as they indicate without doubt that it could not contain 98 per cent. of the pure colouring matter. As a result of the continued use of the tetrasulphonate process, we consider that the claims to accuracy previously made (this J., 1906, 735, and 1907, 4) are fully substantiated, and we shall be only too glad to demonstrate the efficiency of our process to chemists interested in the matter. We are pleased to be able to state that as a result of demonstrations made before Profs. A. G. Green, R. Meldola, F.R.S., Sir William Ramsay, F.R.S., Prof. W. H. Perkin, F.R.S., Mr. A. C. Chapman, and Mr. A. G. Perkin, F.R.S., a general approval of the method was manifested.*

Prof. A. G. Green has introduced it as a standard method in the general analytical curriculum of the Dyeing Department of this University, and it may be mentioned, as an instance of its facility of performance, that all the students of the past two sessions have without difficulty been able to obtain results concordant to within one per cent.

Methods used for the analysis of commercial indigo.—That the necessity exists for establishing, on pre-eminent authority, and once and for all, the accuracy of this tetrasulphonate method is shown by the state of chaos existing in the present commercial methods used for the analysis of indigo. Indigo dyers of large experience state their unwillingness to depend in buying indigo upon statements based on the results of analysis; for as stated by one of them, "he was anxious to buy colour and not figures."

Bergtheil and Briggs (this J., 1906, 729) advocated the use of a process of analysis which we have severely criticised on the ground of its giving too high results, owing to interference of impurities, and its being based on indigotin which was not pure (this J., 1907, 4). Nevertheless, Bergtheil and Briggs (*loc. cit.*, page 734) claim that their method is in fair accord with other methods investigated by them (permanganate method, Rawson and Grossmann; reduction methods, using Grossmann's purification, and subsequent analysis by hydrosulphite, and titanium trichloride; the acetic-sulphuric method of Möhlau and Zimmermann). Having established this agreement of results, Bergtheil ascertained the value of seven samples of commercial indigo which were carefully sealed up in bottles and sent to each of four analysts in Calcutta, Bradford, Manchester, and Berlin, respectively.* It will be necessary here to give the results obtained in the case of one sample only, *viz.*, that marked I. (B.A.S.F., 1898) of this the "correct analysis" made by the method of Bergtheil and Briggs (*loc. cit.*, p. 731) established the value as 98·1 per cent. indigotin. The other values returned were Calcutta, 90·6 per cent.; Bradford, 96·0 per cent.; Manchester, 70·7 per cent.; Berlin, 91·59 per cent. The matters of supreme interest are not stated; the analysts must have been persons of considerable experience, or their opinion would not have been worth taking; and, granting this, what processes did they employ? The results of Bergtheil and Briggs "correct analysis" is higher than all the others—nearly 28 per cent. higher than the values returned from Manchester. This great divergence of opinion as to the indigotin content of one sample of indigo is not in harmony with the contention of Bergtheil and Briggs (*loc. cit.*), above stated, and fully substantiates the criticism we have advanced in earlier papers as to the unreliability of the methods of analysis, previously proposed for indigo, and studied by us. We know, from our experience, that the true value of the B.A.S.F. synthetical indigo lies between 91—92 per cent. indigotin (this J., 1906, 741); and it is interesting to note that the results obtained in Calcutta and Berlin, respectively, suggest that in these cases the tetrasulphonate method was employed.

Section II.—The analysis of the leaf.

Though the accurate analysis of indigo itself is important, the determination of the quantity of indigotin (or of indican) which the leaf contains, is a question of far greater importance in studying the efficiency of the present methods of indigo manufacture. Now, although there can be little doubt that indican on hydrolysis by acids or enzymes will give a quantitative yield of indoxyl, the conversion of the latter into the theoretical amount of indigotin appears to be more difficult than is usually supposed. In reference to this point, Hazewinkel (Proc. Akad. Wetensch., Amsterdam, 1900, 512) states that acid oxidising agents convert indican into indigotin, but this latter in turn is oxidised by an excess of the reagent. Again, Hoogewerff and ter Meulen, in their important paper on crystallised indican, failed in this manner to obtain more than 91 per cent. of the theoretical yield of colouring matter from their substance. In a former communication (this J., 1907, 9) it was shown that the results of analyses made on aqueous extracts of indigo leaf were considerably lower in the cases where the persulphate method was employed than when the isatin process was used. This latter process, as previously stated, is based upon the well-known discovery of Baeyer (Ber., **14**, 1745) that indoxyl and isatin readily condense to form indirubin, and naturally the indirubin obtained in this manner from the leaf extract gives at once the indoxyl (or half the indigotin) value of the material. The method we have adopted in working the isatin process is practically that given in the earlier paper (this J., 1907, 9) but some slight modifications have since been introduced, and the process as it now stands is as follows:—

Isatin method of analysis.—5 grms. of leaf are extracted as described in the previous paper. To test whether extraction is complete, the last washings are collected separately and treated with a little 4 per cent. sulphuric acid and 2 per cent. ammonium persulphate, and warmed to 60° C., when there should be no production of blue if the extraction has been rightly carried out. As some specimens of leaf we have examined show a considerably higher content than 0·94 per cent. indigotin (on which proportion the process was established) a correspondingly larger volume of water is required for complete extraction. It is advisable in such cases to make the extract up to one litre, and to withdraw portions for each estimation.

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* A report made at the request of the India Office on this process by Dr. J. N. Collie will be found in the Report to the Government of India on the work done at Leeds.

* The full table of results will be found in the "Report of the Indigo Research Station, Sirsiah, 1906—1907. (Calcutta, Baptist Mission Press.)

The most suitable volume for estimation is 250 c.c., and the solution is best of such a strength that this volume yields approximately 0·1 grm. of indirubin; for this purpose 0·1 grm. of isatin and 15—20 c.c. of pure hydrochloric acid are required. Air is expelled from the flask by means of a current of carbon dioxide, which is maintained during the whole time of the experiment. The mixture of isatin and plant extract is boiled for 5—10 minutes, and the acid is then run in slowly by means of a stoppered funnel (time of flow, 5 to 7 minutes); the liquid meanwhile is boiled very gently, whilst the gas current is increased to guard against entrance of air to the flask. The mixture is boiled for 20—30 minutes, cooled in a current of cold water, and the precipitate collected on a tared paper, washed very thoroughly with 1 per cent. caustic soda solution at 70° C., and then with 4 per cent. acetic acid, and dried in the water oven till of constant weight.

With solutions of pure indican, the precipitate of indirubin appears almost immediately on the addition of acid, and covers the surface of the liquid with a layer possessing a beautiful lustre. The washings are, in the case of pure indican, perfectly colourless after the small quantity of isatin solution has been removed; whereas the washings from precipitates obtained from plant extracts are always slightly red. Experiments were now carried out to determine if the product thus obtained from leaf extract was, as it appeared to be, almost pure indirubin. Examined by the titanium trichloride process (this J., 1906, 738), figures were obtained indicating its content to be 98·5 per cent. of indirubin. But more important, perhaps, were the results of ultimate analysis, *viz.*, N = 10·58 and 10·56 per cent. (Theory = 10·69). These latter results are in agreement with those obtained by the titanium method. and, on consideration, give ample proof that the substance was nearly pure indirubin. Crystallisation experiments made on this material (notably solution in boiling glacial acetic acid, and careful treatment of the hot liquid with boiling water) gave a homogeneous precipitate, which, under the microscope, seemed to consist entirely of fine red needles. It seemed possible that a trace of furfurol might be formed during the action of acid on the leaf extract during the progress of the isatin reaction; and furfurol, being an aldehyde, would tend to condense with the liberated indoxyl more readily than with isatin itself. Experiments in this direction were now carried out as follows:—(*a*) A solution of pure indican was taken of such a strength that 300 c.c. gave, with 0·1 grm. of isatin, under the usual conditions of performance of the isatin process, as result 0·0860 grm. of indirubin. (*b*) To 300 c.c. of the same solution of indican was now added 3 drops of furfurol, and the isatin process carried out as usual. Duplicate experiments gave 0·075 and 0·075 grm. of indirubin, instead of 0·0860 grm. obtained in (*a*), in the absence of furfurol. So it is evident as a result of these experiments that furfurol, if formed previously to the condensation of indoxyl with isatin, would tend to diminish the weight of the indirubin product obtained. On the other hand, experiments were made with a solution of leaf extract, to which acid was added under the conditions of concentration existing in the isatin process (*v.* p. 1178), and the mixture was slowly distilled for a period of 4 hours to one-fifth of its original volume. The distillates were examined in the usual fashion with aniline acetate and phenyl hydrazine, respectively, but both these reagents failed to indicate even a trace of furfurol or other aldehydic products. This experiment is not, however, regarded as complete proof that furfurol is not formed during the conditions of the isatin process, for, with such an active reagent as indoxyl in the liquid which would so readily condense with products of this type as they were formed; the recognition of furfurol or similar bodies in the distillate would in the foregoing experiment be merely an indication of their excessive production.

As a result of these considerations it suggests itself that, if any error is involved in the application of the isatin process to determination of the indican value of leaf extract, it is one of slight under-estimation of the true indican content of the leaf, and will be too trifling for consideration.

Determination of indican by the isatin method.—It was necessary, if possible, to standardise this method by means of pure indican, and fortunately this could be done, for, by a novel method (Perkin and Bloxam, Chem. Soc. Trans., 1907, 1715) it has been found possible to prepare very large quantities of this compound. 0·6270 grm. of pure indican (dehydrated at 100° C.) was dissolved in water and the solution made up to 1000 c.c. The solution was colourless. For analysis 150 c.c. were withdrawn, in each case, and diluted to 200 c.c. Yield of indirubin = 0·083 and 0·083 grm., the theoretical yield from 150 c.c. of the indican solution being 0·0835 grm. of indirubin. [*] The examination by combustion of the indirubin formed in this fashion indicated that it was chemically pure, thus:—C = 73·19; H = 4·02; N = 10·81. $C_{16}H_{10}N_2O_2$ requires, C = 73·28; H = 3·82; N = 10·69: and it is accordingly evident that this reaction is quantitative, as suggested by Beijerinck (Proc. Roy. Acad. Sciences, Amsterdam, 1899, 20).

It was now of importance to determine the values which could be obtained from pure indican, employing the acid persulphate process of Rawson, as modified by Orchardson, Wood, and Bloxam (this J., 1907, 9), and, independently, by Bergtheil and Briggs (this J., 1906, 734).

Persulphate method.—(Orchardson, Wood, and Bloxam, *loc. cit.*) (*a*) The solution used was the same as that on which the determinations of indirubin were made by the isatin process (0·627 grm. of anhydrous indican = 1 litre) of this 300 c.c. was taken for each analysis. 300 c.c. of solution gave 0·072 grm.; 0·0725 grm. of indigotin. Theoretical value of 300 c.c. = 0·0835 grm. of indigotin. (*b* In a second series of experiments, 1·7906 grms. of anhydrous indican were made up to 1000 c.c. with water, 100 c.c. of this solution was withdrawn, in each case, for analysis and made up to 300 c.c. with water. 300 c.c. of solution gave 0·064 grm.; 0·065 grm. indigotin value. 300 c.c. by isatin method = 0·077 grm. of indigotin. Here the depreciation due to use of the persulphate method is equal to 15 per cent. approximately. The weights of indigotin given in the above analyses by the persulphate method are those actually produced, without any further tests as to purity. It is thus evident that a considerable loss of colouring matter takes place on attempting to analyse indican by the acid persulphate process—the cause of which is possibly explained by the statement of Hazewinkel (*v.* p. 1178). On the other hand, this loss is less in the case of pure indican than when operating on leaf extracts (*v.* p. 1180). The most reasonable explanation of this difference is that indoxyl, as formed, condenses with certain oxidised impurities present, and is thus precipitated together with the indigotin, being subsequently removed from the latter by washing with dilute alkali. Whatever the cause of loss may be, it is evident from these experiments that the acid persulphate method is not trustworthy for the analysis of leaf extracts.[†] It appears, therefore, that no method has yet been discovered by which the theoretical yield of indigotin can be developed from indican, and experiments are now in active progress with the view of effecting this important object.

Subjoined is a table of analyses made both by the persulphate and isatin methods, showing the indigotin values obtained from a number of samples of dried indigo leaf both of *Indigofera Sumatrana* (ordinary Indian plant) and of *I. arrecta* (Java or Natal plant) which we have received at various times from the Government of India and from private persons.

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[*] A later determination, made on anhydrous indican (of which the details of preparation have been contributed to the Chemical Society) gave the following figures:—0·3321 grm. of anhydrous indican, made up to 500 c.c.; for analysis 150 c.c. withdrawn and made up in each case to 250 c.c. Yield of indirubin = 0·089; 0·0885. Theoretical yield = 0·0887 grm.

[†] In addition to the low values obtained by the persulphate method when used on solutions of indican (– 15 per cent.) and on plant extract (– 25 per cent.) these values have to be yet further reduced for the product weighed is not pure. Thus the products of twelve analyses (eight of leaf extract and four of indican) were mixed together, and analysis proved the true indigotin content to be only 94 per cent.

Table (*A*).—*Determinations of indigotin values of dried leaf.*

Variety of leaf.	Indigotin by persulphate method.	Indigotin by isatin method.
	per cent.	per cent.
(1) *I. arrecta* old leaf	0·67	0·87
(2) *I. arrecta* young leaf......	1·48	1·81
(3) *I. Sumatrana* young leaf .	2·43	3·13
(4) *I. Sumatrana* young leaf selected (*v.* below)........		3·53

Here the depression (if the isatin method be taken as returning 100 per cent. of the indigotin actually present) due to use of the persulphate method is (1) 23 per cent. (2) 18 per cent. (3) 22 per cent.

Extraction of indican from the dried leaf by acetone and methyl alcohol.—We were now able to employ the isatin method, with great advantage, to determine the extent to which these solvents were successful in removing indican from the dried leaf. The results shown in the following table were made on the leaf residues, after steeping with the volatile solvents, the residue being dried by air exposure before making the analyses.

Variety of leaf.	Original value of indigotin.	Solvent employed.	Value of leaf residue after		
			1st steeping.	2nd steeping.	3rd steeping.
	per cent.			Indigotin, per cent.	
(1) *I. arrecta*, old leaf	0·87	Acetone		0·38	
(2) Do.	0·87	Acetone		0·36	
(3) *I. arrecta* young leaf	1·81	Methyl alcohol	0·27		
(4) *I. Sumatrana*, young leaf	3·13	Methyl alcohol	0·47		
(5) Do.	3·13	Acetone	1·12	0·69	0·51
(6) Do.	3·13	Acetone			0·73

Note.—The relation of solvent to leaf was, in general, 100 grms. of leaf to 400 c.c. of solvent. Extraction was made in the cold, for an average period of 14 days, shaking at intervals.

It will be seen that methyl alcohol exhibited a greater solvent power for indican than acetone. But in practice methyl alcohol removed, at the same time, so much impurity from the plant, that the isolation of indican was difficult, if not impossible. For this reason, acetone was always used as the solvent for indican.

Determinations of percentage values of fresh leaf.—An important matter connected with the first Report made by one of us (Bloxam) to the Government of Bengal[*] is the determination of the percentage value of the leaf taken on the fresh plant. This, as insisted on by Bloxam, exhibited a range on ordinary Indian plant (51·7 per cent., Delhi, to 61·6 per cent., Cawnpur) and an average for the two cuttings of a set of twelve experimental plots of 65·0 per cent. as the leaf content. This work was carried out in conjunction with Mr. H. M. Leake (Biologist, Dalsingh Serai Research Station). Now, though these results have not been denied, it has been suggested (Report of the Indigo Research Station, Sirsiah, for the year 1905—1906, p. 8) that the results were too high, and could only be explained as due to the plant of Bloxam and Leake having been grown under special conditions, on experimental plots or from selected seed. In support of this criticism, and in harmony with the previous statements of Rawson[†] on this point, it is definitely stated (*loc. cit.*, p. 8) as a result of some hundreds of determinations of leaf content, that in no case of *sumatrana* plant, either at Sirsiah or Pusa, has the percentage of leaf been found higher than 45, the average being about 40.

The objections to the higher leaf percentages obtained by Bloxam and Leake (*loc. cit.*) are erroneous, for (*a*) the plant was grown from the seed with which the whole concern Keonta was provided in that year. This, it is true, was selected seed, purchased on the advice of Leake, but it was surely incumbent on persons making experiments to take reasonable precautions as to seed supply. Leake had already (*loc. cit.*, Section IV., p. 29) pointed out in 1904 the necessity for seed selection. (*b*) Excluding the plant grown on manured plots, the average leaf content of all the unmanured plots of Bloxam and Leake works out to 62·3 per cent.

In final confirmation of these results application was again made to Leake, during the present year, to redetermine this point in case an error should have been possible. The results of this enquiry are as follows:—" Determinations made at Cawnpur on June 20th, 1907. (1) *Ordinary indigo* (*I. Sumatrana*) was sown, on irrigation, at the same time as it is sown in Behar. It is therefore a trifle more succulent than the more woody plant of Behar. It is difficult to know quite what influence this would have on the leaf percentage. The soft woody stems are probably lighter but then the internodes are longer. Weight of plant = 1454 grms.; weight of stem = 549 grms. so that the leaf percentage = 62·2.

(2) *Natal plant* (*I. arrecta*). Sown on irrigation in March instead of September or October after rains. It is a trifle young and succulent for " Mahai." Weight of plant = 1885 grms.; weight of stem = 715 grms.; so that the leaf percentage = 62·1. Thus the original statement of Bloxam and Leake, that the average leaf content of all the unmanured plots was 62·3 per cent., is completely sustained by these fresh estimations.

One reason which may, however, partly explain the difference of opinion on this point is that whereas Bloxam and Leake (*loc. cit.*, p. 11) included the rachis (mid-rib) as part of the leaf, there is considerable probability (and for the reasons there stated) that the rachis was omitted by Rawson in his determinations. Now an examination of the indican content of the rachis has been made by the present authors and, as will be seen below, it contains a considerable quantity of indican. So if this rachis has been omitted, two errors would result: (*a*) The leaf percentage would be returned low; the estimations of Leake (*loc. cit.*, p. 11) give the relations by weight rachis to lamina as 1 : 9, *i.e.*, a correction of some 10 per cent, must be added. (*b*) The total colour yielding value of the plant would be under-estimated. In support of this latter statement, a determination was made of the indigotin value of the rachis of the sample of dried leaf marked (3) *I. Sumatrana*, young leaf, in the Table above. It was found to yield 1·79 per cent. of indigotin by the isatin method, as against 3·13 per cent. for the whole leaf. Being in possession of stem, seed pods, and seeds of the same sample of plant, we made examination of them and found them to be free from indican, thus corroborating Rawson (*loc. cit.*, p. 6), Leake (Annals of Botany, 19, April, 1905, 297), and others. Certain further criticisms offered by Bloxam and Leake to the method of determination of leaf percentage as carried out by Rawson, will be found in the Report to the Government of Bengal (*loc. cit.*, p. 11). The figures for the analysis of the indigotin content of sample of leaf marked (3) *I. Sumatrana*, young leaf, in the table are most interesting on account of the high percentage exhibited.

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[*] " An Account of the Research Work in Indigo," carried out at Dalsingh Serai Research Station (under subsidy of the Government of Bengal) from 1903 to March, 1904. By W. P. Bloxam, H. M. Leake, and R. S. Finlow. Calcutta: The Bengal Secretariat Book Depot. 1905.

[†] " Report on the Cultivation and Manufacture of Indigo in Bengal." (Bradford: W. Byles and Sons, Piccadilly. 1899), pp 6 and 7. Rawson states that 20 determinations were made of various samples of plant. Mean result, 40 per cent. leaf, and 60 per cent. stem. Highest value leaf, 56 per cent.; lowest, 33 per cent.

A point which requires to be discussed in connection with all our samples of dried leaf is the percentage of indigotin revealed by analysis. Although these samples were procured by experienced agents from the best sources, the indigotin content was far inferior to that present in the undried material. Thus, the best sample of Java leaf (table, p. 1180) that has come into our hands yielded 1·81 per cent. as its indigotin value. Now it will be readily understood, without going into detail, that, after making due allowance for the water present in the fresh leaf, and for the percentage of stem which is not blue-bearing, that the resulting figure would be far short of the value as usually given, *i.e.*, 1·0 per cent. of indigotin. Indeed, the figure obtained approximates more closely to 0·5 per cent. In every case this deficiency has been observed, and it is not difficult to understand that this deterioration has arisen during the drying operations, and possibly during storage. It is, therefore, regarded as most remarkable that a sample of leaf of *I. Sumatrana* (table, p. 1180) which is usually considered far inferior for manufacturing purposes to that of *Indigofera arrecta* should contain practically twice the quantity of indican (1·81 per cent. indigotin for *I. arrecta* and 3·13 per cent. for *I. Sumatrana*). Indeed, an examination of the leaf lamina freed from rachis (1·79 per cent. indigotin), seed pods, and stem, gave a still higher value than before (3·53 per cent. indigotin), and even here some of the leaves had obviously undergone fermentation, being stained blue. Had the whole been in good condition, an even higher value would have been obtained. This matter is worthy of most careful investigation, for if so rich a variety of this plant (*I. Sumatrana*) can be obtained, the matter should be followed up without delay.

This observation seems also to indicate that the scientific study of the cultivation of the indigo plant has not as yet received adequate attention in India. For, should the results indicated above hold good for the fresh plant, then the assistance that the indigo industry would thus receive would be of paramount importance.

The stability of aqueous plant extract.—It has long been known that plant extract, prepared by extraction with boiling water from the fresh leaf, and, after sterilisation, protected from the action of micro-organisms, could be kept without change of its indican content (Alvarez, Comptes rend., 1887, 286). In an earlier paper by Orchardson, Wood, and Bloxam (this J., 1907, 7) some experiments were made with aqueous plant extract, the stock solution of which possessed at first the indigotin value, 200 c.c. solution = 0·07 grm. indigotin. It was found, on standardising it every other day, that this indigotin strength was maintained for a week, the solution being kept in a corked bottle without addition of preservative. Experiments on the effect of prolonged boiling on aqueous plant extracts, and their subsequent evaporation to dryness, indicate that some considerable loss of indican occurs during this operation. This is contrary to the statement made (Chem. Soc. Trans., 1904, 877). Thus, an aqueous extract of *I. arrecta*, made as usual (20 grms. of leaf extracted with boiling water and made up finally to 2 litres), and yielding, at first, an indigotin value of 1·81 per cent., was found, after evaporation to dryness on the water bath (3½ hours), to have been reduced to an indigotin value of 1·60 per cent., a decomposition equal to 11·60 per cent. of the indican originally present. Further, it was observed by Bloxam and A. G. Perkin, during preliminary experiments on the isolation of crystalline indican, in which aqueous plant extract was employed and repeatedly concentrated, without neutralisation of the plant acid, that the destruction of indican was complete.

The insoluble indigo enzyme of Beijerinck.—An account of some experiments on the indigo enzyme has been given in a previous paper (this J., 1907, 8), and these have been continued by Dr. R. Gaunt with the following results. We have shown (*loc. cit.*, p. 8) that we were unsuccessful in obtaining the soluble enzyme described by Bergtheil (Chem. Soc. Trans., 1904, 870), for, although the solution obtained agreed in physical properties with that described by Bergtheil, in no case where proper precautions were taken, *viz.*, using sterilised plant extract and enzyme solution filtered through a Berkfeldt filter, could formation of indigo be observed; either when air was bubbled through the mixture of enzyme and plant extract at 40° C., for a few hours, or when the mixture was left in the incubator at 30° C. overnight. Our fear that our failure in this respect might be due to our use, of necessity, of dried leaf, was dispelled by Prof. Beijerinck, who stated that dry or fresh leaves gave the same result, both giving evidence of an insoluble enzyme. Finally, bearing in mind the statement of Bergtheil (*loc. cit.*) that the addition of a few drops of chloroform to his enzyme solution had the effect of preserving it for several weeks without perceptible loss of strength, we had such a preparation made for us in India from the fresh leaf.* Here again, however, we were disappointed, for the two preparations (of *I. Sumatrana*, and *I. arrecta*, respectively) proved on examination by us to be entirely inactive. Consequently we were forced to continue our experiments employing the insoluble enzyme of Beijerinck (Proc. K. Akad. W., 1900, 120).

Being now in possession of pure crystalline indican, we were able to commence, with some prospect of success, the quantitative study of the production of indigotin from it by means of the insoluble enzyme. In the former paper (this J., 1907, 8), we stated as the result of our experience with aqueous plant extracts, "Exact quantitative experiments, however, have not been carried out up to the present, owing to the difficulty of estimating indigotin in the plant (extract) in presence of the leaf substance." In preparing the insoluble enzyme of Beijerinck from dried leaves, it was found, in practice, that the employment of a very large volume of alcohol was necessary. 5 grms. of dried leaves require from 2 to 2½ litres of 90 per cent. alcohol, and yield about 3·5 grms. of a yellowish grey powder, chiefly cellulose, but containing very active enzyme.

Action of the insoluble enzyme on indican.—In the following experiments, which are of a preliminary nature only, the general method of procedure was to allow a known weight of the powder to act on the indican solution, in an atmosphere of carbon dioxide, for a definite time, at 45°—50° C. Then the mixture was filtered by suction through a hardened paper placed in a Gooch crucible, carefully decanting the liquid at first, and, finally, washing the enzyme powder on to the filter with water. When this was done rapidly all the indoxyl solution was removed from the enzyme powder without loss from oxidation. The conversion of indoxyl to indigotin was effected by aspirating air through the liquid at 60° C. for about half an hour. The mixture was then acidified with a little hydrochloric acid, boiled, and the precipitated indigo collected on asbestos (previously purified by treatment with fuming sulphuric acid), washed, removed with the asbestos to a small beaker, and dried at 110°—120° C. The dry material was then analysed by the tetrasulphonate method. In a preliminary experiment, in which the enzyme was allowed to act on plant extract, only 57 per cent. of the theoretically obtainable indigotin (as indicated by analysis of the plant extract by the isatin method) could be obtained.

Experiments upon solutions of indican.—The supply of indican available was that obtained by Perkin and Bloxam by the acetone process. For the preliminary experiments the crude crystalline material was employed after making a determination of the degree of purity as follows, 0·3878 grm. of crude, air-dried crystalline indican was dissolved in water, filtered to remove a slight trace of adherent indigotin, and the solution and washings made up to 500 c.c. Of this 150 c.c. was taken, in each experiment, and made up to 250 c.c. This by the isatin method yielded, in duplicate, 0·082 and 0·082 grm. of indirubin. Now the theoretical value for $C_8H_6NO.C_6H_{11}O_5.3H_2O$ is 0·0874 grm. of indirubin, consequently the purity of the crude material was practically 94 per cent. true glucoside.

I. In the first experiment 0·4 grm. of air-dried crystalline glucoside was employed (containing 94 per cent. true glucoside). Solution was effected and the volume made up to 800 c.c. with water. This was submitted to the action of 1 grm. of enzyme powder for 7 hours at 45°—50° C. After filtration the liquid was oxidised by aspirating air through it, for half an hour, while immersed in water at 60°—65° C.

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* For this preparation we are indebted to the kindly and skilled help of Mr. H. M. Leake, of the Agricultural College, Cawnpur.

At this stage a test portion of the filtered liquid was examined and proved free from indican. The precipitated indigotin was collected on asbestos in the prescribed manner, and yielded on analysis by the tetrasulphonate method 0·07 grm. of indigotin. Now the true weight of glucoside involved was 0·376 grm., and this should yield, according to theory, 0·141 grm. of indigotin, as against 0·07 grm. actually obtained. That is, a yield of practically only 50 per cent. was obtained.

II. With the object of increasing the yield, it was resolved to use the concentration employed on the large scale (about 1 in 1000). Further, in view of the unstable nature of indoxyl, it was thought better to shorten the time of fermentation as much as possible. By withdrawing test portions from the fermentation, it was found that after 4 hours at 50° C. all indican had disappeared. 0·5 grm. of crystalline indican (containing 0·470 grm. of true glucoside) was dissolved in 400 c.c. of water (previously boiled to expel air), and fermented for 4 hours at 50° C. This yielded on analysis 0·12 grm. of indigotin instead of 0·176 grm. (theoretical), *i.e.*, 68 per cent.

III. Under the experimental conditions of II., 0·5 grm. of crystalline indican (containing 0·470 grm. of true glucoside) gave 0·116 grm. of indigotin, instead of 0·176 grm. (theoretical), *i.e.*, 65·9 per cent.

IV. This experiment differed from II. and III. only in that the oxidation of indoxyl was effected in presence of ammonia. Result, 0·5 grm. of crystalline indican (containing 0·470 grm. of true glucoside) gave 0·082 grm. of indigotin, *i.e.*, 46·6 per cent. The most noticeable feature of this experiment was the production of indirubin in large quantity.

V. Under the experimental conditions of IV., 0·5 grm. of crystalline indican (containing 0·470 grm. of true glucoside) gave 0·08 grm. of indigotin, *i.e.*, 45·4 per cent. Here also much indirubin was produced. It is interesting to notice, in this connection, that A. G. Perkin (Chem. Soc. Proc., 1907, 23, No. 320) is of opinion "that the formation of indirubin during the manufacture of natural indigo follows the well-known synthesis of Baeyer (Ber., 1881, 1745). Indirubin appears to be most readily formed when the fermented plant extract is oxidised under slightly alkaline conditions, and in these circumstances the oxidation of a portion of the indoxyl to isatin would appear to be facilitated."

Time did not allow of any further experiments being carried out, but it is our intention to ascertain, if possible, by future experiments employing indican, (*a*) The exact mode in which the fermentation proceeds, and (*b*) the conditions for obtaining the maximum yield of indigotin during fermentation.

In conclusion of this branch of the work it is contended that the difficulties attendant upon developing any considerable percentage of indigotin, even from indican itself, are entirely in harmony with the statements advanced by one of us (Bloxam) as to the low state of efficiency attained in the present process for indigo manufacture in use in India.

Conclusions.

(1) The isatin method for the analysis of the leaf is (as demonstrated by the evidence of the experiments made upon pure indican, page 1181) at present the only trustworthy method for the analysis of the leaf. For the product obtained from it has been clearly proved (p. 000) to be almost chemically pure indirubin. Now the formation of this substance can only originate from the indoxyl liberated from indican on hydrolysis, and must, therefore, be a true expression of the amount of this substance which is present.

(2) It is yet possible that some oxidising agent may be found capable of giving a theoretical yield of indigotin from indican (*v.* p. 1178); but this is now merely of academic importance in connection with the analysis of the leaf, the isatin process being both simple and effective.

(3) Being now in the possession of some 150 grms. of crystallised indican, we are undertaking a scientific study of its quantitative conversion, by various methods, into indigotin—with the view of improving the process of manufacture at present in use in India. The results of our experiments all tend to show that considerable improvement remains to be made in the efficiency of the indigo manufacture, and, point to the fact that the efficiency of the process is far lower than is currently stated.

(4) By the order of the Government of India a report is to be furnished to the India Office covering all the work done on Indigo at the University of Leeds during the years 1905—1907.

In conclusion, the Authors' thanks are due to the University Authorities for the excellent experimental facilities afforded. To Prof. A. G. Green for his great kindness in providing us with two laboratories devoted exclusively to work on indigo. And, finally, to Mr. A. G. Perkin, F.R.S., whose interest in the work has been inexhaustible, and whose many suggestions for improvement have proved invaluable.

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Discussion.

Professor R. **Meldola** said that he was glad to think that the representations he had made some 7 years since to the Indian Government had borne fruit. It had been his duty to present to the British public through the Society of Arts the case for synthetic indigo, but at the same time he had made it his task to look into what was going on with regard to the natural product, and he raised certain pertinent questions, particularly with regard to whether they were getting as much indigotin as they should, and were using the best kinds of plants. He pointed out at that time that it was just as much a biological as a chemical question, and that it was a case in which scientific supervision should have been called in long before. Unlike the Dutch, our planters had been letting matters slide, and then suddenly awakened in a panic. The result was they had had the work of these two gentlemen. The question turned more or less on methods of analysis, and unless anyone had had a great deal of experience in this kind of work, any remarks must necessarily partake more or less of an academic character. He had had the advantage last summer of witnessing an assay by the tetrasulphonate method in Mr. Bloxam's laboratory, and it seemed to leave, in his judgment, nothing to be desired. It appeared to be as good a process as could be devised for such a complicated substance as indigotin. Although there was this conflict of evidence as regards the analytical method, it must be obvious that Mr. Bloxam and his colleagues had now brought this process to such an issue that one could say definitely that they knew what they were dealing with. There was a definiteness about these results which had heretofore been wanting. Again, as regards the practical issue, which was exceedingly simple, apart from any merit or demerit which the process might possess, it seemed to him that a clear case had been made out to show that the indigo planters were not doing themselves justice; and that was a serious point when it came to a question of competing with a chemical product. If there was the slightest suspicion that this loss was going on, even if it did not correspond to Mr. Bloxam's figure, it seemed to him it was the bounden duty of the Indian Government and the planters to keep these researches going until they were satisfied they were doing themselves justice. The end of the matter was not reached when the most perfect of analytical processes had been devised, because it by no means followed that the factory process would run parallel with the laboratory method; there might be great discrepancies. The lesson to be learned from these results appeared to him to be that the persulphate method might be dismissed as unreliable; that the indirubin method as now perfected was dependable, and that it pointed to the fact that it might be possible to get a very much larger quantity of indigotin; that was to say, there was more indican in the plant than had been suspected. It now rested with the planters and manufacturers to see whether it was possible to realise those laboratory conditions in the factory. In this direction, according to his judgment, lay the only hope of salvation of the indigo-growing industry.

Mr. A. G. Perkin said that when Mr. Bloxam first came to Leeds, he did not share his opinion as to the difficulty in preparing chemically pure indigotin, but later became convinced that this was by no means so easy a matter as he supposed. He was satisfied that in evolving the tetrasulphonate process Mr. Bloxam had employed pure indigotin, and it should be borne in mind that the impurities occurring in natural indigo had been separately isolated and examined as to their behaviour by this process. Mixtures of these substances with pure indigotin had been analysed, and the amount of this latter which was present had been indicated by the method to within about 0·5 per cent. The process had therefore been shown in a scientific manner to give correct results. The statements of Messrs. Bergtheil and Briggs with regard to the effect of sulphurous acid in the fuming acid upon the method had been shown that evening to be incorrect, as it had no effect whatever. Again, they were quite mistaken in supposing that a loss of indigotin occurred during the salting out of the sulphonated product with potassium acetate. If one thing was certain about the tetrasulphonate process, it was that the precipitation in this manner was practically complete. The fact that this process of analysis had shown some samples of synthetical indigo to contain but 92 per cent. of indigotin. had caused surprise, and especially so as the sample examined by Mr. Bergtheil had been stated by this author to contain 98 per cent. He had no doubt, however, that the samples analysed at Leeds had been correctly estimated, and a clear proof of this appeared to him to be as follows. When the indigo in question was purified by the method devised by the Badische Anilin und Soda Fabrik, it was found to be chemically pure, and on analysing this side by side with the unpurified sample, the figures given were approximately 100 per cent. and 92 per cent. respectively. Another question the authors had dealt with was the percentage of leaf from the plant. Messrs. Bloxam and Leake had found this to be 62 per cent., whereas Mr. Bergtheil considered it to be but 40 per cent. Mr. Bloxam had recently made fresh inquiries in India upon this point, and as a result his former statement was confirmed, so that it appeared that Mr. Bergtheil's figures referred to a poor quality of plant which was not derived from well-selected seed. On the other hand, the "rachis" was included in the estimate of Bloxam and Leake, for this also contains the colouring principle. As to the "isatin" process of Orchardson, Wood, and Bloxam for the analyses of the leaf, he had seen this frequently carried out, and had not noticed any of the discrepancies alluded to by Mr. Bergtheil. In properly conducted analyses there was of course always an excess of isatin present, as stated by these authors, and the samples of leaf had been examined from time to time and always yielded figures confirming the previous results. This process was based upon scientific facts, for not only was it known that the formation of indirubin from indoxyl and isatin proceeded quantitatively, but it had also been standardised by means of pure indican, from which the expected yield of indirubin had been obtained. Mr. Bergtheil had published articles upon the dyeing properties of natural and synthetical indigos, and had found that the natural dyed better than the artificial. He should be very delighted if this were proved to be really the case, but a study he made in conjunction with Mr. Bloxam upon the brown impurities of cake indigo gave no results in support of this view, for it was found that in the dyeing process these substances were not converted into any colouring matter of the nature of indigotin. He was inclined to think if, after the dyeing operation, Mr. Bergtheil had analysed the respective vats and dyed fabrics, he would have merely found that, through unsuspected causes, one vat had yielded up its colouring matter more readily than the other.

Dr. G. T. Morgan said the great step in advance had been that it was now possible to prepare perfectly pure indigotin, and not only that, but they had this improved sulphonation process of estimation, which would be a great assistance to those engaged in the indigo industry. Formerly, owing to the untrustworthy results obtained with the older analytical processes, buyers of indigo had relied chiefly on comparative dye tests. Now it would be possible to supplement this method by chemical analysis, using pure sublimed indigotin as a standard.

Mr. S. H. Wood said it had been pointed out that everything depended on the ultimate method of analysis of indigo, and the discrepancy had not yet been cleared up between the method advocated by Mr. Bergtheil and the tetrasulphonate method. The former method relied on the selective solution of indigotin from the crude indigo during sulphonation; all the products of crude indigo were soluble in sulphuric acid with more or less prolonged heating, one hour on the water bath being sufficient to dissolve them all, while by stopping at the end of a quarter of an hour, Messrs. Bergtheil and Briggs maintained there should be selective solution of the indigotin; that seemed very improbable. This statement as to complete solubility was based on data obtained from the impurities of crude indigo and not those of the seet water. Messrs. Bergtheil and Briggs being unable to obtain the impurities from the crude cake, evaporated the seet water and used that. It was obvious that for the most part the seet water contained just those substances which the crude cake did not. There was one striking fact, that when pure indigotin was analysed by Mr. Bergtheil's method, the result was 105 per cent. Mr. Bergtheil analysed his indigotin by Mr. Bloxam's method, and said it came out as 95 per cent. The solution of the mystery was clear. If Messrs. Bergtheil and Briggs' method were standardised with indigotin of roughly 95%, then when that indigotin was tested by a more accurate method, it would come out at 95; on the other hand when pure indigotin was analysed by Bergtheil's method, a method which, for the sake of argument, was standardised on 95 per cent. indigotin, that indigotin would come out at 105 per cent. And that was exactly what happened. However much the solution was diluted, 1 c.c. of N/50 permanganate was never equal to 0·0015 grm. of indigotin. In addition to the error of the factor, there was no selective sulphonation, therefore in the persulphate and indirubin process, unless the method of final analysis were accurately standardised with pure indigotin, the figures did not mean as much as they appeared to.

Dr. R. Gaunt said that the part of the work dealing with the action of the enzyme on indican required some explanation. In 1887 Alvarez said that the production of indigo from the plant was brought about by a microorganism, which he called *bacillus indigogenus*. Mr. Bergtheil, in 1904, admitted the existence of such a bacillus, but said there was no doubt that the main action was due to an enzyme. He ignored the fact that Beijerinck, Hazewinkel, and van Romburgh had already, in 1900, arrived at the same conclusion. This was remarkable, as Mr. Bergtheil's results differed from those of the Dutch workers. Beijerinck, for instance, did not admit the existence of a special indigo bacillus, and thought *b. indigogenus* common to most plant infusions. Further, Mr. Bergtheil obtained a very active solution of the enzyme in water. The Dutch investigations were unanimous in maintaining that the enzyme was insoluble in water. They (Gaunt, Thomas, and Bloxam) had not succeeded in obtaining an aqueous solution of the enzyme from dried leaves, and on communication with Professor Beijerinck, the latter had replied that the enzyme was insoluble whether from fresh or dried leaves. They had had no difficulty in obtaining an insoluble active enzyme preparation according to Beijerinck's method, and with this they had carried out their experiments. The low yield of indigo obtained from pure indican by this means suggested the possibility of improvement in the process of manufacture of indigo from the plant. In conclusion he wished to suggest that Mr. Bergtheil should have filtered his enzyme solution through a porcelain filter, which was a much more effective means of excluding the action of bacteria than chloroform which Mr. Bergtheil had employed.

Mr. F. Thomas said he had carried out the work on the "isatin" method from the point at which it was left in the previous paper. It was quite true that some leaves had a different indican content to others, but it was a very simple matter to extract a leaf, with a higher content of indigo, with more water. They found it best to make up the solution to a known volume, and take such a quantity of that as would approximately yield the same amount of indirubin (*viz.*, 0·1 grm.) as in the leaf they first started with, of 0·87 indigotin content. The volume of the water required would naturally increase with the quantity of indican present. Extraction of the leaf with hot water in a funnel (as described in the previous paper) gave in every case a solution of approximately the same concentration.

Mr. A. C. CHAPMAN said that he had had an opportunity of witnessing Mr. Bloxam's process, and in his opinion there could not have been any destruction of indigotin in the salting-out process, as Mr. Bergtheil had suggested. Mr. Wood, who had undertaken the demonstration of the process, weighed out two equal quantities of the same pure indigotin. The one portion was titrated directly with permanganate solution, whilst the other was sulphonated and salted out as the potassium tetrasulphonate salt, and after filtration was titrated in the same way, the same volume of permanganate solution being requred in both cases. This experiment proved conclusively that there could not be any appreciable destruction of the indigotin during the salting-out process. He was convinced that the tetrasulphonate process did serve to separate the indigotin in a pure condition, and to eliminate the other impurities of the crude indigo which interfered not only with the actual amount of permanganate required, but also with the sharpness of the end point of the titration.

Mr. C. BERGTHEIL said that the validity of the method of indigo analysis which had been discussed depended on the purity of the standard used for establishing its correctness. Mr. Bloxam showed them that his indigotin had the correct nitrogen content, and he then said that this was not necessarily a criterion of purity. Apparently the one he used was to submit it to the test of his tetrasulphonate method, and having obtained a correct result by that method he took it that this indigotin was pure. But surely if one called his factor into question, that was merely arguing in a circle. Unless there was some standard entirely independent of any method of indigotin analysis, that was unsatisfactory.

Mr. BLOXAM said it was also tested by combustion.

Mr. BERGTHEIL said that was undoubtedly a reliable method, and assuming that was applied they arrived at an *impasse*. The result he obtained from indigo that he judged pure by the nitrogen content and by its giving correct results by a variety of analytical methods depending on various principles indicated that a certain factor was necessary in order to get 100 per cent. of the pure substance. Mr. Bloxam found another factor was necessary, and it was impossible to find an explanation of that lack of unanimity as far as he could see. A great many experiments had been made, and invariably the end point of the titration was such as to show that the factor he recommended, *i.e.*, 0·0015 was necessary in order to find a pure product from the product which had been tested and found pure in the manner described. With regard to the impurities present in crude indigo, there was no doubt that Mr. Bloxam in one of his past papers had shown that by the tetrasulphonate method he could separate the indigotin from the impurities added, but in most cases it seemed he had added quantities of impurities such as never occurred in practice, and therefore the objection he raised to the old method, that the impurities would remain in solution, was very largely beside the point. As a matter of fact, a large percentage of the impurities came out on dilution of the sulphuric acid, and were removed by the action of barium sulphate, and the amount which remained in solution was so small that the effect was practically unobservable in the result. That was verified in a paper published last year, by comparing the method proposed by him with a variety of other methods depending on entirely different principles, and they obtained practically the same results in every case. With regard to the sulphur dioxide which Mr. Bloxam mentioned in his criticism of the tetrasulphonate method, it was possible that that explanation he offered was correct, that the fuming sulphuric acid he himself had used was particularly impure, and contained sulphur dioxide, which was not a normal constituent of fuming sulphuric acid. He could only say that they used a number of samples and invariably found that on the application of the condition of sulphonation recommended, they got a considerable consumption of permanganate on doing a blank titration. Salting out differentially did not get rid of the difficulty in determining the validity of the factor proposed by Mr. Bloxam. With all due deference to Mr. Perkin, the impression they got from a large number of tests was that salting out led to the destruction of indigotin, and if this were so it was clearly necessary to dispense with the process in judging of the correctness of the factor, since an error would be introduced; the salting out process would also be obviously unnecessary in dealing with the pure substance from which the factor was to be derived. The question of the purity of the Badische Company's samples, of which they had heard a good deal, seemed to him to turn on the question of what samples were spoken of. The original synthetic indigo samples he had seen had been of a high degree of purity. One sample he had, which was put on the market in 1898, certainly showed 98 per cent. when analysed by his method. Later samples, analysed by the same method, showed 94 per cent. Even assuming the method was erroneous, presumably there would have been a constant error, and therefore there was undoubtedly a difference in the samples. There was no doubt of the fact that of recent years the synthetical indigo put on the market had not been as pure as it formerly was. The object of sending samples abroad for analysis was to see how trade analyses in the various countries were carried out, and how they compared with the method they were using. In another paper he had a table comparing their own method with a variety of other methods depending on different principles, and showing that the same results were obtained. He did not think the fact that one got varying results from various analysts, to whom samples were sent, had anything to do with the question of the different methods used in the table. In most cases the permanganate method was used, but so far as he could gather, every second observer appeared to employ a different factor, and necessarily different results were obtained. To his mind, the whole thing turned on what was the correct factor, and there apparently they did not agree. With regard to the method of estimating indican in the leaf, Mr. Bloxam now showed figures obtained from pure indican, and it was extremely satisfactory to find that the method gave the results he was able to show with the pure substance. He was sorry to say he had not had the opportunity of dealing with the pure substance. Admittedly the figures now shown led one to think that it would be worth while going further into the matter, but at the same time it seemed to him that figures obtained from pure indican did not necessarily apply to the crude extract. It did not seem to follow that because pure indirubin could be obtained from pure indican, it could be obtained from the crude extract. It seemed to him that such methods were very much better criticised when they were applied to the crude extract, than when applied to pure indican; after all, one was more nearly approaching the test of practice when dealing with the crude plant. With regard to plants they were told there should always be an excess of isatin present. As a matter of fact, that idea struck him, and they would find figures in his paper in which the method was employed in this way. When such excess had been present, he had admittedly obtained fairly pure indirubin; but in no case did he obtain so high results as those obtained by the persulphate method from the same extract. The purity of the indirubin precipitates varied from 91 to 88 per cent., but on calculating back to the indican content of the leaf, invariably less was obtained than was obtained by the persulphate. Mr. Bloxam told them that the rachis contained two-thirds of the indigotin, but he was not sure what that meant; did it mean that the rachis contained two-thirds of the quantity contained in the leaf? Messrs. Bloxam and Leake showed the leaf content of the plant to be 60 per cent., and Rawson and himself 40 per cent. Their figures were founded on hundreds of samples.

It was possible that, in the case of a very fine plant under favourable circumstances, there might be a higher leaf content; but in technical operations the question was the leaf content of the plant as put in the vats; and 40 per cent. was very nearly the average. The question of the solubility of the enzyme in the indigo leaf appeared to him to be rather one of the meaning of the word "solubility." In speaking of the solution of the enzyme he meant that the solution was clear after passing through paper, and was apparently a solution in the ordinary sense of the word, but the fact that it would not pass through a Berkefeld filter indicated that it was a colloidal solution. It was admitted that in any experiments on fermentation of the indigo plant bacteria should be excluded; but in many experiments he had described, he had not only had an antiseptic present, but the experiments were carried out in many cases at such a temperature that the vital activity of bacteria would be excluded. The figures showing that the course of action followed the mathematical law which had been shown to be peculiar to enzyme action, was conclusive evidence that they were dealing with enzyme action. In practice the great point in indigo manufacture was the enzyme fermentation. The bacteria present had a certain amount of influence, and as regards the *bacillus indigogenus* of Alvarez, that probably was a common bacterium. He called it by that name after Alvarez, but very likely it was a bacterium which took part in other fermentation processes, and had been given another name by somebody else.

To return to the analytical question, some remark had been made upon the selective sulphonation of indigotin. He did not think that had ever been suggested. In the method he had used a large amount of impurities were precipitated, and the amount remaining in solution in sulphuric acid was too small to have any marked influence. The question of selective sulphonation had never been raised by him.

Mr. Bloxam in reply said that he hoped to induce the Government of India to adopt the tetrasulphonate process as the official method of analysis. One point which had not been touched upon during the evening was, that they had received from the Government of India a sample of leaf of *Indigofera Sumatrana*, twice as rich in indigotin as any specimen of dried leaf of *Indigofera arrecta* yet received. They were a little puzzled at present as to what it was botanically, but it would undoubtedly be of the greatest value to the industry. The authors had had the advantage of consulting the Director of Kew Gardens (Col. D. Prain, F.R.S.) as to the exact nature of this rich plant. Col. Prain was of opinion, that no one could answer this question until the authorities in India who had supplied the material sent such properly prepared and duly authenticated specimens of the plant itself in flower and in fruit as to admit of its identification.

He had to thank the authorities of the University at Leeds and Professor Green for the accommodation they had placed at his disposal. Not least was he indebted to Professor A. G. Perkin, who had been the superintendent of the whole work on behalf of the India Office. His care had been unceasing, and an enormous amount of benefit had accrued to the work from the suggestions and criticisms he had made.

Nottingham Section.

Meeting held at Nottingham on Wednesday, Oct. 30, 1907.

MR. O. QUIBELL IN THE CHAIR.

SOME ALGERIAN OLIVE OILS. PART II.

BY L. ARCHBUTT, F.I.C.

In continuation of the paper communicated to the Society last April (this J., 1907, 453), I now give the results of an examination of twelve further authentic samples of Algerian olive oil which have since come to hand. These samples have all been very kindly sent by the Algerian Government authorities, Nos. 1 to 7 having been contributed by the Agricultural Syndicate of Guelma, No. 8 by the Agricultural and Viticultural Syndicate of Tlemcen, and Nos. 9 to 12 by the Agricultural Committee of Tizi Ouzou. For the whole of the samples I am indebted to Dr. Lewkowitsch and Mons. E. Bontoux, to whom my best thanks are due.

No.	Description.	Colour.	Sp. gr. at 60° F.	Free (Oleic) Acid.	Saponification Value.	Iodine Value (Wijs).	Unsaponifiable Matter.
				per cent.	per cent.	per cent.	per cent.
1	Guelma Olive Oil, expressed from mixed olives	Pale grass green	0·9173	1·1	18·99	89·7	0·89
2	Guelma Olive Oil, expressed from the olives "Verdale" and "Roussette"	Pale greenish yellow	0·9169	4·5	18·96	90·4	0·81
3	Medjez-Amar Olive Oil from the olives "Roussette" and "Blanquette" .... 1st expression	Golden yellow	0·9169	0·9	18·96	89·0	0·88
& 4	2nd expression	Brownish yellow	0·9171	0·9	18·92	89·8	0·96
5	Guelaat bou Sba Olive Oil from "Roussette" olives .... 1905 crop	Primrose yellow	0·9173	0·4	19·01	90·1	0·80
& 6	1906 crop	Pale primrose yellow	0·9178	0·5	18·92	90·3	0·72
7	Duvivier Olive Oil from the olives "Blanquette" and "Roussette"	Yellowish green	0·9178	2·3	18·90	88·5	0·78
8	Tlemcen Olive Oil	Golden yellow	0·9166	0·5	18·96	84·9	0·92
9	Olive Oil from Mizrana, near Tizi Ouzou. From mixed olives, but especially "Chemlali" and "Aberkou" varieties	Pale greenish yellow	0·9168	0·6	19·13	83·7	0·74
10	Olive Oil from l'Oued Aissi, near Tizi Ouzou. From mixed olives	Primrose yellow	0·9164	1·6	19·07	82·4	0·77
11	Olive Oil from Mirabeau, near Tizi Ouzou. From mixed olives from the valley of l'Oued Bougdoura	Pale greenish yellow	0·9165	2·1	19·10	82·5	0·98
12	Sample from Makouda of the ordinary mixed olive oil of Mizrana..................	Pale greenish yellow	0·9165	2·4	19·13	82·4	0·88

By Renard's process. working on 10 grms. of oil, no trace of arachidic or lignoceric acid could be obtained from either of these samples. The fatty acids separated from the ether-insoluble lead soaps, when dissolved in 50 c.c. of 90 per cent. alcohol and cooled to 15° C., remained perfectly dissolved, no trace of crystalline precipitate being obtained from either sample. In this respect it will be noticed that the Algerian olive oils differ from the Tunisian (this J., 1907. 454), all of which deposited sparingly soluble crystalline fatty acids from the first solution in 90 per cent. alcohol, and some a considerable amount, though these mostly dissolved on washing and were proved to be free from arachidic and lignoceric acids. Absence of arachidic acid was also confirmed by Bellier's qualitative test (this J., 1899, 303), which I have found quite reliable and useful when carefully applied. 5 per cent. of earthnut oil in olive oil can be detected distinctly by this test, but when the same method is used quantitatively I have found it to give low results, and I, therefore, prefer to use Renard's process for qualitative determinations.

None of these Algerian oils gave any immediate colour when shaken with nitric acid of 1·375 sp. gr., except No. 4, which gave a light greenish colour. After standing 1 hour, the greenish colour of No. 4 changed to a light greenish brown, No. 7 developed a dark greenish, and the remainder a pale brownish tint.

The iodine values of the olive oils from the named varieties (including those previously examined) are given in the following table. It appears that the exceptionally high values are given by a few varieties, grown in certain districts, and that the oils from other varieties and districts give normal or more nearly normal results.

Variety of Olive.	State.	Iodine Value.
Besbassi Rhadès-Tunis	Tunis	82·7
Chemlali Sfax	,,	80·2
Chemlali Gabès	,,	86·9
Blanquette and Roussette (mixed) .	Algeria	88·5 to 89·8
Roussette (alone)	,,	90·1 to 90·3
Verdale and Roussette (mixed)	,,	90·4
Chétui Bizerte	Tunis	91·1
Chétui Mornag	,,	94·7

The whole of the analytical work in this paper has been carried out by my assistant, Mr. C. W. G. Halls.

Yorkshire Section.

Meeting held at Leeds on Monday, Oct. 28th, 1907.

MR. F. W. BRANSON IN THE CHAIR.

THE ANALYSIS OF TANNING MATERIALS.

The Acidity of Tan-Yard Liquors. Part I.

BY H. GARNER BENNETT, M.SC., AND C. D. WILKINSON.

(Contribution from the Leather Industries Department of the University of Leeds.)

The presence of a certain quantity of suitable acids in tannery liquors is one of the most important and well-known factors in a successful tannage, these acids serving both for the neutralisation of the lime, and for the satisfactory swelling of the hides and consequent rapidity of penetration of tanning matters. The rapid and accurate estimation of the acidity of these liquors is thus a matter of considerable importance, and is a problem which has received attention from many chemists. The matter is, indeed, one of singular difficulty, and is complicated by the fact that the nature of the acids present is variable, and that the tannins themselves interfere with all simple methods, such as direct titration with standard caustic potash, because of their ready oxidisability in the presence of alkalis. Many methods have been suggested to meet these difficulties, but none have been hitherto regarded as wholly satisfactory. This dissatisfaction and the urgent need for some accurate and convenient method caused the American Leather Chemists recently to appoint a committee to consider this question and compare the results obtained by methods already suggested and in use. The Committee determined the acidity of three typical liquors by various methods, and after adding a known amount of acid repeated the determination, finding that most of the methods gave results too low. It seemed to the authors, however, that it was strongly desirable to compare also these methods on artificial liquors of precisely known composition, so that it would be more easy to trace the causes of the defects in all the methods, and that when these became more evident the possibility of their elimination might be considered. Some experiments on these lines were therefore undertaken, and the more promising methods were then used for the determination of the acidity of such artificial liquors.

The "charcoal method" of Simand, which is still the "official" method of A.L.C.A., was not used in these experiments, as previous work has shown clearly the unsatisfactory nature of the reagent. Its absorption of some of the free acid, the variability of this absorption according to the quantity used and the extent to which it is washed, its inconstancy of composition, the presence of free bases, and the necessity for a "blank" experiment and correction,—all were taken to indicate the strong improbability of any satisfactory method being obtained on these lines. It soon became clear, however, that the "lime water method" of Procter had scarcely received full justice. This method consists in titrating 10 c.c. of the filtered liquor with clear, saturated lime water until a permanent turbidity is produced by the commencement of the precipitation of the insoluble calcium tannates, which precipitate is not produced so long as any free acid remains in the liquor. This is the only method which does not involve the removal of tannin from the liquor, and whose result indeed depends upon its presence. It has been several times pointed out* that some tannins have soluble calcium salts and therefore do not give a precipitate with lime water, so that in cases where the liquors contain only these tannins, it is clear that there can be no end point. In the case also of liquors which are practically exhausted of their tannin content an imperfect end point may be obtained; but the difficulty in both these cases may be easily and conveniently obviated by the addition of a little pure tannin to the liquor, so that if this be borne in mind it is always certain that the method is workable. The question is now, therefore, whether the results obtained by this method can be regarded as a sufficiently correct guide to the quantity of free acid. The tannins themselves are sometimes considered acids; their solutions undoubtedly contain hydrogen ions, though whether these are desociated from carboxyl groups or phenolic groups is by no means clear. This "acidity," however, is so feeble that in the case of acid-free tannin infusions we may regard the point of commencement of turbidity as being merely dependent upon the solubility of the calcium tannates. Clearly, therefore, we should expect the results obtained by Procter's method to be slightly influenced by the presence of neutral calcium salts in the tan liquors, and this to a variable extent according to the nature of the acid radical and the consequent amount of ionisation of these salts; and from the same considerations it is evident that with acid tan liquors the nature of the acids which are being determined will have a similar influence. In titrating 10 c.c. of a 0·4 per cent. solution of pure, dry gallotannic acid, 1·2 c.c. of lime water were required, (22·2 c.c. = 10 c.c. of $N/10$ hydrochloric acid) but this cannot be regarded as a "blank experiment," or as indicating the extent of the error in the end point when a similar acidified solution is used, for the ionic equilibrium which is the cause of the commencement of precipitation is of a totally different order, and the error due to this source will be certainly less than is indicated by the above figure. Hence no correction can be made, and results must be calculated as if turbidity appears immediately all free acids are neutralised. Procter recommends that from the amount of lime water used results should be calculated into percentage of acetic acid, but in this work so many methods and such a variety of acids have been used that it was found much more convenient to state all in similar terms, and the acidity is therefore expressed throughout this paper in terms of the number of c.c. of $N/10$ potassium hydroxide which would be required to neutralise the acid in 100 c.c. of the tan liquor.

The liquors were made up so as to contain always 0·4 per cent. of dry tannin, however the acidity was varied. This was conveniently done by using a 0·8 per cent. tannin solution and mixing as required with varying proportions of deci-normal acid and distilled water. In this way liquors were made which were $N/20$ and $N/40$ to acetic, formic, and lactic[*] acids, apart from their tannin content, and their acidity determined by Procter's method. It is clear that $N/20$ solutions should give a result of 50 and the $N/40$ a result of 25, whereas the actual experimental results were as below :—

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* Procter and Bennett, this J., 1906, 251.

Liquor.	C.c. lime water required by 10 c.c. liquor.	C.c. lime water required by 10 c.c. $N/10$ hydrochloric acid.	C.c. $N/10$ potass. hydrox. for 100 c.c. liquor.
$N/20$ acetic acid	11·65	22·2	52·1
$N/40$ acetic acid	6·5	22·3	29·1
$N/20$ formic acid	10·45	22·2	47·0
$N/40$ formic acid	5·7	22·2	25·6
$N/20$ lactic acid	10·8	22·9	47·1
$N/40$ lactic acid	5·8	22·9	25·8

Thus, although the method does not give correct theoretical results, it is capable of an accuracy which compares favourably with that of all other methods, and with ordinary care duplicate titrations will always agree within 0·1 c.c. A few experiments were made also with $N/20$ acetic tan liquor in which 5, 10, 15, 20 c.c., etc., of water were added to the 10 c.c. of liquor before adding lime water, and results of 11·8, 11·9, 12·0, 12·1 c.c., etc., were obtained, this being no doubt partly due to the solubility of the precipitate, and partly also to the greater difficulty in observing its appearance. Boric acid was used also in a similar way to the above acids, the $N/10$ solution being standardised by titration with $N/10$ potassium hydroxide in presence of glycerin and phenolphthalein. The lime water method gave a result which seemed to have no theoretical significance, and hence the method in its presence is quite empirical. Some experiments also with gallic acid alone ($N/50$ when considered monobasic) showed that rather more lime water was required than corresponded to the neutralisation of the carboxyl group but not so much more as to correspond with another hydroxyl group. Hence in presence of gallic acid also the results obtained are of an empirical nature, and as some quantity of various hydroxy-compounds are usually present in tan liquors, it must be admitted that generally the results obtained in practice will also be empirical, but it should be always borne in mind that however obscure the exact theoretical significance of results obtained by the lime water method may be, *the figures obtained are always an accurate indication of the amount of those acids which are capable of forming soluble salts with lime,* and as one of the chief functions of these acids is to form such salts with the alkali of the limed hide, the information which this method yields is always valuable. From these considerations it would seem most logical to state results in terms of grams of calcium oxide, but it is by far the most common in practice, and probably more generally convenient to leave the result as the number of c.c. of saturated lime water required for 10 c.c. of the liquor. With regard to manipulation, the method is simplicity itself, and in this respect is by far the best of all methods suggested hitherto. A reservoir of saturated lime water standing over excess of caustic lime and connected with a self-filling burette, is a piece of apparatus which will be difficult to surpass in giving both rapidity and convenience to the works chemist, and these no doubt are some of the reasons which cause Procter's method to be by far the most widely used in this country.

Some experiments were also made with the "quinine method" recently suggested by Hoppenstedt,[†] but as the process depends upon the insolubility of all the tannates of quinine and the solubility of the quinine salts of the free acids in tan liquors, it was obvious at the outset that the method could scarcely be expected to be generally applicable. Artificial liquors were made up as before, and their acidity determined by this method. The results, which are stated below, show that even with gallotannic acid the method does not afford any material increase in accuracy. The observations of the authors in carrying out the process made this scarcely surprising. The mixture of quinine solution and tannin infusion filters badly unless allowed to stand for some time, and if allowed to stand darkens considerably. If it can be filtered at once the filtrate becomes turbid and much darker on standing for a short time, and in any case the filtrate darkens rapidly during the titration and makes it exceedingly difficult to see the end of the reaction, a considerable quantity of indicator being necessary to obtain any end point at all. Moreover, after the titration is apparently complete, the pink colour disappears again in a very short time, and it is difficult to judge to what extent the titration should be continued. It was scarcely to be expected, therefore, that even duplicates would agree unless the conditions of filtration and titration were very rigidly defined. The causes of these difficulties were not perfectly obvious, but apparently rose from the presence of hydroxy-compounds which were present as impurities in the gallotannic acid and which did not give insoluble quinine compounds. This was strongly confirmed by the very indefinite end points and bad results obtained when gallic acid was used to make up the liquors. As such compounds are always present in tan liquors it seems unlikely that this difficulty will ever be completely overcome in this method, though some other alkaloid or even a mixture of alkaloids might offer a partial solution. Much work has previously been done on the precipitation of tannin by alkaloids with a view to estimating the tannin, but the varying solubility of the tannates of any common alkaloid, and of the compounds with bodies allied to tannin, has made this impossible hitherto and improbable in the future, so that it is equally improbable that the removal of tannin by alkaloids for the estimation of acidity will ever yield a method which will be universally applicable.[*] The method also almost necessarily involves a considerable dilution of the tannin infusion and therefore also of the acid it contains ; this causes the titration to be very small and hence a small error in titration corresponds to a much larger error than usual in the actual result. It will be noticed too that the method is inapplicable to liquors containing boric acid. The tannin alone showed some acidity by this method, but whether this is merely due to the defect in the method discussed above or whether it should be regarded as a means of correcting the results to correspond to the increase in acidity is doubtful, so that both results are given in the table. The corrected results are sometimes made nearer and sometimes further from the truth.

Quinine method results.

Liquor used, all 0·4 per cent. tannin.	C.c. $N/10$ potass. hydroxide for 100 c.c. liquor.	Do., corrected for possible influence of acidity in the tannin.
No added acid	3·3	—
$N/20$ acetic	51·7 52·8	48·4 49·5
$N/40$ acetic	27·5	24·2
$N/20$ formic	42·9 48·4	39·6 45·1
$N/40$ formic	23·1	19·8
$N/20$ lactic	49·5	46·2
$N/20$ boric	13·2 15·4	9·9 12·1
$N/20$ gallic	71·5 63·8	68·2 60·5

A few experiments were made with the "gelatine precipitation method" of Koch, a tan liquor which was $N/20$ to acetic acid being used. To 25 c.c. of this liquor, varying quantities of a 0·2 % solution of gelatine were added, and an aliquot portion of the filtrate from this mixture titrated with $N/10$ potassium hydroxide and phenolphthalein. The end point in this method is usually very poor, but in these experiments was probably under the most favourable conditions possible. The results show clearly that the gelatine absorbs appreciable amounts of acid when present in sufficient quantity to remove nearly all the tannin, and that as the quantity of gelatine is decreased, and consequently the amount of unabsorbed tannin increased, the end point becomes indefinite, and too much acid appears to be estimated. The correct result, therefore, can only be obtained with this method by a compensation of errors.

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[*] Total lactic acid.

[†] J. Amer. L. C. A., 1906, 4. 192.

[*] Since doing this work and writing this article Hoppenstedt has published (J. A. L. C. A., 1907, 301) a slight modification of his quinine method, which he now regards as "very nearly faultless." In this modification "hydrogen peroxide is added for the purpose of removing the action of the substances which tend to darken the filtrate of some liquors before and during titration." It is not clear how this can be, and the improbability of any general applicability still remains.

Gelatine method results.

C.c. of liquor used.	C.c. of gelatine solution used.	C.c. of water added.	C.c. $N/10$ potass. hydrox. for 100 c.c. liquor.
25	5	20	49·2—51·6
25	10	15	49·2—50·8
25	15	10	49·2—50·0
25	20	5	49·2—49·6
25	25	—	48·4
25	30	—	47·6
25	35	—	46·8
25	40	—	46·5
25	45	—	46·3*
25	50	—	46·2*

The magnesia method of Kohnstein and Simand appeared to be soundest in general principle, as it involved no dilution of the liquor, but the estimation of magnesium is a laborious process unless other bases are absent, though in the latter case it is noteworthy that the addition of an excess of standard potassium hydroxide, and the titration of an aliquot portion of the filtrate from this, forms a rapid and accurate method. Some experiments by the authors, however, revealed other defects. In the presence of acetic and formic acids the magnesium salts are capable of taking into solution with them a further quantity of magnesia to form basic salts, so that an error is thereby introduced into the process. Experiments with tannin solutions containing gallic acid moreover yielded filtrates of such deep colour that no results could be obtained; and as it is pretty certain also that all magnesium tannates are not insoluble, a similar defect as the quinine method processes comes again to the front. These considerations, together with the fact that tan liquors may possibly contain magnesium introduced from the lime liquors, indicate that magnesium oxide is hardly the reagent to solve the problem.

After much consideration and some experimental work with other metallic oxides, the authors are inclined to believe that in lead oxide is the solution of the difficulty. This compound when digested (3 grms.) with an acid tan liquor (100 c.c.) dissolves to form lead acetate, formate, etc., which salts are capable of taking into solution further quantities of lead oxide to form basic salts. These latter react with the tannins to form insoluble lead tannates, and more lead oxide goes into solution to re-form the basic lead salts of the various acids. All tannins are precipitated under these circumstances as well as gallic and similar compounds, and the authors are aware of no other agent which will do this. Any sulphuric, oxalic, boric, or carbonic acid in the liquors will also be neutralised by the lead oxide, and as their lead salts are insoluble they will be precipitated. All insoluble compounds are filtered off and a clear filtrate of the lead salts of acetic, formic, and lactic acids is obtained. As these are indefinitely basic, a simple estimation of the lead present is no accurate guide as to the quantities of the acid radicals, but the authors have been able to overcome this difficulty in the following manner. Lead is rapidly estimated (†) by titration of 20 c.c. of the filtrate with $N/10$ potassium ferrocyanide solution in the presence of excess of acetic acid, using uranium acetate as outside indicator, the appearance of the brown colour denoting the end of the reaction. Another 20 c.c. of the filtrate is now taken and the same volume of $N/10$ sulphuric acid is added as the volume of $N/10$ ferrocyanide used in the previous titration. A quantity of sodium sulphate is now added, and the mixture warmed slightly for a short time. In this way all the lead is precipitated as sulphate and the organic acids liberated. These are now readily estimated by the addition of phenolphthalein and titration with $N/10$ potassium hydroxide.

It is clear that this method will estimate certain acids only, and where further information is required the lime water method may be found useful in addition. The method has so far given promising results, but the authors do not yet urge it as thoroughly tested on all classes of liquors. They hope, however, to continue their investigations in this direction and state the method in a form convenient for general application.

It is recognised in the analysis of tanning materials that, apart from basic lead solutions, the only general reagent for the complete precipitation of all tannins is hide powder, and the authors have also in consideration the use of hide-powder in removing tannins for the determination of the acidity of liquors. This has previously been suggested in the so called "zinc oxide and hide-powder method," but in such an absurd form as scarcely to deserve criticism. Hide-powder does not completely absorb all hydroxy-compounds, and will doubtless remove some of the free acid, but it might be possible to so fix the conditions that a correction might be applied for this. A possible method also is to add to the tannin infusion hide-powder prepared as for analysis by the basic chloride shake method, and after agitation to titrate the free acids in solution without removing the hide-powder, just as described by one of the authors* for the determination of free acid in fresh hide-powder. The authors are also making experiments on these lines and hope shortly to publish their results.

DISCUSSION.

Prof. H. R. **PROCTER** said the lime water method was the only one at all largely used in practice. The problem was theoretically a very interesting one as tanning materials contained all sorts of acids, pseudo and semi-acids, and substances which set free hydrogen ions. A result depended very much on the indicator used. He thought the use of lead oxide might in the future have other developments besides that of the estimation of acidity. It might be applied as a means of estimating tannins, although he did not think it would ever supplant the hide powder process.

Mr. F. W. **RICHARDSON** asked whether precautions had been taken to prevent contamination with carbonates, of the caustic potash used in the titration. Aqueous solutions of caustic potash or soda were so liable to absorb carbonic acid gas from the air that he thought it would be advisable to use alcohol for the solution of the alkali.

Mr. W. B. **HILL** said he could confirm the authors' statement as to the unreliability of the quinine or charcoal methods. He had been compelled in practice to fall back on the lime water method.

Mr. H. G. **BENNETT**, in reply, stated that he was quite satisfied that the caustic potash used was pure. If the solution was made up properly with fresh and pure caustic potash and care taken to avoid too much contact with the atmosphere there was no danger from this source. The use of acetone or alcohol as solvent might cause difficulties in the end point as these substances were liable to affect indicators. This was probably often the case to a certain extent when they were used in the technical analysis of oils and fats. Prof. Procter had suggested the employment of sulphuretted hydrogen in place of sulphuric acid for the removal of excess of lead salts, but this had not yet been tested.

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* Tannin just detectable in filtrate.

† Sutton's "Volumetric Analysis," p. 234. Ninth Edition.

* Bennett, this J., 1907, 455.

Journal and Patent Literature.

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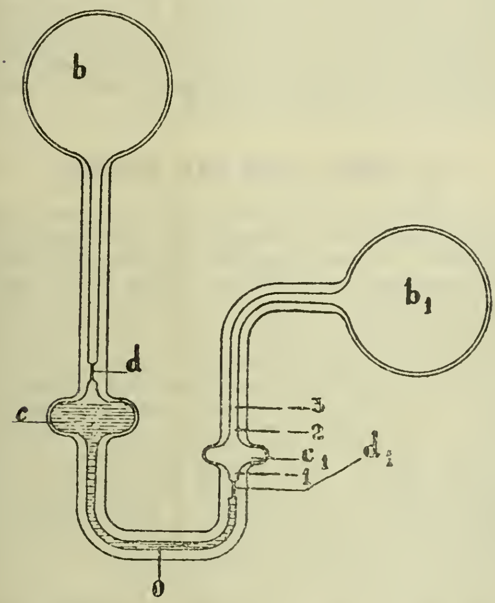
I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Measuring, recording, and indicating the temperature of industrial furnaces or the like; Apparatus for ——. J. E. Symonds, West Drayton. Eng. Pat. 27,064, Nov. 28, 1906.



A DIFFERENTIAL thermometer of the form shown in the figure has the two bulbs, b, b_1, filled with an inert gas, and the U-tube connecting them filled with a liquid which is capable of conducting electricity. Four or more platinum wire contacts, 0, 1, 2, 3, are fused through the glass as shown. Two small flattened bulbs, c, c_1, of inequal volumes are provided to ensure that the volume and pressure of the gas on either side of the liquid are equal when the working end of the liquid is between the contacts, 2, and 3, in order that the thermometer may remain unaffected by a rise in the temperature of the surrounding air. The heat radiated from the furnace, is concentrated upon the bulb, b, by a mirror or lens, and the contacts are connected to external circuits which include a battery and electro-magnets. When the contacts are closed by the movement of the liquid column due to the expansion of the gas in the bulb, b, by the heat from the furnace, their respective electro-magnets are energised and operate either a pen recording on a drum, or else light electric lamps, or ring a bell. A constriction or tap is placed at either end of the fluid column at d, or d_1, to prevent the liquid getting into the bulbs when the apparatus is moved about from place to place, but they do not interfere with the motion of the fluid when the thermometer is in use.—W. H. C.

Regenerative furnaces. F. Brocke, Ulm on the Danube, Germany. Eng. Pat. 5137, March 2, 1907.

SEE Fr. Pat. 375,361 of 1907; this J., 1907, 918.—T. F. B.

Mixing liquids and gases; Apparatus for ——. B. Leuschner, Dresden, Saxony. Eng. Pat. 5189, March 4, 1907.

THE liquid and the gas, both under pressure, enter the mixing-chamber through obliquely inclined slots which cause the jets of liquid and gas to enter in opposed directions to ensure a perfect mixture.—W. H. C.

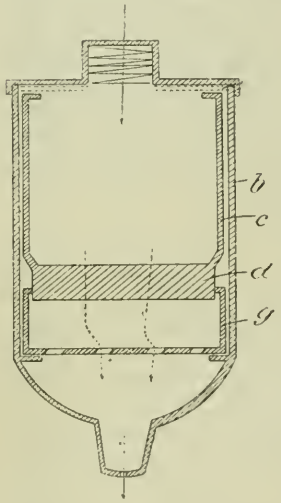
Whisking, churning, and mixing liquid or semi-liquid and pasty or dry powdery matters and compounds; Machines for use in ——. H. Grunow, Middlesex. Eng. Pat. 8640, April 13, 1907.

STIRRERS or beaters are arranged on arms which project from a vertical or horizontal shaft. The mechanism is rotated in a vessel so that not only does the apparatus rotate as a whole, but each stirrer also rotates on the arm on which it is mounted. The material is constrained to keep in the path of the beaters by the shape of the bottom of the vessel which conforms to their outline and by wings which extend above them.—W. H. C.

Freeing gases from solid or liquid particles with which they are charged; Process and apparatus for ——. F. Sepulchre, Liége, Belgium. Eng. Pat. 13,510, June 11, 1907.

THE gases are forced or drawn at a high "rectilinear" speed down a vertical pipe, at the bottom of which a cone causes them to take the form of a narrow annular stream. This issues from the bottom of the tube at a high velocity, and strikes against the surface of a layer of liquid into which an outer tube, surrounding the lower part of the vertical tube, projects. The solid or liquid particles are projected beneath the surface of the liquid, and the purified gas escapes through the outer tube.—W. H. C.

Filters; Liquid ——. L. Wolff, Berlin. Eng. Pat. 13,585, June 12, 1907. Under Int. Conv., Feb. 9, 1907.



THE filtering medium forms the bottom, d, of one or more removable inner casings, c, arranged within the outer vessel, b. By this arrangement, the filtering medium which is attached to the inner casing by any suitable means, *e.g.*, by pressure, can be easily changed. A removable container, g, in which filtering material may be placed, is so disposed in the outer casing as to loosely engage the bottom of the inner casing.—R. L.

Separation of one or more vapours from mixtures of vapour and gas; Process for the ——. P. L. Meurs-Gerken, Steglitz, Germany. Eng. Pat. 14,097, June 18, 1907.

THE separation of any desired vapour from a mixture of vapour and gas is effected by so adjusting the dew-point of the mixture that only the desired vapour shall separate at a predetermined temperature. This adjustment is effected by introducing another portion of gas into the mixture. This gas is previously brought to such a suitable condition of temperature and pressure that while the total pressure of the mixture remains constant, the partial pressure and consequently the dew-point of the vapour it is desired to separate is adjusted. A portion of the same gas previously dried and heated may be employed.
—W. H. C.

Diffusion apparatus. F. Closs, Stuttgart, Germany. U.S. Pat. 868,328, Oct. 15, 1907.

SEE Fr. Pat. 364,223 of 1906; this J., 1906, 898.—T. F. B.

Drying apparatus. J. A. Just, Syracuse, N.Y. U.S. Pat. 868,446, Oct. 15, 1907.

The liquid to be dried is fed on to the surfaces of two hollow drums mounted horizontally so as to rotate in close proximity to one another. One of the drums, or both of them, is perforated. Hot dry air under pressure is forced into the drums, and passes through the perforations and through the liquid on the outside.—W. P. S.

Distillation and rectification apparatus; Segment or tray with multiple and methodical circulation for the columns of ——. E. A. Barbet. Fr. Pat. 379,037, Aug. 28, 1906.

The segments composing the column are rectangular in shape and are divided into a number of compartments by vertical partitions of about half the height of the segment and which extend from side to side. Each partition has an overflow slot, or weir, which is successively of less height as its position recedes from that of the overflow from the segment above. The level of the liquid in each division is constant, and the hoods or caps covering the vapour pipes, of which there are several in each compartment, are so arranged that they are immersed to a constant depth in the liquid which condenses and fills the divisions. The liquid overflows from the segment above into one end of the division at one side of the segment, circulates in a zig-zag manner through the divisions, and overflows from the end of the last division into the segment below.—W. H. C.

Evaporator; Multiple effect ——. E. A. Barbet. Fr. Pat. 379,115, Aug. 30, 1906.

Each effect or unit of the apparatus is composed of a tubular heater and a separator. The length of the tubes is greater than in the ordinary form of apparatus, and the mixture of vapour and liquid passes from the heater to the separator where they are separated, and any salts formed are deposited and withdrawn. The tubes being long and narrow, the circulation is very rapid, the liquid rising in the tubes and returning through the separator. A spare tubular heater is provided which can be coupled to any of the separators in the place of its own heater. When it is necessary to clean out the tubes, the spare heater is connected in the place of the ordinary one, and after the cover of the heater has been removed, the tubes can be brushed out without stopping the work of the rest of the apparatus.—W. H. C.

Evaporator. T. Suzuki. Fr. Pat. 378,978, June 18, 1907.

A reservoir is connected to a vaporising chamber, placed above, by a steam-heated tubular heater which is itself surrounded by an annular chamber forming a secondary evaporator. The liquid is forced upwards through the tubes of the heater by a helical screw situated in the lower reservoir, and after becoming heated, it enters the vaporising chamber in a violent manner. The vapour passes on to a condenser, and the liquid and spray, the latter being stopped by a baffle-plate, flow into the secondary evaporator where they undergo a second heating. The vapour produced here passes through the upper part of the main vaporising chamber to the condenser, and the liquid flows back to the lower reservoir.—W. H. C.

Kilns for calcining pulverulent or granular substances; Rotary gas-fired ——. E. Gobbe. Fr. Pat. 378,701, June 11, 1907. Under Int. Conv., June 23, 1906.

The pulverulent or granular substance to be calcined passes first down through a rotating, inclined, drying cylinder, then through an inclined calcining cylinder, and finally through a cooler, which may consist of either a rotating cylinder or a fixed vertical chamber. Within the drying cylinder, which communicates at its upper end with a chimney and at its lower end receives the hot gases issuing from the calcining cylinder, extend several pipes which open at their upper ends into a common feed-chamber. The substance to be treated is delivered into these pipes, the arrangement being such that the water vapour can only escape from them at the lower ends and is thus prevented from condensing upon the incoming cold substance. The vapour passes back through the outer cylinder to the chimney, along with the hot gases from the calcining cylinder. The latter opens at its lower end into a chamber wherein producer gas and hot air (obtained from the cooler) mingle and burn, the gas-flues being so disposed as to impart a gyratory movement to the burning mixture as it enters and flows up through the cylinder. The calcined substance falls through the combustion chamber into the fixed or rotary cooler, through which is drawn the air required for the combustion of the gas.—H. B.

Liquefaction and separation of gases of low boiling point; Apparatus for ——. G. Hildebrandt. Fr. Pat. 378,918, June 17, 1907.

Those parts of the apparatus which serve for the liquefaction, rectification, or distillation of the gases are constructed of a material which is a bad conductor of heat, strengthened by metallic bands so as to withstand the pressure required. The object of this method of construction is to reduce the undesired transfer of heat from the air to the cold gas.—W. H. C.

II.—FUEL, GAS, AND LIGHT.

Carbon bisulphide; Determination of —— *in a mixture of benzene and carbon bisulphide.* E. P. Harding and J. Doran. J. Amer. Chem. Soc., 1907, **29**, 1476—1480.

Test experiments with mixtures of pure carbon bisulphide and benzene showed that the following simple method gives accurate results. From the mixture of carbon bisulphide and benzene, the former is separated in the form of an aqueous alcoholic solution of potassium xanthate according to the method described by Johnson (this J., 1906, 955). An aliquot portion of the xanthate solution is then acidified with acetic acid, treated with excess of a standard solution of cupric acetate in acetic acid, and filtered. After washing the precipitate, the filtrate is treated with potassium iodide, and the free iodine titrated with thiosulphate. A control titration is also made with a separate portion of the cupric acetate solution. The precipitated copper xanthate has the composition, $(CS.OC_2H_5S)_2Cu$.—A. S.

Carbon bisulphide in illuminating gas; Technical determination of ——. E. P. Harding and J. Doran. J. Amer. Chem. Soc., 1907, **29**, 1480—1482.

The gas is passed first through a meter, then through caustic potash solution (sp. gr. 1·27) for absorption of the carbon dioxide; it is next dried by passing it through concentrated sulphuric acid, and then led through a solution of caustic potash in absolute alcohol. The carbon bisulphide is absorbed, with formation of potassium xanthate, and the latter is treated as described in the preceding abstract.—A. S.

Patents.

Artificial fuel; Manufacture of ——. H. S. Robertson and J. R. Graham, Walthamstow. Eng. Pat. 20,281, Sept. 12, 1906.

Tar, crude naphtha, or other tarry substance is mixed with a hydrocarbon oil, such as petroleum or Texas oil, at a temperature not above 120° F.; after, say, 24 hours' standing, the solid precipitate is separated from the thin fluid and "dried" to a pulverulent mass at a temperature not above 100° F. The thin fluid is heated with about half its weight of resin, to form a thick syrupy mass, which is used subsequently as a binder, either with or without the addition of tarry matter and a little common salt. Any combustible waste material, such as coal washings or sewage sludge, is reduced to a dry powder and mixed with a small proportion of the dried pulverulent precipitate mentioned above; to this mixture is added a suitable small proportion of the binder, and after incorporation, the product is formed into briquettes as usual.—H. B.

Fuel; Artificial ——. The Fuel Patents Synd., Ltd. Fr. Pat. 378,884, June 15, 1907. Under Int. Conv., July 28, 1906.

See Eng. Pat. 17,069 of 1906; this J., 1907, 675.—T. F. B.

Artificial fuel and coke ; Production of ——. Robgrey and Co., Ltd. Fr. Pat. 378,941, June 18, 1907.

See Eng. Pat. 20,281 of 1906 ; preceding.—T. F. B.

Peat ; Process for treating ——. C. U. Greeley. Fr. Pat. 379,206, June 25, 1907.

See U.S. Pat. 863,385 of 1907 ; this J., 1907, 1001.—T. F. B.

Combustibles agglomerated by means of resin ; Process and apparatus for the transformation of ——. G. Dupuy. Fr. Pat. 379,231, June 25, 1907.

Fuel which has been agglomerated by means of resin is converted into a smokeless combustible by subjecting it, in a closed vessel, to the action of a current of hot gas such as superheated steam, whereby the volatile constituents of the resin are carried off without any risk of ignition, the closed vessel being heated on the exterior by the hot gases from the steam-superheating furnace. Various forms of apparatus for carrying out the process are described.—H. B.

Hydrocarbon oils ; Combustion of ——. G. C. Keith, Dulwich. Eng. Pat. 22,122, Oct. 6, 1906.

The oil is injected into the combustion chamber by means of an equal quantity (weight) of steam, preferably under high pressure, and only such a quantity of air or oxygen as is sufficient to support combustion is admitted into the chamber. The latter consists of a comparatively small, partly covered brick compartment with perforated sides. —R. L.

Oils ; Production of —— *for use in explosion motors.* H. H. Lake, London. From Rütgerswerke Akt.-Ges., Berlin. Eng. Pat. 27,629, Dec. 4, 1906.

An oil for explosion motors is prepared by mixing benzol with a coal tar distillate boiling between 100° and 230° C. and free from acids and bases. This fraction of the crude tar oils is subjected to a process of systematic washing with bases and acids, and is then distilled with the aid of steam and in the presence of desulphurising substances such as lead acetate. An addition of 30, 50, 60 or 85 per cent. of this product to commercial benzol has been found to yield a suitable fuel for combustion under 7, 10, 12, and 15—20 atmospheres compression respectively.—R. L.

Hydrocarbon liquid for explosion motors and applicable also for heating, lighting, and like purposes. G. T. B. Cobbett, London. Eng. Pat. 12,606, May 31, 1907. Under Int. Conv., March 15, 1907.

See Fr. Pat. 375,735 of 1907 ; this J., 1907, 957.—T. F. B.

Gas-furnaces ; Regenerative ——. F. C. Siemens, London. Eng. Pat. 13,620, June 12, 1907.

The valves at the ends of the furnace described in Eng. Pat. 14,947 of 1906 (this J., 1907, 12), are simultaneously reversed in the following manner. The two levers from which the valves are suspended have one end of each lengthened and attached to an endless chain which passes over rollers and around a chain wheel. By turning this wheel in one direction, or the other, the two levers are tilted in opposite directions, and the valves are simultaneously reversed. The air-reversing valve is also operated by the same movement of the chain which is attached to an arm or lever projecting from the valve-box.—W. H. C.

Furnace with inclined compartments for the distillation of coal. H. Ries. Fr. Pat. 379,113, June 21, 1907.

In the furnace described, the space between the chambers is expanded upwards into the vault into an enlargement which serves to collect the gas, and into which the shoot for filling the chambers opens. By means of channels arranged in the roof of the chambers, a portion of the heating gases is directed over the lower and middle parts of the inclined chambers, whilst the upper parts are not heated in this way, and thus intense heating of the gas-collecting space is avoided. Channels for the heating gases are arranged in the back wall of the chambers, and communicate with the lateral channels nearest to them, and in this way the back of the chambers is well heated, and complete distillation of the contained material is insured. The chambers are supported in the direction of their length by vertical columns, and rest on massive blocks which form lateral projections ; the wall which separates the channels for the heating gases and for air ends immediately below the projections of the blocks, so that the zone of combustion of the heating gases is situated below the walls of the chambers, in the space bounded on each side by the blocks.—W. C. H.

Gas from garbage or similar gas-producing material ; Compositions for use in the production of ——. L. G. Harris, Canning, Nova Scotia. Eng. Pat. 22,028, Oct. 5, 1906.

Equal weights of a metallic sulphate, preferably ferrous sulphate, caustic potash and caustic lime are thoroughly mixed together with a suitable quantity of hot water, and a farinaceous substance, *e.g.*, flour. After cooling, crude petroleum is added to the mixture, and the composition is finally mixed with or sprinkled upon kitchen garbage or similar material, and the latter subsequently distilled in a suitable retort.—R. L.

Gas-producer. M. V. B. Smith, New York. U.S. Pat. 868,026, Oct. 15, 1907.

The top of the combustion chamber of the producer is in direct open communication with a substantially horizontal conduit. Lengthways within this conduit is a rotary coking chamber, which opens directly into the conduit at its upper end, and at its lower end is in direct communication with the combustion chamber. Means are provided for supplying fresh material to the upper end of the coking chamber, and for regulating the supply in accordance with the speed of rotation of the latter. There is also a supplemental discharge opening from the combustion chamber, arranged at a point below its upper end, and below the normal level of the fuel contained in it, whereby gases evolved in the lower part of the combustion chamber may be discharged, substantially free from gases evolved at a point above the level of the fuel.—W. C. H.

Illuminating gas ; Process of preparing ——. W. H. Gartley, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 868,603, Oct. 15, 1907.

The gas, on its way to the distribution-mains, is gradually cooled from the temperature at which relatively higher-tension vapours cannot remain in liquid form, to a temperature corresponding with that in the mains. The condensation products of the hydrocarbon vapours are made to drop from cooler to hotter zones and thus a continuous return of the high-tension vapours to the gas is secured, during its progressive cooling. The relatively low-tension hydrocarbons which would condense in the mains, are removed from the hottest zone, which is also superheated in order to vaporise the last traces of relatively high-tension hydrocarbons.—W. C. H.

Gas ; Process of making ——. D. A. Short, Cincinnati, Ohio, Assignor to E. F. Spencer, Dayton, Ky., and to A. Reid, College Hill, Ohio. U.S. Pat. 868,710, Oct. 22, 1907.

Producer gas is passed directly from the generator around retorts containing coal, and then, without igniting it, through the flues of a steam generator in order to utilise the remaining heat. The producer gas is afterwards mixed with the gas distilled from the coal in the retorts, and the mixture distributed for use. The coke from the retorts is used to feed the producer.—W. H. C.

Combustible gases ; Producing and distributing ——. M. V. B. Smith, New York. U.S. Pat. 868,717, Oct. 22, 1907.

An automatically fed producer is supplied with a regulated quantity of air through a "wind-box" situated below the grate. The gas which issues from the producer is first passed through a cooler and then into a mixing chamber where a further quantity of air, proportional to that supplied to the producer is added. The mixture is then conveyed by a main to the points where it is to be used and is there passed first through a safety device to prevent explosions or back firing.—W. H. C.

Gas-producers. H. Brüner. Fr. Pat. 378,808, April 11, 1907.

The inventor claims a suction gas-producer, the combustion chamber of which is entirely surrounded by an annular boiler.—W. C. H.

Gas producer. B. Junquera. Fr. Pat. 379,246, June 26, 1907.

Coal is fed into the upper end of a slightly-inclined rotary cylinder, about 15—20 m. long, which is lined with refractory material, the latter having a ribbed surface at the middle part of its length. The lower end of the cylinder communicates with a fixed conical tube, constituting a furnace for pulverised coal, similar to that of a rotary cement kiln. A blast of hot air in excess, with or without steam, is supplied to the pulverised coal, and the gaseous products of combustion, on passing upwards through the coal which is tumbling about in the rotating cylinder, effect the progressive distillation and combustion of the fuel, with formation of producer gas. An outlet for the volatile and gaseous products is provided at the higher end of the cylinder, whilst at the lower end the ashes are discharged through a shoot into a water-sealed ash-pit, the steam rising from which enters the rotary cylinder. When the apparatus has been put in operation, the fixed furnace may be supplied with part of the gas generated, instead of with pulverised coal.—H. B.

Illuminating gas; Manufacture and purification of ——. G. Duncan and W. Hardie, North Shields. Eng. Pat. 29,291, Dec. 22, 1906.

For the removal of naphthalene from coal gas, a solvent, consisting of a mixture of liquid hydrocarbons of the methane and olefine series, is prepared by distilling cannel coal, shale or the like at a low temperature (500° to 900° C.), collecting the liquid hydrocarbon product, distilling the latter, and collecting the fraction having a density below 0·840, and finally subjecting the latter to fractional distillation so as to obtain a fraction having a density of from 0·794 to 0·800.—H. B.

Electric conductors; Method of and means for sealing —— into or through glass or like vitreous material. C. O. Bastian and G. Calvert, London. Eng. Pat. 19,709, Sept. 4, 1906.

In order to provide incandescence lamps and the like with leading-in wires of pure copper or copper alloy, the wires are dipped, at the parts which are to come into contact with the glass, into fused lead chloride, or other suitable fused metallic salt. The coated wire is then inserted into the stem, which is pinched over it to form a seal in the usual way.—H. B.

Plastic mass from tungsten compounds; Manufacture of a ——. Siemens und Halske Akt.-Ges., Berlin. Eng. Pat. 11,716, May 18, 1907. Under Int. Conv., May 19, 1906.

See Fr. Pat. 379,069 of 1907; following.—T. F. B.

Tungsten compounds; Process for obtaining plastic masses by means of —— [for filaments]. Siemens und Halske Akt.-Ges. Fr. Pat. 379,069, May 15, 1907. Under Int. Conv., May 19, 1906.

A solution of the hydrate of tungstic acid in ammonia is boiled until crystallisation begins. The crystals are then heated for a certain time up to 250° C. and then boiled in water to obtain a plastic and tenacious mass, which can be pressed out through suitable orifices in the form of threads.—W. C. H.

Plastic mass [for electric lamp filaments]; Process of preparing a —— with compounds of tungsten. Siemens und Halske A.-G. Fr. Pat. 378,743, June 13, 1907. Under Int. Conv., July 21, 1906.

Acid tungstate of ammonium is heated in the dry state, and preferably in *vacuo*, at about 270° C. until no more ammonia is disengaged. The mass is then heated or boiled with water, when it yields a tenacious, sticky paste, which may be drawn into filaments or may be employed as a binder for a paste of oxides of tungsten used in making tungsten filaments.—H. B.

Filaments for electric glow lamps; Manufacture of metallic ——. H. J. Haddan, London. From Bergmann Elektricitäts-Werke A.-G., Berlin. Eng. Pat. 13,986, June 17, 1907.

See Fr. Pat. 378,917 of 1907; following.—T. F. B.

Filament; Incandescent ——, and process. E. McOuat, New York, and H. W. F. Lorenz, Springfield, Ohio. U.S. Pat. 869,013, Oct. 22, 1907.

The filaments are made by dipping a core into a liquid, carbonisable binding material, in which particles of finely-divided metal and silicon are held in mechanical suspension; the core and its coating are then subjected to the action of heat, to carbonise the binding material of the coating, and to cause the metal and silicon to combine to form a silicide.—W. C. H.

Filaments for electric lamps; Process of manufacture of —— from difficultly fusible metals. Bergmann-Elektricitäts-Werke Akt.-Ges. Fr. Pat. 378,917, June 17, 1907.

Electric lamp filaments composed of difficultly fusible metals, such as niobium, tantalum, molybdenum, tungsten, uranium, titanium, thorium, zirconium, etc., are made by mixing the metal, in the form of powder, with a solution of ammonium sulphide to yield a plastic mass. By this method, any subsequent reducing treatment for the removal of the binding material, is rendered unnecessary.—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum from glycerides; Synthetic preparation of optically-active ——. J. Lewkowitsch. Ber., 1907, **40**, 4161—4162.

By distilling glycerides in presence of zinc dust, a mixture of hydrocarbons resembling crude pertoleum is obtained. The author applied this method to the strongly optically-active chaulmoogra oil (this J., 1904, 669; 1905, 741; 1907, 420), and obtained, besides uncondensable gases with an odour of petroleum hydrocarbons, a liquid which was free from fatty acids and glycerides. It could be almost completely distilled in a vacuum and had the odour characteristic of the higher-boiling fractions of natural petroleum. This artificial "crude petroleum," as also its distillates, were found to be strongly dextro-rotatory in chloroform solution. These results show that optically-active hydrocarbons can be produced from optically-active fats, the activity of which is due exclusively to the configuration of their fatty acids.—A. S.

Petroleum; Formation of ——. C. Neuberg. Chem.-Zeit., 1907, **31**, 961.

The author found that the fatty acids formed in the putrefaction of albumin are optically active, and succeeded in isolating dextro-rotatory caproic and valeric acids. Further, by distilling a mixture of oleic acid with these optically-active fatty acids, a dextro-rotatory "petroleum" was produced, possessing all the characteristic properties of natural petroleum; the optical activity increased to a maximum with rising specific gravity of the "petroleum," and then again became less.
—A. S.

Carbon bisulphide; Determination of —— in a mixture of benzene and carbon bisulphide. E. P. Harding and J. Doran. *See* II.

Petroleum industry of the United States. Oil, Paint, and Drug Rep., Nov. 4, 1907. [T.R.]

The official report of the production of petroleum in the United States during 1906 covers separately each section of the country known as a producer, and treats of their respective yields, the value of the output, the cost of production, the transportation facilities, the peculiarities of the soil or rock formation and the methods of drilling.

The official estimate for 1906 gives the aggregate yield from all fields as 126,493,936 barrels, valued at $92,444,735, an average of 73·1 cents per barrel, as against 134,717,580 barrels, valued at $84,157,399 in 1905, an average price of only 62·5 cents per barrel.

Attention is called to the advance made in the mid-continent and Illinois fields, where the area has been considerably extended and the production proportionately increased. Stress is also laid upon the growth of consumption of fuel oil in California, which during 1906 exceeded the total production in the State. Attention is drawn at the same time to the decline in the quota of oil furnished from the pools of the Coastal Plain district of the Gulf States, and to the steady falling off in the daily average production of the Appalachian field. Another feature of importance has been the laying of the second pipe line from the mid-continent field to Whiting, Ind., and of the building of another across the Isthmus of Panama, which has facilitated to no small extent the delivery of California oil at Atlantic ports.

Of the total production of petroleum, the Appalachian field yielded 27,741,472 barrels, the Lima-Indiana-Illinois field 21,951,711 barrels, the mid-continent field 21,718,648 barrels, the Gulf field 21,645,425 barrels, the California field 33,098,598 barrels, and other scattered districts 338,082 barrels.

The output of the Appalachian fields has decreased by over 8,500,000 barrels since 1900, and this section will continue to fall off each year, as there are now left few untested areas within the limits of the field. The Lima-Indiana-Illinois field showed a decreased yield of 523,544 barrels, which would have been still heavier but for a large new producing area in Illinois that brought the yield of this section from 181,084 barrels in 1905 up to 4,397,050 barrels in 1906. The mid-continent field has increased rapidly since 1902 and helped materially to swell the total United States production of illuminating oil to 71,749,913 barrels.

The Appalachian field is noted for oil of paraffin base of the very best quality. The Lima-Indiana-Illinois field furnishes oil of paraffin base, but contains sulphur. Oil from the mid-continent field has a mixed asphaltic and paraffin base, but the quality varies with the section of supply. The production of the Gulf field has an asphaltic base, and is particularly adapted to the manufacture of lubricants and for fuel purposes. Californian oil has also an asphaltic base.

Considerable space is given to the geology of the different fields and to the transportation facilities of each. The several States in which oil is produced are described, the respective yields and the conditions, geological and otherwise, which govern them being given. These oil-producing States are New York, Pennsylvania, West Virginia, Kentucky, Tennessee, Ohio, Indiana, Illinois, Kansas, Oklahoma, Indian Territory, Texas, Louisiana, California, Wyoming, Colorado, Missouri and Michigan.

During 1906, 10,290 miles of railroad were operated entirely by fuel oil, and 868 miles partially run by the same motive power. The total consumption of oil for the purpose aggregated 15,577,677 barrels, of which California is estimated to have furnished 9,563,314 barrels. It is expected in view of the rapidly increasing demand for fuel to generate steam that the domestic consumption of California fuel oil might within a few years be increased to 50,000,000 barrels a year.

Asphaltum mines in Syria. Mining World, Nov. 2, 1907. [T.R.]

The asphaltum mines lie near Kferie village, 30 miles northeast of the port of Latakia, on the Aleppo road. They form part of a hill 900 ft. in height called Yebel Kferie. At 216 ft. the asphaltum layers are found over a length of 4,500 ft., and a thickness of seams of 4,200 ft. The seams lie in a single compact mass estimated at from 150,000,000 to 200,000,000 tons.

Patents.

Tar from gaseous products of dry distillation; Method of eliminating —— for the purpose of producing acetate solutions. M. Klar, Hanover, Germany. U.S. Pat. 868,347, Oct. 15, 1907.

This method of directly separating tar from distillation gases or from pyroligneous acid, consists in passing the gases, or the pyroligneous acid, still rich in tar, through a series of chambers containing distillates, the temperature of each chamber being progressively lowered, and arranged to correspond with the composition of the distillate contained in it.—W. C. H.

Anthracene of high percentage; Process for preparing—— from crude anthracene. Act.-Ges. f. Anilinfabr. Ger. Pat. 178,764, Jan. 7, 1906.

Potassium hydroxide is added to melted crude anthracene, which is then distilled *in vacuo*, the anthracene distilling over being passed into some solvent in which it is soluble at the temperature of the reaction, and from which it crystallises on cooling. It is stated that 95 to 96 per cent. of the anthracene is recovered as a product containing 95 to 98 per cent. of pure anthracene.—T. F. B.

Mineral oils; Method of deodorising and desulphurating ——. G. H. Hellsing, Rabäck, Sweden. Eng. Pat. 9180, April 19, 1907. Under Int. Conv., April 30, 1906.

See Fr. Pat. 377,197 of 1907; this J., 1907, 1043.—T. F. B.

Petroleum or other mineral oils; Process of saponifying ——, and transformation of the resulting product with a view to its application for various purposes. V. J. Kuess. Fr. Pat. 379,148, June 22, 1907.

Ten kilos. of an animal fat and 10 kilos. of a saponifiable vegetable substance, *e.g.*, rosin, are melted together and mixed with 100 litres of light petroleum (sp. gr. about 0·82). The mixture is treated with a hot solution of 9 kilos. of caustic potash in 12 litres of water, and when saponification is just beginning (after $\frac{1}{2}$—1 hour), is introduced into 12 litres of water which has been boiled with 3 kilos. of boric acid or other boron compound, until half of the latter has dissolved. After 2 or 3 days, the mixture has solidified, and may then be transformed into a soap, by melting it at a temperature of 106—112° C., and heating for 16 hours with a solution of 10 kilos. of caustic potash in 60 litres of water, and 1 kilo. of boric acid.—A. S.

U.S. Pat. 867,704. *Fibrous Tow. See* V.

IV.—COLOURING MATTERS AND DYESTUFFS.

Indican. Part I. A. G. Perkin and W. P. Bloxam. Chem. Soc. Trans., 1907, **91**, 1715—1728.

Anhydrous indican can be readily prepared by dissolving the crude glucoside, containing water of crystallisation (this J., 1907, 522), in three parts of boiling absolute alcohol, filtering the solution, if necessary, with the aid of a vacuum, and then adding boiling benzene to the hot liquid until a turbidity is produced. If the liquid separates into two layers, a drop or two of alcohol is added. On cooling, small colourless prisms of indican separate, and the deposition is hastened by agitation; a yield of 70 per cent. is obtained. Anhydrous indican is somewhat sparingly soluble in boiling absolute alcohol and in acetone. On hydrolysis with dilute acids in presence of isatin, indican gives a quantitative yield of indirubin, and this reaction can be used for the determination of indican (compare Orchardson, Wood, and Bloxam, this J., 1907, 4). On hydrolysis in presence of oxidising agents, however, it was not found possible to obtain a quantitative yield of indigotin. On boiling indican with dilute sulphuric acid in absence of air, dextrose is produced, but the indoxyl simultaneously formed condenses with separation of brown amorphous substances and the production of a trace of indole. The brown product was extracted with boiling alcohol, and the solution, after concentration, treated with ether. The brown amorphous substance thus precipitated, which the authors name *indoxyl-brown*, has a percentage composition almost identical with that of the chief constituent of indigo-brown (this J., 1907, 464): it closely resembles the latter substance, but is more soluble in alcohol. This tends to confirm the authors' view (this J., 1907, 464) that indigo-brown is a derivative of indoxyl and may be formed as the result of a secondary reaction during the manufacture of indigo from the plant. (See this also J., 1900, 1100.)—A. S.

Patents.

Colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 4235, Feb. 20, 1907.

See Addition of Feb. 22, 1907, to Fr. Pat. 365,920 of 1906; this J., 1907, 960.—T. F. B.

Anthracene dyestuff and process of making same. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 868,399, Oct. 15, 1907.

See Fr. Pat. 379,034 of 1907: following.—T. F. B.

Dyestuffs of the anthracene series; Production of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 379,034, June 20, 1907. Under Int. Conv., Nov. 2, 1906.

When hydroxyanthraquinones or their derivatives are treated with formaldehyde and a sulphite in alkaline solution, new dyestuffs are obtained which are readily soluble in water. Example: 10 kilos. of a 10 per cent. paste of hexahydroxyanthraquinone are thoroughly mixed with 100 kilos. of a 30 per cent. solution of neutral sodium sulphite and 60 kilos. of caustic soda (30° B.). 5—6 kilos. of formaldehyde (30 per cent.) are now added and the mixture heated for 3 to 5 hours to 90—100° C. On cooling, 100 litres of hydrochloric acid (30 per cent.) are added, and the dyestuff salted out. It is obtained as a dark brown powder soluble in water with a bluish-red colour; it gives a blue solution with caustic soda and a violet one with concentrated sulphuric acid, becoming red on dilution. The dyestuff produces very fast shades on mordanted cotton.—J. C. C.

p-Diaminoanthrarufine and of p-diaminochrysazine; Manufacture of the monosulphonic acids of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 5841, March 11, 1907.

See Fr. Pat. 376,109 of 1907; this J., 1907, 960.—T. F. B.

Indigo; Manufacture of bromo-derivatives of ——. O. Imray, London. From Soc. Chem. Ind. in Basle, Basle, Switzerland. Eng. Pat. 6105, March 13, 1907.

See Addition of March 18, 1907, to Fr. Pat. 375,514 of 1907; this J., 1907, 961.—T. F. B.

Vat dyestuffs; Manufacture of —— [*from indirubin*]. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 6106, March 13, 1907.

See Addition to Fr. Pat. 372,627 of 1907; this J., 1907, 1135.—T. F. B.

Dyestuff; Process of making a halogenated red ——. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 867,714, Oct. 8, 1907.

A red vat dyestuff is obtained by treating the product of condensation of molecular proportions of α-hydroxythionaphthene and isatin with a mixture of concentrated hydrochloric and nitric acids.—J. C. C.

Vat dyestuff; Halogenated red —— and process of making same. G. Engi, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 867,715, Oct. 8, 1907.

When thioindigo is treated with bromine in presence of nitrobenzene a bromo-derivative is obtained which is a greyish-violet crystalline powder yielding a pale yellow coloured vat from which unmordanted cotton is dyed in Bordeaux red shades.—J. C. C.

Nitro-compounds; Manufacture of ——. R. Wolffenstein and O. Boeters, Berlin. Eng. Pat. 17,521, July 31, 1907. Under Int. Conv., Aug. 3, 1906.

It has been found that if an aromatic substance be treated with nitric acid in presence of mercury or mercury compounds, both the nitro-group and the hydroxyl group are simultaneously introduced into the benzene nucleus. Example: 400 grms. of benzene are heated with 600 grms. of nitric acid (sp. gr. 1·48) and 50 grms. of mercury nitrate on a water-bath. The product after separation from the aqueous solution, is shaken with alkali, which dissolves the picric acid formed and leaves nitrobenzene, simultaneously formed. 180 grms. of picric acid are obtained in this way.—J. C. C.

Gallocyanines; Manufacture of new ——. Farbwerke vorm. L. Durand Huguenin und Co., Hüningen, Germany. Eng. Pat. 19,002, Aug. 23, 1907. Under Int. Conv., June 4, 1907.

Sulphonated Gallocyanines, containing the sulphonic group in the gallic acid nucleus, are obtained by condensing nitroso-monoalkylarylamines, -dialkylarylamines or -diarylamines with pyrogallolsulphonic acid. For example: a mixture of 200 litres of methyl alcohol, 22 kilos. of pyrogallolsulphonic acid, and 30 kilos. of nitrosodimethylaniline hydrochloride is boiled in a reflux apparatus until the whole of the nitroso-compound is decomposed. After cooling and filtering, the residue is dissolved in 1000 litres of warm water containing 10 kilos. of sodium carbonate. This is filtered, and the dyestuff salted out. The sulphonated Gallocyanines, produced in this way are black powders which dissolve in an aqueous solution of sodium acetate or of an alkali to a blue solution. Wool, whether previously chromed or not, is dyed blue, and cotton mordanted with chromium compounds and printed with a pattern in a discharge, is dyed blue with pure whites.—J. C. C.

Gallocyanines; Manufacture of new ——. Farbwerke vorm. L. Durand Huguenin und Co., Hüningen, Germany. Eng. Pat. 19,003, Aug. 23, 1907. Under Int. Conv., June 4, 1907.

If monoalkylamines are used instead of dialkylamines in the manufacture of Gallocyanines, products are obtained which dye in pure violet tints. These dyestuffs can also be transformed into nitrosoamine derivatives.—J. C. C.

Gallocyanines; Process for the preparation of condensation products of —— with amines. Manuf. de Mat. Col. ancien. L. Durand, Huguenin, et Cie. Fr. Pat. 378,923, June 17, 1907. Under Int. Conv., Nov. 19, 1906.

The difficulties met with in condensing Gallocyanines with amines can be avoided by carrying out the process in presence of an aromatic nitro-hydrocarbon or other reducible substance. For example: 50 kilos. of Gallocyanine (from gallic acid and nitrosodimethylaniline) are mixed with 30 kilos. of aniline and 120 kilos. of nitrobenzene the whole is heated for 4 hours to 100° C., when 100 kilos. of nitrobenzene are added, and the product filtered. Trinitronaphthalene is also mentioned as a suitable reagent.—J. C. C.

Vat dyestuff; Red-violet ——, *and process of making same.* A. Schmidt and W. Bertram, Assignors to Farbwerke vorm, Meister, Lucius und Brüning, Höchst-on-the-Maine, Germany. U.S. Pat. 867,679, Oct. 8, 1907.

A red-violet vat dyestuff is obtained by heating 3 : 5-dichlorophenylthioglycollic-o-carboxylic acid with bisulphites; it is a violet-black powder giving a green colour in concentrated sulphuric acid.—J. C. C.

Phenylglycine and its homologues; Process of producing ——. R. Schmidlin, Assignor to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 868,294, Oct. 15, 1907.

See Eng. Pat. 9774 of 1906; this J., 1907, 15.—T. F. B.

Vat dyestuff, and process of making same. A. Schmidt, Assignor to Farbwerke vorm. Meister, Lucius und Brüning, Hoechst-on-the-Maine, Germany. U.S. Pat. 868,295, Oct. 15, 1907.

VAT dyestuffs are obtained by heating arylthioglycollic-*o*-carboxylic acids with bisulphites under pressure. The dyestuff, $C_{16}H_6O_2S_2(CH_3)_2 = 1 : 3$, obtained in this way from tolylthioglycollic-*o*-carboxylic acid ($S.CH_2.CO_2H : CH_3 : CO_2H = 1 : 3 : 6$) is a red powder giving a dark yellowish-green solution in concentrated sulphuric acid and a violet-red solution in hot nitrobenzene.—J. C. C.

Indigo, etc.; Process of making ——. H. Belart, Huddersfield. U.S. Pat. 868,755, Oct. 22, 1907.

SEE Fr. Pat. 369,907 of 1906; this J., 1907, 195.—T. F. B.

p-Aminodiphenylaminesulphonic acid and process of making the same. E. Erdmann, Halle on Saale, Assignor to Act.-Ges. f. Anilinfabr., Berlin. U.S. Pat. 869,073, Oct. 22, 1907.

SEE Eng. Pat. 13,772 of 1906; this J., 1907, 146.—T. F. B.

Anthraflavic acid, Ger. Pats. 179,916; *Trichloranthraflavic acid,* 181,659. *See* XX.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Decolorisation of coloured liquids by different forms of charcoal; Cause of the ——. F. Glassner and W. Suida. Annalen, 1907, **357**, 95—128.

THE authors have studied the absorption of a large number of dyestuffs by various forms of charcoal from aqueous solutions. They find that: (1), charcoals from vegetable sources, when free from nitrogen and containing small amounts of ash, exhibit a very slight capacity for absorbing dyestuffs of whatever nature; (2), animal charcoals, containing nitrogen, show very different capacities of absorption; the extent of this seems to depend not only on the nitrogen and hydrogen contents but also on the amount of ash present and its composition. In view of the possibility of the formation of cyanogen derivatives in the preparation of animal charcoals, experiments were conducted on the fixation of dyestuffs by various cyanogen compounds with the following results:—(1) Potassium cyanide in cold aqueous solution precipitates certain basic dyestuffs such as Magenta, Crystal Violet, and Nile Blue, whilst Methylene Blue and Alkali Blue are not precipitated. Neither the acid dyestuffs nor the dye-acids are altered by this reagent. (2). Potassium ferro- and ferricyanides, as is well known, precipitate basic dyestuffs but not dye-acids or their salts. (3). Potassium cyanate does not precipitate basic or acid dyestuffs or dye-acids. (4). Potassium and ammonium thiocyanates precipitate basic dyestuffs, but no precipitate is obtained with the acid dyestuffs or dye-acids. (5). Cyanuric acid when warmed with solutions of basic dyestuffs gives sparingly soluble, well crystallised, deeply coloured precipitates; from hot solutions of acid dyestuffs or dye-acids the cyanuric acid crystallises out on cooling. (6) Melanuric acid gives deep-coloured precipitates on warming with solutions of basic dyestuffs, but does not react in this way with acid dyestuffs or dye-acids. (7) Ammeline behaves similarly to melanuric acid. (8) Melamine when warmed with solutions of acid dyestuffs or dye-acids completely decolorises them, whilst solutions of basic dyestuffs are precipitated only on long standing. The precipitates with acid dyestuffs yield no dyestuff on treatment with alcohol. (9) Melam behaves like melamine: it also decolorises solutions of molasses, raw sugar or tannin to the extent of more than 50 per cent. The precipitates obtained with dye-acids or acid dyestuffs do not yield the dyestuffs either with alcohol or dilute acids, but the compounds are decomposed by sodium hydroxide.

These results confirm the anticipations of the authors that the origin of the absorptive power may be due to the presence of cyanogen compounds, and further confirmation was adduced by heating an inactive animal charcoal, containing a high percentage of nitrogen, with potash whereby an extremely absorptive charcoal was obtained. Even sugar charcoal, by this treatment, showed an increased activity, which was found to be due to the presence of cyanogen compounds, these having been evidently formed by the fixation of atmospheric nitrogen. (See also Knecht, this J., 1907, 949.)—J. C. C.

Hydrogen peroxide; Determination of —— *on cotton tissues.* A. Scheurer. Bull. Soc. Ind. Mulhouse, 1907, **77**, 336—337.

As a strip of bleached calico, when introduced into 150—200 c.c. of water which has been tinted pink with potassium permanganate, does not completely reduce the latter compound in less than two minutes, it was considered practicable to estimate approximately by means of this reagent the amount of hydrogen peroxide contained in a sample of a cotton tissue. This method was employed in determining the influences of drying and steaming upon the hydrogen peroxide present in a bleached cotton tissue which had been immersed in a hydrogen peroxide solution, 10 grm.-samples of the tissue being immersed in 10 grms. of the solution and then variously treated. The following results were obtained:—

	No. of c.c. of potassium permanganate solution (3 per cent.) required.
1. Titration performed immediately after saturating the tissue	25·8—24·2
2. After suspending the tissue in the air till half the solution had evaporated	17·6
3. After drying in the air	11·4—9·6
4. After drying in the air and placing on a heated copper cylinder, wrapped with calico to prevent direct contact of the strip of tissue with the metal	7·6
5. Air-dried and steamed at 100° C. for 2 minutes	6·2
6. Air-dried and steamed at 100° C. for 4 minutes	2·6
7. Air-dried and steamed at 100° C. for 8 minutes	2·2
8. Air-dried and steamed at 100° C. for 16 minutes	1·6
9. Air-dried and steamed at 100° C. for 32 minutes	0·0

From these results it would appear that, when the drying is effected by the air, the hydrogen peroxide solution becomes considerably concentrated in the cotton, and that drying upon heated cylinders only slowly decomposes the peroxide present.

The method cannot be used in estimating hydrogen peroxide in the presence of wool, as this fibre reduces the permanganate too rapidly.—E. B.

Dyestuffs fixed on cotton fabrics; Action of light on ——, *with collateral influence of heat and moisture.* A. Scheurer. Bull. Soc. Ind. Mulhouse. 1907, **77**, 328—329.

STRIPS, 1 cm. wide, of calico dyed or printed with Indigo (in three shades, dark, medium, and pale), Alizarin Blue (on chrome mordant), Alizarin Viridin (chrome), Alizarin Yellow (chrome), Alizarin Orange (alumina), Alizarin (alumina), were attached to two glass cylinders and exposed to light at a window facing the south. Thermometers were inserted into both cylinders through corks fitted into their tops. A current of cold water was passed through one of the cylinders while the exposure was made. The strips were exposed for 3 weeks in June and July. The temperatures, recorded at intervals daily, were on the average as follows:

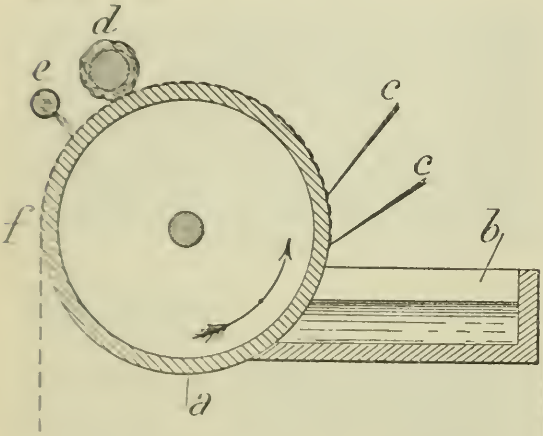
	At 10 a.m.	Noon.	2 p.m.	4 p.m.
Cylinder empty	23°	37°	37°	33° C.
Cylinder cooled	22°	20°	21°	21·5° C.

The strips exposed on the cooled cylinder were alone affected, the Indigo-dyed strips being considerably changed, the others less so. The difference in the action is, it is believed, due to the different degrees of humidity obtaining in the two cases, the relative humidities being at noon in the ratio of 50 : 17.—E. B.

Carbon ; Adsorption of iodine by ——. O. C. M. Davis. *See* XXIV.

Patents.

Fabrics ; Process for the manufacture of artificial ——. Ste. H. Pervilhac & Co., Villeurbanne, France. Eng. Pat. 13,518, June 11, 1907. Under Int. Conv., Feb. 19, 1907.



Artificial fabrics with plain or pattern-formed meshes are produced by filling the recesses of an engraved surface with a viscous substance, this being detached after sufficient solidification. The process is carried out by means of the apparatus shown in the figure. The viscous substance contained in the trough, *b*, is taken up by the engraved roller, *a*, excess being removed by the "strickles," *c*, *c*. It is now subjected to the action of suitable products by means of rollers, *d*, and blowers, *e*. The roller, *a*, can be heated internally if necessary, and the finished fabric is detached at *f*, the speed of rotation being regulated so as to produce a continuous tissue.—J. C. C.

Filaments, films and other cellulose products from a cuprammonium solution of cellulose ; Manufacture of ——. Soc. La Soie Artificielle. Fr. Pat. 379,000, Aug. 27, 1906.

The ammoniacal-copper solution is forced into a precipitating bath of caustic alkali solution, having a temperature of 40°—60° C. The addition of soluble salts, such as sodium chloride, to this bath, causes a more energetic liberation of ammonia and also permits of the use of a weaker solution of caustic alkali as the precipitant. —P. F. C.

Fibrous tow ; Process for treating [degumming] —— *[with liquid from waste liquors from petroleum refineries]*. M. H. Colahan, Chicago. U.S. Pat. 867,704, Oct. 8, 1907.

Flax, tow, hemp or other fibre is degummed by treating it with a solvent produced from the liquid obtained in the manufacture and washing of petroleum oils, known as "white water," which contains traces of hydrocarbons, acids, and alkalis. This is mixed with a small quantity of paraffin oil and the whole blended by agitation and heat.—J. C. C.

Liquids ; Process and apparatus for imparting to —— *certain special [cleansing] properties by the action of light and of metals.* C. Neff and A. Brandes. Fr. Pat. 378,877, June 15, 1907.

See Eng. Pat. 12,258 of 1907 ; this J., 1907, 1129.—T. F. B.

Mercerised fabrics ; Process and apparatus for treating ——. R. Kirchhof. Fr. Pat. 378,826, May 15, 1907.

The material, after being impregnated with the mercerising solution, is subjected, whilst in a stretched condition, to the action of dilute acid. As soon as the alkali is completely neutralised, the fabric loses its elasticity but not its extensibility, and this latter property is then utilised by gradually increasing the stretching force which is being exerted on the material. The apparatus used consists of a stretching frame having clips and guiding devices made of some substance which is unaffected by acids. The acid is discharged on to the material by perforated tubes, arranged above the machine, and the excess of acid is collected in tin-plated receivers and used for a second time.—P. F. C.

Gassing threads ; An electrical process for ——. G. H. Gin. Fr. Pat. 379,023, June 20, 1907. Under Int. Conv., May 1, 1907. See Eng. Pat. 4550 of 1907 (this J., 1907, 868).

In order to keep each tube perfectly straight, it is subjected to a constant tension in a longitudinal direction.—P. F. C.

Indigo vat ; Preparation of an —— *[electrolytically]*. H. Chaumat. Fr. Pat. 379,041, Aug. 28, 1906.

A current of electricity is passed through a solution of a salt of an alkali or alkaline-earth metal, preferably sodium carbonate. The anode is composed of carbon or some unoxidisable metal. The cathode is prepared by intimately mixing finely powdered indigo blue with powdered graphite, or some metallic powder. This mixture is then stuffed into a bag which is arranged round a metallic or carbon rod. The solution through which the current is passed, is preserved from contact with air by covering it with a layer of oil or by working in an atmosphere of carbon dioxide. When the current is passed through the solution, the hydrogen liberated at the cathode reduces the indigo to indigo white and this compound is immediately dissolved in alkali which is also formed at the cathode in just the required quantity for complete solution.—P. F. C.

Sulphide dyestuffs [on the fibre] ; Process for treating —— *with hydrogen peroxide.* Kalle und Co. Ger. Pat. 185,688, March 6, 1902.

Ammonium acetate is added to the hydrogen peroxide solution used for "developing" sulphide dyestuffs. The solution is thus rendered more stable than in the usual process, in which alkali is used.—T. F. B.

Dyeing vegetable fibres, fabrics, etc. ; Process for ——. Farbwerke vorm. Meister, Lucius, und Brüning. Ger. Pat. 183,553, March 10, 1905.

Vegetable fibres or fabrics are padded with hot mixtures of the leuco-base of the dyestuff, glucose, and a sufficient quantity of alkali to mercerise the fibre. They are then immersed in water and allowed to oxidise.—T. F. B.

Fabrics dyed in the piece ; Process for producing two- or many-coloured effects on ——. O. Budde und Co. Ger. Pat. 182,043, July 16, 1905.

A portion of the yarn for the fabric is impregnated with an insoluble metallic powder, which will reduce sulphurous acid to hydrosulphurous acid ; the fabric is then dyed with a dyestuff stable towards sulphurous acid but reducible by hydrosulphurous acid, and finally passed through sulphurous acid. Before it is impregnated with the metallic powder, the yarn may be dyed with a dyestuff which is not reduced by hydrosulphurous acid. Half-wool fabrics may be dyed with an azo dyestuff reducible by hydrosulphite, a white discharge printed on, and the fabric dyed with dyestuffs having an affinity for wool only.—T. F. B.

Dyeing animal fibres black ; Process for making an easily soluble preparation for ——. C. Feuerstein. Ger. Pat. 183,626, Oct. 19, 1905.

The preparation consists of a mixture of dinitroresorcinol, glycerin, and the disazo dyestuff from aminosalicylic acid-azo-*a*-naphthylamine and naphtholsulphonic acid NW (Diamond Black). The glycerin prevents the formation of an insoluble compound of the other two components in presence of iron-mordanted fibres in the hot dye-bath. —T. F. B.

Printing textiles or paper; Process of ——. W. Beer. Fr. Pat. 378,729, June 12, 1907.

Multicolour printing is effected in one operation by applying colours to the material by means of a porous surface on the back of which the colours are distributed and kept separate by suitable partitions. The form taken by the porous surface is preferably that of a cylinder, and the colours are supplied to its internal surface.—J. C. C.

Cotton goods, woollens, silk, paper, wood, hemp, and other analogous substances; Solution for use with —— *for rendering the same capable of resisting fire.* G. W. Wilkins, Penshurst, Victoria. Eng. Pat. 9300, April 22, 1907.

See Fr. Pat. 377,223 of 1907; this J., 1907, 1046.—T. F. B.

Drying fans [for fabrics]. G. Masurel-Leclercq, Roubaix, France. Eng. Pat. 10,533, May 6, 1907.

Instead of a single fan extending the whole length of the shaft, the effect of which is to dry the fabric in the middle rather than at the ends, two separate fans are employed. They are mounted on a single shaft and are rotated together. An adjustable interval is left between them and the quantity of air drawn in at the ends is reduced by adjustable rings so that the fabric is dried equally over its whole surface.—W. H. C.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Patents.

Colouring matter for leather; Pulverulent ——. C. Reinhold, Hanover, Germany. U.S. Pat. 868,008, Oct. 15, 1907.

See Fr. Pat. 378,876 of 1907, following.—T. F. B.

Dyestuff for leather; Process for the manufacture of —— *in the form of a powder.* C. Reinhold and C. Palm. Fr. Pat. 378,876, June 15, 1907.

The dyestuff is mixed into a paste with oil or fat, and talc is added till a dry but dustless powder is obtained. This, rubbed into the leather, gives a uniform and permanent stain and a polished surface.—S. R. T.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Lime, nitric acid, and water; The system ——. F. K. Cameron and W. O. Robinson. J. of Phys. Chem., 1907, 11, 273—278.

The solubility curves and the corresponding solid phases were determined for the system: lime (CaO), nitric acid (N_2O_5), and water at 25° C., the lime being in excess. In general it was necessary to shake for 1—2 months before equilibrium was attained. The curve, A E, constructed with the concentrations of lime as ordinates and of calcium nitrate as abscissæ, shows three breaks at B, C, and D, the concentrations at these points being given in the following table:—

	Grms. of CaO (as $CaOH)_2$ per 100 grms. of water.	Grms. of $Ca(NO_3)_2$ per 100 grms. of water.
A	0·118	0·00
B	0·170	20·73
C	0·440	83·03
D	0·203	135·3
E	0·000	139·30

The solid phases corresponding to the different portions of the curve are: A B, pure calcium hydroxide; B C, a series of solid solutions of varying composition; C D, long needles of basic calcium nitrate, $2CaO,N_2O_5,3\frac{1}{2}H_2O$; D E, calcium nitrate, $Ca(NO_3)_2,4H_2O$. The crystals of basic calcium nitrate lose water rapidly when exposed to the air, and yield a more or less dehydrated product, similar to the commercial basic calcium nitrate produced in the Birkeland-Eyde process (see this J., 1906, 27, 79). —A. S.

Chlorides or bromides in the presence of thiocyanates; Determination of ——. M. A. Rosanoff and A. E. Hill. J. Amer. Chem. Soc., 1907, 29, 1467–1475.

The sum of the chloride (or bromide) and thiocyanate is first determined by precipitating with an excess of silver nitrate, and titrating the excess with ammonium thiocyanate, according to Volhard's method (see this J., 1907, 642). In a second portion of the mixture, the thiocyanate is oxidised to hydrocyanic acid by means of nitric acid, and after expelling nearly all of the hydrocyanic acid, the chloride or bromide is determined by Volhard's method. In carrying out the oxidation process, the solution of the mixed salts is diluted until the concentration of the chloride is about *N*/50 (*N*/100 in the case of bromides), treated with 1 c.c. of a saturated solution of iron-ammonium alum acidified with nitric acid, heated to boiling, and concentrated nitric acid added gradually (3 drops per minute), with frequent stirring, until the colour of the liquid fades to a pale orange. After continuing the boiling, without addition of more acid, for a few minutes longer, the solution is well cooled, and treated with about one-third of its volume (one-sixth in the case of bromides) of concentrated nitric acid, and the chloride or bromide determined by Volhard's method. —A. S.

Iodates in presence of chlorates; Determination of ——. W. H. Gibson and C. M. W. Grieb. Analyst, 1907, 32, 381.

The method is based on the fact that iodine is liberated from an acetic acid solution of potassium iodide by potassium iodate but not by potassium chlorate. The solution containing the iodate and chlorate is treated with a large excess of acetic acid, and then an excess of potassium iodide is added; the liberated iodine is titrated with thiosulphate.—A. S.

Lead acetate; Reaction between carbonic acid and —— *in an aqueous solution.* J. Yamasaki. Mem. Coll. Science and Engin., Kyoto Imp. Univ., 1906-7, 1, 176—182, 274—275.

Working at a temperature of 25° C., the author found that the precipitate produced by carbonic acid in aqueous solutions of lead acetate, with or without the addition of sodium acetate, is normal lead carbonate. The amount of precipitate obtained from a given quantity of lead acetate increases with the dilution of the solution, until the concentration becomes less than 0·1-*N*, when it becomes independent of the dilution. At this concentration, also, addition of acetic acid to the lead acetate solution ceases to exert any influence on the ratio of acetic acid to lead acetate left in solution after reaction. The addition of sodium acetate in quantity greater than equivalent to the lead salt, causes the almost complete precipitation of the lead from dilute solutions. As these results do not agree with those found by G. Bischof (J. prakt. Chem., 7, 181), the author repeated some of his experiments at 15° C., with practically the same results as above, the ratio of acetic acid to lead acetate, after reaction, being found to be somewhat greater for the more concentrated solutions at the lower temperature.—A. G. L.

Potassium tetrathionate in aqueous solution; Action of potassium sulphite on ——. A. Colefax. Chem. Soc. Proc., 1907, 23, 207—208.

By the joint estimation of the iodine titration and the acidity developed in the solution when the iodine titration is completed, the nature of the interaction of potassium sulphite and tetrathionate in aqueous solution has been investigated. If potassium sulphite and tetrathionate react in equimolecular proportions in aqueous solution, the conversion of sulphite into thiosulphate and consequent formation of trithionate which occurs, does not proceed to completion, and pentathionate is not permanently formed in the solution. If the relative proportions in which these bodies are originally present in the solution are either $K_2SO_3 : \frac{1}{2}K_2S_4O_6$, or $K_2SO_3 : 2K_2S_4O_6$, the theoretically complete conversion of sulphite into thiosulphate takes place. In the latter case, where the proportions are $K_2SO_3 : 2K_2S_4O_6$ when the sulphite has been completely converted into thiosulphate, pentathionate is found in the solution in considerable amount. Certain preliminary experiments established the facts that (*a*), potassium sulphite and trithionate do not react in aqueous solution; (*b*), potassium thiosulphate and tetrathionate react in aqueous solution to form pentathionate, the resulting sulphite being immediately reconverted into thiosulphate; (*c*), potassium thiosulphate and trithionate react in aqueous solution, although to an extremely small extent, and (*d*), potassium sulphite rapidly attracts sulphur from pentathionate when the two salts react in aqueous solution.

Sulphur; Behaviour of —— towards water, and vapour pressure of sulphur from 78° *to* 210° *C.* O. Ruff and H. Graf. Ber., 1907, **40**, 4199—4205.

The authors determined the weight of sulphur volatilised at different temperatures, in a known weight of carbon dioxide or steam passed slowly through the apparatus. The same values were obtained in each case, showing that with steam, the reaction $2H_2O + S_3 = 2H_2S + SO_2$ does not occur to any appreciable extent between 78° and 210° C. This is contrary to the statement of Cross and Higgin (Ber., **16**, 1195). Assuming the molecule of gaseous sulphur at these temperatures to be represented by S_8 (compare Bleier and Kohn, Ber., **33**, 50), the following values were obtained for the vapour pressure in an atmosphere of carbon dioxide:—

Temperature. °C.	Vapour pressure. mm.	Temperature. °C.	Vapour pressure mm.
78	0·0021	133·1	0·089
89	0·0055	141	0·131
99·3	0·0085	147	0·192
104	0·010	157	0·332
110·8	0·020	162	0·403
114·5	0·0285	172	0·629
123·8	0·0535	189·5	1·38
131·9	0·081	211·3	3·14
132·2	0·079	—	—

—A. T. L.

Arsenic; Colloidal solution of ——. V. Auger. Compt. rend., 1907, **145**, 718—720.

An alcoholic solution of arsenic trichloride is poured slowly into an alcoholic solution of hypophosphorous acid, both cooled initially to −15° C. After two hours the precipitate is filtered off, thoroughly washed with alcohol, and dried *in vacuo* over sulphuric acid. The product dissolves instantly in dilute alkalis, giving a red-brown solution, perfectly transparent, but appearing opaque or turbid by reflected light. Alcohol, or excess of alkali hydroxide, precipitates brown flocks soluble in water. Dilute acids and soluble salts also form a precipitate, which, however, dissolves neither in water nor in dilute alkalis. The alcohol can be removed from the brown solution by dialysis, but phosphorus (which is always present in quantity about 1/200 of the arsenic) cannot be removed. The original solid loses its property of dissolving in alkali on keeping for some days, on contact with water, or immediately on heating to 100° C.—J. T. D.

Nitrogen, carbon dioxide, and steam; Specific heat of —— up to 1400° *C.* L. Holborn and F. Henning. Ann. der Physik, 1907, [4], **23**, 809—845.

The results obtained for the specific heat of nitrogen, carbon dioxide, and steam at constant pressure and at temperatures up to 1400° C. are expressed by the following formulæ:—

Nitrogen $c_{0..\vartheta} = 0{\cdot}2350 + 0{\cdot}000019\vartheta$.
Carbon dioxide $c_{0..\vartheta} = 0{\cdot}2010 + 0{\cdot}0000742\vartheta - 0{\cdot}000000018\vartheta^2$.
Steam $c_{100..\vartheta} = 0{\cdot}4669 - 0{\cdot}0000168\vartheta + 0{\cdot}000000044\vartheta^2$.

—A. S.

Salt solutions in liquefied sulphur dioxide at low temperatures; Electrolysis of ——. B. D. Steele. *See* XIA.

Magnesite deposit in New South Wales. Board of Trade J., Nov. 14, 1907. [T.R.]

An extensive deposit of magnesite has recently been discovered at Fifield, N.S.W.; the deposit is stated to be of great purity, and to be free from lime.

Chilean nitrate combine. Oil, Paint, and Drug Rep., Nov. 4, 1907. [T.R.]

The Chilean nitrate combine has absolute control of the output of nitrate and its by-products. It fixes the production of each plant, and also the prices. The following figures show the quantity and value of nitrate produced since 1900:—

Year.	Metric quintals.*	Value.
		$
1900	14,659,654	40,148,981
1902	13,305,975	46,138,461
1904	14,861,900	58,585,609
1905	16,689,760	67,313,874
1906	17,668,050	79,320,710

* Metric quintal = 100 kilos.

The Government of Chile has for several years received from 20 to 50 per cent. more from the export duty levied on nitrate than it has received from its import duties, having received $10,306,445 from this source during 1906. As matters are now managed, more than 50 per cent. of the business done is profit, so that of the exports during 1906 more than $39,660,355 was net profit, on a capital actually invested of much less than the profits for one year.

For the first six months of 1907 there was an increase of 735,959 metric quintals exported, and it is expected that the last half of the year will show a greater increase.

At the beginning of 1907 there were 121 nitrate works in Chile. Several new deposits are being opened under the direction of the combine.

Patents.

Sulphuric acid; Lead chambers for the manufacture of ——. L. G. Fromont, Brussels. Eng. Pat. 4861, Feb. 28, 1907.

See Fr. Pat. 375,117 of 1907; this J., 1907, 872.—T. F. B.

Sulphuric acid; [Electrical] Method of producing ——. I. Kitsee, Philadelphia, Pa. U.S. Pat. 869,094, Oct. 22, 1907.

A continuous stream of "sulphurous gas" is passed through a chamber, into which air or oxygen is introduced, and the mixture, in the presence of the requisite amount of moisture, is subjected "to the action of an electric current, adapted to modify the chemical constituents of said gas to convert the same into sulphuric acid."—W. C. H.

Oxide of iron. C. Wülfing, Hönningen, Germany. U.S. Pat. 868,385, Oct. 15, 1907.

See Eng. Pat. 1050 of 1906; this J., 1906, 1226.—T. F. B.

Potassium compounds; Process of producing ——. R. H. McKee, Lake Forest, Ill. U.S. Pat. 869,011, Oct. 22, 1907.

A potash-bearing material, containing mica, is heated to a high temperature in the presence of lime, common salt, and a reducing agent, such as carbonaceous fuel. When cool, the mass is extracted with water, to dissolve out the potassium chloride, which is obtained in the solid form by evaporating the solution.—W. C. H.

Alumina; Process for the manufacture of pure ——. E. Raynaud and F. Laur. Fr. Pat. 379,021, June 20, 1907.

The bauxite or other aluminous mineral is decomposed by sodium carbonate at a relatively low temperature (700—750° C.), under the influence of steam, the silica present in the mineral being rendered insoluble by the addition to the charge, of lime, lead salts, boric acid, &c. The reaction-product is lixiviated, and the resulting solution of sodium aluminate is treated with carbon dioxide The charge is formed into briquettes and heated to redness in a muffle or retort, into which steam is passed, and the escaping steam, charged with carbon dioxide, is used for precipitating aluminium hydroxide from the aluminate solution obtained in a previous operation.—A. S.

Cyanides ; Process for preparing alkali ——. O. Schmidt. Ger. Pat. 176,080, June 1, 1905.

Alkali cyanides may be prepared either by heating a mixture of an alkaline-earth nitride (especially calcium or magnesium nitride), charcoal, and an alkali carbonate, or by passing nitrogen over a heated mixture of an alkaline-earth metal, charcoal, and an alkali carbonate. (See also this J., 1907, 1009.)—T. F. B.

Oxygen ; Processes of generating —— for effervescing baths and other purposes. L. Sarason, Hirschgarten, and S. Haller, Grünau, Germany. Eng. Pat. 23,165a, Oct. 19, 1906.

See Fr. Pat. 372,233 of 1906 ; this J., 1907, 527.—T. F. B.

Oxygen ; Apparatus for generating ——. R. von Foregger, Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 867,964, Oct. 15, 1907.

See Fr. Pat. 366,524 of 1906 ; this J., 1906, 1045.—T. F. B.

U.S. Pat. 868,670, *Alkaline chlorides. See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Plate glass ; Apparatus for drawing ——. C. Menzel, Lommatzsch, Germany. Eng. Pat. 14,587, June 25, 1907. Under Int. Conv., April 10, 1907.

The invention relates to improvements in the apparatus described in Eng. Pat. 20,507 of 1906 (this J., 1907, 48). On each side of the drawing slit an air-duct is formed in the roof of the furnace. Each duct is provided with a number of perforations, which all lead into a slot or its equivalent. The slots and perforations are arranged to direct convergent air currents upon the glass plate along the line at which it leaves the molten glass. This arrangement obviates the withdrawal of the air pipes, in the original apparatus, which would otherwise melt, when a plate has been finished. A modification is also made in the cooling box arranged above the drawing slit. The box is now made with an inclined wall, to the outside of which running wheels are attached. A truck to carry the drawn plates leans against the inside of the inclined wall of the box. The box is mounted to turn without any jolting round a shaft, parallel to the drawing slit, from a vertical to a horizontal position, and to be moved away on the running wheels over suitable rails, carrying the glass plates on the truck inside the box.—W. C. H.

Glass melting and drawing apparatus. L. A. Thornburg, Hartford City, Ind., Assignor to Window Glass Machine Co., Pittsburg, Pa. U.S. Pat. 868,034, Oct. 15, 1907.

The apparatus comprises a melting furnace, with a discharge outlet, provided with a stopper, which can be moved in a horizontal direction between the outlet and the body of the molten glass in the furnace. A portion of the stopper projects through an opening in the furnace wall, and means are provided for moving the stopper by this projection. The apparatus also comprises a movable and reversible pot, to receive molten glass from the furnace, a movable kiln by which the pot is carried, " a melting-out station, a drawing station," and a system of tracks leading from the furnace to the drawing stations and back to the furnace.—W. C. H.

Furnace for melting glass ; A continuously working ——. C. Menzel. Fr. Pat. 378,776, June 14, 1907.

The patent relates to a pot furnace, ⊥-shaped in plan. The pots have straight walls and are preferably rectangular in form, so that the walls of the pots may be supported on all sides by the walls of the furnace. The pots are placed on different levels, so that by introducing raw material into pots at the extremities of the horizontal line of the above figure, the previously molten glass in those pots is caused to flow over suitable troughs into the pot between them and from this into pots arranged on descending levels on the vertical line of the figure. The finished glass is drawn from a pot at the upper end of the vertical arm of the figure. The pots are provided with loose partitions which float on the surface of the glass, and have one side curved in such a way that when these partitions are drawn to one side, raw material can be introduced into the pot, and retained by the curved side of the partition, and thus prevented from mixing, in an unmelted condition, with the previously molten glass in the pot.—W. C. H.

Pottery saggars or the like, and the manufacture thereof. P. Shelley and H. Forester, Fenton, Staffs. Eng. Pat. 3769, Feb. 15, 1907.

It is proposed to make the bottoms of saggars concave on the under surface, and flat or horizontal on the upper surface to avoid the tendency of the saggar bottom to give way or bulge during the firing of the kiln, and to afford a flat surface on which the pottery ware can rest inside the saggar.—W. C. H.

Potters' slip ; Filters for ——. T. R. Brittain, Akron, Ohio. Eng. Pat. 9635, April 25, 1907. Under Int. Conv., April 25, 1906.

The apparatus consists of a horizontal cylinder, preferably composed of two semicylindrical sections, which can be bolted together. One end of the cylinder is contracted, and provided with an opening, through which the plastic mass can pass. The other end of the cylinder is closed, except for an inlet for the slip, which is pumped in under pressure, and a boss through which a shaft passes. This shaft carries a mandrel, which nearly fills the interior of the cylinder, and is provided with a number of spiral blades, which force the material towards the contracted end. The inner surface of the cylinder is "rifled" with a number of circumferential grooves, the bottoms of which are provided with outlets for the expressed liquid. Between the mandrel and the inner surface of the cylinder is a screen or filter, which may be held in position by clamping it between the flanges of the halves of the cylinder. The filter is composed of two layers of wire cloth which serve to hold an intermediate layer of canvas in position. (Reference is directed to Eng. Pat. 1024 of 1864.)—W. C. H.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Asbestos consumption in 1906. "Mineral Resources, 1906." [T.R.]

The uses of asbestos depend primarily upon its fibrous character, but largely also upon its slow conduction of heat and electricity. As amphibole asbestos is not so strong as chrysotile, the latter is the more valuable and useful, especially for products involving spinning. The amphibole asbestos is chiefly used in the manufacture of boiler lagging, steam pipe covering, and insulating cements for general application. The best grade of chrysotile fibre is spun into thread, yarn, and rope, and woven into cloth. The output of asbestos in the United States for 1906 was 1,695 tons, valued at $28,565. This is a decrease of nearly one-half from the 1905 output. Approximately 1,540 tons of the output came from Georgia, Virginia, and Massachusetts, and is fibrous amphibole. The remainder, from Wyoming and Arizona, is chrysotile, as is probably also that of California.

The following table includes the statistics of asbestos in the United States and of asbestos imported since 1890.

Year.	Production.		Import.
	Quantity (short tons).	Value.	Total.
		$	$
1890	71	4,560	257,899
1895	795	13,525	244,878
1900	1,054	16,310	355,951
1905	3,109	42,975	846,479
1906	1,695	28,565	1,076,170

The present supply of asbestos is not sufficient to meet the world's demand. The output of all the existing asbestos mines is insufficient to supply two-thirds of the demand for this product.

The average price per ton of sales reported in the United States in 1906 is $16.86. This represents an increase of $3.04 per ton over 1905.

The production of asbestos in Canada in 1906 is reported as 59,283 short tons, valued at $1,970,878, as against 50,670 tons, $1,486,359, in 1905. The production of asbestic in 1906 was 20,127 short tons, valued at $17,230, as against 17,594 tons, $16,900, in 1905.

The Canadian production of asbestos, wholly chrysotile, was valued at an average of $33.25 per ton, an advance of 23 per cent. on the average price for 1905. Of this product, one-fifteenth classed as crude was valued at $165 per ton, and the remainder, called mill stock, at $24 per ton. The lowest grade of asbestos mine product is "asbestic." It is the rock which has been reduced to sand in the mill, contains some asbestos, and is used for fireproof wall plaster. The production of asbestic from the Canadian mines in 1906 was valued at 85 cents per ton.

Cirkel states that from 30 to 60 per cent. of all the rock mined is suitable for milling. In the majority of the mills an extraction of fibre amounting to from 6 to 10 per cent. of the milling rock is effected, and less than one-half of this will be fibre of spinning grades. The quantity of the higher grade crude asbestos usually secured by hand cobbing in the richest mines is from 1 to 2 per cent., although one or two mines produce a somewhat higher percentage. In a typical mine the asbestos produced amounted to 6 per cent. of the rock mined, at a cost of over $17 per ton of product for labour, power, and supplies.

PATENTS.

Stone ; Artificial or re-constructed ——. W. G. Crotch, Norwich. Eng. Pat. 22,901, Oct. 16, 1906.

CRUSHED stone dust, having a matrix of calcium carbonate, is mixed with about 10 per cent. of powdered, calcined magnesium carbonate, and the mixture worked into a paste with a solution of magnesium chloride. After about 30 minutes the paste is reduced to the consistency of cream by the addition of magnesium chloride solution, and the mixture is then allowed to harden. The product is claimed as a new article of manufacture.—W. C. H.

Tunnel-kiln [for bricks]. P. L. Youngren, Milwaukee, Wis. U.S. Pat. 868,059, Oct. 15, 1907.

A KILN, through which a current of air is induced, is divided by permanent and temporary walls of bricks. The air enters above the former and passes below the latter, and combustible gas is introduced into the air-current by distributers near the top and bottom of the walls.—W. H. C.

Wood of all kinds ; Process and apparatus for impregnating, colouring by injection, and preserving ——. E. Koepfer. Fr. Pat. 379,065, May 11, 1907.

THE block of wood to be treated is placed in a tube, capable of resisting pressure, and the impregnating, colouring, or preserving liquid is introduced into the tube under pressure, and is made to traverse the block in the direction of its length. The tube and one end of the log of wood, which is separated from the tube by a tight joint, are connected with a reservoir of air or liquid under pressure, whilst the cross-section of the other end of the log is freely exposed outside the tube, or may be connected with a suction arrangement, but close to this end the log itself is gripped in the tube by a tight joint. The end of the log which is to be connected with the reservoir of air or liquid under pressure, is made to form a tight joint with the tube by means of a caoutchouc ring held in position by a slightly domed cover, so that either the cavity of the dome, or the cavity between the log and the inner surface of the tube may be connected with the pressure conduit. Between two sections of the tube an annular piece formed of two parts, and provided with caoutchouc to form a tight joint, may be placed, to separate the inside of the tube on one side from that on the other.—W. C. H.

Rotary mixer [for concrete, etc.]. T. L. Smith. Fr. Pat. 379,006, June 19, 1907.

A DRUM mounted on friction rollers and rotated by toothed gearing has a feed hopper attached to one end and a discharge opening at the other. A number of inclined and bent plates, fastened to the walls within the drum, agitate the material as the drum is rotated. When it is desired to discharge the contents, a shoot is introduced into the discharge opening, and the material is lifted by shelves which project from the walls of the drum and dropped into the shoot as each shelf attains the highest position. —W. H. C.

Cement ; Hydrating and cooling ——. E. W. Brooks, Grays, Essex. Eng. Pat. 25,857, Nov. 15, 1906.

CEMENT is hydrated and cooled by means of a spray of cold water, injected by compressed air, into the finishing mill during the grinding of the clinker.—W. C. H.

Cement and other materials ; Separating or sorting process in grinding ——. A. B. Helbig, Frankfurt a/M., Germany. Eng. Pat. 26,005, Nov. 16, 1906.

CEMENT and other materials are first coarsely ground in a ball-mill, or equivalent apparatus, and the crushed material is conveyed to a pneumatic sorter, which consists essentially of a shell in which a fan is made to rotate at any required speed. By the action of the fan, the fine particles are separated and pass down a shoot to a storage vessel, whilst the coarse material is returned by another shoot to the ball-mill to be re-crushed.—W. C. H.

[Cement] Kilns and the like. W. C. T. Weekes, Rochester, Kent. Eng. Pat. 26,732, Nov. 24, 1906.

THIS invention relates to cement kilns of the kind in which slurry is dried on a floor heated by the products of combustion of the furnace. A floor is arranged upon piers and arches supported by the dome of the kiln, and extends some distance behind the latter. The dome may consist of two layers of brickwork, with an air-space between them. The products of combustion pass directly up to the lower side of the drying floor through elbow-shaped openings, controlled by dampers, in the dome of the kiln. Communication between the spaces formed by the transverse walls which support the drying floor, is maintained by a series of "staggered" openings in the walls. The dried slurry is discharged from the floor into the kiln through a central opening in the dome.—W. C. H.

Cement kilns [; Rotary ——]. C. A. Matcham and J. W. Fuller, jun. Fr. Pat. 379,051, March 30, 1907. Under Int. Conv., Dec. 28, 1906.

SEE U.S. Pat. 847,257 of 1907 ; this J., 1907, 470.—T. F. B.

X.—METALLURGY.

"Bears" and graphite accumulations ; Formation of —— *in blast-furnaces.* B. Osann. Stahl u. Eisen, 1907, 27, 1491—1496, 1529—1536.

THE author believes that the formation of "bears" in blast-furnaces can be prevented by using a regular and sufficiently strong blast, and by taking pains to employ good and, if necessary, sieved coke for fine ores. Too large an addition of coke is to be avoided, as tending to give too high a temperature in the upper part of the furnace, leading to the accumulation of masses of wrought (difficultly fusible) iron in the lower part. If too much coke has been added, heavy and difficultly reducible ores in large lumps should be charged, and the blast increased so as to render the working more rapid, even at the risk of obtaining some pig-iron. Ores containing zinc and lead may also cause difficulties in working for foundry cast-iron. By causing the metal to solidify very slowly, a very good and hard cast-iron rich in graphite may be obtained from ores containing much manganese.—A. G. L.

Iron; Corrosion of ——. A. S. Cushman. Office of Public Roads (U.S. Dept. of Agric.), Bull. No. 30, 1907.

Experiments are described in support of the electrolytic theory of the corrosion of iron (see this J., 1907, 1051). The passivity of iron produced by immersion in solutions of chromic acid or chromates or bichromates, is probably due not to an oxide film as is generally believed, but to a film of oxygen, since this property is destroyed by heating the metal to 100° C. for some hours, or by keeping it for some time in a vacuum. In conclusion the use of potassium bichromate as a boiler protective, and of slightly soluble chromates as priming coats for iron and steel surfaces, before the application of paint, etc., is recommended.—A. S.

Phosphorus in iron and steel; Errors in determining ——. G. Chesneau. Compt. rend., 1907, **145**, 720—722.

Certain causes of error in the molybdate precipitation have been investigated. 1. Not less than 30 c.c. of the molybdate reagent (containing 75 grms. of ammonium molybdate per litre) should be used per grm. of iron; this is needed to counteract the solubility of ammonium phosphomolybdate in ferric salts. 2. In washing the precipitate, water should be used; water containing ammonium nitrate or nitric acid dissolves sensible quantities of the precipitate. 3. If acid ammonium molybdate be precipitated along with the phosphomolybdate, solution in ammonia and reprecipitation is not at all a certain way of removing it; to avoid this co-precipitation as far as possible, the precipitation of phosphomolybdate should not be carried out at too high a temperature.—J. T. D.

Metal waste [bronzes, etc.]; Recovery of ——. T. Watanabe. Mem. Coll. Science and Engin., Kyoto Imp. Univ., 1906-7, 1, 183—186.

Experiments on the separation of white metal from yellow metal turnings, obtained in turning bearings, etc., showed that liquation methods gave the best results. Cupellation and roasting in an oxidising atmosphere, as well as electrolysis, using the turnings as anode in an alkaline electrolyte with lead oxide as cathode, failed to separate the metals. Better results were obtained by fusing the turnings with galena (lead sulphide), sodium sulphate, carbon, and glass, a tin-copper button being obtained from which dilute sodium sulphide solution extracts 93 per cent. of the tin; in this method practically the whole of the copper is obtained as sulphide.—A. G. L.

Metallic oxides; Reduction of —— *with calcium hydride.* F. M. Perkin and L. Pratt. Faraday Soc., Oct. 29, 1907. [Advance proof.]

When a mixture of copper oxide and calcium hydride in proportions corresponding to the equation: $2CuO + CaH_2 = 2Cu + CaO + H_2O$, is ignited by means of a match, a vigorous reaction ensues, and from the resulting black mass, finely-divided metallic copper can be obtained by dissolving out the calcium oxide. Pyrolusite, hæmatite, and tin-stone behave in a similar manner with calcium hydride. Lead and antimony sulphides also react, yielding a dark grey mass, apparently a compound of the metal with calcium and sulphur. Calcium hydride also reacts, on heating, with borax, boric anhydride, and silica, and, with difficulty, with wolframite and rutile. The two last named substances are reduced more readily by metallic calcium; indeed, in the case of wolframite, the reaction is so intense that the calcium oxide formed is melted. The chlorides of manganese, cadmium, strontium, barium, and the alkali metals are reduced to metal by metallic calcium. In the case of strontium chloride, it is necessary to take two grm.-atoms of calcium per grm.-mol. of the salt; with 1 grm.-atom, very little metallic strontium is obtained, probably owing to the formation of a sub-chloride, $ClSr.CaCl$.—A. S.

Cobalt and tin; Alloys of ——. F. Ducelliez. Compt. rend., 1907, **144**, 1432—1434.

The author has produced alloys of cobalt and tin, containing from 80 to 90 per cent. of tin. Those containing above 85 per cent. resemble tin in appearance, and can be cut or hammered; those containing less than 85 per cent. are hard and brittle. From all of these alloys, by means of the action of nitric acid and fused potassium hydroxide, a compound can be extracted having the formula, $CoSn$. The formation of this compound is attended by the evolution of a considerable quantity of heat. It is a dark-grey crystalline powder, non-magnetic, of sp. gr. 8·950. Chlorine at a red-heat attacks it, as does oxygen and also sulphur vapour. It is completely dissolved by sulphuric or hydrochloric acid, but dilute nitric acid has no action upon it, and even the concentrated acid attacks it but slowly. It is but slightly affected by fused alkali carbonates, even with the addition of nitrate or chlorate.—J. T. D.

Alloys of potassium with aluminium, magnesium, zinc, cadmium, bismuth, tin, and lead. D. P. Smith. Z. anorg. Chem., 1907, **56**, 109—142.

The method of thermal analysis has been applied to some alloys of potassium, but microscopic examination of their structure is rendered difficult by the readiness with which they undergo oxidation. There is a general likeness between the alloys of potassium and sodium (this J., 1905, 928). They both form compounds with the same metals, though the formulæ are not, as a rule, quite analogous. The potassium compounds have generally higher melting points than those of sodium. Potassium forms no compounds with *aluminium* or *magnesium*, and, in the liquid state, does not mix with them in any proportions. With *zinc* it gives a compound having the probable formula, KZn_{12}; the molten metals are not miscible in proportions between 0 and 97 atoms per cent. of potassium. With *cadmium* potassium forms the compounds, KCd_{11} and KCd_7; the molten metals do not mix when 17—100 atoms per cent. of potassium are present. Potassium and *bismuth* form four compounds, KBi_2, K_3Bi, K_3Bi_2, and probably K_9Bi_7. Potassium and *tin* form the compounds, KSn_4, KSn_2, and probably KSn and K_2Sn. Addition of potassium raises the melting-point of tin considerably. The alloys of potassium and *lead* are very difficult to investigate, but four compounds appear to exist, of which three have the probable formulæ, KPb_4, KPb_2, and K_2Pb respectively. The last three metals are completely miscible with molten potassium.
—F. Sodn.

Sulphur and arsenic determinations; Use of sodium carbonate and zinc oxide in ——. W. C. Ebaugh and C. B. Sprague. *See* XXIII.

Iron ore in Natal. Mining World, Nov. 2, 1907. [T.R.]

It is estimated that the iron ore deposits discovered lately in Natal may yield 3,589,000 tons, sufficient for the requirements of a small plant producing 50,000 tons of pig iron per annum for 35 years. Analyses indicate that the ore would give a good cast iron. For its conversion into steel the basic open-hearth, or Siemens process would probably be most suitable, the percentage of phosphorus being too high for the acid Bessemer or acid Siemens processes, and too low for the basic Bessemer process.

Copper, wolfram, and lead exports from Portugal. Board of Trade J., Nov. 7, 1907. [T.R.

Although the value of copper exports from Portugal increased last year, the amount was less than in 1905, the figures being 377,000 tons in 1906 and 381,000 tons in 1905.

The amount of wolfram exported increased from 9 tons in 1905 to 336 tons in 1906. The principal mines now being worked are the Penasqueira, Cabeco do Pinhao, Cabeco do Seixo, in the Castello Branco District; Mont 'Alegre, in the Villa Real District; Serra das Pedras and Villa Nova de Parva, in the Vizeu District; and Vieira, in the Braga District. The total output in 1906 is given as 570 tons, valued at £45,000.

The export of lead increased from 27 to 360 tons. The only two mines are those of Bracal, with a production of 151 tons, and Barbedalhos, with a production of 360 tons in 1906.

Rhodium and vanadium: *U.S. Customs Decisions.* [T. R.]

METALLIC rhodium was assessed for duty at 20 per cent. *ad valorem* as a "metallic mineral substance in a crude state." On protest from the importer, it was declared subject to duty of 10 per cent. *ad valorem* as an "article unenumerated and unmanufactured."

The Board of General Appraisers has decided that vanadium ore is entitled to free entry as a "crude mineral" under paragraph 614 of the tariff act, instead of being dutiable at 20 per cent. *ad valorem* under paragraph 183 as a "metallic mineral substance in a crude state."

PATENTS.

Iron or steel articles; Hardening or tempering ——. W. S. Simpson, London. Eng. Pat. 22,799, Oct. 15, 1906.

SEE Fr. Pat. 371,098 of 1906; this J., 1907, 260.—T. F. B.

Steel; Manufacture of —— *by the Bessemer or pneumatic process.* W. Galbraith, Sheffield. Eng. Pat. 23,293, Oct. 20, 1906.

THIS invention relates to methods for supplementing the temperature attained in the converter, should this be insufficient, as when small charges are used. Two sets of supplementary tuyères are fixed above but as near as possible to the surface of the molten charge: through one set of these air is blown, through the other is injected Mond gas or other suitable gas. The pressure of the gases must be such that they can be forced to the centre of the converter and thus mix with the issuing gases during combustion.—C. A. W.

Pig-iron; Treating ——. G. S. Page, Assignor to Crucible Steel Co., Pittsburg, Pa. U.S. Pat. 867,593, Oct. 8, 1907.

A BASIC-LINED furnace is charged with iron ore, lime, and unmelted pig metal, and the charge heated at or above a dephosphorising temperature, the slag being partially removed. A reduction in the phosphorus and carbon contents is thus effected, but the metal may be run off before the amount of carbon becomes too low.—C. A. W.

Iron; Purifying ——. J. Misko, Buffalo, N.Y., Assignor to E. N. Dickerson, Stovall, N.C. U.S. Pat. 868,610, Oct. 15, 1907.

THE iron is fused with "ferro-calcium-carbide."—A. G. L.

[Iron] Ores; Process of smelting ——. H. Arden, Los Angeles, Cal. U.S. Pat. 869,043, Oct. 22, 1907.

THE iron ore is mixed with a relatively small proportion of carbon, or of a carbonaceous material coated (*e.g.* with sodium silicate) so as to prevent its oxidation when heated in contact with the ore. The mixture is heated by means of a non-oxidising gas, and is then reduced to pig-iron by the action of carbon monoxide heated to a high temperature and mixed with the vapour of a hydrocarbon.—A. G. L.

Ores; Process of smelting ——. H. Arden, San Diego, Cal. U.S. Pat. 869,125, Oct. 22, 1907.

A LIQUID hydrocarbon is oxidised so as to produce a gaseous mixture containing carbon monoxide, which is passed over heated carbon and then superheated by electrical means. A hydrocarbon vapour is then mixed with the gas, and the whole is brought into contact with the ore, which has been previously heated by means of gaseous non-oxidising products of combustion. (See preceding abstract.)—A. G. L.

Ferro-vanadium; Process of producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., W. Virginia. U.S. Pat. 866,562, Sept. 17, 1907.

VANADIUM compounds are reduced in the presence of iron with the production of ferrovanadium and a slag containing vanadium. The slag is reduced with excess of reducing agent in the presence of iron, with the production of ferrovanadium containing silicon, which is purified by smelting with a vanadium compound.—O. F. H

Steel; Alloy ——. J. Churchward, New York. U.S. Pat. 867,642, Oct. 8, 1907.

CLAIM is made for an alloyed steel containing: (1). Steel (0·5 per cent. of carbon), 96 parts; titanium, 1; chromium, 0·5; nickel, 2; and manganese, 0·5 parts. (2). Steel (0·15—1 per cent. of carbon), 74—98·2 parts; titanium, 0·5—10; chromium, 0·15—5; nickel, 1—10; and manganese, 0·15—1 part.—C. A. W.

Steel; Alloyed ——. J. Churchward, New York. U.S. Pat. 868,327, Oct. 15, 1907.

THE alloy consists of steel containing 0·60 (0·20 to 1·25) per cent. of carbon, 95·10 (91·50 to 98·30) parts; nickel, 3·00 (1·00 to 3·50); chromium, 1·50 (0·50 to 2·50); vanadium, 0·15 (0·05 to 1·50); and manganese, 0·25 (0·15 to 1·00) part.—A. G. L.

Alloys for armour plates and other applications. Schneider et Cie. Fr. Pat. 379,188, Sept. 1, 1906.

THE alloys claimed are produced by adding small proportions of molybdenum, tungsten, or vanadium, or any two, or all of these metals to a steel containing 0·3—0·5 per cent. of carbon, less than 0·35 per cent. of manganese, 3—5 per cent. of nickel, and 0·5—1·5 per cent. of chromium. —A. S.

Gold alloys. G. James, London. From A. E. Hobson, Meriden, Conn., U.S.A. Eng. Pat. 22,264, Oct. 9, 1906.

THE alloys are made by alloying not less than 1 part of gold with 3 parts of a mixture containing not more than 40 per cent. of zinc, and 10 of manganese, and not less than 50 of copper or copper and silver. A suitable mixture is: Zinc, 19·5 to 22·5 per cent.; manganese, 0·5 to 2·5; copper, 80 to 75. It is claimed that the new alloys are more ductile and harder, and possess higher melting-points and a wider range of colouring than the previously known alloys.—A. G. L.

Precious metal; Crushing and treating ores for the extraction of ——. R. Stanley, Nuneaton. Eng. Pat. 25,530, Nov. 12, 1906.

THE invention is a development of that described in Eng. Pat. 24,386 of 1904 (this J., 1905, 1113). The scrapers formerly used to convey the granulated material from the "commencing rolls" to certain of the "finishing rolls," are now replaced by a hopper having two inclined shoots leading to the two pairs of rolls and containing an adjustable baffle-plate set so as to distribute the desired proportions of material to the respective rolls, assisted by a spray of water. A further alteration is in the water-trough which receives the material falling through the travelling belt sieve. This now contains a perforated horizontal partition dividing it into two separate troughs. Extending the whole length of the upper trough are two revolving shafts provided with splayed beaters, whereby the sand and slimes are conveyed towards the front, and, falling through the perforations into the lower trough, are thence carried to the rotary drier.—C. A. W.

Amalgamators. H. I. Seemann, Denver, U.S.A. Eng. Pat. 16,218, July 15, 1907.

THE amalgamator is provided with two semicircular covers which may be swung horizontally together and padlocked; through the centre of this cover passes the feed-pipe. The outlet at the side, through which the gangue passes after contact with the mercury, is provided with an S-trap, and the valve at the bottom can only be opened by a special key. In practice a vibratory movement is imparted to the apparatus, and the pulp to be treated is continually passed in at the top, the gangue flowing away through the trap.—C. A. W.

Gold and silver; Extracting —— from ores. B. Hall, Nevada City, Cal. U.S. Pat. 868,551, Oct. 15, 1907.

The powdered ore is mixed with cyanide solution, and the excess of the latter is sucked off. The mass is then loosened to allow air to penetrate it, and is finally leached, the dissolved metals being recovered by adding zinc. —A. G. L.

Tin from ore or oxide; Extraction of —— and apparatus for use therewith. R. W. E. MacIvor and M. Fradd, London. Eng. Pat. 22,162, Oct. 8, 1906.

The invention is an improvement on that described in Eng. Pats. 10,943 of 1905 and 17,002 of 1906 (this J., 1906, 988; 1907, 1013). Tin oxide or ore is reduced by water-gas (or producer-gas) at a temperature of about 650° C. (not exceeding 700° C.) in a revolving horizontal cylinder of soft cast iron lined with refractory material, and set loosely in brickwork. The cylinder is provided with longitudinal ledges on the inside. One end is connected with a non-rotating nozzle through which the gas enters; this end can be raised so as to run the molten metal towards a tap-hole at the other end.—A. G. L.

Zinc; Separation of —— from its ores and compounds. H. L. Sulman, London. Eng. Pat. 22,534, Oct. 11, 1906.

Zinc ores, roasted, if necessary, to oxide, are treated with an aqueous solution of sulphur dioxide. The solution of zinc bisulphite obtained is filtered. Lead, silver, etc., are recovered from the insoluble residue as usual. Any copper in the filtrate is removed by means of scrap-iron, and a current of air is then passed through the solution to decompose the bisulphite, 90 to 95 per cent. of the zinc being precipitated as hydrated zinc sulphite. Heating converts this compound into zinc oxide, with liberation of sulphur dioxide, which is used over again. The zinc remaining in solution may be recovered by adding any suitable precipitant, *e.g.*, zinc oxide, as in Eng. Pat. 21,672 of 1906 (this J., 1907, 1144). (See also Eng. Pats. 1047 of 1891; 17,001 and 19,130 of 1906, this J., 1892, 351; 1907, 1012 and 1052.)—A. G. L.

Ores; Method of and apparatus for concentrating ——. A. Schwarz, New York. Eng. Pat. 29,728, Dec. 31, 1906.

The method depends on the fact that the metallic particles in an ore, being softer, are more finely ground than the non-metallic particles. The ground ore is graded by means of a number of sieves, and each grade is separately treated on a concentrating table, which has a surface smooth except for a number of fine longitudinal corrugations. The size of these corrugations depends on that of the ore particles, the width being about 4 or 5 times that of the mesh through which the ore has been passed, and the depth somewhat less, about $\frac{1}{25}$ to $\frac{1}{40}$ in. The table is given a reciprocating motion longitudinally, and is also slightly inclined transversely. The top of the table is of electrolytic copper, or of lead, glass, aluminium or rubber. The ore pulp is delivered from a hopper at the left-hand higher corner of the table; jets of water impinge against a vertical wall extending along the whole of the higher side of the table, whilst another series of water-jets extends transversely across the table at right angles to the first from the right-hand corner. The metallic particles move along the corrugations diagonally across the table, and are washed into a trough at the lower right-hand corner; the tailings are washed over the corrugations towards the lower left-hand corner; and "middlings" fall into an intermediate trough.—A. G. L.

Concentrating and separating apparatus for ores. F. and H. Dallemagne. Fr. Pat. 378,895, June 15, 1907.

A concentrating table, the inclination of which may be varied, is provided with longitudinal grooves, of a depth decreasing from one edge of the table to the other. A circular reciprocating oscillating motion is imparted to the table by an arrangement of shafts and levers, so arranged that the amplitude of the oscillations may be varied by changing the point at which the lever from the driving shaft is connected to the cam which transmits the motion to transverse shafts fixed to the frame of the table. The separated particles of ore are received in a vessel divided into several compartments.—A. S.

Copper; Process for obtaining pure ——. L. Jumau, Paris. Eng. Pat. 530, Jan. 8, 1907. Under Int. Conv., June 26, 1906.

See Fr. Pat. 367,452 of 1906; this J., 1906, 1155.—T. F. B.

Copper and other metals; Method for the recovery of —— from their ores. C. H. Ehrenfeld and J. R. Grove, York, Pa. U.S. Pat. 866,849, Sept. 24, 1907.

The sulphide ores of the metals are heated in an atmosphere having a limited supply of oxygen for the purpose of expelling sulphur and forming the lower oxides of the metals. The oxides so formed are then extracted from the material by a suitable solvent, such as ammonium chloride solution, and the metal deposited electrolytically. —O. F. H.

Metallurgical reduction and melting processes; Method of carrying out ——. A. Petersson, Alby, Sweden. Eng. Pat. 5656, March 8, 1907.

See Fr. Pat. 370,910 of 1906; this J., 1907, 327.—T. F. B.

Furnace; Reduction ——. R. L. Baumline, Auburn, N.Y. U.S. Pat. 866,323, Sept. 17, 1907.

The furnace consists of a combustion chamber and a stack, the products of combustion passing round a receiving chamber placed inside the stack. The lower end of the receiving chamber is a short distance above the bottom of the combustion chamber, which extends beneath the stack, the flame being directed by a burner upon the space between the end of the receiving chamber and the bottom of the combustion chamber.—O. F. H.

Ore; Apparatus for treating ——. J. W. Boileau, Assignor to J. B. Knoblock, Denver, Colo. U.S. Pat. 866,570, Sept. 17, 1907.

The apparatus consists of a sloping channel constituting a roasting chamber, the floor of which is composed of a series of concave shelves. Above each concave shelf is a wheel carrying scoops or buckets, which pick up the ore, carry it over, and deposit it on the next shelf below. The sloping channel is heated by a furnace at its lower end, the products of combustion passing through a flue beneath the floor of the channel. A gas generator is also provided with pipes discharging into the channel from opposite sides. The ore is fed into a vertical drying chamber provided with deflecting plates, and forming a continuation of the sloping roasting-channel, into which the ore passes and is automatically discharged at its lower end. The gases in the roasting channel pass through the drying chamber and are drawn off by a pipe leading to a precipitating tank and an acid chamber. —O. F. H.

Metals; Annealing or heating of ——. D. Bates and G. W. Peard, Huyton. U.S. Pat. 868,154, Oct. 15, 1907.

See Eng. Pat. 324 of 1906; this J., 1906, 1153.—T. F. B.

Metals; Apparatus for the heat treatment of ——. T. V. Hughes, Birmingham. U.S. Pat. 868,185, Oct. 15, 1907.

See Eng. Pat. 729 of 1906; this J., 1907, 414.—T. F. B.

Aluminium alloys; Process for improving —— by heating and chilling. F. G. A. Wilm, Drewitz, Germany. U.S. Pat. 868,383, Oct. 15, 1907.

See Addition to Fr. Pat. 358,028 of 1905; this J., 1906, 482.—T. F. B.

Fumes produced in the roasting of ores; Apparatus for recovering the ——. M. Rosazza. Fr. Pat. 378,850, June 7, 1907.

The device, which may be placed at the top of the shaft, or alongside the condensing chambers, consists of an outer casing formed in two parts, in the shape of an inverted truncated cone surmounted by a dome. The casing is connected above with a short cylindrical portion furnished with a damper in the form of a grating. Inside the casing is a "shell" by which a gyratory motion is imparted to the fumes, whereby the entrained dust is caused to deposit on the walls of the outer casing, and thence falls and is aspirated by means of a fan into receptacles or into the condensing chambers.—A. S.

Metallic objects; Process for covering —— with a metallic deposit. A. Sang. Fr. Pat. 379,012, June 19, 1907. Under Int. Conv., April 13, 1907.

The object to be covered and the coating metal (in the form of powder) are heated in separate communicating vessels; the vapour of the coating metal passes into the vessel containing the metallic object, and deposits on the latter in the form of an adherent coating. A reducing agent, *e.g.*, asphaltum is either introduced into one of the vessels, or is previously applied to the metallic object in the form of a thin coating.—A. S.

Sulphide ores of antimony; Treatment of —— in order to obtain metallic antimony and oxides, sulphides, and "oxysulphides" of antimony. A. Germot. Fr. Pat. 379,143, June 22, 1907.

The ore is melted in a crucible or converter and is subjected to the action of a blast of air, air mixed with oxygen, or pure oxygen, whereby, on the one hand, metallic antimony, and on the other, antimony sulphide, "oxysulphide" or oxide (according to the excess of air or oxygen) are produced. The metallic antimony is tapped off from the bottom of the crucible, whilst the sulphide, "oxysulphide" or oxide of antimony escapes with the sulphurous fumes, and is recovered in condensing chambers.—A. S.

Minerals; Process and apparatus for treating —— to extract the metal in a liquid state. F. T. Snyder. Fr. Pat. 379,199, June 24, 1907.

See U.S. Pat. 859,134 of 1907; this J., 1907, 879.—T. F. B.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Salt solutions in liquefied sulphur dioxide at low temperatures; Electrolysis of ——. B. D. Steele. Faraday Soc., Oct. 29, 1907. [Advance proof.]

The author studied the electrolysis of a solution of potassium iodide in liquefied sulphur dioxide. With platinum or mercury cathodes there was a very rapid diminution of current, probably due to the deposition of a film of sulphur; after continued electrolysis, the cathodes were found to be coated with potassium sulphite admixed with sulphur. With silver, copper, or iron cathodes of large area, the current remained constant, and sulphides were formed at the cathodes. Iodine was formed at the anode and was obtained either in the free state or combined with the metal. No metallic potassium separated at the cathode.—A. S.

Patents.

Lead storage batteries; Method of reducing depreciation in ——. H. Rodman, Pittsburg, Pa., U.S.A. Eng. Pat. [illegible]957, March 12, 1907. Under Int. Conv., March 24, 1906.

Planté negative plates are impregnated by precipitation, either during or after their manufacture, with a finely-divided inert insoluble material. Thus the plates may be first impregnated with a saturated solution of a salt of the barium group, such as barium nitrate, and afterwards with a dilute solution of a soluble sulphate or sulphuric acid; or the plate may be impregnated with a saturated solution of barium hydroxide, which is converted into barium sulphate when the plates are immersed in sulphuric acid in erecting the cells.—B. N.

Accumulator plates; Method of preliminary treatment of ——. H. Leitner, Woking. U.S. Pat. 867,517, Oct. 1, 1907.

See Eng. Pat. 6792 of 1904; this J., 1905, 243.—T. F. B.

Arc furnaces for the electrical treatment of gases. Salpetersäure-Ind. Ges., Gelsenkirchen, Westphalia. Eng. Pat. 7320, March 27, 1907. Under Int. Conv., July 6, 1906.

See Fr. Pat. 375,268 of 1907; this J., 1907, 930.—T. F. B.

Furnaces; Electric ——. H. Pauling. Eng. Pat. 18,900, Aug. 22, 1907.

A pair of diverging electrodes is used for producing "strong-current arcs," a current of gas being blown, in the direction of divergence, through the space where the distance between the electrodes is at a minimum. This space is made sufficiently large, so as not to disturb the free passage of the gas current. For starting the discharges, a pair of adjustable auxiliary electrodes is used, these being connected with the main electrodes, and the portions extending into the space between the main electrodes consist of thin bevelled blades, or thin inclined rods, in order not to interfere with the passage of the gas, and at the same time facilitate the passage of the discharge over to the main electrodes.—B. N.

Furnace; Electric ——. P. Lacroix and Cie. Universelle D'Acétylène. Fr. Pat. 378,828, Aug. 22, 1906.

The upper electrode is greater in cross-section than the lower, which is fixed in the base of the furnace, so that the current-density, and therefore also the temperature, gradually increases downwards.—B. N.

Resistance element; Electric ——. A. J. Boult, London. From W. Hoskins, La Grange, Ill., U.S.A. Eng. Pat. 8359, April 10, 1907.

Aluminium, or a similar element, is added to nickel or cobalt, or their alloys, in order to increase the durability of the alloy under high temperatures, a thin, tough and adherent scale being produced which protects the metal against further oxidation; the scale remains intact even at temperatures sufficiently high to melt the core of metal. A suitable alloy for use as a resistance element contains nickel, 88 per cent.; chromium, 8; and aluminium, 4 per cent., or the latter may be replaced by a metal, more electropositive than nickel, forming a refractory oxide with a minimum melting point of about 1200° C. The specific resistance of such an alloy is about 50 times that of pure copper.—B. N.

Carbon and graphite electrodes in aqueous solutions; Process for increasing the durability of ——. Chem. Fabr. Buckau, Magdeburg, Germany. Eng. Pat. 9637, April 25, 1907. Under Int. Conv., May 8, 1906.

See Fr. Pat. 377,026 of 1907; this J. 1907, 1054.—T. F. B.

Alkaline chlorides; Electrolysis of fused ——. F. von Kügelgen and G. O. Seward, Holcombs Rock, Va. U.S. Pat. 868,670, Oct. 22, 1907.

A mixture of an alkali chloride, such as sodium chloride, with a fluoride, or fluorides of higher decomposition voltage, such as sodium and calcium fluorides, is electrolysed.—B. N.

Electrolysis of liquids; Apparatus for the ——. A. O. Tate. Fr. Pat. 379,129, June 21, 1907.

See U.S. Pat. 857,910 of 1907; this J., 1907, 877.—T. F. B.

Insulating material and articles resembling vulcanite; Process for making an ——. Ecorcite, Ltd. Fr. Pat. 379,150, June 22, 1907. Under Int. Conv., June 23, 1906.

See Eng. Pat. 14,395 of 1906; this J., 1907, 1145.—T. F.B.

Eng. Pat. 19,709 of 1906; U.S. Pat. 869,013 of 1907; and Fr. Pats. 378,743, 378,917 and 379,069 of 1907. *See* II.

Fr. Pat. 379,041; *Indigo vat. See* V.

U.S. Pat. 869,094; *Sulphuric acid. See* VII.

(*B.*)—ELECTRO-METALLURGY.

Bismuth; Electrolytic refining of ——. A. Mohn. Electrochem. and Met. Ind., 1907, 5, 314–315.

An account is given of the electrolytic refining of a Mexican lead-bismuth "bullion" containing 81·1 per

cent. of lead and 14·5 per cent. of bismuth, with small quantities of antimony, iron, zinc, arsenic, silver, and gold. The lead is first recovered by using the crude metal as anode in an electrolyte containing 6 per cent. of lead fluosilicate and 14 per cent. of hydrofluosilicic acid (total acid); the lead deposited on thin cast cathodes is quite pure except for the presence of 0·01 per cent. of bismuth. The anode slime, containing 83·9 per cent. of bismuth, is scraped off, washed, and fused with caustic soda and sodium carbonate to remove arsenic, lead, and antimony; if copper is present, sodium sulphide is also added. From the resulting metal, containing 94 per cent. of bismuth, anodes are cast. These are placed in anode boxes having lattice-work bottoms and perforated walls, and lined with filter-cloth, which are suspended in pairs across the electrolytic cell. The electrolyte consists of a solution of bismuth chloride containing 7 per cent. of bismuth and 9 per cent. of free hydrochloric acid. The cathodes are Acheson graphite plates and are placed directly on the floor of the cell. The current-density used is 20 ampères per sq. ft. at the cathode, and 60 ampères at the anode; the P.D. at the terminals is 1·2 volts. The concentration of the electrolyte must be kept constant by adding bismuth chloride or hydrochloric acid from time to time. If the concentration of bismuth is too low, the metal is deposited not in the crystalline form but as a black, spongy mass, whilst if not sufficient acid is present, bismuth oxychloride is formed, and the E.M.F. rises rapidly. The deposited metal is washed, melted in plumbago crucibles, and fused with caustic soda and sodium nitrate, if necessary, to remove traces of lead, arsenic, and antimony. The resulting bismuth has a purity of 99·8 per cent., the chief impurity being silver.
—A. S.

Borides and silicides; An investigation of the ——. O. P. Watts. Bull. Univ. Wisconsin (U.S.A.), No. 145, 1906. Engineering Series, 3, [3], 251—318.

After a general review and description of previous work on the subject, the author describes experiments made with a view to preparing silicides, borides, and silicoborides by the reduction of oxygen compounds of the elements in the electric furnace. The method did not prove satisfactory for the preparation of borides and silicoborides, but it was found that with calcium carbide or aluminium as reducing agents, metallic sulphides and silicates could be simultaneously reduced, with the production of silicides, the yield being a little above 50 per cent., calculated on both the metal and non-metal in the charge. The products can be obtained entirely free from sulphur by the use of lime or aluminium. (See also this J., 1905, 1116; 1906, 1105.) The paper contains a bibliography and two tables showing the chemical and physical properties of the silicides and borides which have been obtained up to the present.—A. S.

Electrical resistance of metal wires; Alteration of the —— *by occlusion of oxygen.* G. Szivessy. Ann. der Physik, 1907, [4], 23, 963—974. Chem. Zentr., 1907, 2, 1577—1578.

The electrical resistance of silver and platinum wires was increased by heating them in a current of oxygen, but no effect was produced on gold and palladium wires. In the case of silver, the increase amounted to 0·3—0·6 per cent., and in that of platinum up to 3·8 per cent.—A. S.

Patents.

White metallic alloys; Deposition of —— *by electrolysis.* R. B. Wheatley and F. B. Lark, London. Eng. Pat. 22,002, Oct. 5, 1906.

The anode consists of an alloy of the following composition: Copper, 230 parts; nickel, 150; zinc, 10; aluminium, 2; tin, 18; manganese-copper (manganese 75 per cent., copper 25 per cent.), 10 parts by weight. The electrolyte, used in conjunction with this alloy, consists of stannous chloride, 12 oz., zinc sulphate, 4 oz., copper sulphate, 2 oz., potassium cyanide (85 per cent.), 16 oz., caustic soda, 24 oz., "liquid ammonia" (0·880), 4 oz., and water to make up to 4 gallons. An additional anode, consisting of a piece of tungsten or molybdenum, is preferably used, and, before the bath is put into use, a current is passed and "directed for some hours on to a suitable cathode in order to thoroughly impregnate the liquid." If necessary, the electrolyte may be provided in the form of a compound salt or powder, which is obtained by evaporating the above solution, preferably after the passing of the current. Four pounds of this powder are dissolved in four or five gallons of water.
—B. N.

Metals; Electrolytic deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 24,985, Nov. 6, 1906.

Three electrodes, arranged concentrically, are supported in an electrolytic cell, an anode being placed between two cathodes. The inner, hollow, cylindrical mandrel or cathode is rotated at a high speed. The annular spaces, provided between the anode and the two cathodes, are separated from one another, or the anode may consist of a vertical cylinder made in segments, so that the spaces are in communication. Metal is dissolved from each side of the anode, being deposited on the inner cathode in the form of a highly polished tube, and on the outer cathode as refined metal in a comparatively smooth condition.—B. N.

Electroplating solution. R. H. Marshall, Scottdale, Pa., U.S.A. Eng. Pat. 8560, April 12, 1907.

See U.S. Pat. 850,944 of 1907; this J., 1907, 622.—T. F. B.

Electrolytic metallic deposits; Bath for obtaining ——. L. Trunkhahn, Vienna. U.S. Pat. 868,729, Oct. 22, 1907.

See Eng. Pat. 11,498 of 1906; this J., 1906, 817.—T. F. B.

Metals; Apparatus for depositing ——. W. A. Hendryx, Denver, Colo. U.S. Pat. 866,858, Sept. 24, 1907.

The apparatus consists of a tank containing the material to be treated, and a number of depositing cells submerged therein. Each cell consists of electrodes enclosed in a framework which supports a filtering medium, the solution being drawn from the tank through the cells. Means are provided for readily detaching the solid matter which accumulates on the filter.—O. F. H.

Tantalum; Purification of ——. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 24,234, Oct. 30, 1906.

Fused potassium tantalum fluoride, or other tantalum salt, is electrolysed between an anode of impure tantalum and a cathode of pure tantalum in a vessel of refractory material, *e.g.*, magnesium oxide or tantalum oxide.
—A. G. L.

Metals or alloys [vanadium]; Process of effecting chemical reductions and producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., W. Virginia. U.S. Pat. 866,421, Sept. 17, 1907.

The process consists in partial reduction by a non-metal such as carbon, followed by complete reduction by silicon. Thus vanadic oxide is treated in the electric furnace with carbon to form vanadous oxide, and the reduction to vanadium is completed by silicon.—O. F. H.

Alloys [ferro-vanadium]; Process of producing ——. F. M. Becket, Niagara Falls, N.Y., Assignor to Electro Metallurgical Co., W. Virginia. U.S. Pat. 866,561, Sept. 17, 1907.

Alloys such as ferrovanadium may be produced by passing an electric current through a molten bath containing vanadic oxide and ferrosilicon, the amount of silicon being just sufficient to combine with the oxygen in the oxide in order to obtain a product low in silicon. The ferrosilicon used should contain not less than 50 per cent. of silicon, and a basic flux is employed, the operation being made continuous by adding fresh portions of the charge and withdrawing the product as required.—O. F. H.

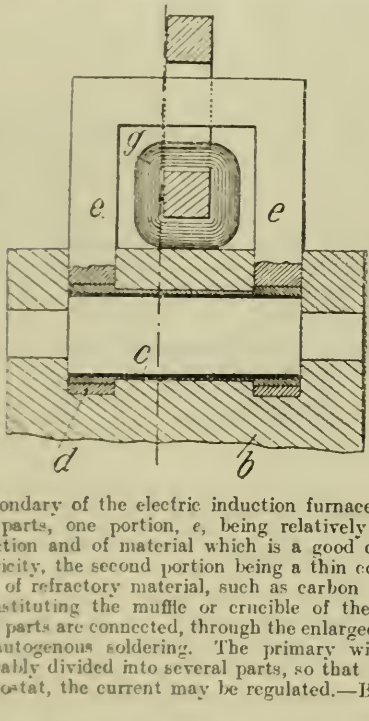
Blende; Process of treating ferruginous ——. W. M. Johnson, Iola, Kans. U.S. Pat. 868,345, Oct. 15, 1907.

The iron in the ore is first reduced to spongy iron disseminated throughout the mass. An electric current is then passed through the charge, which may be mixed with carbon, the increased temperature caused thereby effecting reduction of the zinc by means of the iron. —A. G. L.

Corrosion of metals immersed in water; Preventing the —— by electrochemical action. P. E. G. Cumberland. Fr. Pat. 378,922, June 17, 1907.

One or more auxiliary electrodes are totally or partly immersed in the liquid, and are bound to the positive pole of an auxiliary source of an electric current, the negative pole being connected to the metals to be protected. These electrodes are insulated from the metals to be protected except through the liquid, and the electromotive force of the auxiliary current is equal or superior to that produced by the differences of potential between the metals to be protected. The application of this method to marine boilers, propeller shafts, and other parts of steamers, immersed in or in contact with water, is described.—B. N.

Furnace; Electric ——. Soc. D'Exploitation des Brevets Dolter. Fr. Pat. 378,955, June 18, 1907.



The secondary of the electric induction furnace is made in two parts, one portion, *e*, being relatively great in cross-section and of material which is a good conductor of electricity, the second portion being a thin conducting tube, *c*, of refractory material, such as carbon or nickel, and constituting the muffle or crucible of the furnace. The two parts are connected, through the enlarged portion, *d*, by autogenous soldering. The primary winding, *g*, is preferably divided into several parts, so that by means of a rheostat, the current may be regulated.—B. N.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Beeswax; Saponification of ——. G. Buchner. Chem.-Zeit., 1907, **31**, 1085.

The results obtained with 8 different kinds of pure beeswax, saponified for an hour, agreed closely with the parallel figures obtained when the process was continued for 3 hours, provided the following conditions were followed:—3·6 grms. of the wax were vigorously boiled with 70 c.c. of 96 per cent. alcohol and about 33 c.c. of *N*/2 potassium hydroxide solution in absolute alcohol in a flask on asbestos gauze over a flame 8 c.m. in height, a Soxhlet's extractor being used as a reflux condenser (this J., 1906, 701; 1907, 700).—C. A. M.

Parkia africana; Oil and dawa-dawa cheese from the seeds of ——. H. Fincke. *See* XVIII*A*.

Petroleum from glycerides; Synthetic preparation of optically-active ——. J. Lewkowitsch. *See* III.

Petroleum; Formation of ——. C. Neuberg. *See* III.

Patents.

Fatty acids; Production of ——. W. P. Thompson, London. From G. Bottaro, Genoa, Italy. Eng. Pat. 23,534, Oct. 23, 1906.

The fat is saponified with lime, and the calcium soap decomposed, without the aid of steam, by means of a current of sulphur dioxide at a temperature of 30° to 40° C. The filtrate from the calcium sulphite contains 60 to 70 per cent. of glycerol, whilst the fatty acids are stated to be perfectly white, even when derived from dark fats such as fish stearine or bone grease.—C. A. M.

Fat not readily emulsifiable with water; Preparation of ——. M. Bergès. Fr. Pat. 378,706, June 11, 1907.

Animal fat, after removal of free fatty acids, is subjected to the simultaneous action of oxygen and nitric oxide in approximately equal proportions until the mass appears black by reflected light. The product may then, if required, be treated with a current of chlorine, and may subsequently be mixed with other substances, such as waxes, pitches, hydrocarbons, resins, etc. A current of ozone may be used in place of oxygen, and the oxidation followed by the treatment with nitric oxide.—C. A. M.

Soap powder; Manufacture of ——. W. N. Bacon, London. Eng. Pat. 27,701, Dec. 5, 1906.

The finely powdered soap is incorporated with, say, 60 to 65 per cent. of crystalline sodium monosilicate (Eng. Pat. 24,226 of 1905; this J., 1906, 846). Or, the soap may be melted before the addition of the silicate, and the mixture dried and powdered.—C. A. M.

Soap; Manufacture of ——. J. Crosfield and Sons, Ltd., and K. E. Markel, Warrington. Eng. Pat. 13,042, June 5, 1907.

See Fr. Pat. 378,528 of 1907; this J., 1907, 1150.—T. F. B.

Fr. Pat. 379,148 of 1907. *Petroleum, etc.* *See* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A*.)—PIGMENTS, PAINTS.

Patents.

Lakes [from azo dyestuffs]; Manufacture of red colour ——. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 28,984, Dec. 19, 1906.

See Fr. Pat. 372,681 of 1906; this J., 1907, 537.—T. F. B.

Lithopones; Manufacture of —— by electrolysis. J. B. and A. Candau, Eaux-Bonnes, France. U.S. Pat. 868,253, Oct. 15, 1907.

See Fr. Pat. 341,827 of 1904; this J., 1904, 904.—T. F. B.

Phosphorescent colours; Art of making ——. W. J. Hammer, New York. U.S. Pat. 868,779, Oct. 22, 1907.

Phosphorescent colours are produced by incorporating phosphorescent material with two or more liquids containing fluorescent substances "which respond in different wave-lengths to stimulation." For preparing phosphorescent colours in the red end of the spectrum, the process consists in incorporating a phosphorescent sulphide, *e.g.*, calcium sulphide, with rhodamine dissolved in or mixed with alcohol or ammonia, then adding a viscous preservative such as "varnish gum," and "stimulating the resultant composition."—A. S.

Chrome-yellow; Process for the manufacture of ——. P. D. Potter, Madison, Wis. U.S. Pat. 868,807, Oct. 22, 1907.

A mixture of a chromium compound, *e.g.*, chrome iron ore, and lead carbonate, together with a flux, if necessary, is heated under oxidising conditions, the reaction-product is digested with caustic soda solution, and from the solution, "sulphated chrome-yellow" (a mixture of lead chromate and lead sulphate) is precipitated by adding a "neutralising agent."—A. S.

(*B.*)—RESINS, VARNISHES.

Shellac and a method of determining its impurities or adulterations. H. Endemann. J. Franklin Inst., 1907, **164**, 285—293.

Treatment of shellac with caustic alkali, or dissolving it in sodium carbonate, leaves an insoluble wax composed of myricyl alcohol. The dissolved shellac is re-precipitated by acid. If bleached with sodium hypochlorite in alkaline solution, the shellac absorbs chlorine. Shellac when boiled in sodium carbonate solution does not yield as much carbon dioxide as would be expected from the quantity of acids it contains, indicating that about two-thirds of these are present as anhydrides. "D.C." shellac contains 4·5 per cent. of myricyl alcohol, 8·0 per cent. of acids which are not hydroxy acids and not condensable, 27·0 per cent. of a crystallisable acid soluble in water, and 60·5 per cent. of oily hydroxy acids but slightly soluble in water. The soluble acid forms rhombic plates or leaflets soluble in about 40 parts of water at the ordinary temperature and yields azelaic acid when oxidised with permanganate. It melts at 98·3° C. and corresponds to trihydroxypalmitic acid, $C_{16}H_{32}O_5$. When evaporated with hydrochloric acid it loses in weight, but the product contains 6 per cent. of chlorine. Aleuretic acid, which Farner (this J., 1899, 379) claims to have obtained from shellac, was not met with, nor was butyric acid obtained on oxidation with permanganate in alkaline solution. The liquid acids become thick and will no longer flow when dried *in vacuo.* The non-condensable resins possess a wax-like consistency and impart elasticity to the shellac, whereas pine-resin and similar resins soluble in alcohol do not possess this property. In analysing shellac the amount of these non-condensable resins present should be determined. Two grms. of shellac are mixed with 10 grms. of sand, moistened with alcohol and evaporated to dryness with 10 c.c. of concentrated hydrochloric acid. These manipulations are repeated once or twice, and the residue dried at 105° C. It is then extracted with 150 c.c. of alcohol in portions of 20 c.c., and the extract filtered, evaporated to dryness, and the residue of resins and fatty acids weighed. A good pure shellac contains only about 8 per cent. of resins, and a quantity over this is generally, though not necessarily, an adulterant. In any case this excessive resinous matter is harder and does not improve the shellac.—E. F. A.

Patent.

Resinous substances ; Apparatus for purifying and filtering crude ——. G. Col. Fr. Pat. 378,965, June 18, 1907.

The apparatus consists essentially of two vessels of truncated-conical form, one of which is provided with a steam-jacket and with a rotating shaft carrying radial blades. The crude resin is melted in the jacketed vessel, and passes through a screen or filter into the second vessel, where it is allowed to settle. The screen is kept clean by means of a brush with bronze wire bristles fixed to one of the blades on the shaft.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Rubber crop of Brazil. Board of Trade J., Nov. 14, 1907. [T.R.]

The Governor of the State of Para says that the rubber production of the State in the season 1906–7 amounted to 11,467 tons, valued at £3,392.000, as compared with 11,882 tons, valued at £3.623,440 in 1905–6. The total crop of Brazil in 1906–7 amounted to 37,835,000 kilos., comprising 31,542,972 kilos. of rubber and 6,292,028 kilos. of caucho ball. Of the total crop, 37,666,777 kilos. were exported to New York, Liverpool, Hamburg, Havre and Antwerp, *viz.* :—18,680,383 kilos. of fine, 3,621,387 kilos. of medium, 9.084.352 kilos. of Sernamby, and 6,280,695 kilos. of caucho ball. The quantity of stock on 30th June last was 168,000 kilos.

Patents.

Caoutchouc ; Manufacture of aqueous solutions of —— *and the application thereof for regenerating caoutchouc.* P. Alexander, Charlottenburg, Germany. Eng. Pat. 25,735, Nov. 14, 1906.

See U.S. Pat. 844,077 of 1907 ; this J., 1907, 423.—T. F. B.

Caoutchouc ; Process for refining crude ——. A. G. Bloxam, London. From Raffineries Réunies de Caoutchouc, Soc. Anon., Anvers, Belgium. Eng. Pat. 4717, Feb. 26, 1907.

See Fr. Pat. 375,118 of 1907 ; this J., 1907, 882.—T. F. B.

Caoutchouc, guttapercha, and similar substances ; Apparatus for washing ——. F. Kempter, Stuttgart, Germany. Eng. Pat. 13,908, June 15, 1907.

In apparatus for washing caoutchouc or similar substances by means of rotating rollers mounted in a washing trough, it is proposed to provide the rollers with corrugated "squashing ledges," and to make the bottom of the trough of a shape corresponding to that of the "squashing ledges." Above the axis of the rollers the walls of the trough have stone-catching and rejecting projections, and above these are gratings through which the washing water, together with the impurities, flows into a jacket surrounding the trough.—A. S.

Rubber and gutta-percha, and their substitutes ; Process for the agglomeration and regeneration of ——. E. A. L. Rouxeville. Fr. Pat. 378,801, March 21, 1907. Under Int. Conv., April 2, 1906.

Waste gutta-percha or vulcanised rubber or their substitutes are regenerated by heating them, in a finely-divided condition, with the product prepared by the process described in Fr. Pat. 356,716 of 1905 (this J., 1906, 83), the resulting mass being subsequently treated, if desired, with suitable solvents.—A. S.

Terpenes ; Treatment of —— [*Production of rubber substitutes*]. E. A. L. Rouxeville, Paris. Eng. Pat. 17,773, Aug. 7, 1906. Under Int. Conv., Aug. 7, 1905.

See Fr. Pat. 356,716 of 1905 ; this J., 1906, 83.—T. F. B.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Patents.

Artificial leather and similar products ; Process of manufacture of ——. Soc. Anon. des. Cuirs et Courroies d'Audenarde. Fr. Pat. 378,807, April 8, 1907. Under Int. Conv., Oct. 8, 1906.

Fabrics of felted or woolly texture, preferably in cotton, are repeatedly soaked in ammoniacal or other solutions of tanned albuminoid or proteid substances, which on evaporation are precipitated in the fibres of the fabrics. Reduced pressure may be used to facilitate absorption in making a heavy substitute. Solutions of other bodies, such as fats, gums, glycerin, etc., may be mixed with the tanned solution or applied to the fabric separately to produce desired varieties of artificial leather.—S. R. T.

Leather ; Artificial ——, *and process of manufacture of the same.* J. P. Gauthier. Fr. Pat. 379,094, June 20, 1907.

Fibres of any kind (8 parts) are amalgamated with caoutchouc (2 parts), the materials being either prepared in the form of a sheet, mixed and rolled, or pressed into the desired form, and vulcanised if required.—S. R. T.

Chromated glue compositions ; Manufacture of bodies from ——. R. Neufeld, Vienna. Eng. Pat. 8026, April 5, 1907.

See Fr. Pat. 376,509 of 1907 ; this J., 1907, 1022.—T. F. B.

XV.—MANURES, &c.

Soil phosphates ; Action of water and aqueous solutions upon ——. F. K. Cameron and J. M. Bell. Bureau of Soils, U. S. Dept. Agr., Bull. No. 41, 1907.

Soil phosphates are decomposed or hydrolysed by water, with the formation of other phosphates containing relatively more of the base. Neutral salts in solution have a marked effect upon the amount of phosphoric acid and of lime going into solution from a calcium phosphate, generally increasing both. Calcium salts generally decrease the amount of both in solutions, as do alkaline solutions, whilst acid solutions increase it. Neutral salts have, however, little effect upon the solubility of the phosphates of iron or aluminium and it is impossible to predict the direction of the effect. Salts which hydrolyse with the formation of acid or alkaline solutions, increase the amount of phosphoric acid yielded to the solution by the phosphates of iron and aluminium. The phosphates of the soil, whether solid solutions or definite chemical compounds, are of such a nature as to yield a solution containing very small quantities of phosphoric acid. Inasmuch as all soils contain far more basic matter than is sufficient to combine with the phosphoric acid, the least soluble phosphates are the ones which will be formed and will control the concentration of the soil moisture. This fact, together with the well-known phenomena of absorption, gives a satisfactory explanation of the observation that the concentration of the soil moisture is low and varies but little for different soils and with the total amount of phosphoric acid in the soils. For the same reason, the addition of phosphatic fertilisers cannot be expected to influence materially the concentration of phosphoric acid in the soil moisture. The action of phosphatic fertilisers is, therefore, on the soil and not primarily on the plant; for the concentration in plant food constituents of the solution on which the plant feeds, is not materially altered by the addition of phosphatic fertilisers in the amounts used in ordinary field practice.

Patents.

Calcium nitrate combined with precipitated calcium phosphate; Manufacture of ——. Coignet et Cie. Fr. Pat. 378,931, Aug. 24, 1906.

Calcium nitrophosphates alone or mixed with precipitated calcium phosphate soluble in ammonium citrate solution, and with calcium nitrate, are prepared by acting on calcium phosphates with dilute nitric acid.—A. S.

Calcium cyanamide; Process of treatment of —— with dilute sulphuric acid, and the product obtained to be used for manure. E. and G. Pollacci. Fr. Pat. 378,717, June 12, 1907.

Successive small quantities of calcium cyanamide, in lumps, are added to commercial sulphuric acid of 40° to 50° B., diluted with about its own weight of water, care being taken to maintain a feebly acid reaction in the mixture. The mass obtained is then dried at a moderate heat, and pulverised. The product is claimed as manure.
—W. C. H.

Eng. Pat. 23,055 of 1906. *Yeast, etc.* *See* XVII.

XVI.—SUGAR, STARCH, GUM, &c.

Saccharinic acids; Derivatives of C_5-sugars from meta- and para- ——. H. Kiliani and A. Sautermeister. Ber., 1907, **40**, 4294—4296.

In spite of the very different constitutions of meta- and para-saccharinic acids, *viz.*,

$$CH_2(OH)\cdot\{CH(OH)\}_2\cdot CH_2\cdot CH(OH)\cdot COOH \text{ and}$$
$$CH_2(OH)\cdot CH_2\cdot C(OH)(COOH)\cdot CH(OH)\cdot CH_2OH,$$

respectively, some of their derivatives show very similar properties. These acids are readily converted into the corresponding C_5-sugars, of which, that derived from the meta-acid must be an aldehyde (pentane-3.4.5-triolal) and that derived from the para-acid must be a ketone (pentane-1.4.5-triol-3-one). The authors have prepared the oximes of these sugars; the properties of these derivatives are very similar. The aldoxime melts at 1[illegible]—13[illegible]° C., and has a specific rotation of $[\alpha]_D = +10{\cdot}6°$; the ketoxime melts at 136—137° C., and has a specific rotation of $[\alpha]_D = +11{\cdot}[illegible]°$. Both oximes crystallise readily. By reducing the aldehyde, pentanetriolal, with sodium amalgam, pentane-1.2.3.5-tetrol was obtained in the form of a syrup. The tetrabenzoate of this compound melts at [illegible]° C.—L. E.

Starch in amylaceous materials; Lintner's polarimetric method for the determination of ——. M. Canet and O. Durieux. Bull. Soc. Chim. Belg., 1907, **21**, 329—332.

The authors find that the polarimetric method proposed by Lintner for the determination of starch in barley (this J., 1907, 281) is generally applicable to all cereals and amylaceous materials. They prefer to use the value given by Brown for the specific rotatory power of starch, *viz.*, $[\alpha]_D = 202°$ rather than the value given by Lintner. Unless the material is rich in nitrogenous matter, it is not necessary to add phosphotungstic acid. The material should be freed from fat and dried before treating with the hydrochloric acid. A few of the results recorded for various products may be cited: potato fecula, 84·15; maize starch, 82·66; rice starch, 83·06; corn-flour, 70·04; rice-flour, 76·73; malt-flour, 50·02; yellow maize, 58·16; maize grits, 75·48; bran, 23·51; brewers' grains, 1·73 to 9·10; maize press-cake, 8·66, all results being expressed as dry starch on air-dry material. The method is particularly suitable for the determination of unsaccharified starch in brewers' and distillers' grains.—J. F. B.

Patent.

Milk sugar; Process of obtaining ——. J. A. Just, Syracuse, N.Y. U.S. Pat. 868,443, Oct. 15, 1907.

A solution of crude milk sugar is mixed with infusorial earth so as to form a paste, and the latter is dried. The process of drying renders the impurities insoluble, and, on extracting the dry mixture with water, a solution is obtained from which pure milk sugar may be recovered.
—W. P. S.

XVII.—BREWING, WINES, SPIRITS, &c.

Malt tannin and its detection. A. Reichard. Z. ges. Brauw., 1907, **30**, 509—513, 521—523.

Following up previous work (this J., 1904, 498, 874) the author describes the following test for the presence of malt-tannin in malt worts and beers. Test-tubes of uniform dimensions are filled to about two-thirds with the worts; 4—5 drops of a 0·15 per cent. solution of sodium-gold chloride are allowed to fall from a pipette to a small depth into the liquid and a further quantity of the reagent is caused to run down the walls of the tube, so that a mixed zone of the two liquids, 3—4 mm. deep, is formed, whilst a layer of the reagent floats on the top. The rapidity with which a coloured ring appears in the mixed zone is taken as a measure of the tannin-content of the wort, and is a quantitative test of relative though not absolute value. The temperature is maintained at 17°—18° C., and the tubes are protected from all but diffused light. The presence of sulphurous acid in the malt interferes with the test, but with ordinary malts, it was found as a general rule that the rapidity of the reaction of the worts was proportional to the colour of the malt. Probably the high temperature of curing opens up the tannin cells of the husks, but with re-absorption of moisture, they appear to close again. Comparative mashings of fractionated malt grist showed a complete parallelism between the harshness of flavour and the tannin reaction of the worts. The malt tannin is partly precipitated together with the albumin during the boiling of the wort, and the flavour of the latter is correspondingly altered. Boiling the wort previously to the addition of hops enables the liquid to take up more of the hop-tannin flavour. The tannin reactions of beers follow in the same order as those of the malts from which they were prepared, and are quite uninfluenced by the quantity of hops (within the usual industrial limits) which have been used. Thus the tannin of beer appears to consist entirely of malt tannin, and the hop tannin appears to be completely removed. This occurs in spite of the fact that the malt tannin comes in contact with the albumin at an earlier stage than the hop tannin. It is explained by the observation that the hop tannin is a crystalloid, readily soluble and reacting rapidly, whereas the malt tannin

is a colloid, not in true solution, and therefore sluggish in its reactions. Its compounds with albumin also are capable of passing through filters in the colloidal form.
—J. F. B.

Hop-bitters ; Extraction of —— during boiling. O. Wenglein. Z. ges. Brauw., 1907, **30**, 529—531.

The author has investigated the extraction of the bitter principles from hops by boiling 9 grms. for $\frac{1}{4}$—$2\frac{1}{2}$ hours with 1·5 litres of : (1), distilled water ; (2), water from the Munich supply which exhibits 16 degrees of hardness, mostly due to calcium carbonate ; and (3), 12 per cent. unhopped brewery wort. After $2\frac{1}{2}$ hours' treatment, the hops still contained : (1), 3·03 ; (2), 1·77 ; and (3), 2·21 per cent. of hop bitter, the original content being 10·96 per cent. The extraction is hence most complete in the case of the Munich town water. The addition of calcium sulphate and carbonate to wort or distilled water does not result in any increase in the extraction of hop bitter. Spent hops from the brewery were found to contain from 9·20 to 25·6 per cent. of the proportion of bitter principle originally present ; these numbers are probably somewhat low, since a portion of the lupulin, which becomes separated from the cones during boiling, passes through the false bottom of the hop-back. Disintegration of the hops before boiling with wort, leads to but a slight increase in the proportion of bitter extracted.—T. H. P.

Yeast cell juice ; Some experiments with ——. E. Buchner and R. Hoffmann. Biochem.-Zeits., 1907, **4**, 215. Z. ges. Brauw., 1907, **30**, 526—527.

When blood-fibrin flakes are steeped for 4—6 hours at the ordinary temperature in yeast cell juice, they absorb some of the endotryptase, which, after removal of the flakes and washing, is capable of effecting the digestion of the fibrin under suitable conditions. The fermentative power of the juice is considerably weakened by the treatment with fibrin, but the latter does not acquire fermentative properties. Treatment of the juice with a mixture of alcohol and ether (2 : 1) gives a precipitate which ferments dextrose, sucrose and maltose equally well. A second treatment of a solution of this precipitate with the same mixture gives a second precipitate in which the fermentative power towards maltose is only 75 per cent. of that towards dextrose. Thus, alcohol destroys maltase more rapidly than zymase. Treatment of the yeast juice with ozone causes frothing and gradual separation of a coagulum ; the fermentative power is decreased in proportion to the amount of ozone employed. The addition of solid, powdered phenol to the juice causes a considerable precipitation of albumin, but phenol in the form of aqueous solutions, added drop by drop to the amount of 0·5—1·0 per cent., only causes a precipitate after several hours. The addition of 0·5 per cent. of phenol lowers the fermentative power in degrees ranging from practically nothing up to one-third ; the addition of 1 per cent. lowers the fermentative power from one half to two-thirds ; similar quantities of phenol are sufficient to kill living yeast.—J. F. B.

Brewing industry ; Recent progress in the ——. A. R. Ling. Brewers' J., 1907, **43**, 558—561.

Referring to the work of Brown on the nitrogen question in brewing, the author points out that whilst in Germany a 10 per cent. limit for protein in barley has been fixed, and whilst in England a similar limit, broadly speaking, would probably be suitable, in the United States a preference is shown for six-rowed barleys far richer in protein. This is because the malt is germinated for a much shorter time than in Europe and is brewed in conjunction with large proportions of raw grain. The author refers to Biffen's work on the evolution of hybrid varieties of barley, possessing desirable qualities suited to local conditions, and as stable as the original varieties. With regard to malting, it is now recognised that the pneumatic drum is capable of producing malt equal in quality to that prepared by the flooring system. Formerly, the facilities for ventilation and turning, which the drum presents, led to an abuse of these treatments, with the result that a long straight " wild " rootlet was produced. Similarly in the case of the pneumatic curing drum, the fault was that the drying of the grain in the earlier stages was too rapid, and the important physiological changes which occur during withering were suppressed. In the most approved form of pneumatic malting, an ordinary kiln is employed, but the author thinks that the curing process is carried out most effectively in the drum, because the facilities for turning ensure uniformity. The filter-press method of brewing, with malt-flour, is now being worked with great success, and the large losses of starch in the steely points, inherent in the grist process, are saved. According to Smith (this J., 1906, 438, 599) malt-flour can be mashed in the ordinary tun, provided certain precautions are observed. In cooling and aërating the wort, improvements have been effected in the direction of supplying sterilised filtered air. In the fermentation department, pure-cultivated yeast is now being used in the case of running ales for quick consumption, which do not require a secondary fermentation, since Siau (this J., 1906, 385) pointed out that the primary fermentation may be prolonged for about a fortnight. It is recognised that the secondary changes which take place in beer during storage are the result of the activity of organisms other than the primary yeast, and that these organisms may vary with the locality and conditions of working of the brewery. It is quite conceivable that such secondary flavours may be contributed by bacteria and other adventitious infections, and the author is not prepared to condemn a pitching yeast merely on the ground of infection, without proof that such infection has had undesirable consequences.—J. F. B.

Wines ; Hydrogen sulphide flavour in ——. L. Mathieu. Bull. Assoc. Chim. Sucr. Dist., 1907, **25**, 251—253.

The presence of hydrogen sulphide in wine is due, occasionally to action on glass (of the bottles) containing alkali sulphides, but generally to the reducing action of yeast or bacteria on oxygen compounds of sulphur derived from the soil, sulphur or various sulphates applied to the vines to combat different disease moulds, or sulphur employed for treating the casks. As a rule, it is wines rendered sparkling by fermentation which acquire the flavour of hydrogen sulphide. The production of this flavour is favoured by rise of temperature and by allowing the wine to remain in contact with the lees.—T. H. P.

Starch in amylaceous materials ; Lintner's polarimetric method for the determination of ——. M. Canet and O. Durieux. *See* XVI.

Denatured alcohol ; U.S. Internal Revenue Circular. Oil, Paint, and Drug Rep., Oct. 28, 1907. [T.R.]

The Commissioner of Internal Revenue has issued the following circular to collectors and department agents :—

Collectors and revenue agents are instructed, as opportunities offer, to fully advise those in whose business alcohol can be used as to the rights and privileges of manufacturers using denatured alcohol in manufacturing processes.

Denatured alcohol may, under the law, be employed in the manufacture of anything except beverages or liquid medicinal preparations. Under the amendatory act of March 2, 1907, it may be employed in the manufacture of chloroform and ether. Regulations 30, revised, authorise the use of either completely or specially denatured alcohol in manufacturing processes. There are two formulæ under which alcohol is denatured completely, to wit, the wood alcohol-benzine and the wood alcohol-pyridine formulæ. Completely denatured alcohol is sold on the market without restrictions. Manufacturers using less than fifty gallons of completely denatured alcohol per month are not required to secure a permit. Manufacturers using more than fifty gallons of such alcohol per month are required by regulations 30 to secure a permit from the collector of internal revenue of the district in which the business is located. No records are to be kept or returns made by manufacturers using completely denatured alcohol unless they recover alcohol for reuse. The manufacturer is simply required to keep the alcohol locked in a room or rooms anywhere on his premises, and he may keep it in any room on his premises except one in which distilled spirits, wine, or malt liquors are kept or stored. Completely denatured alcohol may be bought from dealers or denaturers in the open market and may be delivered in either stamped packages, or by transportation tanks (tank cars), or delivery tanks (tank wagons). It may be kept on the manufacturing premises, stored in stamped packages, or in tanks specially set aside for that purpose. Where completely denatured alcohol is not suitable for use in an industry, and denatured alcohol, withdrawn from bond free of tax, can be legally used in such industry, the regulations provide for the authorisation of the use of alcohol denatured under a special formula. If it should be found necessary, more than one formula will be authorised for the same industry. Application for the use of a special formula in an industry must be made to the collector of internal revenue, who will submit such application to this office for a decision. The use of a special formula has been authorised in each of the following industries:—Shellac varnishes, photographic dry plates, embalming fluid, heliotropin, lacquers from soluble cotton, resin of podophyllum and similar products, manufacture of ethyl chloride, acetic ether, surgical ligatures, filaments for incandescent electric lamps, silverware and bronze and of thermometer and barometer tubes, manufacture of celluloid, pyroxylin and similar products, transparent soap, manufacture of smoking and chewing tobacco, manufacture of photo-engravings, manufacture of fulminate of mercury, manufacture of imitation leather, manufacture of matches, manufacture of sulphuric ether, manufacture of sulphonemethane, purification of rubber, manufacture of pastes and varnishes from soluble cotton, manufacture of photographic collodion (2). When a special formula for use in an industry has been authorised by this office, the individual manufacturer, desiring to qualify in order that he may use alcohol denatured under such formula at his manufacturing plant, shall make application to the collector for a permit, in which he shall state the kind of business in which he is engaged and in which he desires to use denatured alcohol, and the location of his plant, and the formula he desires to employ. Manufacturers using specially denatured alcohol must secure their alcohol direct from a denaturer—that is to say, either from a distillery or a central denaturing bonded warehouse. They must give bond, the condition of which is that they will not misapply the alcohol denatured for them and delivered to them for use in manufacture. The penal sum of the bond depends upon the quantity of alcohol the manufacturer uses. Manufacturers using specially denatured alcohol are required to provide a room in which to store the alcohol as it is received. They must also name a custodian who is to have supervision over the room and the alcohol stored therein—that is, to carry the keys to the room or any tanks that may be located therein for the storage of alcohol. This room must be used exclusively for the storage of alcohol. Such manufacturers are permitted to receive alcohol in bulk from transportation or delivery tanks and to keep it stored in their storeroom in storage tanks. They are required to keep a record in which to enter the alcohol as it is received and disposed of, and they are required to make a monthly return to the collector from their record. They are not required, as formerly, to keep any record of the goods in the manufacture of which they use denatured alcohol. Manufacturers using either completely or specially denatured alcohol are permitted to recover the alcohol used by them and to restore it to a condition for reuse. This may be done either at their manufacturing plant under proper supervision, or it may be done at a bonded central restoring and redenaturing plant, to which such recovered alcohol can be shipped and from which it can be received again for reuse.

Revenue agents, inspectors, deputy collectors and other revenue officers are instructed to carefully investigate all industries in which denatured alcohol is being used or can be used, with the view of ascertaining how the regulations heretofore adopted operate, and what objections there are, if any, to said regulations. It is the desire of this office to hear and consider any reasonable objections there may be to existing regulations. In view of the large number of industries in which denatured alcohol is used, the various conditions under which, and the purposes for which, it is employed, it has always been realised here that the making of uniform regulations to meet all conditions in all industries to the entire satisfaction of all concerned would be difficult of accomplishment. The regulations as applied to manufacturers as prepared and adopted have been considered to an extent tentative. This office, therefore, expects all the representatives of this bureau to ascertain and report existing conditions, and submit to this office any suggestions from manufacturers interested, made in good faith, and to submit themselves any suggestions as to amendments or changes in the regulations that may appear to be desirable and practicable.

Alcohol denaturant in Austria-Hungary. Bd. of Trade J., Nov. 7, 1907. [T.R.]

A Decree came into force on Nov. 10 amending the spirit tax regulations of July 21, 1899, and establishing a new general denaturing material as follows:—

A mixture of 19 parts of wood spirit, 2·5 parts of pyridine bases, 2·5 parts of benzol and 1 part of an additional substance, the composition of which is to be fixed by the Ministry of Finance. The denaturant may only be produced in places officially authorised; and will only be sent out directly to persons requiring it, and who have applied for permission to denature spirit with the general denaturing material. The general denaturing material is to be mixed with the spirit to be denatured in the proportion of 2·5 litres to 100 litres of pure alcohol.

German spirit monopoly. Chem. and Drugg., Nov. 16, 1907. [T.R.]

The "Berliner Tageblatt" supplies the following particulars with regard to the proposed State monopoly of German alcohol: (1) The total production of raw spirit produced by the distilleries is to be fixed at 370 million litres of pure alcohol. (2) The establishment of new distilleries will be made dependent on the need for them and subject to the granting of a concession. (3) The "Maischbottich" (mash-tun) tax lapses, and a "register" price, amounting to about 35M. per 100 litres of pure alcohol, is to be secured to the distilleries. Instead of the usual 20M. "contingent," only 10M. per hectolitre of pure alcohol is to be granted, and this only for a period of ten months, after which the "contingent" is to lapse entirely. (4) A distillery council is to be associated with the State monopoly administration for the purpose of advising as to the fixing of prices each year. The present syndicate, or "Centrale," is to be taken over by the Government, and distilleries outside are to be acquired. The indemnity granted to the distilleries is to be based on the average profits of the last three years, and is to correspond to a 6 per cent. capital value of the yearly profits. (5) The law is to take effect from October 1, 1908. (6) The State will have an increase in revenue of 70 million marks from the spirit monopoly. There are some eighty large factories and about 100 small ones to be taken over by the State, and in addition to these, there are numerous warehouses used by the wholesale dealers, and a quantity of fittings, &c., the value of which will amount to about 250 million marks. The indemnities to spirit manufacturers and dealers may be estimated at about 750 million marks, so that the Government will require about 1000 million marks if the monopoly is to be introduced.

PATENTS.

Yeast and products containing yeast; Method of drying —— for use as food, fertiliser, insecticide and fly preventative. A. J. Oxford, Walton-on-Trent, Derbyshire. Eng. Pat. 23,055, Oct. 18, 1906.

YEAST is first liquefied in any of the known manners, preferably by heating it with the addition of common salt. The liquid, either alone or in admixture with other substances, such as molasses, blood, flesh, bone meal or oil-seed meal, is evaporated in thin layers on the surface of internally heated, revolving cylinders, and the dried product is scraped off continuously. It is sometimes necessary to lubricate the surfaces of the cylinders, after scraping off the dried product by applying oil, before the layer of liquid comes in contact with them, in order to facilitate the removal of the product.—J. F. B.

Lactic acid; Process of making ——. J. A. Just, Syracuse, N.Y. U.S. Pat. 868,444, Oct. 15, 1907.

A solution containing pure milk sugar (prepared as described in U.S. Pat. 868,443, page 1208) is treated with a preparation containing lactic ferments, a calcareous neutralising material being also added. The calcium lactate formed is decomposed by the addition of an acid which will yield an insoluble calcium salt, and the lactic acid is then recovered from the solution.—W. P. S.

Brandy and cream of tartar from marcs; Simultaneous extraction of ——. E. A. Barbet. Fr. Pat. 379,038, Aug. 28, 1906.

The marcs of red wines, containing both alcohol and cream of tartar, are lixiviated systematically in a battery with water made alkaline by sodium carbonate, both the valuable constituents being thus extracted in a single operation. The extract is then treated with a quantity of sulphuric acid exactly equivalent to the sodium carbonate used. After a few days, the clear liquid is decanted off from the deposit of cream of tartar, and the alcohol is recovered by distillation. If desired, the tartar may be precipitated from the alkaline extract by the addition of lime or calcium chloride.—J. F. B.

Alcohol; Denaturing agent for ——, *and its process of manufacture.* T. Heidlberg. Fr. Pat. 378,988, June 19, 1907.

A new denaturing agent for alcohol consists of a mixture of a carbylamine, preferably phenylcarbylamine, thiocresol or other body of the thionic series, and, if desired, traces of methyl orange. The phenylcarbylamine is prepared in alcoholic solution by treating a mixture of chloroform and aniline with alcoholic potassium hydroxide and decanting the clear solution. Thiocresol is preferably obtained by the reduction of *p*-toluenesulphonic-chloride, a by-product of the manufacture of saccharin. Suitable proportions of the components for the production of a commercial denaturing agent consist of 15 parts of phenylcarbylamine and 7·5 parts of thiocresol in 100 parts of alcohol.—J. F. B.

Ammonia from distillery washes; Recovery of ——. J. Effront, Brussels. U.S. Pat. 868,976, Oct. 22, 1907.

See Fr. Pat. 369,630 of 1906; this J., 1907, 109.—T. F. B.

Fr. Pat. 379,036; *Green coffee, etc.* *See* XVIII*A*.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A*.)—FOODS.

Meat; Formation of volatile sulphur compounds in ——, *and their influence on the detection of added sulphites.* A. L. Winton and E. M. Bailey. J. Amer. Chem. Soc., 1907, 29, 1499—1503.

In order to ascertain the effect of volatile sulphur compounds formed in meat on the determination of added sulphites, 50 grm. portions of chopped meat were distilled with phosphoric acid solution, the vapours collected in bromine water, and the sulphur precipitated as barium sulphate. The quantities of volatile sulphur from fresh meat and from meat 14 days old, determined thus, were as follows:—

	Beef. mgrms.	Mutton. mgrms.	Veal. mgrms.	Pork. mgrms.
1st day	0·0	0·0	0·1	0·0
14th day	1·4	2·1	4·0	2·4

Experiments were also made with meat (50 grms.) from 1 to 27 days old, in which the vapours from the distillation flask, before being absorbed in bromine water, were passed through a 1 per cent. solution of copper sulphate, which retains the hydrogen sulphide class of compounds (sulphides, mercaptans, etc.), without absorbing an appreciable quantity of sulphur dioxide. The results were somewhat irregular, but during the first four days, the quantities of volatile sulphur both as sulphur dioxide and as hydrogen sulphide, were inconsiderable. After the fourth day, the amount of sulphur as sulphur dioxide increased, the largest quantity obtained being 1·9 mgrms. after 18 days from veal. The greatest amounts of sulphur as sulphur dioxide from beef and pork were 1 mgrm. (after 19 days) and 0·8 mgrm. (after 9 days) respectively. The amounts of sulphur as hydrogen sulphide were larger than those of sulphur as sulphur dioxide; especially with veal, from which the maximum amount—3·4 mgrms. after 9 days—was obtained. The largest amount of total volatile sulphur, *viz.*, 4·6 mgrms. after 9 days, was also obtained from veal.—A. S.

Bleached flours; Detection of ——. F. J. Alway and R. A. Gortner. J. Amer. Chem. Soc., 1907, 29, 1503—1513.

Flours bleached by means of nitrogen peroxide give a pink coloration with the Griess-Ilosvay reagent [a mixture of acetic acid solutions of sulphanilic acid and *α*-naphthylamine], whilst unbleached flours give no coloration, provided care be taken that the atmosphere in which the test is performed, and the reagents employed, are free from nitrous acid or nitrites. Bleached flours do not give off any substance which will so affect unbleached flours stored alongside them, that these will subsequently give the pink coloration with the Griess-Ilosvay reagent. In a large number of samples of bleached flours, the average content of nitrites was 6·3 parts per million. Flours bleached by means of chlorine and bromine are characterised by increased acidity, which is especially evident in the oil extracted by means of benzene from the flour. Such flours may be detected by extracting 30 grms. with benzene, and evaporating the extract, an oily residue being obtained. A piece of copper wire is then heated in a Bunsen flame, until the latter is no longer coloured green; the wire is now dipped in the oil and again heated in the flame, when a green or blue coloration indicates the presence of chlorine or bromine. The quantity of halogen may be estimated by titrating an aqueous extract of the flour with $N/10$ silver nitrate solution; about one-half of the halogen used for bleaching is left as chlorides or bromides.—A. S.

Cacao; Composition of the "crude fibre" of ——. H. Matthes and F. Streitberger. Ber., 1907, 40, 4195—4199.

The quantity and proximate composition of the "crude fibres" have been proposed as a measure of the purity or adulteration of substances, such as cacao or pepper, which are liable to be mixed with the husks of the same or other seeds. The authors, working on cacao powder, have found that the "crude fibre" always contains variable quantities of coloured extractive matters and nitrogenous substances, according to the process by which it has been prepared. Moreover, the "crude fibre" prepared by König's method, which gives the highest yield, is the most contaminated with nitrogenous residues. The authors have also investigated the process described by König (this J., 1906, 1069) for the proximate separation of cellulose, lignin, and cutin in "crude fibre," as applied to that of cacao. In the first place they show that the action of the ammoniacal hydrogen peroxide there prescribed is not confined to the lignin, but that it attacks not only the impurities mentioned above, but also the cellulose. Filter paper treated with this reagent suffered a loss of 3—4 per cent. and was reduced to a short-fibred hygroscopic mass. When König's method of proximate separation was applied to the "crude fibre" of the same cacao powder, prepared in various ways, the following results were obtained :—

Method of preparing "crude fibre."	Yield of "crude fibre."	Nitrogen in "crude fibre" from 9 grms. of cacao.	Ratio of lignin to cellulose.
	per cent.	grms.	
Weende	7·83	0·0086	1 : 0·95
König	12·56	0·0285	1 : 0·5
König, modified by Matthes and Müller	7·34	0·0068	1 : 1·37
Ludwig	6·21	—	1 : 2·87

Thus, since "crude fibres" represent such variable mixtures, all results relating to them should always be accompanied by a reference to the process by which they were obtained. The authors conclude that König's process for the separation of lignin and cellulose is not applicable to cacao.—J. F. B.

Parkia africana ; Oil and daua-daua cheese from the seeds of ——. H. Fincke. Z. Untersuch. Nahr. Genussm., 1907, **14**, 511—520.

The seeds of *Parkia africana*, which in the roasted state are known as "Soudan coffee," contain about 16 per cent. of fat, and 29 per cent. of protein, the corresponding amounts in the kernels being 22 per cent. and 42 per cent. respectively. The fat is semi-fluid to solid at the ordinary temperature, and has hardly any taste or smell. It possesses weak drying properties, and apparently does not readily become rancid. A sample extracted with petroleum spirit gave the following results :—Refractometer reading at 25° C., 67·2 ; at 40° C., 58·8 ; acid value, 2·5 ; saponification value, 184·5 ; iodine value (Wijs), 91·6 ; Reichert-Meissl value, 0·6 ; and Hehner value, 95·5. *Daua-daua cheese* is prepared by boiling the kernels of *P. africana* with water until soft, beating the mass into a pulp in wooden mortars, flavouring it with salt and red pepper, and compressing it into small cakes, which are dried in the sun. In another method the pulp is allowed to stand for 3 days and then spread in the sun to dry, no flavourings being added. The cheese is largely used by the natives of the Soudan in place of meat. A sample gave the following results :—Water, 17·45 ; ethereal extract, 35·40 ; total nitrogen, 5·89 ; protein nitrogen, 2·42 ; water-soluble nitrogen, 4·53 ; nitrogen of indigestible protein, 0·30 ; albumose nitrogen, 0·12 ; nitrogen of peptones and bases, 0·58 ; ammoniacal nitrogen, 1·05 ; amino-nitrogen, 0·24 ; sugars, 0 ; crude fibre, 3·38 ; free acid (as lactic acid), 1·74 ; ash (without sand), 2·73 ; and sand, 1·24. The ash contained no chlorine. The fat, extracted with petroleum spirit, agreed closely in characteristics with that obtained from the seeds themselves, with the exception of the acid value which was 31·7. The cheese is remarkably stable, a sample kept under glass showing no appreciable change after the lapse of 6 months.—C. A. M.

Patents.

Grain ; Process of treating ——, *for use as a foodstuff, as an ingredient of cocoa and chocolate preparations, as a coffee substitute, and for like purposes.* A. De Crignis, Augsburg, Germany. Eng. Pat. 1041, July 18, 1907. (Under Rule 5 of the Pats. Rules, 1905.)

The grain, such as maize, barley and the like, but preferably oats, is, after removing the husks, sprayed with water at a temperature of from 25° to 30° C. The quantity of water thus added is from 25 to 30 per cent. and after every 24 hours a further quantity is added to replace that lost by evaporation. After two or three days, when the formation of lactic acid begins, the grain is dried. It may be then shredded, ground to a flour, mixed with cocoa, or roasted to form a coffee substitute.—W. P. S.

Casein soluble to a neutral solution ; Process of preparing ——. J. A. Just, Syracuse, N.Y. U.S. Pat. 868,445, Oct. 15, 1907.

Separated milk is diluted with from two to four times the volume of water, and the casein is precipitated by adding 0·1 per cent. of acetic acid, the precipitation being aided by heating the mixture to a temperature not exceeding 140° F. The casein is collected, washed, mixed with a sufficient quantity of alkali to form a neutral soluble compound, and then dried. Or, the washed and dried casein may be mixed with the requisite quantity of dry alkali.—W. P. S.

Evaporating process [*for milk*]. J. A. Just, Syracuse, N.Y. U.S. Pat. 868,447, Oct. 15, 1907.

The liquid, such as milk, to be evaporated, is continuously supplied to the upper part of two rotating perforated drums, mounted horizontally close to each other. Hot, dry air is forced under pressure into the interior of the drums and passes through the perforations and milk on the outer surface of the drums. The partially evaporated milk is pressed as it passes between the drums, and, after the drying has been completed, the dry film is removed from the drums before it reaches the point where the fluid milk is supplied to the apparatus.—W. P. S.

Green coffee, spirits, wines, etc. ; Process for improving ——. J. M. L. Desvignes. Fr. Pat. 379,036, Aug. 28, 1906.

Coffee, wines and spirits or any products, vegetable or mineral, which are capable of being improved by natural oxidation, are "aged" rapidly artificially by treating them in closed vessels with compressed air.—J. F. B.

Eng. Pat. 23,055 ; *Yeast, etc.* *See* XVII.

(*B.*)—SANITATION ; WATER PURIFICATION.

Patents.

Air ; Automatic apparatus for indicating the presence of dangerous gases or vapours in mixture with ——. A. Philip and L. J. Steele, Portsmouth. Eng. Pat. 22,129, Oct. 6, 1906.

The air is drawn by means of a pump through a series of pipes extending to the places where it is desired to perform the test, and is then conducted into an apparatus containing two separate but similar wires of palladium, platinum, or like catalytic substance. The air circulates round one wire, and the resistance of the two wires is so regulated that an electric current, supplied to both, passes through that in contact with the air, and causes a solenoid to draw a pivoted armature towards it so that a white lamp is lighted up. When combustible gases are present in the air, the wire around which the air circulates becomes heated, its resistance increases, and the current passes through the second wire, causing the pivoted armature to be drawn over in the other direction, and lighting up a red lamp. The wires may be suitably heated, preferably by the passage of the current, before commencing the circulation of the air. The apparatus is enclosed in a case and means are provided for breaking the connections before the case can be opened. Pilot lamps are also provided to show whether the apparatus is in working order.—W. P. S.

Gases ; Process for abstracting from a liquid —— *dissolved therein.* J. F. P. Kestner, Lille, France. Eng. Pat. 1843, Jan. 24, 1907. Under Int. Conv., Jan. 24, 1906.

See Fr. Pat. 371,486 of 1906 ; this J., 1907, 429.—T. F. B.

Water ; Apparatus for separating foreign substances from ——. V. Antoine, Labermont, Belgium. Eng. Pat. 1[illegible],288, Aug. 27, 1907. Under Int. Conv., Aug. 28, 1906.

See Fr. Pat. 374,040 of 1907 ; this J., 1907, 775.—T. F. B.

Purifying water and other liquids ; Apparatus for use in ——. P. G. Griffith, London. U.S. Pat. 867,969, Oct. 15, 1907.

See Fr. Pat. 360,970 of 1906 ; this J., 1906, 605.—T. F. B.

Liquids [*water*] ; *Process and apparatus for the purification of* ——. J. T. Harris. Fr. Pat. 378,777, June 14, 1907.

See U. S. Pat. 857,277 of 1907 ; this J., 1907, 829.—T. F. B.

Eng. Pat. 22,028 ; *Gas from garbage.* *See* II.

(*C.*)—DISINFECTANTS.

Nicotine in tobacco; Determination of ——. W. W. Garner. *See* XXIII.

PATENTS.

Paraformaldehyde and peroxide mixture [*for generating formaldehyde*]. A. Eichengrün, Düsseldorf, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 866,850, Sept. 24, 1907.

SEE Fr. Pat. 366,605 of 1906; this J., 1906, 1063.—T. F. B.

Formaldehyde gas; Generation of ——. A. Eichengrün, Düsseldorf, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 866,851, Sept. 24, 1907.

SEE Addition to Fr. Pat. 366,605; this J., 1907, 839.—T.F.B.

Eng. Pat. 23,055; *Yeast, etc. See* XVII.

XIX.—PAPER, PASTEBOARD, &c.

PATENTS.

Rosin size for paper-making purposes; Manufacture of ——. W. N. Bacon, London. Eng. Pat. 28,886, Dec. 18, 1906.

FINELY-GROUND rosin is mixed with the requisite quantity of crystallised sodium monosilicate (Eng. Pat. 24,226, 1905; this J., 1906, 846), and the mixture is heated in a steam-jacketed pan for 30 minutes or more. The melt is then run out on to a cold surface, allowed to set, and finally ground.—J. F. B.

Millboards and moulded products [*from peat fibre*]; *Manufacture of* ——. O. P. Beck. Fr. Pat. 378,858, June 14, 1907.

PEAT is washed and is then beaten to a pulp in a beating engine so adjusted as to separate the fibres from their aggregates without damage to the individual units. During this process a considerable proportion of gelatinous colloidal matter, peculiar to the peat owing to the conditions under which the latter was formed, enters the surrounding water in a dissolved or semi-dissolved state. When the millboard has been made, either from peat fibre alone or in admixture with other pulps, the back-water from the machine, containing this gelatinous matter, is returned to the beating engines for the treatment of further quantities of peat. Thus in course of time the water in which the pulp is suspended becomes so highly charged with gelatinous matter, that boards and other products made with it possess remarkable qualities as regards strength and impermeability.—J. F. B.

Cellulose derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,067, Oct. 29, 1906.

SEE Fr. Pat. 371.447 of 1906; this J., 1907, 310.—T. F. B.

Cellulose derivatives and their solutions; Manufacture of ——. A. and H. Knoll and M. Daege (Knoll und Co.), Ludwigshafen on Rhine, Germany. Eng. Pat. 8369, April 10, 1907. Under Int. Conv., April 10, 1906.

SEE Fr. Pat. 376,578 of 1907: this J., 1907, 988.—T. F. B.

Fr. Pat. 379,000; *Filaments, etc. See* V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS

Apomorphine; An intermediate product in the formation of ——. [*β-chloromorphide.*] L. Ach and H. Steinbock. Ber. 1907, 40, 4281—4285.

THE authors obtained β-chloromorphide by the following method. Morphine was heated in a closed vessel with fuming hydrochloric acid to 65° C. The liquid was then evaporated in a vacuum, neutralised with sodium bicarbonate, and extracted with ether. When crystallised from much ether, β-chloromorphide, $C_{17}H_{18}NO_2Cl$, forms aggregates of prisms, melting at 188° C. It is thus isomeric with the chloromorphide of Schryver and Lees (Chem. Soc. Trans., 1900, 77, 1029). On boiling with water, it forms the hydrochloride of a chlorine-free base. It can also be produced by warming chloromorphide with fuming hydrochloric acid in a closed vessel at 80° C. When β-chloromorphide is warmed with concentrated sulphuric acid, a sulpho-product, $C_{17}H_{18}NO_5ClS$, is formed, which crystallises from water in glistening prisms, containing one molecule of water of crystallisation. This substance is difficultly soluble in organic solvents, but easily soluble in alkalis or ammonia, being reprecipitated on the addition of acids. Chloromorphide gives no sulpho-product when treated in the same way. When heated with water to 140° C., sulpho-β-chloromorphide loses chlorine forming a well-crystallised compound; it also forms an acetyl-product crystallising in fine glistening needles. The methiodide of β-chloromorphide crystallises from water in thick prisms melting at 210° C. with decomposition. Acetyl-β-chloromorphide crystallises from alcohol in fine, minute needles, melting at 163° C. The methiodide of the acetyl-product melts at 177° C. with decomposition.—F. SHDN.

Yohimbine; Characteristic reactions of ——. C. Reichard. Pharm. Zentralh., 1907, 48, 755—761.

YOHIMBINE gives no reaction, in the cold, with strong sulphuric acid even on prolonged contact, but if excess of acid be removed with filter-paper, the moist mass remaining shows a blue fluorescence. Yohimbine hydrochloride dissolves in warm sulphuric acid with the production of a blue colour, changing to dull greyish-blue on cooling. The salt is coloured yellow, without dissolving, by 25 per cent. nitric acid, and this colour is persistent on dilution. If the yellow mass be warmed, the colour is sometimes discharged and sometimes changes to a greenish-yellow tint. Yohimbine hydrochloride is insoluble in potassium hydroxide solution: a particle of the salt, moistened with that reagent, affords characteristic microscopic needles of the free base, and a fine violet or blue fluorescence under suitable illumination. If a trace of yohimbine hydrochloride be rubbed down with a small quantity of potassium bichromate, or ammonium molybdate, then moistened with a few drops of water, and allowed to evaporate spontaneously, a yellow residue is obtained with the bichromate mixture, which gradually becomes blue, surrounded by an almost yellow edge. The molybdate mixture, under similar conditions, gives a deeper blue colour. Both blue residues are permanent, but the colour is discharged on the addition of a drop of strong sulphuric acid. The following reaction is recommended for the toxicological detection of yohimbine. A mixture of the alkaloid and potassium ferrocyanide is treated with a drop of water; the edge of the mass then develops a blue colour. On drying, the edge forms a silvery white band with a bluish reflection, and the inner part has a golden, shining aspect. The addition of hydrochloric acid destroys these colours; the residue, observed obliquely shows a blackish-grey colour.—J. O. B.

Picrolonates of certain alkaloids. W. H. Warren and R. S. Weiss. J. of Biol. Chem., 1907, 3. 327—338.

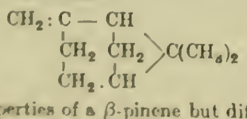
THE authors find that picrolonic acid (1-*p*-nitrophenyl-3-methyl-4-nitro-5 pyrazolone) is a more sensitive reagent than picric acid for the identification of certain alkaloids, especially coniine, strychnine, and morphine. The picrolonic acid is best prepared by Braun's method (Inaug. Diss., Jena. 1899). 200 grms. of methylphenylpyrazolone are introduced, 1 grm. at a time, into 600 c.c. of 90 per cent. nitric acid (sp. gr. 1·49) cooled by means of ice-water, the mixture being continually agitated, and the temperature kept below 15° C. After standing for 30 mins., the separated crystals are collected on an asbestos filter, drained from acid and washed successively with dilute nitric acid and water, with the aid of the pump. These crystals are converted into picrolonic acid by digestion with 33 per cent. acetic acid at 50°—60° C., and the crude acid is purified by converting it into its sodium salt by means of sodium carbonate, and decomposing this with concentrated hydrochloric acid. For the precipitation of alkaloids, picrolonic acid is best used in the form of a saturated alcoholic solution. A comparison of the results obtained with saturated solutions of picric and picrolonic acids, respectively, in 90 per cent. alcohol is given in the following table :—

Alkaloids.	Picric acid.		Picrolonic acid.	
	Positive in 15 mins.	Remarks.	Positive in 15 mins.	Remarks.
Coniine	1—250	Turbidity without ppt.	1—800	Very slight in 15 mins.
Nicotine	1—20000	Slight crystalline ppt.	1—20000	Slight crystalline ppt.
Strychnine	1—40000	Very slight in 15 mins.	1—75000	Very slight in 15 mins.
Brucine	1—20000	Positive in 12 mins.	1—10000	Very slight in 15 mins.
Morphine	1—400	Very slight in 15 mins.	1—500	Positive in 30 mins. at 1—1000.
Codeine	1—1000	Very slight	1—500	Very slight.
Atropine	1—1000	Turbidity which becomes crystalline	1—1000	Turbidity which becomes crystalline.
Quinine	1—50000	Turbidity without ppt.	1—50000	Turbidity without precipitate.
Hydrastine	1—10000	Turbidity without ppt.	1—10000	Turbidity which becomes crystalline

Although the two reagents are about equally sensitive towards nicotine, picric acid is the best precipitant for this alkaloid, as the precipitate is distinctly crystalline and quite characteristic at a dilution of 1 in 20,000. For the microscopic examination of picrates and picrolonates of alkaloids, it is advisable to use crystals which have separated slowly from alcoholic solutions. A description (with micro-photographs) of the more important salts is given. Coniine picrolonate, large rhombohedrons or short, thick, irregular crystals with pointed ends, melts at 195·5° C. Nicotine picrolonate forms long, thin, prismatic needles with square ends, often grouped in fan-shaped clusters ; m. pt., 213° C. Strychnine picrolonate, rectangular prisms, sometimes arranged in star-shaped clusters, melts at about 275° C. Brucine picrolonate forms cubical crystals which melt at 256° C. Morphine picrolonate, broad flattened needles, sometimes arranged in fan-shaped clusters, melts at 186·5° C. Codeine picrolonate, truncated pyramids, melts at 219° C. Atropine picrolonate, short pointed crystals grouped in spherical masses, melts at 194° C. Quinine picrolonate, hair-like needles arranged in spherical masses or sheaf-like clusters, melts at 225° C. Hydrastine picrolonate forms long, flat prismatic needles with square or pointed ends, which melt at 220° C.—A. S.

Terpenes and essential oils. Parts 88 *and* 89. O. Wallach. Annalen, 1907, **357**, 49—71, 72—84.

By treating nopinone with bromoacetic ester and zinc in benzene solution, a hydroxyester is obtained which loses water when heated with potassium bisulphate, yielding the corresponding unsaturated ester. This on hydrolysis and elimination of carbon dioxide gives a dextrorotatory bicyclic terpene of formula



having the properties of a β-pinene but differing from the β-pinene (nopinene) occurring in oil of terpentine, from which the nopinone used in the synthesis had been obtained. When nopinone reacts with magnesium-ethyl iodide, an intermediate compound is produced which yields ethylnopinol, and this when shaken with 5 per cent. sulphuric acid, gives a homologue of terpine hydrate, $HO.C(CH_3)_2.C_6H_9(C_2H_5).OH$. Both ethylnopinol and the compound just described readily give a dihydrochloride which on treatment with aniline yields the corresponding hydrocarbon, b. p. 201—202° C. ; this has probably the constitution, $CH_2 : C(CH_3).C_6H_8.C_2H_5$. By a similar series of reactions, using magnesium-methyl iodide, sabinaketone yields terpinene-terpine (1 : 4-*p*-dihydroxy-*p*-terpane), m. p. 137° C. (this J., 1907, 221), and by employing magnesium-ethyl iodide, the corresponding ethyl derivative, m. p. 141—142° C. is obtained. Sabinaketone when treated with bromoacetic ester and zinc as described for nopinone, ultimately yielded a terpinene, b. p. 176° C., probably $(CH_3)_2CH.C_6H_7 : CH_2$. When sylvestrene dihydrochloride is shaken with aqueous potassium hydroxide, sylveterpine, $C_{10}H_{18}(OH)_2$, m. p. 135—136° C., and sylveterpineol, $C_{10}H_7.OH$, b. p. 210—214° C., are formed. The author describes a new synthesis of anethol from anisaldehyde by treating it with bromopropionic ester and zinc, and subsequently as explained above, and also of *iso*safrol from piperonal by the same method. Finally it is shown that camphene from Siberian pine-needle oil and from a citronella oil containing camphene are identical, and only physically isomeric with the artificial product from pinene or borneol. A new camphene, b. p. 160—161° C., m. p. 50° C., $[\alpha]_D = +103{\cdot}89°$, was obtained from bornylamine by treatment with sodium nitrite.—J. C. C.

Camphor group ; Syntheses in the ——. *Complete synthesis of campholene.* G. Blanc. Compt. rend., 1907, **145**, 681—683.

The sodium compound of malonic acid ester is allowed to act upon γ-bromo-1.1-dimethylbutyric acid ethyl ester, forming the ester of 1.1-dimethylbutane-1.4.4.-tricarboxylic acid, which boils at 168° C. at 14 mm. The acid corresponding to the latter ester forms small needles, slightly soluble in water, more soluble in ether and formic acid. This acid melts at 205° C., giving off carbon dioxide with the formation of 1.1.4-trimethylbutane-1.4.-dicarboxylic acid (*ααδ*-trimethyladipic acid), which melts at 113°—114° C., and is slightly soluble in water. When trimethyladipic acid is heated with acetic anhydride, it loses water forming 1.1.4-trimethylcyclopentanone-5. This new ketone is a mobile liquid, with an odour of camphor and menthone, and boiling at 152° C. The oxime crystallises from light petroleum in large prisms melting at 62° C. When condensed with methyl-magnesium iodide, it forms a tertiary alcohol boiling at 72° C. at 18 mm. This on distillation at the ordinary pressure loses water with the formation of campholene, identical with that prepared from β-campholenic acid.—F. Shdn.

Artemisia cina [*Wormseed*] ; *Essential oil of* ——. J. Schindelmeiser. Apoth.-Zeit., 1907, 22, 876—877.

Essential oil of wormseed is a light yellow liquid, which darkens on keeping, even in a sealed tube ; $\alpha_D = -2°18'$; $n_D^{20°} = 1{\cdot}4652$; sp. gr. 0·924 at 20° C. In addition to cineol, it contains small quantities of pinene, terpinene, and terpineol, the latter partly free, and partly as ester ; the amount of terpineol isolated from 2 kilos. of oil was 30 grms. Although terpineol has been recorded as occurring in the essential oils produced by plants of widely different botanical sources, it has only once previously been isolated from a member of the N.O. *Compositæ*, having been detected by Power, and also by Hunkel, in the oil of *Erigeron canadense*.—J. O. B.

Antipyrine [*phenyldimethylpyrazolone*] ; *New reaction for* —— [*with dimethylaminobenzaldehyde*]. F. A. Steensma. Apoth.-Zeit., 1907, 22, 819.

A trace of antipyrine is dissolved in a few c.c. of the following reagent :—*p*-dimethylaminobenzaldehyde, 1 grm.; 25 per cent., hydrochloric acid, 5 c.c. ; absolute alcohol, to make 100 c.c. The solution is evaporated to dryness, on the water-bath, in a porcelain capsule, when a residue showing red patches is obtained. If only a minute quantity of antipyrine is present, the reagent should be diluted with an equal volume of absolute alcohol, and the residue obtained on evaporation will show a red ring instead of patches or spots; as little as 0·001 mgrm. may be thus detected. Antipyrine may be removed from aqueous solution by shaking out with chloroform; the chloroform residue may then be tested as above. Pyramidone (dimethylaminoantipyrine), under these conditions, gives no colour reaction, so that the test serves to detect the adulteration of pyramidone with antipyrine. Salipyrine (antipyrine salicylate) and acetopyrine (antipyrine acetosalicylate) react like antipyrine.—J. O. B.

Iodomercurates. A. Duboin. Compt. rend., 1907, **145**, 713—715.

The author has prepared a ferrous salt, $FeI_2,2HgI_2,6H_2O$, in dark orange crystals, of density 4·04, and the corresponding cobalt salt, indistinguishable in appearance from the ferrous salt, but having a density of 4·17. In the case of aluminium, crystals separate only after several months of spontaneous evaporation; they contain oxygen, their formula being $HgO+2AlI_3,3HgI_2,15H_2O$. An aluminium-silver salt is also obtainable, of the formula, $2AlI_3,5AgI,Ag_2O,13H_2O$; this salt, however, very rapidly alters in composition.—J. T. D.

Methylsulphonal [*or Trional. Diethylsulfone-methyl-ethylmethane*]; *U.S. Customs Decision.* Oil, Paint, and Drug Rep., Oct. 28, 1907. [T.R.]

Methylsulphonal was assessed for duty at the rate of 25 per cent. ad valorem under paragraph 68 of the tariff act of 1897. It was claimed to be dutiable under paragraph 15 at 20 per cent. ad valorem. An examination of the record failed to disclose any cause for disturbing the decision of the collector, which was affirmed, and the protest offered was overruled.

Patents.

Tartaric acid; Manufacture of ——. Sir J. McDougall and F. L. McDougall, Greenwich. Eng. Pat. 4613, Feb. 25, 1907.

In the manufacture of tartaric acid, instead of preparing the calcium salt, the crude tartrate, in the form of a salt of an alkali metal, is treated with sulphuric acid in order to produce tartaric acid and an alkali sulphate. The filtered liquid is then treated with aluminium sulphate in proportion sufficient to form an alum, and this latter is separated by evaporation and crystallisation, whilst the tartaric acid is recovered from the mother liquors.—J. F. B.

Thiosinamine compound. F. Mendel, Essen on Ruhr, Germany. U.S. Pat. 868,204, Oct. 15, 1907.

See Eng. Pat. 22,533 of 1905; this J., 1906, 134.—T. F. B.

Alcohol [*3.7-dimethyloctanol*] *and process of obtaining the same from carboxylic compounds.* L. Bouveault and G. Blanc, Paris. U.S. Pat. 868,252, Oct. 15, 1907.

See Eng. Pat. 14,758 of 1903; this J., 1904, 798.—T. F. B.

Aldehydes and solutions thereof; Process of making ——. H. S. Blackmore, Mount Vernon, N.Y. U.S. Pat. 868,320, Oct. 15, 1907.

Aldehydes are prepared by oxidising alkyl hydroxides in presence of a fluid which is capable of absorbing the aldehyde produced, maintaining the temperature below the point of dissociation of the aldehyde, by abstracting the heat liberated during the oxidation, and recovering the aldehyde in combination with the absorbing fluid. Formic aldehyde is prepared by establishing a sphere of reaction between vaporised methyl alcohol and oxygen, maintaining the temperature at the desired limit by the heat-absorbing action of steam, and condensing the products in the form of an aqueous solution of the aldehyde.—J. F. B.

Salicylic acid derivatives and intermediate products; Process for preparing ——. Farbenfabr. vorm. F. Bayer und Co. Addition, dated June 1, 1907, to Fr. Pat. 368,133, July 17, 1906. Under Int. Conv., July 18, 1906.

Anhydromethylenecitryl-hydroxytoluic acids are prepared by the action of dihalogen derivatives of anhydromethylene-citric acid on hydroxytoluic acids or their salts, in the manner described in the principal patent (this J., 1907, 947).—T. F. B.

Acetylene tetrachloride; Preparation of ——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 378,713, June 11, 1907.

When chlorine and acetylene are previously intermingled with inert solid substances, their mixture may be effected without the danger of explosion. The combination between the mixed gases under the influence of contact substances is then preferably carried out under similar conditions of dilution. The apparatus consists of a reaction-tube containing coarse gravel in its lower portion, a mixture of fine sand and iron filings in its middle portion, which is surrounded by a cooling jacket, and pure sand in its upper portion. The acetylene and chlorine are introduced through separate tubulures, and, mixing together in presence of the sand, they react in the middle portion under the influence of the iron filings, the acetylene tetrachloride being discharged through the coarse gravel in the lower portion. According to another process, the whole tube is filled with sand, and the lower portion is immersed in an absorbing liquid such as antimony pentachloride in which the reaction takes place.—J. F. B.

Phenol ethers; Process of manufacture of derivatives of ——. C. Dreyfus. Fr. Pat. 378,856, June 14, 1907.

Phenol ethers containing the aldehyde group can be saponified by anhydrous aluminium chloride without the aldehyde group being attacked. Example: 16·6 parts of 1 : 2-dimethoxy-4-benzaldehyde are dissolved in 20 parts of dry benzene, and 14 to 16 parts of sublimed anhydrous aluminium chloride are added. When the latter is dissolved, the benzene is distilled off and the residue heated to 130—170° C. until the reaction is finished. The mass is then powdered, boiled with acidified water, and, on cooling, extracted with ether or benzene. The resulting extract is treated with aqueous alkali which dissolves 1 : 2-dihydroxy-, 1-hydroxy-2-methoxy- and 1-methoxy-2-hydroxy-4-benzaldehyde. These are separated from each other by known methods.—J. C. C.

Perfumes and other pulverulent products; Process for preparing —— *by absorption of little volatile or non-volatile oils and essences.* R. P. Warcollier. Fr. Pat. 378,867, June 14, 1907.

Precipitated and dry silica or a precipitated and dry silicate is mixed with perfumed oils, essences, etc. The oil or essence is liberated in contact with water. When the oil or essence absorbed by the vehicle is liable to oxidation, etc., on exposure to the air, it is best to incorporate with the mass about 5 per cent. of a mixture of sodium bicarbonate and tartaric acid. By the action of traces of moisture present in the containing vessel, carbon dioxide is liberated from this mixture and protects the essence, etc., from oxidation.—T. F. B.

Salts from naphtholmonosulphonic acids and p-aminobenzoic acid ethyl ester; Process for preparing ——. Act.-Ges. f. Anilinfabr. Ger. Pat. 181,324, Feb. 13, 1904.

Stable salts are obtained by combining *p*-aminobenzoic ethyl ester with naphtholmonosulphonic acids, or by combining neutral metallic salts of the acid with salts of the ester, in each case in aqueous solution.—T. F. B.

1-*Phenyl-2.3-dimethyl-4-dimethylamino-5-pyrazolone; Process for making a preparation of* —— *containing iodine.* G. Nardelli and V. Paolini. Ger. Pat. 180,120, March 31, 1905.

Hydriodic acid of sp. gr. 1.7 is added to a saturated aqueous solution of phenyldimethyl-4-dimethylaminopyrazolone, the mixture is evaporated to dryness on a water-bath, and the product extracted with a mixture of equal parts of alcohol and ether.—T. F. B.

Acetylenetriphenyltriamine ; Process for preparing ——. G. Imbert and Konsortium f. Elektrochem. Ind. Ger. Pat. 180,011, April 23, 1905.

A TETRAHALOGEN-SUBSTITUTED ethane or a trihalogen-substituted ethylene (1 mol.) is heated with aniline (3 mols.) and an aqueous solution or suspension of an alkali hydroxide, alkaline-earth hydroxide, or alkaline salt. The yield is stated to be 60 per cent. of theory.—T. F. B.

Anthraflavic acid ; Process for preparing chloro-addition products of ——. R. Wedekind und Co. Ger. Pat. 179,916, Aug. 19, 1905.

NASCENT chlorine is allowed to act on a suspension of anthraflavic acid in calcium chloride or magnesium chloride solution at a temperature of 110° C. The addition products obtained thus are of use in pharmacy or for the preparation of dyestuffs.—T. F. B.

Trichloroanthraflavic acid ; Process for preparing ——. R. Wedekind und Co. Ger. Pat. 181,659, Aug. 19, 1905.

THE addition-product of anthraflavic acid and chlorine (see preceding abstract) is converted into trichloroanthraflavic acid by heating with solvents of high boiling-point such as xylene, nitrobenzene, or phenol.—T. F. B.

Isoeugenol from alkali-eugenols ; Process for preparing ——. F. Fritzsche und Co. Ger. Pat. 179,948, Sept. 27, 1905.

ALKALI derivatives of eugenol can be converted into iso-eugenol by heating to 200° C., air being excluded ; no free alkali or solvent is necessary.—T. F. B.

p-Aminodiphenylaminemonosulphonic acid ; Process for preparing a ——. E. Erdmann. Ger. Pat. 181,179, Nov. 22, 1905.

p-AMINODIPHENYLAMINE is heated to 110°—130° C. with sulphuric acid containing at least 100 per cent. of "monohydrate," and not more than 20 per cent. of anhydride, the melt is poured into water, and the acid is purified by solution in alkali.—T. F. B.

Fr. Pat. 379,038 ; *Brandy, etc.* *See* XVII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographs on metal, glass, porcelain, and the like ; Process of producing ——. A. Hans, Friedenau, Germany. Eng. Pat. 1928, Jan. 25, 1907.

SEE Fr. Pat. 373,652 of 1907 ; this J., 1907, 717.—T. F. B.

Photographic halation ; Preparation of coloured layers which prevent the formation of ——. Soc. Anon. des Plaques et Papiers Photogr. A. Lumière et ses fils Fr. Pat. 379,187, Sept. 1, 1906.

COLLOIDAL, brown manganese oxide is used as the colouring matter for the film which is interposed between the sensitive emulsion and the glass to prevent halation in photographic plates. It may be prepared either by warming together solutions of gelatin and potassium permanganate, and mixing the brown liquid thus obtained with gelatin, or by adding ammonia to a solution of gelatin, a manganous salt, and an oxidising agent (*e.g.*, hydrogen peroxide).—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

PATENTS.

Smokeless powder. J. L. Brown, Indianhead, Md., and D. P. Moore, Washington, D.C., Assignors to M. A. G. Himalaya, Arcos-de-Val-de-Vez, Portugal. U.S. Pat. 868,158, Oct. 15, 1907.

CLAIM is made for a non-hygroscopic, stable powder consisting of a powdered chlorate, each particle of which is coated with a drying oil, such as linseed oil, mixed with a substantially pure carbohydrate, such as starch, containing little or no proteid matter or moisture.—C. A. M.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 868,636, Oct. 22, 1907.

THE explosive consists of a mixture of nitro-starch (95—97 parts) and borax or a borate (3—5 parts), the latter being added in such proportion as to stabilise the nitro-starch.—G. W. McD.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 868,637, Oct. 22, 1907.

THE explosive composition consists of an intimate mixture of nitro-starch (30—70 parts) and finely-divided iron or iron filings (70—30 parts).—G. W. McD.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 868,638, Oct. 22, 1907.

CLAIM is made for an explosive base consisting of nitro-starch (98—90 parts) and lime (2—10 parts) ; and an explosive consisting of an intimate mixture of nitro-starch (30—70 parts) and an added material consisting of finely-divided metallic iron and lime (70—30 parts), the proportion of lime being approximately 2 to 10 per cent. by weight of that of the nitro-starch and lime.—G. W. McD.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 868,760, Oct. 22, 1907.

NITRO-STARCH is stabilised by treating it with five times its weight of a 10 per cent. solution of borax, agitating, washing, and drying.—G. W. McD.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 868,837, Oct. 22, 1907.

THE explosive consists of an intimate mixture of nitro-starch (30—70 parts) and an added material consisting of iron filings and ammonium nitrate (70—30 parts), the ammonium nitrate constituting by weight from 5—20 per cent. of the added material.—G. W. McD.

Explosive ; Nitro-starch ——. J. B. Braunstein, Allentown, Pa. U.S. Pat. 869,051, Oct, 22, 1907.

THE explosive consists of an intimate mixture of nitro starch (30—70 parts), and finely-divided iron and sodium carbonate (30—70 parts). The sodium carbonate is added in order to stabilise the nitro-starch.—G. W. McD.

Powder ; Semi-smokeless ——. G. W. Gentieu, Peoria, Ill. U.S. Pat. 868,919, Oct. 22, 1907.

THE powder consists of ammonium picrate (25 parts), potassium nitrate (52), sulphur (10), charcoal (3), and starch (10 parts).—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Platinum vessels ; A cause of destruction of ——. W. C. Heraeus. Z. angew. Chem., 1907, 20, 1892—1894.

BY direct experiment with a crucible with internal vacuum, the author has shown that hydrogen diffuses through platinum, not only from the inner but also from the outer cone of a Bunsen burner. When the crucible contained ferric oxide, this was partially reduced to metal, and the crucible was attacked so strongly that after five hours the vacuum could no longer be maintained within it. Magnesium sulphate was partially reduced to sulphide, and sodium sulphate to sulphite ; but neither of these substances attacked the crucible. Magnesium pyrophosphate was not affected by the temperature produced by an ordinary Bunsen burner ; but when a powerful Teclu burner was used, phosphorus was produced, and the upper and cooler parts of the crucible were strongly attacked.—J. T. D.

INORGANIC—QUANTITATIVE.

Sulphur and arsenic determinations; Use of sodium carbonate and zinc oxide in ——. W. C. Ebaugh and C. B. Sprague. J. Amer. Chem. Soc., 1907, **29**, 1475—1476.

The following methods have given satisfactory results in practice, during several years, in the analysis of sulphide minerals, sulphates (gypsum, etc.), and metallurgical products such as matte, speiss, and flue-dust. *Determination of sulphur.* 0·5 grm. of substance is mixed intimately with a quantity of a mixture of 1 part of anhydrous sodium carbonate and 4 parts of zinc oxide, containing twice as much sodium carbonate as is required for the sulphur, arsenic, etc., present. The mixture is placed in a small porcelain dish, covered with the sodium carbonate-zinc oxide reagent, and heated to redness for 15—20 mins. in a muffle. The residue is extracted with water, boiled, filtered, the filtrate acidified with hydrochloric acid, and the sulphur precipitated as barium sulphate. *Determination of arsenic.* After heating in the muffle as described above, and extracting with water and filtering, the alkaline filtrate is acidified with acetic acid, treated with silver nitrate, boiled for a few minutes, and filtered. The precipitate of silver arsenate is washed, dissolved in dilute nitric acid, and the solution titrated with thiocyanate.—A. S.

Nickel; Determination of —— *in the presence of cobalt, zinc, manganese, iron, aluminium, and chromium, by means of dimethylglyoxime.* O. Brunck. Z. angew. Chem., 1907, **20**, 1844—1850.

Dimethylglyoxime may be used, not only for the determination of nickel in the presence of cobalt, as already described (this J., 1907, 643), but also for its quantitative separation from the other metals of the ammonium sulphide group. The method is accurate and rapid, a determination being completed in an hour, and the somewhat costly reagent may be readily recovered from the precipitates. *Nickel and cobalt.* The conversion of nitrates into chlorides before precipitation is unnecessary (*loc. cit.*). If more cobalt than nickel be present, a larger excess of the reagent is required, and where the quantity of nickel is small, a method is used, in which sodium acetate replaces ammonia. 0·5 grm. of the sample is dissolved in hydrochloric acid and the solution evaporated nearly to dryness. To the hot liquid, diluted to 400 c.c., are added 0·2 grm. of dimethylglyoxime and 2 grms. of sodium acetate, and the precipitate is filtered off after half an hour. *Nickel and manganese.* Sodium acetate is used, instead of ammonia, to neutralise the mineral acid. *Nickel and zinc.* The separation succeeds in the presence of ammonia or acetic acid, but the latter is preferable. *Nickel and iron.* To the solution containing iron, in the ferric state, tartaric acid is added before precipitation, to prevent the subsequent formation of ferric hydroxide on adding ammonia. The method is applicable to nickel steels, since manganese does not interfere. *Nickel and aluminium.* The method is similar to the preceding. *Nickel and chromium.* Tartaric acid is added, as above, to prevent the precipitation of chromium by ammonia, but it is necessary to have a sufficiency of ammonium chloride present also. Nickel in nickel chrome steel may be thus directly determined.

—F. Sodn.

Hydrogen peroxide; Determination of —— *on cotton tissues.* A. Scheurer. *See* V.

Chlorides or bromides in the presence of thiocyanates; Determination of ——. M. A. Rosanoff and A. E. Hill. *See* VII.

Iodates in presence of chlorates; Determination of ——. W. H. Gibson and C. M. W. Grieb. *See* VII.

Phosphorus in iron and steel; Errors in determining ——. G. Chesnau. *See* X.

ORGANIC—QUALITATIVE.

Malt tannin and its detection. A. Reichard. *See* XVII.

Bleached flours; Detection of ——. F. J. Alway and R. A. Gortner. *See* XVIII*A*.

Yohimbine; Characteristic reactions of ——. C. Reichard. *See* XX.

Picrolonates of certain alkaloids. W. H. Warren and R. S. Weiss. *See* XX.

Antipyrine; New reaction for —— [*with dimethylaminobenzaldehyde*]. F. A. Steensma. *See* XX.

ORGANIC—QUANTITATIVE.

Nicotine in tobacco; Determination of ——. W. W. Garner. Bureau of Plant Industry (U.S. Dept. of Agric.), Bull. No. 102 (1907), Part VII.

For the extraction, petroleum spirit is used as solvent; this removes only the nicotine and a portion of the ammonia, leaving amide-compounds undissolved. Six grms. of the finely-divided air-dried tobacco are well mixed with 3—5 c.c. of a 5 per cent. solution of sodium hydroxide and then shaken with 100 c.c. of petroleum spirit (b. pt. 60°—100° C.). The mixture is let stand for four hours, with vigorous agitation at intervals of 30 mins., and then, after allowing to settle, the clear extract is passed through a filter, 75 c.c. (=4·5 grms. of tobacco) of filtrate being collected. This is allowed to stand exposed to the air, or a current of air is drawn through it, in order to remove ammonia; it is then shaken with 10 c.c. of $N/5$ sulphuric acid diluted to 50 c.c. with water, the aqueous layer is drawn off, the petroleum spirit washed twice with a little water, and the excess of acid in the aqueous liquid titrated back with $N/10$ alkali, using cochineal as indicator. (1 c.c. of $N/5$ acid = 0·0324 grm. of nicotine.)—A. S.

Carbon bisulphide in illuminating gas; Technical determination of ——. E. P. Harding and J. Doran. *See* II.

Beeswax; Saponification of ——. G. Buchner. *See* XII.

Shellac and a method of determining its impurities and adulterations. H. Endemann. *See* XIII*B*.

Starch in amylaceous materials; Lintner's polarimetric method for the determination of ——. M. Canet and O. Durieux. *See* XVI.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Carbon; Adsorption of iodine by ——. O. C. M. Davis. Chem. Soc. Trans., 1907, **91**, 1666—1683.

The author studied the adsorption of iodine from its solutions in toluene, alcohol, ethyl acetate, benzene, and chloroform, by animal-, sugar-, and cocoanut-charcoal respectively. In experiments of short duration, it was found that "equilibrium" could be obtained from both sides; that is, when the carbon was immersed in a $N/5$ solution of iodine, which was subsequently diluted to $N/10$ strength, the proportion of iodine adsorbed by the carbon was practically the same as when the latter was immersed directly in a $N/10$ solution. This result points to a surface condensation, which is nearly instantaneous. If the carbon and iodine solution be allowed to remain in contact for longer periods, however, adsorption continues for weeks, and even months, and this slower adsorption must be due to diffusion into the interior of the carbon, *i.e.*, to the formation of a solid solution. The amount of adsorption is not independent of the nature of the adsorbing surface for identical surface area, but is specific, depending both on the nature of the solvent and the adsorbing solvent. For sugar- and animal-charcoals, the amount of adsorption is approximately the same, the surface condensation being more prominent. Cocoanut charcoal adsorbs much less iodine, and that chiefly owing to diffusion into the interior. (See also Freundlich and Losev, this J., 1907, 682; and Hübner, this J., 1907, 866.)—A. S.

New Books.

The Metric and British Systems of Weights, Measures and Coinage. By F. Mollwo Perkin, Ph.D., Head of Chemistry Department, Borough Polytechnic Institute, London. Whittaker and Co., 2, White Hart Street, Paternoster Square, London, and 64-66, Fifth Avenue, New York. 1907. Price 1s. 6d. net.

8vo volume, containing 84 pages of subject matter, with 17 diagrams. The text is subdivided and arranged according to the following scheme:—I. Introduction. II. The metric system. Measurements of length. III. Measurements of area. IV. Measurements of weight. V. Measurements of volume. VI. Specific gravities. VII. Temperature measurements. VIII. Money. IX. Appendix, with tables of nautical measures; wine measure; comparison of the United States weights and measures with the metric system. Screw threads. Thermal units, etc.

A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century, a.d., with Sanskrit Texts, Variants, Translation, and Illustrations. By Praphulla Chandra Ray, D.Sc., Professor of Chemistry, Presidency College, Calcutta. Vol. I. 2nd Edition: revised and enlarged. Williams and Norgate, 14, Henrietta Street, Covent Garden, London. 1907. Price 10s. 6d. net.

8vo volume, containing 267 pages of subject matter, followed by an appendix with seven sheets of engravings, alphabetical indexes of proper names and of subjects, and 70 pages of Sanskrit texts. The text is subdivided as follows:—I. Alchemical ideas in the Vedas. II. The Ayurvedic period. III. The Transitional period. IV. The Tantric period. V. The Iatro-chemical period. VI. Indebtedness of the Arabians to India. The Ayurvedic period. a. Constitution and properties of matter. The atomic theory. b. Chemistry in the Charaka and the Susruta. c. Chemistry in the Bower MS. d. In the Vagbhata. The Transitional Period. e. Chemistry in the Siddha Yoga of Vrinda and Chakrapani. f. Black sulphide of mercury (Kajjali), or Æthiops Mineral. The Tantric Period. g. Chemistry in Rasarnava. The Iatro-Chemical Period. h. Chemistry in Rasaratnasamuchchaya. i. On Metals and Metallurgy. j. On gunpowder, saltpetre and the mineral acids. k. Knowledge of Technical Arts and Decline of Scientific Spirit. Appendix I. Analysis of some preparations used in the Hindu medicine.

The Chemistry of Commerce. A Simple Interpretation of some New Chemistry in its Relation to Modern Industry. By Robert Kennedy Duncan, Professor of Industrial Chemistry in the University of Kansas. Harper and Brothers, Albemarle Street, London, and New York. 1907. Price 7s. 6d. net.

8vo volume, containing 256 pages of subject matter, with a frontispiece and 58 illustrations, and followed by an alphabetical index. The subject matter is classified under the following headings:—I. Introductory. II. Catalysis. III. Problem of the fixation of nitrogen. IV. The rare earths, and some of their applications. V. High temperatures, and modern industry. VI. Modern chemistry, and glassmaking: the type of a crude and wasteful traditional industry. VII. Industrial alcohol. VIII. Floral perfumes. IX. The making of medicines. X. The new microbe inoculation. XI. Cellulose. XII. Industrial fellowship. Scheme by which a manufacturer may solve his problems.

Photographisches Rezept-Taschenbuch—Eine Sammlung von erprobten Rezepten für den Negativ- und Positivprozess unter Berücksichtigung der neuesten Verfahren, von P. Hanneke. Verlag von Gustav Schmidt, Berlin W.10. Price M. 2.25.

Small 8vo volume, containing 171 pages of matter, followed by an alphabetical index of subjects. The work is subdivided as follows:—Negative processes. 1. Silver bromide dry plates and films. 2. Collodion processes. 3. Preparation of enlarged, duplicate, or reduced negatives. 4. Appendix. Positive processes. 1. Silver "printing-out" process. 2. Silver bromide and chloride-bromide papers; diapositives. 3. Printing processes involving the use of iron salts. 4. Bichromate processes. 5. Working up residues.

Tinning of Metals. Special report on dangerous or injurious processes in the coating of metal with lead or a mixture of lead and tin; together with a report on an experimental investigation into the conditions of work in tinning workshops. Anderson, Legge and Duckering. Home Office Report, Nov., 1907. [Cd. 3793.] Price 1s.

The present report completes the inquiry into the subject of the enamelling and tinning of metals begun some years ago by the Principal Lady Inspector of Factories and the Medical Inspector of Factories. A first report by them, which was published in the Annual Report of the Chief Inspector of Factories for the year 1903, contained suggestions for the regulation of Enamelling processes, but not of Tinning processes, the inquiries in connection with which presented very considerable difficulties, and necessitated a long series of experiments which have only recently been brought to a conclusion. An account of these experiments by Mr. Duckering, one of H.M. Inspectors of Factories, who conducted them, forms part of the Report.

The Report shows a serious percentage of poisoning cases among persons employed in the processes of tinning with the use of lead, and contains a number of recommendations as to the steps which should be taken to protect the workers. The Secretary of State has under consideration the question of making Regulations for the industry under Section 79 of the Factory Act in substitution for the existing special rules, but before proceeding formally to issue draft Regulations, he would be glad to consider any observations with reference to the recommendations contained in the Report. These should reach him not later than the 10th December next. He may add, with reference to the use of the term "metal hollow-ware" in the suggested Regulations contained in the Report, that he understands the term is one well recognised in the trade as referring to culinary vessels alone. It is not intended to include under this term such articles as iron drums and kegs, which, although hollow, are not pressed in a single piece, and are not usually classed as hollow-ware.

The Secretary of State proposes at the same time to consider the question of Regulations for enamelling processes, which has been kept back, pending the completion of the inquiry into tinning.

Proceedings of the National Association of Cement Users. Volume III. 1907. Published by the Association, Harrison Building, Philadelphia, Pa., U.S.A.

The volume contains lists of officers and members of the Association, copies of the charter and by-laws, a summary of the proceedings of the third convention, and reports of the executive board and various committees (including report of committee on testing cement and cement products), together with the following papers:—The success and failures of cement construction (R. L. Humphrey); Cement sidewalk paving (A. Moyer); Reinforced concrete (W. K. Hatt); Forms for concrete construction (S. E. Thompson); Selecting the proportions for concrete (W. B. Fuller); Artistic treatment of concrete (A. O. Elzner); Concrete surfaces (H. H. Quimby); Treatment of concrete surfaces (L. White); Concrete blocks (H. H. Rice); Tests of building blocks (R. D. Kneale); Waterproof cement mortars and concretes (H. Weiderhold, E. de Knight, R. R. Fish, G. G. Fry, and S. J. Binswanger, five papers); Investigation of cement mortars and concretes in the U.S. Geological Survey Laboratories (R. L. Humphrey).

Iron and Steel, 1906. Statistical Tables. 350. Wyman and Sons, Fetter Lane, London, E.C. Price 3d.

This memorandum, which has been drawn up in the Commercial, Labour and Statistical Department of the

Board of Trade, is in continuation of Parliamentary Paper No. 322 of Session 1906, and deals with the production and consumption during the 16 years 1890—1905 (and, where possible, to 1906) of iron ore and pig iron, and the production of steel in the United Kingdom, and in the principal foreign producing countries, *viz.*, Russia, Sweden, Germany (including Luxemburg), Belgium, France, Spain, Austria-Hungary, and the United States of America. An appendix shows the production and exports of iron ores from certain British Colonies and Possessions and Foreign Countries, not elsewhere included, in each of the years 1903–5, so far as the figures are available.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

23,888. Harrison, Bate, and Perks. Recovery of volatile liquids. Oct. 29.

24,250. Adams. Filters. Nov. 2.

24,295. Black, Lennox, and Lennox. Drying machines. Nov. 2.

24,357. Richmond, and Lister and Co. Centrifugal liquid separators. Nov. 4.

24,577. Payne. Composition for making firebricks, crucibles, retorts, furnace lining, &c. Nov. 6.

24,766. Hinne. Furnaces.* Nov. 8.

24,785. Norton and Shaw. Furnaces.* Nov. 8.

24,951. Duryea. Drying apparatus.* Nov. 11.

25,215. Jaubert. *See under* II.

25,399. Holzer. Centrifugal separators.* Nov. 15.

25,436. Mills (Hendricks). Apparatus for desiccating.* Nov. 16.

25,473. Fritsche. Drying apparatus.* Nov. 16.

Complete Specifications Accepted.

25,108 (1906). Leiser. Mixing fluids of different densities or a heavy precipitate with a liquid. Nov. 13.

25,435 (1906). Trobridge. *See under* VII.

29,390 (1906). Scard. Multiple evaporators. Nov. 20.

3650 (1907). Stevens. Filter presses. Nov. 6.

4124 (1907). Rehne. Apparatus for heating, refrigerating, and evaporating liquids. Nov. 13.

6171 (1907). Macfarlane. Centrifugal drying machines. Nov. 6.

7116 (1907). Brandenburg. Absorbing, condensing, or purifying gases. Nov. 20.

9285 (1907). Rossée, and Unionwerke A.-G. Fabr. f. Brauerei-Einrichtungen. Filter presses. Nov. 20.

12,626 (1907). Junkers. Apparatus for heating liquids. Nov. 13.

13,715 (1907). Talansier, and Cie. Franç. des Prod. Fixator. Apparatus for stoppering bottles, &c., *in vacuo.* Nov. 13.

16,344 (1907). Lake (Stohr und Co.). Concentration of liquids. Nov. 13.

II.—FUEL, GAS, AND LIGHT.

Applications.

23,796. Engelhorn. *See under* XII.

24,028. Wolfram-Lampen A.-G. Decarbonising tungsten filaments containing carbon or carbide. [Ger Appl., Oct. 31, 1906.]* Oct. 30.

24,097. Hardy Patent Pick Co., and Smith. Apparatus for washing coal, coke, &c. Oct. 31.

24,140 and 24,141. Roberts and Wilson. Production of gases and vapours. Nov. 1.

24,429. Hall-Brown. Gas producers. Nov. 5.

24,813. Ward and Stevens. Filament for electric glow lamps. Nov. 9.

25,215. Jaubert. Manufacture and purification of gas or vapours. [Fr. Appl., Nov. 14, 1906.]* Nov. 13.

25,262. Jones. Coke ovens. Nov. 14.

25,279. Schulthorpe. Production of inflammable gas. Nov. 14.

Complete Specifications Accepted.

17,347 (1906). Parker. Production of partially coked fuel. Nov. 13.

23,950 (1906). Nemerovsky. Incandescent gas mantles. Nov. 6.

24.624 (1906). Bentley. Gas washing and cooling apparatus. Nov. 13.

24,687 (1906). Bowing. Destructive distillation of coal and other substances. Nov. 6.

24,695 (1906). Woodall and Duckham. Vertical retorts for carbonising coal. Nov. 6.

26,882 (1906). Brown. Ovens for the manufacture of coke for metallurgical purposes. Nov. 20.

665 (1907). Thwaite. Securing ready ignitability and continuity of combustion of fixed carbon fuels. Nov. 6.

2828 (1907). Smith and Shaw. Gas plant. Nov. 6.

5195 (1907). Drawbaugh and Gamble. Fuel composition. Nov. 6.

5576 (1907). British Thomson-Houston Co. (General Electric Co.). Manufacture of filaments for incandescent electric lamps. Nov. 20.

12,751 (1907). Doherty. Apparatus for washing and cooling gas. Nov. 6.

17,360 (1907). Collidge. Filaments for electric lamps. Nov. 6.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

24,115. Wynne. Amelioration of petrol, alcohol, benzol, &c. Oct. 31.

24,125. Cooper and Shattock. Manufacture of non-inflammable benzine. Oct. 31.

25,152. Henderson. Apparatus for treating paraffin wax.* Nov. 13.

Complete Specifications Accepted.

24,687 (1906). Bowing. *See under* II.

28,689 (1906). Soc. Anon. des Combustibles Industriels. Distillation and partial dehydrogenation of hydrocarbons. Nov. 13.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

24,330. Vlies, and Claus and Co., Ltd. Manufacture of dyestuffs of the oxazine series. Nov. 4.

25,080. Soc. Anon. Mat. Col. et Prod. Chim. de St. Denis. Manufacture of a black sulphurised dyestuff. [Fr. Appl., Nov. 14, 1906.]* Nov. 12.

25,337. Kugler. Dyestuffs and the production thereof. Nov. 15.

Complete Specifications Accepted.

26,416 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-oxyuzo colouring matters. Nov. 13.

28,240 (1906). Johnson (Badische Anilin und Soda Fabrik). Manufacture of compounds and colouring matters containing sulphur. Nov. 13.

9961 (1907). Johnson (Durand, Huguenin, et Cie.). Manufacture of leucogallocyanine corresponding to pyrogallol. Nov. 6.

19,001 (1907). Durand, Huguenin et Cie. Manufacture of derivatives of gallocyanine dyestuffs. Nov. 13.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

22,405a. Courtauld and Co., and Wilson. Manufacture of threads, strips, or films of cellulose. Oct. 31.

23,736. Burgoyne. Treatment of wool or like fibres by dyeing and kindred processes.* Oct. 28.

23,793. Johnson (Badische Anilin und Soda Fabrik). Printing on textile fibres. Oct. 28.

23,795. Schmid frères. Degumming raw silk. [Fr. Appl., Nov. 10, 1906.]* Oct. 28.

23,902. Sulzbach. Dyeing machine.* Oct. 29.

24,284. Wetter (Knoll und Co.). Dyeing acetylcellulose or fabrics made therefrom.* Nov. 2.

24,428. Sarafian and Costikyan. Apparatus for printing or dyeing yarn. Nov. 5.

24,892. Marx. *See under* XIX.

24,978. Imray (Soc. Chem. Ind. in Basle). Printing sulphurised dyestuffs.* Nov. 11.

25,125. Scott. Treatment of liquors recovered from the mercerisation of cotton. Nov. 12.

25,310. Johnson (Zeidler and Wengraf). Production of aniline black on the fibre.* Nov. 14.

25,330. Rothwell-Jackson. Kiers for bleaching. Nov. 15.

Complete Specifications Accepted.

25,445 (1906). Pickles and Pickles. Dyeing and mercerising fabrics. Nov. 20.

26,526 (1906). Clerc-Renaud. Apparatus for sizing tulle and analogous fabrics. Nov. 13.

27,349 (1906). Weinberg and Weinberg. Surface-proofed fabrics. Nov. 6.

7150 (1907). Bloxam (Soc. Anon. des Usines Remy). Finish for use in dressing fabrics. Nov. 6.

4614 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Dyeing furs, feathers, or the like. Nov. 13.

10,083 (1907). Goold (Jute and Hemp Manufacturing Co.). Procuring textile fibres from certain plants. Nov. 6.

17,460 (1907). Diamanti. Denitration of artificial silk on spools. Nov. 20.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

Complete Specification Accepted.

13,938 (1907). Pichard and Pichard. Dyeing and secreting of hairs, skins, and hides. Nov. 6.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

23,794. Gossage and Sons, Ltd., and Weissmüller. Manufacture of silicates of soda and potash. Oct. 28.

24,273. Boult (Gasse). Conversion of sulphurous acid into sulphuric acid and extraction of copper from ores. Nov. 2.

24,847. Thwaites. Treatment of pyrites cinder. Nov. 9.

24,864. Morris, Raine, Kerr, and McLachlan. Production of an alkali metal cyanide.* Nov. 9.

24,865. Morris, Raine, Kerr, and McLachlan. *See under* XIII.A.

24,913. Holmes and Howell. Ammonia stills. Nov. 11.

24,967. Read. Treatment of barytes for the preparation of barium sulphate or other barium compounds. Nov. 11.

25,114. Hellstern and Vincent. Manufacture and uses of ozone. Nov. 12.

25,165. Mackey. Treatment of spent ammonia liquor. Nov. 13.

25,227. Pochin and Richardson. Treatment of the residue from the production of aluminium sulphate. Nov. 14.

25,228. Pochin and Richardson. Treatment of bauxite or aluminous material. Nov. 14.

25,261. Stanton Iron Works Co., Ltd., and Ward. Preparation of alkaline salts from blast furnace or like flue dust. Nov. 14.

25,311. Fousset. Treatment of solutions containing ammonia and obtainment of ammoniacal salts. Nov. 14.

25,375. Clayton and White. Manufacture of carbonic acid gas. Nov. 15.

Complete Specifications Accepted.

22,327 and 22,327a (1906). McTear. Manufacture of salt. Nov. 20.

25,404 (1906). McTear. Manufacture of salt. Nov. 13.

25,435 (1906). Trobridge. Nitric acid and other condensers. Nov. 20.

28,963 and 28,964 (1906). Woltereck. Production of ammonia. Nov. 20.

3210 (1907). Schulthess. Apparatus for producing hydrate of lime. Nov. 6.

3435 (1907). Johnson (Chem. Fabr. Griesheim-Elektron). Removal of arsenic from liquids and gases. Nov. 13.

5032 (1907). Meyer. Manufacture of sulphide of zinc. Nov. 6.

9939 (1907). Neuburger, and Westdeuts. Thomasphosphat-Werke. Production of compounds of nitrogen and oxygen. Nov. 13.

10,771 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of stable anhydrous hydrosulphites. Nov. 6.

15,087 (1907). Calico Printers' Assoc., and Warr. Utilising spent nitric acid used by engravers and recovery of copper therefrom. Nov. 13.

20,125 (1907). Von Belatini. Production of concentrated acetic acid hydrate solution from dilute solutions. Nov. 13.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

23,989. Cox and Olsson. Gas-fired pottery kilns or ovens.* Oct. 30.

24,979. Imray (Window Glass Machine Co.). Apparatus for drawing glass.* Nov. 11.

Complete Specifications Accepted.

5379 (1907). Thomson and Barr. Bleaching kieselguhr. Nov. 6.

11,711 (1907). Gobbe. Apparatus for the manufacture of plate glass. Nov. 13.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Application.

24,577. Payne. *See under* I.

Complete Specifications Accepted.

2131 (1907). Matcham. Cement kilns and process of burning cement therein. Nov. 13.

2378 (1907). Lee. Building blocks or material. Nov. 13.

3294 (1907). Müller. Obtaining cement from highly basic blast furnace slag. Nov. 13.

9633 (1907). Thom. Manufacture of stone or marble artificially. Nov. 20.

X.—METALLURGY.

Applications.

23,873. Harbord. Drying blast for metallurgical or other purposes. Oct. 29.

23,901. Hommel and Sulman. Separation of zinc from ores or compounds. Oct. 29.

23,988. Harrison. Production of tungsten and like metal combination. Oct. 30.

23,997. Höveler. Smelting furnaces. Oct. 30.

24,096. Schoop. Welding aluminium or alloys rich in aluminium. [Ger. Appl., Nov. 12, 1906.]* Oct. 31.

24,213. Felten und Guilleaume Lahmeyerwerke. Means for use in making steel and other metallurgical operations. [Ger. Appl., Nov. 1, 1906.]* Nov. 1.

24,273. Boult (Gasse). *See under* VII.

24,283. Schoop. Welding or melting aluminium or alloys rich in aluminium. [Ger. Appl., Oct. 5, 1907.]* Nov. 2.

24,396. Cowper-Coles. Manufacture of calcium.* Nov. 5.

24,517. Herrenschmidt. *See under* XI.

24,612. Viel. Production of aluminium.* Nov. 6.

24,697. Viel. Fusing or refining furnace.* Nov. 7.

24,875. Viel. Production of pure chromium from commerical ferro-chromium or an oxide such as chromite.* Nov. 9.

24,968. Buendia. Concentration and preparation of minerals. [Span. Appl., Nov. 10, 1906.]* Nov. 11.

25,087. Machlet. Case-hardening steel and iron articles.* Nov. 12.

25,099. Hopkins. Apparatus for smelting zinc ore, galvanisers' dross, &c. Nov. 12.

25,229. Wigg and Peers. Recovery of zinc from residual liquors of wet copper processes. Nov. 14.

25,357. Rosalt. Extraction of metals from ores.* Nov. 15.

25,400. Marks (Rombacher Hüttenwerke). Manufacture of malleable iron and steel and other alloys of iron.* Nov. 15.

25,408. Sinding-Larsen. Manufacture of aluminium or aluminium alloys or silicides. [Appl. in Norway, Nov. 17, 1906.]* Nov. 16.

Complete Specifications Accepted.

24,352 (1906). Viel. Obtaining metals, metalloids, and alloys, particularly aluminium, silicon, &c., from their compounds. Nov. 6.

25,112 (1906). Harbord. Drying air for blast furnaces. Nov. 13.

26,311 (1906). Rübel. Manufacture of alloys. Nov. 20.

26,664 and 26,665 (1906). Hadfield. Manufacture of magnetic material. Nov. 20.

26,882 (1906). Brown. *See under* II.

703 (1907). Jumau. Process for obtaining pure copper. Nov. 13.

3374 (1907). Landsberg and Roitzheim. Mechanical roasting furnaces. Nov. 13.

9740 (1907). Sang. Depositing metallic coatings on metal surfaces. Nov. 13.

15,087 (1907). Calico Printers' Assoc., and Warr. *See under* VII.

16,504A (1907). Becker and Lamb. Production of alloys. Nov. 20.

19,547 (1907). Ruthenberg. Cementation process. Nov. 20.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

23,903. Szek. Carbon electrodes. Oct. 29.

23,907. Brownsdon and Payne. Electrolytes for the electro-deposition of copper and other metals. Oct. 29.

24,189. Hill (Lay). Cathodes for electrodeposition of metals. Nov. 1.

24,517. Herrenschmidt. Melting in electric furnaces, and the extraction of easily volatilisable metals. [Fr. Appl., Nov. 9, 1906.]* Nov. 5.

24,807. Viel. Electric furnace.* Nov. 8.

25,126. Cowper-Coles. Apparatus for the electro-deposition of metals.* Nov. 12.

25,296. Greenwood. Manufacture of depolarisers and electrolytes. Nov. 14.

25,324. Hartnell. Electrodepositing apparatus. Nov. 15.

Complete Specifications Accepted.

24,986 (1906). Cowper-Coles. Electrolytic deposition of metals. Nov. 6.

26,144 (1906). Taylor. Electrolytic deposition of metals. Nov. 6.

26,211 (1906). Cowper-Coles. Electrolytic production of metal sheets, tubes, wire, &c. Nov. 20.

26,212 (1906). Cowper-Coles. Anodes for electro-deposition. Nov. 20.

5223 (1907). Johnson (Chem. Fabr. Griesheim Elektron). Electrodes for electrolytic purposes. Nov. 6.

6592 (1907). Egger. *See under* XIV.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

23,796. Engelhorn. Use of compounds of ammonia and the higher fatty acids for candle-making and other illuminating and heating purposes. [Ger. Appl., Nov. 13, 1906.]* Oct. 28.

24,705. Smith. Combining oils and fats with heavier fluids. [U.S. Appl., Nov. 12, 1906.]* Nov. 7.

25,276. Lindemann (Gebr. Körting). Manufacture of soap powder.* Nov. 14.

Complete Specifications Accepted.

24,822 (1906). Karsam Soap Co., and others. Manufacture of soap or mixtures containing soap. Nov. 6.

5277 (1907). Holt. *See under* XVIIIA.

6726 (1907). Imray (Jacobi). Apparatus for setting soap and like materials. Nov. 6.

16,448 (1907). Charlton. Manufacture of soaps, detergents, and saponaceous compounds generally. Nov. 13.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

24,865. Morris, Raine, Kerr, and McLachlan. Production of white lead.* Nov. 9.

25,181. Anderson. Dry water-colour or distemper. [Appl. in Denmark, March 14, 1907.]* Nov. 13.

(*B.*)—Resins, Varnishes.

Applications.

25,216. Helm. Manufacture of substitutes for resins or gums from aldehydes and phenols.* Nov. 13.

25,459. Chem. Fabr. Dr. Elkeles und Co. Production of resins for polishing purposes. [Ger. Appl., Nov. 16, 1906.]* Nov. 16.

(*C.*)—India-Rubber.

Applications.

23,755. Tolkien. Substitute for indiarubber. Oct. 28.

24,607. Weiser (Boegel). Manufacture of natural rubber. Nov. 6.

24,652. Couchman. Rubber compound. Nov. 6.

25,091. Grummel. Separating vulcanised indiarubber from fibrous or other material combined with it.* Nov. 12.

Complete Specifications Accepted.

24,787 (1906). Lesage. Elastic material. Nov. 13.

2065 (1907). Brownlow. Artificial rubber. Nov. 6.

19,894 (1906). Gare. Reclaiming old vulcanised indiarubber. Nov. 13.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

25,182. Feuerlein. Decolorisation of tannin extracts.* Nov. 13.

Complete Specifications Accepted.

420 (1907). Baker. Treatment of hides, leather, &c., with liquids. Nov. 13.

6592 (1907). Egger. Manufacture of leather for electrical insulation. Nov. 13.

13,938 (1907). Pichard and Pichard. *See under* VI.

XV.—MANURES, &c.

Application.

24,891. Riber. Manufacture of manure products containing phospher.* Nov. 9.

Complete Specification Accepted.

24,492 (1906). Lehmann. Manufacture of fertilisers from animal refuse and the like. Nov. 13.

XVI.—SUGAR, STARCH, GUM, &c.

Applications.

24,503. Hafner and Krist. Manufacture of fermentable sugar from materials containing starch or cellulose. Nov. 5.

24,623. Eastick. Removal of alkaline salts from saccharine and other products. Nov. 7.

25,274. Newton (Bayer und Co.). Manufacture of soluble starch. Nov. 14.

Complete Specification Accepted.

11,159 (1907). Klopfer. Production of starch and gluten from wheat flour. Nov. 13.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

23,787. Bristow. Treatment of malt grain for brewing. Oct. 28.

25,356. Breker. Clarification of mash.* Nov. 15.

Complete Specifications Accepted.

23,678 (1906). Zimmer. Brewing beer. Nov. 6.

28,920 (1906). Maardt. Manufacture of beer wort. Nov. 6.

12,454 (1907). Ackermann. Coating fermenting vessels for breweries. Nov. 13.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Application.

24,375. Erfurt. Homogeneous emulsifying of milk, and preparation of homogeneous milk from milk powder.* Nov. 4.

Complete Specifications Accepted.

4994 (1907). Bringk. Preserving fish and other alimentary substances. Nov. 13.

5277 (1907). Holt. Apparatus for extracting fats, &c., from condemned meat and other substances. Nov. 20.

10,362 (1907). Litsche, and Nutricia Centrale f. Backhausmilch Ges. Preparing cow's milk for food. Nov. 20.

11,159 (1907). Klopfer. *See under* XVI.

12,561 (1907). Schou and Schou. Manufacture of margarine. Nov. 6.

15,395 (1907). Goldberg. Preparation of non-alcoholic beer and other beverages. Nov. 13.

18,220 (1907). Wesener. Bleaching and ageing flour. Nov. 20.

(*B.*)—Sanitation; Water Purification.

Applications.

24,381. Allen. Treatment of effluents. Nov. 4.

25,222. Rumin. Purification of waste water. Nov. 13.

25,362. Losange. Biological purification of waste water and sewage.* Nov. 15.

Complete Specifications Accepted.

24,172 (1906). Girerd and Drapier. Purifying waste water. Nov. 6.

10,984 (1907). Imhoff. Apparatus for purifying sewage and other waste water. Nov. 20.

(*C.*)—Disinfectants.

Application.

23,954. Lehmann. Disinfecting process.* Oct. 30.

XIX.—PAPER, PASTEBOARD, &c.

Applications.

24,284. Wetter (Knoll und Co.). *See under* V.

24,892. Marx. Manufacture of paper, textile material, &c., impregnated with resinous material. Nov. 9.

Complete Specifications Accepted.

25,647 (1906). Eschalier. Strengthening cellulose bodies produced from cellulose solutions. Nov. 20.

22,092 (1907). Bronnert and Fremery. Manufacture of cellulose products from solutions of cellulose in cuprammonium. Nov. 20.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

24,662. Read Holliday & Sons, and Silberrad. Manufacture of mellitic acid. Nov. 7.

24,763. Robertson and Graham. Substitutes for camphor. Nov. 8.

24,806. Schmitz und Co. Manufacture of borneol from isoborneol. [Ger. Appl., Nov. 15, 1906.]* Nov. 8.

25,453. Schmitz und Co. Manufacture of camphene. [Ger. Appl., Dec. 8, 1906.]* Nov. 16.

25,458. Klein. Production of cantharidin acid derivatives containing iodine and mercury.* Nov. 16.

Complete Specifications Accepted.

2484 (1907). Newton (Bayer und Co.). Manufacture of iodine preparations. Nov. 6.

3367 (1907). Sorger. Production of salicylic acid glycerin ester. Nov. 13.

14,549 (1907). Verley, Urbain, and Feige. Manufacture of ethers of borneol and isoborneol. Nov 20.

19,943 (1907). Elektrochem. Werke. Manufacture of oxalates from corresponding formates. Nov. 6.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Applications.

24,124. Rawlins, and Griffin & Sons, Ltd. Gelatin compound for use in photographic printing processes. Oct. 31.

25,396. Spong. Manufacture of screens and colour sensitive plates, films, &c., for photographic process printing, &c. Nov. 15.

Complete Specifications Accepted.

24,667 (1906). Bolas. Sensitised surfaces for use in photography. Nov. 6.

25,728 (1906). Husson and Bornot. Manufacture of photographic dry plates. Nov. 13.

25,869 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Agent for fixing photographic images. Nov. 13.

7132 (1907). Boult (Soc. Anon. des Plaques et Papiers Photographiques A. Lumière et ses fils). Photographic films. Nov. 13.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

24,025. Anglo-French F. & S., Ltd., and Edwards. Explosives. Oct. 30.

Complete Specifications Accepted.

7838 (1907). Ceipek. Manufacture of a safety explosive. Nov. 13.

18,597 (1907). Haddan (Lehmann). Accelerating the separation of nitroglycerine from acids. Nov. 20.

21,116 (1907). Haddan (Lehmann). Explosive oil. Nov. 20.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

23,996. Fery. Calorimeters. [Fr. Appl., Nov. 26, 1906.]* Oct. 30.

Journal of the Society of Chemical Industry.

No. 23, Vol. XXVI. DECEMBER 16, 1907. No. 23, Vol. XXVI.

Official Notices.

It is with the deepest regret that announcement is made of the death, on Monday, the 9th inst., of Mr. Samuel Hall, one of the Founders of the Society, and its Honorary Treasurer since the death of Mr. E. Rider Cook in 1898.

BY-LAWS.

In accordance with the provisions of Clause 37 of the Charter, a printed copy of draft By-laws is sent to each Member of the Society in this number of the Journal. The Council invites Members to offer observations thereon, which should reach the Secretary not later than January 15th next, in order that the final draft may be settled and submitted for consideration and adoption by the Members at a General Meeting to be held not later than March 17th, 1908, as provided by the said clause of the Charter.

By order of the Council,
Charles G. Cresswell,
Secretary.

SUBSCRIPTIONS.

Important Notice.

In consequence of the death of Mr. Samuel Hall, Hon. Treasurer of the Society, Members are requested to make all cheques and Postal Orders payable to the "Society of Chemical Industry," which may then be forwarded to the Hon. Acting Treasurer, East London Soap Works, Bow, E.

Newcastle Section.

Meeting held at Armstrong College on Thursday, Nov. 7, 1907.

MR. N. H. MARTIN IN THE CHAIR.

I.—OIL FROM THE ROOF OF THE COCKSHEAD COAL SEAM, NORTH STAFFORDSHIRE.

BY A. A. HALL, M.SC., PH.D.

This oil in thin layers was of a dark brown colour, in reflected light it was dirty green; it contained brown particles in suspension which settled out on long standing. The crude oil was solid at 15° C., crystals beginning to separate out at a temperature of 18° C. Water boiled with the crude oil for a long time was coloured faint yellow, was neutral, and contained traces of some sulphur compounds. Shaken with strong sulphuric acid, the oil was much reduced in bulk, and the acid was coloured a dark brown. On shaking with caustic soda solution, an extract containing traces of phenols was obtained. A proximate analysis gave the following results:—Volatile matter, 98·25 per cent.; fixed carbon, 1·71 per cent.; ash, 0·03 per cent.

The sulphur, determined by Garrett and Lomax's method (this J., 1905, 1212), was found to be 0·62 per cent.

Under a pressure of 20 mm. of mercury, with a slow current of air kept bubbling through, the oil distilled quickly and without any apparent decomposition up to 300° C., when a violent cracking set in, whereupon the distillation was stopped and the dark brown solid residue left for further examination. The distillate (60 per cent. of the whole) was light yellow in colour and liquid at 15° C.

The purified oil was then fractionated, the lower fractions by means of a rod and disc still head (15 discs), and the higher by five distillations from an ordinary distillation flask.

As can be seen from the following table, the fractions increased considerably in bulk as the temperature rose. All the fractions distilled under atmospheric pressure were liquid. The first fraction containing solid was that which distilled between 200° and 220° C., under 20 mm. pressure. They were, with the exception of the last three fractions, all clear and colourless when freshly distilled, but on standing some of the higher fractions became yellow, and a slight brown sediment was formed. The specific gravities of these oils were all rather high, probably owing to the presence of naphthenes, these bodies having high specific gravities and often being found in natural oils; in order to obtain further evidence of their presence, the fraction boiling between 220° and 235° C. was shaken with a mixture of nitric and sulphuric acids and the decomposition products were removed by shaking with sulphuric acid. The oil was then washed with caustic potash and with water, and finally dried over calcium chloride and sodium. After this treatment the oil did not react with bromine water and was not changed by shaking with sulphuric acid; it had a specific gravity of 0·7765, showing that some substance of high specific gravity had been removed.

No.	Boiling point.	Volume per cent.	S.p gr. 15° 15°	n_D^{15}	Specific refraction.	Iodine value.
1	Under 145°C.	5·0	0·7362	1·41179	0·3378	3·4
2	145°—160°	2·0	0·7480	1·41845	0·3372	3·6
3	160°—175°	2·0	0·7540	1·42165	0·3365	3·7
4	175°—190°	4·0	0·7580	1·42425	0·3364	6·3
5	190°—205°	3·0	0·7651	1·42855	0·3364	6·6
6	205°—220°	3·2	0·7727	1·43145	0·3353	6·9
7	220°—235°	3·0	0·7775	1·43567	0·3359	5·5
8	235°—250°	4·0	0·7840	1·43908	0·3355	5·3
9	250°—265°	2·5	0·7890	1·44119	0·3349	8·8
10	265°—280°	4·0	0·7942	1·44361	0·3341	9·2
11	280°—300°	1·0	0·7995	1·44591	0·3335	9·45
12	*Under 175° C	7·3	0·7950	1·44521	0·3349	9·65
13	175°—190°	6·3	0·8040	1·44842	0·3332	12·2
14	190°—205°	5·0	0·8072	1·45012	0·3330	12·2
15	205°—220°	7·5	0·8120	1·45232	0·3324	12·9
16	220°—235°	6·5	0·8170	1·45492	0·3320	9·7
17	235°—250°	11·0	0·8210	1·45652	0·3315	8·7
18	250°—265°	9·0	0·8240	1·45800	0·3311	8·7
19	265°—280°	10·0	0·8280	1·45952	0·3309	8·5

* Fractions 12—19 were distilled under a pressure of 20 mm. of mercury.

The specific refraction of each fraction calculated by the Lorenz-Lorentz formula from the refractive index and the specific gravity, is given in the following table; the numbers are rather lower than the theoretical values, probably owing to the specific gravities being too high; as an example showing this, the theoretical values for the specific refraction were calculated for two fractions, namely, the fractions boiling at 190°—205° C. and at 220°—235° C., with the following results:—

B. pt. of oil.	Specific refraction	
	Observed.	Calculated.
190°—205° C.	0·3364	0·3380
220°—235° C.	0·3359	0·3374

The amount of olefines in each fraction was determined by Hanus' method, which is both quick and accurate. It will be seen from the table that the percentage of olefines gradually increases until the fraction boiling between 200°—220° C. (under 20 mm. pressure) is reached, and then decreases in value; this is contrary to what one would expect, but it is confirmed by Petrie's observations on the Torbane mineral oils (this J., 1905, 997). The percentage of olefines and paraffins has been calculated by assuming that the paraffins boiling at the temperature of the different fractions are mixed with olefines having the same number of carbon atoms. The percentage of olefines was found to vary from 2 to 11 per cent. In order to test the truth of this assumption, molecular weight determinations were made of the oils contained in two fractions by the freezing point method, the following results being obtained:—

Boiling point °C.	Paraffin.	Molecular Weight	
		Observed.	Calculated.
190—205	$C_{11}H_{24}$	158	156
220—235	$C_{13}H_{28}$	185	184

As many of these natural oils have been found to be optically active,* and as such important deductions have been made from this fact with regard to their formation, the effect of these oils on polarised light was examined, but no rotation could be observed.

In conclusion, the oil has been found to be a mixture of paraffins, mostly those of high molecular weight, with some olefines and possibly some naphthenes and phenolic bodies.

I have to thank Mr. Cadman and Prof. Louis for the specimen of oil with which I have conducted this investigation.

II.—PARAFFIN WAX FROM THE LADYSMITH PIT, WHITEHAVEN COLLIERIES.

BY P. PHILLIPS BEDSON.

The paraffin wax the results of the examination of which are detailed in this paper was discovered as an exudation in a drift of the Ladysmith pit of the Whitehaven Collieries. Its mode of occurrence was described by Mr. R. W. Moore, of Whitehaven, to whom I am indebted for samples of the material, at a meeting of the North of England Institute of Mining and Mechanical Engineers, in April, 1905, on which occasion I communicated a note of the results of an examination of this substance by Mr. R. Dodds. On the occasion referred to Mr. Moore stated "that about 250 gallons of the substance, pronounced to be a natural paraffin, had been yielded by the stone-drift driven from the Ladysmith pit, but the supply had now practically ceased. The drift was set away from the shaft (which had passed, in succession, through Permian strata, the Whitehaven sandstone, and coal measures) at the depth of 1065 feet from the surface, in what are evidently the Yoredale rocks, the top of which was found at about 358 feet below the main band coal seam. The drift had been driven nearly level in a south-westerly course, towards St. Bee's Head, in the direction of the dip, and had intersected the main band coal seam, over a large downthrow west fault, at a distance of 3900 feet from the Ladysmith shaft. Throughout that distance, the main band coal seam had been wrought into pillars overhead; and in these workings no whin-dyke or basaltic intrusion in any form had been encountered. Indeed, the West Cumberland coal field, so far as at present known, does not furnish a single instance either of a whin-dyke or of a naturally-coked coal. At a distance of 750 feet from the Ladysmith shaft, the drift passed from the Yoredale rocks into the coal-measures; and at 2370 feet from the shaft, the natural paraffin was first encountered. It was found oozing from the base of a bed of white post, about 30 feet thick, overlying a coal seam, 15 inches thick, which had been cut through in the drift. On exposure to the atmosphere, the liquid became viscid, and eventually quite stiff. The application of very gentle heat speedily liquefied the substance. This semi-solidification retarded the flow of the paraffin; but during the continuation of the drift for a distance of at least 300 feet, as new ground was cut, similar exudation took place from the freshly exposed surfaces. The main band coal-seam is about 300 feet above, and the Yoredale rocks are about 58 feet below the drift where the paraffin was found. It would be interesting to know whether the natural paraffin has any commercial value."

The substance, as found, is a dark brown semi-solid material, not unlike vaseline in consistency; it possesses an odour resembling that of paraffin oil, and has a disagreeable taste, like that of lubricating oil. It is entirely combustible, contains no mineral matter, and appears to be a mixture of hydrocarbons mainly of the paraffin series. Traces of sulphur are found in the more volatile portions.

In the note already referred to is given the result of the fractionation of this material under reduced pressure, *viz.*, 70 mm., which may be stated as follows:

Boiling at °C.		Amount per cent.
I. 90°—180°	colourless liquid*	37·5
II. 180°—240°	slightly coloured liquid	17·5
III. 240°—300°	pale yellow solid	25
IV. Residue in retort	dark fusible solid	20

* Sp. gr., 0·777 at 17° C.

The third fraction melts about 35° C., and by crystallising from petroleum ether a white solid melting at 48—51° C. was obtained from it.

A redistillation under reduced pressure of the first two fractions gave distillates, the lower boiling portions being colourless liquids, then liquids having a slightly yellow colour, and the highest fractions easily fusible solids. Of these several fractions the specific gravities and refractive indices were determined, and from the results of such determinations it would appear that the lowest number of the paraffin series present is $C_{10}H_{22}$, whilst from the melting point of the solid mentioned above it is evident that a hydrocarbon $C_{24}H_{50}$ may be present.

Having obtained a larger quantity of this material, a further examination was undertaken by Mr. Scott. Inasmuch as the crude material was found to decolorise bromine water, it was warmed before distillation with concentrated sulphuric acid, to which it imparted a dark colour; after treatment with sulphuric acid it was shaken with caustic soda, washed, dried, and then distilled under a pressure of 30 mm., a slow current of air being drawn through the liquid. The heating of the flask was effected by an air bath. In this way a series of fractions was obtained ranging from 80°—310° C.

The lower boiling portions were submitted to distillation under ordinary atmospheric pressure, and separated into some thirteen fractions, the lowest boiling at 165° and the highest at 300°—310° C. The lower fractions are colourless, mobile liquids, possessing a distinct paraffin-like odour; as the temperature rises there is a gradual change in colour and loss of mobility; a colourless crystalline solid separates from the highest fraction on cooling.

In the following table are given the specific gravities, the refractive indices for sodium light, and the specific refractions of the several fractions. In the fifth column of this table are also given the iodine absorptions, the determinations of which have been made by Mr. J. Watson, B.Sc., using a method which Dr. Hall has referred to in his paper, and by the aid of these results the proportion of olefine to paraffin has been calculated, on the assumption that the olefine contains the same number of carbon atoms as the paraffin with which it is associated :—

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* Chem. Zeit. 1906, [illegible], 1155

No.	Boiling point.	Sp. gravity at 15° C.	Refractive index.	Specific refraction.	Iodine absorption.	Ratio per cent.	
						Olefines.	Paraffins.
	°C.				per cent.		
1	165	0·7530	1·41905	0·3354	—	—	—
2	180	0·7594	1·42405	0·3353	9·5	—	—
3	195	0·7667	1·42625	0·3344	—	—	—
4	210	0·7764	1·43165	0·3338	—	—	—
5	225	0·7823	1·43517	0·3334	5·9	$C_{13}H_{26}$ 4·24	$C_{13}H_{28}$ 95·76
6	240	0·7939	1·44069	0·3325	8·46	$C_{13}H_{26}$ 6·08	$C_{13}H_{28}$ 93·92
7	250	0·7984	1·44441	0·3328	10·9	$C_{14}H_{28}$ 8·41	$C_{14}H_{30}$ 91·59
8	260	0·8064	1·44762	0·3317	9·75	$C_{14}H_{28}$ 7·52	$C_{14}H_{30}$ 92·48
9	270	0·8138	1·45032	0·3305	6·67	$C_{15}H_{30}$ 5·53	$C_{15}H_{32}$ 94·47
10	280	0·8167	1·45222	0·3303	6·13	$C_{16}H_{32}$ 5·43	$C_{16}H_{34}$ 94·57
11	290	0·8194	1·45412	0·3305	9·0	$C_{16}H_{32}$ 7·96	$C_{16}H_{34}$ 92·04
12	300	0·8269	1·45832	0·3288	10·35	$C_{17}H_{34}$ 9·73	$C_{17}H_{36}$ 90·27
13	310	—	1·45862	—	11·25	$C_{18}H_{36}$ 11·20	$C_{16}H_{38}$ 88·80

The boiling points and specific gravities of the different distillates may be taken as an indication of the composition of the paraffin hydrocarbons contained in them, although the specific gravities are somewhat high, which is usually the case with those obtained by fractionating natural petroleums. Further, the specific refraction has been employed to calculate the percentage of carbon and hydrogen, and thus an approximation formula obtained. For example, the fraction boiling at 225° C. with a specific refraction of 0·3334 is found to contain 85·12 per cent. of carbon, and 14·88 per cent. of hydrogen. The high specific gravity, already referred to, has the effect of raising the percentage of carbon, calculated in this way, and consequently the boiling point and specific gravity have been relied on as a guide to the composition of the paraffins contained in these distillates. In this case the indications correspond most nearly to the hydrocarbon $C_{13}H_{28}$, a conclusion supported by the determination of the molecular weight made by the freezing point method, using glacial acetic acid as solvent. The molecular weights of four of the fractions are as follows :—

Boiling point.	Molecular weight	
	Found.	Calculated.
225°	178·5	184 for $C_{13}H_{28}$
250°	200·9	198 ,, $C_{14}H_{30}$
280°	226	226 ,, $C_{16}H_{34}$
310°	256	254 ,, $C_{18}H_{38}$

No indication of optical activity was obtained in the higher boiling fractions and the solid hydrocarbons.

It is evident that this exudation met with in the Ladysmith drift is a mixture of hydrocarbons mainly of the paraffin series, containing a considerable proportion of the solid members of the group. It is very similar in fact, to the substance described by Johnston in the Philosophical Magazine of 1838, which had been found in the workings of the Urpeth Colliery, Durham, and which Johnston pointed out resembles ozokerite in composition and properties.

These conclusions are confirmed by the results of the elementary analysis of some of the fractions referred to in the table above.

See also following papers :

1. On the occurrence of petroleum in a shale mine at Broxburn. D. R. Steuart, this J., 1887, 128.

2. The soluble and resinoid constituents of bituminous coal. Watson Smith, *ib.*, 1891, 975.

3. Soluble and resinous constituents of coals. Watson Smith and J. C. Chorley, *ib.*, 1892, 591.

4. Composition of the petroleum-like bitumen of Japanese coal. Watson Smith and J. C. Chorley, *ib.*, 1893, 221.

Nottingham Section.

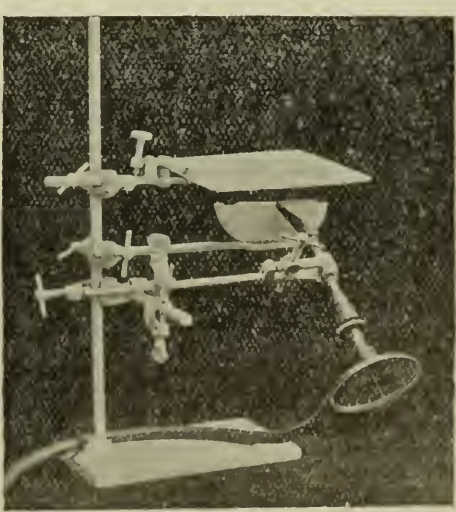
Meeting held at Nottingham on Wednesday, Oct. 30, 1907.

MR. OLIVER QUIBELL IN THE CHAIR.

LABORATORY APPARATUS FOR THE EVAPORATION OF LIQUIDS BY RADIATION FROM ABOVE.

BY DR. H. J. S. SAND.

Attempts have at various times been made to evaporate liquids for purposes of analysis by radiating heat on them from above, as the risk of loss by " bumping " is evidently avoided, and that by " spirting " reduced when all evaporation proceeds from the surface only. This takes place in the water-bath when it is employed for aqueous solutions, but the smallness of the range of temperature over which it is efficient considerably curtails its usefulness. No such limitation is inherent in an apparatus in which radiation of heat takes place directly from above. In order to be efficient, a solid held in position over the liquid must be heated to a very high temperature, but until recently a material has not been available which would at the same time stand strong heating without cracking or melting and remain unattacked by the vapours of such liquids as might undergo evaporation.



It is the object of the present note to draw attention to the suitability of plates of fused silica, which have now become a common article of commerce, for the purpose in question.

The accompanying figure shows an arrangement which may be employed. The silica-plate is held either in a horizontal or in a slightly inclined position by a small clamp, the cork linings of which have been replaced by pieces of asbestos board. It is heated by the hot flat flame of a small blast-burner with spreader. The method of holding the latter will be evident from the figure. With the exception of the short iron rod of about eight inches in length, to which the clamp holding the burner is attached all the apparatus employed is of ordinary stock pattern. The rate of evaporation for pure water is about one and a half times as great as that obtained with a water bath with average draught. Thus, 120 c.c. of water were completely evaporated in 80 minutes, while a vigorously boiling water-bath with fair draught required 125 minutes for a dish of the same size and pattern. For liquids of a higher boiling point, such as solutions containing sulphuric acid, the comparison would evidently be still more favourable to the apparatus here described. Liquids from which large quantities of crystals separate unfortunately show a considerable tendency to creep up the sides of the vessel owing to the formation of crusts. When these are produced on the sides of the basin or on the surface of the liquid, they must be removed by continued stirring with a long glass rod if loss by spirting is to be avoided.

Meeting held at Nottingham on Wednesday, Nov. 27, 1907.

MR. O. QUIBELL IN THE CHAIR.

NOTE ON THE ESTIMATION OF ARSENIC BY THE GUTZEIT TEST.

BY T. F. HARVEY.

In the issue of this JOURNAL for Nov. 15th there appears a paper on the above subject by C. R. Sanger and O. F. Black. The authors, however, appear to have overlooked a paper by myself published in the Chemist and Druggist of Jan. 28, 1905, page 168, as they take no cognisance thereof. I there described at some length an apparatus for, and mode of working the Gutzeit test which is convenient, gives reliable and consistent quantitative results, and is capable of detecting with certainty 0·0005 mgrm. of arsenic. The test was simplified by the adoption of a standardised colour scale, which only requires occasional verification. The apparatus there described has now given complete satisfaction in a busy laboratory for nearly four years, and several thousand tests have been made with it, so that its utility and accuracy are established.

I also described experiments made with "known amounts" of the oxides of antimony, selenium, and tellurium, showing the effect upon the results caused by the presence of these elements. With regard to antimony, I showed that quantities of the trioxide up to 0·1 mgrm. yielded grey stains alone, or reddish to orange stains in the presence of arsenic—that a quantity of antimonious oxide equal to the arsenic present did not interfere with the estimation, while much more than this rendered it correspondingly unreliable, but that no amount of antimony sufficient to interfere with the estimation could be present and escape observation. I further showed that means must be adopted to ensure constant humidity of the gas reaching the mercuric chloride paper. This was provided for by a small scrubbing tower loosely packed over a definite length with cotton wool, which is renewed after each test. The gas could be readily dried with calcium chloride so that quantities of arsenic varying from 0·003 to 0·02 mgrm. entirely failed to give any indication of their presence, but re-moistening of the gas at once restored the sensitiveness of the test.

In conclusion, it seems to me decidedly preferable to have the stains of uniform rather than of varying size, and confined to one side of the paper only.

Scottish Section.

Meeting held at Glasgow on Friday, October 25, 1907.

MR. JOHN S. MACARTHUR IN THE CHAIR.

THE APPLICATION OF LOVIBOND'S TINTOMETER TO THE ANALYSIS OF SPIRITS, &c.

BY EMIL WESTERGAARD,

Lecturer on Technical Mycology, Heriot Watt College, Edinburgh.

SOME eighteen months ago, a number of samples of whisky were sent to me for analysis. It seemed to me that little would be gained by simply performing the analysis in the usual way, as this had been done so often that there was scarcely any possibility of finding out anything new. I therefore decided to investigate some of the less frequently employed methods, in order, if possible, to throw some new light on the subject. My attention was concentrated on the colorimetric reactions, and more especially the determination of aldehyde and furfurol. The following is the first instalment of the results obtained in this investigation.

At the time I was commencing this work, Dr. A. P. Laurie called my attention to some work he had previously done with the aid of the Lovibond Tintometer. (See Oil and Colourman's Journal, 30th June and 14th July, 1906.) The results which he had obtained by examining mixtures of white lead with varying quantities of colour, and the fact that he had been able to express these results in distinct mathematical curves, encouraged me to try the tintometer in this investigation.

The first part of the investigation was to determine the relation between the degree of coloration and the quantity of acetaldehyde present in a solution. For this purpose, a solution of aldehyde was made up, according to Rocques, from aldehyde-ammonia, previously purified by anhydrous ether, to which was added the calculated quantity of sulphuric acid (see Girard and Cuniasse, p. 181). From this solution various dilutions were made, of which five were more closely examined, viz., those containing 0·2, 0·15, 0·1, 0·05, and 0·2 grms. of aldehyde in one litre of alcohol of 50 per cent. by volume. The reagent employed was that proposed by Gayon and Schiff (Comptes rend., 1887, 1182), consisting of a solution of fuchsine, to which is added sodium bisulphite and sulphuric acid. (See Girard and Cuniasse, p. 182.) Four c.c. of this reagent are added to 10 c.c. of the aldehyde solution. Instead of leaving the reaction to go on at room temperature, I placed the mixture in a water-bath at 25° C. for 15 minutes, after which it was taken out and examined in the ½-inch cell of the tintometer, the reading being taken five minutes after the solution had been taken out of the bath. I was at once confronted with the difficulty that, no matter what I did, I could not match, or anything like match, the colour produced, owing to a peculiar luminosity, which might to some extent be removed by the introduction of large quantities of neutral tints, but, as the neutral tint had to be employed in very large and varying quantities, no satisfactory results could be obtained. After a number of failures, it occurred to me that, instead of matching the colour, I might be able to neutralise it, and in this way obtain relative values sufficient for my purpose. The first experiments showed that it would be possible to get good results in this way, and therefore I proceeded to carry out a series of determinations. The colour obtained is a mixture of red and blue, plus something else not determined. By the addition of yellow and blue glasses, this colour can be neutralised, that is to say, after the addition of the glasses, no colour is visible in the tintometer. The results obtained were as follows, where x represents the number of centigrams of aldehyde per litre, and the y's represent the yellow and blue glasses required for neutralising. The examinations were made in the ½-inch cell of the tintometer.

	Yellow.	Blue.
$x=20$	$y=24$	$y=12$
$x=15$	$y=17$	$y=8\cdot5$
$x=10$	$y=9\cdot2$	$y=4\cdot6$
$x=5$	$y=3$	$y=1\cdot5$
$x=2$	$y=\cdot8$	$y=\cdot4$

From this it will be observed that the quantity of yellow required is in all cases twice that of the blue, a fact which simplifies the determination very much. Assuming now that these results can be represented by a logarithmic curve, we have the law $y=ax^n$. On substituting the values observed, we get five equations, the summation of which gives a sixth equation from which, combined with the five original equations, five equations may be obtained from which a is eliminated. From these five equations n was determined, and was found to be 1·5530, and on inserting this value for n in the sixth equation mentioned above, we get an average value for $a=0\cdot2514$, or, the law for the yellow curve $y=0\cdot2514x^{1\cdot153}$.

The accompanying table shows in the first column the yellow tintometer reading. In the second column, the weight of aldehyde per litre corresponding to that reading. The third column shows the weight of aldehyde in 100 grms. of absolute alcohol, while the fourth column gives the differences between the last mentioned figures, so as to enable interpolations to be made.

Table I.

y=Tintometer reading.	Centigrams aldehyde per litre=	Milligram aldehyde per 100 grms. absolute alcohol.	Difference.
1	2·4330	6·1313	3·4432
2	3·8017	9·5805	2·9575
3	4·9358	12·4380	2·5320
4	5·9401	14·9700	2·3120
5	6·8575	17·2820	2·2540
6	7·7125	19·4360	2·0290
7	8·5173	21·4650	1·9270
8	9·2822	23·3920	1·8420
9	10·0134	25·2340	1·7720
10	10·7167	27·0060	1·7110
11	11·3950	28·7170	1·6510
12	12·0500	30·3680	1·6070
13	12·6880	31·9750	1·5610
14	13·3070	33·5360	1·5240
15	13·9120	35·0600	1·4920
16	14·5040	36·5520	1·4550
17	15·0820	38·0070	1·4210
18	15·6460	39·4280	1·4000
19	16·2010	40·8280	1·3720
20	16·7500	42·2000	1·3420
21	17·2780	43·5420	1·3230
22	17·8030	44·8650	1·3100
23	18·3230	46·1750	1·2830
24	18·8320	47·3580	1·2620
25	19·3330	48·7200	

The next step was the determination of the furfurol, for which aniline acetate was used as the reagent. The determination was carried out in the following way:—10 c.c. of a 50 per cent. alcohol containing the furfurol was mixed with ten drops of re-distilled and practically colourless aniline oil, and 1 c.c. of glacial acetic acid. The mixture was placed in a water bath at 25° C. for ten minutes. It was then examined, five minutes being allowed for the examination, so that the reading in the ½-inch cell was taken 15 minutes after the mixing of the solutions. Five concentrations were examined, containing 1·25, 2·5, 5, 7·5 and 10 mgrms. of furfurol respectively per litre, and the results are shown in the following table:—

	Blue.	Yellow.
$x=10$	$y=15$	$y=12$
$x=7\cdot5$	$y=11\cdot8$	$y=9\cdot4$
$x=5$	$y=8\cdot2$	$y=6\cdot6$
$x=2\cdot5$	$y=4\cdot3$	$y=3\cdot6$
$x=1\cdot25$	$y=2\cdot2$	$y=1\cdot9$

where x indicates the number of milligrams furfurol per litre, while the first column y indicates the tintometer reading in blue, and the y of the second column indicates the corresponding reading in yellow. By combining these equations in a similar manner to that previously described under the aldehyde, we find the laws for the two curves to be: $y=1\cdot8138x^{0\cdot92694}$; $y=1\cdot5805x^{0\cdot884}$

Table II.

Blue.	Yellow.	Mgrms. per litre.	Mgrms. per 100 grms. absolute alcohol	Difference.
y.	y.	x.		
1	0·8957	0·526	·13256	·14746
2	1·735	1·111	·28002	15366
3	2·557	1·721	·43368	·15782
4	3·360	2·347	·59150	·16100
5	4·157	2·986	·75250	·16352
6	4·946	3·635	·91602	·16578
7	5·730	4·292	1·08180	·16760
8	6·508	4·958	1·24940	·16940
9	7·281	5·630	1·41880	·17060
10	8·051	6·307	1·58940	·17220
11	8·817	6·990	1·76160	·17340
12	9·580	7·678	1·93500	·17450
13	10·340	8·371	2·10950	·17560
14	11·097	9·068	2·28510	·17650
15	11·852	9·768	2·46160	

Table II. shows in the first column the tintometer reading in blue, and in the second column the corresponding reading in yellow. The third column shows the weight per litre, and the fourth column shows the weight per 100 grms. of absolute alcohol, while the fifth column shows the differences between the last mentioned figures.

The results obtained in these two cases, by using the neutralising instead of the matching method, seemed so encouraging that I decided to see how they would work out in the case of other colour reactions, and as examples I chose the determination of ammonia by means of Nessler's reagent, and of sodium nitrite with metaphenylenediamine.

The determination of the ammonia was carried out by adding 2 c.c. of freshly prepared Nessler's solution to solutions of ammonium chloride of known strength, viz., 0·1, 0·15, 0·2, and 0·25 mgrms. of NH_3 in 50 c.c. The mixture was kept at 25° C. for ten minutes, and five minutes were allowed for the examination in the tintometer, giving fifteen minutes in all. The solution was examined in the 1-inch cell, with the following results, where x indicates the number of 100th parts of a mgrm. of NH_3 in 50 c.c.:—

	Blue.	Red.
$x=10$	$y=4\cdot9$	$y=3$
$x=15$	$y=7\cdot6$	$y=4\cdot8$
$x=20$	$y=9\cdot8$	$y=6\cdot2$
$x=25$	$y=12$	$y=8$

By combining these equations we find in both cases that n is practically equal to 1, only differing in the second decimal. Assuming therefore that this difference is due to faulty observations, and that n should be 1, and the curve a straight line, we get the following two laws:—$y=0\cdot49x$; $y=0\cdot314x$.

In the case of the sodium nitrite, five solutions were examined, containing 0·05, 0·075, 0·1, 0·125, and 0·15 mgrms. of nitrous anhydride as sodium nitrite in 50 c.c. To these solutions 1 c.c. of the metaphenylenediamine solution (5 grms. per litre, and decolorised over charcoal) and 1 c.c. of sulphuric acid, 1 to 3 by volume, were added. The solutions were examined in the 1-inch cell, after having been kept for 25 minutes at 25° C., and, in addition, five minutes being allowed for the observation. The results were as follows:—

	Blue.	Red.
$x=15$	$y=14\cdot5$	$y=11$
$x=12\cdot5$	$y=10\cdot6$	$y=7\cdot6$
$x=10$	$y=7$	$y=5$
$x=7\cdot5$	$y=3\cdot8$	$y=2\cdot5$
$x=5$	$y=2$	$y=1\cdot25$

From these results, the following two laws for the curves were found, viz., $y=0\cdot09207x^{1\cdot8758}$; $y=0\cdot04226x^{2\cdot0603}$ where x indicates the number of 100th parts of a mgrm. of N_2O_3 in 50 c.c.

It is of course well enough known that the colour reaction in the case of the aldehyde and the furfurol changes very rapidly, and that therefore the time, and—as I found—the temperature are of very great importance, no results of any value whatever being obtainable without these factors being kept constant. I was somewhat surprised however to notice the rapidity with which the degree of coloration in the case of the sodium nitrite and more especially the ammonia changed, and this rapid change caused me to keep these solutions at 25° C. for some minutes, in order to keep the factors constant. I am just now trying to ascertain the rate of this change, and hope shortly to be able to publish my results.

It would seem as if this method of neutralising the colour might be of some practical value, as the observation is here reduced to ascertaining whether colour of any kind is present or absent, a much simpler task than determining if a colour is accurately matched, which is a process allowing too much room for the personal equation. That the method can be usefully employed for the determination of the aldehyde and the furfurol I have no doubt, but whether it will be found of as much value in the case of ammonia, nitrite, or any other colour reaction remains yet to be seen, although it seems highly probable. In any case, it will be advisable, for such determinations, to employ cells of a greater depth than 1 inch, the deepest I have had at my disposal so far.

These are the results which I have so far obtained in trying to use the tintometer, and, everything considered, they seem to be rather encouraging.

It now only remains to say a few explanatory words on the results of the examination of the samples of whisky. These results are set out in the accompanying table. The aldehydes were there determined according to the neutralising method described above, while the furfurol had been previously determined by matching the colour as far as possible. The esters were determined by saponification with calcium saccharate and titration. The higher alcohols were determined according to the Röse-Herzfeld method, as it seemed to me of sufficient interest to justify trying this method once more. I found that if the chloroform employed is sufficiently pure, made from chloral and redistilled, and if the mixture is shaken 300 to 400 times, very uniform results can be obtained. I am of course aware that there are certain objections to this method, but on the whole they do not seem to have much more weight than the objections to the other methods. However, apart from ascertaining that the results would be uniform, I have not had an opportunity of examining the actual value of the methods, so that the results set out in this paper must be regarded as being only of relative value. The acids were determined by titration and subsequent spontaneous evaporation in a vacuum during three weeks, after which the non-volatile acids were determined, the difference giving the volatile acids. The extract was determined by spontaneous evaporation in a vacuum.

	Age, Years.	Sp. gr. of sample at 15° C.	Sp. gr. of distillate at 15° C.	Grms. abs. alcohol in one litre.	Mgrms. of "extract" per litre.	c.c N/10 Alkali to neutralise non-volatile acids per litre.	Mgrms. volatile acids per litre as calculated acetic acid.	Mgrms. volatile acids per 100 grms. abs. alcohol (as acetic acid).	Mgrms. higher alcohols per 100 grms. abs. alcohol (Röse-Herzfeld).	Mgrms. esters per 100 grms. abs. alcohol (as ethyl acetate).	Mgrms. aldehyde per 100 grms. abs. alcohol (by Tintometer).	Mgrms. furfurol per 100 grms. abs. alcohol.
Grain	New	0·90613	0·90571	503·244	44	None	9·00	1·7883	362·73	63·4	3·6786	perhaps a slight trace
do.	5	0·90787	0·90754	497·451	64	None	41·40	8·3224	861·50	146·4	2·4525	0·1260
do.	10	0·91774	0·91725	462·530	216	2·500	116·40	25·1660	793·50	128·7	9·2356	0·0882
do.	15	0·92149	0·92034	450·944			127·20	28·2080	249·36	177·4	15·8950	0·2520
Lowland Malt I.	New	0·90995	0·90959	490·228						125·5	11·2960	2·2680
Lowland Malt II.	New	0·90261	0·90248	514·069	40	None	57·60	11·2050	1088·20	57·7	6·7444	2·7720
do. do.	5	0·91314	0·91226	480·705	328	6·600	191·40	39·820	884·10	201·8	8·2010	3·4020
do. do	10	0·92213	0·92013	448·404		5·800			634·84	146·4	8·2010	2·2680
Lowland Malt III.	New	0·90652	0·90557	504·355	76	None	68·40	13·562	398·28	239·5	13·9580	4·1580
do. do.	5	0·90999	0·90952	490·308	192	2·00	159·00	32·430	906·75	155·3	15·4320	3·4020
do. do.	11	0·91471	0·91411	474·589	1056		183·60	38·684	612·10	192·9	15·8950	2·7720
do. do.	13	0·92698	0·92529	432·372		26·00	136·20	31·500	793·50	164·1	11·3550	3·0240
Highland Malt I.	New	0·90097	0·90000	523·164	32	None	141·00	26·952	963·38	201·8	5·5182	3·0240
do. do.	5	0·90946	0·90897	492·451	216	None			929·54	186·3	18·5720	3·0240
do. do.	10	0·91408	0·91355	475·943	472	6·400	272·20	57·190	793·50	288·3	17·2820	3·4020
Highland Malt II.	New	0·89666	0·89584	537·350	36	None	81·00	15·074	1405·40	186·3	32·7660	5·0400
do. do.	5	0·91144	0·91059	486·517	1020	9·700			997·60	232·9	19·7524	4·0320
do. do.	10	0·91491	0·91386	474·912					952·10	241·8	31·9900	6·5520
do. do.	15	0·91699	0·91614	466·578	600				861·50	201·8	42·2110	4·7880
do. do.	20	0·92151	0·92019	451·578	1664				748·00	286·1	46·1750	5·0400
Coal Ila Islay I.	New	0·90648	0·90630	501·815		None	93·00	18·533	362·73	122·0	16·3570	4·1580
do. do.	5	0·91283	0·91271	479·048	128	3·2			1156·10	137·5	15·3288	6·8040
do. do.	10	0·92419	0·92308	440·705					793·50	146·4	17·7820	2·7720
Campbeltown I.	New	0·90651	0·90637	501·577	56	None	88·80	17·704	612·10	226·2	16·8200	2·7720
do.	5	0·90860	0·90799	495·780	156	4·200	112·80	22·757	861·50	201·8	19·4320	2·2680
do	11	0·91387	0·91350	476·181	364	4·200	225·00	47·250	453·30	197·4	73·1040	1·5120
Campbeltown II	New	0·90992	0·90887	492·838	12	2·400	130·20	26·419	589·40	206·3	75·9090	8·3160
do.	5	0·91411	0·91383	475·864	240	3·400	159·00	33·415	430·75	188·5	32·7140	10·0800
do.	12	0·92667	0·92612	429·277	628	16·00	205·80	47·942	566·80	199·6	48·9960	9·5760
Brora	New	0·91413	0·91364	475·706						155·3	7·1861	4·1580
do.	5	0·91234	0·91174	482·530						157·5	40·8220	5·0400
do.	9		0·92665	427·294						157·5	29·5410	4·7880
do.	16	0·93303	0·93268	403·723						153·00	20·2450	2·5200
Lowland Malt IV.	New	0·90622	0·90589	503·174	12	1·300	61·80	12·282	498·80	223·7	10·1721	5·0400
Lowland Malt V.	New	0·90521	0·90464	507·371	40	None	20·40	4·0202	476·20	184·1	18·1420	3·7800
Varia *a*		0·94214	0·94104	368·484	1290	15·400	169·20	45·918	430·75	206·3	17·7120	2·0160
.. *b*		0·94199	0·94073	369·913	1040	20·700	137·40	37·145	679·96	167·0	25·2350	2·2680
.. *c*		0·94270	0·94054	371·707	1264	8·100	137·40	36·966	476·20	156·5	16·3570	2·7720

Sydney Section.

Meeting held at Sydney on Thursday, Sept. 26, 1907.

PROFESSOR LIVERSIDGE, F.R.S., IN THE CHAIR.

THE MEAT EXTRACTS OF NEW ZEALAND.

BY ALLISTER MACLEAN WRIGHT.

Numerous papers have been published on various meat extracts, but up to the present no work appears to have been recorded on those of New Zealand. The New Zealand Year Books show that the exports of this article rose from 3615 lb., valued at £847, in 1901, to 28,120 lb. valued at £3014, in 1905; it will thus be seen that the commodity is of increasing importance in the export trade of the Colony, and to the meat freezing and preserving industry with which it is allied. The following are the analyses of the principal meat extracts manufactured, together with the analyses of Australian and South American products.

In New Zealand the extract is manufactured mainly from mutton, whereas South American extract is a beef product.

In making these analyses the following methods were used. The estimations for moisture, ash, sodium chloride, and total nitrogen were carried out according to Stutzer's method.* The creatine was determined by the method described by Micko.† The residue of sand and extract left in the moisture determination was used for the fat estimation, which was carried out in the usual way, petroleum ether being the solvent. The substance insoluble in water was determined by dissolving 1—2 grms. in 50 c.c. of water, and weighing the dry residue upon a tared filter. In this determination the fat in the extract was found to emulsify with the liquor and pass through the filter paper, and is apparently of the nature of cholesterin, especially in Nos. 1, 2, and 7. The estimations by alcohol precipitation were carried out in a manner similar to that described by Hehner,‡ as follows:—1—2 grms. of extract were dissolved in 20 c.c. of water, and 20 c.c. of absolute alcohol added to the solution; after standing 24 hours, the clear supernatant liquid was decanted from the precipitate, the latter dissolved in hot water without washing, evaporated, dried at 100° C., and weighed. The nitrogen was determined in the residue by the Kjeldahl method, and after deducting the substance insoluble in water, the results are expressed as substance and nitrogen precipitated by 50 per cent. alcohol, but soluble in water. To the clear supernatant liquid from the previous determination 60 c.c. of absolute alcohol was added, the estimation being carried out in the manner described above, and the results expressed as substance and nitrogen precipitated by 80 per cent. alcohol, but soluble in 50 per cent. alcohol and in water. The figures for substance and nitrogen soluble in 80 per cent. alcohol are arrived at from the difference between the total and the part insoluble in water.

	New Zealand.								South America.	Australian.
	1	2	3	4	5	6	7	8		
Moisture	21·79	17·16	13·10	24·21	13·46	17·28	20·65	16·42	19·04	19·48
Organic matter	59·95	65·58	67·78	59·44	69·43	62·82	71·51	69·91	59·57	62·59
Sodium chloride	3·36	3·14	4·11	2·89	3·03	3·68	1·78	3·43	4·22	3·71
Other mineral salts	14·90	14·12	15·01	13·46	14·08	16·22	6·06	10·24	17·17	14·22
Fat	0·33	0·38	0·41	0·34	0·46	0·26	14·10	0·31	0·28	0·36
Substance insoluble in water	1·02			0·36		0·21				
Substance precipitated by 50 per cent. alcohol and soluble in water	4·61	5·38	8·21	7·45	10·92	3·38		5·22	6·92	3·23
Substance precipitated by 80 per cent. alcohol and soluble in 80 per cent. alcohol and in water	15·16	20·92	16·82	15·08	22·48	18·58		13·36	12·93	11·24
Substance soluble in 80 per cent. alcohol	57·42	56·54	61·87	52·90	53·14	60·55		65·00	61·11	66·05
Nitrogen precipitated by 50 per cent. alcohol	0·32	0·48	0·62	0·58	0·71	0·29		0·42	0·46	0·28
Nitrogen precipitated by 80 per cent. alcohol and soluble in 50 per cent. alcohol and in water	1·25	1·64	1·39	1·22	1·96	1·40		1·06	1·15	0·97
Nitrogen soluble in 80 per cent. alcohol	7·15	7·69	8·31	6·85	7·93	7·82		9·25	7·29	8·07
Total nitrogen	8·72	9·81	10·32	8·65	10·60	9·51	8·26	10·73	8·90	9·32
Creatine	4·82	3·88			6·19			6·21	5·03	4·11

No. 1 was taken from the sample which gained the principal award at the New Zealand International Exhibition, and was made wholly from mutton; while containing more moisture than the average, it probably represents the best quality manufactured in New Zealand. The substance insoluble in water is meat fibre.

No. 2 was taken from lots manufactured at the same factory as No. 1.

Nos. 3, 4, 5, and 6 are from lots put up by other factories in the Colony. The substance insoluble in water in No. 4 is meat fibre, while that in No. 6 is phosphate of lime.

No. 7 is an extract made from sheep heads, and put on the market as "stock." The high fat content consists mainly of wool fat which was obtained from the small quantity of wool left on the head, and fat from the brains which were not removed, and as some of the constituents of these fats readily emulsify with the liquor and cannot be economically removed, the manufacture of this article has been discontinued.

No. 8 was taken from a trial lot of rabbit extract, and while this article is not manufactured in the Colony, its analysis indicates the possibility of utilising this material.

As a whole, the meat extracts of New Zealand compare favourably with those manufactured elsewhere. For permission to publish these results I have to express my thanks to the General Manager of the Christchurch Meat Co., Ltd., in whose laboratory most of the work was carried out.

DISCUSSION.

Mr. A. RAMSAY, referring to the similarity shown between rabbit extract and those from mutton and beef, said that he had found considerable difference.

Mr. T. STEEL pointed out that wide variations in the moisture would affect the comparison to some extent. With reference to the explanation of the high proportion of fat in the sheep's head extract, he thought the lanoline in the small amount of wool left on the head could have no appreciable effect. But brain matter, which contained about half its dry weight of fat, was doubtless the main source.

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* Flesh Foods, Mitchell, p. 193; Zeits. anal. Chem., 1895, 372 and 568.

† J. Chem. Soc., 82, 369.

‡ Flesh Foods, Mitchell, p. 199; Analyst 10, p. 221.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows :—
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I.—PLANT, APPARATUS, AND MACHINERY.

Patents.

Filter-presses. G. A. Stevens, Paignton. Eng. Pat. 3650, Feb. 14, 1907.

The mud to be filtered is drawn into the press by an injector actuated either by steam, or by air. When the press is full, the steam is caused to enter directly into the press, by altering the valves, in order to drive the liquid out of the press-cakes.—W. H. C.

Filtering apparatus. D. J. Kelly, Assignor to The Kelly Filter Press Co., Salt Lake City, Utah. U.S. Pat. 869,372, Oct. 29, 1907.

One or more cloth-covered filter-frames or diaphragms are supported within a tank provided with a conical removable bottom-piece attached by rods and made tight by a screw. The liquid to be filtered is forced into the tank under pressure : the clear portion passes through the frames to the delivery tube, and the solids collect as a cake on the exterior of the filter-frames. From time to time the detachable bottom is removed, and the solid matter allowed to drop out into a receptacle placed below.
—W. H. C.

Heating, refrigerating, and evaporating liquids ; Apparatus for ——. F. Rehne, St. Petersburg. Eng. Pat. 4124, Feb. 19, 1907.

See Fr. Pat. 376,337 of 1907 ; this J., 1907, 1000.—T. F. B.

Drying machines ; Centrifugal ——. J. W. Macfarlane, Cathcart, N.B. Eng. Pat. 6171, March 14, 1907.

In ordinary centrifugal machines the spindle is carried by one elastic rubber buffer and guided by another. As these wear with use, the supporting buffer is kept adjusted by the pressure due to the weight of the spindle and basket, but the other has to be adjusted from time to time. To overcome this defect, the spindle is suspended from, or supported by, two separate annular discs, or rings, each of which has a separate support and bears a portion of the weight of the spindle and basket. As the discs wear away by use, they are kept pressed into position by the weight which they support.—W. H. C.

Drying apparatus ; Vacuum ——. Fellner und Ziegler. Fr. Pat. 379,343, June 11, 1907.

The materials to be treated are charged and withdrawn through intermediate chambers which form air-locks. The dryer consists of a horizontal, steam-jacketed, rotating drum into which the material is introduced from the air-locks by a pipe which passes centrally through one end of the drum and extends nearly to the other end. This pipe is surrounded by another, forming an annular conduit leading to the vacuum pump. The dried material, crushed to powder by loose pieces of iron placed within the drum, is discharged by an endless screw conveyor, fixed upon the exterior of the vacuum pipe at one end, into another annular tube surrounding the vacuum tube and communicating with the discharge air-locks.—W. H. C.

Separating liquids from vapours ; Apparatus for ——. H. W. Aitken and W. Mackie, Glasgow. U.S. Pat. [illegible], Oct. 29, 1907.

See Eng. Pat. 17,612 of 1906 ; this J., 1907, 460.—T. F. B.

Regenerative furnace. N. Lébédeff and B. Pomeranzoff. Fr. Pat. 379,474, July 2, 1907.

In regenerative furnaces fed with gas from external producers, a loss occurs owing to the greater part of the heat of formation of carbon monoxide being wasted. To overcome this defect, an inverted combustion chamber is placed between the hearth and the regenerators on each side of the former. Solid fuel is introduced into this chamber and is converted into water-gas and then burnt at once, and the resulting flame allowed to play on the hearth. The water necessary is introduced either as steam before the regenerators, or else as moisture or water of hydration or constitution along with a fuel such as wood.
—W. H. C.

II.—FUEL, GAS, AND LIGHT

Coke making in the United Kingdom. Times. Eng. Suppl., Nov. 20, 1907. [T.R.]

The production of both blast-furnace and gas-works coke in the United Kingdom amounted in 1906 to 19,296,256 tons, principally from coal mined in Durham, Yorkshire, Lancashire, Glamorgan and Monmouth. The output in 1905 was 18,037,985 tons. The quantity of coking coal consumed in 1906 was 35,402,677 tons, which compares with 33,452,943 tons in 1905. The following table shows the various types of coke ovens in operation in the United Kingdom in the last two years :

	1905.	1906.
Bee-hive	25,514	23,454
Coppée	2,233	2,308
Simon-Carvès	726	808
Otto-Hilgenstock	503	768
Semet-Solvay	470	670
Koppers	72	108
Simplex	78	78
Bauer	52	52
Other types	1,412	1,482
Total	31,060	29,728

Returns made by 257 coking plants show that 51 recovered their by-products last year.

Messrs. Cochrane and Company, of Middlesbro', have decided to instal fifteen additional Otto-Hilgenstock by-product coke-ovens at their New Brancepeth Colliery, in the county of Durham. They have already an installation of 80 of these ovens now working at this colliery, each oven taking a charge of 7½ tons of coal, the by-products manufactured being tar and sulphate of ammonia. At the Port Clarence works of Messrs. Bell Brothers, where a battery of 120 of the Huessener coke-ovens are in operation, the Coal Distillation Company (a branch of the Aktien-Gesellschaft Kohlendestillation), are laying down a modern tar distillation plant similar to installations at some of the large tar distillation and aniline works in Germany. At their Dean and Chapter Colliery, near Spennymoor, county Durham, Messrs. Bolckow, Vaughan, and Co. have just recently arranged for the installation of 100 by-product coke-ovens of the Semet-Solvay type. This installation is expected to be in operation by September next. Each oven will take about 40 tons of coal per week, giving 1·12 per cent. of sulphate and 6 per cent. of tar. At the same company's Auckland Park Colliery, Shildon, a battery of 100 similar ovens is also now in course of erection, and will be working in May next. From these ovens about 1·33 per cent. of sulphate and 5 per cent. of tar will be derived. Messrs. Strakers and Love, of Newcastle-on-Tyne, have this month placed a contract for the installation of a battery of 120 of the Semet-Solvay ovens at their Brancepeth Colliery, county Durham, and this plant is expected to be ready by the end of next year. These ovens, which will replace old-fashioned bee-hive ovens, are each to be capable of treating 41 tons of coal per week, giving 4 per cent. of tar and 1·25 per cent. of sulphate.

Coke production in the United States. U.S. Geol. Survey. [T.R.]

The production of coke from the beehive and by-product ovens of the United States in 1906 surpassed all previous records, amounting to 36,401,217 tons, as compared with 32,231,129 tons in the previous year. The value increased from 72,476,196 dols. in 1905 to 91,608,034 dols. in 1906. Of the output last year, 31,843,090 tons were produced in beehive ovens, against 28,768,781 tons in 1905. The production from retort or by-product ovens in 1906 was 4,588,127 tons, against 3,462,348 tons in 1905. For a number of years, prior to 1902, there was a large annual increase in the number of retort ovens built for the manufacture of coke, and as a result there was a large gain in the output of tar, ammonia, and other by-products. At the close of 1901, when there were only 1165 by-product ovens completed in the United States, there were 1533 in the course of construction, 498 of which were completed during the following year. At the close of 1902, 1346 retort ovens were building, 293 of which were added to the completed plants in 1903. At the close of 1903, 1335 new ovens were building, and 954 of these were put in blast before Jan. 1, 1905, at which time 822 new ovens were in course of construction. At the close of 1905 there were only 417 new ovens building, and at the close of 1906, new work was limited to 112 Otto-Hoffman ovens, which have since been completed and put in blast.

One of the reasons that has been assigned for the retrogressive condition exhibited by the statistics for 1905 and 1906 (comparison being made with beehive oven construction, 5893 new beehive ovens having been completed in 1906, with 4407 building at the close of the year), is the lack of a profitable market for coal tar, and yet the United States is importing coal-tar products to the value of several million dollars annually, while the development of the fuel-briquetting industry has been held back because of the lack of assurance of a steady supply of coal-tar pitch for a binder, and users of creosoting oils for the preservation of timber complain of an insufficient domestic supply of this product of coal-tar distillation.

A plant of 1000 retort ovens will be built at Gary, Ind., and operated in connection with the new steel works under construction at that place.

Patents.

Fixed carbon fuels; Process and apparatus for securing the ready ignitability and continuity of combustion of ——. B. H. Thwaite, London. Eng. Pat. 665, Jan. 10, 1907.

Coke, charcoal, anthracite, or other fixed carbon fuel is broken up so that it will pass through a 1½-inch ring, and then placed in a vessel capable of withstanding considerable internal or external pressure. A vacuum is produced within the vessel and a spray of heated hydrocarbon, or other oil is introduced, which penetrates into the porous fuel. The introduction of the spray is continued until a suitable pressure has been attained. The impregnated fuel is then either withdrawn, or the external surfaces of the pieces may be coated by continuing the introduction of the hydrocarbon spray after the pores of the fuel have been filled. Coke for impregnation may be prepared in a retort oven by a special process of carbonisation for a shortened period.—W. H. C.

Fuel; Composition of matter for use as —— and method of mixing the same to form the fuel. D. Drawbaugh, Camp Hill, and B. E. Gamble, Bowmansdale, Pa., U.S.A. Eng. Pat. 5195, March 4, 1907.

See Fr. Pat. 375,336 of 1907; this J., 1907, 956.—T. F. B.

Fuel; Process for the production of solid ——. S. Börlin. Basle, Switzerland. Eng. Pat. 7857, April 4, 1907.

See Fr. Pat. 365,762 of 1906; this J., 1906, 974.—T. F. B.

Peat; Process and apparatus for the treatment of ——, S. Biddulph. Fr. Pat. 379,429, July 1, 1907.

The raw peat is forced through perforations in the walls of a conical hopper, by means of a compressing-screw mounted on a vertical rotating shaft. The roots and fibres, which do not pass through the perforations, are removed from the apparatus through the bottom of the hopper. The disintegrated peat falls on to a heated conical surface, and is worked towards the outlet and delivered on to a conveyor, by a rotating scraper mounted on the shaft. The apparatus is provided with a steam-jacket, and there is an outlet for the steam driven off from the peat. The material delivered to the conveyor is ready for compressing into blocks.—A. T. L.

Fuel; Manufacture of agglomerated —— by means of pitch from coal-tar or wood-tar. J. P. Serve. Fr. Pat. 379,475, July 2, 1907.

The invention relates to the use of pitch from coal-tar or from wood-tar as binding agent, and consists in mixing the powdered fuel and the pitch in a heated but dry condition. The process is carried out in a horizontal chamber, heated externally, the materials being mixed and passed through the chamber by helical blades mounted on an axial rotating shaft.—A. T. L.

Coke and gas; Apparatus for making ——. J. Armstrong. First Addition, dated June 6, 1907, to Fr. Pat. 355,428, June 21, 1905.

See Eng. Pat. 21,486 of 1906; this J., 1907, 1078.—T. F. B.

Gas generator. P. R. J. Willis, Kingston-on-Thames. From J. Sale, Sandwich, Ontario. Eng. Pat. 23,080, Oct. 18, 1906.

The generator is provided with a conical grate, having a central valve-controlled air-inlet pipe, and is surmounted by a steam generator. Air is drawn through the latter, and the mixture of air and steam is led down a pipe, which passes through the refractory lining, to an annular chamber surrounding the combustion zone, issuing thence through a series of slide-controlled openings into the fuel. The air-inlet pipe, which passes up through the grate, communicates with both the outer air and the above-mentioned annular chamber. A handle attached to the conical grate enables it to be shaken from the outside, to facilitate the discharge of ashes.—H. B.

Gas producer and ammonia or equivalent generator; Combined ——. Clarke, Chapman and Co., Ltd., and J. Robson, Gateshead. Eng. Pat. 342a, Jan. 5, 1907.

The apparatus consists essentially of a vertical cylindrical gas-producer, surrounded by a jacketed cylindrical heat-interchanger in which ammonia or other volatile liquid is vaporised by the heat of the producer gases flowing through the jacket, and by the heat of the exhaust gases from a gas-engine which flow through the tubes of the interchanger. The gas producer and its adjuncts (fuel-hopper, water vaporiser, etc.) are so constructed as to be removable as a whole from the centre of the apparatus. —H. B.

[Power-] gas; Process of producing ——. B. E. Eldred and C. Ellis, Assignors to Combustion Utilities Co., New York. U.S. Pat. 869,486, Oct. 29, 1907.

A power-gas is obtained by drawing a regulated mixture of lime-kiln waste gases and air through a deep bed of ignited fuel, and adding lime-kiln or other inert gases to bring the gas to a standard strength. The gas is purified and collected for use.—A. T. L.

[Producer-] gas; Process of making ——. B. E. Eldred, Assignor to Combustion Utilities Co., New York. U.S. Pat. 869,487, Oct. 29, 1907.

A rich producer-gas, composed chiefly of carbon monoxide and nitrogen in about equal parts, is obtained by blowing hot fuel alternately with air and with waste gases containing over 25 per cent. of carbon dioxide, *e.g.*, lime-kiln gases, and collecting the products of the latter blow. The hot gases from the "air blow" may be used to calcine lime, or to heat a carburetting and fixing chamber in which the producer-gas is further enriched.—A. T. L.

Water-gas apparatus. J. H. Taussig, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S Pat. 869,814, Oct. 29, 1907.

THE fixing chamber of a water-gas apparatus is connected to the upper end of an inclined tubular boiler, with connections arranged so that either the illuminating or the blast gases can be passed through the boiler tubes or through a by-pass. Any tarry deposit from the illuminating gas flows to the lower end of the boiler. A steam drum placed above the boiler is connected thereto by vertical passages near the tube-plates, and contains water, so that the tubes are always wholly immersed. The connection between the boiler and the water-gas apparatus is made in sections, some of which are wedge-shaped and detachable.—A. T. L.

Gas from refuse or similar material; Composition for producing ——. L. G. Harris. Fr. Pat. 379,358, June 22, 1907.

SEE Eng. Pat. 22,028 of 1906; this J., 1907, 1191.—T. F. B.

Carburetted air; Apparatus for producing ——. A. H. Warmsley. Fr. Pat. 379,363, June 26, 1907. Under Int. Conv., June 13, 1907.

THE apparatus comprises a hot-air engine driving a blower which forces air through a carburetter into a gasholder, and the invention relates chiefly to controlling devices actuated by the rise and fall of the bell. When the bell rises to a certain height, it moves a lever which brings a cover against the air intake of the blower, and the supply of air to the carburetter is cut off until the bell falls and re-opens the air inlet. These actions may take placed at any desired positions of the bell. The carburettor consists of a vertical casing in the lower part of which the petrol or alcohol, supplied from a float-chamber, is kept at a constant level. The air enters through a horizontal pipe, extending through the carburettor at about the middle of its height, and having vertical branches opening below the surface of the liquid. When the bell of the gas-holder falls, a second lever is actuated and turns a cylindrical sleeve in the carburettor air-pipe, cutting off the latter from the interior of the carburetter. The upper part of the carburetter forms a mixing chamber, and may contain plates of perforated zinc. A "safety-valve" in the gas-main is automatically closed if the bell falls below its lowest working position, and is not re-opened when the bell rises until the operating levers are re-set. In cold countries, a vertical leather bellows is used, in place of the bell and tank.—A. T. L.

Gas from peat or other low-grade combustible substances; Process for the continuous production of ——. F. Fritz. Ger. Pat. 180,603, Nov. 13, 1901.

THE peat is distilled in retorts heated externally, and the incandescent charcoal or coke is conveyed to an adjoining chamber, where it is treated with atomised water, the water-gas thus produced being withdrawn, along with the distillation-gases, from the retorts. The apparatus is so arranged that the charge of peat and the resulting coke or charcoal move continuously through the retort and the adjoining water-gas producer respectively.—A. S.

Gas; Apparatus for washing and cooling ——. H. L. Doherty, New York. Eng. Pat. 12,751, June 1, 1907.

SEE U.S. Pat. 855,448 of 1907; this J., 1907, 816.—T. F. B.

Incandescence mantles; Bath for hardening ——. R. Eisenmann. Fr. Pat. 379,499, July 3, 1907.

SEE Eng. Pat. 15,536 of 1907; this J., 1907, 1079.—T. F. B.

Incandescing bodies or filaments for electric lamps; Manufacture of ——. A. Bourdon, R. Rothschild, and J. W. Ratcliffe, London. Eng. Pat. 23,119, Oct. 18, 1906.

PITCHBLENDE is treated with hydrochloric acid or some other chlorine-yielding reagent, and the pumice-like mass and powder obtained are washed, dried, and pulverised. Carbon or other suitable filaments are heated along with the powder to a high temperature in a closed crucible containing a little free hydrogen or other reducing agent, and are then heated by means of an electric current in an atmosphere of hydrogen and aqueous vapour.—H. B.

Electric incandescent lamps [; Filaments for ——]. A. Lederer, Vienna. Eng. Pat. 24,973, Nov. 6, 1906.

SEE Fr. Pat. 371,148 of 1906; this J., 1907, 250.—T. F. B.

Refractory bodies [incandescence filaments], especially for lighting and heating purposes; Manufacture of ——. Cie. Française pour l'Exploit. des Procédés Thomson-Houston. Fr. Pat. 379,310, May 8, 1907. Under Int. Conv., May 9 and Aug. 9, 1906.

THIS invention relates to the production of filaments, etc., of refractory bodies, such as, tungsten, molybdenum, thorium, zirconium, boron, titanium, etc., or of alloys of these metals. In order to bring these refractory metals into a condition in which they can be drawn into filaments or ribbons, their fine powders are incorporated with some less refractory metallic material, which may be used in the form of the metal itself, or of an alloy, amalgam, or colloïdal solution of it; or the refractory metal may be impregnated with the less refractory metallic material. In either case the less refractory material is afterwards volatilised by heating the compounded mass in the presence of an inert gas.—W. C. H.

Incandescent bodies for incandescence electric lamps; Process of treatment of —— *with the view of estimating the quality.* The Westinghouse Metal Filament Lamp Co., Ltd. Fr. Pat. 379,342, June 8, 1907.

IN order to ascertain whether the cross-section of incandescence lamp filaments is uniform, it is proposed to subject the filaments momentarily to the action of an electric current, in such a way that the small particles in the filament may glow brightly, whilst other particles of a larger diameter only glow slightly, or not at all. By momentarily subjecting a metallic filament to the action of an electric current in an atmosphere of vapours or gas capable of reacting with the filament (*e.g.*, oxidising it), in such a way as to change its colour when heated, a permanent indication of all the variations in the cross-section may be obtained.—W. C. H.

Incandescent bodies for incandescence electric lamps; Process of manufacture of ——. Deutsche Gasglühlicht Akt.-Ges. (Auerges). Fr. Pat. 379,379, June 28, 1907. Under Int. Conv., July 11, 1906.

THESE incandescence bodies are made from tungsten filaments containing carbon. The elimination of the carbon from the filaments of crude tungsten, is effected by the action of hydrogen, or hydrogen diluted with nitrogen, which contains not more than 1 per cent. (of the hydrogen) of water vapour, the filaments being heated to a white heat by an electric current.—W. C. H.

Tungsten conductors [for incandescence electric lamps]. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 379,393, June 29, 1907. Under Int. Conv., July 2, 1906.

SEE Eng. Pat. 21,513 of 1906; this J., 1907, 1132.—T. F. B.

Refractory metals [for lamp filaments]; Treatment of ——. Comp. Française pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 379,394, June 29, 1907 Under Int. Conv., July 2, 1906.

THE refractory metals are obtained by reduction of their compounds in a vacuum in an electric furnace. Lampblack is used as the reducing agent for the production of finely-divided tungsten, which may be compressed into a coherent rod and then rolled, drawn, etc. Claim is also made for the production of tungsten filaments by mixing the finely-divided oxide with lampblack together with wax, gum, resin or other similar binding material, filaments being made from this mixture and afterwards transformed, by heating, into filaments of pure tungsten. —O. F. H.

Metallic compounds [for lamp filaments]; Purification of ——. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 379,679, July 6, 1907. Under Int. Conv., July 12, 1906.

SEE Eng. Pat. 18,489 of 1906; this J., 1907, 1042.—T.F.B

Metallic filaments [for incandescence electric lamps]. Cie. Franç. pour l'Exploitation des Procédés Thomson-Houston. Fr. Pat. 379,680, July 6, 1907. Under Int. Conv., July 9, 1906.

See Eng. Pat. 21,505 of 1906 ; this J., 1907, 1131.—T. F.B.

Naphthalene, etc. Fr. Pat. 379,559. *See* XVIIIC.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

p-Xylidine ; Derivatives of ——. G. Schultz and A. Petény. J. prakt. Chem., 1907, 76, 331—336.

In the separation of *p*-xylidine from *m*-xylidine by the aid of benzaldehyde, a by-product results, on decomposing the benzylidene-*p*-xylidine with sulphuric acid, which melts at 208° C., and is di-*p*-amino-di-*p*-xylylphenylmethane, $NH_2 . C_6H_2(CH_3)_2 . CH(C_6H_5) . C_6H_2(CH_3) . NH_2$. This is best prepared by warming 20 grms. of benzaldehyde and 50 grms. of *p*-xylidine with alcoholic hydrochloric acid for 6 hours, using a reflux condenser. Water is added and the solution filtered, treated with sulphuric acid, and the excess of benzaldehyde removed by steam. The residue is now made alkaline with caustic soda, and unchanged xylidine driven off, when the diaminodixylylphenylmethane remains as a crystalline mass which may be recrystallised from alcohol and obtained in pale yellow prisms. The yield is 40—45 grms. By using *m*- or *p*-nitrobenzaldehyde, the corresponding nitro-derivatives of the base are obtained.—J. C. C.

Coal tar products in the United States ; Imports of ——. U.S. Geol. Survey. [T.R.]

The value of the imports of coal tar products during the last five years, with the duties paid thereon, are shown in the following table :—

Year.	Value.	Duty.
1902	$7,494,340	$1,594,799
1903	7,690,885	1,692,445
1904	7,146,871	1.578,647
1905	8,344,994	1,856,607
1906	8,536,243	1,889,185

Imports of salicylic acid have declined from 57,852 dollars in 1902 to 2,772 dollars in 1906, the domestic product having displaced the foreign article. Imports of " alizarin and colours or dyes, natural or artificial " were valued at 661,155 dollars in 1906 ; this shews no great variation from the figures of the three preceding years. Imports of aniline salts increased slightly to 806,901 dollars, as did " coal tar colours or dyes, not specially provided for," the value of this item being 5,717,932 dollars. " Coal tar, all preparations not colours or dyes " were imported to the value of 864,067 dollars in 1906, and " coal tar products, not medicinal, not dyes, benzol, toluol, etc.," 483,416 dollars.

Patents.

Emulsions [of tar oils and mineral oils] ; Preparation of ——. W. F. A. Ermen, Manchester. Eng. Pat. 24,135, Oct. 30, 1906.

An emulsifying agent is prepared by treating suitable fatty substances, such as cottonseed oil, castor oil, tallow, wool grease, or fish oil, with sulphuric acid at a temperature above that permissible in the production of sulphonated oil. The product is preferably washed with salt solution until free from acid, or with about 1 per cent. (by volume) of other substances, such as sulphuric anhydride, nitric acid, oxides of nitrogen, metals, metallic oxides, or hydrocarbons or their derivatives. Emulsions are prepared by well mixing the product with the tar, tar oil, mineral oil, or the like, with the addition, if required, of caustic alkali and water. The emulsions may be employed for laying dust on roads, destroying noxious insects or plants, disinfecting, assisting the action of cutting tools, and as a solid lubricant. Examples are given of their preparation for these purposes. —A. S.

Hydrocarbons ; Distillation and partial dehydrogenation of ——. Soc. Anon. des Combustibles Industriels, Haine-St.-Paul, Belgium. Eng. Pat. 28,689, Dec. 15, 1906. Under Int. Conv., April 19, 1906.

See Fr. Pat. 365,428 of 1906 ; this J., 1906, 977.—T. F. B.

Pyroligneous products ; Process of obtaining —— *directly.* Pagès, Camus et Cie. Second Addition, dated Sept. 5, 1906, to Fr. Pat. 375,314, May 10, 1906.

Modified forms of apparatus are claimed for carrying out the process described in the main patent and the first addition thereto (this J., 1907, 920, 1080). One of the features of the apparatus described, is that the distillation products, after leaving the tar-separator, are passed through one or more vessels, suitably heated, wherein they are agitated mechanically with solid reagents, in order to obtain pyrolignites directly in a dry, fused, or fritted condition.—A. S.

Tar products containing sulphur from cereal grains ; Process for preparing ——. E. Meyer. Ger. Pat. 180,113, Dec. 2, 1905.

Tarry products containing sulphur are obtained by submitting cereal grains from which the husks are removed, and preferably with the addition of about 10 per cent. of sulphur, to carbonisation.—T. F. B.

Petroleum ; Process of fractional distillation of ——. W. C. and F. E. Wells. Fr. Pat. 379,521, July 3, 1907.

The invention relates to the fractional distillation of petroleum, at a temperature below its boiling point, by means of a permanent gas, *e.g.*, hydrogen. The apparatus comprises a still connected with a condenser, a circulating pump, and a gasometer. The petroleum is heated gradually in the still to a temperature below its boiling point, and the permanent gas is passed through a series of perforated tubes immersed in the heated petroleum, and caused to bubble up through the latter. The gas and the entrained vapours, liberated progressively in the order of their volatility, pass to the condenser, where the vapours are condensed and flow into a receptacle, whilst the permanent gas is aspirated by the pump and caused to circulate through the apparatus again. If the petroleum contain water, it is fed into the still through a coil, which is immersed in the hot liquid, and opens into a perforated enlargement, below which is a perforated conical hood, for the purpose of increasing the surface of the petroleum and thus facilitating the vaporisation of the water. A guard-tube is provided just after the condenser, for drawing off the condensed water. It is claimed that by this process, petroleum distillates are obtained, which do not need further refining by chemical methods.—A. S.

Emulsification of oils, &c. Eng. Pat. 23,768. *See* XII.

[Heat] Insulating material, &c. Fr. Pat. 379,359. *See* IX.

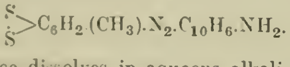
IV.—COLOURING MATTERS AND DYESTUFFS.

Carbazol. G. Schultz and L. Hauenstein. J. prakt. Chem., 1907, 76, 336—349.

By heating carbazol (20 grms.) with concentrated sulphuric acid (12·5 grms.) for 6—7 hours at 70—75° C., a large proportion of the carbazol (10—11 grms.) remains unchanged, whilst the rest is converted into the disulphonic acid, and a little trisulphonic acid is also formed. Carbazoldisulphonic acid, obtained by decomposing the barium salt with dilute sulphuric acid, is a compact, transparent mass, the surface of which soon becomes blue and its aqueous solutions also change to this colour especially on evaporation. The acid is very readily soluble in water and the usual organic solvents. On nitration with dilute nitric acid, mononitrocarbazoldisulphonic acid is produced which yields the corresponding amino-acid on reduction with ammonium sulphide. This amino-acid can be converted into a diazo-compound which combines with β-naphthol to give a red dyestuff dyeing wool red in an acid bath. A mononitro-acid is also obtained by adding a mixture of concentrated sulphuric acid (11·6 grms.) and concentrated nitric acid (11·6 grms.) to the product of sulphonation of carbazol (20 grms.) by concentrated sulphuric acid (56 grms.), the operation being carried on for half an hour on the boiling-water bath. This acid on reduction yields an amino-acid, the diazo-compound of which gives with β-naphthol a red, and with α-naphthylamine a violet dyestuff. When carbazoldisulphonic acid is treated with concentrated nitric acid, tetranitrocarbazolmonosulphonic acid is obtained. Potassium carbazoltrisulphonate is prepared from the mother liquors left after separating the barium salt of the disulphonic acid.—J. C. C.

1-*Methyl-2-aminophen*-4 : 5-*dithiol. Contribution to the knowledge of sulphineazo dyestuffs.* F. Fichter, J. Fröhlich, and M. Jalon. Ber., 1907, **40**, 4420—4425.

The authors find that when two mercaptan groups in the ortho position to one another, are introduced into the molecule of an azo dyestuff, the resulting compound possesses the properties of a sulphide dyestuff in that it dyes cotton direct from a sodium sulphide bath. 2-Nitro-4-toluidine-5-sulphonic acid is diazotised and treated with potassium xanthate, and the product, on hydrolysis, yields potassium 1-methyl-2-nitrophen-4-thiol-5-sulphonate, $CH_3.C_6H_2(NO_2)(SO_3K).SK$, which is readily oxidised by air to the disulphide, $[CH_3.C_6H_2(NO_2)(SO_3K).S]_2$. By means of phosphorus pentachloride this is converted into the sulphochloride which on reduction gives 1-methyl-2-aminophen-4 : 5-dithiol, $CH_3.C_6H_2(NH_2)(SH)_2$, the hydrochloride of which is diazotised and combined with β-naphthylamine producing 1-methylphen-4 : 5-disulphide-2-azo-β-naphthylamine,



$$\begin{matrix}S\\S\end{matrix}\!>C_6H_2.(CH_3).N_2.C_{10}H_6.NH_2.$$

This substance dissolves in aqueous alkali sulphide, the dithiol, $(SH)_2C_6H_2(CH_3).N_2.C_{10}H_6.NH_2$, being probably formed, and from this solution, cotton is dyed in red shades which, however, are not fast to light or acids.
—J. C. C.

Regulations for the manufacture of nitro- and amido-derivatives of benzene, and the manufacture of explosives with use of dinitrobenzol or dinitrotoluol. Factory and Workshop Act, 1901. Amended draft. [T.R.]

Part I.—Duties of Occupiers.

1. Every vessel containing any substance named in Schedules A or B shall, if steam is passed into or around it, or if the temperature of the contents be at or above the temperature of boiling water, be covered in such a way that no steam or vapour shall be discharged into the open air at a less height than twenty feet above the heads of the workers.

In every room in which fumes from any substance named in Schedules A or B are evolved in the process of manufacture and are not removed as above, adequate through ventilation shall be maintained by a fan or other efficient means.

2. No substance named in Schedule A shall be broken by hand in a crystallising pan, nor shall any liquor containing it be agitated by hand, except by means of an implement at least 6 feet long.

3. No substance named in Schedule A shall be crushed, ground, or mixed in the crystalline condition, and no cartridge filling shall be done, except with an efficient exhaust draught so arranged as to carry away the dust as near as possible to the point of origin.

4. Cartridges shall not be filled except by means of a suitable scoop.

5. Every drying stove shall be efficiently ventilated to the outside air in such manner that hot air from the stove shall not be drawn into any workroom.

No person shall be allowed to enter a stove to remove the contents until a free current of air has been passed through it.

6. A Health Register, containing the names of all persons employed, shall be kept in a form approved by the Chief Inspector of Factories.

7. No person shall be newly employed for more than a fortnight without a certificate of fitness granted after examination by the Surgeon by signed entry in the Health Register.

8. Every person employed shall be examined by the Surgeon once in each calendar month (or at such other intervals as may be prescribed in writing by the Chief Inspector of Factories) on a date of which due notice shall be given to all concerned.

9. The Surgeon shall have power of suspension as regards all persons employed, and no person after suspension shall be employed without written sanction from the Surgeon entered in the Health Register.

10 and 11. (Provide for the use of overalls, gloves, clogs, etc., and for the maintenance of meal rooms, cloak rooms, and lavatories.)

12. No person shall be allowed to introduce, keep, prepare, or partake of any food, drink, or tobacco in any room in which a process mentioned in the Schedules is carried on.

Part II.—Duties of Persons Employed.

13. Every person employed shall :—

(*a*) present himself at the appointed time for examination by the Surgeon as provided in Regulation 8 ;

(*b*) wear the overalls or suit of working clothes provided under Regulation 10 (*a*), and deposit them, and clothing put off during working hours, in the places provided under Regulation 10 (*c*) and (*d*) ;

(*c*) use the protective appliances supplied in respect of any process in which he is engaged ;

(*d*) carefully clean the hands before partaking of any food or leaving the premises ;

(*e*) take a bath at least once a week, and when the materials mentioned in the Schedules have been spilt on the clothing so as to wet the skin. Provided that (*e*) shall not apply to persons employed in processes mentioned in Schedule C. nor to persons exempted by signed entry of the Surgeon in the Health Register.

14. No person employed shall :—

(*a*) after suspension, work in any process mentioned in the Schedules without written sanction from the Surgeon entered in the Health Register ;

(*b*) introduce, keep, prepare, or partake of any food, drink, or tobacco, in any room in which a process mentioned in the Schedules is carried on ;

(*c*) break by hand in a crystallising pan any substance named in Schedule A, or agitate any liquor containing it by hand, except by means of an implement at least 6 feet long ;

(*d*) interfere in any way, without the concurrence of the occupier or manager, with the means and appliances provided for the removal of the fumes and dust, and for the carrying out of these Regulations.

Schedules.

A. Processes in the manufacture of :—Dinitrobenzol, dinitrotoluol, trinitrotoluol, and paranitrochlorbenzol.

B. Processes in the manufacture of :—Aniline oil and aniline hydrochloride.

C. Any process in the manufacture of explosives with use of dinitrobenzol or dinitrotoluol.

Patents.

Diacetyldiaminophenol derivatives and dyestuffs therefrom ; Manufacture of ——. R. B. Ransford, Upper Norwood. From L. Cassella und Co., Frankfort on Maine, Germany. Eng. Pat. 27,322, Nov. 30, 1906.

When diacetyl-2 : 4-diaminophenol is treated with nitrous acid in mineral acid solution, a nitro-derivative is obtained. This can be reduced by means of zinc dust and sulphuric acid, to the corresponding aminodiacetyldiaminophenol which gives a sparingly soluble diazo compound. On combining this with 1-amino-8-naphthol

4-sulphonic acid in alkaline solution, a dyestuff is formed which dyes wool violet shades; these, on chroming, are changed to greenish-blue. In a second example the combination of the above diazo-compound with sodium 1 : 8-dihydroxynaphthalene-3 : 6-disulphonate is described, whereby a dyestuff is obtained which produces on wool violet shades becoming pure blue on chroming.—J. C. C.

Compounds or colouring matters of the anthracene series; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,139, Dec. 10, 1906.

SEE Fr. Pat. 379,034 of 1907; this J., 1907, 1194.—T. F. B.

Vat dyestuffs of the anthracene series; Manufacture of ——. Badische Anilin und Soda Fabrik. Fr. Pat. 379,414, June 29, 1907. Under Int. Conv., Oct. 15, 1906.

WHEN mono- or di-aminoanthraquinones (2 parts) are treated with metals, preferably copper (1 to 2 parts), in sulphuric acid solution (20 parts), violet to brown vat dyestuffs are obtained. The shades produced on cotton are modified slightly on washing.—J. C. C.

Compounds and colouring matters containing sulphur [Thioindigo dyestuffs]; Manufacture of ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 28,240, Dec. 11, 1906.

SEE Fr. Pat. 374,287 of 1907; this J., 1907, 757.—T. F. B.

Anthracene derivatives; Manufacture of ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 28,765, Dec. 17, 1906.

SEE Fr. Pat. 372,676 of 1906; this J., 1907, 523.—T. F. B.

Vat dyestuffs; Manufacture of new ——. O. Imray, London. From Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1472, Jan. 19, 1907.

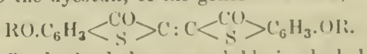
NEW vat dyestuffs are obtained from alkyloxy- and alkylthio-derivatives of phenylthioglycollic-*o*-carboxylic acid by: (1), heating them with solutions of alkali bisulphites or thiosulphates; (2), by heating them with sulphur or nitro-hydrocarbons with or without diluents; (3), by oxidising the oxythionaphthenes obtained from them by heating with alkali or boiling with acetic anhydride. The shades of the new dyestuffs depend on the position of the RO or RS group: when such a group is in the para position to the $S.CH_2.CO_2H$ group of the parent substance, the shades are violet to green-blue, but when it is in the para position to the CO_2H group, the shades produced by the resulting dyestuffs are yellowish-red. Example 1: 5-Acetylamino-2-aminobenzoic acid is diazotised and treated with potassium xanthate, and the product heated with chloroacetic acid. The 5-acetylaminophenylthioglycollic-*o*-carboxylic acid thus produced is hydrolysed, the resulting amino-acid diazotised, treated with potassium xanthate, and the product boiled with sodium-methyl sulphate, whereby 5-methylthiophenylthioglycollic-*o*-carboxylic acid is obtained. On fusing this substance with caustic soda, 5-methylthio-oxythionaphthene-carboxylic acid is formed, which readily loses carbon dioxide on boiling with hydrochloric acid, giving the corresponding 5-methylthio-oxythionaphthene. When either of these compounds is oxidised by potassium ferricyanide in alkaline solution, a green-black dyestuff is produced which with alkaline hydrosulphite yields a vat, dyeing wool and cotton in green-black shades. Example 2: 4-Acetylamino-2-aminobenzene-1-carboxylic acid when subjected to exactly the same series of reactions, using, however, sodium-ethyl sulphate instead of the methyl compound, furnishes a dyestuff which produces alizarin-red shades. Example 3: Aminophenolcarboxylic acid ($OH : NH_2 : CO_2H = 5 : 2 : 1$) is acetylated, the product treated with dimethyl sulphate, and, after hydrolysis, the methoxyamino-acid is diazotised and treated with potassium xanthate. The resulting substance is boiled with sodium chloroacetate and alkali, when 5-methoxyphenylthioglycollic-*o*-carboxylic acid [$OCH_3 : (S.CH_2.CO_2H) : CO_2H = 5 : 2 : 1$] is formed. On fusing this with caustic soda, 5-methoxyoxythionaphthene-carboxylic acid is produced, which readily loses carbon dioxide to form 5-methoxyoxythionaphthene. On oxidation, each of these compounds yields a violet dyestuff giving dark violet-blue tints on cotton and wool. Example 4: By similar reactions, 4-ethoxy-2-acetylaminobenzoic acid (obtained from *m*-amino-*p*-cresol) is converted into 4-ethoxyphenylthioglycollic-*o*-carboxylic acid which, on oxidation, furnishes a dyestuff giving yellowish-red shades from the vat. Example 5: 4-Methoxythiophenylthioglycollic-*o*-carboxylic acid [$CH_3.S : (S.CH_2.CO_2H) : CO_2H := 4 : 2 : 1$] is boiled with acetic anhydride and the product, on oxidation, yields a dyestuff giving yellowish-red shades. Example 6: 4-Ethylthiophenylthioglycollic-*o*-carboxylic acid is heated in a closed vessel with a concentrated solution of sodium bisulphite; the resulting dyestuff yields a vat with hyposulphite, dyeing wool and cotton in fast red shades similar to those obtained with alizarin. Example 7: 5-Ethoxyphenylthioglycollic-*o*-carboxylic acid is converted into the corresponding dyestuff when heated with aqueous sodium thiosulphate in a closed vessel. Example 8: 4-Methoxyphenylthioglycollic-*o*-carboxylic acid is boiled with nitrobenzene, when a yellowish-red dyestuff is produced which dyes wool and cotton in the vat orange-red. Example 9: 4-Ethoxyphenylthioglycollic-*o*-carboxylic acid is heated with sulphur; the excess of sulphur is removed from the fusion by extraction with carbon bisulphide, and the remaining dyestuff is purified by dissolving in alkali hyposulphite and subsequent oxidation.—J. C. C.

α-Oxythionaphthenes; Manufacture of ——. O. Imray, London. From Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 1592, Jan. 21, 1907.

α-HYDROXYTHIONAPHTHENES (thio-indoxyl and its substitution derivatives) are obtained by heating methylthiophenol-*o*-carboxylic acid, its salts, or esters, or substitution derivatives with alkaline condensing agents such as caustic alkalis and alkaline-earths, alkali or alkaline-earth metals by themselves or in the form of alloys or amalgams, alkali alkylates or dialkali salts of cyanamide. These α-hydroxythionaphthenes yield valuable vat-dyestuffs on oxidation. *Example.*—A mixture of 10 parts of sodium methylthiophenol-*o*-carboxylate, 10 parts of finely-powdered quicklime and 30—50 parts of a mixture of molecular proportions of caustic potash and caustic soda is fused. The hydroxythionaphthene is formed at about 200° C. When the reaction is completed, the cooled mass is dissolved in water and the α-hydroxythionaphthene is isolated after adding an excess of carbonic or mineral acid, by filtration or distillation with steam. It may be transformed into a red vat dyestuff by oxidation.—A. B. S.

Vat [thioindigo] dyestuff. K. Schirmacher and B. Deicke, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 867,305, October 1, 1907.

m-AMINO-*p*-CRESOL is acetylated and then treated with an alkylating agent; the product is oxidised by means of permanganate to *o*-acetamino-*p*-alkyloxybenzoic acid, which is boiled with alkali to remove the acetyl group, and then diazotised and treated with a xanthate and subsequently with chloroacetic acid, *p*-alkyloxyphenylthioglycollic-*o*-carboxylic acid ($RO : SCH_2COOH : COOH = 4 : 2 : 1$) being thus formed. This is converted into 4-alkyloxy-hydroxythionaphthenecarboxylic acid by heating with alkali hydroxide to 180°—200° C., and the product is in turn oxidised by ferricyanide, in alkaline solution, to the dyestuff, of the general formula,



$$RO.C_6H_3{<}{\overset{CO}{\underset{S}{}}}{>}C : C{<}{\overset{CO}{\underset{S}{}}}{>}C_6H_3.OR.$$

The dyestuffs obtained thus are soluble in alcohol, acetic acid, benzene, and chloroform. With alkali hydrosulphites they yield vats dyeing wool and cotton yellowish-red shades.—T. F. B.

Vat [thioindigo] dyestuff. K. Schirmacher and R. Leopold, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 867,306, Oct. 1, 1907.

THE dyestuffs are similar in constitution to those described in the preceding abstract, and are identical in composition, save that the –OR groups are replaced by –SR groups: they are obtained from *p*-methyl-*m*-amino-thiophenol, and only differ in properties from those mentioned above in that they dye alizarin-red shades on wool and cotton from a hydrosulphite vat.—T. F. B.

Monoazo dyestuff suitable for the preparation of dye lakes; Manufacture of a ——, and of lakes from such dyestuff. O. Imray, London. From Farbwerke vorm. Meister, Lucius, und Brüning, Hoechst a/Main, Germany. Eng. Pat. 7351, March 27, 1907.

See U.S. Pat. 858,065 of 1907; this J., 1907, 920.—T. F. B.

Leucogallocyanine corresponding to pyrogallol; Manufacture of ——. C. W. Johnson, London. From Dye Works, formerly Durand, Huguenin et Cie., Basle, Switzerland. Eng. Pat. 9961, April 29, 1907.

See U.S. Pat. 863,907 of 1907; this J., 1907, 1004.—T. F. B.

Gallocyanines from monoalkylarylamines; Production of ——. Manuf. des Mat. Col., ancien. L. Durand, Huguenin et Cie. Fr. Pat. 379,761, July 9, 1907. Under Int. Conv., June 4, 1907.

See Eng. Pat. 19,003 of 1907; this J., 1907, 1194.—T. F. B.

p-Dialkylaminophenylglyoxylic, p-tetra-alkyldiaminodiphenylglycollic, and p-hexa-alkyltriaminotriphenylacetic esters; Preparation of —— by condensation of oxalic esters with aromatic tertiary amines. M. J. C. A. Guyot. Fr. Pat. 379,438, Sept. 8, 1906.

The compounds claimed in this patent have already been described. (See this J., 1907, 603, 679.)—J. C. C.

Sulphide dyestuffs; New ——, and process of making the same. Act.-Ges. f. Anilinfabr. Fr. Pat. 379,416, June 29, 1907.

Dark brown dyestuffs which are fast to washing are obtained by heating *op*-dinitro-*o′*-hydroxydiphenylamine or its homologues or other derivatives with sulphur and an alkali sulphide in presence of metallic copper or one of its salts.—J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Skin wools; Treatment of ——. H. Priestman. Leather Trades Rev., 1907, **40**, 817.

The cause of the bad reputation of skin wools obtained by the lime process is shown to be due to the presence of insoluble and sticky calcium soaps, which cause trouble in the washing. It is pointed out that lime is not only taken up mechanically from the milk of lime used, but that it is also absorbed from solution. Suggestions are made as to the removal of this lime before washing, by means of a bath of dilute hydrochloric acid, and experimental results are given proving the efficiency of this treatment in abolishing much of the trouble with calcium soaps. After-treatment of such wools with grease, might further make them suitable for many purposes for which they are otherwise quite unsuitable, especially restoring to the limed wool some of the elasticity, etc., which has left it.—H. G. B.

Mercerised cotton; Increased affinity of —— for dyestuffs, and causes of the same. W. Minajeff. Z. Farben-Ind., 1907, 6, 233—237, 252—254, 309—314, 345—347.

This work is a continuation of the quantitative investigation of the same subject by Schaposchnikoff and Minajeff (this J., 1903, 903; 1904, 604; 1905, 272), and the conclusions now arrived at by the use of the microscope and the Abbe sketching apparatus support the inferences drawn from the quantitative data. Turkey Red was chosen as the typical mordant colour and the sketches show that the colour lake is deposited irregularly on the surface of the fibre and in the case of the non-mercerised cotton, it often lies in the folds of the twisted fibre. Fibre sections show that the substance of the non-mercerised fibre is only rarely and that of the mercerised one never dyed. Schweitzer's reagent removes the dyed cuticula, the remaining fibre being undyed. This also occurs in the case of the mercerised fibre and does not support the prevailing opinion that in the latter instance, the cuticula is absent. In the case of mordant dyeings, when the conditions of dyeing and mordanting are identical, stretched mercerised and non-mercerised cotton have the same appearance; thus the quantities of mordant taken up by equal surfaces in the two cases must be equal. Manganese bronze dyes principally on the surface; no colour is deposited in the canal. The appearance resembles that of fibres dyed with mordant dyestuffs. The fibre walls of the non-mercerised cotton are only partially dyed, resembling in this respect the corresponding dyeing with Turkey Red, whilst the walls of the mercerised fibres are for the most part quite evenly dyed. The intensity of Iron Buff dyeings is similar on both mercerised and non-mercerised cotton. The colour lake is visible in the canals of the latter fibres, whilst it is entirely absent from the canals of the mercerised ones. Chrome Yellow appeared dispersed in brownish-yellow and light yellow granules over the surfaces of the fibres, these particles being more numerous on the non-mercerised cotton. The canals of the fibres in both cases contained brownish-yellow particles. The Prussian Blue lake appears entirely on the surface as a kind of colloidal skin. Aniline Black showed the cuticula dyed more strongly than the fibre walls: no difference in the intensity of the dyeing of the mercerised and non-mercerised fibres was observed. The canal walls and the cuticula of the fibres dyed with Paranitraniline Red were distinctly and strongly coloured. Little difference in the intensity of the dyeing of non-mercerised and mercerised cotton was observed, but this is probably due to the action of the caustic soda solution of β-naphthol on the non-mercerised cotton. The dyeings were uniform, resembling those obtained with substantive cotton colours in that respect. When using the substantive cotton colours, it was also observed that the cuticula is always more intensely dyed than the cell walls and that the shade of the dyed mercerised fibres is always heavier than that of the non-mercerised. Sulphur colours behave similar to the substantive colours. When dyeing with basic colours, the mercerised fibres are seen to be heavier in shade than the non-mercerised, and small particles are visible in the canals of the fibres. Sketches of indigo-dyed fibres show that the mercerised cotton is more heavily dyed than the non-mercerised.—S. H. H.

Methylene Blue; Action of —— on cotton fibre. J. O. W. Barratt and E. S. Edie. Bio-Chem. J., 1907, 2, 443—457.

The method of investigation followed consisted in leaving cotton wool for some days in an aqueous solution of Methylene Blue and determining at the end the concentrations of the dyestuff in the solution and in the cotton wool. The value of the adsorption constant, $\frac{1}{n}$, calculated on the assumption of equilibrium between adsorbed and dissolved substance according to the relation, $C = aC'^{\frac{1}{n}}$ was found to be 0·1, a value considerably lower than the usual range obtaining in adsorption processes. The action is best interpreted as a mixed process of chemical combination and adsorption, the former being the chief factor.—E. F. A.

Dyestuff solutions; Behaviour of —— towards silicic acid and silicates. W. Suida. Z. Farben-Ind., 1907, 6, 365—367.

The author finds that pure silicic acid dissolves to a considerable extent in solutions of basic dyestuffs. If the filtered solution is evaporated, a sudden coagulation occurs at a certain concentration, whereby the silicic acid and dyestuff are combined together; the filtrate from the coagulum does not contain silicic acid. The same phenomenon is exhibited by a solution obtained by washing with water the precipitate furnished by adding a solution of Magenta to a dilute solution of water-glass. The precipitate obtained by adding calcium chloride or aluminium sulphate to a water-glass solution also absorbs basic dyestuffs. Two different preparations of the precipitate obtained by mixing solutions of Magenta and water-glass gave, after drying at 100° C., colour base ($C_{20}H_{19}N_3$), 65·5 and 66·6; silica (SiO_2), 29·8 and 28·4; water (by difference), 4·7 and 5·0 per cent. respectively. These precipitates are sparingly soluble in water and, on solution, lose silicic acid. Alcohol extracts only the colour base.—J. C. C.

Sulphide dyestuffs; Printing of ——. K. Wander. Z. Farben-Ind., 1907, **6**, 367—368.

The use of large quantities of caustic alkali in printing sulphide dyestuffs can be avoided by adding rape oil to the latter, whereby the shade produced becomes fuller and brighter, and the small amount of alkali necessary does not mercerise the fabric. In applying the process, the dyestuff must be mixed with the thickening material, the reducing agent (hydrosulphite or its formaldehyde compound) added, then the alkali, and finally the whole is warmed to 45—50° C. for 15 minutes. The addition of potassium sulphite has also a beneficial effect.—J. C. C.

Lactic acid in lactates; Determination of ——. J. Paessler. *See* XXIII.

Patents.

Willow bark and other bast containing material; Process for the treatment of —— in order to produce long fibres suitable for spinning. L. von Ordody and Westdeutsche Thomasphosphat-Werke, Berlin. Eng. Pat. 23,555, Oct. 23, 1906.

See Fr. Pat. 370,511 of 1906; this J., 1907, 252.—T. F. B.

Willow bark and other bast containing material; Apparatus for the treatment of —— in order to produce long fibres suitable for spinning. L. von Ordody and Westdeutsche Thomasphosphat-Werke, Berlin. Eng. Pat. 23,556, Oct. 23, 1906.

See Fr. Pat. 370,512 of 1906; this J., 1907, 253.—T. F. B.

Jute; Process of treating fibres of ——. T. E. Schiefner, Berlin. Eng. Pat. 23,761, Oct. 25, 1906.

See Fr. Pat. 371,033 of 1906; this J., 1907, 253.—T. F. B.

Textile fibres from certain plants; Process of procuring ——. L. W. Goold, Birmingham, From The Jute and Hemp Manufacturing Co., Ltd., Budapest, Hungary. Eng. Pat. 10,083, May 1, 1907.

The stalks of various plants growing in marshy regions such as *Typha latifolia*, *Scirpus lacustris*, etc., are made into bundles and packed into a boiler where they are treated with water under a steam pressure of 1½—3 atmospheres, after removal of the air by steam or a vacuum. This operation lasts two hours, after which the softened stalks are crushed between rollers, being sprayed with water during the operation, in order to remove the short loose fibres. Scrapers are fitted to prevent the fibres from sticking to the rollers, and the latter are oiled with the same object. The strips of long fibres are removed from the crushing machine on endless belts and pass between steam-heated drying rollers and when sufficiently dry are passed into a beating machine which removes the short fibres, woody particles, and other impurities.
—A. B. S.

Artificial hair from gelatin; Manufacture of ——. L. E. Jannin. First Addition, dated June 6, 1907, to Fr. Pat. 342,112, April 1, 1904 (this J., 1904, 899).

The characteristic features of the present additional patent are:—(1), The proportion of glycerin in the gelatin syrup is reduced from 100 grms. to 20 grms. for each 1000 grms. of gelatin; (2), the spun thread is passed through an additional tanning bath (*e.g.*, formalin solution); (3), if the product is to be used for stuffing purposes, it is dried in the loose state so as to enable it to curl like natural hair; (4), if it is to be used for brush making, the product is dried under tension in order that it may develop both straightness and stiffness.—P. F. C.

Artificial textile fibres; Manufacture of ——. Verein. Glanzstoff Fabriken A.-G. Fr. Pat. 379,935, July 15, 1907. Under Int. Conv., Aug. 3, 1906.

See Eng. Pat. 16,495 of 1907; this J., 1907, 1004.—T. F. B.

Washing and scouring or similarly treating textile fabrics Machines for ——. J. S. Ainley, Huddersfield, Yorks. Eng. Pat. 25,248, Nov. 9, 1906.

In order to prevent the creasing of the fabric by the slipping or momentary holding of the squeezing rollers, each roller is provided with an endless apron of some suitable material, which is turned by two other rollers, one being situated at the front and the other at the rear of the squeezing device. These aprons, arranged so as to travel at the desired rate, carry and protect the fabric whilst it is in the nip of the squeezing rollers.—P. F. C.

Treating and degumming porous and fibrous substances Process for ——. G. D. Burton, Boston, Mass. U.S. Pat. 870,157, Nov. 5, 1907.

The material is immersed in a hot solution of a suitable softening acid, then passed between pressure rollers, and finally washed in a suitable medium such as a warm aqueous solution of oxalic acid and castile soap.—A. B. S.

Washing, bleaching and dyeing combed wool; Machine for mechanically ——. A. Vanzeveren. Fr. Pat. 379,299, Mar. 29, 1907.

This machine consists essentially of two tanks which are placed in communication with each other and also with a centrifugal pump. The dye-solution, etc., is prepared in one of the tanks and is then transferred by means of the pump into the other. This second tank is provided with a perforated false bottom on which the bobbins of combed wool have been suitably arranged. As soon as the wool has acquired the desired depth of shade, the dye-solution is pumped back into the storage tank.—P. F. C.

Dyeing and bleaching of textile materials; Process and apparatus for the ——. A. Holle und Co. Fr. Pat. 379,694, July 6, 1907. Under Int. Conv., May 25, 1907.

Dyeing machines in which the liquid is alternately aspirated and forced through the textile material by means of a pump, suffer from the defect that the liquid passes through the material during the aspiration much less readily than when it is forced through, and especially is this the case where the material is placed in two connected vessels and the liquid pumped from one to the other, the slow aspiration from the one vessel hindering the impregnation of the material in the other. It is proposed to avoid this difficulty by means of check valves so placed that they open during the aspiration and allow a portion of liquid to pass direct to the pump, without passing through the material. When the pump is being used to force the liquid through the material, these valves close, and the whole of the liquid has to pass through the material.—A. B. S.

Dyeing furs, feathers, or the like. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4614, Feb. 25, 1907.

See Fr. Pat. 375,085 of 1907; this J., 1907, 870.—T. F. B.

Dyeing with the jigger. W. Peters, Düsseldorf, Germany. Eng. Pat. 7099, March 25, 1907.

See Fr. Pat. 376,146 of 1907; this J., 1907, 1006.—T. F. B.

Yarn-cops; Apparatus for dyeing ——. J. F. Roberts, Assignor to J. C. Nowell, New Bedford, Mass. U.S. Pat. 868,699, Oct. 22, 1907.

Claim is made for a machine for dyeing yarn-cops consisting of a closed vessel in the shape of an inverted truncated cone in which a conical cop fits so as to leave spaces above and below. These spaces are connected with the dye-circulating apparatus, and the liquid is forced through the material in a downward direction. A perforated inverted cone is placed in the centre of the cop to aid the penetration of the dye-liquor.—A. B. S.

Fatty compounds for use in Turkey red dyeing; Process for preparing ——. A. Schmitz. First Addition, dated May 27, 1907, to Fr. Pat. 376,555, April 9, 1907.

SEE Eng. Pat. 11,903 of 1907; this J., 1907, 964.—T.F.B.

Sulphide dyestuffs; Preparations of ——, *and process for dyeing with sulphide dyestuffs.* Badische Anilin und Soda Fabrik. Fr. Pat. 379,584, June 3, 1907. Under Int. Conv., Jan. 4, 1907.

SEE Eng. Pat. 12,219 of 1907: this J., 1907, 964.—T. F. B.

Fabrics; Process for impregnating ——. Kraemer und Van Elsberg Ges.m.b.H. Fr. Pat. 379,589, June 5, 1907.

SEE Eng. Pat. 11,928 of 1907; this J., 1907, 1046.—T. F. B

Hydrosulphite preparation; Manufacture of a stable ——. O. Imray, London. From Society of Chemical Industry in Basle, Switzerland. Eng. Pat. 7149, March 25, 1907.

SEE Fr. Pat. 376,206 of 1907; this J., 1907, 1007.—T.F.B.

Hydrosulphite mixture; Stable dry ——. A. Rinckenberger, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 869,655. Oct. 29, 1907.

SEE Eng. Pat. 26,380 of 1905; this J., 1906, 847.—T. F. B.

Finish for use in dressing fabrics; Manufacture of a ——. A. G. Bloxam, London. From Soc. Anon. des Usines Remy, Wygmael-lez-Louvain, Belgium. Eng. Pat. 7150, Mar. 25, 1907.

THE finish is prepared as follows:—(A) 9 parts of pure alkaline rice starch powder are mixed with one part of borax and 1·4 parts of boric acid. (B) One part of monobasic ammonium phosphate is mixed in a crusher with two parts of tribasic ammonium phosphate, and the whole reduced to a fine powder. (C) An intimate mixture in fine powder is made of 9 parts of ammonium sulphate and 5 parts of "extra white" talc. The three constituents A, B and C, are mixed in a suitable apparatus in the proportion of 4 parts of A, 1 part of B and 2 parts of C. Fifteen parts of this mixture are mixed with 100 parts of clean water and heated to 50° C., and then used for rough starching. The textile material is removed from the bath and wrung out. The bath is then heated to produce "boiled starch," the fabric being starched again and finally ironed whilst slightly damp. The monobasic phosphate is used to prevent the loss of ammonia from the tribasic phosphate on ironing, whilst the latter renders the textile material non-inflammable.—A. B. S.

Finishing, sizing and other purposes; Preparation for ——. P. C. D. Castle. Fr. Pat. 379,476, July 2, 1907.

THE preparation consists of a mixture of gum tragasol with from one to nine per cent. of glycerin, and it may either be used alone or in combination with other finishing and sizing preparations. The glycerin is incorporated with the gum tragasol during the extraction of the latter substance.—P. F. C.

VI.—COLOURING WOOD, PAPER, LEATHER, &c.

PATENTS.

Hides, skins, and hair; Dyeing and secreting ——. C. and E. Pichard, Paris. Eng. Pat. 13,938, June 17, 1907. Under Int. Conv., Aug. 8, 1906.

SEE Addition, of Aug. 8, 1906, to Fr. Pat. 355,121 of 1905; this J., 1907, 93.—T. F. B.

Paper; Machine for marbling ——. J. W. Newbery. Fr. Pat. 379,593, June 6, 1907.

THE machine comprises an annular tank containing a solution of size or the like, and a carriage, in which is mounted the roll of paper, which travels round the tank. A distributing roller and brush are mounted so that they travel just in advance of the paper, and scatter a suitable colour on to the surface of the size. As the carriage travels round, the paper is unwound, passes below a roller and in contact with the size in the annular tank, and takes up the colour on the surface of the size. It next passes between squeezing rollers and in contact with a scraper, in order to remove excess of size, then through a drying chamber, and is afterwards wound on another roller. The rollers and the drying chamber are mounted on the travelling carriage. The excess of size removed from the paper falls into a receptacle, from which it is pumped back into the annular tank, in which the size is maintained at a constant level.—A. S.

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Gold; Action of sodium and barium dioxides on ——. F. Meyer. Compt. rend., 1907, **145**, 805—807.

BY the action of fused sodium peroxide on precipitated gold, sodium aurate is produced, and in a similar manner, though less readily, barium peroxide and gold yield barium aurate. Alkaline-earth aurates were prepared from sodium aurate, and potassium aurate from barium aurate, by double decomposition. These salts, when anhydrous, have the composition, $A_2(AuO_2)_2$ and $B(AuO_2)_2$, where A and B represent an alkali and an alkaline-earth metal respectively. Auric acid, prepared from sodium aurate was found to have the constitution, $Au_2O_2(OH)_2,2H_2O$. Solutions of the aurates decompose under the action of heat and light, but the dark violet substance formed is not gold, as stated by Frémy, but aurous oxide, Au_2O, which is soluble in hydrochloric acid.—A. S.

Continuous or alternating current for heating air or fused masses; Relative value of ——. H. Lee and A. Beyer *See* VII.

Tungstic acid; Electrolytic reduction of ——. H. Leiser. *See* XIA.

PATENTS.

Sulphurous gases from pyrites burners; Process for purifying the ——. Direction der Tentelewschen Chem. Fabrik. Fr. Pat. 379,565, May 17, 1907.

SEE Eng. Pat. 12,213 of 1907; this J., 1907, 1138.—T.F.B.

Arsenic; Effecting the removal of —— *from liquids and gases.* G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort on Maine, Germany. Eng. Pat. 3435, Feb. 12, 1907.

SEE Addition of Feb. 18, 1907, to Fr. Pat. 376,931 of 1907; this J., 1907, 1047.—T. F. B.

Kieselguhr; Bleaching ——. W. Thomson, Manchester, and J. Barr, Dinting. Eng. Pat. 5379, March 6, 1907.

SEE Fr. Pat. 377,086 of 1907; this J., 1907, 1047.—T. F. B.

Compounds of oxygen and nitrogen; Process for producing ——. A. Neuburger and Westdeutsche Thomasphosphatwerke, Berlin. Eng. Pat. 9939, April 29, 1907.

SEE Fr. Pat. 377,199 of 1907; this J., 1907, 1054.—T.F.B.

Nitrogen peroxide; Method of working combustion motors to obtain ——. F. Häusser. First Addition, dated June 17, 1907, to Fr. Pat. 366,604, May 26, 1906. Under Int. Conv., July 2, 1906.

SEE Eng. Pat. 13,989 of 1907; this J., 1907, 1138.—T. F. B.

Hydrosulphites; Manufacture of stable anhydrous ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. Eng. Pat. 10,771, May 8, 1907.

SEE Addition of May 6, 1907, to Fr. Pat. 354,273 of 1905; this J., 1907, 1091.—T. F. B.

Hydrogen peroxide; Process of producing ——. R. Wolffenstein, Berlin. U.S. Pat. 870,148, Nov. 5, 1907.

See Fr. Pat. 367,199 of 1906; this J., 1906, 1117.—T. F. B.

Barium oxide; Process for producing porous ——. H. Schulze, Bernburg, Germany. U.S. Pat. 870,691, Nov. 12, 1907.

See Fr. Pat. 335,677 of 1903; this J., 1904, 253.—T. F. B.

Alumina; Process for the preparation of pure ——. H. Arsandaux. First Addition, dated Aug. 31, 1906, to Fr. Pat. 361,766, Sept. 13, 1905 (this J., 1906, 1146).

The sodium carbonate and milk of lime which, according to the original patent, are added to the lyes of sodium aluminate, are replaced, according to the present addition, by a mixture of sodium carbonate and some salt of calcium, such as the phosphate or chloride. By this means, calcium carbonate is formed in the solution, in the nascent state, and separates the silica from the solution by causing the formation of calcium silicoaluminate.—W. C. H.

Gas producer, etc. Eng. Pat. 342a. *See* II.

Furnace, etc. Fr. Pat. 379,437. *See* XIA.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patent.

Glass; Process and apparatus for making window and sheet ——. C. Menzel. First Addition, dated June 14, 1907, to Fr. Pat. 369,708, Sept. 14, 1906. Under Int. Conv., April 10, 1907.

See Eng. Pat. 14,587 of 1907; this J., 1907, 1199.—T.F.B.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Clay analysis: Examination of the residue left after volatilisation of the separated silica with hydrofluoric and sulphuric acids. I. W. R. Bloor. J. Amer. Chem. Soc., 1907, 29, 1603—1606.

The residue left after volatilising the separated silica with hydrofluoric and sulphuric acids in clay analysis, does not consist of iron and aluminium oxides only, as is generally assumed. Analysis of a number of such residues showed that they contained, on the average, Fe_2O_3, Al_2O_3, 57·36; CaO, 21·48; and MgO, 14·05 per cent. Unless extreme accuracy is required, however, this source of error may be neglected. The author has also made experiments to find if the presence of oxides other than those of iron and aluminium is due to the evaporation of the solution of the melt in a porcelain dish, but has not yet obtained conclusive results.—L. E.

Cements; Hydration of ——. C. Montemartini. L'Ind. Chimica, 1907, 7, 169—174. Chem. Zentr., 1907, 2, 1713.

The author has studied the action of aqueous vapour or steam on cement. In an atmosphere saturated with moisture, cement at first rapidly increases in weight, then after some days, the weight remains almost constant, this second period being of short duration, especially if the initial increase of weight was large. After the period in which the weight remains constant, there is a period in which increases and decreases in weight alternate, with a final preponderance of the former. This behaviour is especially characteristic of quick-setting cements. During the final period, the cement passes from the pulverulent to the spongy condition, and then changes, with an increase of volume, into a mass of doughy consistence. Stirring accelerates the increase of weight during the first period, but later, has a contrary effect. Cements kept under water behave in an analogous manner. In the second and third periods mentioned above, carbon dioxide plays an important part; experiments showed that it is responsible for two-thirds of the total absorption. With cement exposed to the action of aqueous vapour free from carbon dioxide, the increase of weight in 690 days was much less than the increase observed in one-third of this time in an atmosphere containing carbon dioxide. The author distinguishes the water absorbed by the cement as "labile water" which can be removed *in vacuo* over sulphuric acid, and "firmly combined water," which is expelled only at a high temperature. The amount of water removed from cements kept over sulphuric acid *in vacuo* is greater than that expelled by heating at 100° C., or, frequently even at 212° C.—A. S.

Patents.

Stones; Process and apparatus for manufacturing artificial ——. B. Alexander-Katz, Görlitz, Germany. Eng. Pat. 10,532, May 6, 1907. Under Int. Conv., May 5, 1906.

This is a process of manufacturing artificial stone from fibrous material, such as asbestos, and hydraulic agents. The composition, mixed with a little water, flows into a moulding box, composed of a bottomless frame, beneath which is situated an endless filtering cloth moving over guide-rollers. The drive of the filtering cloth is so arranged that the latter comes to a standstill at the moment when the frame of the moulding box is brought into intimate contact with the cloth. At the same time a vacuum is produced under the cloth, thus drawing off by suction the liquid contained by the mixture inside the moulding box. The composition, thus freed from water, can be felted and moulded. After this the moulding box is moved upwards, and the filtering cloth is released and moved on, carrying the ready moulded stone.—O. R.

Stone, artificial, and concrete; Process for making ——. F. S. Lamson, Assignor to Cosmos Construction Co., Washington, D.C. U.S. Pat. 870,370, Nov. 5, 1907.

Artificial stone is made by mixing the cement, sand, water, etc., at a temperature of about 39° F. The mixture is kept under compression until it has set, the temperature being at the same time decreased to 32° F., or lower, whereby the expansion of the water in falling through this range of temperature is caused to increase the compression.—A. G. L.

Wood; Product for replacing ——, *and process for preparing it.* F. Schnell, G. W. Mayer, and E. Hartwich. Fr. Pat. 379,609, Sept. 12, 1906.

See U.S. Pat. 848,133 of 1907; this J., 1907, 529.—T. F. B.

[Heat] Insulating material or insulating mortar for building and other purposes; Process of manufacture of ——. Wunner'sche Bitumen-Werke, G.m.b.H. Fr. Pat. 379,359, June 22, 1907.

This heat-insulating material is made by emulsifying a mixture of pitch and heavy oils, to which "soluble glass" and suitable filling materials have been added, by means of alkalis, such as sodium carbonate, and then oxidising the product by means of barium peroxide or other similar compounds.—W. C. H.

Cements; [Regulating the setting of] Portland and like ——. H. Kelway-Bamber, Croydon. Eng. Pat. 23,450, Oct. 22, 1906.

Water in the form of fine spray or drops is supplied under pressure to the cement in a tube-mill or other suitable appliance in which it is being ground, or re-ground. By using a definite quantity of water to a known quantity of cement, the latter becomes cooled (if hot) and hydrated. The cement in consequence becomes slower setting and more regular in its properties.—O. R.

Cement kilns and process of burning cement therein. C. A. Matcham, Allentown, Pa., U.S.A. Eng. Pat. 2131, Jan. 28, 1907.

See U.S. Pats. 842,848 and 847,257 of 1907; this J., 1907, 410 and 470.—T. F. B.

Lime and cement; Process and apparatus for submitting —— to the action of steam. M. Davidsen. Fr. Pat. 379,621, June 22, 1907.

THE lime or cement to be treated first passes through a horizontal cylinder, along which it is moved by blades fixed to two parallel, longitudinal, rotating shafts. In this cylinder the material is heated by means of gaseous products of combustion to a temperature at which steam will not condense on it. The material then falls through a shoot on to a horizontal screw-conveyor, which transfers it to a second horizontal cylinder, provided with curved blades in its interior. This cylinder may be rotated, in which case the blades remain stationary; or else the cylinder may be fixed, and the blades rotated. Steam is supplied to this cylinder at the end nearest the first cylinder; the cylinder may be externally heated, or it may be covered with non-conducting material. The cylinder also contains balls which serve to powder the material, which is finally discharged through openings in the further end of the cylinder.—A. G. L.

Slag-cement; Process of making ——. Latin Countries Cement Co., Ltd. Fr. Pat. 379,718, July 8, 1907.

MILK of lime and a solution containing a salt of a metal of the alkaline-earth group (*e.g.*, magnesium sulphate), or of the earth group, are simultaneously but separately added to the liquid blast-furnace slag, in such quantity that the water introduced evaporates at once.—A. G. L.

X.—METALLURGY.

Standards and definitions adopted by the Institution of Mining and Metallurgy. Inst. Min. and Met., Bull. No. 38, 1907, 13—17.

THE following definitions have been adopted by the Institution:—

(1) The word "ton" shall represent a weight of 2000 lb. avoirdupois (29,166·6 oz. troy). *Note.*—It is advisable to abandon the use of the terms hundredweights and quarters, and to express fractions of a ton in pounds or in decimals of a ton.

(2) The term "miners' inch" shall represent a flow of 1·5 cub. ft. of water per minute; and the term "sluice head" shall represent a flow of 60 cub. ft. of water per minute. *Note.*—It is advisable to abandon the use of both terms, as being merely of local usage, in favour of definite expression of the flow of water per minute, or per second, in cub. ft. or in gallons.

(3) The word "gallon" shall represent the Imperial gallon measure of 10 lb. of water.

(4) Temperatures shall be expressed in degrees Centigrade.

(5) Returns of gold and silver shall be expressed in terms of fine gold and fine silver respectively, not as "bullion."

(6) Gold contents of ores, etc., determined by assay, shall be expressed in money values as well as in weights; and in this connection the value shall be taken (as a convenient constant) at 85 shillings, or $20.67 U.S. currency, per troy ounce of fine gold.

The following table of "I. M. M. Standard Laboratory Screens" is intended for use in making grading tests and for the correlation of screens used in commercial or other work. When screens other than the I. M. M. Standards are employed, the diameters of apertures should be given in any published results, so that comparisons may be made. When screens are described simply by the number of meshes per linear inch, it will be understood that the I. M. M. Standard is referred to. The number of sizes standardised has been reduced to a minimum, as it is desirable to abandon excessive refinements in grading tests. It is believed that the I. M. M. Standards will meet all necessary requirements of the laboratory. In reporting grading tests it is desirable to state whether wet or dry screening has been employed.

Table.—I. M. M. Standard Laboratory Screens.

Mesh or apertures per linear inch.	Diameter of wire.		Aperture.		Screening area.
	in.	mm.	in.	mm.	per cent.
5	0·1	2·540	0·1	2·540	25·00
8	0·063	1·600	0·062	1·574	24·60
10	0·05	1·270	0·05	1·270	25·00
12	0·0417	1·059	0·0416	1·056	24·92
16	0·0313	0·795	0·0312	0·792	24·92
20	0·025	0·635	0·025	0·635	25·00
30	0·0167	0·424	0·0166	0·421	24·80
40	0·0125	0·317	0·0125	0·317	25·00
50	0·01	0·254	0·01	0·254	25·00
60	0·0083	0·211	0·0083	0·211	24·80
70	0·0071	0·180	0·0071	0·180	24·70
80	0·0063	0·160	0·0062	0·157	24·60
90	0·0055	0·139	0·0055	0·139	24·50
100	0·005	0·127	0·005	0·127	25·00
120	0·0041	0·104	0·0042	0·107	25·40
150	0·0033	0·084	0·0033	0·084	24·50
200	0·0025	0·063	0·0025	0·063	25·00

Note.—Whilst *absolute* accuracy to the fourth place of decimals of an inch is impracticable in the manufacture of wire cloth, a sufficiently close approximation to the above standards is attainable. The adoption of a screening area of 25% necessitating equality of size of wire and aperture, secures perfect interlocking and consequent permanence of aperture. Some of the finer mesh screens can only be woven in what is known as "twilled."

With a view to securing the greatest uniformity in the drawing of the wire and the manufacture of the standard screens, Messrs. N. Greening and Sons, Ltd., of Warrington, have agreed to manufacture a certain quantity of each of the standard sizes to a width of 8 in. at one operation, and these will be supplied by them direct, by their agents abroad, or by dealers in laboratory supplies. Sizes 5, 8, 10, 12, 16, 20, 30, 40 and 50 of these screens are now ready in 8 in. squares, and may be obtained in made-up "nests" by the end of November. The manufacture of the remaining sizes is being pressed forward with the least possible delay.

Copper; Roasting and extraction of —— from pyrites without chloridising roasting. K. Millberg. Chem.-Zeit., 1907, 31, 1143—1145.

THE process consists in the conversion of insoluble copper compounds into the soluble sulphate by treatment of the roasted ore with ferric sulphate at a temperature of 450—500° C. The ore itself should be roasted at 550—600° C. If skilled workmen are available, the requisite quantity of ferric sulphate may be added in the original roasting to the ore whilst the latter lies on the lower stages of a Malétra or Herreshoff furnace. If this is not the case, the roasted ore is sieved through a 2—3 mm. mesh sieve, and is then mixed with 3—5 per cent. of chamber acid previously diluted with its own weight of water. After 12 hours the dry mixture is heated for 3 hours in a muffle furnace at a temperature not exceeding 500° C. The reactions which take place are as follows:—

$$CuS + Fe_2(SO_4)_3 = CuSO_4 + S + 2FeSO_4.$$
$$3Cu_2O + 4Fe_2(SO_4)_3 = 6CuSO_4 + 6FeSO_4 + Fe_2O_3.$$
$$Cu_2S + 2Fe_2(SO_4)_3 = 2CuSO_4 + S + 4FeSO_4.$$

The temperature is then raised somewhat for another two hours, so as to decompose as much as possible of the excess of ferric sulphate. The roasted ore is then leached with water to which sulphuric acid and, if necessary, ferric sulphate are added. The residues left should contain not more than 0·1—0·2 per cent. of copper. From the solution, iron is removed as basic sulphate by heating to 40—50° C., adding milk of lime, and blowing in air. If the precipitate contains copper, this must be extracted by the cautious addition of sulphuric acid. The operation requires about 4—6 hours. The filtered liquid is next heated to boiling, and copper oxide precipitated by adding 6—10 per cent. of milk of lime, until a sample of the liquid no longer reacts for copper with ammonia. From the filtrate, nickel, cobalt, zinc and manganese may be recovered as usual.—A. G. L.

Aluminium-bronzes ; Constitution of ——. B. E. Curry. J. of Phys. Chem., 1907, **11**, 425—436.

The author discusses the results of Carpenter and Edwards (this J., 1907, 153, 206), and then gives his own results, based upon the thermal and micrographic examination of alloys prepared from electrolytic copper, and aluminium of 99·97 per cent. purity. Copper containing a trace of aluminium was found to melt at about 1100° C. The melting-point curve of the alloys consists of seven portions, and contains two minima, at 90·5 per cent. of copper (1038° C.), and 32 per cent. of copper (544° C.) respectively, and one maximum at 87·5 per cent. of copper (1050° C.). The different portions of the curve correspond to six series of solid solutions, and one compound, $CuAl_2$. The α-series of mixed crystals are soft and ductile and of a copper-red to golden-yellow colour ; their composition varies from 92 to 100 per cent. of copper at 1000° C. to 91—100 per cent. at 700° C. The β-series of mixed crystals are yellow and consist of fine long needles ; they are harder and more brittle than the α-crystals and have a high tensile strength ; their composition ranges from 85—90 per cent. of copper at 1000° C. to 87—88·5 per cent. at 700° C. ; at 566° C. they decompose into α- and γ-crystals, with change of colour. The γ-series of alloys consist of nearly white, very hard large foliaceous crystals, with a vitreous fracture ; their composition varies from 83—84 per cent. of copper at 1000° C. to 80—84 per cent. at 700° C., and 79—84 per cent. at 500° C. ; at 845° C. they react with any liquid metal present to form δ-crystals. The δ- series of crystals are white and have a foliaceous structure ; they contain 75—77 per cent. of copper at 700° C., and decompose when heated above 845° C. with separation of γ-crystals, and on cooling below 570° C. with formation of γ- and ϵ-crystals ; at 630° C. they react with any liquid alloy present to form ϵ-crystals. The ϵ-series of alloys consist of large white crystals, varying in composition from 73·5—76 per cent. of copper at 500° C. to 72—73 per cent. at 600° C. The compound, Al_2Cu, forms long white prismatic crystals melting at 585° C. The η- series of mixed crystals form large white plates containing at 500° C. from 0 to 11 per cent. of copper. The alloys containing the γ-, δ-, and ϵ- mixed crystals, and the compound, $CuAl_2$, have no technical value.—A. S.

Copper-aluminium alloys ; Tensile strength of ——. B. E. Curry and S. H. Woods. J. of Phys. Chem., 1907, **11**, 461—491.

Of the alloys rich in aluminium, only those containing not more than 20 per cent. of copper are likely to be technically useful : the alloy containing 10 per cent. of copper has the highest tensile strength, but it has a low ductility. The strongest alloys are those of the β-series. The presence of a small quantity of β- or γ- mixed crystals in the α-series of alloys causes a decrease of ductility, and an increase of tensile strength. Annealing increases the ductility of the alloys rich in aluminium, but diminishes that of the alloys rich in copper, with the exception of those containing more than 92 per cent. of the latter metal, upon which annealing has no effect. "Air-cooling" bronzes of 90—91 per cent. of copper causes increased ductility with but slightly reduced strength. With 90 per cent. of copper, a strength of 100,000 lb. per sq. in. may be expected from alloys which are "chill-cast" or annealed above 566° C. The strength is much reduced by annealing below 566° C.

—A. S.

Patents.

Ferro-chromium ; Manufacture of ——. H. W. C. Annable, Assignor to The Ferro Alloys Synd., Ltd., London. U.S. Pat. 869,681, Oct. 29, 1907.

See Fr. Pat. 370,644 of 1906 ; this J., 1907, 260.—T. F. B.

Iron or steel ; Treatment of —— for preventing oxidation or rusting. T. W. Coslett, Birmingham. U.S. Pat. 870,937, Nov. 12, 1907.

See Eng. Pat. 8667 of 1906 ; this J., 1907, 207.—T. F. B.

Detinning tin-plate scraps and other tinned waste materials. K. and H. Goldschmidt, Essen-on-Ruhr, Germany. Eng. Pat. 23,449, Oct. 22, 1906. Under Int. Conv., Oct. 24, 1905.

See Fr. Pat. 368,618 of 1906 ; this J., 1907, 22.—T. F. B.

Ore ; Apparatus for sintering fine ——. J. G. Bergquist, Chicago. Eng. Pat. 23,869, Oct. 26, 1906.

See Fr. Pat. 371,648 of 1906 ; this J., 1907, 416.—T. F. B.

Metals, metalloids, and alloys, particularly aluminium, silicon, and the like ; Process of obtaining —— from their oxides and compounds and apparatus therefor. E. Viel, Rennes, France. Eng. Pat. 24,352, Oct. 31, 1906. Under Int. Conv., Oct. 31, 1905.

See Fr. Pat. 359,042 of 1905 ; this J., 1906, 323.—T. F. B.

Copper ; Process for obtaining pure ——. L. Jumau, Paris. Eng. Pat. 703, Jan. 10, 1907.

See Addition of Oct. 27, 1906, to Fr. Pat. 367,452 of 1906 ; this J., 1907, 419.—T. F. B.

Copper ; Process of obtaining pure ——. L. Jumau, Paris. U.S. Pat. 870,786, Nov. 12, 1907.

See Fr. Pat. 367,452 of 1906; this J., 1906, 1155.—T F. B.

Copper and lead in strongly basic ores ; Process for extracting the ——. J. Gathy. Fr. Pat. 379,578, May 30, 1907.

The patent relates to the treatment of copper and lead ores accompanied by an alkaline-earth gangue. Oxidised ores are well mixed with a hot concentrated solution of calcium chloride, and the liquid decanted or filtered. and cooled, when lead chloride separates out. The lead chloride is reduced to metal by heating with charcoal and calcium carbonate, calcium chloride being regenerated. The solution, after separation of the lead chloride is treated with lime, and after separating insoluble calcium salts, the dissolved cupric hydroxide is either precipitated as carbonate by means of carbon dioxide, or is converted into cupric chloride by means of hydrochloric acid, then reduced to cuprous chloride (see Fr. Pat. 368,467 of 1906 ; this J., 1907, 53), and the latter reduced to metal by heating with charcoal and calcium carbonate. Sulphide ores are first roasted, and then treated with concentrated calcium chloride solution to remove free lime (Belg. Pat. 192,636 of 1906). The residues may be treated according to the process described in Fr. Pat. 368,467 of 1906 (*loc. cit.*).—A. S.

Metallic coatings on metal surfaces ; Method of depositing ——. A. Sang, Sewickley, Pa., U.S.A. Eng. Pat. 9740, April 26, 1907.

See Fr. Pat. 379,012 of 1907 ; this J., 1907, 1204.—T. F. B.

Ores ; Cyanide treatment of ——. A. Adair, Johannesburg, Transvaal. U.S. Pat. 869,287, Oct. 29, 1907.

Claim is made for the use in the cyanide process of a "manganese compound in which manganese dioxide occurs in a finely-divided amorphous form," and an easily reducible soluble oxygen-yielding salt.—O. F. H.

Zinc skimmings ; Process of utilising ——. B. Terne, Philadelphia, Pa. U.S. Pat. 869,750, Oct. 29, 1907.

The skimmings are ground with hot water, and the mixture boiled, the insoluble residue being separated, dried and treated in a reduction furnace for metallic zinc. The solution, which contains zinc chloride, is treated with ammonia, and the precipitated hydrated oxide of zinc separated. Ammonium chloride is finally recovered by crystallisation from the residual solution.

—O. F. H.

Zinc-lead ores ; Treatment of refractory ——. P. C. C. Isherwood. Fr. Pat. 379,939, July 16, 1907. Under Int. Conv., July 19, 1906.

See Eng. Pat. 16,364 of 1906; this J., 1907, 1012.—T.F. B.

Furnace ; Metallurgical ——. J. C. Cromwell, Assignor to the Garrett-Cromwell Engineering Co., Cleveland, Ohio. U.S. Pat. 869,960, Nov. 5, 1907.

The furnace is provided with a door which is given a reciprocating motion by a motor rotating an intermediate part, on which is pivoted a connection secured to the door. Each rotation of the intermediate part corresponds to a complete reciprocating movement of the door.—A. G. L.

Ores and other substances; Process and apparatus for the treatment of —— by the action of heat and of reducing agents, and for the extraction of volatile reaction-products. J. H. Reid. Fr. Pat. 379,566, May 18, 1907.

The apparatus comprises a series of superposed chambers, with conical bottoms, each provided with an outlet for volatile products, and with a tuyère, through which the reducing agent is forced by means of a jet of steam or the like. The ore is fed into the uppermost chamber, and after accumulating somewhat on the conical bottom, falls through a central opening into the next lower one, and so on. In each chamber the ore is subjected to the heat of an electric arc. From the lowest chamber, the ore falls on to an endless belt, by which it is conveyed, if desired, to the top of a second series of chambers.—A. S.

Alloy and its process of manufacture. R. B. Wheatley. Fr. Pat. 379,403, June 29, 1907.

The alloy is composed of 87 per cent. of copper, 12 per cent. of zinc and tin in the proportions of 1 : 1, or 2 : 1, ¼ to ½ per cent. of tungsten, ½ to 1 per cent. of molybdenum, and traces of phosphorus and arsenic. In the manufacture of the alloy, the tungsten is added in the form of phosphide, while the arsenic, in the proportion of 1 to 2 per cent. is added in the metallic state. The greater part of the phosphorus and arsenic is used up in combining with oxygen, thus allowing the copper, zinc, tin, molybdenum and tungsten to come into intimate contact, and so form a homogeneous alloy.—O. F. H.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Continuous or alternating current for heating air or fused masses; Relative value of ——. H. Lee and A. Beyer. Z. Elektrochem., 1907, 13, 701—707.

The authors have compared the yields of nitric acid with arc flames in air maintained between iron, platinum, and oxide electrodes. In each case with the same energy consumption, closely concordant yields were obtained with alternating and continuous currents, unless the conditions were such as to cause a change in the nature of the arc flame. The conclusion arrived at is that variations in the yield may be caused by differences in the subsequent cooling of the reaction products, but are not due to any intrinsic difference between the alternating and continuous current. A higher voltage is generally necessary with alternating current for the same energy consumption than with direct current, but this may be accounted for by the cooling of the electrodes between each alternation and the consequent difficulty of restarting the arc. Emphasis is laid on the great influence of the nature of the arc flame on the yield, and of the means adopted for removing the oxides of nitrogen from the further action of the arc discharge.

In the case of smelting operations; both for heating empty crucibles and in the production of calcium carbide, alternating and continuous current arcs of the same voltage and amperage gave results which agreed closely, both as to the length of arc and the yield of carbide.—R. S. H.

Tungstic acid; Electrolytic reduction of ——. H. Leiser. Z. Elektrochem., 1907, 13, 690—694.

Solutions of normal tungstates upon electrolysis do not appear to undergo reduction, but when a hot acid solution of metatungstic acid is employed, a deep blue solution is obtained around the cathode. The author has attempted to obtain the substance causing the blue colour in the solid form, but in this condition it is so readily oxidised that no success attended his efforts. By electrolysing with a platinum cathode and nickel anode, complete reduction of the tungstic acid could be effected, and subsequent titration with permanganate proved that the compound formed corresponds to the oxide, W_4O_{11}. With platinum cathodes an exceedingly thin film of a black deposit is obtained on the electrode, and upon lead cathodes this substance occurs in greater quantity. Analysis suggests that this substance is the oxide, WO_2, but the quantity obtainable is too small to prove this conclusively.—R. S. H.

Zinc by electrolysis; Rapid determination of ——. F. C. Frary. *See* XIA.

Patents.

Electrodes for electrolytic purposes; Manufacture of ——. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfort, Germany. Eng. Pat. 5223, March 4, 1907.

See Fr. Pat. 375,595 of 1907; this J., 1907, 930.—T. F. B.

Insulation of electric conductors and compounds therefor. W. A. Phillips and F. Hutchins, London. Eng. Pat. 13,943, June 17, 1907.

Two parts by weight of the mineral gilsonite are mixed with three of castor oil, or equal parts by weight of gilsonite, castor oil and linseed oil may be used, and the mixture is heated until it is reduced by about 15 per cent. of its weight. When cool, it is mixed with paraffin oil, or other hydrocarbon, so as to give the substance a sp. gr. of 0·840 at 38° C. Electrical conductors are drawn through the mixture, and then subjected, in a tube or chamber, to a heating process, the duration and intensity of which is sufficient to drive off the volatile constituents of the mixture, and convert the coating into a hard, tough and flexible enamel.—B. N.

Insulating material and method of manufacturing same. R. Müller, Munich, Germany. U.S. Pat. 869,321, Oct. 29, 1907.

See Fr. Pat. 349,781 of 1904; this J., 1905, 739.—T. F. B.

Reducing compounds with electrically developed heat. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 869,276, Oct. 29, 1907.

Silicon and other elements capable of forming similar compounds are obtained in the following manner. The oxides mixed with carbon are first electrically heated with the production of a definite compound of the element with carbon and oxygen. This compound is then mixed with a further quantity of the oxide and electrically smelted with the production of the element.—R. S. H.

Furnace; Electric ——. F. J. Tone, Niagara Falls, N.Y. U.S. Pat. 870,326, Nov. 5, 1907

The patent relates to a combined arc and resistance furnace, the resistance-element being composed of shaped pieces assembled to form a self-sustaining continuous conductor of uniform resistance throughout the portion of its length exposed to the charge. The conductor is enclosed in a chamber provided with a receptacle for the charge, the latter not being in contact with the conductor. The charge is so disposed in the furnace that it has a sloping surface, conforming approximately to the surface of an inverted cone, exposed to the heat radiated from the resistance-element. Means are provided for withdrawing the reaction-product and for feeding fresh material to the zone of reaction.—A. S.

Furnace; High-tension electric —— specially applicable to the nitrification of air. C. Limb and F. Louis. Fr. Pat. 379,437, Sept. 8, 1906.

The apparatus is shown diagrammatically in Figs. 1 and 2. The arc is struck between the points of P_1 and P_2, which are placed sufficiently near together for the arc to restart whenever it is interrupted. By the continued action of two opposing magnetic fields, A B and C D, the arc is electro-magnetically repulsed from either end of the forked electrodes, E^1, E^2, and by this action, a high degree of regularity can be assured. The several transformers yielding power for such furnaces are so arranged that

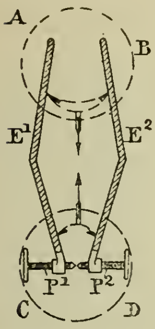


FIG. 1.

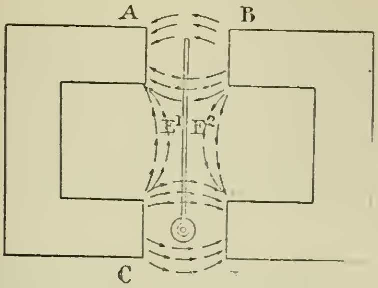


FIG. 2.

whilst their primaries are in series, the secondaries are each connected independently to one furnace; in this manner regularity of working is obtained.—R. S. H.

Wood diaphragms for accumulators; Preparation of ——. H. Leitner. Fr. Pat. 379,280, June 27, 1907. Under Int. Conv., Oct. 15, 1906.

IN order to remove the deleterious constituents of the wood without the use of alkalis, the inventor saturates the pores of the wood with a dilute solution of a hypochlorite and subsequently treats the wood with dilute acid; the chlorine evolved oxidises the deleterious constituents without damaging the wood fibre. The wood is then submitted to prolonged washing. In order to render the wooden diaphragms more permanent when exposed to the air, they may finally be treated with some hygroscopic substance or with a solution of tragacanth.
—R. S. H.

Incandescing bodies, etc. Eng. Pat. 23,119. *See* II.

Refractory bodies, etc. Fr. Pat. 379,310. *See* II.

Incandescent bodies, etc. Fr. Pats. 379,342 and 379,379. *See* II.

Refractory metals, etc. Fr. Pat. 379,394. *See* II.

(*B.*)—ELECTRO-METALLURGY.

Desulphurisation of steel in the Kjellin induction furnace. A. Schmid. Stahl und Eisen, 1907, 27, 1613—1615.

As a result of trials with the plant at Gurtnellen, the author has established the fact that charges of iron and ore heated in the induction furnace with a very small quantity of lime as flux, show a rapid diminution of the sulphur content of the metal. When a charge was heated with slightly oxidised scrap, but without ore, the sulphur remained quantitatively in the metal. Although some of the sulphur passes into the slag, and passes back again into the metal if the re-carburisation is effected without the removal of the slag, by far the greater quantity apparently disappears as sulphur dioxide in the gases escaping from the furnace. The author considers this effect to be much more marked than would be possible in an open-hearth furnace, and since it is observed even if the electric furnace is worked at a relatively low temperature, he seeks for an explanation. The phenomenon is attributed to a reaction occurring between oxide of iron and the sulphur of the metal under the influence of the alternating current which is passing through the charge. Analyses are given which demonstrate the considerable extent to which this desulphurisation proceeds at different stages of the process.—R. S. H.

PATENTS.

Metals; Electrolytic deposition of ——. S. O. Cowper-Coles, London. Eng. Pat. 24,986, Nov. 6, 1906.

A CENTRAL, cylindrical, revolving cathode is surrounded by an intermediate electrode, the latter consisting of refined metal, the same as that to be deposited, and this in turn is surrounded by a cylindrical anode of the crude metal or ore from which the refined metal is to be obtained. The intermediate electrode is provided with ribs or projections on its inner side, and means are provided whereby the outer stationary electrodes may be moved or turned at intervals. The three electrodes form two separate annular compartments containing electrolyte, and the metal is deposited twice in its passage from anode to cathode, thus undergoing a double refining process.—B. N.

Metals; Electrolytic deposition of ——. J. Taylor, Birmingham. Eng. Pat. 26,144, Nov. 19, 1906.

A CATHODE disc is fixed to a vertical shaft, the latter being suitably supported between a vertical standard attached to the bottom of the bath and an arm or bracket fixed to the sides of the bath. The disc is provided with apertures, through which wires or hooks pass for the suspension of the articles to be plated. The cathode disc is rotated by means of friction wheels, one of which is secured to but insulated from the disc, the other being connected with a driving shaft. The upright standard is surrounded by a hollow cylindrical anode, and a contact piece, mounted and hinged on a shaft, is arranged to press upon the upper face of the cathode disc.—B. N.

Metallic powders [for electro-plating purposes]; Method of preparing ——. W. F. McNulty, Allegheny, Pa. U.S. Pat. 869,591, Oct. 29, 1907.

METALLIC powders for electro-plating purposes are prepared and cleansed from greasy impurities by adding to them an inflammable liquid, and then heating them.
—O. F. H.

Furnaces; Electric ——. H. Pauling. Eng. Pat. 18,901, Aug. 22, 1907.

THE furnace is designed for the production of "strong-current" arcs, suitable for use in physical and chemical processes. One pole of an electro-magnet forms an outer receptacle open at one end, and encloses the other pole, with a clear space between them. A pair of curved electrodes is arranged within this space so as to embrace the inner pole, the electrodes diverging towards the open end of the outer pole. A current of gas is blown through the space between the electrodes in the direction of divergence, by means of a pair of "nose pipes," the latter passing through the closed end of the outer pole on opposite sides of the inner pole.—B. N.

Furnace; Electric ——. G. Gin, Paris. U.S. Pat. 869,432, Oct. 29, 1907.

SEE Fr. Pat. 362,734 of 1906; this J., 1906, 767.—T. F. B.

Cast-iron; Manufacture of —— *in the electric furnace, from minerals rich in titanium.* J. J. W. H. Van der Toorn. Fr. Pat. 379,466, July 2, 1907. Under Int. Conv., April 18, 1907.

SEE Eng. Pat. 598 of 1907; this J., 1907, 1148.—T. F. B.

XII.—FATTY OILS, FATS WAXES, AND SOAPS.

Fish-liver oil; Liquid and solid constituents of Japanese ——. H. Okada. Chem.-Zeit., 1907, 31, 1135.

METHODS already known for deodorising oils caused considerable reduction, though not complete removal, of the unpleasant odour of Japanese fish-liver oil. The malodorous constituent could be destroyed by treating a chilled aqueous solution of the potassium soap from the oil with alkaline potassium permanganate solution. The white hydroxy-fatty acid recovered from the oxidation products melted at 118°—120° C., and had not the least trace of the original odour. On cooling the oil at −10° C., separating the deposit, repeatedly crystallising it from ether, and finally treating it with absolute alcohol, the final product, when dried at 50° C. in a current of carbon dioxide, had only a faint tallow-like odour. Hence the author concludes that the malodorous substance is a liquid constituent of the oil. The odour cannot be attributed to nitrogenous substances, since the oil contained no nitrogen.—C. A. M.

Coffee bean oil. W. L. A. Warnier. Pharm. Weekblad, 1907, **44**, 1080—1081. Chem. Zentr., 1907, **2**, 1695.

By extracting 4·4 kilos. of unroasted Java coffee with petroleum ether, 400 grms. of a light brown oil were obtained. This oil is coloured dark red by ammonia. It has the sp. gr. 0·942 at 24·5° C.; “$n_D^{25} = 81\cdot5$”; solidifying point, 5—6° C.; m. pt., 8—9° C.; saponification value, 177·5; acid value, 6·2; ester value, 166·7; acetyl value, 0; iodine value, 85.—A. S.

Fatty acid esters of the phytosterols of Calabar fat, and analogous esters of cholesterol which have three stable liquid phases. F. M. Jaeger. Rec. trav. chim. Pays-Bas, 1907, **26**, 311—356.

The heptylate, nonylate, laurate, myristate, palmitate and stearate of cholesterol were prepared by heating, for several hours, mixtures of pure cholesterol with the respective fatty acids. The esters were purified by re-crystallisation from a mixture of anhydrous ether and alcohol, or of ethyl acetate and alcohol. Most of these esters have several liquid phases, which remain in a condition of stable equilibrium with the melted isotropic mass of the ester. Their behaviour in this respect is described in detail. The fatty acid esters of α-phytosterol (this J., 1907, 69, 346, 1150) yield crystals which are better developed than those of the corresponding esters of β-phytosterol. The formates, acetates, and probably also the propionates of the two phytosterols show no anisotropic liquid phases. The solidifying points of the formate, acetate, and propionate of α-phytosterol are 102·5°, 127·1°, and 107° C. respectively, whilst the corresponding numbers for the esters of β-phytosterol are 125·1°, 141·2°, and 123° C.; the melting points are somewhat higher than the solidifying points. The behaviour of the higher esters of the phytosterols with respect to the appearance of several liquid phases is described in detail. Also, a table is given showing the specific rotatory power of solutions of the esters of the two phytosterols and of cholesterol in benzene and chloroform.—A. S.

Patents.

Emulsification of oils; Means for use in the ——. L. E. Common, Sutton-on-Hull, and The Hull Oil Manufacturing Co., Ltd., Hull. Eng. Pat. 23,768, Oct. 25, 1906.

Castor oil or other oil, fat, or oleine is sulphonated, and the product is completely saponified by means of caustic soda or other suitable alkali. On adding products to oils, fats, etc., they render the latter emulsifiable with water.—A. S.

Marrow fat; Process of and product from treating ——. E. Klein, New York. U.S. Pat. 862,337, Aug. 6, 1907.

The marrow is disintegrated, washed, heated to a temperature of about 150° C., and filtered. The filtered fat is then heated to a temperature of 250° C. and treated with a current of superheated steam for 2 hours in order to remove acrolein. After cooling somewhat, the fat is stirred with twice its volume of alcohol, the latter is allowed to separate and is removed, the residual fat is again heated to 250° C., and filtered. The resulting product has a butter-like consistency, a sp. gr. of 0·931 to 0·938, and a m. pt. of from 37° to 45° C.—W. P. S.

Liquids [oils, sugar juice, etc.]; Process for purifying —— [by treatment with zinc and plumbago]. T. Macherski and E. Koperski. First Addition, dated June 22, 1907, to Fr. Pat. 377,700, May 11, 1907 (this J., 1907, 1099).

Ordinary powdered charcoal may be used in place of the plumbago employed in the process described in the original specification.—W. P. S.

Fat and wax; Process for the extraction of —— from moist substances. Nassextraktion Ges.m.b.H. Ger. Pat. 179,449, Jan. 3, 1902.

The extraction of the fat is effected with one of the following solvents, viz., benzene, carbon bisulphide, acetone, alcohol, chloroform, carbon tetrachloride, or ether, having a boiling point below 100° C. The vapours of the solvent, together with the steam from the moist material, are condensed in a special receiver.—A. S.

Solvents; Process for the recovery of —— in the extraction of fatty substances. H. Kirchner. Ger. Pat. 178,185, April 20, 1904.

In order to allow of the recovery of the solvent whilst it is still hot, the condensate from any desired part of the condenser is led to a "water-separator" through a pipe which discharges so far below the level of the solvent in the separator, that the pressure of the column of liquid above the outlet of the pipe, will prevent the entry of gases from the condenser. The gases finally escape from the condenser through a pipe provided for the purpose.—A. S.

Wool-fat; Process for separating —— into two portions by one of which water is absorbed readily, and by the other with difficulty. A.-G. Norddeutsche Wollkämmerei und Kammgarnspinnerei. Ger. Pat. 178,804, Jan. 23, 1906. Addition to Ger. Pat. 163,254, Oct. 15, 1903 (see this J., 1905, 1242).

According to the present patent the solvents (alcohol, ether, etc.) used for extracting the portion of the fat absorbed by bone charcoal, may be diluted with liquids (benzine and the like) which by themselves are not capable of extracting the fat from the charcoal. For example benzine mixed with only 5—10 per cent. of 95 per cent. alcohol, acts as efficiently as absolute alcohol.—A. S.

Soap or mixtures containing soap; Manufacture of ——. The Karsam Soap Co., Ltd., M. R. A. Samuel, and A. A. Lockwood, London. Eng. Pat. 24.822, Nov. 5, 1906.

A hydrocarbon oil is injected in a finely-divided state into the soap or soap mixture at any suitable stage of its manufacture, the temperature being meanwhile kept below the volatilisation point of the oil.—C. A. M.

Soap and like materials; Apparatus for setting ——. O. Imray, London. From A. Jacobi, Darmstadt, Germany. Eng. Pat. 6726, Mar. 20, 1907.

The frames of the apparatus are constructed on the principle of a filter-press, with both the inlet and outlet for the water at the bottom of the plates. These cooling plates have corresponding ribs, so that when bolted together, channels are left for the passage of the water. Or a sheet, with the necessary perforations, may be fixed between each pair of plates, dividing the water-channel in two and doubling the distance to be traversed by the water. The channels may also be made horizontal instead of vertical. In order to permit of easy removal of the solidified soap slabs, the walls of the partitions are given a glass-like surface, *e.g.*, by coating them with nickel or by screwing nickel or nickel-coated plates to their faces.—C. A. M.

Soap powder ["Schaumseife"]; Process for the manufacture of —— by introducing air into the soap. "Centaur" Chem.-Techn. Fabr. Ger. Pat. 183,673, March 21, 1906.

Compressed air is forced into the soap paste, thereby causing the formation of lather (foam), and at the same time, cooling the soap.—A. S.

Emulsions, etc. Eng. Pat. 24,135. *See* III.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(A.)—PIGMENTS, PAINTS.

Patents.

Sulphide of zinc; Manufacture of ——. J. C. A. Meyer, Lyons, France. Eng. Pat. 5032, March 1, 1907.

See Fr. Pat. 373,027 of 1906; this J., 1907, 701.—T. F. B.

Lithopone or lithopone-white; Process for rendering —— proof against sunlight and atmospheric influences. C. R. Steinau, Eisenach, Germany. Eng. Pat. 11,803, May 21, 1907. Under Int. Conv., Sept. 17, 1906.

See Fr. Pat. 377,429 of 1907; this J., 1907, 1099.—T. F. B.

Lead pigments; Method of making ——. A. S. Ramage, Detroit, Mich. U.S. Pat. 870,316, Nov. 5, 1907.

A solution containing basic carbonate of lead is prepared by the action of alkali carbonate and hydroxide on lead sulphate, and is then mixed with "chamber sulphate," whereby the solution is acidified and the lead precipitated, whilst, at the same time, the "chamber sulphate" is converted into basic carbonate. The crude basic carbonate of lead is dissolved in acetic acid, the solution is "purified" by the addition of an oxidising agent, *e.g.*, a bichromate, then rendered basic by the addition of a lead compound, and used for the preparation of chrome pigments.—A. S.

(*B.*)—RESINS, VARNISHES.

Japan lac; A main constituent of ——. R. Majima and S. Chō. Ber., 1907, **40**, 4390—4393.

Urushinic acid, separated by treating the milky juice of the lac tree (*Rhus vernicifera*) with alcohol, and purified by means of petroleum spirit, was found to contain 79·65 per cent. of carbon and 9·75 per cent. of hydrogen, both figures being somewhat higher than those obtained by Miyama. The alcoholic solution of the acid reduced silver salt solutions, and gave a precipitate with lead acetate, and greenish-black colorations with ferric chloride and alkalis. It was readily oxidised on exposure to the air. On dry distillation it yielded various hydrocarbons and polyvalent phenols. Among the products identified were methane, hexane, hexylene, heptane, heptylene, octane, octylene, $C_{14}H_{28}$, $C_{14}H_{26}$, and pyrocatechol, with small amounts of carbon dioxide and fatty acids. It is noted as remarkable that no simple aromatic hydrocarbon or ordinary terpene was found. The acid was readily oxidised by nitric acid with the formation of suberic, succinic, oxalic and other acids. It gave an acetyl derivative which was readily saponifiable, though with some decomposition, by alcoholic alkali. In the author's opinion most, if not all, of the oxygen in urushinic acid is present in the form of phenolic hydroxyl, and the molecule also contains a large hydrocarbon group. (See also this J., 1906, 81.)—C. A. M.

(*C.*)—INDIA-RUBBER, &c.

Rubber; Vulcanisation tests with plantation ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 235—236.

In continuation of their investigations on this subject (this J., 1907, 935; also Chem. News, 1907, **96**, 187), the authors have endeavoured to trace a connection between the "apparent" specific gravity of a sample of vulcanised rubber and the conditions under which it has been vulcanised, but no very clear relationship has been found to exist. As a general rule the specific gravity of samples vulcanised with 6 per cent. of sulphur does not fall below 0·94 and seldom reaches 0·96, except in cases where the samples have been over-cured and kept for some months, when it usually exceeds 0·96 and may reach 0·98. Tests carried out on samples of a Ceylon biscuit rubber containing: moisture, 0·5; proteins, 0·1; resins, 2·8; ash, 0·4; and caoutchouc (by difference), 96·2 per cent., and vulcanised with 6 per cent. of sulphur for varying lengths of time, indicated that the tensile strength rises to a maximum with a cure of about four hours when the elongation of the test strip under a strain of 1500 grms. is 10·1 times its original length. Longer heating diminishes the elongation and, after about 5 hours, weakens the rubber. The average tensile strength of the samples examined was not very different from that found for hard-cure Parà rubber, but was not equal to that of the sample of vulcanised "block" rubber previously examined. (*loc. cit.*).—E. W. L.

Patents.

Caoutchouc; Process of extraction of —— from caoutchouc-bearing plants. P. J. Bigeard. Fr. Pat. 379,534, July 4, 1907. Under Int. Conv., July 6, 1906.

The bark is immersed for three minutes in a boiling solution (1 per cent.) of caustic soda or potash, and then passed between two revolving cylinders, which transform it into a paste. On immersing this paste in the bath of caustic alkali, most of the bark settles out, whilst the caoutchouc rises to the surface. The separated caoutchouc is freed from adherent bark by means of washing rollers. It is claimed that by this method a more efficient separation of caoutchouc is obtained, and the putrefactive ferments are also destroyed.—S. R. T.

Elastic material and machinery or apparatus employed in the manufacture thereof. L. C. G. Lesage, Paris. Eng. Pat. 24,787, Nov. 5, 1906. Under Int. Conv., Nov. 6, 1905.

See Fr. Pat. 359,183 of 1905; this J., 1906, 384.—T. F. B.

Rubber; Artificial ——. W. H. Brownlow, Brockville, Canada. Eng. Pat. 2065, Jan. 28, 1907.

A preparation particularly suitable for filling pneumatic tyres so as to make them puncture-proof, or for moulding rubber toys, is obtained by heating together 1 lb. of glue, 1 lb. of molasses, 4 fl. ozs. of glycerin, and ¼ teaspoonful of tar.—C. A. M.

Caoutchouc, artificial; Manufacture of ——. J. Ohm. Fr. Pat. 379,526, July 4, 1907.

The basis of the substance is a mixture of chromed gelatin and glue. The addition of flowers of sulphur and flaked graphite prevents overheating for certain purposes. Reduction in weight and increase in elasticity are caused by the incorporation of fragments of natural sponge and a solution of Para rubber in nitrated linseed oil is added to prevent drying and hardening.—S. R. T.

Elastic material; Manufacture of —— of any desired elasticity. M. Bartels. Fr. Pat. 379,530, July 4, 1907.

Gelatin is added to a mixture of glycerin, water and formaldehyde, the proportions being adjusted according to the degree of elasticity required for the product, and, after heating, sufficient potassium chromate is introduced to protect the mass from the effects of heating. The product is then cooled and moulded into the desired form.—S. R. T.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Leather; Influence of retained sulphuric acid on the quality of ——. W. Eitner. Der Gerber, 1907, **33**, 267—269, 281—283, 296—299, 309—311.

The assumption that sulphuric acid was detrimental to leather was due to the strong competition of American hemlock leather in Continental markets, this leather being swollen with sulphuric acid. It proved to be a cheap and excellent material and its importation was only checked by high tariffs. It is pointed out that a sample of hemlock leather containing 0·42 per cent. of free sulphuric acid, kept at the Vienna Research Station since 1876, and another sample containing 0·64 per cent. kept for 12 years had not deteriorated in any way. Moreover, out of 25 samples of brittle leather received for analysis, only 2 contained more than 2 per cent. of acid. The rest had become brittle by a kind of fermentation process, owing to the leather having been piled for some time, when containing 20—30 per cent. of moisture. Brittleness caused by acid can be distinguished from that caused by a fermentation process or by loading with too much glucose, barium chloride, extract, etc., as follows. The sample is thoroughly washed and then dried. If after drying, the leather is no longer brittle, the cause was too much loading material; if it remains brittle, this is due either to acid or "fermentation," and these may be distinguished by bacteriological examination. The author investigated the effect of sulphuric acid by placing leather of different tannages in sulphuric acid solutions of various strengths, and afterwards determining the amount of acid retained, and the tenacity and extensibility of the leather: some determinations were made after 14 days and others after a few months.

It was found that an oak-tanned leather treated with 1—5 per cent. sulphuric acid solutions for 2 hours, then washed for 24 hours, and examined after 44 days, had in no respect lost its good quality; on the contrary, 1 per cent. of acid considerably improved the quality and increased the tenacity of the leather. In every case the same amount of acid was retained by the leather. A slight decrease in tenacity was effected by bleaching the same sample with lead acetate and sulphuric acid. With other leathers similar results were obtained, the amount of acid retained varying slightly, but in every case the good quality and colour of the leather being unaltered. To find the length of time required to wash out all the sulphuric acid possible, pieces of leather were washed for 3, 6, 12, 24, and 48 hours respectively, and then dried and examined. After 24 hours no more acid was removed, and the remaining 1·1—1·2 per cent. must be considered as combined with the leather. To show the influence of free sulphuric acid, *i.e.*, acid removable by washing, pieces of leather were immersed in 5 and 10 per cent. solutions of the acid, and subsequently examined. In these cases the leather was distinctly deteriorated, being brittle and possessing very little tenacity or stretch. Sulphuric acid thus appears to combine with hide fibre to a certain extent, the amount varying with the class of skin and the tannage. As a permissible content of sulphuric acid for leather, the author gives 1 per cent., this including the sulphur of hide substance (about 0·2 per cent.), the sulphur from sulphide limes (0·2 per cent.), and from swelling (0·4 per cent.) leaving 0·2 per cent. for finishing processes. Brittle leather is only caused by over swelling, and can be caused also by other acids than sulphuric acid. The Wünsch method was used for the sulphuric acid determinations.—H. G. B.

Neatsfoot oil; Effect of —— on chrome leather. H. Becker. Collegium, 1907, 370—371.

NEATSFOOT oil when used for chrome leather, along with other fats, often causes a sticky exudation on the surface of the leather, which unlike an ordinary stearine deposit is not removed on warming.—H. Br.

Tanning materials; Extraction of ——. H. C. Reed. J. Amer. Leather Chem. Assoc., 1907, 2, 239—280.

As the result of a large number of analyses of chestnut and quebracho wood, extracted in a great variety of ways, the "Committee on the Extraction of Tanning Materials," appointed by the American Leather Chemists Assoc., suggest the following provisional method in order to secure approximate concordance of results. Sections 1, 2, 3, and 5 of the present official method are retained intact. To Section 4, the following is added:—*Fresh materials, wood, barks and spent materials.* 500 c.c. of extractive solution, shall be collected by outside condensation in approximately two hours, and the extraction continued with 500 c.c. for fourteen hours longer, by the process of continuous extraction with a reflux condenser. The applied heat shall be such as to give, by condensation, approximately 500 c.c. in 1¼ hours.

With methods consisting of percolation with outside collection only, concordance will never be attained, and no one method will serve for the extraction of all materials. Great discrepancies occur with the use of gelatin salt tests, as a means of ascertaining the degree of extraction, and doubts are entertained, as to whether the precipitated compound in the case of solutions subjected to prolonged boiling during extraction, is really tanno-gelatin.—H. Br.

Tanning liquors; Determination of the acidity of ——. A. W. Hoppenstedt. J. Amer. Leather Chem. Assoc., 1907, 2, 301—304.

To 200 c.c. of the solution, of the same strength as used for tannin determination, 10 c.c. of previously neutralised hydrogen peroxide (commercial 3 per cent.) are added, and the whole well mixed. The peroxide prevents the action of substances which tend to darken the filtrates of some liquors before and during the subsequent titration. 50 c.c. of quinine solution are now added slowly, with stirring, and the solution is filtered. 100 c.c. of the filtrate are titrated with $N/10$ caustic alkali solution with 1 c.c. of a 5 per cent. alcoholic solution of phenolphthalein as indicator.

When calculating the proportion of acetic acid from the number of c.c. of alkali used, the factor 0·0069 is used, instead of 0·006, to allow for the dilutions. Occasionally, solutions weak in tannin, filter very slowly after precipitation. This defect is obviated, by making the solution of the liquor stronger. The quinine solution is made by dissolving 15 grms. of pure quinine in 110 c.c. of previously neutralised 95 per cent. alcohol, and then adding slowly, while stirring, 90 c.c. of water.—H. Br.

Tanning liquors; Amount of hide powder for the analysis of ——. W. A. Fox. J. Amer. Leather Chem. Assoc., 1907, 2, 394—400.

THE article embraces the report of the committee appointed by the Amer. Leather Chemists Association to consider the revision of the official regulations as to the amount of hide powder to be used in the analysis of tanning liquors. A series of experiments are recorded with liquors of varying strength, age, and acidity, and with specified variations in the amounts of hide powder used. The amounts officially prescribed are found to be too small, and in many cases to leave unabsorbed tannin in the non-tannin filtrates. Increase in the amount of powder used is shown to give a greater absorption of non-tannins, especially when the tannin content is low and the acidity of the liquor is high, thus making it difficult to fix quantities of hide powder suitable for all classes of liquors. The committee recommend the following amounts:—

Tannin content of liquor.	Grms. of dry hide powder.
Grms. per 100 c.c.	
0·35—0·45	9—11
0·25—0·35	6·5—9
0·15—0·25	4—6·5
0·00—0·15	0—4

These amounts always give complete detannisation, and yield results differing very slightly from the official method. The chairman, however, doubts whether any such scale will ever prove satisfactory, and inclines to the use of a fixed amount for all liquors.—H. G. B.

Chromed hide powder and the influence of acidity upon chroming and non-tannins. H. C. Reed. J. Amer. Leather Chem. Assoc., 1907, 2, 426—438.

THE author criticises the method of chroming hide powder proposed by Procter and Bennett (this J., 1906, 1203; 1907, 79), which is now the official method of the I.A.L.T.C. The author's experiments embrace the use of chromium chloride, chrome alum, and chromium formate. Assuming that the compounds formed with hide powder hydrolyse when used for detannisation, yielding the corresponding free acids, the author makes a series of experiments on the effect of these acids in varying quantities on the typical non-tannins of the common tanning materials when evaporated to dryness with them. Sulphuric and hydrochloric acids are said to hydrolyse the sugars, and afterwards produce "caramelisation," and slight lowering of estimated non-tannins. The residues are found to be rather difficultly soluble and to possess an odour of caramel. With formic and acetic acids this effect is found to be less marked and to have a negligible influence on results. The combined evaporator and dryer was used in these experiments. A description is also given of the preparation of crystallised chromium formate from chromium sulphate and barium formate, and its subsequent use in chroming hide powder. The normal salt is shown to be useless for this purpose, and various basic solutions are used. The author confirms the observations of Procter and Bennett as to the more rapid chroming obtained with such basic solutions, the greater absorption of non-tannins with acid powders, and also further emphasises the desirability of a fixed acidity to ensure uniform absorption. It is suggested that this might be done in the case of chromium formate by a prescribed mode of washing, this latter to be determined for each batch of powder by titration with standard sodium hydroxide. Sulphited tanning extracts are shown to yield with chromium formate distinctly higher values for non-tannins than with chrome alum.—H. G. B.

Tannin solutions ; Filtration of ——. H. C. Reed. J. Amer. Leather Chem. Assoc., 1907, 2, 420—426.

A new apparatus for the filtration of tannin infusions is described involving asbestos and kaolin as filtering media and the use of diminished pressure. This is found to give clear filtrates with any infusion, but the amounts of asbestos and kaolin most suitable for this purpose are not yet determined.—H. G. B.

Filter papers [in analysis of tanning materials] ; Comparison of S. and S. No. 590 and No. 602 hard ——. W. K. Alsop and W. A. Fox. J. Amer. Leather Chem. Assoc., 1907, 2, 281—284.

The absorption of tannin by No. 602 hard paper, has been found to be much greater than by No. 590 paper, under the specified conditions of the official method, and the absorption is greater from extracts of the character of unclarified quebracho than from clarified quebracho or chestnut extract.—H. Br.

Hide substance dissolved in lime- and tan-liquors ; Direct determination of ——. R. A. Earp. Collegium, 1907, 412—414.

The method depends upon the co-precipitation of the dissolved colloidal hide substance and another insoluble colloid, the reagent for tan-liquors being lead acetate, and for lime-liquors, chrome alum. The nature of the precipitate necessitates a very thorough washing to remove all crystalloidal matter. After washing, the precipitate is drained and the contained nitrogen determined, the amount of hide substance being then calculated in the usual way. In a check experiment with a solution of gelatin of known strength, mixed with a weak tan-liquor, 95 per cent. of the dissolved gelatin was found to be removed.—H. G. B.

Lactic acid in lactates ; Determination of ——. J. Paessler. *See* XXIII.

Patents.

Leather for producing electrically-insulating wearing apparel or for insulating electric conduits ; Process for the manufacture of ——. H. Egger, Brixlegg, Austria. Eng. Pat. 6592, March 19, 1907.

See Fr. Pat. 376,660 of 1907 ; this J., 1907, 1022.—T. F. B.

Glue ; Bleaching ——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 4049, Feb. 18, 1907.

See Addition to Fr. Pat. 366,701 of 1906 ; this J., 1907, 921.—T. F. B.

Glue ; Bleaching ——. A. J. Stiegelmann and E. Dehnel, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 867,167, Sept. 24, 1907.

See Addition to Fr. Pat. 366,701 ; this J., 1907, 921. —T. F. B.

Gelatin forms for moulds ; Process of producing ——. A. Leuchter, Brooklyn, N.Y. U.S. Pat. 869,311, Oct. 29, 1907.

A solution of gelatin containing a large proportion of liquid is used for obtaining a mould from a model. The mould is then subjected to the action of such reagents as sodium silicate, alkali or formaldehyde, either alone or together, which cause contraction and hardening to take place.—S. R. T.

Gelatin forms or moulds ; Process of producing ——. A. Leuchter, Brooklyn, N.Y. U.S. Pat. 869,312, Oct. 29, 1907.

Gelatin moulds obtained by the process described in the previous abstract from a solution of gelatin containing acetic acid, with or without gum tragacanth, are treated with water to cause enlargement, and then hardened by means of a bath of alum and acetic acid.—S. R. T.

Albuminoid matters, especially casein ; Electrolytic treatment of ——. R. Desgeorge and F. Lebreil. First Addition, dated Sept. 14, 1906, to Fr. Pat. 373,756, March 27, 1906.

See U.S. Pat. 863,268 of 1907 ; this J., 1907, 1022.—T.F.B.

XV.—MANURES, &c.

Nitrogen ; Assimilation of atmospheric —— *by a free living soil organism, viz. : Azotobacter chroococcum of Beijerinck.* S. F. Ashby. J. Agric. Science, 1907, 2, 35—51.

The author describes experiments on the fixation of atmospheric nitrogen by pure cultures of *Azotobacter chroococcum* from Rothamstead soil and by mixed soil cultures, the organisms being grown in culture solutions containing mannitol as carbohydrate food for the organisms. The best results are shown in the following table :—

Mgrms. of nitrogen fixed per grm. of mannitol oxidised.

Pure cultures.	Mixed soil cultures.
7·30	9·2
7·64	8·8
7·24	9·22
7·84	9·53

It would appear that the presence of other bacteria in the primary cultures acts favourably on the fixation of nitrogen, provided the reaction remains neutral or alkaline ; the presence of free acid in the culture medium seriously affects the growth of *Azotobacter.* The fixation of nitrogen is favoured by aëration and by the presence of a base such as calcium carbonate or magnesium carbonate, especially the latter. With respect to aëration, in two culture solutions of equal surface area, but of which one was only half as deep as the other, the proportion of nitrogen fixed in the shallow solution was nearly twice as much as in the other. *Azotobacter* is present in soil most abundantly near the surface, the amount decreasing with increasing depth of the soil. The fixation of nitrogen by the organisms does not proceed uniformly over the period of active oxidation of the carbohydrate nutrient, but increases rapidly at first and then becomes slower, corresponding with the decrease in the concentration of the carbohydrate. A pure culture of *Azotobacter* from Cairo soil resembled the Rothamstead organism, except that the fixation of nitrogen was more rapid and greater. Pure cultures of *Azotobacter* from soil from Mombassa and the Transvaal differed in many respects from the Rothamstead organism and appear to represent a distinct variety, which is very active, fixing 7·3 mgrms. of nitrogen per grm. of mannitol oxidised, as compared with 7·64 mgrms. by the Cairo, and 4·91 mgrms. by the Rothamstead organism under similar conditions. A bibliography is appended to the paper.—A. S.

"Nitrification" ; Some observations on ——. S. F. Ashby. J. Agric. Science, 1907, 2, 52—67.

It is known that nitrification does not take place in absence of a base. The author made a series of experiments to ascertain whether the most generally available base—calcium carbonate—can be replaced by other constituents of soil, *e.g.*, kaolin, modelling clay, and ferric hydroxide. It was found that a marked nitrification of an ammonium salt can be effected in presence of ferric hydroxide, either in the freshly-precipitated state or as iron rust. In solutions, nitrification is not completed in presence of ferric hydroxide, probably owing to dissociation of ferric nitrite and nitrate, with liberation of acid. Kaolin and modelling clay are not capable of serving as bases for nitrification. The double ammonium compound formed by the absorption of ammonium salts from dilute solutions by modelling clay can probably be nitrified in the absence of a base, but this is not the case with the corresponding double ammonium compound formed by peat. The function of the base in nitrification is to form ammonium carbonate, which is alone directly nitrifiable, and the ease with which nitrification is set up in presence of different carbonates, depends upon the rapidity with which they can react with a neutral ammonium salt to produce ammonium carbonate; magnesium carbonate is more effective in this respect than calcium carbonate. The oxidation of nitrites to nitrates by *Nitrobacter* is inhibited by ammonium salts and asparagine, but this action can be largely obviated by abundant inoculation of the organism; by allowing the organism to multiply before the addition of the ammonium salt or asparagine; and by inoculating with an organism which has become habituated in previous culture to ammonium salts or asparagine by gradually increasing the concentration of the latter substances.—A. S.

Nitrification; Researches on intensive ——, and the installation of nitre-beds capable of giving high yields. Müntz and Lainé. Bull. Soc. d'Encour., 1907, **109**, 951—1042.

THE paper is subdivided as follows:—I. Nitrification of ammonium salts in earthy media: nature of the earth; influence of the organic matter of the soil on nitrification; influence of temperature; concentration of ammoniacal solutions in the liquids of the soil; limit of the enrichment of earthy nitre-beds; substitution of peat for earth and mould; nitrification of organic matter; installation of an earthy nitre-bed. II. Nitre-beds with continuous flow of liquid: influence of temperature on the behaviour of continuous nitre-beds of peat; concentration of ammoniacal solutions; yields of continuous nitre-beds; concentration of calcium nitrate solutions; accumulation of calcium sulphate in nitre-beds; transformation of calcium nitrate into nitric acid and alkali nitrates; loss of nitrogen during nitrification; installation of continuous nitre-beds. In view of tho results of their investigations, the authors recommend the installation of nitre-beds on a large scale in the vicinity of peat-bogs (see Fr. Pat. 377,711 of 1906 and addition thereto; this J., 1907, 1100, 1154). They estimate that with such an installation, a peat-bog of an area of 1000 hectares (1 hectare = 10,000 sq. m. or 2·47 acres) and an average depth of 2 metres, and containing 2 per cent. of nitrogen, would yield 800,000—900,000 tons of sodium nitrate.—A. S.

Humic acids; Chemistry and physiological action of ——. R. A. Robertson, J. C. Irvine, and M. E. Dobson. Bio-Chem. J., 1907, 2, 458—480.

NATURAL humic acid obtained from peat varies greatly in composition according to the method of preparation. When prepared through the ammonium salt, the percentage of carbon is lower and that of nitrogen is higher, than when prepared from the potassium salt. Artificial humic acid prepared from pure cane sugar by the action of hydrochloric acid, contains less combined nitrogen and more methoxyl than the artificial forms. It is unaltered in composition by conversion into the ammonium salt and reprecipitation, and is best represented by the formula, $C_{39}H_{32}O_{14}$. Humic and saccharohumic acids and their potassium salts are utilisable by *Penicillium* as sources of organic carbon; further, potassium humate and to a less extent, potassium saccharohumate serve as organic nitrogen food compounds for this mould. The physiological results fully confirm the chemical on such points as that the artificial acids are richest in carbon. Experiments with *Lemna* (an iron-storing plant) lend support to the chemical statement that only the natural acids contain iron.—E. F. A.

Chemical manures in Egypt. Board of Trade J., Nov. 21, 1907. [T.R.]

IN 1902 the total imports of chemical manures into Egypt were 2,000 metric tons, valued at £E 13,000, whilst in 1906 the figures were nearly 13,000 metric tons, valued at over £E 122,000. For the first nine months of 1907 the deliveries amounted to 7,579 metric tons, valued at £E 76,907. Belgium supplies about two-thirds of the total imports, and the United Kingdom one-seventh. The average prices for the principal manures, c.i.f. Alexandria are:—Nitrate of soda, £12 10s. per ton; sulphate of ammonia, £13 to £13 5s. per ton; superphosphates, £3 2s. to £3 6s. per ton. The superphosphates imported contain from 16 to 18 per cent. of phosphoric acid (water and citrate soluble).

Owing to the very small Egyptian demand prior to last year, it was found cheaper and more convenient to bring the nitrate of soda from Chili to Belgium and then tranship to Alexandria according to requirements. This largely accounts for the fact that in 1905 Belgium had practically the whole of the Egyptian trade. In 1906, the sales having increased so enormously, the Khedivial Agricultural Society of Cairo chartered two vessels and brought full cargoes direct from Chili to Alexandria, and the same process is being repeated this year. Belgium is the principal source of supply for superphosphates. Glasgow also ships some superphosphates, but Antwerp does nearly the whole of the trade. The main port of shipment for sulphate of ammonia is Glasgow, after which comes Antwerp.

Practically the only manures manufactured in Egypt are those turned out by a Cairo company, such as "poudrette" and other sewage products. The company also work up various slaughter-house products, such as dried blood, powdered hoof and horn and ground bones. Artificial manures are allowed to enter Egypt free of duty, and the State railways transport them into the interior at reduced rates.

PATENT.

Fertilisers, filtering materials [for sewage], and the like; Production of ——. J. Brightmore, Tideswell, Derbyshire. Eng. Pat. 15,922, July 13, 1906.

BLOCKS or slabs are prepared by moistening lime, lime-ashes, and slag, with water, and pressing the mixture in suitable moulds. The moist blocks are then heated and subjected to the action of a current of electricity, and after cooling, are placed in an atmosphere of air or nitrogen at a pressure of about 15 atmospheres; this air, or nitrogen, may be "ionised previously by passing it through an electric arc." The blocks are then treated with superheated steam, cooled, and immersed in a fluid containing nitrogenous matter, such as sewage, or they may be used as filtering material in filter-beds for sewage. Previous to use for fertilising purposes, the blocks are ground to a suitable degree of fineness.—W. P. S.

XVI.—SUGAR, STARCH, GUM, &c.

Glucose [dextrose]; Influence of catalysis by acids and bases on the mutarotation of ——. C. S. Hudson. J. Amer. Chem. Soc.; 1907, 29, 1571—1576.

FROM his own results on the rate of mutarotation of dextrose in acid (hydrochloric) solutions and Osaka's results (this J., 1907, 395) on the same phenomenon in alkaline solutions, the author has calculated the following formula for a temperature of 25° C., in aqueous acid, and alkaline solutions,

$$k = 0{\cdot}0096 + 0{\cdot}258(\mathrm{H}^{\cdot}) + 9750(\mathrm{OH}'),$$

in which $(\mathrm{H}^{\cdot})$ and (OH') are the concentrations of the hydrogen and hydroxyl ions respectively. The author's experiments show that there is a distinct depression of the rate of mutarotation in weak acid solutions as compared with the rate in pure aqueous solutions, the minimum rate—0·0096—being attained at a concentration of hydrogen ions $= 2{\cdot}3(10)^{-5}$ mols. per litre. This depression is due to the fact that addition of small quantities of acid to pure water lowers the concentration of hydroxyl ions nearly as much as it increases the concentration of hydrogen ions, and the catalytic power of the former, with reference to the mutarotation of dextrose, is about 40,000 times greater than that of the latter. The experiments also show "that there is a linear relation between the hydrogen ion concentration and the rate of mutarotation in solutions of such acid strength that the influence of the hydroxyl ions upon the rate can be neglected." Osaka's statement that the rate of mutarotation is proportional to the square root of the hydrogen ion concentration (*loc. cit.*) holds fairly well between the concentrations 0·01—0·10 mols. per litre, but does not agree with measurements outside these limits.—L. E.

PATENTS.

Sugar juice; Process for the purification of hot crude —— by means of lime and kieselguhr. R. Stutzer. Ger. Pat. 185,655, Jan. 29, 1905.

THE hot crude juice is mixed first with unwashed and unignited kieselguhr, and then, without filtering, with lime. It is stated that the preliminary addition of an indifferent substance, such as kieselguhr, effects a considerable saving in the quantity of lime required to produce complete precipitation of protein matters and to yield a juice which will filter readily.—A. S.

Evaporating and boiling apparatus especially for the sugar industry. A. Müller. Ger. Pat. 186,074, April 13, 1906.

THE patent relates to evaporating apparatus of the type in which the circulating liquid descends through a wide central tube. Below this tube is a kind of bucket-wheel, formed of an annular plate, conforming in shape with the bottom of the evaporator, and provided with conical scoops and with an opening. The fresh liquid enters the evaporator through a tangential pipe below the bucket-wheel, and passes into an annular passage, then, through openings in the wall of this passage, against a baffle-plate, which directs it towards the walls of the evaporator. It then rises through the heating tubes and descends through the wide central tube, falling on to the bucket-wheel, whence part is directed towards the walls of the evaporator, whilst part falls through the opening mentioned above, and mixes with the incoming fresh liquid. The lower ends of the heating tubes are cut off at an angle.—A. S.

Evaporation of solutions especially of sugar solutions; Process for the ——. R. Bergmans. Ger. Pat. 185,829, June 26, 1906.

THE vapours evolved from the solution being evaporated are passed through a superheater, and then utilised again as heating agent.—A. S.

Molasses; Process and apparatus for the partial desaccharification of ——. A. Gräntzdörffer. Ger. Pat. 184,644, Feb. 1, 1906.

MOLASSES still containing crystallisable sugar, is heated to about 60° C., and then whilst cooling to about 40° C., is filtered through sugar. The apparatus for carrying out the process consists of a movable vessel, divided into three compartments and mounted on a horizontal axis. The sugar is placed in the middle compartment and the molasses in the two outer ones. —A. S.

Liquids, etc. Addition to Fr. Pat. 377,700. *See* XII

XVII.—BREWING, WINES, SPIRITS, &c.

Yeasts; Propagation of different races of culture —— in nutrient media of known composition. W. Henneberg. Woch. f. Brau., 1907, **24**, 542—546, 575—579, 581—586, 596—601, 609—613, 618—620.

THE author has studied the influence of various nitrogenous and mineral nutrient substances on the characters of yeast when grown, for more or less prolonged periods, in solutions containing these substances. Seven yeasts representing types of the different varieties employed industrially were studied. With respect to microscopical structure, the top-fermentation beer yeasts retained a spherical form under all conditions; bottom-fermentation yeasts were mostly spherical but in some media often assumed an oval form, and in one case amœba forms were developed. The distillery yeasts, races II. and XII., showed extreme variations in form over long periods of sub-cultivation. The yeasts could only be maintained in normal condition in peptone media, though in most cases neutralised asparagine media were nearly as good. Thickening of the cell walls was generally traceable to excessive quantities of salts, ammonium salts particularly; an acid reaction is not the cause of thickening. The formation of complex budding chains in the case of the top-fermentation yeasts can be induced by controlling the composition of the medium, but only after prolonged propagation. In the distillery yeasts abnormal cell forms (amœbæ) appear after three or four cultivations with excessive nutrition; they are to a certain extent hereditary. Similar conditions of nutrition often induce similar forms of cells in different yeasts. Acid media favour the rapid dying out of the cultures; this occurs more easily the more often the yeast has been propagated in the same solution. Calcium salts, *e.g.*, the chloride, phosphate and lactate, delay the dying out of the cultures. Top-fermentation yeasts never coagulate so strongly as the bottom yeasts, the formation of large budding chains keeping the flakes loose. By suitable nutrition the cell walls can be made more slimy and the yeast more flocculent. Strong flocculation of bottom yeast only takes place in neutral, alkaline or very weakly acid media; top-fermentation yeasts can "break" in any medium. The distillery yeast race XII. sometimes forms such large budding chains that the yeast lies at the bottom whilst fermentation is still going on, the liquid being nearly clear and without a trace of foam. In neutral or alkaline media, a yellow to reddish coloration of the liquid, and often of the yeast also, occurs after several sub-cultivations; it appears to be due to magnesium and calcium salts. Foaming fermentations (Schaumgährungen] are especially common with race II., when cultivated in solutions of ammonium salts, asparagine or peptone. The yeast excretes a soluble protein, the presence of which causes the filtrate to froth when shaken; calcium phosphate and lactate increase this tendency. The other yeasts rarely give foaming fermentations. Top-fermentation yeasts multiply far more rapidly than bottom yeasts; in some solutions containing fermentable sugar an increase of the yeast may take place without a corresponding fermentation. As regards the yield of alcohol, substances which neutralise acidity are favourable, also calcium sulphate, phosphate and lactate. Calcium salts are not essential to the continued propagation of yeast. Distillery yeast race II. shows a greater tendency to increase the acidity during fermentation than does race XII.; calcium salts, particularly the lactate, increase this tendency, potassium sulphate reduces it.—J. F. B.

Yeast cells; Effect of acids, alkalis, and neutral salts on the fermentative activity and on the rate of multiplication of ——. E. Drabble and D. G. Scott. Bio-Chem. J., 1907, 2, 340—348.

SODIUM and potassium chlorides and nitrates when added to sugar solution in strengths of 0·1, 0·01, 0·001 and 0·0001 grm. mols. per litre, do not exercise any marked inhibiting action on the fermentative activity of yeast. Hydrochloric and nitric acids of 0·1 grm.-molecular strength entirely prevent fermentation and they exercise a depressing action at lower concentrations. Sodium and potassium hydroxides of 0·1 grm.-molecular strength likewise entirely prevent fermentation. Weaker solutions depress the action, while 0·0001 grm.-molecular solution affects the process but little. Hydrochloric and nitric acids at 0·1 grm.-molecular strength completely inhibit reproduction and are to some extent fatal to the yeast cells; lower concentrations permit reproduction. In all strengths of the neutral salts employed, the cells reproduce actively. The more concentrated acids bring about a shrinkage of the diameter of the cell to nearly that of the dead cell. The alkali hydroxides at 0·1 grm.-molecular strength prevent reproduction and are to some extent lethal. In lower concentrations reproduction takes place, except in 0·01 grm.-molecular potassium hydroxide. In the case of sodium nitrate the greatest reproduction was found in 0·2 grm.-molecular solutions. Increasing strengths depressed the reproductive activity, and solutions of greater strength than 0·7 grm.-molecular proved lethal to some of the cells.—E. F. A.

Betaine as a nitrogenous nutrient for yeast. V. Stanek and O. Miskovsky. Z. ges. Brauw., 1907, **30**, 566—568.

Experiments with two bottom-fermentation brewery yeasts and a distillery yeast show that none of these organisms is capable, even after a long time and in presence of dextrose and mineral nutrient materials, of utilising betaine as a source of nitrogen. The yeasts increased only slightly and developed involution forms. The betaine remained undiminished and unchanged.—T. H. P.

Yeast: Action of certain vapours on pressed ——. B. O. Herzog and F. Hörth. Z. physiol. Chem., 1907, **52**, 432; Chem.-Zeit., 1907, **31**, Rep., 553.

About 2 grms. of fresh pressed yeast were spread in a small dish and placed in a desiccator on the bottom of which were 50—100 c.c. of a volatile organic liquid, and the air was then exhausted from the vessel. Liquefaction of the yeast took place after a definite time, depending on the nature of the liquid. At a temperature of 20° C., the following average times were required for liquefaction: Methyl alcohol, 1·2 mins.; acetone, 3·3 mins.; ethyl alcohol, 6·2 mins.; chloroform, 13·8 mins.; ether, 33·8 mins.; carbon bisulphide, 7·3 hours; benzene, 6·8 hours; toluene, 17 hours; light petroleum spirit, 8 days; formaldehyde, no liquefaction. When the pressed yeast was previously mixed with a dried alcoholic extract of yeast, all the vapours showed a considerably diminished liquefying power. The retarding influence of aqueous solutions of the above substances on the fermentative action of yeast followed the same order as the liquefying power of the vapours; those substances which liquefied most slowly had the least inhibiting influence on fermentation.—J. F. B.

Revertase in fungi. E. Pantanelli. Atti R. Accad. dei Lincei, Roma, 1907, [5], **16**, II., 419—428. Chem. Zentr., 1907, **2**, 1751.

The author has studied the reverting power of *Mucor mucedo, M. stolonifer, Botrytis cinerea, Aspergillus niger*, and *Penicillium glaucum*. For the detection of the revertase, enzymatic preparations obtained from the different fungi were allowed to act upon a 40 per cent. solution of invert sugar, prepared by boiling, for 1 hour, a mixture of 40 grms. of crystallised sucrose dissolved in 100 c.c. of water, and 5 c.c. of $N/_{10}$ sulphuric acid, and then after rapidly cooling, neutralising with 5 c.c. of $N/_{10}$ sodium hydroxide solution, and making up to 100 c.c. 10 c.c. of this solution of invert sugar were treated with 10 c.c. of the enzymatic preparation, and kept for 1 hour at 56° C., then diluted to 500 c.c. with water, and in 10 or 20 c.c. of the diluted solution, the sugar determined by Allihn's method. In all cases a slow reversion was observed, which proceeded more rapidly in presence of free alkali. The revertase occurs abundantly in the mycelia of the fungi, and is transferred to the culture liquid by secretion or diffusion. It is more active in alkaline than in acid media, and its activity also appears to increase with the age of the culture of the fungus.—A. S.

Tartaric acid; Determination of —— *in presence of malic and succinic acids.* J. von Ferentzy. *See* XXIII.

Patents.

Malting grain; Apparatus for ——. J. Sleeman, Portishead, Somerset. Eng. Pat. 19,140, Aug. 27, 1906.

The apparatus, which is of the type described in Eng. Pat. 18,412 of 1898 (this J., 1899, 936), consists of a cylindrical vessel with perforated walls, and containing a central air-pipe. The ends of the air-pipe are narrower than the middle portion, and the latter portion is perforated. Annular movable plates are provided in the space between the outer walls and the central pipe, so that a chamber is formed between the outer casing and the narrow ends of the air pipe. The apparatus is mounted so that it can be rotated. By removing the upper annular plate, after the apparatus has been filled with grain in the space between the plates, and rotating the whole apparatus, the grain falls into the wide chamber where it is separated or dispersed; the walls of the outer vessel and of the central pipe are not perforated where they form the sides of this dispersing chamber. Air is supplied to the central pipe by suitable connections. Other modifications of the apparatus are described.—W. P. S.

Malt; Apparatus for the production of ——. W. P. Rice. Fr. Pat. 379,639, July 2, 1907.

See Eng. Pat. 14,103 of 1905; this J., 1905, 1318.—W. P. S.

Brewing beer. C. Zimmer, Barcelona, Spain. Eng. Pat. 23,678, Oct. 24, 1906.

See Fr. Pat. 370,728 of 1906; this J., 1907, 270. Reference is directed under Sect. 1, Sub-sect. 6, of the Patents Act, 1902, to Eng. Pats. 26,655 of 1896 and 21,721 and 21,731 of 1902.—T. F. B.

Beer wort; Manufacture of ——. J. G. Maardt, Hellerup, Denmark. Eng. Pat. 28,920, Dec. 18, 1906.

See Fr. Pat. 371,650 of 1906 and Addition thereto; this J., 1907, 428 and 708.—T. F. B,

Saccharine juices for fermentation; Process of sulphitation and desulphitation of ——. E. A. Barbet. Third Addition, dated Aug. 28, 1906, to Fr. Pat. 361,869, Oct. 27, 1905 (this J., 1907, 29, 109 and 708).

In the application of this process for the manufacture of red wines, the juice of the grapes is caused to absorb about 1 grm. of sulphurous acid per litre. This juice is then mixed with the skins of the grapes from which it was pressed, so that a distribution of the sulphurous acid takes place. After digestion for several days, the colouring matter of the skins is bleached and dissolved by the sulphited juice. The juice is then pressed out in the usual manner and is preserved until required for fermentation. Before this takes place, the juice is desulphited and the red colour is thereby restored. The marcs may be preserved, if protected from the air, and are exhausted with water at the time of the desulphitation of the juice, the exhausted residues serving as fodder for cattle.—J. F. B.

Volatile substances [spirits]; Purifying ——. J. U. Lloyd, Norwood, Ohio. U.S. Pat. 869,375, Oct. 29, 1907.

"High wines" are separated from fusel oil by heating the upper surface only of the liquid and keeping the body of the liquid cool; in this way the more volatile portions only are driven off and the less volatile retained. —W. H. C.

Brandy; Apparatus for the continuous distillation of fine ——. E. A. Barbet. First Addition, dated Aug. 30, 1906, to Fr. Pat. 376,352, June 9, 1906 (this J., 1907, 1024).

The chief improvement consists in placing a separate retort on the top of the plate column, D^1 (see fig., *loc. cit.*), this retort being heated at the bottom by means of the vapours in D^1. The brandy from the column, F, drawn off through the cock, M, instead of being sent to the condenser, is passed into this new retort and there undergoes a second "repasse" in order to eliminate a certain proportion of the "tail" products. A second improvement relates to the distillation of acid wines, in which case the vapours are treated with an alkaline reagent before passing into the rectifying column, F. Four modified types of the still are described.—J. F. B.

Distillation of wine and other fermented liquors to obtain brandy and other spirits; Process for the ——. J. N. Watt. Fr. Pat. 379,551, April 23, 1907.

See U.S. Pat. 851,718 of 1907; this J., 1907, 630.—T. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A.)—FOODS.

Milk; Heat value of —— *as a test of its quality.* J. Malcolm and A. A. Hall. J. Agric. Science, 1907, 2, 89—95.

The results of the determination of the "caloric value" of 43 samples of milk in a Berthelot-Mahler bomb calorimeter are given, determinations being also made in certain cases after diluting the milk with water. The results show that the "caloric value" of milk would be useful in detecting the removal of fat, or dilution with water. The minimal "caloric values" to correspond with the present legal standard for milk would appear to be 650 cals. per c.c., or 5650 cals. per grm. of total solids. —A. S.

Patents.

Butter; Process of rendering vegetable —— capable of being spread. P. Kolesch, Cannstatt, Germany. Eng. Pat. 18,499, Aug. 15, 1907.

Vegetable butter, prepared from cocoanut oil, palm oil or the like, is mixed at a temperature slightly above the normal, with from 7 to 9 per cent. of alcohol (96 per cent.), and the mixture is stirred until set.—W. P. S.

Butter; Process for determining the percentage of water in ——. G. E. Patrick, Ames, Iowa. U.S. Pat. 864,913, Sep. 3, 1907.

A weighed portion of the butter is heated in an aluminium beaker over an Argand burner until most of the water has boiled away and the final foaming has taken place. —W. P. S.

Butter; Manufacture of ——. A. H. Borgström, Hangö, Russia. U.S. Pat. 870,217, Nov. 5, 1907.

See Eng. Pat. 6394 of 1907; this J., 1907, 887.—T. F. B.

Acid-albumin or albumose; Preparation of —— from albumin and substances containing albumin. E. Nussbaum. Fr. Pat. 379,689, July 6, 1907.

Albumin, or substances containing albumin such as rice, leguminous seeds, etc., is digested in a dilute solution of phosphoric, lactic, or hydrochloric acid, a quantity of yeast and malt, or maltose, being also added. The digestion is continued for 72 hours at a temperature of 30°—40° C., the mixture being stirred every two hours. The albumose solution is then filtered off and concentrated, or evaporated to dryness. Solutions of acid salts may be used in place of the above-mentioned acids. An example is given in which 20 parts by weight of albumin, 5 parts of malt, maltose or other sugar, and 1 part of yeast are treated with 200 parts by weight of a 1 per cent. solution of sodium phosphate.—W. P. S.

Fat from albumin; Process for the separation of —— in the determination of fat in milk and other substances. A. Sichler. Ger. Pat. 184,639, Dec. 11, 1903.

The claim is for the addition of a tribasic phosphate to the solvent used for extracting the fat. This addition is stated to render the casein soluble in water, and to precipitate lactalbumin free from fat.—A. S.

Fat in milk and other dairy products; Process for the alkali-butyrometric determination of ——. A. Sichler. Ger. Pat. 187,810, Feb. 21, 1906. Addition to Ger. Pat. 187,809, Jan. 11, 1905.

The claim is for adding to the milk, besides isobutyl alcohol, a tartrate and free alkali, a mono- or dibasic, neutral, indifferent salt, for the purpose of increasing the specific gravity of the aqueous solution. *Example.* 11 c.c. of an aqueous solution containing, per 1000 parts, about 90 parts of sodium hydroxide, 70 parts of sodium chloride, and 70 parts of sodium-potassium tartrate, are introduced into a butyrometer together with 10 c.c. of milk, and 0·6 c.c. of isobutyl alcohol, preferably coloured. After shaking and warming on the water-bath at 40°—45° C., the isobutyl alcohol solution of the milk fat is separated by centrifugalising. (See also Fr. Pat. 362,444; this J., 1906, 716.)—A. S.

Saccharine juices, etc. Third Addition to Fr. Pat. 361,869. [*See* XVII.

(B.)—SANITATION; WATER PURIFICATION.

Carbon monoxide in atmospheric air; Determination of ——. J. L. R. Morgan and J. E. McWhorter. J. Amer. Chem. Soc., 1907, 29, 1589—1592.

In the determination of carbon monoxide in air by Kinnicutt and Sandford's method (which is based upon the reaction: $I_2O_5 + 5OC = 5CO_2 + I_2$, the liberated iodine being absorbed by potassium iodide solution and titrated with $N/1000$ sodium thiosulphate) (this J., 1900, 275), the authors found, that to get good results, the junctions between the iodine pentoxide U-tube and the other portions of the apparatus must be made by sealing the glass; the use of lubricated glass stoppers is not permissible, since, at the temperature employed (150° C.), or even lower, all animal fats react violently, even explosively, with iodine pentoxide, and a trace of organic matter coming in contact with the pentoxide would give high results. The authors subsequently used a modification of the method which consists in passing the iodine-free gas from the potassium iodide tube through a long test-tube containing 50 c.c. of barium hydroxide solution of known strength and titrating the excess of the hydroxide with oxalic acid, using phenolphthalein as indicator. Experiments showed that titrating the iodine absorbed by the potassium iodide, and the carbon dioxide absorbed by the barium hydroxide, yield concordant results. By placing another tube of barium hydroxide solution in front of the potash and sulphuric acid tubes used for purifying the air prior to its entrance into the pentoxide U-tube, determinations of carbon monoxide and dioxide may be effected simultaneously.—L. E.

Water; Improvement of —— for domestic and industrial purposes by means of alumino-silicates or artificial zeolites. R. Gans. J. Gasbeleucht., 1907, 50, 1026—1029.

Further evidence is given of the usefulness of aluminium silicates (see this J., 1907, 711) for improving water supplies. Iron and manganese are removed completely by passing the water through a filter composed of calcium-aluminium silicate. A hard water may be softened by filtration through sodium-aluminium silicate, the latter material also removing any iron, manganese, and ammonia which may be present in the water. In supplies where the hardness is due chiefly to calcium sulphate, the water is passed successively through layers consisting of strontium-aluminium silicate and calcium-aluminium silicate. —W. P. S.

Patents.

Waste water; Purifying ——. L. C. Girerd and J. Drapier, Paris. Eng. Pat. 24,172, Oct. 30, 1906.

See Fr. Pat. 366,614 of 1906; this J., 1906, 1063.—T. F. B.

Liquids [water]; Apparatus for the purification, decantation, and treatment of ——. W. Reeves and B. Bramwell, Belfast. Eng. Pat. 19,005, Aug. 23, 1907.

The apparatus consists of four, or more, cylindrical tanks of gradually increasing diameter, placed within one another so as to form a tier. The water is delivered to a mixing tray connected with a central pipe in the upper and smallest tank; this pipe allows the water to enter the bottom of the tank. The chemicals with which it is desired to treat the water are added to the mixing tray. The water then rises in the tank, overflows the upper edge into a trough, whence it is conducted by a pipe to the central pipe in the next lower tank, and so on through the whole apparatus. The water may receive further chemical treatment in the second tank. Valves, operated by a central rod and lever, are placed at the bottom of each tank for the discharge of the settled mud, etc.—W. P. S.

Liquids from solids or matter held in suspension [sewage]; Method of and apparatus for separating ——. F. E. Whitham, Sowerby Bridge, Yorks. Eng. Pat. 28,977, Dec. 19, 1906.

In treating sewage, trade effluents, or the like, the liquid containing matter in suspension is passed horizontally through narrow inlets or channels into one or more series of separating chambers. Each chamber contains a central midfeather, or division plate, having suitable curved vanes for creating eddies, whereby the liquid deposits a portion of its suspended matter into a settling tube or hopper placed underneath. Before passing into the separating chambers the effluent may proceed by way of a tank, also containing a central division plate, which prevents the scum from entering the separating chambers. A vertical or ascending flow may be used instead of a horizontal one. In this case the chambers contain inclined plates surmounted by a double curved plate for creating the eddies. Each chamber then has an opening at the base of the inclined plate, through which the precipitated matter is discharged into vertical hoppers.—O. R.

Sewage matter and the like ; Treatment of —— for separating floating material from liquids. T. Lewicki, Warsaw, Russia. Eng. Pat. 17,325, July 29, 1907.

The sewage, or other liquid, is conducted through a number of channels into compartments formed by vertical partitions in a tank. These partitions extend to a certain depth in the tank and below them is a funnel-shaped settling chamber. After passing downwards through the compartments, the liquid flows through the settling chamber and then upwards through a similar set of compartments at the top of which are situated a number of discharge channels. The height of the latter channels is adjustable, and an outlet is provided at the bottom of the settling chamber.—W. P. S.

Sewage sludges ; Treatment of ——. F. M. and H. Spence, Manchester, and R. Ockel, Lower Walton, Assignors to Peter Spence and Sons, Ltd., Manchester. U.S. Pat. 869,272, Oct. 29, 1907.

See Eng. Pat. 8347 of 1905 ; this J., 1906, 333.—T. F. B.

Fertilisers, etc. Eng. Pat. 15,922. *See* XV.

(*C.*)—DISINFECTANTS.

PATENT.

Naphthalene and sulphur ; Manufacture of a preparation of —— yielding naphthalene and free sulphur. Rütgerswerke Akt.-Ges. Fr. Pat. 379,559, May 14, 1907.

Naphthalene and sulphur, preferably in equal parts by weight, are fused together, and the mixture is allowed to cool. The product is apparently a solid solution of sulphur in naphthalene, and may be used as a disinfectant or insecticide, etc., or sulphur in a finely-divided state may be obtained from it by treatment with a suitable solvent, *e.g.*, alcohol, or by heating it moderately in a current of gas. The formation of this combination of naphthalene and sulphur may be utilised for the extraction of sulphur, for example from spent gas-purifying material, the latter being treated with fused naphthalene which dissolves the sulphur.—A. S.

XIX.—PAPER, PASTEBOARD, &c.

PATENT.

Marbling paper. F. A. Bayer, Aschaffenburg-Damm and Passauer Mech. Papierfabr., Erlau, Germany. Eng. Pat. 27,788, Dec. 6, 1906.

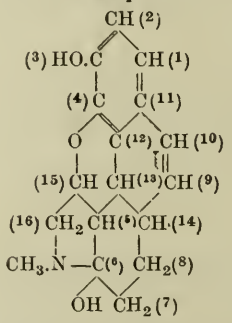
The temporary unevenness of the waterleaf whilst moving forward on the wire of a paper-making machine is made use of in obtaining marbling which possesses a relief effect. An automatic spraying apparatus is provided, which ejects colour at an acute angle on to the waterleaf immediately after it has reached the first suction-box. The waterleaf, the higher parts of which are thus more deeply coloured than the lower parts, then passes between the couch rolls, and the manufacture of the paper proceeds as usual.—P. F. C.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

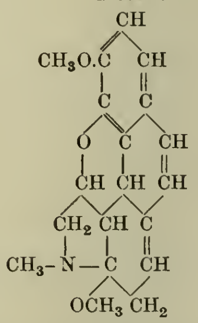
Morphine and thebaïne ; Constitution of ——. H. T. Bucherer. J. prakt. Chem., 1907, 76, 428—432.

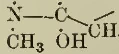
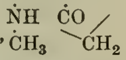
As the result of an investigation of the action of sulphurous acid on pyridine and its derivatives and on morphine and thebaïne, the author proposes the following formulæ for the two alkaloids mentioned :—

Morphine.



Thebaïne.



The ready conversion of the alkaloids (tertiary bases) into secondary bases becomes intelligible, with the formulæ given, in view of the known transformation (*e.g.*, conversion of quinine into quinotoxine) of the carbon-nitrogen linkage,  $\dot{N}(\dot{C}H_3)—\dot{C}(\dot{O}H)—CH_2$, into the configuration,  $\dot{N}H(\dot{C}H_3)\ \dot{C}O—CH_2$, whereby, in part, ketonic compounds (thebaïnone and codeïnone) are formed, and in part, the alcoholic hydroxyl is converted into a phenolic one. Various other facts not hitherto capable of clear explanation are discussed in the light of the proposed formulæ, and shown to be in accord therewith.—A. S.

Strychnine and bismuth ; Crystallised double iodide of ——. M. E. Pozzi-Escot. Ann. Chim. anal. appl., 1907, 12, 357.

On adding a concentrated or dilute solution of strychnine to a very dilute, and but slightly alcoholic solution of bismuth trichloride, in presence of a large excess of potassium iodide and hydrochloric acid, a crystallised double iodide of bismuth and strychnine is produced. It is a heavy precipitate of chocolate-brown colour, becoming very quickly crystalline. Most other alkaloids give amorphous precipitates under similar conditions. If the test-tube containing the strychnine precipitate be moved to and fro, a brilliant dichroïc appearance is observed. Under the microscope the precipitate is very clearly seen to consist of prismatic needles, and it is suggested that this may be made to serve as a characteristic test for the identification of strychnine.—A. S.

Cocaine and bismuth ; Double iodide of ——. M. E. Pozzi-Escot. Ann. Chim. anal. appl., 1907, 12, 358.

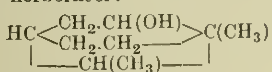
The double iodide of bismuth and cocaine usually separates in an amorphous condition, but when prepared by the method described in the preceding abstract, the precipitate becomes crystalline after some hours, especially when exposed to light. Under the microscope it appears as a conglomerate of red needles. It is soluble in alcohol forming an orange-yellow solution. These crystals cannot be obtained by an evaporation process. A very characteristic micro-chemical reaction for cocaine is thus obtained.—A. S.

Alkaloids ; Determination of —— by means of picrolonic acid (dinitrophenylmethylpyrazolone). H. Matthes and O. Rammstedt. Z. anal. Chem., 1907, 46, 565—574.

The use of picrolonic acid (dinitrophenylmethylpyrazolone, $C_{10}H_8N_4O_5$) as a precipitant for alkaloids and other bases was first suggested by Knorr (Ber., 1897, 30, 917). The authors have used this acid for the estimation of narcotine, codeine, and morphine contained in tablets and solutions, and in powders with sugar. The preparation is dissolved in the least possible amount of water and treated with a slight excess of a $N/10$ solution of picrolonic acid in alcohol. After standing for 15 hours at 10°—15° C., the precipitate is collected and well drained on a Gooch crucible, washed with a very little water, dried at 110° C., and weighed. The melting point of the precipitate will indicate its identity and also its purity. Cotarnine picrolonate, mol. wt. 501, melts at 205°—210° C.; codeine picrolonate, mol. wt. 563, melts at about 225° C.; morphine picrolonate, mol. wt. 549, melts between 200° and 210° C. Sufficiently accurate results were obtained with 0·01 to 0·05 grm. of the alkaloid salt in 10 c.c. of water. (See also this J., 1907, 483 and 1213.)—F. Shdn.

Essential oils. (*Teresantalic acid and a new norcamphor.*) F. W. Semmler and K. Bartelt. Ber., 1907, **40**, 4465—4472.

Teresantalic acid was boiled in a reflux apparatus with pure formic acid. The liquid was poured into water, taken up with ether, and the ethereal solution shaken with sodium carbonate. The ether was then distilled off, leaving a residue which was separated into two fractions by distillation under reduced pressure. The high-boiling fraction remained behind as a solid, and was shown to be a lactone. The low-boiling fraction proved to be π-norborneol formate, $C_{10}H_{16}O_2$, boiling at 87°—94° C. at 9 mm., with the sp. gr. 1·0092 at 20° C., $n_D = 1·46559$, and $\alpha_D = -10°15'$ in a 100 mm. tube. On hydrolysing with alcoholic potassium hydroxide, π-norborneol, $C_9H_{16}O$ was obtained. This, distilled *in vacuo*, passed over undecomposed and at once solidified. The boiling point was 87°—88° C., and melting point, 68°—70° C. Both this acohol and its acetate are optically inactive. Oxidation with chromic acid in acetic acid produced π-norcamphor, $C_9H_{14}O$, boiling at 75°—76° C. at 9 mm., with the sp. gr. 0·966 at 20° C., and $n_D = 1·46900$. It is optically inactive and melts at about 30° C. When dissolved in ether and treated with sodium and isoamyl formate, the oxymethylene compound, $C_{10}H_{14}O_2$, is produced. This boils at 110°—113° C. at 9 mm., has the sp. gr. 1·066 at 20° C., and $n_D = 1·50045$. It gives a strong bluish-violet coloration with ferric chloride, and is dissolved by alkalis, being liberated on the addition of acids. When the ketone is reduced with sodium and alcohol, π-norisoborneol, $C_9H_{16}O$, is produced, boiling at 88° C. at 9 mm., and melting at 91°—92° C. The lactone obtained with the norborneol formate (see above) melts at 190° C., and has the composition, $C_{10}H_{14}O_2$. On reduction with sodium and alcohol, it forms a glycol, $C_{10}H_{18}O_2$, melting at 254° C. The acid corresponding to the lactone melts at 196° C., and its methyl ester, $C_{11}H_{18}O_3$, boils at 125° C. at 9 mm., has the sp. gr. 1·098 at 20° C., and $n_D = 1·48616$. As shewn already by Müller (Arch. Pharm., 1900, 238, 376), the hydrochloric acid addition product of teresantalic acid when treated with dilute sodium hydroxide solution, yields a lactone, $C_{10}H_{14}O_2$, melting at 103° C. This gives a glycol, $C_{10}H_{18}O_2$, boiling at 160°—163° C. at 10 mm., and an acid, $C_{10}H_{16}O_3$, melting at 159° C., the methyl ester of which boils at 120°—123° C. at 9 mm. and has the sp. gr. 1·089 at 20° C., and $n_D = 1·48228$. Constitutional formulæ of these substances are given, the following being that of π-norborneol :—



$$HC \begin{matrix} < CH_2.CH(OH) > \\ < CH_2.CH_2 \text{———} > \\ \text{———} CH(CH_3) \text{———} \end{matrix} C(CH_3)$$

(See also this J., 1907, 890.)—F. Shdn.

Acetamide ; Preparation of —— from ammonium hydroxide and ethyl acetate. I. K. and M. A. Phelps. Amer. J. Sci., 1907, **24**, 429—432.

The theoretical yield of acetamide may be obtained by saturating a mixture of ethyl acetate and ammonium hydroxide with ammonia gas at —10° C. and allowing it to stand for 4—6 days. A weaker solution requires a longer time, but the final result is the same. The acetamide may be isolated by fractionation *in vacuo*, without appreciable loss and practically free from ammonium salts. It must not be dried in a desiccator over sulphuric acid.—F. Sodn.

Patents.

Iodine preparations [*Esters of mono-iodo-fatty acids*] ; *Manufacture of* ——. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 2484, Jan. 31, 1907.

See Fr. Pat. 374,231 of 1907 ; this J., 1907, 778.—T. F. B.

Salicylic acid glycerine ester ; Process for the production of ——. C. Sorger, Frankfurt a/Main, Germany. Eng. Pat. 3367, Feb. 11, 1907.

See Fr. Pat. 373,854 of 1907 ; this J., 1907, 778.—T. F. B.

Oxalates from the corresponding formates ; Process for manufacturing —— by heating in a space from which the air has been partially exhausted. Elektrochemische Werke, Bitterfeld, Germany. Eng. Pat. 19,943, Sept. 6, 1907. Under Int. Conv., Oct. 13, 1906.

Formates are converted smoothly and rapidly into the corresponding oxalates by heating them in a vessel in which partial vacuum obtains, to a temperature below 360° C. (preferably about 280° C.). Processes such as those described in Eng. Pats. 26,172 of 1897 and 9327 of 1903 are said to be improved by working *in vacuo*, but the conversion is best accomplished by heating the formate alone. (See this J., 1898, 1146, and 1904, 203.) —T. F. B.

Alcohol ; Apparatus for producing —— [*synthetically*]. F. H. Bowly, Assignor to F. L. Wellman, W. W. Gooch, and W. G. Demarest, New York. U.S. Pat. 866,426, Sept. 17, 1907.

The apparatus consists of an acetylene generator into which hydrogen is injected, an absorption drum, and a still. Acetylene is produced in the generator and combines with the hydrogen ; the resulting ethylene is conducted to a revolving drum containing sulphuric acid. When sufficient absorption has taken place, the acid solution is drawn off into the still, diluted with water, and the alcohol is distilled off. The sulphuric acid may be recovered again for further use. The revolving drum is provided with interior pockets, and the ethylene is introduced through a hollow central shaft.—W. P. S.

Borate of hexamethylenetetramine and process of making same. O. Mankiewicz and J. Altschul, Berlin, and W. Urban, Assignors to Act.-Ges. f. Anilinfabr., Wilmersdorf, Germany. U.S. Pat. 869,636, Oct. 29, 1907.

See Fr. Pat. 363,764 of 1906 ; this J., 1906, 867.—T. F. B.

Carbon tetrachloride ; Process of producing ——. F. J. Maywald, New York. U.S. Pat. 870,518, Nov. 5, 1907.

This process for the production of carbon tetrachloride consists in passing chlorine through an incandescent mass of carbon or coke, and removing the products of the reaction as fast as they are formed and condensing them. The carbon may be heated by an electric current. —F. Shdn.

Camphene ; Manufacture of ——. F. Koch, London. U.S. Pat. 870,829, Nov. 12, 1907.

See Eng. Pat. 22,810 of 1906 ; this J., 1907, 343.—T. F. B.

Isoborneol esters ; Manufacture of ——. Clayton Aniline Co., Ltd. First Addition, dated May 16, 1907, to Fr. Pat. 375,007, Feb. 19, 1907.

See Eng. Pat. 10,798 of 1906 ; this J., 1907, 343.—T. F. B.

Isoborneol esters ; Manufacture of ——. Clayton Aniline Co., Ltd. Fr. Pat. 379,687, July 6, 1907. Under Int. Conv., Aug. 14, 1906.

See Eng. Pat. 18,280 of 1906 ; this J., 1907, 947.—T. F. B.

Esters of cyclic terpene alcohols of the formula $C_{10}H_{17}OH$; *Process for preparing acid* ——. O. Zeitschel. Fr. Pat. 379,430, July 1, 1907.

Turpentine oil, or other material containing terpene alcohols of the formula, $C_{10}H_{17}OH$, is heated with only sufficient of an organic acid (preferably anhydrous) or its anhydride to combine with the alcohol. For example, 136 kilos. of French terpentine oil is heated with 60 kilos.

of glacial acetic acid, for five hours at 200° C. in an autoclave. Any excess of acid is removed, and the product is fractionated; the products are said to consist of camphene (10 to 15 per cent.), dipentene (30 to 40 per cent.), and isobornyl acetate (about 40 per cent.).—T. F. B.

Aluminium salts; Production of insoluble organic ——. Chem. Werke F. Friedlaender. Fr. Pat. 379,547, April 8, 1907.

INSOLUBLE basic salts of aluminium can be produced by allowing aluminium oxide or hydroxide to interact with an organic acid or its anhydride. The reaction may be accelerated by a moderate amount of heat, or it may take place in a closed vessel. The preparation of the basic formate, acetate, acetoformate, and acetotartrate of aluminium is described.—F. SHDN.

Ferro-albumins; Preparation of "organo-mineralates" [glycerophosphoric acid compounds] of ——. P. Hoering. Fr. Pat. 379,693, July 6, 1907. Under Int. Conv., July 8, 1906, and Feb. 23, 1907.

WHITE of egg, or casein, is treated with excess of ferric chloride, the precipitate is collected, washed, and dissolved in a dilute solution of sodium glycerophosphate. The resulting solution is then evaporated in the form of thin films. The casein or albumin may be also treated direct with a solution of iron glycerophosphate, and the precipitate afterwards dissolved in sodium hydroxide solution, or the protein may be partially neutralised with sodium hydroxide, then treated with the iron glycerophosphate, and the solution evaporated. The dry product obtained by the above methods contains from 0·75 to 4·2 per cent. of iron and from 1·5 to 2·0 per cent. of phosphorus.—W. P. S.

Benzoic aldehyde and acid; Catalytic production of ——. J. Chavy, M. Delage, and P. Woog. Fr. Pat. 379,715, July 8, 1907.

BENZOIC aldehyde can be made by passing a current of air charged with the vapour of toluene through a chamber containing a catalyser, such as oxide of iron, and heated between 150° and 300° C. To obtain benzoic acid, porous carbon is used as the catalyser, and the reaction takes place at a somewhat higher temperature.—F. SHDN.

a-Methylimidazole; Process for preparing ——. F. Knoop and A. Windaus. Ger. Pat. 183,588, Feb. 21, 1905.

a-METHYLIMIDAZOLE is obtained by the action of ammonia, at the ordinary temperature, on hexoses in presence of a metallic hydroxide (hydroxides of zinc, cadmium, or the alkali metals are suitable). It is probable that formaldehyde and methylglyoxal are the first products, the latter reacting with the ammonia to form the imidazole ring.
—T. F. B.

Narceine and homonarceine derivatives; Process for preparing ——. Knoll und Co. Ger. Pat. 183,589, May 20, 1905. Addition to Ger. Pat. 174,380, Feb. 8, 1905. (See this J., 1907, 114.)

ALKYL derivatives of narceine or homonarceine are obtained by treating the alkali derivatives of these compounds with alkyl iodides, trimethyl phosphate, methyl nitrate, or other neutral alkylating agents, in molecular proportions.—T. F. B.

Alkylnarceine or alkylhomonarceine and their alkyl esters; Process for preparing addition products from ——. Knoll und Co. Ger. Pat. 186,884, April 20, 1906. Addition to Ger. Pat. 174,380, Feb. 8, 1905. (See this J., 1907, 114; also preceding abstract.)

ALKYL derivatives of narceine or homonarceine, or the alkali-metal derivatives of narceine or homonarceine are treated, either alone or in alcoholic solution, with alkyl halides, dialkyl sulphates, trialkyl phosphates, alkyl nitrates, or benzenesulphonic esters, and the quaternary ammonium compounds thus obtained are esterified; similar results are obtained by esterifying alkylnarceine or alkylhomonarceine, and combining the products with one of the compounds named above.—T. F. B.

Mercurous oxide in colloidal form; Process for preparing solutions containing ——. M. K. Hoffmann. Ger. Pat. 185,599, May 20, 1905.

AQUEOUS solutions of mercurous salts are treated with alkali salts of lysalbinic or protalbinic acid, or salts of other acids of albuminoid derivation or similar acids, in presence of an alkali hydroxide or carbonate, and the colloidal mercurous oxide solutions are purified by dialysis. The solutions thus obtained are said to be stable.—T. F. B.

Mercury in colloidal form; Process for producing preparations containing ——. M. K. Hoffmann. Ger. Pat. 185,600, May 20, 1905.

PREPARATIONS containing colloidal mercury may be made by gently heating the colloidal mercurous oxide preparations described in Ger. Pat. 185,599 (see preceding abstract) with an alkali hydroxide or carbonate, or by reducing such solutions at the ordinary temperature with a suitable reducing agent; the solutions are subsequently dialysed. An alternative method for obtaining these preparations consists in gradually adding aqueous solutions of mercurous salts to solutions of an alkali salt of lysalbinic acid, protalbinic acid, etc., and a reducing agent, which have been made strongly alkaline with an alkali hydroxide or carbonate.—T. F. B.

Pyrimidine derivatives; Process for preparing ——. E. Merck. Ger. Pat. 185,963, July 6, 1905.

THE alkali- or alkaline-earth metal derivatives of acetylene are employed as condensing agents in the production of pyrimidine derivatives from urea, thiourea, guanidine, or their derivatives, on the one hand, and malonic esters, malonaminic esters, malonitriles, cyanoacetic esters, or their derivatives on the other hand. (Compare Eng. Pat. 26,061 of 1901; this J., 1902, 608.)—T. F. B.

2-Alkyliminopyrimidines; Process for preparing ——. E. Merck. Ger. Pat. 186,456, Aug. 27, 1905.

MALONYL halides, malonaminic esters, cyanoacetic esters, or their derivatives are condensed with guanidine derivatives of the formula, $(NH_2)_2 : C : NX$, X being an alkyl or aryl group, with or without alkaline condensing agents. The resulting 2-alkyliminopyrimidines are converted by hydrolysis into barbituric acids.—T. F. B.

5-Dialkyl-2-thio-4.6-dioxypyrimidines; Process for preparing ——. E. Merck. Ger. Pat. 182,764, May 13, 1905. Addition to Ger. Pat. 146,949, Feb. 27, 1903.

BY condensing thiourea with dialkylmalonyl chlorides, 5-dialkyl-2-thio-4.6-dioxypyrimidines are obtained.
—T. F. B.

Thebaine derivatives; Process for preparing ——. M. Freund. Ger. Pat. 181,510, Oct. 7, 1905.

THE products obtained by the action of organo-magnesium compounds on thebaine in ethereal solution are decomposed by water. In order to obtain as complete a decomposition as possible, excess of the magnesium compound should be used. The products, which possess both acidic and basic powers, are said to be of medicinal value.—T. F. B.

Santalol esters; Process for preparing ——. Chem. Fabr. von Heyden. Ger. Pat. 182,627, Feb. 13, 1906.

SANTALOL is combined in the usual manner, with fatty acids of the formula, $C_nH_{2n}O_2$ or $C_nH_{2n-2}O_2$, where *n* is not less than 5. These esters are said to be free from the objectionable taste of santalol and its esters with lower fatty acids.—T. F. B.

Acetyl morphines; Process for preparing sulphonic acids of ——. Knoll und Co. Ger. Pat. 185,601, May 3, 1906. Addition to Ger. Pat. 175,068, May 24, 1905. (See this J., 1907, 114.)

SULPHONIC acids of acetyl derivatives of morphine are obtained by the action of a mixture of sulphuric acid and acetic anhydride on morphine or its monoalkyl-, mono- or diacyl- or alkylacyl-derivatives, the temperature being kept so low that no sulpho-acetic acid is formed.—T. F. B.

Hydrogen peroxide solutions; Process for transforming —— into solid, stable form. C. R. Böhm and H. Leyden. Ger. Pat. 185,597, June 8, 1906.

Hydrogen peroxide solutions are warmed with gelatin (or other substance which melts at a similarly low temperature) and a small quantity of glycerin, and the product is allowed to set.—T. F. B.

Amino-ethers of primary alcohols; Process for preparing ——. E. Merck. Ger. Pat. 184,968, Sept. 15, 1906.

Secondary amines are condensed with halogen derivatives of ethers of the general formula $X.(CH_2)_xO.R$, X being a halogen atom, and R an aryl or substituted aryl group. The tertiary amino-ethers thus produced are chiefly of value in medicine, especially as anæsthetics. Among the products described are those derived from dimethylamine, piperidine, and camphidine on the one hand, and guaiacyl-, phenyl-, menthyl-, and thymyl-alkyl ethers on the other hand.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Photometers [for photographic purposes]. J. E. Evans-Jackson, London. From H. Bryhni, Börsen, Norway. Eng. Pat. 19,768, Sept. 4, 1907.

The invention relates especially to devices for indicating the intensity of light for the purpose of determining the time of exposure required for a photographic plate or film, and it is based on the fact that the diameter of the pupil of the eye changes according to the intensity of the light. In one form of the apparatus, a lens, on which a scale is marked, is mounted a short fixed distance above a mirror, so that an image of the scale and of the pupil of the eye can be simultaneously observed on the mirror. In a second modification, a mirror, and an opening closed by a glass plate, are arranged on opposite sides of a closed box, which in one of its other sides has an adjustable opening through which light is admitted. Two marks are provided on the glass plate, and the adjustable opening is so regulated that, as observed in the mirror, the pupil of the eye is of a diameter equal to the distance between the marks. Tables may be provided for calculating the required time of exposure for a given plate from the observed size of the pupil of the eye in the first form of apparatus or from the size of the adjustable opening in the second form.—A. S.

Photography; Sensitised surfaces for use in ——. T. Bolas, Chiswick. Eng. Pat. 24,667, Nov. 3, 1906.

This invention relates to self-developing plates or films. The alkaline and reducing constituents of the developer may be separated by a neutral or acid paint-like material (*e.g.*, a paste of barium or calcium sulphate and gum), or they may be separated by the support which holds the sensitive surface, or by a separate sheet. The reducing agent may, in some cases, be painted in a narrow margin on the sensitive surface. The use of hydroxylamine salts as reducing agents for this purpose, in conjunction with an ammonium salt as a preservative, is claimed. Sugar-like substances, such as mannitol and erythritol, sulphites, and organic acids are also claimed as preservatives, and the use of bicarbonates is claimed for the alkaline portion of the developer. Reference is made to Eng. Pats. 1201 of 1888 and 22,727 of 1901 (see this J., 1888, 401, and 1902, 1411).—T. F. B.

Photographic films; Manufacture of ——. A. J. Boult, London. From Soc. des Plaques et Papiers Photographiques A. Lumière et ses fils, Lyon, France. Eng. Pat. 7132, March 25, 1907.

See Fr. Pat. 375,433 of 1907; this J., 1907, 1029.—T. F. B.

Films for photography and other purposes; Manufacture of ——. Soc. Anon. de Cellulose-Coton pour Poudres Blanches de Guerre et Celluloid. Fr. Pat. 379,421, June 29, 1907.

Casein (20 grms.) is dissolved in glacial acetic acid (100 grms.), and a small quantity (2–4 grms.) of benzoic acid is added; the solution is then coagulated by adding hexamethylenetetramine (2 grms.). To prepare films from this, it is dissolved in chloroform or other suitable solvent, and the solution is run on to glass, and allowed to evaporate in the usual manner.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Cellulose; Nitration of ——, and denitration of cellulose nitrates by mixed acid. E. Berl and R. Klaye. Z. ges. Schiess- und Sprengstoffw., 1907, 2, 403—406.

The incomplete nitration of cellulose, *i.e.*, the failure to obtain with mixed acid a nitrated cellulose containing more than about 13·5 per cent. of nitrogen as against the theoretical 14·14 per cent., is regarded as being due to the hydrolytic action of the sulphuric and nitric acids. According to this view, with a given mixed acid, the same condition of equilibrium between the nitrating action of the acid and the hydrolytic action on the cellulose nitrates, should always be attained, whether starting from cellulose or from highly-nitrated cellulose. In the light of these views, the authors carried out some experiments with cellulose and with three different specimens of nitrocellulose and of mixed acid. The characters of the nitrocelluloses and of the mixed acids were as follows:—

Nitrocellulose.	Nitrogen. Per cent.	Viscosity in 2 per cent. acetone solution.	Solubility in ether-alcohol.
I	13·50	10,000	1·2%
II.	12·75	2320	90%
III.	10·93	103	97·1%

Mixed acid:	HNO_3.	H_2SO_4.	H_2O.
	per cent.	per cent.	per cent.
I.	44·88	43·62	11·50
II.	41·64	40·42	18·00
III.	40·64	39·51	19·85

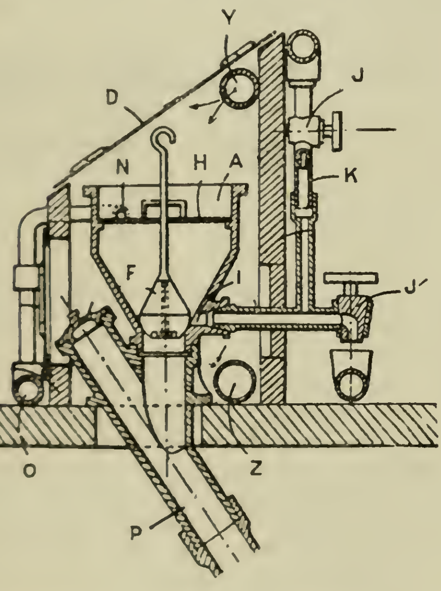
In the experiments the ratio of cellulose-derivative to acid was 1 : 80, in order to avoid, as far as possible, any considerable alteration of the composition of the acid. A comparison of the nitration of cellulose and the partial denitration of the nitrocellulose I. by means of the mixed acid II., showed that invariably the product formed by denitration contained somewhat more nitrogen (12·27—12·57 per cent.) than that formed by nitration (11·65—12 per cent.). Microscopic examination showed that this was due to incomplete attack of the fibres of the highly-nitrated product by the mixed acid. The viscosity of the products decreased with increase of the time of nitration and of temperature. The denitration of the highly nitrated product was also accompanied by a decrease of viscosity. The products formed by nitration were all completely soluble in ether-alcohol, whilst with those formed by denitration, the solubility increased with the duration of the reaction, whilst concurrently the viscosity decreased, although the nitrogen content remained almost unaltered. It would thus appear that nitrocelluloses of equal nitrogen-content may be soluble or insoluble in ether-alcohol, according to the degree of complexity of the molecules. Similar comparative experiments on the nitration of cellulose and the denitration of the nitrocelluloses I. and II. by means of the mixed acid III., gave analogous results with respect to the nitrogen-content and viscosity of the products, but the latter were all completely soluble in ether-alcohol. A third set of experiments covered the nitration of pure cellulose and of the nitrocelluloses II. and III. by means of the mixed acid I. The nitrogen-content of the products was approximately the same in all cases. The solubility of the nitrocelluloses II. and III. in ether-alcohol was strongly diminished by the action of the mixed acid, and would thus appear to bear a relation to the number of nitric acid residues in the molecule. The solubility was, however, greater than would have been expected from the nitrogen-content of the products, and this, together with the low viscosity points to a breaking-down of the molecules by the action of the acid.—A. S.

PATENTS.

Explosives for charging projectiles. Schneider et Cie. Fr. Pat. 379,506, Sept. 10, 1906.

AMMONIUM nitrate and organic nitro derivatives when used in the compressed state as charges for projectiles are somewhat difficult to detonate with certainty. It is said that an addition of from 10 to 15 per cent. of carborundum or ferrosilicon ensures the transmission of the explosion wave throughout the entire mass of the charge. The carborundum or ferrosilicon may be either intimately mixed with the whole charge of explosive or on the other hand placed in successive layers therein. A third method is to mix these bodies with a small portion of the charge in immediate contact with the detonator, and this allows of a smaller detonator being used than is ordinarily the case.—G. W. McD.

Nitration; Apparatus for ——. H. Diamanti, H. Champin, and P. Loisif. Fr. Pat. 379,509, Sept. 10, 1906.



THE apparatus, which consists of a battery of nitrating vessels placed in a polygonal shaped chamber, is intended especially for carrying out the process described in Fr. Pat. 377,425 of 1906 (this J., 1907, 1066). The accompanying figure is a section of one of the nitrating vessels and its accessories. The nitrating vessel, A, of earthenware is closed at its lower end by a plug, F, provided with a long handle terminating in a hook. The nitrating acid enters the pot, through the opening, I, by turning the cock, J. A glass tube, K, allows the rate of flow to be observed. The vessel can, if necessary, be emptied by opening the cock, J′. The vessel being filled to the required level with acid, a charge of cellulose is introduced through D, and kept pressed down by the perforated aluminium plate, H. When nitration is complete, the cock, J, is turned, and the spent acid displaced by fresh acid and forced through the opening, N, into the tube, O, leading to the acid reservoir. The strong displacing acid is then shut off, and the plug, F, raised by means of a lever, the acid and nitrocellulose passing by the inclined pipe, P, to a perforated funnel. The bulk of the acid flows through the perforations and away to the acid storage tanks, whilst the nitrocellulose, with adherent acid, passes through the stem of the funnel to the centrifugal machines. A current of air at any desired temperature can be introduced into the compartment containing the nitrating vessel by the opening, Y, and discharged at the exit, Z.—G. W. McD.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS.

Standards and definitions adopted by the Institution of Mining and Metallurgy. See X.

PATENTS.

Photometers, etc. Eng. Pat. 19,768. *See* XXI.

Colours; Process for determining ——. F. V. Kallab. Fr. Pat. 379,469, July 2, 1907.

THREE transparent plates or discs are used with bands arranged in the following manner:—

Band.	Red disc.	Yellow disc.	Blue disc.	Result of superposing.
1	red	yellow	blue	Mixed tertiary
2	red	colourless	do.	violet
3	colourless	do.	do.	blue
4	do.	yellow	do.	green
5	do.	do.	colourless	yellow
6	red	do.	do.	orange
7	do.	colourless	do.	red

Each band consists of a graduated shade of colour to which certain numerical values are assigned. When exactly superposed, the primary, secondary and mixed tertiary colours are produced. By moving the discs parallel to each other, any desired colour tint can be produced, and by the use of a fourth disc of a grey colour and with similar bands, further graduations can be obtained.—G. W. McD.

INORGANIC—QUANTITATIVE.

Potassium; Determination of —— *volumetrically, as cobaltinitrite.* W. A. Drushel. Amer. J. Sci., 1907, 24, 433—438.

THE determination of potassium by means of sodium cobaltinitrite is best carried out as follows:—The potassium, in the absence of ammonium salts, is precipitated as potassium-sodium cobaltinitrite by an excess of sodium cobaltinitrite, acidified with acetic acid, and the mixture is evaporated on the steam bath. The precipitate is separated by filtration through asbestos and oxidised by hot standard potassium permanganate solution. The excess of permanganate is destroyed by a standard solution of oxalic acid, the excess of which is then titrated by permanganate. The amount of potash (K_2O) is found by multiplying the oxygen value of the permanganate used by the factor 1·09. No definite concentration of the potassium solution is necessary, and the method may be used in the presence of phosphoric acid; it is, therefore, applicable to the estimation of potassium in fertilisers.—F. SODN.

Mercury; Determination of —— *by means of hydrogen peroxide.* A. Kolb and A. Feldhofen. Z. angew. Chem., 1907, 20, 1977—1980.

MERCURIC chloride is reduced quantitatively to mercurous chloride by hydrogen peroxide in presence of ammonium tartrate. A 5 per cent. solution of mercuric chloride is assayed as follows. To 25 c.c. are added 10 c.c. of $2N$ hydrochloric acid and 25 c.c. of 10 per cent. tartaric acid solution. The liquid is neutralised with concentrated ammonia and rendered very slightly acid again with tartaric acid. After warming up on the water-bath, 10 c.c. of hydrogen peroxide (3 per cent.) are added, followed by further quantities of 5 c.c. at intervals, until 25—30 c.c. have been added within 45 minutes. The liquid is kept for 15 minutes more on the water-bath, then diluted with an equal volume of water and allowed to stand for some little time. The precipitate is then filtered off and either weighed as such or determined by shaking up with $N/_{10}$ iodine solution, together with 10 c.c. of 10 per cent. potassium iodide, and titrating back, first with $N/_{10}$ solution, finally with $N/_{100}$ solution of sodium thiosulphate. This method of determining mercury is shown to work well in presence of arsenic, antimony, tin, cadmium, and bismuth, but not in presence of lead or copper. When nitrates are present, the reduction by means of hydrogen peroxide is retarded, so that the time of reaction must be extended to 3 hours and the quantity of hydrogen peroxide increased to 50 c.c.—W. A. C.

Zinc by electrolysis ; Rapid determination of ——. F. C. Frary. J. Amer. Chem. Soc., 1907, 29, 1596—1603.

The author's experiments show that zinc may be accurately determined as follows:—(1) A current of 4·5 ampères is passed for 30 minutes through a solution containing about 8 grms. of sodium hydroxide and not more than 0·1 grm. of zinc, a platinum spiral and a nickel gauze cylinder being used as anode and cathode respectively. The solution is kept in electromagnetic rotation by a current passing through a solenoid of insulated copper wire which surrounds the beaker containing the solution. The electrolysis should be conducted at as low a temperature as possible and, after electrolysis, the solution must be tested for zinc. (2) If the amount of zinc to be precipitated is between 0·1 and 0·2 grm., the current strength should be 4·5 ampères for 15 minutes and then about 1·5 ampères for 20 minutes, the other conditions being the same as in (1). The author considers that "it is highly improbable that complete precipitation of 0·2 grm. of zinc can be obtained with 5 ampères in 15—20 minutes as stated by Exner (see this J., 1903, 1150) and Ingham." It also seems improbable that "the concordant results obtained by Langness (see this J., 1907, 644) with 10—13 ampères in 3 minutes, represent complete precipitation."—L. E.

Clay analysis : Examination of the residue left after volatilisation of the separated silica with hydrofluoric and sulphuric acids. I. W. R. Bloor. *See* IX.

Carbon monoxide in atmospheric air ; Determination of ——. J. L. R. Morgan and J. E. McWorter. *See* XVIII*B*.

ORGANIC—QUALITATIVE.

Strychnine and bismuth, and cocaine and bismuth ; Crystallised double iodides of ——. M. E. Pozzi-Escot. *See* XX.

ORGANIC—QUANTITATIVE.

Lactic acid in lactates ; Determination of ——. J. Paessler. Collegium, 1907, 388—392 and 396.

The method, which gives good results in some cases where other methods are either useless or too troublesome, depends upon the oxidation of lactates in sulphuric acid solution, by means of standard potassium bichromate solution, when the following reaction takes place:—

$$3C_3H_6O_3 + 2K_2Cr_2O_7 + 8H_2SO_4 =$$
$$2K_2SO_4 + 2Cr_2(SO_4)_3 + 3C_2H_4O_2 + 3CO_2 + 11H_2O.$$

An accurately weighed quantity of the material (about 0·4 grm.), or an aliquot part of the solution after having been made up to a definite volume, is, after suitable dilution, boiled gently for one hour with 10 c.c. of 10 per cent. sulphuric acid and 25 c.c. of *N*/2 potassium bichromate in an Erlenmeyer flask, fitted with a reflux condenser. The excess of potassium bichromate is titrated in the usual manner with *N*/10 sodium thiosulphate solution, after the addition of 10 c.c. of 10 per cent. potassium iodide solution, and one drop of starch paste. 1 c.c. of *N*/2 potassium bichromate corresponds to 0·01127 grm. of lactic acid.

If volatile matters which reduce chromic acid are present, they must be first removed by repeated evaporation. The presence of sugar, dextrin or similar materials renders this method useless, as they reduce chromic acid, and moreover, cannot be separated. Good results are obtained with mixtures of double salts such as antimony calcium lactate and antimony sodium lactate, containing more or less great excess of free lactic acid. In this case, the antimony is first precipitated as sulphide by means of sulphuretted hydrogen, excess of the latter being subsequently expelled by boiling. Lactic anhydride is not oxidised by the above treatment, and if present, must be first converted into lactic acid by heating with a slight excess of alkali.—H. G. B.

Tartaric acid ; Determination of —— *in presence of malic and succinic acids.* J. von Ferentzy. Chem.-Zeit., 1907, 31, 1118.

The process depends on the formation of a basic magnesium tartrate, which is quite insoluble in a mixture of equal parts of alcohol and water, whereas the corresponding succinate and malate are readily soluble in this medium. The solution containing the three acids is evaporated to a small bulk, and sufficient alcohol is added to bring the alcoholic strength up to 50 per cent. Magnesia mixture is then added in quantity corresponding with the tartaric acid contents, together with 10 c.c. of strong ammonia, and the alcoholic strength is again made up to 50 per cent. The liquid is allowed to stand for 12 hours until the crystalline precipitate has fully separated. This is then filtered off and washed with 50 per cent. alcohol ; it is incinerated and weighed as magnesium oxide. One molecule of tartaric acid corresponds to two molecules of magnesium oxide.—J. F. B.

Tanning liquors ; Amount of hide powder for the analysis of ——. W. H. Fox. *See* XIV.

Chromed hide powder, and the influence of acidity upon chroming and non-tannins. H. C. Reed. *See* XIV.

Filter papers [in analysis of tanning materials] ; Comparison of S and S No. 590 *and No.* 602 *hard* ——. W. K. Alsop and W. A. Fox. *See* XIV.

Tanning liquors ; Determination of the acidity of ——. A. W. Hoppenstedt. *See* XIV.

Hide substance dissolved in lime- and tan-liquors ; Direct determination of ——. R. A. Earp. *See* XIV.

Glucose [dextrose] ; Influence of catalysis by acids and bases on the mutarotation of ——. C. S. Hudson. *See* XVI.

Alkaloids ; Determination of —— *by means of picrolonic acid [dinitrophenylmethylpyrazolone].* H. Matthes and O. Rammstedt. *See* XX.

Patents.

Butter, etc. U.S. Pat. 864,913. *See* XVIII*A*.

Fat from albumin, etc. Ger. Pat. 184,639. *See* XVIII*A*.

Fat in milk, etc. Ger. Pat. 187,810. *See* XVIII*A*.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Colloidal solutions [of metals] ; Stability of ——. T. Svedberg. Z. Chem. Ind. der Kolloide, 1907. 2, 142—149.

In studying the properties of colloidal solutions of metals prepared electrically (this J., 1906, 543), the author has observed that, besides the influence of the ions and the force of gravitation, other factors play an important part in their stability. These factors may be brought into prominence by suppressing as far as possible the influence of the ions by choosing a medium, such as ether, which possesses a very small ionising power and which is relatively non-reactive under the conditions selected, and by choosing a colloidal substance, such as platinum, which has a very low solution-pressure and little tendency to react with the medium. When these conditions are fulfilled, there is found to be a very definite critical temperature for the existence or stability of each "sol" according to its concentration. The addition of small quantities of non-colloidal foreign substances raises the critical temperature and thus favours stability. The curve expressing the relations between the critical temperature and the concentration of the foreign substance runs asymptotically to the negative temperature axis, *i.e.*, a colloidal solution of the type in question cannot exist in an absolutely pure suspension-medium. The rule as to the critical temperature does not generally apply when the conditions stated above are not observed, *i.e.*, with metals other than the noble metals and with media, such as alcohol, of greater ionising power.—J. F. B.

Nitrous acid in Erythrina L. F. Weehuizen. Pharm. Weekblad, 1907, **44**, 1229—1232. Chem. Zentr., 1907, 2, 1751.

Fresh *Erythrina* leaves were crushed, allowed to stand for half-an-hour, and then heated on the water-bath, without addition of water. The vapours evolved gave all the reactions for nitrous acid. When the fresh leaves were immersed for half-a-minute in boiling water before crushing, or when, after being rapidly crushed, they were dipped into dilute sulphuric acid, they subsequently yielded no nitrous acid. The author concludes that *Erythrina* leaves contain a glucoside-like compound, from which nitrous acid is liberated by the action of an enzyme.
—A. S.

The Imperial College of Science and Technology. Times, Nov. 29, 1907.

The Earl of Crewe, chairman of the governing body of the Imperial College of Science and Technology, has authorised the publication of the following communication:—

The governing body of the Imperial College of Science and Technology have appointed three standing committees—a Finance Committee (chairman, Sir Francis Mowatt), an Education Committee (chairman, Mr. Arthur Acland), and a General Purposes Committee (chairman, Lord Halsbury). In addition, they have appointed two temporary committees, a Transfer Committee (chairman, Mr. Arthur Acland), and an Organisation Committee (chairman, Mr. Gerald Balfour; vice-chairman, Sir William White). Matters relating to the transfer to the Imperial College of the constituent institutions, which it has been arranged shall take effect as from January 1 next, and to the transfer of land from the Exhibition Commissioners, have been referred to the Transfer Committee. The Organisation Committee, to which have been referred matters relating to the future organisation of the Imperial College, have appointed four sub-committees to consider questions arising under this head in relation to the following sciences or groups of sciences, viz.:—(1) Mining and metallurgy (chairman of the sub-committee, Sir Julius Wernher), (2) other branches of engineering (chairman, Sir John Wolfe Barry), (3) Biological sciences (chairman, Sir Archibald Geikie), and (4) other pure and applied sciences (chairman, Sir Arthur Rücker). The governing body have authorised the appointment of persons not members of the governing body who are specially conversant with the sciences in question, or with their industrial applications, as additional members of these sub-committees, which are now engaged in considering the questions referred to them. The governing body have also approved in principle the appointment of a principal officer of the Imperial College, and have referred the question of his title and functions to the Organisation Committee.

Trade Report.

India; Chemical exports from ——. Review of the Trade of India in 1906—1907. [Cd. 3787.]

The exports *of saltpetre* from India increased from 336,429 cwt. in 1905–6 to 353,378 cwt. in 1906–7, whilst the value rose from Rs. 38·5 lakhs to Rs. 41·4 lakhs. *Borax* was exported to the extent of 5,613 cwt., with a value of Rs. 1,15,300. Exports of *Malwa opium* to China continue to decline. *Indigo* (See this J., 1907, 1082). *Cutch* increased by 76·6 per cent. to 97,269 cwt. (Rs. 15,92,561), *myrabolams* declined slightly to 1,162,219 cwt. (Rs. 43,97,591), and *turmeric* increased 25 per cent. to 62,246 cwt. (Rs. 7,08,967). Exports of *oils* declined 14·5 per cent.; *mineral oils* receded 49 per cent. to 906,136 gallons, although the production in Burma remains fairly constant. Exports of *paraffin wax* increased 6 per cent. to 60,209 cwt. *Vegetable oils* decreased 13·4 per cent., the value of the export being Rs. 46·77 lakhs. The export of *oil-seeds*, however, increased to 986,550 tons, an increase of over 100,000 tons from the previous year. The quantity of all seeds exported increased except linseed, which declined 24·36 per cent. from 1905–6. *Caoutchouc* exports declined in value from Rs. 12,82,129 to Rs. 11,18,487. *Lac* increased from Rs. 7,79,613 to Rs. 12,86,242. *Mica* increased from Rs. 23 lakhs to Rs. 38 lakhs, and *oil cake*, etc., increased from Rs. 68·98 lakhs to Rs. 75·99 lakhs.

New Zealand; New customs tariff of the Dominion of ——. Supplement to the Board of Trade Journal, Nov. 21, 1907.

The New Zealand Tariff Act (No. 15 of 1907) was assented to on Sept. 25 last. The following table shows some articles on which the duty varies from that in force under the old tariff:—

Import Duties.

Article.		Old rates.		New rates.	
		General.	On produce or manufacture of British countries.	General.	On produce or manufacture of British countries.
Glucose	per lb	1d.	1d.	1d.	1d.
Caramel, brewers'	do.	3d.	3d.	1d.	1d.
do. other	*ad val.*	15 per cent.	15 per cent.	1d.	1d.
Tartaric acid	per lb.	1d.	1d.	Free	Free
Cream of tartar	per lb.	1½d.	1d.	Free after	Dec. 31.
Sodium bicarbonate	cwt.	1s.	1s.	Free	Free
Soda crystals	cwt.	2s.	2s.	2s. 4·8d.	2s.
Baking powder, ferments, and yeast foods	*ad val.*	20 per cent.	20 per cent.	30 per cent.	20 per cent.
Chemicals not otherwise enumerated, including photographic chemicals, also boiler compounds, etc.	*ad val.*	15 per cent.	15 per cent.	30 per cent.	20 per cent.
Flavouring essences	do.	15 per cent.	15 per cent.	30 per cent.	20 per cent.
Glycerin, refined	do.	20 per cent.	20 per cent.	30 per cent.	20 per cent.
Brewers' chemicals, etc	do.	15 per cent.	15 per cent.	30 per cent.	20 per cent.
Saccharin in tablets containing alkali	do.	15 per cent.	15 per cent.	30 per cent.	20 per cent.
Oil, viz., crude petroleum, residual oil, etc.	per gall.	Free	Free	½d.	½d.
Oils not otherwise enumerated, including lubricating oil	per gall.	6d.	6d	7·2d.	6d.
Paints and colours ground in oil or turpentine	per cwt.	2s. 6d.	2s. 6d.	3s.	2s. 6d.
Driers	per cwt.	Free	Free	3s.	2s. 6d.
Paints mixed ready for use	per cwt.	5s.	5s.	6s.	5s.
Stearine	per lb.	¾ to 1½d.	¾ to 1½d.	0·9d.	¾d.
Varnish and lacquers	per gall.	2s.	2s.	2s. 4·8d.	2s.
Axle grease, other solid lubricants, petroleum greases	*ad val.*	20 per cent.	20 per cent.	30 per cent.	20 per cent.
Soap, [illegible] yellow, and blue mottled	per cwt.	5s.	5s.	6s.	5s.
Soap powder, soap extract, liquid soap, etc.	*ad val.*	—	—	20 per cent.	20 per cent.
Soap not otherwise enumerated	*ad val.*	25 per cent.	25 per cent.	37·5 per cent.	25 per cent.
Starch	per lb.	2d.	2d.	2·4d.	2d.
Paraffin wax	per lb.	¾d.	¾d.	1d.	1d.
[illegible] surfaces and papers	*ad val.*	Free	Free	10 per cent. after Mar. 31, 1908	Free
Paints and colours not otherwise enumerated	*ad val.*	Free	Free	10 per cent. after Mar. 31, 1908	Free

Most chemicals are on the free list.

New Books.

The Chemistry of Gas Manufacture. A Practical Manual for the Use of Gas Engineers, Gas Managers, and Students. By Harold M. Royle. Crosby Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London. 1907. Price 12s. 6d. net.

8vo volume, containing 316 pages of subject matter, with eighty-three illustrations, and the alphabetical index. The subject matter is classified according to the following scheme :—I. Preparation of standard solutions. II. Coal. III. Furnaces. Testing and regulation. IV. Products of carbonisation. V. Analysis of crude coal-gas. VI. Analysis of lime. VII. Ammonia. VIII. Analysis of oxide of iron. IX. Naphthalene. X. Analysis of fire-bricks and fire-clay, Weldon mud, and spent oxide. XI. Photometry and gas testing. XII. Carburetted water-gas. XIII. Metropolitan gas. XIV. Miscellaneous extracts. XV. Tables (pages 295—316).

Manufacture of Chemical Products from Wood By F. P. Veitch. Oil, Paint, and Drug Reporter, New York, U.S.A. Sept. 9th to Oct. 14th, 1907.

The text of this monograph on wood distilling is subdivided as follows :—I. Statistics of wood distillation. II. Properties of wood affecting yield of products. III. Yield of distillation products from different woods. IV. Apparatus for destructive distillation. V. Manufacturing processes. VI. Crude products of destructive distillation. VII. Aqueous distillate of crude pyroligneous acid. VIII. Recovery of certain wood products by treatment with chemicals. IX. Suggestions for the development of these industries. In the monograph the various kinds of wood used for distillation are specified. Illustrations are given of the various kinds of apparatus now used.

Descriptive Biochemie mit besonderer Berücksichtigung der Chemischen Arbeitsmethoden. Von Dr. Sigmund Fraenkel. J. F. Bergman's Verlag, Wiesbaden. 1907. Price M. 17.

Large 8vo volume, containing 600 pages of subject matter, alphabetical indexes of subjects and authors, a list of errata, and a spectrum table. The arrangement of the subject matter is according to the following scheme :—I. Fatty acids ; Fats ; Hydroxy-fatty acids. II. Polycarboxylic acids. III. Hydrocarbons ; alcohols ; ketones. IV. Carbohydrates. V. Thio-alcohols ; ethers, and acids. VI. Aliphatic bases. VII. Guanidine and derivatives. VIII. Urea and derivatives. IX. Amino fatty acids. X. Pyrimidine derivatives. XI. Purine derivatives. XII. Nitrogenous substances of unknown constitution. XIII. Brain constituents (Lipoïds). XIV. Nucleinic acids. XV. Sulphonic acids. XVI. Iodised substances. XVII. Hydroaromatic substances. XVIII. Conjugated bile acids. XIX. Aromatic substances. XX. Aromatic acids combined with glycocoll. XXI. Quinoline derivatives. XXII. Aromatic bases. XXIII. Acids of unknown constitution from urine. XXIV. Proteins. XXV. Decomposition products of protein, and derivatives. XXVI. Investigation and isolation of protein decomposition products. XXVII. System of the proteins. XXVIII. Albuminoids. XXIX. Proteins with prosthetic groups (*i.e.*, radicles not proteins). XXX. Hämoglobin and its derivatives. XXXI. Higher decomposition products of the proteins. XXXII. Colouring matters. XXXIII. Ferments (enzymes). XXXV. Chemistry of the organs, secretions and excretions.

The British Journal Photographic Almanac and Photographer's Daily Companion, 1908. Edited by George E. Brown. H. Greenwood & Co., 24, Wellington Street, London, W.C. Price 1s. (in paper), or 1s. 6d. (in cloth).

Crown 8vo. volume, containing 480 pages of subject matter. The work includes the following, among other subjects :—List of photographic societies and associations ; recent novelties in apparatus ; screen-plate processes of colour photography ; epitome of progress during the year ; formulæ for the principal photographic processes ; developing formulæ of the principal plate and paper makers ; miscellaneous ; tables of weights and measures, atomic weights, and sizes of plates and lantern slides, various chemical and exposure tables ; optical tables. The book concludes with a subject matter index covering eight pages.

East India (Trade). Review of the Trade of India in 1906–7. [Cd. 3,787.] Wyman & Sons, Fetter Lane. London, E.C. Price 1s. 3d.

This is the annual report on the foreign trade of British India for the year ended 31st March, 1907, which has been issued as an Indian Government publication. It has now been presented to Parliament as a command paper. (See p. 1258.)

Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions, 1906. Supplement to Vols. I. and II. [Cd. 3,687.] Wyman & Sons, Fetter Lane, London, E.C. Price 3s. 9d.

This volume contains abstract and detailed tables showing countries of consignment of imports and countries of ultimate destination of exports, compiled in the Statistical Office of the Custom House, with a prefatory memorandum drawn up in the Commercial Department of the Board of Trade. The present volume also contains statements of the consignments from each country retained for consumption in the United Kingdom, or the "special" imports from each country into the United Kingdom.

Statistical Abstract for the Principal and other Foreign Countries in each year from 1895 to 1904–5. [Cd. 3,291.] Wyman & Sons, Fetter Lane, London, E.C. Price 1s. 6d.

This Abstract contains statements in regard to the trade, navigation, agriculture, railways, telegraph and telephone systems, finance, mineral production, &c., of the principal foreign countries for a series of years, the information in each case being carried down to the latest year—in the majority of cases 1905—for which data have been received in the Board of Trade. New tables appear in the present issue dealing with the import and export trade of Servia, and summarising the foreign trade of Spain.

Statistical Abstract for the United Kingdom in each of the last fifteen years from 1892 to 1906. [Cd. 3691.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 7d.

This is the fifty-fourth number of a publication which is compiled annually in the Commercial, Labour and Statistical Department of the Board of Trade. It embodies in a concise form the more important statistical data available from official sources in regard to the finances, trade, shipping, banking operations, &c., of the United Kingdom during the past 15 years.

Royal Commission on Canals and Waterways. Volume II., Part I. Second Report of the Royal Commission appointed to inquire into and to report on the Canals and Inland Navigations of the United Kingdom. [Cd. 3716.] Price 1d. Part II. Ireland. Minutes of Evidence accompanying Part I. [Cd. 3717.] Price 3s. 9d. (Wyman and Sons, Fetter Lane, London, E.C.)

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

25,493. Sebastian. Drying apparatus.* Nov. 18.

25,517. Hildebrandt. Cooling and liquefying gases.* Nov. 18.

25,644. Beth. Filtering smoke gases or products of combustion. [Ger. Appl., Nov. 20, 1906.]* Nov. 19.

25,907. Watson. Apparatus for removing solid matter from liquids. Nov. 22.

26,052. Wiart. Instantaneously condensing vapours and gases without a cooling agent.* Nov. 25.

26,265. Parry. Ascertaining the temperature of kilns, etc. Nov. 27.

26,314. McDonald and Nickle. Evaporating apparatus.* Nov. 28.

26,471. Bennis. Furnaces. Nov. 30.

Complete Specifications Accepted.

3079 (1907). Rees. Centrifugal apparatus for pumping and mixing liquids. Dec. 4.

9741 (1907). Imray (Soc. Chem. Ind. in Basle). Apparatus for drying and grinding. Nov. 27.

10,664 (1907). Moffat. Drying apparatus. Nov. 27.

14,844 (1907). Huillard. Drying apparatus. Dec. 4.

15,150 (1907). Buch. Drying peat or other vegetable substances containing much water. Dec. 4.

15,257 (1907). Schmidt. Apparatus for boiling easily foaming or frothing substances, especially resin size. Nov. 27.

16,237 (1907). Simoneton. Filter. Nov. 27.

18,576 (1907). Kestner. Continuous concentrating apparatus. Nov. 29.

19,292 (1907). Schmidt. Solvent for calcareous fur deposit. Dec. 4.

II.—FUEL, GAS, AND LIGHT.

Applications.

25,479. Armour. Manufacture of gas from coal. Nov. 18.

25,582. Breadner and Billington. Manufacture of carbon. Nov. 19.

25,657. Robin (Salomon). Manufacture of incandescent gas mantles. Nov. 19.

25,896. Lewis and Briggs. Suction gas producer plant. Nov. 22.

26,032. Vass. Gas purification.* Nov. 25.

26,056. Bauke. Desulphurising gases.* Nov. 25.

26,057. Koppers. Gas retorts.* Nov. 25.

26,224. Fennell. Apparatus for producing and utilising ignited gases under pressure.* Nov. 27.

26,504. Mannesmann. Illuminating bodies. [Ger. Appl., Dec. 1, 1906.]* Nov. 30.

26,537. Mond. *See under* VII.

Complete Specifications Accepted.

23,334 and 23,336 (1906). Coolidge. Manufacture of electric conductors especially for use as incandescing bodies for electric lamps. Nov. 27.

23,335 (1906). Arsem. Manufacture of electric conductors especially for use as incandescing bodies in electric lamps. Nov. 27.

26,039 (1906). Glover and Glover. *See under* VII.

27,908 (1906). Grafton. Removal of naphthalene from illuminating gas. Nov. 27.

29,155 (1906). Norden (Bartel). Manufacture of mantles for incandescent gas lighting. Dec. 4.

1313 (1907). Daniels, Higgins, and Daniels. Gas producers for use with bituminous coal or other fuel containing volatile matter. Nov. 27.

14,795 (1907). Taverner. Manufacture of insoluble briquettes of fuel. Dec. 4.

15,150 (1907). Buch. *See under* I.

16,786 (1907). Wise (Solvay et Cie.). Coke ovens. Dec. 4.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Application.

25,711. De Fazi, Claussen, and Coblett. Deodorising naphtha. Nov. 20.

Complete Specification Accepted.

24,553 (1906). Thorpe. Manufacture of diamino-naphthalene and derivatives thereof. Dec. 4

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

25,507. Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series. Nov. 18.

25,513. Imray (Meister, Lucius, und Brüning). Manufacture of highly brominated dihalogen-indigos. Nov. 18.

25,514. Imray (Meister, Lucius, und Brüning). Manufacture of highly brominated halogenised indigos. Nov. 18.

25,817. Bachmann. Soluble dioxynaphthylmethane preparation. Nov. 21.

26,053. Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Nov. 25.

26,275. Imray (Meister, Lucius, und Brüning). Manufacture of brominated indigos. Nov. 27.

26,276. Imray (Meister, Lucius, und Brüning). Manufacture of products from highly brominated di-halogen indigos. Nov. 27.

26,538. Imray (Meister, Lucius, und Brüning). Manufacture of halogenised dibromindigos. Nov. 30.

Complete Specifications Accepted.

26,508 (1906). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of *o*-oxydisazo colouring matters. Nov. 27.

2592 (1907). Imray (Meister, Lucius, und Brüning). Manufacture of a red vat dyestuff. Dec. 4.

4413 (1907). Newton (Bayer und Co.). Manufacture of azo colouring matters. Dec. 4.

10,541 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of vat colouring matters. Dec. 4.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Applications.

25,696. British Cotton and Wool Dyers' Association, and Hoegger. Cop dyeing machines. Nov. 20.

25,801. Ostersetzer. Colour printing on half-wool fabrics.* Nov. 21.

25,913. Scott. Treatment of liquor obtained from mercerising cotton. Nov. 22.

26,290. Silberrad. Dyeing. Nov. 28.

26,414. Koblischke. Dyeing vegetable fibres with alizarine dyes.* Nov. 29.

Complete Specifications Accepted.

25,781 (1906). D'Iszoro. Machines for bleaching, dyeing, scouring, etc. Nov. 27.

26,843 (1906). Hey and others. Apparatus for washing, impregnating, drying, or extracting liquids from fabrics and other goods. Nov. 27.

29,135 (1906). Calico Printers' Association, and Hadfield. Dunging and mordanting cotton piece goods. Dec. 4.

10,557 (1907). Johnson (Durand, Huguenin et Cie.). Vat dyeing with gallocyanines or their derivatives. Nov. 27.

11,412 (1907). Evans (Minimax Consolidated Co.). Colour spraying devices. Dec. 4.

12,033 (1907). Schmitt. Production of artificial wool from vegetable fibres. Dec. 4.

15,352 (1907). Venter. Removing soda lye from fabrics saturated therewith. Nov. 27.

22,753 (1907). Follet and Ditzler. Manufacture of filaments of fibroin cellulose, etc. Nov. 27.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

25,632. Birkeland. Utilisation of nitrous gases.* Nov. 19.

26,537. Mond. Recovery of ammonia in gas producer or like plants. Nov. 30.

Complete Specifications Accepted.

26,039 (1906). Glover and Glover. Revivifying oxide of iron. Nov. 27.

27,006 (1906). Moscicki. *See under* XI.

18,922 (1907). Westinghouse Metal Filament Lamp Co. Production of tungsten dioxide. Nov. 27.

22,201 (1907). Spitzer. Manufacture of nitrogen oxides. Dec. 4.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

26,189. Meakin, Ltd., and Jackson. Ovens and kilns for drying or firing ceramic wares. Nov. 26.

26,391. Adams. Glazed brick. Nov. 29.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Applications.

25,498. Hutchinson. Artificial stone. Nov. 18.

25,795. Collos Portland Cement Co. (Colloseus). Manufacture of hydraulic or like cement.* Nov. 21.

25,969. Potter. Manufacture of hydraulic cement. Nov. 23.

26,235. Marshall. Cements for uniting glass, etc. Nov. 27.

26,236. Marshall. Indurating cement surfaces. Nov. 27.

Complete Specifications Accepted.

26,150 (1906). Von Radlowski. Rotary kilns for burning and calcining lime, cement, etc. Nov. 27.

8760 (1907). Morgan. Rotary cement kilns. Nov. 27.

X.—METALLURGY.

Applications.

25,496. Sperry. Detinning process.* Nov. 18.

25,705. Holloway. Magnetic separation of minerals. Nov. 20.

25,742. Cie. des Forges et Aciéries de la Marine et d'Homécourt. Steel for armour plates, projectiles, etc. [Fr. Appl., Sept. 7, 1907.]* Nov. 20.

25,891. Butterfield and Ogle. Treating copper, lead, tin, and antimony ores to obtain the metals. Nov. 22.

25,985. Dwight and Lloyd. Roasting and sintering ores.* Nov. 23.

26,131. Moore and Heskett. Directly reducing iron ore and manufacture of wrought iron and steel. Nov. 26.

26,332. Centrals. f. Wissensch.-Techn. Untersuchungen. Aluminium alloys. [Ger. Appl., Jan. 10, 1907.]* Nov. 28.

26,363. Lockwood and Samuel. Separation of minerals from ores by the selective action of oils, soaps, etc. Nov. 28.

Complete Specifications Accepted.

29,156 (1906). Oettinger. Obtaining oxide fumes from ores and furnace products. Dec. 4.

604 (1907). Fletcher. Metallurgical furnaces. Dec. 4.

7698 (1907). Boult (Du Faur). Separating copper from acid or neutral solutions. Dec. 4.

11,865 (1907). Buendia. Concentration of minerals by an intermittent liquid current. Nov. 27.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

25,553. Levy. Electric dissociation of metals by the wet method.* Nov. 18.

25,655. Von Seemen. Bodies capable of conducting electricity when cold. [Ger. Appl., Nov. 19, 1906.]* Nov. 19.

25,669. Hausmann. Electrodeposition. [Ger. Appl., Nov. 23, 1906.]* Nov. 20.

26,130. Brewer (Taylor). Electric furnaces.* Nov. 26.

Complete Specifications Accepted.

23,334 (1906). Coolidge. *See under* II.

23,335 (1906). Arsem. *See under* II.

23,336 (1906). Coolidge. *See under* II.

27,006 (1906). Moscicki. Apparatus for producing oxides of nitrogen by electric process. Dec. 4.

29,367 (1906). Bijur. Treatment of negative pole plates. Nov. 27.

1678 (1907). Connolly. Insulating materials. Dec. 4.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Applications.

25,721. Linoleum Manufacturing Co., and Dewar. Means for boiling oils.* Nov. 20.

26,270. Hym. Manufacture of soap. Nov. 27.

26,540. Schou. Manufacture of soap. Nov. 30.

Complete Specifications Accepted.

25,882 (1906). Pearson. Apparatus for extracting oil and producing fertilisers from fish, fish offal, etc. Nov. 27.

5047 (1907). Wilson. Soap. Dec. 4.

13,701 (1907). Verein. Chem. Werke. Bleaching fats, oils, resins, waxes, etc. Nov. 27.

19,392 (1907). Levi. Obtaining edestin from cotton seeds. Nov. 27.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

25,753. Hannay and Wilson. Manufacture of a white lead sulphate pigment. Nov. 20.

25,759. Scott. Manufacture of a white pigment of barium and lead salts. Nov. 21.

(*B.*)—Resins, Varnishes.

Applications.

25,823. Strange, Pim, and Burrell. Manufacture of varnishes. Nov. 21.

26,317. Newton (Bayer und Co.). Manufacture of resin-like products. Nov. 28.

Complete Specifications Accepted.

6717 (1907). Guittet. Driers for paints, varnishes, and oils. Dec. 4.

13,701 (1907). Verein. Chem. Werke. *See under* XII.

15,257 (1907). Schmidt. *See under* I.

(*C.*)—India-Rubber.

Applications.

26,365. Douse. India-rubber substitutes. Nov. 28.

26,432. Roland. Elastic compositions. [Fr. Appl. Dec. 5, 1906.]* Nov. 29.

26,446. Roland. Elastic compositions. [Fr. Appl., May 22, 1907.]* Nov. 29.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

APPLICATION.

25,528. Müller. Manufacture of artificial leather.* Nov. 18.

COMPLETE SPECIFICATION ACCEPTED.

28,806 (1906). Boult (Sylvestre). Manufacture of artificial leather. Dec. 4.

XV.—MANURES, &c.

COMPLETE SPECIFICATION ACCEPTED.

25,882 (1906). Pearson. *See under* XII.

XVI.—SUGAR, STARCH, GUM, &c.

COMPLETE SPECIFICATION ACCEPTED.

25,860 (1906). Ost. Sugar purification. Nov. 27.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—FOODS.

APPLICATIONS.

25,809. Silberberg. Manufacture of flour.* Nov. 21.

25,890. Risberg. Emulsifying and homogenising milk and other liquids. [Swed. Appl., Nov. 26, 1906.]* Nov. 22.

26,192. Dreaper. Manufacture of food products. Nov. 27.

26,200. Richmond. Apparatus for testing the acidity of milk. Nov. 27.

COMPLETE SPECIFICATIONS ACCEPTED.

28,703 (1906). Kupfer. Food for cattle and other animals. Dec. 4.

6796 (1907). Hughes. Cattle foods. Dec. 4.

21,783 (1907). Andersson and Lindblad. Beverages from apple juice. Nov. 27.

XIX.—PAPER, PASTEBOARD, &c.

COMPLETE SPECIFICATIONS ACCEPTED.

4683 (1907). Eibel. Manufacture of paper. Nov. 27.

8179 (1907). Soc. Franç. de la Viscose. Manufacture of viscose. Dec. 4.

16,653 (1907). Wallace and Wallace. Linenising the surfaces of paper. Dec. 4.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

APPLICATION.

26,415. Noerdlinger and Noerdlinger. Preparation of pure lactic acid. [Ger. Appl., Dec. 1, 1906.]* Nov. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

13,383 (1907). Scheitlin. Production of 1-phenyl-2.3-dimethyl-4-dimethylaminopyrazolone. Dec. 4.

19,576 (1907). Askenasy and Mugdan. Manufacture of dichloroethylene from symmetrical tetrachloroethane. Nov. 27.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

APPLICATION.

26,445. Roth. Photographic or blue print paper.* Nov. 29.

COMPLETE SPECIFICATIONS ACCEPTED.

26,503 (1906). Lederer. Emulsions for photographic purposes and paper, films, and plates made with the same. Nov. 27.

993. (1907). Schwartz. Preparation of paper for photographic purposes. Nov. 27.

XXII.—EXPLOSIVES, MATCHES, &c.

APPLICATIONS.

19,565A. Schultze. Manufacture of safety explosives from the nitro-compounds of solvent naphtha.* Nov. 21.

26,261. Winand. Manufacture of explosives. [Ger. Appl., Dec. 6, 1906.]* Nov. 27.

Journal of the Society of Chemical Industry.

No. 24, Vol. XXVI. DECEMBER 31, 1907. No. 24, Vol. XXVI.

Official Notices.

At a meeting of the Council held on December 23rd, 1907, the President in the Chair, it was resolved :—That the Council of the Society of Chemical Industry place on record their profound sense of the grievous loss which the Society has sustained by the death of Mr. Samuel Hall, who had been its Honorary Treasurer since the year 1898, and their high appreciation of the immeasurable services rendered by him to the Society which he assisted to found, and to whose affairs he loyally, liberally, and successfully devoted the energies of his later life.

That the President convey the above resolution to Mr. Hall's family, and express to them the heartfelt sympathy of the Council in their affliction.

SUBSCRIPTIONS.

Important Notice.

In consequence of the death of Mr. Samuel Hall, Hon. Treasurer of the Society, Members are requested to make all cheques and Postal Orders payable to the "Society of Chemical Industry," which may then be forwarded to the Hon. Acting Treasurer, East London Soap Works, Bow, E.

Canadian Section.

Meeting held in Toronto on Thursday, Oct. 24th, 1907.

PROF. W. HODGSON ELLIS IN THE CHAIR.

THE LATE MR. THOS. MACFARLANE.

The following resolution was passed, and ordered to be sent for insertion in the Journal:—"That the members of the Section have heard with deep regret of the death of their esteemed colleague and past Vice-Chairman, Thomas Macfarlane of Ottawa, and take this opportunity of expressing their sense of the loss which the Section has thereby sustained."

London Section.

Meeting held at Burlington House on Monday, Dec. 2, 1907.

MR. R. J. FRISWELL IN THE CHAIR.

THE ESTIMATION OF NAPHTHALENE IN COAL GAS AND IN SPENT OXIDE OF IRON.

BY C. J. DICKENSON GAIR.

In the discussion on a former paper (this Journal, 1905, 1279), on the subject of estimating naphthalene in coal gas, it was brought to the author's notice that it was a disadvantage for the method there suggested to be solely a gravimetric one, and on consideration this appeared to be undoubtedly the case. It was to remedy this defect that the following experiments were made and the acetic acid method so modified, as to be available either gravimetrically or volumetrically. The amount of acetic acid, sp. gr. 1·044, used in the test should not be too great, but should be varied in quantity according to the quality of the gas as regards naphthalene. The following table may be found useful in this connection :—

Grns. of naphthalene (approx.), per 100 cu. ft. of gas.	C.c. of acetic acid to be used or c.c. of picric acid in reprecipitation test.
5 to 15	200
15 to 60	400
60 to 80	450
80 and above	500 and above.

The volume of acetic acid to be used having been determined, this quantity is poured into two Dreschel bottles of suitable size. These are closely connected with rubber tubing, together with another Dreschel bottle containing 150 c.c. of strong picric acid solution, to act as a catch. A measured quantity of the gas, not more than 10 cu. ft. usually, is now passed through, at the rate of about 0·75 cu. ft. per hour. If the gas is impure, as regards ammonia, use is made of concentrated oxalic acid solution, placed in a Woulff's bottle, immediately in front of the acetic acid bottles. After the requisite volume of gas has been passed, the three bottles are disconnected, and their contents mixed with about 500 c.c. of strong picric acid solution. The flask is well agitated and allowed to stand five minutes, or if there is very little naphthalene in the gas or only a few feet have been registered, it is advisable to let the liquid stand ½ hour or more. Pure naphthalene picrate separates out in large flocculent masses and is filtered off. If the test is to be a gravimetric one, the naphthalene picrate is dried and weighed, but if not, the following procedure is followed :—The precipitate is washed with 300 to 500 c.c. of dilute picric acid solution (not weaker than $N/40$ strength) to free the precipitate entirely from acetic acid, which would otherwise render the test inaccurate. Picric acid solution was found to be the only reagent that would do this, without decomposing or dissolving the naphthalene picrate. It was also found that a comparatively slight washing sufficed for the bulkiest precipitate. This was proved by using standardised picric acid solution as the washing medium. After 300 c.c. had been used a portion titrated with $N/10$ sodium hydroxide solution was found to be of exactly the same strength on leaving the filter funnel as it was before being used. This result practically coincided with the loss of the acetic acid smell. After the washing process, the precipitate is thoroughly drained on a filter pump, and washed into a beaker with a small quantity of cold distilled water : 180 c.c. of distilled water are then added, together with 10 to 25 c.c. of $N/10$ sodium hydroxide solution. The mixture is then boiled for 5 or 10 minutes with occasional stirring, with the result that the naphthalene is quantitatively liberated, sodium picrate being formed. If, on testing with lacmoid indicator the solution shews no green coloration, more sodium hydroxide solution should be added, and the liquid again boiled. The liquid is finally transferred while hot to a porcelain basin and $N/20$ picric acid solution added in excess, as shown by the lacmoid indicator becoming yellow-brown in colour. The liquid is again titrated with $N/10$ sodium hydroxide solution till the olive-green tint again becomes permanent. The total volume of sodium hydroxide solution used is noted, and the equivalent of the picric acid solution used, deducted from it ; the difference will be the volume of sodium hydroxide solution actually required to decompose the naphthalene picrate. As each c.c. of $N/10$ sodium hydroxide solution corresponds to 0·0128 grm. or 0·197 grain of naphthalene, the result in grains per 100 cubic feet of gas is readily found. This method of estimating naphthalene in coal gas is exceedingly rapid and easy of execution, the whole determination after the bottles were disconnected being finished in less than an hour ; the results are at the same time accurate. Experiments were made to prove this in the following manner. A quantity of naphthalene crystals was inserted into a small U tube with glass stoppers, and the whole weighed. The Dreschel bottles containing acetic acid and picric acid were closely connected up, and a current of dry air drawn through the apparatus. After a few hours the air current was stopped and the U-tube again weighed, the loss of weight corresponding to the naphthalene passed into the bottles. The same process was gone through with the acetic acid, and the quantity of naphthalene found thus was compared with that found by actual weighing. The results were as follows :—

Weight of naphthalene used, grains.	Weight of naphthalene found, grains.
0·500	0·492
0·750	0·748
0·250	0·252

showing that the method is remarkably accurate.

Comparative experiments were also made against Colman and Smith's method and the results corresponded very closely. While engaged in making the above experiments, another method was devised by the author for determination of naphthalene. This method, called the "reprecipitation method," is commenced in a similar manner to Colman and Smith's well-known test, that is to say, only picric acid is used, but instead of heating the precipitate and picric acid solution *in vacuo*, cooling, etc., etc., the precipitate, consisting of naphthalene, and naphthalene picrate, is filtered and washed into a flask with the smallest possible quantity of strong picric acid solution. Absolute alcohol or denatured alcohol, which does not form a precipitate with picric acid, is now added in sufficient quantity (50 to 100 c.c. usually) to dissolve the precipitate, a clear yellow solution remaining. About 300 c.c. of concentrated picric acid solution are now added and the whole well agitated. Pure naphthalene picrate at once separates and is filtered off. The same procedure of decomposition, etc., is now gone through with the naphthalene picrate as in the acetic acid method, with the exception that the picrate does not need to be washed with picric acid solution before being decomposed with boiling sodium hydroxide. This method is very rapidly and easily carried through, less than 45 minutes being sufficient to finish it after the gas is shut off. Experiments of a similar kind to those made to test the acetic acid method were carried out to test the "reprecipitation method," and the results were as follows :—

Weight of naphthalene used, grains.	Weight of naphthalene found, grains.
0·250	0·252
0·400	0·394
0·750	0·748
0·570	0·571

showing the extreme accuracy of the method.

The reprecipitation method can also be modified to estimate naphthalene in spent oxide of iron as follows :—Ten grms. of the undried oxide, roughly pulverised, are placed in a small flask together with 100 c.c. of 80 per cent. alcohol. The flask is corked, agitated, and allowed to stand three or more hours, after which the whole of the naphthalene will be dissolved out of the oxide. The liquid is now filtered into a larger flask and the filter paper washed once or twice with dilute alcohol. 300 c.c. of strong picric acid solution are added, the flask well agitated and allowed to stand a short time. The naphthalene picrate which separates out is treated in the same way as that obtained in the reprecipitation method. The method may be relied upon as being accurate to within one per cent.

DISCUSSION.

Dr. H. G. COLMAN said he was glad that the author had been able to modify his former process so as to make it volumetric instead of gravimetric. There was no doubt that naphthalene picrate could be titrated in the way described, and he saw no reason why it should not give equally accurate results with the other methods in use.

Dr. S. RIDEAL said it was interesting to know that a substance like naphthalene, which was always a trouble in gas works practice, should be studied by gas manufacturers themselves, and that their own chemists were devising methods of analyses which would enable them to detect and thus to prevent the trouble arising from naphthalene. This was a very satisfactory state of affairs and better than having restrictions placed upon them by the Legislature.

Mr. GAIR said, in reply, that in all naphthalene tests there was a little difficulty owing to the fact that naphthalene when brought into a cooler atmosphere readily condensed and some of it was always to be found in the leading tube of the apparatus. That naphthalene could not be neglected, as it was part of the actual naphthalene to be estimated in the gas. The best way to deal with that was to wash the tubes out with a little alcohol, and add it to the acetic acid or picric acid of the test as the case might be. He recommended Schleicher and Schull's 15 c.m. No. 575 filter papers for these tests, or, if they could not be obtained, their No. 597 were convenient substitutes. He had made experiments with indicators other than lacmoid, though lacmoid was an excellent one to use. Methyl orange was usable but gave rather an indistinct end reaction. Phenolphthalëin, on the other hand, gave good results practically identical with lacmoid ; care should, however, be taken that all solutions titrated with this indicator have previously been boiled to expel carbon dioxide. If instead of titrating the whole of the solution obtained in the tests, it were divided into two parts and each titrated separately, the absolute accuracy of 98·5 per cent. to which he had referred in his paper was by no means difficult to obtain.

NOTE ON THE INFLUENCE OF FORMALDEHYDE ON THE PROPERTIES OF THE LATEX OF *FUNTUMIA ELASTICA*.

BY PHILIP SCHIDROWITZ, PH.D., AND FREDERICK KAYE, A.R.C.S.

In a recent paper (India-Rubber J., Sept. 23, 1907 ; this J., 1907, 1152) on "The influence of the method of coagulation on the physical and chemical properties of *Funtumia elastica*," we alluded to the fact that a sample of *Funtumia* latex to which formaldehyde had been added had coagulated in transit, the effect of the addition of the formaldehyde thus being exactly the reverse of that obtained in the case of *Hevea*, where, as is well known, formaldehyde acts as an anti-coagulant. The properties of the rubber thus coagulated by natural means in the presence of formaldehyde appear to be of a sufficient interest to warrant the present brief communication. The latex from which this specimen of rubber was obtained was from mature trees in the Mabira Forest (Uganda), during the dry hot weather of last February. The quantity of formaldehyde added was roughly 0·8 per cent. (2 per cent. of a 40 per cent. solution). On arrival in England practically the whole of the latex had coagulated. A portion of the moist coagulum was pressed into block form, and the remainder was rolled into sheets of uniform thickness. The latter after a short drying in the desiccator contained :—Moisture, 23·4 per cent. ; resin, 6·71 per cent. (resin referred to dry substance = 8·76 per cent.). The sample was then further dried until it was practically transparent. The main physical characteristics of the specimen were then found to be as follows :—Elongation (at break), 6·4 (original length = 1) ; breaking strain per sq. mm. cross section in grms., 264 ; permanent elongation* (resiliency), 100 per cent. After further drying for several months the figures obtained were, elongation, 7·5 ; breaking strain, 570. The points of interest in connection with this sample are (*a*) the fact that coagulation in the presence of formaldehyde by natural means appears to increase the quantity of resin in the rubber, inasmuch as *Funtumia*, when coagulated by other appropriate means, need not contain more than 6·5 to 7·5 per cent. of resin (referred to dry substance), and (*b*) the extreme toughness of the rubber. Collating the results of the physical tests we come to the conclusion that formaldehyde increases strength (*i.e.*, toughness, or breaking strain), but decreases elasticity and resiliency. The extreme toughness of the material is, we think, highly interesting, and it is possible that the observation may be of practical importance, inasmuch as for some purposes great strength combined with moderate elasticity may be preferable to normal strength and high elasticity.* We have some reason to think that it may in the future be found possible and desirable to prepare different qualities of rubber from the same latex by different methods of coagulation, according to the purpose for which the rubber is ultimately intended.

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* The residual elongation (after breaking) after a period of 24 hours' rest.

We have to thank the Mabira Forest Co., Ltd., of Uganda, and Dr. Christy for kindly supplying us with the latex for this experiment.

Discussion.

The Chairman said it was very remarkable that different rubbers behaved in different ways towards coagulants, and that the results should vary so much as they did.

Mr. W. F. Reid asked if the author had tried the action of vulcanisation on this rubber. It seemed to him almost that he (the author) had found a new method of vulcanising rubber which would be of importance if it could be carried out on the large scale. He understood the process had hitherto been worked with the juice alone. Of course it would not be possible to make tyres in that way; the rubber must be in such a form that it could be manipulated by the ordinary processes and machinery, but if the process added to the toughness of rubber it would be valuable in certain industries. It was difficult to get indiarubber manufacturers to introduce new processes, but if it could be utilised in the same way as ordinary rubber after treatment with the formaldehyde it would be a discovery of importance.

Dr. S. Rideal said that as a rule the coagulant used for plantation rubber was the smoke from green wood, which contained formaldehyde in varying amounts. The value of a rubber depended on its quality after vulcanisation, and it would have been interesting to see whether the rubber which had been coagulated by a known amount of formaldehyde vulcanised in the same way as rubber which had been coagulated by smoke alone. In other cases acids like acetic acid were used for coagulation, and those rubbers would be lighter in colour in which no iron vessels were brought in contact with the acid, but he did not know before on what the colour depended, and the enzyme action suggested by the author was novel. If it were as described, it would be a very easy way of getting light-coloured rubber.

Dr. J. N. Goldsmith enquired whether it was to be inferred that formaldehyde would polymerise the terpenes of the latex. When formaldehyde and terpenes were heated in a sealed tube to about 130° C. for a number of hours, a reaction occurred with the formation of bodies which were not much like rubber, *viz.*, the liquid condensation products of the terpenes with formaldehyde.

Dr. J. Lewkowitsch asked what was the chemical action of the formaldehyde in this process, and if it really helped on the process of polymerisation.

Mr. Herbert Wright said the physical properties of raw rubber differed greatly according to the botanical origin and the method used in coagulating or curing the samples. At the present time, although the physical properties were so variable, there was very little in the chemical sense to indicate to what those differences were really due. They could say that there were differences in the raw material according to the mechanical processes to which the fresh rubber had been subjected, but they were only just beginning to learn something regarding the effect of different chemical coagulants on the final product. It had been suggested that they could not in any way hope to benefit the industry by improving the raw product on the plantation, his point being that the value of the rubber depended mainly on the result after vulcanisation. The properties of the vulcanised article should be kept in view, but, speaking on behalf of the planting community, they were bound to adopt those methods which would impart the best physical properties to the raw material which they turned out. The growers were concerned with selling the raw rubber and not the vulcanised products; in fact much plantation rubber was never used in the vulcanised form.

Mr. J. F. Briggs asked if formaldehyde could be detected in the products, by distilling with dilute sulphuric acid, as was the case when gelatin or cellulose was hardened by formalin. If the latter products were distilled with dilute sulphuric acid, traces could always be obtained, and sometimes large quantities of formaldehyde distilled over.

The Chairman said there were several points of interest arising out of the paper. It appeared to him that the action of formaldehyde on the hydrocarbons of the $C_{10}H_{16}$ series was rather different to the action of formaldehyde on the latex. It might well be in that case that something might happen when the latex was treated, which did not happen when the hydrocarbon alone was treated. Professor Armstrong had pointed out that formaldehyde was a probable intermediate product in certain forms of combustion, and Dr. Rideal had asserted the presence of formaldehyde in smoke. They would like more definite information from Dr. Rideal on this point.

Dr. Schidrowitz said he quite agreed with the Chairman that when dealing with the latex, one was not dealing with pure hydrocarbons. There were very many other substances present in the rubber latex which might affect the result. He had been asked as to the effect of vulcanisation on the rubber produced in different manners, and it had been rather suggested that the vulcanised article was of most importance. Those questions were partly answered by Mr. Wright. So far, he thought, they had not progressed sufficiently in laboratory methods to be able to correlate the results obtained on vulcanised specimens with the properties of the crude rubber in a standard manner. There had been a discussion on this matter already, and he believed that the general opinion with regard to estimating the quality of the crude product by vulcanising it, was that it was not at present practical as an ordinary commercial test, but apparently there were a few who held that view, and therefore he would deal with it further. When a sample of rubber was bought by a broker or merchant, and he wanted an opinion on it, he could not be asked to wait whilst the chemist washed and dried the rubber and then carried out a piece of research work concerning the most favourable conditions of mixing and vulcanising, particularly as every rubber differed in this regard. Such research work was highly important and should be carried out in regard to all the new rubbers certainly, and also in regard to many of the well known varieties, but it was not practicable at present as an everyday commercial test. He preferred to apply the physical tests to the crude article at present, and in the majority of cases he found no insuperable difficulty in this regard. It was desirable to apply the chemical tests after washing the rubber. With a view to ascertaining "loss on washing," and the condition of the rubber after washing in a manner comparable to that obtaining at the works he had found it necessary, in his laboratory, to make use of small scale works plant, as, in his experience, ordinary laboratory apparatus was not satisfactory. He feared that many results which had been published were of little value if, as seemed apparent in many cases, they had been carried out with the ordinary plant of the laboratory. He had not tried the experiment mentioned by Mr. Briggs.

NIAM FAT.

BY DR. J. LEWKOWITSCH.

The note on the "analysis of the fat from *Lophira alata* seeds" by E. S. Edie (this J., 1907, 1148) gives me an opportunity of placing on record the results of an examination of the same fat, carried out over a year ago in my laboratory. Owing to unforeseen circumstances, the publication of this note elsewhere has been delayed.

Through the kindness of Professor W. R. Dunstan, I received a considerable quantity of the fruits of *Lophira alata*, Banks, a tree indigenous to Senegambia, Sierra Leone, and the Egyptian Soudan. (Excellent illustrations are published by Drabble, in the Quarterly Journal of the Liverpool University Institute of Commercial Research in the Tropics, Sept., 1907, 2, [5], 125.)

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* For instance, in the case of rubber intended for the covers of motor tyres.

The fruits had been collected in Sierra Leone. They consisted of 61·5 per cent. of kernels and 38·5 per cent. of husks. On extracting the kernels with ether there was obtained, together with the fat, a black resinous mass, which separates out from the oil on evaporating off the ether. This black resinous matter amounted to 0·8 per cent. of the weight of the kernels. The fat freed from the black resinous matter forms 41·19 per cent. of the kernels; hence the whole seeds yield 19·18 per cent. The fat represents at the ordinary temperature a soft buttery mass melting at 24° C. In West Africa this fat is known as "Niam fat" or "Meni oil." I propose to adopt the name Niam fat.

Together with the seeds I also received a sample of the Niam fat itself as prepared by natives in the Egyptian Soudan. The following characteristics were determined in the two specimens:—

	Fat extracted from kernels.	Fat prepared by natives.
Specific gravity at 40° C. (water at 40° = 1)	0·9105	0·9063
Acid value	18·54	5·78
Saponification value	195·6	190·1
Unsaponifiable matter ...	1·49 per cent.	1·38 per cent.
Iodine value	68·4	78·12
Mean molecular weight of the fatty acids	—	283·7
Solidifying point of the fatty acids (titer test) .	—	42·5° C.

The fat has an unpleasant taste, which seems to be due to a small quantity of dissolved resinous matter. It is used by the natives for culinary purposes and as a hair oil.*

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* *Cf.* Schweinfurth, Botan. Ergeb. der ersten Niam-Niam Reise.

Nottingham Section.

Meeting held at Nottingham on Wednesday, Oct. 30, 1907.

MR. J. M. C. PATON IN THE CHAIR.

SHEEP DIPS.

BY O. QUIBELL.

The Board of Agriculture of Great Britain recently conducted a series of experiments on the Dipping of Sheep with various preparations; it also held an enquiry, during the course of which a large number of witnesses were examined, and as a result of the report of the Committee, the Government have passed an Act by which dipping is made compulsory.

Dipping is resorted to for killing parasites and for preventing infestation. The parasites of sheep which chiefly concern us are the "scab acarus" (*Psoroptes communis*), the ked (*Melophagus ovinus*), the tick (*Ixodes reduvius*), the maggot (*Lucilia*), and the red louse (*Trichodectes sphærocephalus*). The parasite which causes the greatest ravages and the most serious trouble is the "scab mite." It is important that the farmer should prevent his sheep being infested with this pest, as the value of his flock is very largely reduced thereby both from the wool and mutton point of view. With favourable conditions as to moisture and temperature, scab is readily conveyed through a flock and the pasture occupied by the infested animals becomes a source of danger for a long time. The disease is known as Scab owing to the fact that the acari when they attack the sheep cause a considerable breakdown accompanied with the formation of an exudate, which dries into a hard incrustation which is known as the scab.

The "ked" is commonly known in this country as the tick. It really does not belong to the tick family at all, but is a wingless fly, which in the fleece of the sheep causes much irritation. The sheep do not thrive; they become emaciated and the wool is much reduced both in quality and quantity. The sheep owing to this pest frequently becomes "east."

Lice.—There is only one variety of this family which is found on sheep, namely the red louse. The irritation which this little insect sets up is very great. It irritates the skin which excretes a substance which mats the wool, thus rendering it unmarketable, and the sheep become depreciated in value as well.

The *tick* proper is not often the cause of serious trouble in England. When an animal is attacked the trouble which is set up is rather serious, as it burrows underneath the skin and remains there until completely gorged with blood. When the female has in this manner obtained a sufficient "fill," she drops off and lays her eggs on the pasture; these are hatched out and the young ticks re-infest the sheep. The trouble caused by this form of life is very great in South America, South Africa and Queensland. It also conveys many diseases to which cattle and sheep are prone in much the same manner as the mosquito conveys malaria.

Thus the subject of sheep parasites is one of great importance, and it is well that its gravity has at last been recognised by the Agricultural Departments of most Governments throughout the civilised world. In Australia and New Zealand not only were very stringent measures enacted but they were strictly carried out, and as a result both these countries, once scab-ridden, are now perfectly free from it, and have been so for several years. It is to be hoped that with the co-operation of the farmer and those interested that the Board of Agriculture of Great Britain will, in the very near future, be able also to report the same satisfactory state of affairs in our own country.

The early attempts at eradicating Scab usually took the form of anointing the affected portions of the body of the sheep with an ointment made of lard, mercury and its salts or with the salts of copper and zinc, but by far the most popular preparation was "mercurial ointment," which was also known under the synonym of "troopers' ointment." This consisted of 16 parts of metallic mercury, 16 parts of lard, and 1 part of suet. This ointment successfully killed off the *acari* (in the affected parts), but a great drawback in connection with its use was the fact that where *acari* had migrated to other parts and had not set up irritation, they were entirely missed; these ultimately set to work, and fresh scab spots would be found later on, but in addition to this the mercury was rapidly absorbed through the skin and all the symptoms of mercurial poisoning were soon set up after the inunction; thus frequently the curing caused very much more loss than the disease.

Another preparation at one time popular was copper oleate, which was rubbed in, in much the same way as the mercury compound just described, but it was subject to the same disadvantages as troopers' ointment. It was quite possible to go on treating isolated portions in this manner for an indefinite period. Then, too, the other parasites which infested the sheep were not in any way touched, as these local applications did not reach them; hence the necessity for the total immersion or dipping of the sheep in a bath containing a specific which would kill off the whole of the parasites and which would not injure the animal.

Farmers exist who did not believe in dipping their sheep, and preferred troopers' ointment, as they thought that a proprietary article would cost too much. However, as a result of the application of the mercury compound to two flocks of about 300 sheep, in one case 60 sheep were lost and in the other 80 sheep during the course of a year. After using carbolic acid dip the flocks were entirely cleared of scab in a comparatively short time and there was no loss of animals.

Arsenic was the main ingredient in some of the earliest dips. Some of these were very crude, consisting merely of arsenious acid boiled with water, to which was added an astringent such as alum, or iron or zinc sulphates. Little of the arsenious acid was however dissolved, it being contained in the bath principally as a sediment. An attempt was made to distribute it evenly in the bath so that each sheep should have its fair proportion of it. The concoction killed off parasites freely, but the acid frequently stripped the sheep of its wool, in spite of the added astringent. Losses too occurred owing to some of the mixture being drunk by the sheep. To prevent this, some aloes was dissolved in the bath with the object of colouring it, and also making it bitter. The following is the formula which is published in Neumann's "Parasites" of an arsenical dip which was popular in France in 1844:—Arsenious acid, 1,000 grms.; sulphate of zinc, 5,000 grms.; aloes, 500 grms.; water, 100 litres. Frequently the well-known symptoms of arsenical poisoning were set up in addition to the troubles already mentioned, anæmia and marasmus being the cause of death. A very interesting case is recorded where the loss of sheep was very large owing to the substitution of sodium sulphate for the zinc sulphate. Of 51 sheep dipped, 49 died in less than 24 hours, so the necessity for the astringent with a crude bath such as this is amply demonstrated.

Hellebore in either of its varieties was found to be sometimes effective, but its cost was too high. Moreover, if the root was ground, the powder set up irritation of the mucous surfaces both of the sheep and of the persons handling it. Tobacco, too, was used in the early days, but the mixtures were very crude and sometimes failed to kill off the pest, while it stained the wool and lowered its market value. Sulphydrates of lime and potash also came early into use, but, though they killed off the scab mite, they had little or no effect upon the keds. Then, too, any free lime present made the wool fibre very brittle and uneven, while sulphydrate of potash had very marked depilatory properties.

Lime and sulphur is an undoubted cure for scab, though it fails to kill off other parasites. The Australian Governments, when they framed their regulations for the eradication of scab, all advocated its use, and though the value of Australian wool was very low while this dip was in use, the Governments were quite justified in their action, for it completely put an end to a trouble which has caused the loss of millions of pounds per annum to squatters. The New Zealand Government also did the same thing, and there the same success as far as scab was concerned, was obtained. Since scab has been eradicated, and the low price of wool was definitely traced to the use of lime and sulphur, the flock-owners in Australasia now almost invariably dip in either an arsenical or a carbolic preparation, either of which is effective in killing off all forms of life, in addition to stimulating the skin, thus increasing the wool value of the sheep and also the mutton value of the carcase. The Cape Government has not been so successful, but a large proportion of sheep in the Cape are dipped in lime and sulphur, and it is interesting to note that the wools from this Colony fetch a far lower price than those produced in the countries which have given up its use. That arsenical and carbolic preparations are quite as efficient as lime and sulphur, has been amply demonstrated by the report of the Committee appointed by the Board of Agriculture. Their conclusions are confirmed by my own experience in the curing of scab, and I have no hesitation in saying that if due care is exercised in the use of these dips, scab will soon cease to exist.

Arsenical dips consist of the alkali salts of arsenious acid, sulphides of arsenic, and free sulphur, together with some free arsenious acid. The efficiency of this class of preparation as a parasiticide is admitted everywhere, and where the dip is well manufactured and properly blended its value as a wool stimulant is also recognised. In the modern dip the use of astringents is not called for, as the caustic action of the arsenious acid in the earlier preparations is now absent. In addition to killing off the parasites actually present on the animals dipped, the arsenic precipitated in the fleece together with the sulphides of arsenic and sulphur, acts as a prophylactic against re-infestation. What actually happens to the sulphur and sulphides of arsenic in the fleece is not clear, but it is evident that both are acted on. A distinct odour is given off by the sheep after dipping, indicating that some chemical action is taking place. Whether the emanation keeps off parasites is doubtful, but it is certain that any parasites that get on the sheep within a reasonable time after dipping are killed. In the report of the Departmental Committee of the Board of Agriculture, attention is drawn to the fact that the pupæ of keds are not destroyed after dipping in arsenic. This, too, bears out my own observations. I have frequently watched these hatch out and have found the keds dead in 24 to 48 hours after they have left the shell. An arsenical dip kills scab mite in from 5 to 20 hours. Whether its eggs are killed is doubtful, but if the dip has been used in proper strength, fresh acari are not always found on the sheep, even though those eggs take from 12 to 15 days to hatch out. One of the difficulties which we have to contend with in the curing of scab is that the scab crust is not always penetrated by the dip, so frequently some of the eggs are protected by it; hence it is imperative for perfect safety to re-dip the sheep at the end of from 12 to 15 days, when the protected eggs will have hatched out. The Board of Agriculture, however, recommend that one dipping only is necessary for the curing of scab. The sheep which were experimented on by the Departmental Committee were inoculated with scab. Their condition was very high and the weather was very dry. It was found that the scab did not spread, so it was decided that the necessary moisture should be imparted to the fleece by watering the sheep with a watering-can. Even then the scab was not at all virulent, hence the test could not be considered typical, *i.e.*, where scab abounds in a flock it is usually of a more virulent type than that which obtained in the experiment, and more protection would be afforded by the scab crust to the acari which were present. I have had some experience of scab in dry weather. Some sheep which had some very small scab spots and in which acari were found, were watered in much the same way as those described in the report. The scab, instead of spreading, became gradually less, until ultimately the whole of the acari were killed off by the watering. The condition of the sheep was finally excellent, though when I first saw them they were in a low condition. This experiment runs almost parallel with that outlined by Prof. Winter, hence I venture to think that the Board should re-consider the matter with regard to second dippings. The use of an arsenical dip is much appreciated in countries where scab abounds owing to its preventive powers, and also where the tick is a cause of trouble, as the young ticks which have been hatched out in the pastures are killed off as soon as they try to adapt themselves to the host.

The red louse and any maggots which may be on the sheep at the time of dipping are also exterminated, and it is important to note that, though the maggot fly may strike a sheep some time after dipping, the eggs which are deposited either do not hatch out, or if they do, the maggot hatched from the egg is killed as soon as it is developed.

The good effect of an arsenical dip upon the quality of the fleece of the animal is amply proved by the high prices which are obtained for the wool. Almost invariably the highest priced wools are those that have been dipped in arsenical and carbolic preparations.

The following is the composition of a typical dip of the sulphur-arsenic type:—Arsenic trioxide, 21·90 per cent.; alkali, 2·86 per cent.; moisture, 6·70 per cent.; sulphur, 68·54 per cent.: 1 lb. of it is diluted with eleven gallons of water.

Carbolic acid dips were also found by the Sheep Dipping Committee to be highly effective as parasiticides, but their lasting properties are very small, and in this respect they are inferior to the arsenical dips. Their action in killing the adult parasite is very rapid, death usually occurring in from 5 to 15 minutes. The pupæ of the keds are not destroyed by it, neither are the eggs of sheep scab acari. The red louse is rapidly destroyed, as also are any ticks and maggots. The lack of preventive power of carbolic dips is shown by the fact that sheep dipped in them have frequently been fly-struck within 3 or 4 days after dipping, and the maggots developed in quite a normal manner.

There are three main types of the carbolic dip on the market; the first type is that which forms a rich emulsion when added to water. In addition to carbolic acid it contains a large amount of hydrocarbon oils and soaps. The second is a semi-solution or emulsion containing a smaller amount of hydrocarbon oils, while the third variety is a true solution, the carbolic or cresylic acid being made soluble by the addition of a fairly large amount of soap. The first type has been widely condemned, as it contains a comparatively small amount of carbolic acid with a relatively large amount of neutral hydrocarbon oils. The latter are said to have little power as parasiticides, but the Board of Agriculture do not agree with this contention, as they approve of a dip of this kind which contains far less carbolic acid than they insist upon in the case of the semi-emulsion or true solution. The amount of tar acid contained in the bath for the effectively killing parasites is far less with a true emulsion than is the case with the other types, but that the emulsion kills far more quickly and effectively is I believe beyond doubt. If a parasite is placed under the microscope with an emulsion it will be seen that the suspended globules attach themselves to the organism, killing it very rapidly by completely surrounding it with an envelope of the insoluble material (of course containing carbolic acid as well as the neutral hydrocarbon oils). The action of solutions of carbolic acid must naturally be very different from this, as the poison must first dialyse through the outer walls of the insect before coming into contact with the vital parts, hence its action would be somewhat slower than is the case with the emulsion. In addition to this, if sheep were not given a sufficiently long time in the bath, such dialysis, which is apparently necessary to the death of the parasite, would not take place. Early removal of the sheep from the bath containing an emulsion would not apparently be a serious matter, as the deposition of the active constituents would have efficiently taken place and killed the pest after the sheep had been removed from the dip. Emulsifying preparations have a decided stimulating influence upon the skin of the animal, causing a much finer fleece to be produced both as to quality and quantity. The wool grown after dipping can be readily traced on examining the sheep and it is remarkable to note how the dips stimulate the growth.

The preventive properties of carbolic dips are very low, and where parasites have to be dealt with a second dipping should take place some 14 to 18 days after the first immersion, as by then the whole of the keds contained in the pupæ present at the first dipping will have hatched out, as also will the acari from any eggs deposited by the scab mite which was killed at the first dipping.

I append two typical analyses of carbolic dips, No. 1 being an emulsifying dip and No. 2 a soluble one. No. 1:—Phenols, 16·30 per cent.; hydrocarbon oils, 60·16 per cent.; bases, 2·10 per cent.; fatty acids, 14·08 per cent.; alkali and water (by difference), 7·36 per cent.: One gallon of the dip is diluted with 50 gallons of water. No. 2:—Phenols, 60·1 per cent.; hydrocarbon oils, 2·0 per cent.; fatty acids, 23·0 per cent.; alkali, 4·1 per cent.; water, 10·8 per cent.: One gallon of the dip is diluted with 100 gallons of water.

During recent years a tendency has been shown by many flock-owners to use a combination of both carbolic and arsenical dips. At first this was done by mixing an arsenical powder dip and a liquid carbolic dip. It was the practice to use one of the dips in full strength and the other at half strength, but more recently, manufacturers have produced a preparation which is sold in the form of a paste. This contains carbolic acid together with hydrocarbon oils and some greases which are said to waterproof the fleece; into this paste is incorporated arsenic in a more or less soluble form. These dips are found extremely effective. The carbolic acid portion kills off the parasites very rapidly while the arsenic which remains in the fleece kills off the eggs and pupæ which would hatch out at a later date. Their effect upon the wool is usually a good one and the popularity of this kind of dip is a rapidly growing one. I append an analysis of a dip of this kind. Tar acids, 13·32 per cent.; fatty acids and glycerides, 22·48 per cent.; hydrocarbons, 32·72 per cent.; bases, 1·03 per cent.; arsenic trioxide, 8·05 per cent.; alkali, 5·83 per cent.; water (by difference), 16·57 per cent.

In connection with the tar preparations it is well to mention that care must be exercised in the selection of the tar oil present. The distillates known as "middle oils" should be used and the higher boiling oils avoided as they discolour the wool and adversely affect the fibre, rendering the whole fleece of little value to the manufacturer as they cannot be scoured successfully.

I have little personal experience with tobacco dips, but I have seen wools badly discoloured by some solutions. As the colour was not readily washed out, considerable depreciation in value took place. They kill scab and other insects with facility, but like carbolic dips they do not kill off the pupæ of the keds, though they appear to be effective in destroying the eggs of the acarus.

Foot rot is the cause of considerable trouble to the sheep-farmer, but I do not know that any definite pronouncement has yet been made as to the cause of this infection. It has sometimes been claimed that it is set up by an animal parasite, but bacteriologists claim that it is due to bacteria. The popular mode of treating it is to pass sheep through a foot-bath of copper sulphate solution or to treat the part, after paring, with an ointment containing various salts of copper. Sheep which suffer from the disease, walk very much better after being dipped in a carbolic or an arsenical preparation and the parts heal to a very considerable extent. The disease is one which demands attention, and I trust that in the near future a specific remedy will be evolved which will be a radical cure.

In conclusion, I desire to express my appreciation of the steps which the Board of Agriculture have taken with regard to the eradication of scab in Great Britain, and I am pleased to note that, unlike the Agricultural Departments of some other countries who have undertaken similar measures, they approve of the dips which are effective. This is surely far better than to allow the onus of the proof of the efficiency of a particular preparation to lie with the user of the dip. Frequently where this has been the case, the farmer has found that he has been imposed upon and that his sheep are still full of lice and other parasites, and the result has been that he has appeared before the magistrates and been fined (as in New Zealand).

DISCUSSION.

Mr. C. J. **GILBERT** referred to the sheep dips in their economical aspect. There were hundreds of thousands of acres of rich land in South Africa and elsewhere, eminently adapted for the breeding of flocks and herds, in which the stock-raising industry had been rendered impossible owing to virulent diseases which were transmitted by ticks. Dipping alone could destroy these parasites, and render this land again available for the flockmaster. He also pointed out the importance of protective properties in all dipping preparations; a protective dip would in this case be invaluable. Naturally a protective dip was also an economical dip except in presence of scab, as it often obviated the necessity for a second dipping to destroy the new brood of ticks and keds that hatched out after dipping, and which a protective dip would destroy as fast as they appeared. Sheep scab had never been exterminated in any country by the aid of non-protective dips, and he believed never would be. He believed that the officials of the Agricultural Department, in practice, fully recognised the fact that one dipping could not be relied upon to cure scab.

Obituary.

SAMUEL HALL.

Samuel Hall, F.I.C., Treasurer of the Society of Chemical Industry, and one of its founders, was born in Austin Friars, London, Sept. 24th, 1829. Following his elementary education at a private school in Brighton, he became one of the earliest pupils of the City of London School. On leaving school at the age of fifteen, he entered University College, where he completed his education. His favourite studies were chemistry and science generally, but on leaving college he entered his father's business, which was that of Messrs. Hall Brothers, hat manufacturers, Fore Street, and Frampton Cotterell. Three years later his father became blind, and thus the conduct of the whole business fell upon the son's shoulders. Samuel Hall continued this business successfully until the beaver hats then manufactured, became replaced by the more modern silk hats. Having disposed of the old business in 1870, he became a partner in the firm of Messrs. Edward Cook & Co. On entering the soap business, Mr. Hall, who had never lost his hold of chemistry, studied the subject more deeply so as to take charge of the chemical side of the business. Under his guidance this has steadily developed, and the works contain well-equipped laboratories, which he superintended. Samuel Hall was one of the original members of the Society of Chemical Industry, and when his relative and co-partner, Edw. Rider Cook, died in 1898, Mr. Hall was appointed to succeed him as Honorary Treasurer, an office which has been associated with their firm since the foundation of the Society. Mr. Hall, like his partner, the late E. Rider Cook, was an admirable treasurer, and spared no trouble in conserving the Society's financial matters, whilst he attended with consistent regularity the meetings of both the Council and the Publication Committee as well as the ordinary scientific meetings of the London Section. Such, indeed, was the confidence of the Council in their Hon. Treasurer's ability and judgment that they deputed him on many occasions to act for them in matters of urgency.

In the circles of chemical industry, Samuel Hall was one of the most beloved of men, and his death comes as a break to many friendships. His was a remarkable life, and as is usually the case, his very friendships indicate the intellectual status of the man. Among former intimate friends, he could count on the one hand Michael Faraday, and on the other, the late Bishop Colenso, with whom he corresponded: in short, besides being a chemical technologist, he was a generally thoughtful and widely-read man.

Mr. Samuel Hall died at his residence, Aberdeen Park, Highbury, N., on December 9th, aged 78 years.

Journal and Patent Literature.

Patent Specifications may be obtained by post by remitting as follows:—
English.—8*d.* each, to the Comptroller of the Patent Office, C. N. Dalton, Esq., Southampton Buildings, Chancery Lane, London, W.C.
United States.—1*s.* each, to the Secretary of the Society
French.—1 fr. 25 c. each, to Belin et Cie., 56, Rue des Francs-Bourgeois, Paris (3e.).

I.—PLANT, APPARATUS, AND MACHINERY.

Heat-insulating materials; Laboratory test for ——. C. R. Darling. *See* XXIII.

Royal Commission on Canals and Waterways. Times, Dec. 12, 1907.

The Royal Commission on Canals and Waterways have recently obtained Treasury sanction for an inquiry into the probable cost of improving the canals and waterways connecting the Midlands with the Thames and the Humber. Unless the results of this inquiry lead the Commission to reconsider their scheme, the investigation as to cost will not stop with these two routes, but will be extended to two more—viz., those connecting the Midlands with the mouths of the Mersey and the Severn.

The firm of Sir John Wolfe Barry and Partners have undertaken the investigation on behalf of the Commission, and will shortly inspect, first, the route from Brentford to Birmingham *via* the Grand Junction, Oxford, and Warwick Canals, and, secondly, the route from Norton Junction, on the Grand Junction Canal, *via* the Leicester and Loughborough Navigations, through Nottingham, and by the river Trent to the Humber. The improvement of the Regent's Canal in connection with the route to the Thames will be reported upon. The estimates as regards canals will be for two or three alternative gauges, of which the smallest will be a canal with locks capable of accommodating not only barges carrying 100 tons, but also multiples of smaller canal boats. In the case of rivers, the cost of improving them so as to render them navigable by barges and sea-going lighters of still larger capacity will be studied.

Meanwhile, for some time, a committee of the Commission has been collecting the necessary information as regards the water supply available for such improved inland navigations.

Patents.

Mixing fluids of different densities or a heavy precipitate with a liquid; Device for ——. H. Leiser, Thorn, Germany. Eng. Pat. 25,108, Nov. 7, 1906.

A number of S-shaped tubes having their lower ends flared and pointing in the direction of rotation, are mounted on arms which project from a vertical shaft, which can be rotated by suitable means in a vessel containing the liquids to be mixed. On rotating the shaft, the liquids are agitated as a whole and at the same time the lower layers of liquid rise up the tubes and flow out of the upper orifices of the latter, producing a thorough mixing.—W. H. C.

Evaporators; Multiple ——. F. I. Scard, London. Eng. Pat. 29,390, Dec. 24, 1906.

A number of evaporating vessels each formed of a vertical tubular heater, with a liquor space below and a vapour space above, are superposed one upon the other. The steam from the vapour space of a lower vessel passes by internal lateral passages directly to the steam space of the tubular heater of the vessel next above. The liquor is fed into the vapour space of the lowest vessel and passes through the tubes of the heater to the liquor space below. From this space it is withdrawn by a pump, part being returned to the vapour space of the same vessel and part being delivered to the vapour space of the vessel next above. The evaporation in the lowest vessel is effected by steam from an external source. The liquor passes upwards from vessel to vessel, to the uppermost, from which it is delivered to the store tank by the circulating pump proper to this vessel, which has its vapour space connected to the vacuum pump.—W. H. C.

Concentration of liquids [*soap lyes, etc.*]; *Process for the* —— *and apparatus therefor.* H. W. Lake, London. From Stöhr und Co., Ltd., Leipzig-Plagwitz, Germany. Eng. Pat. 16,344, July 16, 1907.

The liquid to be concentrated is mixed with toluol or other aromatic hydrocarbon having a boiling point of over 100° C., and the mixture is heated. In the presence of water, a mixture of toluol and water vapour boiling between 80 and 82° C. distils off, leaving the liquid in a concentrated form. The mixed vapours are passed through a condenser and the condensed liquids separated. The toluol is continuously returned to the distilling vessel and used over again until the liquid is sufficiently concentrated. The heating is then stopped, the mixture withdrawn from the distilling vessel, and the concentrated liquid separated from the toluol. The hydrocarbon prevents the formation of a scum, allows the concentration to be effected at a comparatively low temperature, acts as an efficient seal preventing the disengagement of obnoxious odours, and dissolving any fatty or other impurities from the liquid which are soluble in the hydrocarbon.—W. H. C.

Drying or evaporation ; New process for ——. H. Kayser. Fr. Pat. 380,065. July 19, 1907.

The steam given off during the process is absorbed by a salt solution which is afterwards separately evaporated at a high temperature and the steam obtained used in an engine, or for heating the evaporating apparatus.
—W. H. C.

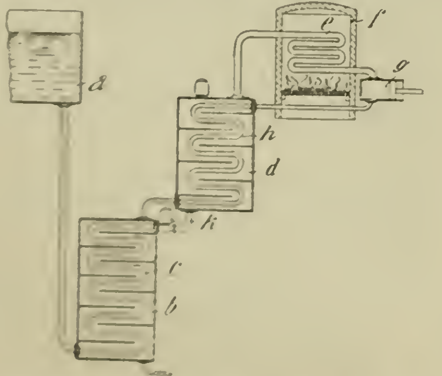
Filter-presses. R. Rossée, Heidelberg and Unionwerke A.-G. Fabr. für Brauerei-Einrichtungen vorm. H. Stockheim, vorm. O. Fromme, vorm. H. Gehrke und Co., Mannheim. Eng. Pat. 9285, April 22, 1907.

A previously prepared filter-slab or cake of fibrous material is supported on each frame of the press by a grid which has the centre portion of each of the bars bent upwards towards the slab, in order to provide a free passage for the entry of the liquid to be filtered and for the exit of the filtrate.—W. H. C.

Stoppering bottles, jars and the like in vacuo ; An apparatus for ——. J. Talansier and La Comp. Francaise des Produits Fixator, Paris. Eng. Pat. 13,715, June 13, 1907.

The bottle or other vessel is placed in position under a vertical spring plunger, the lower end of which carries an air-tight chamber within which a vacuum may be produced and through which the plunger passes air-tight. The stopper, cork, or the special capsule described in Eng. Pat. 22,600 of 1906, is placed in the neck of the bottle, and the plunger forced downwards a short distance by means of a rack and pinion actuated by a lever. This brings the orifice of the vacuum chamber into contact with the neck of the bottle, the joint being made tight by a rubber ring carried by the former. Connection is next established between the vacuum chamber and the vacuum pump, and the air is pumped out of the bottle. The lever is then further depressed, so that the plunger forces the stopper or capsule into the neck of the bottle. If a capsule is used, the plunger forces it against the sides of the neck. After releasing the vacuum, the lever is reversed, and the plunger is withdrawn along with the vacuum chamber. The lower end of the plunger is fitted with a spring cap which prevents the stopper being withdrawn from the bottle as the plunger is raised.
—W. H. C.

Boiling and distilling apparatus. R. Planckh, Graz-Eggenberg, Austria-Hungary. U.S. Pat. 870,747, Nov. 12, 1907.



The apparatus comprises a tank, *a*, from the bottom of which a tube extends vertically downwards, the lower end of this tube being connected with the lower end of the serpentine pipe, *c*, which is surrounded by a casing, *b*. The upper end of the pipe, *c*, is connected by a tube with the bottom of another casing, *d* ; this casing surrounds a second serpentine pipe, *h*, which is connected at its lower end with the upper part of the casing, *b*. The upper part of the casing, *d*, is connected with a tube, *e*, contained in the superheater, *f*, and a suitable compressing device, *g*, is connected by a tube with the tube, *e*, and also with the upper part of the serpentine pipe, *h*.—W. C. H.

Impregnating liquids with gas ; Means for ——. H. Stroh, Heilbronn, Germany. U.S. Pat. 871,245, Nov. 19, 1907.

See Fr. Pat. 371,308 of 1906 ; this J., 1907, 308.—T. F. B.

Inflammable liquids ; Storage and transference of ——. C. Martini and H. Hüncke, Hanover, Germany. U.S. Pat. 871,353, Nov. 19, 1907.

See Eng. Pat. 4589 of 1907 ; this J., 1907, 1078.—T. F. B.

Liquid separator ; Centrifugal ——. E. A. Forsberg, Assignor to Aktiebolaget Separator, Stockholm. U.S. Pat. 872,173, Nov. 26, 1907.

See Eng. Pat. 21,190 of 1905 ; this J., 1906, 211.—T. F. B.

Crystallising apparatus. G. Schicht, Vienna. U.S. Pat. 872,257, Nov. 26, 1907.

See Fr. Pat. 354,522 of 1905 ; this J., 1905, 1161.—T. F. B.

II.—FUEL, GAS, AND LIGHT.

Ash in coals ; Electromagnetic separation as a means of lessening ——. E. Prost. Bull. Soc. Chim. Belg., 1907, 21, 361—373.

Electromagnetic separation does not afford a means, even in the case of coals with ferruginous ash, of obtaining portions having ashes of easier and of less easy fusibility ; but by its means the coal can be separated into portions containing lower and higher percentages of ash. In some cases the yield of low-ash coal and the percentage of ash are more favourable than the results of separation by washing, but at present the cost of electromagnetic separation, even where the results are most favourable, is so great as to be prohibitive. In the case of many of the Belgian coking coals, electromagnetic separation would be of great advantage ; for washing with water destroys the coking property, and the coals have to be put into the ovens in the natural state, with all their ash. Even where washing has not this result, electromagnetic separation would have the great advantage that, as there would be no water to evaporate, the coking temperature would be reached much more rapidly, and the quality of the coke correspondingly improved.—J. T. D.

Gas purification ; Burnt spent oxide for ——. J. Tysoe. J. Gas Lighting, 1907, 100, 566.

Contrary to the prevalent opinion, the author has found that burnt spent oxide, as obtained in the manufacture of sulphuric acid from spent oxide, can be used successfully for the removal of hydrogen sulphide from gas. The burnt oxide from the kilns, after being quenched, is mixed with about 25 per cent. of sawdust, and well wetted. It is not very active at first, and hence it is best to prepare it for use in a box which can be controlled independently of the other purifier-boxes. This box is placed at the beginning of a series, and when no more hydrogen sulphide is absorbed by the spent oxide, the box is shut off and the contents removed and distributed among the other boxes. Just as with new bog ore, this preliminary absorption of sulphur renders the oxide more active.—A. S.

Peat utilisation ; The Ziegler system of ——. Engineering, Nov. 15, 1907, 671—675. (See this J., 1907, 142.)

The peat is cut in the ordinary way and then pressed and formed into sods which are dried in the air. The moisture is thus reduced to from 25 to 18 per cent. Peat which has been dried so that it contains less than 25 per cent. of moisture is converted into coke, and that which cannot be brought below this limit, is used for the production of half-coke, or for power-gas. To produce coke, the dried peat is heated in semicylindrical retorts set in pairs in a furnace and heated by the gas given off after the tar and water have been condensed. The peat in one retort is dried while that in the other is being coked. To produce half-coke, the peat is heated in a shaft kiln by gases from some external source which pass through the peat ; and to obtain power gas, it is used in a producer or generator. The peat coke obtained forms a good substitute for charcoal, and has been successfully employed for hardening armour plates, for the production of calcium carbide, and as a smokeless fuel in the German Navy. The half-coke forms a good fuel which burns with a flame and produces but little smoke and soot.—W. H. C.

Coke manufacture in Great Britain. Times, Eng. Suppl., Dec. 11, 1907. [T.R.]

THE Coal Distillation Company have received a contract for 34 Huessener by-product coke ovens for the Holbrook Colliery, near Killamarsh, Derbyshire. Koppers' Coke Oven and By-Products Company, of Sheffield, have in hand the installation of 30 of their ovens with by-product plant for the recovery of tar, benzol, and ammonia at the Rockingham Colliery, Birdwell, near Barnsley. The same firm have just recently completed 50 ovens at the Bargoed Colliery, South Wales, which is a duplicate of an installation installed at the same colliery last year. The Bryncethin Colliery Company, South Wales, are also having installed 60 Coppée ovens, and 45 similar ovens are being laid down at one of the South Wales collieries of the Lancasters' Steam Collieries (Limited).

PATENTS.

Fuel ; Production of a partially coked ——. T. Parker, London. Eng. Pat. 17,347, Aug. 1, 1906.

IN order to avoid the superficial coking of the mass of coal, which may occur on carrying out the process of partial destructive distillation described in Eng. Pat. 14,365 of 1906, (see U.S. Pat. 865,724 ; this J., 1907, 1130), the heat is applied to the coal gradually and slowly. The maximum temperature attained is about 800° F., the heating being stopped as soon as a flame test shows that illuminating gas has ceased to come off.—H. B.

Coke for metallurgical purposes ; Ovens used in the manufacture of ——. H. Brown, Bolton, Lancs. Eng. Pat. 26,882, Nov. 27, 1906.

PASSAGES are formed in the roofs of the coking ovens, into which the gases generated on charging pass, and from which they are led to the usual zig-zag passages in the side-walls of the ovens, where they are burnt, the heat given out aiding to heat the ovens. Controlling dampers serve to close these passages during the ordinary run of the ovens.—A. G. L.

Motive fluid in explosion motors ; New gasifiable liquid combustible mixture applicable as ——. G. Leclerc. Fr. Pat. 379,714, Sept. 15, 1906.

THIS motive fluid for explosion motors consists of a solution of nitroglycerin in denatured alcohol, or in petroleum spirit ("mineral essence") or analogous hydrocarbons. —W. C. H.

Gas furnaces ; Regenerative ——. F. Siemens. Second Addition, dated July 22, 1907, to Fr. Pat. 333,299, June 23, 1903. Under Int. Conv., June 12, 1907.

SEE Eng. Pat. 13,620 of 1907 ; this J., 1907, 1191.—T. F. B.

Distillation of coal and other substances ; Destructive —— *and apparatus therefor.* J. Bowing, London. Eng. Pat 24,687, Nov. 3, 1906.

COAL and other substances are subjected to destructive distillation in a narrow retort of uniform width, but tapered from the bottom towards the top. The two larger walls of the retort are provided with outer walls to form jackets, into which atmospheric gas flames are injected, in such a way as to practically fill the jacket with flame. (See also Eng. Pat. 580 of 1905 ; this J., 1906, 171.)—W. C. H.

Retorts for the carbonisation of coal ; Vertical —— *and settings therefor.* H. W. Woodall, Wimborne, and A. McD. Duckham, Upper Parkstone, Dorset. Eng. Pat. 24,695, Nov. 3, 1906.

THE vertical retorts are built up entirely or partly of sections, each of which has top and bottom flanges, between which longitudinal ribs extend. The setting for the retorts consists of brickwork columns arranged to engage the ribs on the retort sections, the retorts being held securely in position by the ribs fitting into grooves in the brickwork. The sides of the setting are shaped to surround the retorts as far as possible, and thus to contract the cross-section of flues in a suitable manner. (See also Eng. Pat. 11,956 of 1905 ; this J., 1906, 581.) —W. C. H.

Coal and other carbonaceous substances ; Retorts for the distillation of ——. T. Parker. Fr. Pat. 380,017, June 1, 1907. Under Int. Conv., Feb. 19, 1907.

THESE retorts are oblong in section, and taper from the bottom to the top. The residue left after distillation is discharged through the bottom of the retort, which is closed by a flap hinged on a rod attached to the retort base. The flap is raised or lowered by means of a rod passing up the retort close to one of its walls. This rod projects through a stuffing-box on the top of the retort, and the top of the rod is tapped, and the screw provided with a wheel, on which is a central boss which is pushed upwards by a spiral spring through which the rod passes. On turning the wheel, the rod and flap can be raised or lowered, but owing to the pressure of the spring on the boss of the wheel an elastic relation is maintained between the flap and the means for opening or closing it. The retorts are specially applicable to the process described in U.S. Pat. 865,724 of Sept. 10, 1907 ; this J., 1907, 1078.—W. C. H.

Gas-producer. W. B. Hughes, Cleveland, Ohio. U.S. Pat. 866,032, Sept. 17, 1907.

A CASING is arranged to hang down from the outside of the bottom of the body of the producer, and contains a hopper which forms a continuation of the interior of the body of the producer. A basin, to which water can be supplied, is arranged at a short distance below the hopper, and is also contained within the casing. Pokers, mounted on universal joints, are arranged at definite points, and pass through openings in the casing, and can be moved about so as to shift ashes in the space between the hopper and the basin. A blower passes through the casing and the ash-basin.—W. C. H.

Gas-producer. G. W. Bulley, New York. U.S. Pat. 870,271, Nov. 5, 1907.

THE producer comprises an inclined generating chamber, which contains a mass of incandescent carbonaceous material ; the lower end of this chamber is provided with a water-seal, through which fresh fuel can be continuously introduced, whilst the upper end is connected directly with the top of a vertical chamber. A zone of combustion is maintained part way up the inclined chamber by a number of blast tuyères, arranged to deflect the entering air in a downward direction, and the fresh fuel introduced at the bottom of the chamber is forced upwards by suitable means and becomes carbonised on passing through this zone, and is then discharged from the upper end of the inclined chamber into the top of the vertical chamber. The bottom of the vertical chamber is also provided with a water-seal, and a receptacle for ashes. The inclined and vertical chambers may also be provided with auxiliary blast tuyères. A gas exit opening is provided at the upper end of the inclined chamber, and another at the lower part of the vertical chamber.—W. C. H.

Gas ; Process of generating ——. G. W. Bulley, New York. U.S. Pat. 871,202, Nov. 19, 1907.

GASES of different characteristics may be produced in this process at the same time, from carbonaceous material. The carbonaceous mass is confined in a closed retort, and caused to move progressively through it by the continuous introduction of fresh material through a water-seal. The mass comprises three portions, one of fresh fuel, a second of partially coked fuel, and a third of completely coked fuel, which follow in this order from one end of the retort to the other. A zone of incomplete combustion is formed in that region of the retort where the fuel becomes partially coked, and this partially coked portion is then subjected to an air-blast, and the resulting gas is caused to infiltrate through the fully coked fuel which is in a highly heated condition. A portion of the gas is withdrawn from the upper part of the retort, and the remaining gas is caused to infiltrate through another bed of coke, also in a highly heated condition, contained in another limb of the retort, this gas being withdrawn below the point of withdrawal of the first-mentioned gas. See also U.S. Pat. 870,271 above.—W. C. H.

Gas-generator. S. C. Gorsuch, Braddock, Pa. U.S. Pat. 871,497, Nov. 19, 1907.

AN injector, consisting of a vertical cylinder is mounted upon the base of the generator, and extends into the generating chamber. The cylinder is divided into a series of chambers by a number of partitions of greater length than the cylinder. A flange, the lateral extension of which is provided with a series of openings, is secured to the cylinder. The top of the cylinder is provided with a conical cover, resting partly upon the tops of the partitions, and partly upon the lateral extension of the flange; the upper edges of the partitions are sloped downwards, but at a greater inclination than the inclination of the conical cover of the cylinder. A supply pipe communicates with each chamber of the cylinder.
—W. C. H.

Producer gas plant. G. L. Morton, Sutton Coldfield. U.S. Pat. 871,810, Nov. 26, 1907.

SEE Eng. Pat. 1980 of 1906; this J., 1907, 41.—T. F. B.

Gas-producer without a grate. Akt.-Ges. Görlitzer Maschinenbau-Anstalt und Eisengiesserei. Fr. Pat. 380,177, July 23, 1907.

THIS producer is of the type in which the air for combustion is previously heated, and the gas produced, is withdrawn from the axis of the generator at its hottest zone. Round the upper end of the gas-discharge pipe, which is situated at or below the hottest zone of the producer, is arranged an air or water reservoir, which takes the form of a hollow bell, and round which the discharge gases circulate, heating it, and either vaporising the water, or re-heating the air. The re-heated air passes by a conduit into the combustion chamber of the producer, and the steam passes through exit openings in the bell into the hottest zone of the producer. When the reservoir is to be used for air, it is provided with a partition, which causes the air to come into close contact with the walls. The supplementary air may be supplied by a pipe, which passes up the central axis of the gas-discharge pipe, the air becoming thus heated by the discharge gases. The body of fuel in the producer rests upon a mass of cinders and ashes, not on a grate.—W. C. H.

Gas and coke; Process for the manufacture of —— from waste sulphite-cellulose lyes. E. Trainer. Ger. Pat. 181,126, Jan. 14, 1905.

THE waste lyes are evaporated to dryness with the addition of compounds of the alkalis or alkaline-earths and of finely-divided lignite or low-grade coal, and the residue is formed into briquettes, and carbonised. Claim is also made for the addition to the lyes, of such substances as will produce slag during the carbonisation process and thus render the coke stronger.—A. S.

Gas washing and cooling apparatus. G. H. Bentley, Manchester. Eng. Pat. 24,624, Nov. 3, 1906.

THE combined cooling and washing apparatus, which is designed for the treatment of producer gas and the like, consists of a vertical cylindrical casing, the lower end of which is open and rests in a water-seal pan. The upper portion of the casing is fitted internally with perforated horizontal pipes for producing showers of water, whilst the lower portion is divided by vertical partitions into two or three water-sealed chambers, the central chamber enclosing a rotary fan which revolves in a vertical plane and dips slightly into the water in the pan. The producer gas, on entering the lower part of the apparatus, passes below the water-sealed partitions and then enters the fan chamber, where it is washed and cooled by the spray produced by the fan; it is projected thence into the upper part of the apparatus, where it is further cleansed and cooled by the showers of water. The falling water drains into the fan chamber and thence into the water-seal pan.—H. B.

Gases; Process for absorbing, condensing, or purifying ——. F. Brandenburg, Lendersdorf, Germany. Eng. Pat. 7116, March 25, 1907.

SEE U.S. Pat. 859,427 of 1907; this J., 1907, 862.—T. F. B.

Gas purification system for suction or other plant. R. V. Farnham. Fr. Pat. 379,983, July 17, 1907.

SEE Eng. Pat. 11,213 of 1906; this J., 1907, 248.—T. F. B.

Sulphuretted hydrogen; Process for the removal of —— from gases. Gewerkschaft Messel. Ger. Pat. 181,063, April 29, 1906.

THE gas is treated with a solution (of acid reaction) of neutral or basic ferric salts of organic hydroxycarboxylic acids, especially lactic acid. The spent reagent may be regenerated by warming and treating with oxygen or air under pressure. The reagent oxidises the sulphuretted hydrogen with formation of sulphur.—A. S.

Incandescence mantles; Process of manufacture of ——. Deutsche Gasglühlicht Akt-ges. (Auerges.). Fr. Pat. 379,928, July 13, 1907.

THREADS or tissues for incandescence gas mantles are impregnated in the usual way with solutions of the luminiferous salts, and then treated with organic bases, such as aniline, toluidine, xylidine, pyridine, etc., in place of treatment with alkalis.—W. C. H.

Filaments for incandescent electric lamps; Apparatus for treating electric conductors, especially applicable in the manufacture of ——. The British Thomson-Houston Co. Ltd., London. From General Electric Co. of Schenectady, N.Y., U.S.A. Eng. Pat. 5576, March 7, 1907.

THIS apparatus is for use in the removal, by distillation, of the cadmium amalgam employed to give the ductility necessary for drawing filaments of refractory bodies, such as tungsten. It consists of a hermetically closed vessel, which can be exhausted, and contains a supply of untreated ductile filament on a reel. Mechanism is provided in the vessel for automatically unwinding a definite length of the filament from the reel, and for forming the length into a loop, to which a low current is supplied and automatically increased until the loop is heated to incandescence. Means are provided for removing the loop after treatment, and the apparatus is arranged to repeat these operations on successive lengths of the untreated conductor.—W. C. H.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Petroleum production of the world. Mineral Resources, 1906. [T.R.]

THE following table shows the world's production of crude petroleum for the last three years, in barrels:—

Country.	1904.	1905.	1906.
U.S.	117,080,960	134,717,580	126,493,936
Russia	78,536,655	54,960,270	59,043,829
Sumatra, Java, and Borneo	6,316,169	7,334,310	7,399,024
Galicia	5,947,383	5,765,317	5,467,967
Roumania	3,599,026	4,420,987	6,378,184
India	3,385,468	4,137,098	4,015,803
Japan	1,418,767	1,341,157	*1,341,157
Canada	552,575	634,095	569,753
Germany	637,431	560,963	579,101
Peru	49,524	37,720	42,419
Italy	25,476	44,027	*50,000
All others	40,000	*30,000	*30,000
Total	217,589,434	213,983,524	211,411,173

* Estimated.

The slight decrease in production noted in 1905 as against 1904 is shown also in 1906 as against 1905. This was due in 1906 chiefly to the decrease in output in the United States.

IV.—COLOURING MATTERS AND DYESTUFFS.

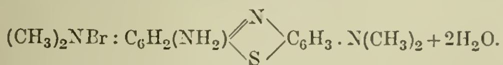
Phenol; The ferric chloride reaction of ——, and the hypochlorite reaction of aniline. F. Raschig. Z. angew. Chem., 1907, **20**, 2065—2071.

The isolation by the author in 1899 of the blue compound $Fe[OC_6H_2(CH_3)(SO_3H)_2]_3$ by treating *p*-cresol-*oo*-disulphonic acid with ferric chloride led him, in 1900, to conclude that all such colorations produced from phenols and ferric chloride were due to the formation of the phenolic iron salt. This statement has received confirmation by the preparation by Hantzsch and Desch of iron salicylate. As the acid character of the phenol is increased, the colorations become more intense, thus the iron salt of pyrogallol is deep, dark-blue and that of gallic acid black (ink).

In studying the coloration produced by the action of sodium hypochlorite on aniline, the author treated the solution with alkaline stannous chloride and isolated *p*-aminohydroxydiphenylamine, the leuco-compound of Indophenol. It is to the production of this dyestuff, therefore, together with azobenzene and benzoquinonediimide that the violet colour is due. The first product of the reaction is probably phenylchloroamine which, under the influence of alkali, gives phenylhydroxylamine. This is then transformed to *p*-aminophenol which, as is well known, condenses with aniline to Indophenol.
—J. C. C.

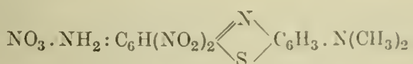
Thiazines. I. Derivatives of Methylene Blue. R. Gnehm and E. Walder. J. prakt. Chem., 1907, **76**, 401—427. (Compare this J., 1906, 368.)

By reducing Methylene Green hydrobromide with zinc and acetic acid, Aminomethylene Blue is obtained, which, as hydrobromide, has the constitution :



$$(CH_3)_2NBr:C_6H_2(NH_2)\langle{}^{N}_{S}\rangle C_6H_3.N(CH_3)_2+2H_2O.$$

It is soluble in water, methyl-, ethyl-, or amyl alcohols, glacial acetic acid, sparingly in acetone or chloroform, and is insoluble in water. The concentrated solutions are violet-blue and the dilute, pure blue. Silk and tannin-mordanted cotton are dyed rather more strongly and in more violet shades than is the case with Methylene Blue. Aminomethylene Blue yields a very unstable diazo-derivative, which gives with R-salt, an azo-dyestuff producing violet shades on silk or wool. The diazo-group can be replaced by iodine, furnishing Iodomethylene Blue which gives similar shades on silk or tannin-mordanted cotton as does Methylene Blue. When the diazo compound is heated with water, Hydroxymethylene Blue is formed, which dyes silk and tannin-mordanted cotton in more violet shades than does Methylene Blue. When Methylene Blue is treated with a mixture of glacial acetic and nitric acids, Methylene Green is first formed, and, after warming for two hours on the water-bath, dinitrodimethylthionine is produced, which, as nitrate, has the constitution :



$$NO_3.NH_2:C_6H(NO_2)_2\langle{}^{N}_{S}\rangle C_6H_3.N(CH_3)_2$$

The base is very sparingly soluble in water, or methyl and ethyl alcohols, but dissolves more readily in acetic acid with a blue-red dichroic colour. It dyes silk and tannin-mordanted cotton in full, brownish-violet shades. The diamino-compound, obtained on reduction, gives blue-green solutions in water, alcohol or glacial acetic acid and dyes silk and tannin-mordanted cotton in green shades.
—J. C. C.

Morinda longiflora; Chemical examination of the root and leaves of ——. M. Barrowcliff and F. Tutin. Chem. Soc. Trans., 1907, **91**, 1907—1918.

From the root of *Morinda longiflora*, the authors have isolated a hydroxymethoxymethylanthraquinone (m. pt. 290° C.) from which a dihydroxymethylanthranol (m. pt. 235° C.) and 1:3-dimethoxy-2-methylanthraquinone (m. pt. 181° C.) were prepared. The leaves yielded a new, crystalline alcohol, *morindanol*, $C_{38}H_{62}O_4$ (m. pt. 278° C.) having the optical rotation $[\alpha]_D = +65{\cdot}9°$, and giving methylmorindanol (m. pt. 116° C.) on treatment with sodium ethoxide and methyl iodide.—J. C. C.

Morindin. O. A. Oesterle and E. Tisza. Arch. Pharm., 1907, **245**, 534—553. (Compare Perkin and Hummel, Chem. Soc. Trans., 1894, **65**, 851.)

The authors have repeated much of the earlier work on morindin and consider that morindon, obtained from the glucoside on hydrolysis, may possess the constitution, $C_{15}H_{17}O_2(CH)_2.OC_{12}H_{14}O_3(OH)_7$. Morindon produces pale violet shades on cotton mordanted with cobalt, nickel, zinc, cadmium and tin, pale violet to full blue-violet shades with chromium, copper, bismuth, germanium, cerium, thorium and yttrium mordants progressively, and pale violet to chocolate brown tints on lead, manganese and iron mordants progressively. The zirconium and thallium lakes are red-violet, aluminium, orange red ; and uranium, grey green. The dyeings are enhanced by treatment with Turkey-red oil, thus the aluminium lakes are bright orange to scarlet and the iron lake is grey-violet to dark violet or even black. Fibres printed with a mixture of iron and aluminium mordants are dyed red-violet. Wool and silk are dyed orange, which changes to violet on soaping.—J. C. C.

Patents.

Ortho-oxy-monoazo-colouring matters [azo dyestuffs]; Manufacture of new —— A. G. Bloxam, London. From Act.-Ges. f. Anilin-Fabr., Berlin. Eng. Pat. 26,416, Nov. 21, 1906.

New dyestuffs derived from picramic acid are obtained by the gentle reduction of azo-dyestuffs having the general formula, $C_6H_2.OH.(NO_2)_2.N:N.R$, wherein R represents an acid such as a naphtholsulphonic acid, an aminonaphtholsulphonic acid, a naphthylaminesulphonic acid or the like. The reducing agent used may be either the "hydrogen sulphide" of an alkaline-earth metal or a mixture of sodium sulphide and a suitable salt of an alkaline-earth metal. The dyestuffs dye wool from an acid bath, and by subsequent chroming, shades are obtained which are exceedingly fast to milling and to boiling water.—P. F. C.

p-Nitrodiphenylamine or p-aminodiphenylamine and their derivatives; Method of preparation of ——. Act.-Ges. f. Anilinfabr. Fr. Pat. 379,949, July 16, 1907.

p-Nitrodiphenylamine or *p*-aminodiphenylamine and their derivatives are prepared by treating the corresponding ortho-sulphonic acids with mineral acids at temperatures not exceeding 100° C., under the ordinary pressure.
—J. C. C.

Gallocyanine dyestuffs; Manufacture of new derivatives of ——. Farb. vorm. L. Durand, Huguenin und Co., Hüningen i E, Germany. Eng. Pat. 19,001, Aug. 23, 1907. Under Int. Conv., May 18, 1907.

New dyestuffs are obtained by reducing the condensation product of a gallocyanine dyestuff with an amine, in acid solution at a temperature of 80°—100° C., until a sample of the reaction mixture gives a pure green solution in concentrated sulphuric acid. The dyestuffs separate from the mother-liquor on cooling. Their aqueous solutions are almost colourless, but rapidly turn blue on exposure to air. With metallic mordants they give brilliant pure blue shades which can be discharged to a pure white.—P. F. C.

Anthrachrysone derivatives. B. Homolka, Frankfort, and J. Erber, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 871,507, Nov. 19, 1907.

See Eng. Pat. 22,202 of 1906 ; this J., 1907, 960.—T. F. B.

Arylthioglycol-o-carboxylic acids and derivatives ; Method of production of ——. Farbwerke vorm. Meister, Lucius und Brüning. Fr. Pat. 380,053, July 18, 1907. Under Int. Conv., July 19, 1906.

Arylthioglycol-*o*-carboxylic acids are obtained by heating *o*-xanthobenzoic acids with monohalogenated acetic acid. Example 1 : 13·7 kilos. of anthranilic acid are diazotised and treated with an alkaline solution of potassium ethyl xanthate at 80—90° C. When the reaction is complete, 9·5 kilos. of chloroacetic acid are added together with 30 kilos. of sodium carbonate or 8·3 kilos. of caustic soda. The mixture is heated for 2—3 hours at 90°—100° C., and, on cooling, phenylthioglycol-o-carboxylic acid, $CO_2H.C_6H_4.S.CH_2.CO_2H$ is precipitated by adding hydrochloric acid. Example 2 : 24·2 kilos. of *o*-xanthobenzoic acid are heated with 9·5 kilos. of chloroacetic acid for 2—3 hours at 160°—180° C. The cooled mass is heated with water or dilute alcohol, and the phenylthioglycol-*o*-carboxylic acid separates.—J. C. C.

Indigo ; Mixed chlorobromo-derivatives of ——, *and process of making same.* G. Engi, Basel, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 872,115, Nov. 26, 1907.

Mixed chlorobromo-derivatives of indigo are obtained by treating mono- and dichlorindigo with bromine in nitrobenzene solution. The products are blue or violet powders, insoluble in water, sparingly soluble in cold aniline or nitrobenzene, but more easily in the hot solvents, with a blue to violet colour. They dissolve in fuming sulphuric acid with a blue to violet colour and yield yellowish vats on reduction, from which unmordanted cotton is dyed in beautiful violet or blue shades, fast to washing, light and chlorine.—A. B. S.

Dyestuff ; Process for the manufacture of a green vat ——. G. Engi, Basel, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 872,227, Nov. 26, 1907.

A bromo-derivative of β-naphthylindigo is prepared by first brominating β-naphthylisatin, then reducing the bromo compounds produced, preferably after their conversion into the corresponding bromo-β-naphthylisatin chlorides, and finally treating the reduction products thus obtained, with suitable oxidising agents. The product is a dark green crystalline powder dissolving in concentrated sulphuric acid with a greenish-blue colour, sparingly soluble in cold, but easily soluble in hot nitrobenzene, with a greenish-blue colour. On treatment with alkaline reducing agents it gives a reddish-brown solution which dyes unmordanted cotton in bright green shades, fast to washing, light and chlorine.—A. B. S.

Indigo ; Monochloromonobromo-derivatives of ——, *and process of making same.* G. Engi, Basel, Assignor to Soc. Chem. Ind. in Basle, Switzerland. U.S. Pat. 872,240, Nov. 26, 1907.

Monochloromonobromo-derivatives of indigo are obtained by treating monochlorindigo with two atomic proportions of bromine in nitrobenzene solution. The products are blue crystalline powders, nearly insoluble in alcohol and benzene, fairly soluble in hot aniline to a greenish-blue solution and in hot nitrobenzene with a pure blue coloration. They give a yellowish-green colour with concentrated sulphuric acid and yield on reduction, yellowish solutions which dye unmordanted cotton in bright reddish-blue tints, fast to washing, light and chlorine.—A. B. S.

Dyestuff ; Process for making a ——. F. J. Oakes, New York, N.Y. U.S. Pat. 872,250, Nov. 26, 1907.

Oxygen is injected into a solution of hæmatoxylin until the latter has been converted into hæmatin, and the solution is neutralised by the addition of an alkali nitrite. —A. B. S.

Monoazo dyestuffs for wool, susceptible to chroming ; Process for producing ——. L. Cassella und Co. Fr. Pat. 379,999, Sept. 25, 1906.

See Eng. Pat. 22,021 of 1906 ; this J., 1907, 1003.—T. F. B.

Glycine ; Preparation of aromatic derivatives of ——. G. Imbert. Fr. Pat. 379,830, June 6, 1907.

Aromatic glycines can be obtained by condensing aromatic amines with dihalogenated ethoxyethylenes, the process being probably due to the intermediate formation of monohalogenated acetic esters, thus: $CCl_2 : CH.OC_2H_5 + H_2O = HCl + CH_2Cl.CO_2C_2H_5$. The reaction is carried out by heating one molecular proportion of the dihalogenated ethoxyethylene with three molecular proportions of an aromatic amine in aqueous or aqueous-alcoholic solution. The amount of the amine may be reduced to one molecular proportion if a substance such as chalk is added during the operation, so as nearly to neutralise the mineral acid liberated.—J. C. C.

Anthracene series ; Manufacture of vat dyestuffs of the ——. Badische Anilin und Soda Fabrik. First Addition, dated June 29, 1907 (under Int. Conv., Nov. 5, 1906) to Fr. Pat. 370,070, Sept. 27, 1906.

See Eng. Pat. 29,750 of 1906 ; this J., 1907, 1135.—J. C. C.

a-Naphthylamine ; Process for producing pure ——. Chem. Fabr. vorm. Weiler-ter-Meer. Fr. Pat. 379,985, July 17, 1907. Under Int. Conv., Aug. 1, 1906.

See Eng. Pat. 16,446 of 1907 ; this J., 1907, 958.—T. F. B.

Nitro compounds ; Process for making ——. R. Wolffenstein and O. Boeters. Fr. Pat. 380,121, July 22, 1907. Under Int. Conv., Aug. 3, 1906.

See Eng. Pat. 17,521 of 1907 ; this J., 1907, 1194.—T.F.B.

Reduction [of nitro-compounds] by carbon or sulphides of heavy metals in presence of alkali ; Method of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 380,175, July 23, 1907. Under Int. Conv., Nov. 24, 1906, and April 24, 1907.

Azo or azoxy compounds are obtained by heating nitro compounds with carbon and alkali or the sulphide of a heavy metal and alkali. Example 1 : One part of nitrobenzene is boiled with three parts of caustic soda (60 per cent.) and one part of iron pyrites for about 36 hours. When the nitrobenzene has disappeared, the azoxybenzene is extracted by a suitable solvent. Example 2 : One part of nitrobenzene is heated with three parts of caustic soda (60 per cent.) and 1½ parts of carbon to 110—140° C. for 72 hours. Azobenzene is extracted from the product. —J. C. C.

Dyestuffs (vat) ; Production of ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 380,176, July 23, 1907. Under Int. Conv., Dec. 12, 1906.

Vat dyestuffs are obtained by heating anthranol or its derivatives with sulphuric acid. Example 1 : 10 kilos. of anthranol are heated with 100 kilos. of concentrated sulphuric acid to 100—110° C. The resulting dyestuff furnishes a hyposulphite (hydrosulphite) vat producing brown shades on cotton. Example 2 : 10 kilos. of *a*-amino-anthranol are heated with 100 kilos. of concentrated sulphuric acid to 80—90° C. The dyestuff thus formed gives very fast olive shades on cotton from the hyposulphite vat. —J. C. C.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES YARNS, AND FIBRES.

Hydrocelluloses. C. G. Schwalbe. *See* XIX.

Horsehair ; Regulations for use of ——. Factory and Workshop Act, 1901.

The following " definitions " are used in draft regulations which are to apply to factories and workshops in which horsehair from China, Siberia, or Russia is used :—

"Material" means tail or mane horsehair from China, Siberia, or Russia, whether in the raw state or partially or wholly prepared, notwithstanding that such preparation may have taken place in some country other than those named.

"Disinfection" means—

(*a*) exposure to steam at a temperature not less than 212° F. for at least half an hour, of material so loosened, spread out or exposed as to allow the steam to penetrate throughout; or

(*b*) exposure of material, on premises to which these Regulations apply, to such disinfectant under such conditions of concentration and temperature of the disinfectant, and duration and manner of exposure of the material to it, and otherwise, as are certified to secure the destruction of anthrax spores in all parts of all horsehair subjected to the process. Provided that such a certificate shall have no force unless and until (1) a copy of it has been submitted to the Secretary of State, and (2) a copy of it is kept in the Register required under Regulation 1. Provided, further, that any such certificate may at any time be disallowed by the Secretary of State, either generally or with regard to a factory or workshop in which anthrax has occurred.

"Certified" means certified by the director of a bacteriological laboratory recognised by a corporation in the United Kingdom having power to grant diplomas registrable under the Medical Acts, 1858 to 1905.

Patents.

Silk, artificial; Process for denitration of —— on spools. H. Diamanti, Paris. Eng. Pat. 17,460, July 30, 1907.

See Fr. Pat. 378,143 of 1906; this J., 1907, 1136.—T. F. B.

Cellulose products from cuprammonium solutions of cellulose; Manufacture of ——. E. Bronnert, Mulhausen i/Elsass, and M. Fremery, Oberbruch, Prussia. Eng. Pat. 22,092, Oct. 7, 1907.

The cellulose is precipitated from its cuprammonium solution by passing into a solution of caustic soda at a temperature of 45°—60° C. The decomposition of the cellulose solution is almost instantaneous, and the speed of drawing off the thread may be increased over that employed when the caustic soda solutions are used at a lower temperature, without fear of breakage. The products obtained at 45°—65° C. take up dyestuffs more strongly than those obtained at 40° C.—A. B. S.

Wool-washing machine. W. McNaught, Rochdale. U.S. Pat. 871,433, Nov. 19, 1907.

See Fr. Pat. 351,629 of 1905; this J., 1905, 888.—T. F. B.

Bleaching of cotton fibres; Process for the ——. R. van Buggenhoudt, New York, N.Y., Assignor to O. Goetze, New York, N.Y. U.S. Pat. 872,097, Nov. 26, 1907.

Claim is made for a bleaching process in which the fibres are moved along on a travelling apron and submitted to the action of an alternate spraying with a bleaching solution and pressure between squeezing rollers, after which the impregnated fibres are left in the moist condition until the bleaching action is completed, being finally washed with water, extracted in a hydro-extractor, and dried.—A. B. S.

Bleaching apparatus. R. van Buggenhoudt, New York, Assignor to O. Goetze, Brooklyn, N.Y. U.S. Pat. 872,265, Nov. 26, 1907. (See preceding abstract.)

Claim is made for a machine consisting of a number of tanks arranged side by side, and of a bleaching apparatus supported on a wheel platform moving on rails parallel to the row of tanks. The bleaching apparatus consists of an endless apron which moves in a direction at right angles to the tanks and, conveys the material to be bleached beneath a number of sprays of bleaching solution and through a number of pairs of squeezing rollers, and then finally into the tanks.—A. B. S.

Bleaching solution [hydrogen peroxide]; Manufacture of a stable ——. R. Wolffenstein. Fr. Pat. 380,181, July 24, 1907. Under Int. Conv., Aug. 3, 1906.

Salts of an acid stronger than carbonic acid and having an alkaline reaction to litmus, are added to hydrogen peroxide solution. Suitable salts are the alkali salts of certain organic acids and alkaline salts of such inorganic acids as phosphoric acid.—A. S.

Fabrics; Processes and apparatus for removing soda-lye from —— saturated therewith. O. Venter, Chemnitz, Saxony. Eng. Pat. 15,352, July 3, 1907. Under Int. Conv., March 1, 1907.

See Fr. Pat. 379,992 of 1907; following.—T. F. B.

Mercerisation; Process and apparatus for the removal of caustic soda from fabrics after ——. O. Venter. Fr. Pat. 379,992, July 18, 1907.

The apparatus consists essentially of a covered vat fitted with a number of horizontal rollers arranged in pairs. The upper roller of each pair presses on the lower one with its own weight. The bearings of these rollers are arranged so that they can be displaced axially for cloths of varying width. The cloth, saturated with soda-lye, passes horizontally through a number of these pairs of rollers and is submitted to the action of steam from perforated pipes placed above and below the cloth before each pair of rollers. The steam removes the caustic soda, which falls into a tank below, and the material passes on immediately to the tenter frame.—A. B. S.

Dyeing and mercerising of fabrics; Process for ——. T. and J. Pickles, Burnley. Eng. Pat. 25,445, Nov. 12, 1906.

The material, which may be first singed, if necessary, is passed, in the open width, through a series of baths containing heated scouring solutions, the excess of liquor being removed from the fabric by suitable pressure rollers. The damp cloth is then mercerised, washed, and dried, in the usual manner. A sulphide dyestuff may be applied to the fabric either before or during mercerisation.
—A. B. S.

Vat dyeing with colouring matters of the gallocyanine series or derivatives therefrom. G. W. Johnson, London. From Dye Works, formerly Durand, Huguenin, et Cie., Basle, Switzerland. Eng. Pat. 10,557, May 6, 1907.

See Fr. Pat. 377,288 of 1907; this J., 1907, 1045.—T. F. B.

Dyeing of silk, wool and all materials of animal origin, by means of sulphide dyestuffs. M Sestier. Fr. Pat. 379,960, Sept. 24, 1906.

The animal fibres are first prepared with a metallic oxide, such as lead dioxide, chromic acid or manganese dioxide, which has an oxidising action and will therefore counteract the reducing action of the animal fibre. For example, the goods are treated in a bath of potassium permanganate (1 per 1000), until they have taken up from 2—5 per cent. of their weight of manganese dioxide; they are then well washed and dyed in the usual manner with sulphide dyestuffs, with the addition of gelatin or glucose to the dye-bath.—A. B. S.

Zinc formaldehyde hydrosulphite; Process of making ——. H. Labhardt, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 871,600, Nov. 19, 1907.

See Eng. Pat. 81 of 1906; this J., 1906, 260.—T. F. B.

Discharging paste. K. Reinking, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 871,629, Nov. 19, 1907.

See Addition of Oct. 23, 1904, to Fr. Pat. 297,370 of 1900; this J., 1905, 672.—T. F. B.

Hydrosulphite preparation; Stable —— and process of making same. G. Engi, Assignor to Society of Chemical Industry in Basle, Switzerland. U.S. Pat. 872,114, Nov. 26, 1907.

See Fr. Pat. 376,206 of 1907; this J., 1907, 1007.—T. F. B.

Sizing tulle and analogous fabrics; Apparatus for ——. J. M. Clerc-Renaud, Villeurbanne, France. Eng. Pat. 26,526, Nov. 22, 1906. Under Int. Conv., Dec. 28, 1905.

THE material is unwound from a roller and passed on to a clip-stenter, the chains of which converge, near to the fore-part of the machine. The fabric, after being engaged by the clips, is first passed through one or more troughs which are arranged across the machine and contain size or some other finishing preparation. The material is then subjected in succession to the action of rotating, rubbing and brushing devices. The rubbers consist of adjustable curved rods, tubes, or rollers, and are arranged in a circular group upon horizontal arms which radiate from a rotatable vertical axis. The brushes, mounted in a similar manner to the rubbers, are kept free from solidified size by causing them to pass over sponges which are placed in a reservoir containing water or fresh size. The sized fabric is dried by passing it over some heating arrangement at the rear of the machine, it is then disengaged from the clips, passed over two hot cylinders to complete the drying process, and finally delivered on to a winding reel.—P. F. C.

Paper and linen, etc. Fr. Pat. 379,979. *See XIX.*

VII.—ACIDS, ALKALIS, AND SALTS, AND NON-METALLIC ELEMENTS.

Nitrogen compounds; Lecture experiments relating to the chemistry of inorganic ——. F. Raschig. Ber., 1907, **40**, 4580—4588. (See also this J., 1904, 934, 1213; 1905, 923.)

Nitrilosulphonic acid, $N(SO_3H)_3$. To 125 c.c. of a 5-*N* solution of sodium nitrite (350 grms. of the commercial salt per litre), a few drops of phenolphthalein solution are added, when the liquid becomes coloured red owing to the presence of a trace of alkali. On now adding 300 c.c. of 5-*N* sodium bisulphite solution (commercial solution of 35°—36° B. or 1·32 sp. gr.), the red colour disappears at first, but reappears after a few moments, and considerable heat is developed. The reaction is: $NaNO_2 + 3NaHSO_3 = N(SO_3Na)_3 + NaOH + H_2O$, but the free alkali formed prevents its completion. Sodium nitrilosulphonate is very easily soluble, but on pouring the reaction-mixture into 1 litre of a cold saturated solution of potassium chloride, the whole solidifies to a crystalline paste of the sparingly soluble potassium salt. (See also Divers, this J., 1901, 757.) *Hydroxylaminedisulphonic acid*, $HO.N(SO_3H)_2$. To 100 c.c. of 5-*N* sodium nitrite solution and 200 grms. of ice, 100 c.c. of 5-*N* sodium bisulphite solution are added, with stirring, and then 20 c.c. of glacial acetic acid. The reaction: $NaNO_2 + 2NaHSO_3 = HO.N(SO_3Na)_2 + NaOH$, proceeds rapidly and quantitatively. On treating the reaction-mixture with an equal volume of a cold saturated solution of potassium acetate, the easily soluble sodium hydroxylamine disulphonate is converted into the less soluble potassium salt, which crystallises out. In a cold solution of the potassium salt, barium chloride produces no precipitate, even in presence of hydrochloric acid, but on warming, barium sulphate is precipitated.

$$HO.N(SO_3K)_2 + H_2O = HO.NH.SO_3K + KHSO_4.$$

If about 1 grm. of the potassium salt, in presence of a little water and a few drops of sodium hydroxide solution, be warmed with lead peroxide or with 10 c.c. of *N*/$_{10}$ iodine solution, a violet-coloured solution is produced, owing to the formation of potassium nitrosodisulphonate. This reaction proceeds quantitatively if potassium permanganate be used as oxidising agent. (See also Divers, this J., 1900, 348.) *Nitrosodisulphonic acid*, $NO(SO_3H)_2$. A solution of sodium hydroxylaminedisulphonate, prepared as described above, is treated with 25 c.c. of a 20 per cent. solution of ammonia and then with 400 c.c. of permanganate solution (32 grms. of $KMnO_4$ per litre). After filtering, 250 c.c. of the solution are mixed with 500 c.c. of a saturated solution of potassium chloride, when the whole soon sets to a paste of yellow crystals of potassium nitrosodisulphonate. The yellow crystals dissolve in water with formation of a violet solution, which is stable in presence of alkali, but is decomposed by acids. Nitrosodisulphonic acid is a compound of quadrivalent oxygen, and it is to this fact that the author attributes its intense colour. (See also Divers, this J., 1904, 60, 185.) *Nitrosisulphonic acid*, $NO(OH)SO_3H$. This acid is best prepared by the reduction of nitrosulphonic acid, $NO_2.SO_3H$, with mercury or copper, in presence of concentrated sulphuric acid (see this J., 1907, 966). The blue copper salt may also be prepared by passing nitric oxide through a mixture of concentrated sulphuric acid and a saturated solution of copper sulphate. The copper salt is decomposed by oxidising agents such as nitric acid and by diluting its solution with water. The ferrous salt, on the other hand, which is the cause of the brown coloration produced on leading nitric oxide into a ferrous solution, is stable in aqueous solution. For the action of nitrosisulphonic acid in the chamber process, see this J., 1907, 966. *Lead chamber in a beaker.* One c.c. of 5-*N* sodium nitrite solution is diluted with 400 c.c. of water and 100 c.c. of dilute sulphuric acid, and 1 c.c. of a 10 per cent. solution of potassium iodide and a little starch paste are added. A blue coloration is produced, owing to the liberation of iodine by the nitrous acid. A weak solution of sodium bisulphite (5 c.c. of 5-*N* solution diluted to 100 c.c.) is now run in until the coloration disappears, owing to the conversion of the nitrous acid into nitrosisulphonic acid: $2HNO_2 + SO_2 = NO(OH)SO_3H + NO$. Bubbles of nitric oxide are now observed, and the air above the liquid is coloured yellowish-brown. On shaking, the nitric oxide dissolves, with formation of nitrous acid, until eventually the blue coloration reappears. More sodium bisulphite solution is now run in, and the operations described are repeated, and so on. In this way, large quantities of sulphurous acid can be converted into sulphuric acid through the agency of the nitrosisulphonic acid. The author also describes the preparation of a solution of pernitric acid (HNO_4) (this J., 1904, 935), and of monochloramine, and the conversion of the latter into hydrazine (this J., 1907, 1108).—A. S.

Alloys not attacked by acids, cold or hot. A. Jouve. Soc. Ing. Civils de France. Procès-Verbal, 1907, [16], 206—208.

THE author, as the result of technical experiments, recommends the use of alloys of industrial metals, such as iron, with silicon, for the construction of apparatus for the treatment of acids, *e.g.*, for the concentration of sulphuric acid, condensation of nitric acid, etc.—A. S.

Nitrogen trioxide; Gaseous ——. H. Brereton Baker and M. Baker. Chem. Soc. Proc., 1907, 23, 239.

THE authors have found that liquid nitrogen trioxide can be converted into the gaseous state if it is dried completely. Seventeen determinations of the density of the gas have been made by Victor Meyer's method in very dry nitrogen. Several different preparations were used and the densities varied from 38 to 62. The density corresponding to the formula N_2O_3 is 38, and it is concluded that there is partial polymerisation to the double molecule N_4O_6. The analysis of the substance gave 63·12 per cent. of oxygen (mean of 5 experiments), the calculated value for the trioxide being 63·09. Determinations of the molecular weight by the cryoscopic method in dried benzene gave 83 and 83·2 for one sample and 95 for another. The liquid is green at the ordinary temperature, but becomes blue below −2°. It does not solidify at −80°, but in liquid air it solidifies to a mass of very dark blue crystals.

In the discussion, E. Divers pointed out that, two years ago, Raschig (Zeits. angew. Chem., 1905, 18, 1281), and Rây and Gañguli (Chem. Soc. Proc., 1905, 21, 280), showed, independently, that nitric oxide distinctly forms nitrogen trioxide with oxygen before it goes on to produce nitric peroxide, and thus furnished chemical evidence, for the first time, of the existence of nitrous anhydride, N_2O_3, in the gaseous state.

Ammonia; Synthesis of —— by catalysis. L. Brunel and P. Woog. Compt. rend., 1907, **145**, 922—924.

GREEN hydrated nickel oxide, spread thinly over fragments of powdered glass, is heated in a current of dry air, and a mixture of hydrogen and nitrogen is then passed over the sesquioxide thus formed, heated to 180°—200° C. A small amount of ammonia and of water is formed. On then passing a mixture of air and excess of hydrogen, the nickel oxide is alternately reduced and re-oxidised with evolution of much heat, and continuous formation of ammonia and water, so long as the temperature is kept below incandescence of the oxide. The requisite cooling is effected by suspending the nickel oxide in a liquid which boils at the temperature at which ammonia is formed and thus absorbs the excess of heat. Petroleum, b. pt. 200—240° C. is found to answer this purpose, and by its intervention, a regular formation of ammonia is obtained.—J. O. B.

Barytes, celestine, and anglesite; Artificial production of ——. P. Gaubert. Compt. rend., 1907, **145**, 877—879.

SULPHATES of barium and strontium when crystallised from their solution in sulphuric acid give forms similar to those found in natural barytes and celestine. These are identical for the different sulphates which can be crystallised together. The differences of form observed in products of different operations are due to unequal rates of crystallisation. The microchemical process of Behrens is insufficient to distinguish between barium and strontium if the morphological characters of the crystals are alone studied. But if the solution of the sulphates in sulphuric acid be evaporated at, or a little below, the boiling point, crystals can be obtained which are sufficiently large for the determination of the angle between the optic axes. This angle is characteristic for each of these sulphates or their mixtures.—F. SHDN.

Metallic sulphates and caustic alkalis; Interaction of ——. Spencer Pickering. Chem. Soc. Proc.,.1907, **23**, 261.

ALKALIS, added to solutions of various metallic sulphates, precipitate a definite basic sulphate, except in the case of manganese and magnesium, where the hydroxide is precipitated. After the precipitation is complete, the further addition of alkali converts the basic sulphate either into another, sometimes consecutively into two other, more basic products (for example, copper and nickel), or into the hydroxide (aluminium). When one of the stronger alkalis (potash, soda) is used in excess, the product is probably always the hydroxide, but in the case of lime, this does not appear to be so, at any rate not with the sulphates of copper and nickel (see page 1291). In every case examined, different alkalis have given the same results as regards the basicity of the sulphates precipitated by them in each particular case. The existence of the following eleven basic sulphates has been established in this way; the predominance of 5 as the coefficient of equivalents of metallic oxide present is very noticeable. Those marked with an asterisk are the ones formed when the whole of the metal has been precipitated from the solution; the others are products of the action of further quantities of alkali: $5NiO,3SO_3$*, $5NiO,2SO_3$; $5Al_2O_3,3 \times 2SO_3$*; $4CuO,SO_3$*: $4CoO,SO_3$*; $4CdO,SO_3$*; $5CuO,SO_3$; $5NiO,SO_3$; $5ZnO,SO_3$*; $10CuO,SO_3$; $10FeO,SO_3$*.

Ferrocyanides; Double —— of calcium with potassium and ammonium. J. Campbell Brown. Chem. Soc. Trans., 1907, **91**, 1826—1831.

POTASSIUM-CALCIUM ferrocyanide is precipitated on mixing cold concentrated solutions of potassium ferrocyanide and calcium chloride in molecular proportions. It is an anhydrous salt, and has the formula, $K_2CaFe(CN)_6$. At 15°—17° C., 244 parts of water dissolve 1 part of the salt. Ammonium-calcium ferrocyanide is best prepared by precipitation from a mixture of solutions of ammonium ferrocyanide and calcium chloride; it forms minute white anhydrous prisms, which become coloured on exposure to light. At 15°—17° C., 388 parts of water dissolve 1 part of the salt. When potassium ferrocyanide is added to a mixture of calcium chloride and ammonium chloride, the precipitate formed contains both of the double salts, the proportion of the ammonium-calcium salt increasing with the proportion of ammonium chloride present.—J. T. D.

Cupric nitrite. Edward Divers. Chem. Soc. Proc., 1907, **25**, 269.

A PAPER appeared not long ago in the Chem. Soc. Trans., 1907, 1405; this J., 1907, 526, on cupric nitrite, in which Rây sets forth his observations on what he regards as being the atmospheric oxidation and autoxidation of this salt. Now nitrites, as such, do not oxidise and, in the cases where they do not hydrolyse in water, they are stable in solution. (The passage of cobaltous into cobaltic nitrite is, of course, no exception to the statement.) What Rây has occupied himself with is simply the oxidation of nitrous acid, not cupric nitrite, in aqueous solution. For when a cupric salt is dissolved in water, it is always hydrolysed to some extent, as is shown by its acid reaction and other facts. Nitrous acid in aqueous solution becomes nitric acid and nitric oxide, and nitric oxide oxidises in the air. When it is added that nitric acid decomposes some of the cupric nitrite to form nitrate together with more free nitrous acid, there seems to be no more to be said. As to the oxidation of cupric nitrite, as such, we are left as we were, without any evidence whatever of its occurrence.

Silicon monoxide. H. N. Potter. Amer. Electrochem. Soc. Electrochem. and Met. Ind., 1907, **5**, 442—445.

THE author describes the preparation and properties of silicon monoxide (" monox ") (see Eng. Pats. 26,788 and 12,210; U.S. Pats. 830,739 and 830,740; and Fr. Pat. 366,644; this J., 1907, 434, 684, 938, 939 and 1056). With carborundum as reducing agent, the highest yield of silicon monoxide from silica is obtained with a charge made up in the proportions required by the equation: $2SiO_2 + SiC = 3SiO + CO$. With carbon as reducing agent, the most satisfactory charge consists of 1 atomic proportion of carbon to 1 molecular proportion of silica. Silicon monoxide has a higher heat of combustion than silicon. The following table shows the relations by weight and volume of various pigments (including " monox ") and raw linseed oil, when mixed into paints of suitable thickness for spreading properly.

Pigment.	Sp. gr.	Approximate percentage of pigment in paint:		Weight of 1 gallon of paint in pounds.
		by weight.	by volume.	
White lead	6·43	80	36·6	21—24
Red lead	8·53	88 +	45·4	30—35
Zinc oxide	5·60	57 +	18·1	14·8
Iron oxide	—	—	—	15·6
Indian red	4·32	64 +	27·5	—
Ochre	2·97	50	25·7	11·8
" Monox "	2·2	20	10·2	8·6

—A. S.

Graphite; Deflocculated ——. E. G. Acheson. Amer. Electrochem. Soc. Electrochem. and Met. Ind., 1907, **5**, 452—453.

DEFLOCCULATED graphite (U.S. Pats. 843,426 and 844,989; this J., 1907, 414) will remain permanently suspended in water or oil, and such suspensions are efficient lubricants. For most work, an oil suspension containing 0·5 per cent. of deflocculated graphite is quite satisfactory. Comparative tests by G. H. Benjamin with spindle oil alone and after mixing with 0·5 per cent. of graphite, showed that the initial coefficient of friction of the latter was 65 per cent. of that of the oil alone. After 60 minutes, the coefficient of the mixture was 55 per cent. of that of the oil alone. During this period the coefficient of friction of the oil increased by 54 per cent., whilst that of the oil and graphite increased by only 30 per cent. After shutting off the supply of lubricant, the coefficient of the oil increased by 125 per cent. in 30 minutes, whilst that of the oil and graphite increased by only 14 per cent. in 80 minutes.

A suspension of deflocculated graphite in water is stated to prevent the rusting or corrosion of iron and steel.—A. S.

Iodine ; Polymorphous form of ——. V. Kurbatow. Z. anorg. Chem., 1907, 56, 230—232.

Iodine crystallises from solution in two forms :—(1), Dendritic aggregates, which chiefly form on the walls of the vessel ; and (2), rhombic tables, which adhere strongly to the bottom. The former are deposited chiefly at low, the latter at higher temperatures. When iodine is sublimed, the sublimate, if condensed on a surface at a temperature below 46°—47° C., is dendritic, but is rhombic if the temperature of the condensing surface be higher than that. The rhombic crystals are always difficult to detach from the condensing surface, a point of some practical importance.—J. T. D.

Sulphur production of the world. Oil, Paint, and Drug Rep., Dec. 2, 1907. [T.R.]

The report of the U.S. Geological Survey on sulphur announces an increased production in the United States of 50 per cent., and of value 33 per cent. during 1906 over 1905. The total output for 1905 was 294,153 tons, the heaviest production in any one year since 1901, when the output was 241,691 tons. The imports of crude sulphur during 1905 and 1906 are respectively given as 82,961 tons and 72,404 tons.

The Sicilian production in 1906 was 833,937 long tons, a reduction of 81,788 tons from the previous year. There were exported from the island in 1906, 357,432 tons, compared with 456,260 in 1905, and of the former exports, 47,029 tons went to America. The stock in Sicily at the close of the last year was 525,115 tons, which can be accounted for only by the fact that the American product has crowded out the Sicilian in the markets of the world. In 1906, Japan produced 24,000 tons of sulphur ; Chile, 4000 tons ; Spain, 2263 tons ; and Greece, 1200 tons. No other country produced over 1000 tons.

The output of pyrites in the United States increased from 253,000 long tons in 1905 to 261,422 long tons in 1906, but its value declined from an average price per ton of $3·71 to $3·56. The production of pyrites, while it has fluctuated during different years, has gradually increased. The producers claim also that their total product has been sold a long way ahead, and that the growing demand from new sources will render the production impervious to the inroads of competing sulphurous ores. The World's production of pyrites in 1905 amounted to 1,742,686 tons.

Arsenic production in the United States. Oil, Paint, and Drug Rep., Dec. 2, 1907. [T.R.]

The United States daily pours great quantities of arsenic fumes from its smelter stacks, thus wasting thousands of tons yearly. And yet with such an incessant waste, the country imported in 1906 more than 8,000,000 pounds of arsenic and arsenic compounds, at a cost of approximately $375,000. During the same time there was produced in this country only a little more than one-sixth of the quantity imported, valued at but $63,460. In England, as in the United States, a large part of the arsenic produced is obtained as a by-product in smelting other ores. France, Germany, Portugal, Spain and Turkey have very large worked deposits of arsenic ores, and during recent years the first two have surpassed England in production. No statistics of mineral production are gathered by the Turkish government, but the output of arsenic is known to be large.

In the United States the great bulk of arsenic produced is obtained from smelter fumes. There are, however, but two smelters which have plants for saving it—the Washoe smelter and the smelter of the American Smelters Securities Company at Everett, Wash. The latter plant uses flue dust, both from its own and from other smelters of the company, and also some arsenic ore from Montecristo, Wash. A smaller plant, belonging to the Mineral Creek Mining and Smelting Company, is located at Mineral, Lewis county, Wash., and makes arsenic trioxide from realgar. All three plants produce arsenic only in the form of white arsenic.

The production and imports of the United States for the last six years have been as follows :—

Year.	Production.		Imports.	
	Tons.	Value.	Tons.	Value.
1901...........	300	$18,000	3,495	$316,525
1902...........	1,353	81,180	4,055	280,055
1903...........	611	36,691	4,179	294,602
1904...........	36	2,185	3,400	243,380
1905...........	754	35,210	3,838	256,540
1906...........	737	63,460	3,987	350,045

Imports include metallic arsenic, arsenic trioxide, and arsenic sulphides. Paris green and London purple have been imported for consumption during the last three years as follows :—28,498 lb., valued at $985, in 1904 ; 44,931 lb., valued at $1,118 in 1905, and 311,293 lb., valued at $21,347, in 1906.

In 1905 Austria produced 3 tons of arsenic ore, valued at $160 ; France, 3,998 tons of ore, valued at $21,357 ; Germany, 5,416 tons of ore, valued at $98,532 ; Great Britain, 718 tons of ore (pyrites), valued at $7,540, and 1,711 tons, presumably white arsenic, valued at $36,469 ; Japan, 9 tons of white arsenic, valued at $492 ; Ontario, 549 tons of ore, valued at $2,693 ; Portugal, 1,721 tons of white arsenic, valued at $58,220, and 24 tons of arsenical pyrites, valued at $151 ; Spain, 4,790 tons of arsenical pyrites, valued at $16,131. Turkey is estimated to have an output of about 2,200 tons of arsenic ore per year. For 1906 but few figures are available, but Germany produced 3,364 tons, Ontario 1,440 tons, and Sweden 56 tons of white arsenic. The values are unknown.

Potash salts and rock salt in Spain. Board of Trade J., Dec. 12, 1907. [T.R.]

Large tracts of ground between Torrelavega and Cabezon de la Sal (near Santander) have been taken up by a Belgian firm of alkali manufacturers, and it is reported that borings have proved the existence of practically inexhaustible supplies of rock salt and potash salts, which will be treated in the factory recently erected at the former town.

Bromine and iodine ; Duty-free admission of —— *into France.* Board of Trade J., Dec. 12, 1907. [T.R.]

The French "Journal Officiel" for the 1st December contains a Presidential Decree laying down the conditions under which duty-free admission of bromine and iodine can be effected. The products in the manufacture of which imported bromine and iodine have been used must be presented for verification at the Customs-house in Paris within three months from the time of the importation of the bromine or iodine ; and the quantities of such products which must be re-exported for every 100 kilos. of bromine or iodine imported are fixed as follows :—Sodium bromide (anhydrous), 125·400 kilos. ; ammonium bromide, 119·400 kilos. ; sodium iodide (anhydrous), 115·150 kilos.

Magnesium carbonate ; U.S. Customs decision on ——. Oil, Paint, and Drug Rep., Dec. 2, 1907. [T.R.]

Magnesium carbonate, for medicinal use, was assessed for duty at 3 c. per lb. as "magnesium carbonate." The claim of the importer for assessment at 25 per cent. *ad val.* as a "chemical compound" was overruled.

Patents.

Nitric acid and other condensers. A. Trobridge, Felling-on-Tyne. Eng. Pat. 25,435, Nov. 12, 1906.

To protect earthenware or other fragile pipes used in the condensation of nitric acid, etc., from fracture by currents of the cold water in which they are set, each vertical pipe is surrounded, from the bottom of the containing condensing tank to near the top, with a lead pipe of about an inch greater diameter than the enclosed pipe.—E. S.

Ammonia; Production of ——. H. C. Woltereck, London. Eng. Pats. 28,963 and 28,964, Dec. 19, 1906.

The following improvements are now made on the process for the production of ammonia, described in Eng. Pat. 16,504 of 1904 (compare Fr. Pat. 345,399 of 1904; this J., 1904, 1215), consisting essentially in passing air or steam at a regulated temperature over or through peat. The first improvement (in Eng. Pat. 28,963), consists in passing the hot gases from the distillation through a scrubber containing heated hydrocarbons of high boiling point, in order to arrest tarry products, without condensing any of the steam or ammonia which pass on to be condensed in the usual way. The second improvement (in Pat. 28,964) consists in reducing by suitable suction or pressure, the water in the peat to be employed in the process, to 65 to 70 per cent., without further drying. —E. S.

Hydrate of lime; Apparatus for the production of ——. W. Schulthess, Zürich, Switzerland. Eng. Pat. 3210, Feb. 8, 1907.

In this apparatus the slaking chamber is a fixed horizontal cylinder, through which passes a shaft, provided with mixing and transporting blades. The feed opening from the charging hopper into the slaking chamber is provided with a grid-shaped slide, to hold back the lime in the hopper, and to allow the dust raised during the charging of the hopper to be drawn off by the current of air in a conduit or pipe arranged on the chamber. The lime passes from the hopper into a cylindrical sieve attached to the longitudinal shaft in the slaking chamber, and the water required for slaking is supplied through perforations in the portion of the shaft within the sieve. A worm is attached to the external periphery of the sieve to convey the lime which falls through the sieve, to the mixing and transporting blades attached to the shaft between the sieve and the outlet end of the chamber. The arms which support the sieve in the middle of its length are adapted to serve as mixing and transporting blades to pass the burnt lime from the front to the rear part of the sieve. The annular space between the sieve and the inner surface of the slaking chamber may be of conical form to facilitate the advance of the lime falling into the sieve, by means of the worm attached to the periphery of the sieve. A blade is attached to the longitudinal shaft close to the outlet end of the slaking chamber, for the purpose of scraping away the slaked lime which accumulates at that end when the outlet opening is closed.—W. C. H.

Salt; Manufacture of ——. B. F. McTear, Lea Green, Lancs. Eng. Pats. 22,327A, and 22,327, Oct. 9, 1906.

Eng. Pat. 22,327A relates to the furnace and accessories used in the melting of rock salt ready for running into the converters, described in Eng. Pat. 22,327. The furnace is of the open-hearth reverberatory regenerative type, provided with a continuous sloping surface along one side of and above the hearth, on to which the salt is delivered by a conveyor through a series of hoppers, in a thin stratum, which is quickly melted by the impinging flames. The molten salt overflows into a chamber below the hearth and heated independently, and from this chamber is run into converters (described in the second patent, 22,327), in which it is subjected to the action of hot compressed air, or to other means of purification. Inside each converter is placed a "liner" or shield, formed without a bottom part, and rising above the top of the converter, so that it may be readily lifted up. After the purification process, the layer of discoloured salt adhering to the lining, which has escaped purification, is drawn up with the shield, and a suitable lifting bar is lowered into the still molten salt. When the mass has become solid, it is lifted out of the converter, and the bottom layer of sediment is cut off, leaving the block with a white peripheral surface, ready for cutting up.—E. S.

Salt; Manufacture of ——. B. F. McTear, Lea Green, Lancs. Eng. Pat. 25,404, Nov. 10, 1906.

The impure or rock salt is melted and run into a "converter," where it is stirred by means of mechanical agitators for about 15 minutes. The impurities are then allowed to settle and are afterwards removed from the lower portion of the resulting block of pure or white salt. The converters are mounted on trolleys and arranged to run round a track, so that the process is made a continuous one. Lime or potassium nitrate may be added to aid chemically in removing the impurities.—F. Sodn.

Salt; Manufacture of an alimentary ——. M. Beaumont. Fr. Pat. 379,986, July 18, 1907.

The deliquescent salts present in ordinary sodium chloride are converted into non-deliquescent salts by the addition of such compounds as phosphates, or sodium carbonate or sulphate. The salt thus prepared may also be mixed with "fortifying substances" such as calcium phosphates, hypophosphites of sodium and calcium, oxides of iron and aluminium, etc.—A. S.

Sodium sulphate; Method of making ——. J. D. Pennock, Syracuse, N.Y., Assignor to The Solvay Process Co., New York. U.S. Pat. 870,746, Nov. 12, 1907.

"Nitre cake" and a sodium compound, having an alkaline reaction, are ground and intimately mixed together, in approximately reacting proportions, and the mixture heated to a temperature above 125° C.—W. C. H.

Sodium sulphate and compounds of lead; Method of preparing ——. A. S. Ramage, Detroit, Mich. U.S. Pat. 871,066, Nov. 12, 1907.

The process consists in reacting on lead sulphate with an alkali carbonate and hydroxide to produce basic lead carbonate. The resulting solution is brought into contact with sulphuric acid, or "chamber sulphate," whereby the solution is acidified, and lead eliminated from it, and acid abstracted from the chamber sulphate, which is converted into basic lead carbonate. The solution is neutralised and purified, and sodium sulphate separated by refrigeration.—W. C. H.

Nitrites; Process of making ——. O. Schönherr and W. Gaus, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 871,640, Nov. 19, 1907.

See Fr. Pat. 363,643 of 1906; this J., 1906, 847.—T. F. B.

Cyanide of potassium or sodium; Process for the manufacture of ——. F. W. Morris, Victoria, British Columbia. U.S. Pat. 871,948, Nov. 26, 1907.

Caustic alkali and formic acid are produced by the electrolysis of a solution of an alkali formate, and the formic acid is neutralised with an ammonium salt in order to obtain ammonium formate, the solution of which is evaporated. The crystals of ammonium formate obtained are distilled, and the resulting hydrocyanic acid is condensed and combined with the caustic alkali obtained in the first stage of the process.—A. S.

Stannic chloride; Process of producing ——. E. A. Sperry, Brooklyn, N.Y. U.S. Pat. 872,205, Nov. 26, 1907.

The process consists in treating tin-bearing material in anhydrous liquid tin chloride with a mixture of chlorine and gaseous stannic chloride, the gases being passed over the surface of the liquid. Before use, the gases are subjected to refrigeration and passed through a liquid dehydrating agent.—A. S.

Phenomena of dissociation; Process for the industrial utilisation of the ——. Soc. pour l'Utilisation de l'Air et de ses Dérivés and G. Claude. Fr. Pat. 380,072, Sept. 27, 1906.

In order to facilitate the process of dissociation at a high temperature, for example that indicated by the equation, $BaCO_3 - CO_2 + BaO$, a stream of inert gas or of one which has an action which is favourable to the dissociation, is passed over the body being treated in order that the tension of the volatile constituent (CO_2) may be less than the tension of dissociation. The gas coming from the apparatus is passed through a heat interchanger through which the incoming gas is passed in the reverse direction in order that it may absorb and utilise the heat from the outgoing gas. The heat necessary for the reaction may be carried to its sphere of action by the incoming current of gas which is passed through a preheater for the purpose. —W. H. C.

Nitrous fumes; Process for the absorption of weak ——. Det Norske Aktieselskab for Elektrokemisk Ind. and B. F. Halvorsen. Fr. Pat. 380,190. July 24, 1907. Under Int. Conv., July 26, 1906.

The use of solid absorbents is claimed, such as lime or salts of acids which are liberated by nitric acid. The solid absorbents are preferably used in a finely divided state, and are kept continuously in motion during the absorption of the nitrous fumes.—A. S.

Sulphur Mining ——. H. Frasch, New York, Assignor to The Frasch Sulphur Process Co., Kittery, Me. U.S. Pat. 870,620, Nov. 12, 1907.

In this process of "fusion mining" in porous deposits, hot water is supplied from heaters through three pipes which open at different levels in an underground deposit of a fusible material (sulphur). Means are provided for shutting off the water from the pipe which opens at the lowest level of the deposit during certain intervals, and also for raising the melted material through that pipe during the intervals. The water is supplied from the heaters at a temperature above the melting point of the material to be mined, and additional pressure is applied to the water after heating, and before its introduction into the deposit, in order that it may be introduced into it, without return to the surface of the ground, at a rate sufficiently above 500 gallons per minute, to cause the supply of water to flow away underground, and thus to prevent inroads, into the melting space, of water naturally present in the surrounding rock. The apparatus also includes a mixing tank, provided with a stirrer, by which comminuted material, specifically lighter than water, such as sawdust, may be mixed with the hot water, and delivered by pumps to the mine piping, the function of the comminuted material being to choke the passages in the deposit, and thus restrict the freedom of movement of the mining fluid in the deposit.—W. C. H.

Sulphur from furnace gases; Apparatus for obtaining ——. F. R. Carpenter, Assignor to A. H., C. H., and M. H. Carpenter, Denver, Colo. U.S. Pat. 871,912, Nov. 26, 1907.

Furnace-gases containing "sulphurous oxide" are passed first through a dust chamber and then into a refrigerating chamber, wherein steam and sulphur dioxide are condensed, whilst the fixed gases escape. The condensed sulphurous acid is passed to an evaporating chamber, the vapours from which are led upwards through a tower containing incandescent coke, and then through a chamber containing iron oxide, to which air is also admitted. Means are provided for carrying off and collecting the sulphur from the latter chamber. The evaporating chamber is heated by means of a coil communicating with a similar coil in the dust chamber, the heat of the furnace-gases being thus utilised.—A. S.

Elements; Process of converting —— into the colloidal state. H. Kuzel, Baden, Austria. U.S. Pat. 871,599, Nov. 19, 1907.

See Fr. Pat. 371,799 of 1906; this J., 1907, 434.—T. F. B.

Liquefying air; Apparatus for ——. J. F. Place. Fr. Pat. 379,605, June 14, 1907.

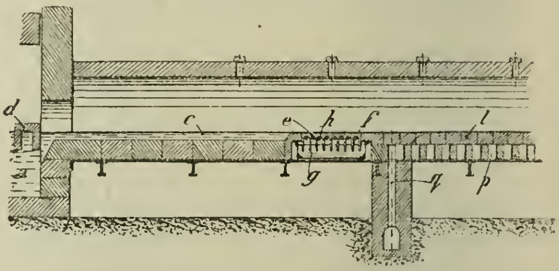
The air is compressed, and after being partially dried by passing it over calcium chloride, is freed from carbon dioxide by passing it over solid sodium hydroxide. The remaining moisture is then abstracted by cooling the compressed air by passing it through a vessel cooled by liquefied carbon dioxide. The dry air is now passed through the coils of a counter-current apparatus and delivered into a closed chamber at the end of the coils, where it is liquefied under pressure by the cold produced by the expansion, at the ordinary pressure, of previously liquefied air contained in a double-walled vacuum vessel which surrounds the closed chamber. This vessel is supplied with liquid air from the inner closed chamber by a pipe and valve which allows liquefied air only to escape and to become reduced in pressure without releasing the pressure in the closed chamber. The vacuum vessel is provided with a valved overflow at its upper extremity for the discharge of liquefied air, and the liquid air which evaporates in it is conducted back over the coils of the counter-current apparatus to perform the preliminary cooling of the compressed and purified air. The apparatus is enclosed in an isolating jacket to prevent the access of external heat.—W. H. C.

Arsenic compounds of lead, etc. U.S. Pat. 870,915. *See* XI*A*.

VIII.—GLASS, POTTERY, AND ENAMELS.

Patents.

Plate glass; Apparatus for the manufacture of ——. E. Gobbe, Jumet, Belgium. Eng. Pat. 11,711, May 18, 1907. Under Int. Conv., June 20, 1906.



Glass is melted in the tank, *a*, and overflows into the gallery, *c*, a floating bridge, *d*, preventing the entry of any scum into *c*. The still liquid glass next flows on to the top of a cast-iron table, *e*, which is kept at such a temperature that the lower part of the glass solidifies but does not adhere to the metal, whilst the upper part remains liquid. This regulated temperature of the plate is maintained by means of ribs, *f*, extending from it into a vessel, *g*, containing water, the height of the water in *g* determining the temperature of the plate. Moreover, water may be circulated through conduits, *h*, formed in the lower part of the plate. From the plate the partly formed glass sheet is pulled over a smooth sole, *l*, where it completely solidifies and is partly annealed, and then passes between a series of tractor rollers located in an ordinary annealing gallery, or in a special gallery, the sole-plate and roof of which are double and are provided with flues through which cold air is circulated. To facilitate the passage of the glass, the sole, *l*, may be formed of graphite blocks, or better, it may be perforated by a number of holes, and compressed air blown into the conduits, *p*, the chimney, *q*, then being closed. The sheet of glass has a brilliant upper surface, but its lower face requires polishing. The width depends on that of the metal plate, *e*, and the thickness on the level of the glass in *a*, which must be kept constant. To start a sheet, molten glass is allowed to flow on to the plate, *e*, and a sheet of metal with projecting angle irons is attached to it and drawn along by the tractor rollers mentioned.—A. G. L.

Furnaces, etc. Eng. Pat. 1824. *See* X.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Portland cement: relations between its ultimate composition and physical properties. R. K. Meade. Techn. Lit., 2, 3—5.

Whatever may be the nature of the combination with each other, the essential elements of Portland cement are, lime, silica and alumina. In the cements of commerce iron replaces some alumina, and magnesia some lime. The amount of lime a cement may contain is dependent upon factory conditions and the relative amount of silica to iron and alumina present. Overlimed cements are "unsound," that is, in time, concrete made from them will disintegrate and crumble or crack. Cements which are high in lime without being unsound are very slow setting but harden rapidly, sometimes reaching their maximum strength in as short a period as seven days. Such cements, when subjected to tension tests, usually show retrogression as the test pieces grow older, but, when subjected to compression tests, show an increase of strength with age. Provided a cement is sound, there is nothing in the theory that a cement must show a progressive gain, a cement acquiring its strength promptly being certainly better adapted to modern building conditions than one requiring a long period. Low lime cements are of low tensile strength, and they are quick-setting, if the lime content is low enough, either when freshly made or after standing some time. The writer advances the following hypothesis: The lime in Portland cement clinkers exist in three forms: (1), in combination with silica, alumina, iron, etc., to form a magma of ortho-silicates, $2CaO.SiO_4$ ortho-aluminates, $2CaO.Al_2O_3$, etc.: (2), as the oxide itself in solid solution in this magma of silicates, aluminates, etc.: and (3), as undissolved oxide —that is, lime merely disseminated through the magma, forming with the latter, simply a mechanical mixture. If this be assumed, then it readily follows that it is the lime in the second condition which causes the hardening of cement mortars and the lime in the third form which leads to unsoundness. In any event, low lime cements, contain less of the active lime than high lime cements, and over-limed cements contain the excess lime mechanically distributed through the clinker. Anything which will promote the combination or solution of the lime during burning will promote soundness. Cements rich in alumina are apt to be quick-setting and, indeed, if much more than 10 per cent. of alumina be present, the cement is almost sure to be quick-setting. High-alumina cements, also, are quick-hardeners, and consequently cements containing from $7\frac{1}{2}$—10% of alumina show high 7-day tests. Cements should contain at least 2·5 times as much silica as alumina. Portland cement in which iron replaces alumina, resists sea-water much better than ordinary cements. The popular supposition that magnesia in considerable amounts causes cement in time to expand and crack, is an error. Cements in which magnesia replaces lime are of low tensile strength, because magnesium compounds have only faint hydraulic properties. Magnesia lowers the clinkering temperature of the cement and hence makes a more fusible clinker, and a more easily burned cement. The alkalis are present in cement only in small quantities. They may to some extent act as a flux, promoting the combination of the lime with the silica and alumina. A large percentage of the alkalis present in the raw material is driven off, however, during the burning of the cement. Additions of small quantities of either potassium or sodium carbonate or hydroxide will cause cement to set quickly, and if the quantity be increased, to expand and crack on hardening. Large amounts of calcium sulphate cause cement in time to disintegrate. Additions of either calcium sulphate or calcium chloride will often cause unsound cement to pass the soundness tests, and indeed to become sound. If either slaked or unslaked lime be added to cements which have become quick-setting, these become slow-setting, consequently it would appear that the effect of seasoning (exposure to air) upon such cements will be to convert some of the hydroxide or oxide of lime into carbonate. The following data represent about the limits of chemical composition met with in freshly made American Portland cements which pass the standard specifications for soundness, setting-time and tensile strength:—Silica, 20—24 per cent.; alumina, 5—9; iron oxide, 2—4; lime (CaO), 60—63·5; magnesia, 1·2; and sulphur trioxide, 1·5 per cent. Most of the marl cements are low in magnesia; some down to 0·5 per cent.

PATENTS.

Fire-extinguishing agent; Freezing-proof ——. [*Potassium thiocyanate.*] W. E. Evans, London. From W. Graaf und Co., Neuruppin, Germany. Eng. Pat. 25,416, Nov. 10, 1906.

THE addition of certain thiocyanates, particularly the potassium salt, to a solution of sodium carbonate renders the liquid proof against freezing down to a temperature of —50° C. The alkali thiocyanates, moreover, give rise to no precipitation when added to sodium carbonate solution, and in no way interfere with the generation of carbon dioxide on the addition of an acid. They also greatly increase the fire-extinguishing properties of the liquid and have no injurious effects upon timber or masonry, or upon the metal parts of the fire extinguisher. The thiocyanate solution, or a mixture of this with glycerin, may be used alone as a fire-extinguishing agent. —F. SODN.

China clay, mica and quartz from decomposed granite; Dry process of extracting ——. A. E. Gaved, St. Austell, Cornwall. Eng. Pat. 27,034, Nov. 28, 1906.

THE decomposed granite is dried and broken into lumps of a convenient size, which are fed into a roller-mill or jaw-crusher. The crushed material passes into a sifting drum, which is mounted at a slight angle to the horizontal. The mesh of the end of the cylindrical screen next to the crusher is finer than that at the other end. The clay and mica together pass through the finer meshed portion into a bin beneath, and the coarser grained quartz passes through the coarse-meshed portion into another bin, whilst any lumps that are too large to pass the screen, pass out of the end of the drum and are returned to the crusher. The mixed clay and mica are fed from the bin on to a jigging screen of fine mesh, such as silk, through which the clay passes into a storage bin, whilst the mica passes through coarser meshed material, and by varying the mesh, it can be graded into any required grain. The screening and sifting power of the apparatus may be increased by feeding the crushed granite into the inner of two concentric rotating drums, and separating the clay and mica by means of another drum from which the quartz is delivered as "tailings."—W. C. H.

Stone or marble; Manufacture of —— artificially. T. M. Thom, Ponders End, Middlesex. Eng. Pat. 9633, April 25, 1907.

MOULDED blocks or slabs of disintegrated stone, marble, or blast furnace slag, mixed with slaked lime, are introduced into a closed vessel, to which carbon dioxide is gradually admitted. The rate at which the gas is admitted is regulated so that carbonation begins and is maintained at first at a pressure less than atmospheric pressure, and the rate is subsequently increased and maintained until a pressure necessary for completing the carbonation is arrived at. (See also Eng. Pat. 20,070 of 1905; this J., 1906, 1097.)—W. C. H.

Wood; Preserved ——, and process of making same. C. Ellis, Larchmont, N.Y. U.S. Pat. 871,392, Nov. 19, 1907.

THE wood is impregnated with "copper carbolate" dissolved in an "organic oil," *e.g.*, creosote oil.—A. G. L.

Wood substitute and process for its preparation. F. Schnell, G. W. Mayer, and E. Hartwich. First Addition, dated April 10, 1907, to Fr. Pat. 379,609, Sept. 12, 1906. (See U.S. Pat. 848,133 of 1907; this J., 1907, 529.)

BY this modification of the original process, a wood substitute, of very low specific gravity, may be obtained by mixing wood sawdust with a thick paste of cereal flour and water, and adding a very small quantity of fibrous material.—W. C. H.

Refractory materials; Process of making ——. H. A. D. Collins. Fr. Pat. 379,784, July 10. 1907. Under Int. Conv., July 11, 1906.

SEE Eng. Pat. 15,735 of 1906; this J., 1907, 925.—T. F. B.

Bricks, plain or perforated, tiles and similar building materials; Process of making —— without burning. S. Merenda. Fr. Pat. 380,104, July 20, 1907.

BRICKS are made by adding a solution of magnesium chloride of 22—25° B. to a mixture of 1 part of magnesite, 2 of fine sand, and 1 of sawdust, moulding the pasty mass obtained, and then drying for three hours as usual. To obtain tiles, magnesite is mixed with a solution of magnesium chloride of 20° B.: the pasty mixture is moulded and dried for 6 hours. Colouring agents may be added in both cases.—A. G. L.

Cement; Process of obtaining —— from highly basic blast-furnace slag. A. Müller, Wetzlar, Germany. Eng. Pat. 3294, Feb. 9, 1907.

Whilst in the molten condition, highly basic blast-furnace slag is intimately mixed with solutions of barium or strontium salts of such concentration as to yield a dry cement ready for use.—A. G. L.

X.—METALLURGY.

Chromium [in iron and steel]; Two volumetric methods of determining ——. A. W. Gregory and J. McCallum. Chem. Soc. Trans., 1907, **91**, 1846—1849.

The methods have been devised for application to the determination of chromium in iron and steel. Two grms. of the metal are dissolved in as little nitric acid as possible, and silver nitrate and ammonium persulphate added (Walters, this J., 1906, 138): after boiling, ammonium chloride is added in quantity sufficient to precipitate nearly all of the silver, the solution is diluted to a definite volume, and filtered through asbestos. A quantity of the filtrate equal to half the original volume of the solution is taken, excess of standard ferrous sulphate solution is added to reduce the chromate which has been formed, and the excess of ferrous sulphate determined by titration with standard potassium bichromate solution.

Chromium can also be determined by means of sodium bismuthate. Two grams of the steel are dissolved in nitric acid, and about 3 grms. of bismuthate added in small quantities; the solution is boiled till all the manganese is precipitated as dioxide, enough very dilute hydrochloric acid is added to dissolve the manganese dioxide, and then excess of silver nitrate. The solution is boiled, made up to a definite volume, filtered through asbestos, and an aliquot portion titrated with ferrous sulphate and bichromate as above.—J. T. D.

Graphite; Deflocculated ——. E. G. Acheson. *See* VII.

Alloys not attacked by acids, cold or hot. A. Jouve. *See* VII.

Mercurial poisoning; Antidotes to —— and their relation to the electrolytic dissociation theory. C. Raimondi. *See* XVIII*B*.

Mineral production of Japan. Board of Trade J., Dec. 5, 1907. [T.R.]

The following statistics relate to the mineral production of Japan in 1905 and 1906:—

Patents.

Drying air for blast furnaces. F. W. Harbord, Englefield Green, Surrey. Eng. Pat. 25,112, Nov. 8, 1906.

Before entering the blast-furnace, the air-blast is dehydrated by passing through a chamber containing porous material, preferably common bricks, which have been dried after being sprinkled with, or soaked in, strong solutions of salts, such as the sulphates of copper, zinc, and magnesium, which are readily dehydrated at temperatures not exceeding 300 or 400° C., absorb moisture in the dehydrated condition, and do not liquefy in the water absorbed. Preferably two such chambers are used in conjunction with one air-blast, one chamber drying the blast, whilst the salts in the other chamber are being dehydrated by hot air or gas from the furnace passing through the chamber in the reverse direction.—A. G. L.

Magnetic material; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 26,664, Nov. 23, 1906.

See U.S. Pats. 836,757 to 836,761; this J., 1907, 155; also Reissue No. 12,691; this J., 1907, 1095.—T. F. B.

Magnetic material; Manufacture of ——. R. A. Hadfield, Sheffield. Eng. Pat. 26,665, Nov. 23, 1906.

See U.S. Pat. 842,403 of 1907; this J., 1907, 415.—T. F. B.

[Steel] Metals; Manufacture of certain molten ——, and apparatus therefor. B. H. Thwaite and W. Defries, London. Eng. Pat. 28,573, Dec. 14, 1906.

The metal is treated in a converter, the lower part of which is divided into two segments by a vertical partition which does not extend to the bottom of the converter, and which terminates below the surface of the molten metal. By means of a blast entering the bottom of one of the segments, and directed vertically upwards, the metal is caused to pass up through this segment, over the partition, down the other segment, and so back again to the point at which the blast is applied. The blast may be oxidising or reducing, and may carry reagents, etc. When the blast is stopped and whilst the metal is still circulating, a vacuum may be produced in the upper part of the converter for the purpose of removing gas from the metal before pouring.—A. G. L.

Steel; Manufacture of open-hearth ——. A. W. Allen, Philadelphia, Pa. U.S. Pat. 870,921, Nov. 12, 1907.

Iron oxide and burnt lime are heated in a basic open-hearth furnace until the iron oxide shows signs of incipient fusion, when molten pig-iron containing phosphorus is run on to the surface of the first charge. The bulk of

—		1905.		1906.	
		Quantity.	Value.	Quantity.	Value.
			Yen.		Yen.
Gold	momme	812,764	4,063,820	766,185	3,722,127
Silver	,,	22,103,408	3,293,408	20,332,664	3,151,563
Copper	kin	59,158,327	23,663,331	61,606,557	25,751,541
Lead	,,	3,787,006	321,896	5,842,356	467,388
Tin	,,	*	*	12,810	12,562
Antimony	,,	476,664	91,784	1,045,044	493,677
Mercury	,,	*	*	560	750
Iron	kwan	14,189,913	2,639,117	15,299,767	2,810,320
Iron pyrites	,,	6,818,432	75,003	8,384,108	92,225
Manganese	kin	23,361,637	81,766	Kwan 14,490,606	72,453
Arsenic	,,			8,750	639
Phosphorus	kwan	*	*	810,000	13,770
Graphite	kin			295,462	29,546
Coal	tons	11,593,292	40,276,804	13,255,972	55,409,963
Peat	,,	*	*	72,820	129,230
Petroleum	koku	1,187,136	2,942,910	1,510,950	4,738,355
Asphaltum	kin	*	*	453,000	4,983
Sulphur	,,	41,087,568	575,226	45,981,833	666,737
Zinc ore	,,	*	*	14,677	293,540
Total value		—	78,109,797	—	97,861,368

* Not available.

Note.—Momme = 2·41 dwts.; Kin = 1·32 lb. (av.); Kwan = 8·26 lb. (av.); Koku = 39·70 galls.; Yen = 2*s.* 0½*d.*

the slag is retained on the hearth until the final stages of heating, so as to obtain the iron of the slag, and to eliminate the phosphorus from the metal.—A. G. L.

Steel directly from ore; Process for producing —— in the blast-furnace. E. Osten. Ger. Pat. 181,191, Feb. 22, 1905.

The ore is mixed with a quantity of reducing agent just sufficient, or barely sufficient, for the reduction of the iron oxides, and is smelted in a blast-furnace, into which a non-oxidising gas is introduced, this gas being previously heated to such a temperature that the heat carried by it, alone suffices for the reduction of the ore and the melting of the resulting steel and slag.—A. S.

Furnaces for annealing iron, steel and other goods and for burning pottery and the like. G. B. Wright, Wolverhampton, Staffs. Eng. Pat. 1824, Jan. 24, 1907.

The furnace is made as a short tunnel with arched top and open ends, which can be closed by means of shutters. At either end of the furnace is constructed a "soaking chamber." Two tracks extend through the furnace and the soaking chambers. Trolleys containing the goods to be heated are run into the furnace from either end in opposite directions, passing on their way through one of the soaking chambers, in which they take up heat by radiation from the highly heated goods which have just left the furnace and are going outwards on the other track.—A. G. L.

Gold and silver; Process of extracting —— from ores. G. Gurney, Berkeley, Cal. U.S. Pat. 871,766, Nov. 19, 1907.

The ores are treated at the ordinary temperature and pressure with a solution containing a metallic perchloride (ferric chloride), an alkali chloride (sodium chloride), and a mineral acid (hydrochloric acid). The solution obtained is drawn off, and the precious metals are precipitated by electrolysis, which also regenerates the solution.—A. G. L.

Alloys; Process for the manufacture of metallic ——. W. Rübel, Hamburg, Germany. Eng. Pat. 26,311, Nov. 20, 1906.

See Fr. Pat. 371,695 of 1906; this J., 1907, 416.—T. F. B.

Alloys; Production of metallic ——. L. M. Becker, Hampton Wick, and E. F. Lamb, London. Eng. Pat. 16,504a, July 18, 1907.

Zinc (95 parts) is first alloyed with iron (5 parts); 18—22 lb. of this "ferro-zinc" are then alloyed with 26—30 lb. of copper, $\frac{1}{2}$—1 lb. of phosphor-copper containing 12 per cent. of phosphorus, $\frac{3}{4}$—$1\frac{1}{4}$ oz. of aluminium, and $\frac{1}{2}$—$\frac{3}{4}$ lb. of tin.—A. G. L.

Roasting furnaces; Mechanical ——. A. Landsberg and A. Roitzheim, Stolberg, Germany. Eng. Pat. 3374, Feb. 11, 1907.

The furnace (for roasting zinc suphide, etc.) is provided with a rotating hearth sole carrying the fire-grates and fire-flues, and with an outer wall, carrying the fire-doors, which rotates with the hearth. The fire-grates may be connected removably with the hearth sole, in which case the fire-conduits are provided with dampers controlling the course of the gases. The furnace may be fitted with a device for raising and lowering the sole, so as to enable the temperature to be regulated.—A. G. L.

Melting furnace. A. Koch. First Addition, dated June 12, 1907 (under Int. Conv., Aug. 4, 1906), to Fr. Pat. 367,470, June 27, 1906.

The furnace consists of two or more chambers playing the parts alternately of fusion chamber and preheating chamber. The furnace is fired with oil, and the hot gases from the melting chamber pass directly into a chamber in which the air supply is heated and the oil gasified. The waste gases then pass into the chamber used for preheating the material to be melted.—O. F. H.

Muffle furnaces. F. Söllner and H. Köppel. Fr. Pat. 379,420, June 29, 1907.

The fireplace is placed near the middle of the muffle, and the hot gases circulate through passages around one portion of the muffle, the other portion being cooled by the circulation of cold air through similar passages. The articles to be treated are charged into the hot end of the muffle in boxes attached to an endless chain, and are withdrawn through the cool end, which is provided with a sheet iron extension.—O. F. H.

Minerals; Process for the concentration of —— by means of an intermittent liquid current. F. G. Buendia, Cartagena, Spain. Eng. Pat. 11,865, May 22, 1907.

See Fr. Pat. 377,761 of 1907; this J., 1907, 1096.—T. F. B.

Spent nitric acid [from copper engraving]; Utilisation of —— and the recovery of copper therefrom. The Calico Printers' Assoc., Ltd., Manchester, and W. Warr, Staleybridge. Eng. Pat. 15,087, July 1, 1907.

The spent nitric acid used by engravers, which contains copper, is diluted with an equal volume of boiling water and is then treated with an excess of litharge. The lead nitrate crystals thus obtained are recrystallised from a saturated solution of purified lead nitrate, from a previous operation, and from this mother liquor the copper is removed by inserting a sheet of lead, which renders the liquid ready for use again. The original mother liquor is diluted to about 1·275 specific gravity and is allowed to remain some days in contact with sheets of lead, until all the copper is deposited, the clear liquor, containing nitrates and nitrites, being boiled down with nitric acid to obtain lead nitrate crystals. The copper sludge is boiled with water and pieces of lead are separated from it by sifting under water; it is finally allowed to stand in contact with spent acid, until free from lead. The dilute solutions, after removal of copper, may be used, without crystallisation, if desired, for the manufacture of lead chromate or other products.—F. Sodn.

Sulphide ores; Desulphurising and reducing ——. E. Dedolph, Marysville, Canada. U.S. Pat. 870,668, Nov. 12, 1907.

Ore containing zinc and sulphur as impurities is intimately mixed with sawdust or other finely-divided carbonaceous fuel. The mixture is roasted so as to oxidise the sulphur and the volatile constituents only of the fuel, after which the residue of roasted ore and fixed carbon is smelted in a blast-furnace.—A. G. L.

Sulphurous ores; Method of roasting ——. A. Savelsberg, Aachen, Germany. U.S. Pat. 870,690, Nov. 12, 1907.

The sulphurous ore is mixed with "a substance (*e.g.*, limestone) which, after being heated, swells up or disintegrates on contact with water." The mixture is roasted and partially desulphurised in a converter. The mass obtained is next wetted with water so as to destroy its sintered structure, and the wet mass is then again roasted in a converter by means of a blast.—A. G. L.

[*Copper*] *Converter.* R. Baggalley, Pittsburg, Pa. U.S. Pat. 870,925, Nov. 12, 1907.

The converter is constructed of heavy metal exterior walls and a basic refractory lining, through a single large block of which a tuyère orifice is formed. Adjacent to the tuyère a water-cooled metal block is placed against the lining. This block is inset into the other metal blocks, and is provided with a number of cooling passages and with means for individually controlling the same.
—A. G. L.

Ores containing copper pyrites; Process for the treatment of —— with recovery of the sulphur. O. Frölich. Ger. Pat. 180,307, Aug. 8, 1903.

The ore is heated in absence, or with limited access, of air, and the sulphur which distils over is condensed; the residue is treated with suitable solvents for the extraction of the copper, which is stated to be rendered soluble after only a short period of heating.—A. S.

Zinc distilling furnace. L. Lynen. Ger. Pat. 187,413, March 26, 1905.

The furnace is constructed of shaped stones so arranged as to form niches which serve as retorts. The zinc vapours from the several retorts pass to a common condensing chamber. The furnace is heated by means of water-gas. —A. S.

Ores and metallurgical products ; Process for the treatment of earthy, pulverulent and finely-divided ——. J. Wiess. Ger. Pat. 185,602, June 23, 1905.

The finely-divided ore or the like is mixed with a coke-yielding substance and with lime, limestone, etc., and the mixture carbonised. The resulting coke is treated with a solution of alkali silicates, in order to cause the formation of silicates of calcium, etc., which increase the strength of the product.—A. S.

Bearing metal. Hannoversche Ind.-ges. G.m.b.H. Ger. Pat. 184,476, Nov. 22, 1905.

The alloy contains about 83 per cent. of tin, 6·25 per cent. of tungsten, and 10·4 per cent. of nickel.—A. S.

Coke for metallurgical purposes, etc. Eng. Pat. 26,882. *See* II.

Cement, etc. Eng. Pat. 3294. *See* IX.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Ash in coals ; Electromagnetic separation as a means of lessening ——. E. Prost. *See* II.

Patents.

Electrical accumulators or secondary batteries. G. P. Triquet, Paris. Eng. Pat. 6735, March 20, 1907.

See Fr. Pat. 373,098 of 1906 ; this J., 1907, 698.—T. F. B.

Electrochemical analysis ; Apparatus for ——. G. A. Guess, Silverton, Colo., and H. E. T. Haultain, Nelson, British Columbia. U.S. Pat. 870,674, Nov. 12, 1907.

Three aluminium terminals are arranged in a set, these being slit longitudinally, so that an electrode may be slipped into the slit of each terminal and held by friction, the electrode in the middle terminal being adapted to receive the deposit. A series of adjustable beaker-supports are arranged on a bench, with a set of terminals over each. The terminals are connected in series, but by means of a metallic thimble interposed between the terminals, any set may be short-circuited.—B. N.

Electrode. G. A. Guess, Silverton, Colo., and H. E. T. Haultain, Nelson, British Columbia. U.S. Pat. 870,675, Nov. 12, 1907.

The blade of the electrode and the central straight " tang " are constructed out of a single piece of thin sheet metal, the electrode being corrugated longitudinally, and adapted to be engaged frictionally with a slit terminal (see previous abstract), without the intervention of a binding screw or similar device.—B. N.

Furnace ; Electric ——. K. G. Sjöberg. Fr. Pat. 379,820, April 17, 1907.

The fusion chamber constitutes the secondary circuit of a transformer furnace, and is in the form of a horse-shoe. The two extremities of the horse-shoe are connected with a chamber, but are separated from each other by an insulating and refractory partition. The material to be treated is fed into this chamber above the melted material in the extremities of the fusion channel, and above the separating partition, and voltaic arcs are produced between the melted material in the bath and the unmelted material above. An arrangement of magnetic sheathing is described, with the object of acting on the voltaic arcs, and directing them upwards from the bath over the insulating partition, thus protecting the latter and producing longer arcs.—B. N.

Arcs ; Process and apparatus for producing high-tension flame ——. Salpetersäure-Ind. Ges. Fr. Pat. 380,059, July 18, 1907.

See Eng. Pat. 18,900 of 1907 ; this J., 1907, 1204.—T. F. B.

Arcs of high tension, directed downwards ; Magnetic blower for producing two flame——. Salpetersäure Ind.-Ges. Fr. Pat. 380,060, July 18, 1907.

See Eng. Pat. 18,901 of 1907 ; this J., 1907, 1243.—T.F.B.

Arsenic compounds of lead ; [*Electrolytic*] *Process of manufacturing* ——. C. D. Vreeland, Montclair, N.J. U.S. Pat. 870,915, Nov. 12, 1907.

The process consists in immersing a suitable cathode (*e.g.*, iron) in a solution of an alkali hydroxide, contained in a porous receptacle, which is immersed in a vessel containing a solution of an electrolyte, and an anode of lead or of a lead compound. The electrolyte in the anode compartment is chosen so that under the influence of an electric current, a solvent for lead is produced from it, and the lead salt thus formed is precipitated as an arsenic compound of lead by introducing a soluble compound of arsenic into the anode compartment. —W. C. H.

White lead, etc. U.S. Pat. 871,947. *See* XIII*A*.

Cyanide of potassium, etc. U.S. Pat. 871,948. *See* VII.

Pigments, etc. U.S. Pats. 871,161 and 871,162. *See* XIII*A*.

(*B.*)—ELECTRO-METALLURGY.

Galena ; Electrolytic treatment of ——. E. F. Kern and H. S. Auerbach. School of Mines Quart., 1907, 29, 63—81.

The authors have made a series of experiments on the cathodic reduction of artificially prepared lead sulphide with different fused electrolytes. In each case the lead sulphide was crushed to about 30-mesh size and floated on the surface of a cathode of molten lead in a crucible of clay (for chlorides) or graphite (for fluoride electrolytes). The anodes were strips of Acheson graphite. It was found that fused alkali chlorides or calcium chloride are satisfactory as electrolytes ; the E.M.F. required is lower (about 5 volts) with the former than with the latter (about 20 volts), but calcium chloride is less easily volatilised and gives a more fluid bath. Below 1000° C., clay crucibles are scarcely acted upon by these electrolytes, except that they become impregnated with the fused salts. With a mixture of cryolite and fluorspar as electrolyte, a higher current-efficiency is attained, but the bath becomes viscous. Spent chloride electrolytes may be regenerated by dissolving in water and re-crystallising. With these electrolytes, chlorine is evolved at the beginning of the process, but after a time, the decomposition of the chloride ceases, as the E.M.F. of decomposition of the alkali or calcium sulphides formed by the reduction of the lead sulphide, is lower than that of the corresponding chlorides. Hence, eventually, sulphur is liberated at the anode, and may be collected, or allowed to oxidise, and escape as sulphur dioxide. With chloride electrolytes, the current-efficiency increases with rise of temperature. No loss of lead by volatilisation occurs. In experiments, with calcium chloride electrolyte, with natural galena ore (66·9 per cent. Pb.) only a low current-efficiency was obtained at first, but on remelting the reaction-product under a covering of fused salts, and heating at a temperature of about 1200° C., the calcium which had alloyed with the fused lead cathode, was liberated and reduced a further quantity of galena which was floated on the lead. In this way the current-efficiency was increased from 26·5 to 43 per cent. A summary of the results is given in the following table :—

Electrolyte.	Average ampères.	C.D. per sq. ft. at :		Average voltage.	Temp. ° C.	Time, hours.	Lead reduced. Grms.	Current-efficiency. Per cent.	Loss in weight of anode per ampère-hour. Grms.
		anode.	cathode.						
6 parts cryolite 3 ,, NaCl 1 ,, KCl	32·2	2040	384	9·5	770—810	3½	205	47	0·032
4 parts NaCl 1 ,, KCl 1 ,, $CaCl_2$	27·6	1944	331	9·2	750—880	4	162	38	0·014
3 parts cryolite 1 ,, CaF_2	30·5	2160	366	9·0	950—1075	3	275	77·9	0·045
$CaCl_2$	39·0	2808	546	20·4	810—1025	5½	460	55·6	0·021
$CaCl_2$	42·7	2135	491	14·6	775—980	4½	360	51·7	0·019
$CaCl_2$	44·8	1344	515	22·0	848—908	4½	363	46·6	0·016
$CaCl_2$	39·4	1143	453	24·6	875—990	4	425	70·0	0·041
$CaCl_2$*	38·5	1116	441	32·7	837—923	4½	287	43·0	0·080

* Experiment with natural galena ore, containing 66·9 per cent. of lead.

—A. S.

Metals and alloys free from or poor in silicon and metallic silicides ; Production of —— together from one ore J. Weekbecker. Bull. Ass. Ing. et Indust. Luxembourg, 1907, **7**, 108 ; Chem.-Zeit., 1907, **31**, Rep., 600.

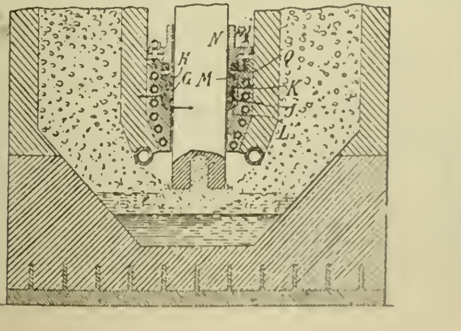
ORES (of manganese, for example) are smelted in an electric furnace with just enough reducing material to reduce the iron and part of the manganese. The rest of the manganese goes into the slag which is run off into a second electric furnace, and smelted with coke and silica, to a silicomanganese containing 20—30 per cent. of silicon. Thus ferromanganese and silicomanganese are obtained from the same ore, and very little manganese goes into the final slag.—J. T. D.

PATENTS.

Furnace : Electric —— and method. P. L. T. Héroult, La Praz, Assignor to Soc. Electro-Metallurgique Française, Froges, Isère, France. U.S. Pat. 871,273, Nov. 19, 1907.

A BASE of conducting material acts as one electrode, and a ring at the bottom of the feeding shaft forms the second electrode. A "false or dummy" electrode, without electrical connections, passes through the shaft and the charge, forming part of the path of the current from the ring electrode to the base, the false electrode being adjustable so as to vary the length of the path of the current.—B. N.

Furnace ; Electric ——. P. L. T. Héroult, La Praz, Assignor to Soc. Electro-Metallurgique Française, Froges, France. U.S. Pat. 871,338, Nov. 19, 1907.



A STUFFING-BOX surrounds the electrode where it enters the furnace, and, in order to make contact between the furnace and the electrode, divided rings, G and H, made up of carbon blocks adapted to surround the electrode, are used. The ring, G, has an upper conical face, J, and in engagement with this is a ring, H, with a lower conical face, K, the inner face, L, of the lower wall of the stuffing-box being also conical. A copper ring, M, is placed above the carbon rings, and above this is a ring, Q, of packing material, pressure being exerted upon the rings by means of a gland, N, which is provided with a flange for protecting the packing ring, Q, from the heat of the electrode.—B. N.

Furnace ; [Electric ——] for smelting and refining. E. Viel. Fr. Pat. 380,119, July 22, 1907.

A BARREL-SHAPED crucible of refractory material is mounted horizontally in the centre of a metal casing carried on a truck. The crucible has an opening at each end for charging and discharging, and can be either rotated or tipped about its horizontal axis. By means of the truck, the crucible may be approached close to two stationary electrodes between which an arc is formed. This arc is deflected into the interior of the crucible, preferably by electro-magnetic means.—A. G. L.

Aluminium ; Method of producing ——. E. Viel. Fr. Pat. 380,087, July 20, 1907.

NATURAL aluminium silicates (kaolin or other aluminium silicate, or even bauxite) are mixed with a quantity of carbon insufficient to reduce the whole of the aluminium present, and with lime and oxide of iron, if the mineral itself does not contain sufficient of the latter. The mixture is heated in an electric furnace, when metallic aluminium is produced according to the equation :

$$Al_2O_3(SiO_2)_2 + FeO + CaO + 2C =$$
$$2Al + FeSiO_3,CaSiO_3 + 2CO + O.$$

The aluminium obtained contains 3 to 5 per cent. of silicon and several tenths per cent. of carbon. It may be refined by heating in an electric converter (see preceding abstract), and blowing in air, or by heating with iron oxide, which oxidises the silicon, the light silica produced floating on the top of the aluminium, whilst the heavy reduced iron sinks to the bottom. The metal obtained contains 99 to 100 per cent. of aluminium. To avoid the presence in it of traces of iron, the iron oxide used in the refining may be replaced by copper oxide. Carbon may be removed by heating with about 20 per cent. of a mixture of lime and alumina. The original crude aluminium may alternatively be freed from silicon by liquating in a reverberatory furnace at about 700° C. The fused metal obtained contains but little silicon, and is refined as above.—A. G. L.

Metallic sheets, tubes, wire, strip or the like; Electrolytic production of ——. S. O. Cowper-Coles, London. Eng. Pat. 26,211, Nov. 19, 1906.

A cylinder of gun-metal, or of steel coated with copper or lead, is mounted on *lignum vitæ* or glass bearings in a tank containing the electrolyte (*e.g.*, copper sulphate) and is revolved at a peripheral speed of not less than 1000 ft. per minute. To prevent the liquid from being thrown out of the tank by centrifugal force, a cap of lead or of material cased in lead is placed over the revolving mandrel, and this cover is made an anode by supplying it with current at a higher voltage than that supplied to the soluble (copper) anodes, from which it is insulated. Or else, the same current is supplied to both, but the lead anode is placed nearer the mandrel than are the soluble anodes.—A. G. L.

Cementation processes. M. Ruthenburg, Lockport, N.Y. Eng. Pat. 19,547, Aug. 31, 1907.

The carburetting material, *e.g.*, powdered charcoal, is heated in contact with the metal to be treated, by causing an electric current to flow parallel to the face of the metal through a poor conductor, which may consist either of the carburetting material itself, or of a separate conductor, *e.g.*, carbon rods, embedded in sand or other insulating material.—A. G. L.

Alloys; Production of —— by electrolysis. Virginia Laboratory Co. Fr. Pat. 380,213, April 3, 1907.

See U.S. Pats. 856,475 and 865,648 of 1907; this J., 1907, 768 and 1096.—T. F. B.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Graphite; Deflocculated ——. E. G. Acheson. *See* VII.

Patents.

Fats, glutinous matter and the like; Apparatus for the extraction of —— from condemned meat and other substances. W. Holt, King's Heath, Worcester. Eng. Pat. 5277, Mar. 5, 1907.

The apparatus consists of a steam-jacketted digester or cylinder containing a vertical rotating steam-charged central hollow shaft to which are attached wire meshed cylindrical cages arranged in a concentric ring within the digester. The cages contain the material, and these cages are removable through an opening in the top of the digester.—J. W. G.

Bleaching fats, oils, resins, waxes, and the like; Process for ——. Verein. Chem. Werke Akt.-Ges., Charlottenburg, Germany. Eng. Pat. 13,701, June 13, 1907. Under Int. Conv., Aug. 11, 1906.

See Fr. Pat. 378,515 of 1907; this J., 1907, 1150.—T. F. B.

Soaps, detergents, and saponaceous compounds generally; Manufacture of ——. A. H. Charlton, Brentford. Eng. Pat. 16,448, July 17, 1907.

Soap prepared in the usual way is mixed with an emulsion of talcum (1 to 2 per cent.), sodium carbonate (2 per cent.), potassium carbonate (4 per cent.), and petrol or other spirit (6 per cent.), in approximately the proportions mentioned. An addition of sodium silicate and sodium sulphate may also be made.—C. A. M.

Concentration of liquids, etc. Eng. Pat. 16,344. *See* I.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—PIGMENTS, PAINTS.

Silicon monoxide. H. N. Potter. *See* VII.

Mineral paint; Production of —— in the United States. U.S. Geological Survey. [T.R.]

The following table shows the production of the various mineral paints in the United States in 1905 and 1906:—

Kind.	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
		$		$
Ochre	13,402	126,351	15,482	148,049
Umber and sienna	689	17,004	657	17,394
Metallic paint	16,489	176,722	17,992	204,026
Mortar colour	10,494	120,430	10,309	111,720
Zinc white	68,603	5,520,240	74,880	5,999,375
Slate*	5,181	24,108	5,481	40,540
Other pigments	10,344	240,318	—	—
Total	125,202	6,245,173	124,601	6,521,104

* Slate and shale ground for pigments.

Lead paints, lithopone and Venetian red.—Under this head are included white lead, red lead, Venetian red, &c., which cannot properly be classed as mineral paints, as they are secondary products and are not made from crude minerals. The quantities of white lead "dry" and "in oil" shown in the 1906 figures are probably close to the truth, while the 1905 figures show too high an output of white lead "dry" and a correspondingly low output of white lead "in oil."

	1905.		1906.	
	Quantity.	Value.	Quantity.	Value.
White lead—		$		$
In oil	62,767	7,577,437	93,763	12,357,632
Dry	73,909	8,261,212	38,318	4,571,618
Sublimed lead	6,977	732,585	7,988	958,440
Zinc-lead	6,779	474,530	8,124	681,292
Red lead	16,378	2,049,888	13,808	1,924,288
Litharge and orange mineral	19,878	2,307,233	18,910	2,551,346
Lithopone	—	—	4,400	311,500
Venetian red	6,789	137,541	13,526	198,394

Imports of such paints in 1906 were :—White lead, 647,636 lb. ; red lead, 1,093,639 lb. ; litharge, 87,230 lb. ; orange mineral, 770,342 lb. ; Venetian lead, 5,432,732 lb.

Patents.

Pigments (white lead) ; Producing —— by electrolysis. E. D. Chaplin, Boston, Mass., Assignor to International Lead Companies. U.S. Pat. 871,161, Nov. 19, 1907.

Lead is dissolved electrolytically in an aqueous solution of a non-alkaline salt in the presence of a soluble chlorate, thus producing an alkali hydroxide and a solution of a "soluble acid salt of lead" (lead oxychloride). The hydroxide and lead oxychloride are withdrawn and mixed, in order to precipitate lead hydroxide, which is then carbonated to produce lead carbonate.—B. N.

White lead ; Process for the manufacture of ——. F. W. Morris, Victoria, British Columbia. U.S. Pat. 871,947, Nov. 26, 1907.

A solution of sodium formate is electrolysed, using lead electrodes, in a cell provided with a diaphragm, whereby formic acid and spongy lead are produced, and these are subsequently mixed together to obtain lead formate, from which lead carbonate is precipitated by addition of an alkali carbonate or ammonium carbonate.—A. S.

Pigments (lead chromate) ; Producing —— by electrolysis. E. D. Chaplin, Boston, Mass., Assignor to International Lead Companies. U.S. Pat. 871,162, Nov. 19, 1907.

Lead is dissolved electrolytically in the presence of a soluble alkali chloride, producing alkali hydroxide and lead chloride. This lead chloride is then converted into oxychloride. The alkali hydroxide and the lead oxychloride are next withdrawn into separate receptacles and a mixture of chromate and bichromate of the alkali base is electrolytically produced from the alkali hydroxide, and the lead oxychloride is then treated with this mixture so as to produce lead chromate.—B. N.

Lakes ; Process of making red ——. C. Immerheiser, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 872,181, Nov. 26, 1907.

See Eng. Pat. 82 of 1906 ; this J., 1906, 224.—T. F. B.

Paints ; Manufacture of a new base for ——. H. Herrenschmidt. Fr. Pat. 379,964, Sep. 24, 1906.

Finely-divided artificial or natural corundum or magnesium silicates are mixed with the materials ordinarily employed for paints, especially in cases where acid fumes are met with.—G. W. McD.

Paint and varnish remover, and process of making same. P. T. Austen and F. J. Maywald, New York, and F. N. Govers, Oswego, N.Y.U.S. Pat. 871,750, Nov. 19, 1907.

The composition consists of a number of paint-softening solvents, one of the solvents being of acid nature and another of a neutral volatile character. Sufficient casein is dissolved in one of the solvents to give the remover a salve-like consistency.—G. W. McD.

(*B.*)—RESINS, VARNISHES.

Patents.

Rosin oils ; Process for obtaining resinous products, easily soluble in dilute alkali solutions, from ——. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pat. 175,633, March 21, 1905. Addition to Ger. Pat. 163,446, June 18, 1903.

The process described in Ger. Pat. 163,446 (this J., 1906, 367) for the treatment of beechwood tar, is extended to rosin oils. The evolved vapours are condensed, and the oils thus obtained may be used as substitutes for oil of turpentine.—A. S.

Varnish ; Process for the preparation of a hard matt ——. F. Wachendorf. Ger. Pat. 180,148, April 4, 1905.

For the preparation of a product giving matt coatings which do not become sticky or soft, and are not attacked by water, a drying oil or an oil-varnish is mixed with basic aluminium compounds.—A. S.

Acetylene tetrachloride ; Process for obtaining from —— a preparation which will remain neutral. Salzbergwerk Neu-Stassfurt. Ger. Pat. 185,374, Aug. 19, 1905.

Acetylene tetrachloride is mixed with unsaturated organic compounds, *e.g.*, oil of turpentine, capable of combining with hydrochloric acid. The mixture may be used as a solvent for resins, lacs, etc.—A. S.

(*C.*)—INDIA-RUBBER, &c.

Para rubber ; Distribution of protein in ——. D. Spence. Inst. Comm. Research in the Tropics, Liverpool Univ., Journal Reprint No. 13, 1907.

When crude Para and other rubbers are treated with caoutchouc-solvents, a spongy mass remains behind which swells up, but does not dissolve. To this Weber attributed the formula, $C_{30}H_{68}O_{10}$, whilst Ditmar regards it as a higher polymerisation-product of the caoutchouc molecule. The author finds that it contains up to 5·4 per cent. of nitrogen and considers it to consist mainly of protein. Amounts of ash up to 8·7 per cent. were also found. Photo-micrographs are reproduced showing the peculiar distribution of this body in fibre-like threads in hard-cure Para, which somewhat resembles the structure of certain animal tissues.—W. A. C.

Rubber ; The so-called "nerve" of ——. C. Beadle and H. P. Stevens. Chem. News, 1907, **96**, 247—248.

In support of their contention that the so-called "nerve" of rubber is not a suitable criterion by which to judge of the relative value of a sample of raw plantation rubber, the authors exhibit some results obtained by them, showing the effect upon tensile strength, elongation, and "apparent" specific gravity, of varying the conditions to which the sample is subjected before testing. In the table, the numbers in the first column refer to the following samples of raw rubber :—No. 1, a sample taken direct from a freshly-cut loaf of "hard-cure Para" ; No. 2, taken from the same loaf, and dried in a desiccator until transparent, before testing ; No. 3, a sample of hard-cure Para "cut-sheet" from a block of masticated rubber which had been frozen while under great pressure : No. 4, a sample of hard-cure Para, masticated until homogeneous, and kept for a week in sheet-form before testing ; No. 5, a sample of best quality Ceylon biscuit ; No. 6, a sample from a "block" full of flaws and small holes ; No. 7, from a very compact block ; No. 8, from the same sample as No. 7, but treated as No. 4 ; No. 9, from a sample of block similar to No. 8, but kept in an ice-chest for a week before testing. The figures given for "per cent. elongation at rupture" are only approximate. The method of testing was that described in this J., 1907, 935.

No.	Tensile strength.	Per cent. elongation.	Per cent. elongation after 4 hrs.	Apparent specific gravity.
1	487	970	10·7	0·9271
2	847	670	—	0·9209
3	2222	800	6·8	0·9376
4	430	300	—	0·9224
5	468	500	2·0	0·9194
6	929	672	0·0	0·910[illegible]
7	1454	760	10·8	0·9231
8	500	425	—	0·9228
9	780	420	—	0·9214

E. W. L.

Rubber and rubber analysis ; Studies on ——. G. Fendler and O. Kuhn. Gummi-Zeit., 1907, **22**, 132—134 ; 160—163 ; 215—219 ; 249—252.

The authors have investigated the behaviour of rubber to different solvents, and also the various methods which have been proposed for the analysis of rubber. It was found that the solubility of rubber in cold solvents (petroleum spirit, benzene, and carbon tetrachloride) is incomplete, and varies with the duration of the treatment, the temperature, the frequency of shaking during the treatment, and the degree of sub-division of the rubber. The solubility is also influenced by the treatment which the rubber has undergone previously. For example rubber which has been previously heated, dissolves to a greater extent and yields a less viscous solution, probably owing to depolymerisation of the caoutchouc on heating. The solubility is increased by heating the rubber with the solvent, but yet remains incomplete. Of the solvents mentioned, carbon tetrachloride is the best. It is evident from these results that the method of analysis depending upon the precipitation of rubber from solutions by means of alcohol cannot be generally reliable. The rubber can be dissolved completely by heating with toluene, but cannot then be satisfactorily re-precipitated by alcohol. The "nitrosite" method for the determination of rubber was also found to be unsatisfactory, as was also Budde's tetrabromide method (this J., 1907, 1057). The latter method however, when modified by using toluene in place of carbon tetrachloride as solvent for the rubber, proved very good. The procedure recommended is as follows:—About 1 grm. of the finely-divided rubber is heated with 60 c.c. of toluene on a water-bath, with occasional vigorous agitation. When the rubber has dissolved, the solution is cooled, made up to 100 c.c. with toluene, and filtered through cotton-wool. 10 c.c. of the filtrate are evaporated on the water-bath, the residue is dissolved in 50 c.c. of carbon tetrachloride, treated with 50 c.c. of Budde's bromine solution, and allowed to stand for 24 hours. The mixture is then vigorously agitated with 50 c.c. of absolute alcohol, the precipitate collected on a filter, washed with a mixture of carbon tetrachloride and alcohol (2 : 1), and then with absolute alcohol, dried at 50°—60° C. and weighed.—A. S.

Lupeol [from bresk]. P. van Romburgh. Compt. rend., 1907, **140**, 926—927.

LUPEOL derived from the commercial product, bresk, formed chiefly of the juice of *Dyera lowii* differs from the lupeol derived from the gutta-percha of *Palaquium treubii*. The latter when heated with sodium acetate and acetic acid, is not acetylated but is converted into a hydrocarbon by dehydration. Bresk lupeol, on the other hand, is readily acetylated. The latter lupeol also behaves differently when heated. It loses no weight at 100° or 135° C. after several hours, and practically none at 170—177° C.; even when heated to 190° C. *in vacuo* practically no water is formed, any slight loss in weight being due to sublimation.—J. O. B.

PATENT.

India-rubber; Process of reclaiming old or waste vulcanised ——. T. Gare, New Brighton, Cheshire. Eng. Pat. 19,894, Sept. 7, 1906.

OLD or waste rubber is converted gradually into a fluid or plastic mass, by subjecting it after previous softening in the presence of indirect heat or a solvent, first to the operation of mincing into small pieces, secondly to the combined operation of mincing and milling into smaller particles, and finally to the operation of milling only, the india-rubber being in each case fed by force to the mincing and milling devices.—G. W. McD.

XIV.—TANNING, LEATHER, GLUE, SIZE.

Tannin analysis; Comparison of the filter method with the shake method. H. R. Procter. Collegium, 1907, 423—424.

BELOW are the results of a number of determinations of non-tannins, carried out by the shake and filter-bell methods respectively. The filter-bell analyses are of little value for purposes of comparison, owing to the poor quality of the official Freiberg powder. The concordance between duplicates by the shake method is excellent. While the results obtained with several consignments of the same make of oakwood extract are very regular by the filter-method, the shake method shows considerable differences. The author suggests that this is due not to a defect of the method, but rather to differences in the manufacture of the extract, which passed unnoticed by the filter method. An extract containing gallotannic and gallic acids might have these ingredients in different proportions and this without being detected by the filter method, but such differences would be rendered obvious by the shake method. The shake method, when applied to the control of extract works, will give valuable information to the manufacturers which they do not at present possess.

Average difference of duplicates by shake and filter methods.

Oakwood.		Mimosa D.		Ordinary Quebracho.		Chestnut.		Various solid extracts.		Supposed Chestnut.	
Filter.	Shake.	Filter.	Shake.	Filter.	Shake.	Filter.	Shake.	Filter.	Shake.	Filter.	Shake.
0·0023	0·0017	0·0035	0·0008	0·0077	0·0007	0·0059	0·0001	0·0070	0·0010	0·0042	0·0009

—H. BR.

Chromed hide powders; Some experiments with ——. F. P. Veitch. J. Amer. Leather Chem. Assoc., 1907, 2, 454—456.

THE author has found that hide powder absorbs sulphates during the chroming process, and these are not removable by washing, but readily given up to tannin solutions, being therefore calculated as non-tannins. The quantity varies with different extracts and increases with heavier chroming though not proportionately. To obviate this source of error, experiments were made with hide powder chromed with chromium acetate, but the non-tannin results were slightly higher than those obtained by the regular method; this difference must be due to some factor not yet investigated. It is also pointed out as a result of experiments on the action of chromed hide powder, that the official method for chroming hide powder will not give a satisfactory product in all cases, and that alkaline hide powders are totally unreliable. It is suggested that the method be suitably modified to ensure the production of a "rapidly working" hide powder of very slight acidity, which will not give to tanning solutions, residues due to the chroming.—H. G. B.

PATENTS.

Glutinous substance from tang-acid; Process of obtaining a soluble ——. E. Herrmann, Assignor to Cie. Internationale La Norgine, Paris. U.S. Pat. 872,179, Nov. 26, 1907.

SEE Fr. Pat. 361,498 of 1905; this J., 1906, 897.—T. F. B.

Glue and gelatin in farinaceous or granular products; Process and apparatus for extracting the ——. O. Schneider. Fr. Pat. 380,033, Sept. 26, 1906.

SEE Eng. Pat. 19,848 of 1906; this J., 1907, 1100.—T.F.B.

Meat, hides, etc. Eng. Pat. 420. *See* XVIIIA.

Fats, glutinous matter, etc. Eng. Pat. 5277. *See* XII.

XV.—MANURES, &c.

Manganese and the development of plants. G. Salomone. Staz. sperim. agrar. ital., 1907, **40**, 97—117. Woch. Brau., 1907, **24**, 659.

Field experiments confirmed earlier results as to the favourable effect of manganese on the growth of plants. Manganous sulphate and nitrate and manganese peroxide gave the best results with cereals. Relatively more manganese salts can be applied, without ill effects, to humous soils than to others. The manganese accumulates especially in the leaves and fruits of the plants; it migrates in the plant cells in an analogous manner to the nitrogenous constituents and the phosphorus.—A. S.

Patent.

Fertilisers and other useful products from animal refuse and the like; Manufacture of ——. A. J. Lehmann, Liverpool. Eng. Pat. 24,492, Nov. 2, 1906.

The fumes and gases from the chambers in which animal refuse, etc., is being boiled or dried, are brought into contact with coke or similar material saturated with creosote or the like. The fumes from the drying chamber may be conducted over inclined plates at the top of the boiling chamber, and the mixed vapours passed on to the absorbent material. Claim is also made for special apparatus for carrying out the process.—C. A. M.

XVI.—SUGAR, STARCH, GUM, &c.

d-Phenylglucosazone; Melting point of ——. F. Tutin. Chem. Soc. Proc., 1907, **23**, 250—252.

During the past few years a number of plants have been submitted to exhaustive investigation, and in all cases where sugar was found to be present, the osazones were prepared. In a number of instances the phenylosazone obtained melted at a temperature considerably higher than that at which *d*-phenylglucosazone is stated to fuse, namely 205°. Several of these preparations melted at or above 215°, whilst the osazone yielded by the sugar contained in the leaves of *Gymnema sylvestre* (Power and Tutin, this J., 1904, 997) fused at 218—219°. Analyses of these preparations of high melting point showed that they were the osazones of hexoses, and as the only compound of this class stated to melt above 206° is *a*-acrosazone (m. p. 217°), it was at first thought that they must be identical with this compound and were derived from inactive sugars.

It was, therefore, deemed of importance to recrystallise and examine a number of the specimens of osazones which had been prepared from plant sugars by different workers in these laboratories. With this end in view experiments were instituted with the object of finding a better means of purifying osazones than by recrystallisation from alcohol, and it was ascertained that the use of pyridine was attended with excellent results. The osazone was dissolved in a small quantity of boiling pyridine, hot alcohol and subsequently a little water added, when, on allowing the mixture to cool, the osazone separated in a pure condition.

Specimens of osazones prepared from plant sugars were then recrystallised in this manner, with the results shown in the following table:—

Source of Sugar.	Original melting point of osazone.	Melting point after recrystallisation.
	°	°
Brucea antidysenterica (fruit)	205	217
,, ,, (bark)	205	215—216
Gymnema sylvestre (leaves)	218—219	217
Aethusa cynapium (herb)..	218	217
Grindelia camporum (herb)	205—206	216
Chailletia toxicaria (fruit)..	211—212	216
Eriodictyon Californicum (leaves)............	205	216—217
Morinda longiflora (root) .	215	216
Lippia scaberrima (herb)..	210	216—217
Ipomoea purga (tuber) ...	217—218	217—218
Olea Europaea (bark)	216	217
Micromeria Chamissonis (herb)...............	205	217

A specimen of *d*-phenylglucosazone (from dextrose) melting at 205° was then recrystallised in a similar manner, after which it melted at 217°. Furthermore, it was found that *d*-phenylglucosazone, when prepared from dextrose by the aid of freshly-distilled phenylhydrazine, and avoiding a too protracted period of heating, exhibited an initial melting point of 216°.

It is evident, therefore, that *d*-phenylglucosazone, when pure, melts at about 217°, and not at 205° as stated by Fischer (Ber., 1884, **17**, 579).

Iodide of starch. M. Katayama. Z. anorg. Chem., 1907, **56**, 209—217.

The concentration of the iodide of starch formed (as measured by the intensity of the blue coloration) when starch, iodine and potassium iodide are mixed, is proportional to the concentration of the starch and to that of the iodine present. It also increases rapidly with the concentration of the potassium iodide when that is low, but less rapidly when the original concentration is higher. Increase, either of the total iodine-ions or of total potassium-ions, raises the concentration of the iodide of starch, though not proportionally. The author concludes that the iodide of starch is either a chemical compound or a solid solution; in either case it forms a separate phase in the reaction.—J. T. D.

Patent.

Starch and gluten from wheat flour; Production of ——. F. A. V. Klopfer, Leubnitz, Germany. Eng. Pat. 11,159, May 13, 1907.

Wheat flour is stirred into water to which is added at the same time a small quantity (up to 1 per cent.) of sodium chloride, with the object not of dissolving the cellular gluten structure, but only loosening it to such an extent that the large starch granules are easily separated. The pulp is then placed in a closed centrifugal separator, under the action of which the large starch granules are driven to the periphery, whilst the small granules and gluten are drawn off as a fluid mass from the middle portion of the machine. This pulp is then allowed to settle in tanks, the wheat-flour extract is drawn off, and the small starch granules are separated from the insoluble gluten by lixiviation of the residue. The large-grained starch forms a separate product of higher value than ordinary mixed wheat-starch.—J. F. B.

XVII.—BREWING, WINES, SPIRITS, &c.

Aspergillus [*A. Okazakii*]; *A new species of* —— *and its practical application.* K. Okazaki. Cent. Bakt., 1907, [Abth. II.], **19**, 481; Z. Spiritusind., 1907, **30**, 534.

In studying the peptonising action of mould fungi, the author discovered on putrefying rice-koji a new species of *Aspergillus*, to which he has given the name of *A. Okazakii* and which shows some resemblance to *A. albus* Wilh. This new fungus secretes a proteolytic enzyme which liquefies gelatin rapidly. This enzyme is prepared on a commercial scale and is sold in Japan under the name of "digestin." The fungus develops in the form of a white mycelium which later becomes sulphur-yellow and produces conidia-carriers terminating in a spherical head. From this, several slender primary sterigmata branch out radially, each bearing four conidia-chains, the conidia having a diameter of 2·5—5·4 μ. The fungus grows better on solid media than in liquids, the most favourable temperature being 25°—28° C. The enzyme is obtained by digesting the fungus with water under aseptic conditions and adding alcohol to the filtrate. The enzyme saccharifies starch paste, and inverts sucrose, but has no action on inulin or milk sugar. It reacts like diastase with guaiacum resin and hydrogen peroxide and therefore contains catalase and peroxydase. Coagulated white of egg, fibrin, and gelatin are rapidly liquefied, and the product shows the biuret reaction. Cultures on rice-bran or beans develop a characteristic aroma. For preparing the "koji," conidia of the fungus are mixed with steamed rice-bran, and the mixture is spread on trays made of the wood of *Cryptomeria japonica*. The trays are kept for 5 days in a chamber at a suitable temperature, and the mass is stirred daily. When the "koji" is ready, the enzyme is extracted and precipitated. The precipitate is purified by re-solution and re-precipitation, and the preparation is dried *in vacuo*.—J. F. B.

Patents.

Fermenting vessels for breweries and other vessels liable to be corroded by the action of liquids; Process for coating the surfaces of ——. W. Ackermann. Berlin. Eng. Pat. 12,454, May 29, 1907.

The vessel is first covered with a suitable glue or paste, then a woven or closely felted fabric of animal, vegetable, or other fibres is carefully applied so as to form a uniform layer over the walls of the vessel; fustian 1—2 mm. thick is the most suitable fabric for the purpose. After drying, the porous tissue is saturated with a waterproof and resistant substance in the molten condition, *e.g.*, paraffin, ozokerite, ceresin, wax, resin, pitch, stearic acid, oil-varnish or india-rubber.—J. F. B.

Beer-fermenting vats; Process for coating the surfaces of vessels, especially —— with a material resistant to the action of liquids and of fermenting beer wort. W. Ackermann. Fr. Pat. 380,016, May 27, 1907.

See Eng. Pat. 12,454 of 1907; preceding.—T. F. B.

Potassium bitartrate, etc. Fr. Pat. 379,902. *See* XX.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

Wheat flour; Chemistry of strength of ——. I. Size of the loaf. T. B. Wood. J. Agric. Science, 1907, 2, 139—160.

Flours which are desirable from the baker's point of view are described as strong. Since so many distinct qualities are desired, some confusion has arisen in the use of the term. The definition here adopted is the capacity for making large well-piled loaves and includes the separate qualities of size and shape. The chemical composition of the gliadin and glutenin of strong and weak flours has been investigated, and it is shown that they are identical in all the flours examined. The conclusion of Hall and other workers is confirmed that neither the percentage of total nitrogen nor of gliadin in the flour, nor the ratio of gliadin to glutenin, can be taken as a measure of strength. It is suggested therefore that the difference between strong and weak flours is connected rather with the physical properties of their gluten than with the chemical composition. Acidity of the soluble extract does not appear to be related to strength; in the few cases examined, it was found that strength was associated with a high ratio of protein to salts, and weakness with a low ratio. It is suggested that the variation of this ratio is the factor which determines that component of strength which governs the shape of the loaf and its power of retaining gas. The volume of the loaf is governed by the amount of extract other than nitrogenous compounds and ash, and depends in the first instance on the amount of sugar contained in the flour together with that formed in the dough by diastatic action. This can be measured by incubating the flour with yeast and water and collecting the carbon dioxide evolved during 24 hours. Particular attention should be paid to the rate of gas evolution in the later stages of the fermentation: this affords a measure of the diastatic capacity of the flour. Experiments show that the relative rate of gas evolution at the time of baking runs parallel with the size of the loaf.—E. F. A.

Milk; Effect of treating —— with carbon dioxide under pressure. L. L. van Slyke and A. W. Bosworth. New York Agric. Exp. Stat. Bull., 1907, [261], 371—384.

In making a study of the chemical changes that take place in cows' milk when made into "kumiss," the authors observed that the product remained for a much longer time without turning sour than did ordinary milk kept under the same conditions. This retarding action on the formation of lactic acid was found to be due to the effect of carbon dioxide under pressure. Various qualities of milk, namely, fresh separated milk, fresh whole milk, fresh skimmed milk pasteurised at 185° F., and fresh whole milk pasteurised at 185° F., were employed in the experiments, and the gas pressures used were 70, 150, and 175 lb. per square inch respectively. The treated milk was kept at temperatures varying from 35° to 70° F. From the tabulated results given, it is seen that unpasteurised whole milk, charged with carbon dioxide at a pressure of 70 lb. per square inch, coagulated after 35 days; the same milk, untreated, coagulated in 4 days. Under the same pressure, pasteurised milk showed only 0·3 per cent. of acidity at the end of 35 days. Further experiments showed that there was practically no increase in the acidity when fresh whole milk was pasteurised, charged with carbon dioxide under a pressure of 150 lb. per square inch, and kept for 9 months. The effect of carbonating milk upon organisms other than lactic was not investigated during the course of the experiments. (See also this J., 1906, 945.)—W. P. S.

Caseïn compound; Spontaneous separation of a —— from milk. L. Preti. Z. physiol. Chem., 1907, 53, 419—426. Chem. Zentr., 1907, 2, 1857—1858.

Paracaseïn differs from caseïn in: (1), its larger content of calcium and phosphorus (caseïn contains on the average 1·315 per cent. of phosphorus and 2·16 or 0·613 per cent. of calcium, according as it is separated by means of rennet or acid); (2), its lesser solubility in a suspension of calcium carbonate in water; (3), by the fact that its solution in lime water is precipitated by phosphoric acid; and (4), by the larger nitrogen-content and smaller calcium content of the milk serum. The precipitate produced when milk is kept for a long time in a sterile condition (by means of chloroform) consists of a mixture of calcium phosphate and calcium caseïnate, but it was not found possible to distinguish whether the formation of the precipitate was an enzymic action or a physical process.—A. S.

Albumin; Peptonisation of —— by thorium and uranium nitrates. B. Szilard. J. Chim. Physique, 1907, 5, 495—496.

When egg albumin or keratin is ground up with hot water and poured into a boiling 2 per cent. solution of thorium or uranium nitrate, the particles first shrink and fall to the bottom, then swell and go into solution, leaving a slight residue. Concentrated solutions of albumin in the state of albumose or peptone are thus obtained; those prepared with the aid of thorium nitrate do not show the reactions of thorium.—W. A. C.

Patents.

Fruit; Treatment of —— for preservative purposes. E. Harvey, London. Eng. Pat. 25,512, Nov. 12, 1906.

Dried or partially dried fruit is immersed for a very short time in a boiling dilute alkaline solution, *e.g.*, of sodium carbonate; it is then dried at a moderate heat and again immersed in a hot dilute antiseptic solution such as sodium carbonate and sulphurous acid, or sodium carbonate and boric acid, and finally dried at a moderate heat (100°—120° F.). In the treatment of raisins, the fruit, after the alkaline treatment, is subjected to the action of an antiseptic solution containing cream of tartar and sodium chloride, in conjunction with a suitable coating medium such as starch.—J. F. B.

Meat, hides, leather and other substances; Means for treating —— with liquids for the purpose of impregnating same. E. B. Baker, Melbourne, Australia. Eng. Pat. 420, Jan. 7, 1907.

Claim is made for an apparatus for treating substances with liquid under pressure, for the purpose of impregnating the same, consisting of the combination of a chamber mounted on a hydraulic ram, adapted to be raised and lowered relatively to a cover. Tubing is provided for

exhausting the air from the chamber, and for heating or cooling the chamber contents. Means are provided for so supporting hides, meat, or other substances within the chamber as to allow circulation of liquid therein. Liquid, under pressure, can be forced to enter and leave the chamber through numerous small perforations.
—G. W. McD.

Cows' milk; Preparing —— for food, especially for infants. G. Litsche and Nutricia Centrale für Backhausmilch, G.m.b.H., Berlin. Eng. Pat. 10,362, May 3, 1907.

The process of preparing cow's milk for food by separating the same into cream and skim milk, and adding papayotine or analogous ferment to the latter, diluted with water if necessary, and then sterilising, is objectionable, because sterilisation in this case results in the casein separating out as a thick coagulated mass. To prevent this, it is proposed to add an acid such as citric acid, or a feebly alkaline salt such as sodium citrate or bicarbonate in the proportion of 0·3—3·0 grm. to every litre of the mixture of cream and skim milk before sterilisation.
—J. W. G.

Flour; Bleaching and ageing ——. J. A. Wesener, Chicago. Eng. Pat. 18,220, Aug. 12, 1907.

See U.S. Pat. 863,684 of 1907; this J., 1907, 1025.—T.F.B.

Acetic acid; Process for the concentration of ——. G. B. von Belatini, Budapest, Hungary. Eng. Pat. 20,125, Sept. 9, 1907.

Dilute acetic acid is stirred up with an immiscible solvent, such as ethyl ether, which extracts the acetic acid. The solvent is then separated from the aqueous layer and fractionally distilled. In this manner a concentrated solution of hydrated acetic acid may be readily obtained, and the flavour and aroma of the original dilute solution (*e.g.*, vinegar) is successfully transferred to the extracted acid.—F. Sodn.

Starch and gluten, etc. Eng. Pat. 11,159. *See* XVI.

Salt, etc. Fr. Pat. 379,986. *See* VII.

(*B.*)—SANITATION; WATER PURIFICATION.

Mercurial poisoning; Antidotes to —— and their relation to the electrolytic dissociation theory. C. Raimondi. Boll. Chim. Farm., 1907, **46**, 717—721. Chem. Zentr., 1907, **2**, 1807.

As antidotes to mercurial poisoning the author recommends sodium chloride, sodium bromide, sodium iodide, hydrogen sulphide, and sodium thiosulphate, in the order given, the last-named being the most efficient. The sodium halides diminish the concentration of the mercury ions both by diminution of the electrolytic dissociation and by the formation of complex salts. Hydrogen sulphide (or alkali sulphide) forms mercuric sulphide which is not readily dissociated. Sodium thiosulphate produces double compounds, in which, on dissociation, mercury forms part of the anion.—A. S.

Patents.

Sewage or other waste water; Apparatus for the purification of ——. K. Imhoff, Bredeney, Germany. Eng. Pat. 10,984, May 10, 1907. Under Int. Conv., May 11, 1906.

The sewage is led into a depositing chamber which may be either trough-like and traversing one or more circular decomposing chambers, or placed inside in one such chamber, or outside of, and annular to it. The mud flows automatically into the decomposing chambers or chamber through openings having overlapping edges, whereby the return of gas and particles entrained thereby is prevented. As the liquid in the depositing and decomposing chambers is at the same level, its return to the depositing chamber or to the effluent therefrom is reduced to a minimum.—J. W.{G.

Trade effluents; Apparatus for treating ——. B. and A. Broadbent, Longwood. U.S. Pat. 872,049, Nov. 26, 1907.

See Eng. Pat. 4537 of 1906; this J., 1907, 164.—T. F. B.

Fæcal matter, sewage, and waste water; Apparatus for the bacterial treatment of ——. G. A. Lucas. Fr. Pat. 380,070, Sept. 27, 1906.

See Eng. Pat. 21,444 of 1906; this J., 1907, 1062.—T. F. B.

(*C.*)—DISINFECTANTS.

Bordeaux mixture; Chemistry of ——. Spencer Pickering. Chem. Soc. Proc., 1907, **23**, 261.

The substances formed on the addition of lime to copper sulphate, as in the preparation of Bordeaux mixture, are dependent on the proportions of lime used, and may be either (1) $4CuO,SO_3,0{\cdot}06CaSO_4$; (2) $5CuO,SO_3,0{\cdot}25CaSO_4$; (3) $10CuO,SO_3,1{\cdot}3CaSO_4$; (4) $10CuO,SO_3,4CaO,SO_3$; (possibly 5) $10CuO,SO_3,10CaO,SO_3$, or (6) $CuO,3CaO$; that present in most cases probably being (4).

The fungicidal action of Bordeaux mixture seems to depend on the liberation of normal copper sulphate by the action of carbon dioxide on the basic sulphate. The action begins only after a certain lapse of time, the basic calcium sulphate having to be decomposed before the basic copper sulphate is attacked. By using only sufficient lime to form $4CuO,SO_3$, the presence of basic calcium sulphate and the consequent delay in the action is avoided; in addition to this, the amount of normal copper sulphate liberated (for a given amount of copper sulphate taken) and the insecticidal value of the mixture will be two and a half times as great as when it consists of $10CuO,SO_3,4CaO,SO_3$.

The basic sulphates, when precipitated by lime in presence of excess of sodium sulphate, contain sodium sulphate as well as calcium sulphate; the formula of the most basic sulphate is $10CuO,SO_4,(Na_2,Ca)SO_4$. When precipitated by soda, they contain no appreciable amount of sodium sulphate, unless a large excess of the latter is present in the liquid.

Nickel sulphate with lime gives a basic sulphate containing a very little calcium sulphate, but, if the lime is at all times in excess, the basic sulphate is deprived of most of its acid, the precipitate consisting essentially of a double oxide.

Thymol; Oxidation of —— by the oxidising ferment of fungi. H. Cousin and H. Hérissey. *See* XX.

Patent.

Formaldehyde; Process for preventing the polymerisation of ——. A. Guasco and R. Jérôme. Fr. Pat. 379,998, Sept. 25, 1906.

Gaseous formaldehyde is mixed with sulphurous gases (sulphur dioxide or sulphur trioxide, etc.).—A. S.

XIX.—PAPER, PASTEBOARD, &c.

Hydrocelluloses. C. G. Schwalbe. Ber., 1907, **40**, 4523—4527.

Continuing his studies on the cupric-reducing values of various celluloses (this J., 1907, 548) the author gives a table containing further results of a similar character. Artificial silks, after boiling with Fehling's solution and washing, retain both cuprous and cupric oxides; a correction for the latter, therefore, has to be made by extracting the mixed oxides by acetic acid, again boiling the exhausted cellulose with Fehling's solution and determining the cupric oxide under identical conditions. Viscose and Pauly silk ("Glanzstoff,") both made by alkaline processes, show low copper values, 0·8 and 0·9 respectively. Chardonnet silk, being made by an acid process, shows the high copper value of 3·1. The cupric-reducing power of mercerised cellulose is very little higher than that of the cellulose from which it was prepared. Hydrocelluloses, formed by the action of non-oxidising

acids, show moderately high copper values (1·9—8·8) depending on the degree of hydrolysis which has taken place. Oxycelluloses show still higher cupric-reducing values (7·6—34·9). Mercerised cellulose is a cellulose hydrate corresponding with the formula, $2C_6H_{10}O_5 + H_2O$. The water of hydration may be determined as the difference between the hygroscopic moisture, lost at 100°—105° C., and that which is driven off at the temperature of boiling toluene. The sample is boiled with toluene and the water which distils over is absorbed by calcium chloride, the increase in the weight of which, after removal of the hydrocarbon, gives the total water in the cellulose. Hydrocellulose is slightly hydrated; its composition corresponds with the formula $6C_6H_{10}O_5 + H_2O$. The degree of hydration of any cellulose may be determined qualitatively by staining the sample blue with zinc chloride-iodine reagent and noting the rapidity with which the colour is removed by water. Highly hydrated celluloses, such as mercerised cotton, parchment paper, and viscose silk, retain the colour for a considerable time. Pauly silk differs from viscose silk in the fact that the colour is washed out almost immediately; hydrocellulose also shows little power of retaining the stain. Concentrated acids have the property of hydrating the cellulose considerably before their hydrolytic effect, as measured by the cupric-reducing value, has gone very far; hence the relatively low copper values of parchment papers (1·9—4·2). In their affinity towards basic dyestuffs, the hydrocelluloses resemble the celluloses and cellulose hydrates, taking up very little of the dyestuff, whereas the oxycelluloses, in addition to their higher cupric-reducing values, are characterised by a strong affinity for basic dyestuffs; Chardonnet silk belongs to this class.
—J. F. B.

Patents.

Paper and linen; Transparent ——. L. Fiorillo. Fr. Pat. 379,979, July 17, 1907.

The composition used for producing transparent material consists of celluloid (10 grms.), acetone (120 c.c.), amyl acetate (20 c.c.) and castor oil (1 c.c.). On spreading this material out in a thin layer and allowing to dry, a transparent sheet is obtained which is said to be superior to ordinary tracing paper. Paper pulp may be advantageously impregnated with the above composition to produce transparent effects, and linen and silk can be treated with a surface coating.—G. W. McD.

Cellulose bodies produced from cellulose solutions; Process for strengthening ——. X. Eschalier, Villeurbanne, France. Eng. Pat. 25,647, Nov. 13, 1906.

See Fr. Pat. 374,724 of 1906; this J., 1907, 821.—T. F. B.

Cellulose products, etc. Eng. Pat. 22,092. *See* V.

Gas and coke, etc. Ger. Pat. 181,126. *See* II.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Methylsparteine; Two isomeric forms of ——. C. Moureu and A. Valeur. Compt. rend., 1907, **145**, 929—930.

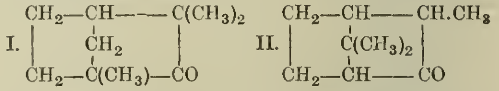
Crude methylsparteine has been separated into *α-methylsparteine*, in crystals, m. p., 30—31° C.; $[\alpha]_D = -55°4$ in absolute alcohol; b. pt., 178—179° C. (corr.) at 11 mm.; and *β-methylsparteine*, a colourless liquid with an alkaloidal odour, $[\alpha]_D = +9°·9°$; b. pt., 181°—183° C. (corr.) at 16 mm. α-Methylsparteine is more difficult to methylate than the β-form, so that methylation affords a ready means of isolating the former base, but β-methylsparteine is not easily regenerated from the iodomethylate formed. On heating the mixed bases with a slight excess of $N/_1$ sulphuric acid, α-methylsparteine sulphate only is transformed into sulphomethylate; the action of alkalis then liberates the unaltered bases; these are converted into monohydriodides, and fractionally crystallised, when ultimately the β-methylsparteine monohydriodide is obtained pure. The characters of the haloid and platino-salts of the two bases are given.
—J. O. B.

Verbenalin, a new glucoside from Verbena officinalis. H. Bourquelot and Bourdier. J. Pharm. Chim., 1907, **26**, 472.

Verbenalin, a new crystalline glucoside, m. pt. 181·5° C.; $\alpha_D = -180·3°$; has been isolated by the biological method from *Verbena officinalis*. It is hydrolysed by emulsin, yielding dextrose; it strongly reduces Fehling's solution.
—J. O. B.

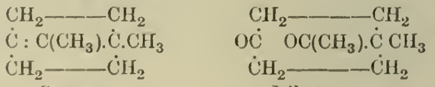
Essential oils; Constituents of ——. *I. Separation of camphor and fenchone. II. Santene,* C_9H_{14}. F. W. Semmler. Ber., 1907, **40**, 4591—4598.

The formula, I., suggested by the author for fenchone contains no hydrogen atoms in close proximity to the carbonyl group, whereas that of Wallach (II.) contains two such hydrogen atoms:—



$$\text{I.}\ \begin{array}{lll} CH_2— & CH——— & C(CH_3)_2 \\ | & \ \ CH_2 & | \\ CH_2— & C(CH_3)— & CO \end{array} \qquad \text{II.}\ \begin{array}{lll} CH_2— & CH——— & CH.CH_3 \\ | & \ \ C(CH_3)_2 & | \\ CH_2— & CH——— & CO \end{array}$$

According to the author's formula, fenchone should act as an oxide with metallic sodium. This is borne out by the fact that pure fenchone can be distilled without decomposition in presence of sodium. The methylene group being in such close proximity to the keto group causes camphor to react with sodium to form sodium-camphor. Hence pure fenchone can be separated from a mixture of fenchone and camphor by distilling two or three times over sodium. According to Müller (Arch. Pharm., 1900, **238**, 366, 380), santene, C_9H_{14}, was found in the first fractions on distilling East Indian sandalwood oil, and was also obtained from teresantalic acid. Santene obtained from sandalwood oil and distilled over sodium was found by the author to have the following constants:—boiling point, 31°—33° C. at 9 mm.; sp. gr. 0·863 at 20° C.; $n_D = 1·46658$; it was optically inactive. When oxidised by ozone in benzene solution, santene is converted into a diketone, $C_9H_{14}O_2$. The same result is obtained by oxidation with permanganate, confirming the author's view that santene is a bicyclic hydrocarbon with one double linkage. The diketone boils at 124°—127° C. at 9 mm., has the sp. gr. 1·024 at 20° C., and $n_D = 1·46658$; the dioxime after crystallising from methyl alcohol melts at 129° C., and the disemicarbazone at 216° C. The diketone is oxidised by an alkaline solution of bromine to a keto-acid, $C_8H_{12}O_3$, boiling at 175°—205° C. at 9 mm. and forming a semicarbazone melting at 168° C. Probably the formation of santene from teresantalic acid by the action of dilute sulphuric acid takes place in two phases. First a lactone is formed by the addition of water; this then loses carbon dioxide and owing to the wandering of a hydrogen atom becomes converted into santene.



$$\begin{array}{l} CH_2———CH_2 \\ \dot{C} : C(CH_3).\dot{C}.CH_3 \\ \dot{C}H_2———\dot{C}H_2 \end{array} \qquad \begin{array}{l} CH_2————CH_2 \\ O\dot{C} \quad OC(CH_3).\dot{C}\,CH_3 \\ \dot{C}H_2————\dot{C}H_2 \end{array}$$

Santene Diketone.

—F. Shdn.

Camphor; Some mercury derivatives of ——. J. E. Marsh and R. de J. F. Struthers. Chem. Soc. Proc., 1907, 23, 246.

When camphor is heated with an alkaline solution of mercuric iodide, mercury derivatives of camphor are formed. By treatment with glacial acetic acid, *camphor dimercuri-iodide*, $C_{10}H_{14}O,Hg_2I_2$, is precipitated. The filtrate, when diluted with water, gives with potassium iodide, or, better, with a solution of mercuric iodide in potassium iodide, an orange precipitate of the double salt, $C_{10}H_{15}O,HgI + HgI_2$. This, on treatment with potassium iodide in neutral solution, gives *camphor mercuri-iodide*, $C_{10}H_{15}O,HgI$, which is pale yellow. The above-mentioned acetic acid solution also gives with potassium chloride and bromide white precipitates of *camphor mercurichloride*, $C_{10}H_{15}O,HgCl$, and *camphor mercuribromide*, $C_{10}H_{15}O,HgBr$, respectively, which, however, have not yet been obtained quite free from iodide.

Essential oil of tarragon ; Paramethoxycinnamic aldehyde in ——. Derivatives of estragol. M. Daufresne. Compt. rend., 1907, **145**, 875—877.

The essential oil of tarragon was freed from terpenes and estragol by fractionation, when *p*-methoxycinnamic aldehyde, $CH_3O.C_6H_4.CH : CH.CHO$, was isolated. It is a yellow oil boiling at 171° C. at 15 mm., and with the sp. gr. 1·137 at 0° C. On oxidation with acid permanganate solution, it forms anisic acid, melting at 184° C. Silver oxide in the presence of an alkali converts it into *p*-methoxycinnamic acid, melting at 170° C. The oxime melts at 154° C., and the semicarbazone at 222° C. Estragol dissolved in ether containing water but no alcohol, is capable of uniting with a molecule of hypoiodous acid to form the monoiodhydrin of *p*-methoxyphenylpropanediol, $CH_3O.C_6H_4.CH_2.CH(OH).CH_2I$. This substance when treated with a 15 per cent. solution of potassium hydroxide gives the glycol corresponding to estragol, or *p*-methoxyphenylpropanediol, which boils at 200°—205° C. at 20 mm., and melts at 52° C. When treated in the cold with a benzene solution of dimethylamine, this iodhydrin gives an amino-alcohol, $CH_3O.C_6H_4.CH_2.CH(OH).CH_2.N(CH_3)_2$, boiling at 166°—167° C. at 12 mm., and with the sp. gr. 1·038 at 0° C. ; the hydrochloride of the benzoyl derivative melts at 98° C. The corresponding base obtained by using diethylamine in place of dimethylamine boils at 187°—189° C. at 15 mm., 308°—310° C. at 755 mm., and has the sp. gr. 0·946 at 0° C. Under the action of iodine and mercuric oxide in absolute methyl alcohol, estragol yields a methyliodhydrin, $CH_3O.C_6H_4.CH_2.CH(OCH_3)\,CH_2I$, which distils with partial decomposition at 178°—180° C. at 14 mm., and has the sp. gr. 1·459 at 0° C. When boiled with potassium hydroxide, this substance loses hydriodic acid and is converted into the methyl ether of a vinyl alcohol, $CH_3O.C_6H_4.CH_2.C(OCH_3) : CH_2$, which boils at 144°—145° C. at 15 mm., and 262°—264° C. (corr.) at 760 mm., and has the sp. gr. 1·073 at 0° C. This substance is hydrolysed by dilute sulphuric acid to anisylacetone. The methyliodhydrin reacts with a saturated solution of silver nitrate giving a nitric ether which on distilling in a vacuum loses nitric acid and passes into anisylacetone.
—F. Shdn.

Betel oil. Schimmel's Rep., Oct., 1907, 16—18.

Oil distilled from betel leaves from Java, and having the following characters : sp. gr. at 15° C., 1·0325 ; $a_D = -1°55'$; $n^{20°}_D = 1·51362$, was shaken with dilute caustic soda, and the mixture of phenols obtained in the usual manner, was fractionated. Pure chavibetol, isolated in this manner, had the sp. gr. 1·0690 at 15° C., $n^{20°}_D = 1·54134$, b. pt., 107°—109° C. at 4 mm. In a freezing mixture it congealed to a crystalline mass which melted at 8·5° C. The distillation residue from the chavibetol, boiling above 113° C. at 4 mm., was further fractionated, and an oil boiling at 137°—139° C. at 4 mm. was obtained, which solidified on cooling. After purification with benzene and petroleum spirit, it crystallised in long, colourless downy needles of m. pt. 48°—49° C., and b. pt., 139° C. at 4 mm. This new phenol yielded a dibenzoyl compound melting at 71°—72° C., and a diacetyl compound boiling at 299° C. On methylating with dimethyl sulphate, it was converted into the methyl ether of eugenol, and it is therefore allylcatechol, $C_3H_5.C_6H_3(OH)_2$, the parent substance of chavibetol, $C_3H_5.C_6H_3(OH)(OCH_3)(OH : OCH_3 = 3 : 4)$, eugenol, and safrol. In the betel oil, after removal of the phenols, the presence of a terpene, cineol, methyleugenol, and caryophyllene was detected. It is stated that caryophyllene nitrosate melts at 158° C. and not 148° C. as is generally stated.—A. S.

Carrot seed ; Oil of ——. Schimmel's Rep., Oct., 1907, 31—32.

By distilling the fruits (not rasped) of *Daucus carota*, L., grown in Germany, 1·26 % of a brownish-yellow oil was obtained, having the following characters :—Sp. gr. at 15° C., 0·9440 ; $a_D = -13° 5'$; acid value, 2·2 ; ester value, 17·8 and after acetylation, 77·5 ; soluble in 1·8 or more vols. of 80 per cent. alcohol. Oil distilled in 1902 had the sp. gr. 0·9226 at 15° C., $a_D = -23° 16'$, acid value 4·6, and ester value, 30·6, and was soluble in 4·5 or more vols. of 80 per cent. alcohol. Oil distilled from French carrot seed (rasped) in 1904 (yield, 0·5 per cent.) had the following characters :—Sp. gr. at 15° C., 0·9117 ; $a_D = -18° 18'$; acid value, 1·24 ; ester value, 51·93 and after acetylation, 95·7 ; not completely soluble in 10 vols. of 80 per cent. alcohol, soluble in 0·4 or more vols. of 90 per cent. alcohol.
—A. S.

Quercitol in the leaves of Chamærops humilis. H. Müller. Chem. Soc. Trans., 1907, **91**, 1766—1767.

Quercitol, $C_6H_{12}O_5$, occurs to the extent of 1·35 per cent. in the dry leaves of *Chamærops humilis*. The crushed leaves are extracted with boiling water, and the resulting liquid precipitated first with neutral then with basic lead acetate. The liquid after removal of the lead, and filtration, is concentrated, when crystals of quercitol make their appearance. The substance had the optical rotation, $[a]_D = +23·9°$. (See this J., 1904, 797.)
—F. Shdn.

Cocositol, a constituent of the leaves of Cocos nucifera and Cocos plumosa. H. Müller. Chem. Soc. Trans., 1907, **91**, 1767—1780.

Cocositol, $C_6H_{12}O_6$, isomeric with inositol, is contained in the leaves of *Cocos plumosa* and *Cocos nucifera*, and also in the so-called milk of the cocoanut. It was obtained by adding milk of lime to a hot decoction of the leaves, filtering, and concentrating. This liquid was treated with a hot concentrated solution of baryta and boiled. The precipitate produced was collected, washed well, and decomposed by a current of carbon dioxide whilst suspended in water. On filtering and concentrating, the cocositol separated in fine crystals. It crystallises from water in fine, transparent, lustrous monoclinic crystals, of which measurements are given. 100 c.c. of water at 15° C. dissolve 1·7 grms. of cocositol, whilst the same volume at 100° C. dissolves 8·3 grms. It is insoluble in organic solvents, melts between 345° and 350° C. and is optically inactive. When sodium hydroxide dissolved in methyl alcohol is added to a hot solution of cocositol, the sodium compound, $C_6H_{11}O_6Na,H_2O$, separates out. *Hexacetylcocositol*, $C_6H_6(C\,H_3O)_6O_6$, prepared by boiling cocositol with acetic anhydride and zinc chloride or sodium acetate, crystallises from acetic anhydride in fine monoclinic prisms, melting at about 300° C. Measurements of the crystals are given. *Pentabenzoylcocositol*, $C_6Hs(CsH_5O)_5O_6$, melts above 360° C., and is very slightly soluble in the usual solvents. The pentanitrate was formed by adding fuming sulphuric acid to the solution of cocositol in fuming nitric acid ; it crystallises from acetic anhydride in rhombohedra, and explodes without melting on being heated. Like inositol, cocositol gives the rhodizonic acid reaction when treated with hydrogen peroxide and a little ferrous sulphate. It more closely resembles the quercin of acorns described by C. Vincent and Delachanal (Compt. rend., 1887, **104**, 1855) and the scyllit of Staedeler and Frerichs (J. prakt. Chem., 1858, [i] **73**, 48), which has been recently described by J. Müller (Ber., 1907, **40**, 1821).
—F. Shdn.

Inositol. H. Müller. Chem. Soc. Trans., 1907, **91**, 1780—1793.

In order to gain information as to the best method of procedure for the examination of cocositol (see preceding abstract), experiments were made with the corresponding substance, inositol. *Hexacetylinositol* was prepared by the action of acetic anhydride and zinc chloride on inositol. The substance was crystallised from toluene in order to obtain crystals for measurement, the results of which are given. It was then heated with a saturated solution of hydrogen bromide in glacial acetic acid to 100° C. and then to 150° C. for several hours under pressure, according to the method of Perkin and Simonsen (Chem

Soc. Trans., 1905, **87**, 855). The following products of the reaction were isolated. *Pentacetyl-monobromoinositol acetate*, $C_6H_6Br(O.CO.CH_3)_5$, separates from absolute alcohol in minute indistinct white crystals, which melt at 240° C., and are insoluble in water. With sodium in methyl alcohol, this bromo-substance forms a deep orange-brown coloration, and is decomposed on boiling. The solution thus formed reduces Fehling's solution. *Tetracetyldibromoinositol*, $C_6H_6Br_2$ $(O.CO.CH_3)_4$, crystallises in two isomeric varieties, both of which are described and measurements of their crystals given. The first isomeride crystallises from alcohol in fine transparent crystals, more than a centimetre in diameter, and melting at 140° C. The substance is insoluble in water. When boiled with alcoholic potassium hydroxide, a deep orange-brown colour is formed, and the liquid reduces Fehling's solution. When acted upon by zinc dust, both forms are decomposed into acetic acid and phenol. The second isomeride crystallises from toluene in small slender scales, melting at 235° C., and is less soluble in most solvents than the first-mentioned modification. Inositol dibromhydrin, $C_6H_{10}O_4Br_2$, crystallises from water in fine, massive, colourless crystals, which melt at 210° C. with partial decomposition. Measurements of the crystals are given. Caustic alkalis produce a dark brown coloration on boiling, and Fehling's solution is reduced by it. The monobromopenta-acetate when warmed with zinc dust and acetic acid gives a substance, $C_{14}H_{18}O_8$, which crystallises from dilute alcohol in soft, slender, prismatic crystals, melting at 95° C. When treated with hydrogen peroxide in the same way as cocositol (see preceding abstract), inositol gives a deep purple-blue coloration, which soon fades, and oxalic and rhodizonic acids are formed.—F. Shdn.

Thymol; Oxidation of —— by the oxidising ferment of fungi. H. Cousin and H. Hérissey. J. Pharm. Chim., 1907, **26**, 487—491.

Thymol, in aqueous solutions, in the presence of air, is converted, by the oxydase of *Russula delica* and the ferment of *Lactarius controversus*, chiefly into dithymol, $C_{20}H_{26}O_2.H_2O$, m. pt., when hydrated, 100—101° C., when anhydrous, 164·5° C. The oxidation product obtained with the first-named ferment is much purer than that resulting from the action of the second, since the latter contains tyrosinase. Since dithymol is insoluble in water, and is devoid of antiseptic properties, thymol and other phenols cannot be considered good antiseptics for many purposes, such as preserving solutions of oxidising ferments when in contact with air. In all cases of oxidation of phenolic bodies by organic ferments hitherto recorded, the action has been the same; two atoms of hydrogen are removed and two mols. of the body oxidised are condensed. In the case of thymol, more complex condensation bodies are formed simultaneously with dithymol. These are being investigated.—J. O. B.

Formaldehyde; Studies on ——. II. F. Auerbach and H. Barschall. Arbb. Kais. Gesundh.-Amt., 1907, **27**, 183—230.

In continuation of their previous work (this J., 1905, 1157), the authors have studied the solid polymers of formaldehyde, more especially as to how far these represent definite chemical individuals. The results may be summarised as follows:—*Paraformaldehyde* is an amorphous colloidal substance with a molecular weight at least three times that of formaldehyde, and containing a variable quantity of adsorbed water. When prepared by concentrating solutions of pure formaldehyde, it melts at about 170°—180° C., dissolves to the extent of 20—30 per cent. in water at 18° C., is insoluble in ether and alcohol, is not altered by boiling with water, and forms an addition compound with sodium sulphite. *α-Polyoxymethylene*, $(CH_2O)n$, is obtained by the addition of 1 vol. of concentrated sulphuric acid to 10 vols. of a pure aqueous solution of formaldehyde. It forms ill-defined crystals which melt at 163°—168° C. when heated in a sealed tube, but are volatilised without melting when heated in an open tube. It is soluble to the extent of 11 per cent. in water at 18°—25° C., is insoluble in alcohol and ether, and forms a compound with sodium sulphite. Its vapours at 180° C. are composed of single CH_2O-mols. *β-Polyoxymethylene* is precipitated from a pure aqueous solution of formaldehyde by addition of 0·4 vol. of concentrated sulphuric acid. It is crystalline, melts at 163°—168° C. when heated in a sealed tube, is soluble to the extent of 3·3 per cent. in water at 18° C., and up to 4 per cent. in water at 25° C., and is insoluble in alcohol and ether. Its vapour density is 32 at 184° C. and increases slowly with rising temperature. It forms a compound with sodium sulphite, and when heated at 100° C., is converted into the γ-modification. *γ-Polyoxymethylene.*—On addition of 0·4 vol. of sulphuric acid to formaline (a solution of formaldehyde containing methyl alcohol), γ-polyoxymethylene is precipitated along with the corresponding β-compound, and is freed from the latter by treatment with sodium sulphite solution. It is distinctly crystalline and melts at 163°—165° C. It dissolves in water at 18°—25° C. to the extent of about 0·1 grm. in 100 c.c., and is insoluble in alcohol and ether. It does not react with sodium sulphite. At 184° and 198° C., its vapours contain polymerised molecules together with simple CH_2O-mols.; the proportion of the former increases with rising pressure and decreases with rising temperature, the vapour densities at the temperatures given are 40 and 60 respectively. On boiling with water, γ-polyoxymethylene is converted into the δ-modification. *δ-Polyoxymethylene* obtained by prolonged boiling of the γ-compound with water, forms ill-defined crystals, the melting point (169°—170° C. in a sealed tube) of which is lowered by even traces of impurities. This modification also melts when heated in an open tube, whereas all of the others are volatilised below the melting point. It is insoluble in alcohol and ether and nearly so in water. Its vapour density slowly decreases between 190° and 240° C.; at these temperatures the vapours consist of highly-polymerised molecules which split up only very slowly into simpler ones. The compound does not react with sodium sulphite. *α-Trioxymethylene*, $C_3H_6O_3$, is formed by subliming polyoxymethylene and collecting the sublimate in water. Commercial "trioxymethylene" (β- + γ-polyoxymethylene, or γ-polyoxymethylene) was sublimed by heating in a glass retort in a slow current of nitrogen, and the sublimate was collected in a receiver containing a small quantity of water, and cooled by ice. The distillate was submitted to fractional distillation, and the crystals which separated from the earlier fractions were purified by recrystallisation from ether, or by sublimation in closed tubes. α-Trioxymethylene obtained in this way forms colourless needles or strongly refracting prisms, which are tough and soft, and melt at 63°—64° when heated in a closed tube. It boils at 114·5° C. at 759 mm., but is very volatile even at the ordinary temperature. It is soluble to the extent of 17·2 grms. in 100 c.c. of water at 18° and 21·1 grms. in 100 c.c. at 25° C.; it is easily soluble in alcohol, ether, methyl alcohol, acetone, chloroform, carbon tetrachloride, carbon bisulphide, and benzene, and soluble with difficulty in petroleum ether. It is probably a cyclic compound, as unlike the other polyoxymethylenes, it does not respond to the usual reactions for aldehydes or ketones; with sodium sulphite it does not react either in alkaline or acid solution. It exhibits a constant vapour pressure and vapour density.

Paraformaldehyde differs from α-polyoxymethylene chiefly by its amorphous condition and its content of adsorbed water, and by the properties depending upon these factors. Paraformaldehyde and α-, β-, γ-, and δ-polyoxymethylenes all exhibit a tendency, decreasing in the order given, to split off formaldehyde as a gas or in aqueous solution; the aqueous solutions of these compounds do not differ from those of formaldehyde. For the determination of small quantities of formaldehyde in dilute solutions, the authors find Romijn's iodometric method (this J., 1897, 366) most satisfactory.—A. S.

Formaldehyde [solution]; Action of light and heat on ——. J. W. de Waal. Pharm. Weekblad, 1907, [70]; J. Pharm. Chim., 1907, 26, 498—500.

Aqueous solutions of formaldehyde, kept at ordinary temperatures, in contact with air, but protected from light, are not oxidised to formic acid, even in the presence of traces of ferric chloride. Increase of temperature causes oxidation, but this is slight at 50° C., even after exposure for 400 hours. The acidity of commercial formaldehyde is not due to subsequent oxidation, but to acid formed in the process of manufacture. No appreciable increase in acidity was observed in a specimen which was exposed to the light for 3 months in a partially filled stoppered bottle.—J. O. B.

Colloidal hydroxides of thorium, zirconium, and uranium; New methods for preparing ——. B. Szilard. J. Chim. Physique, 1907, **5**, 488—494.

Colloidal solutions of thoria and zirconia can exist in the absence of even a trace of electrolyte. In order to prepare them, a moderately dilute solution of the nitrate is precipitated with excess of ammonia, and the hydroxide is exhaustively washed by decantation with hot water free from carbonic acid. After 3—6 washings daily for 3—6 days, the particles have almost lost the property of separating from the liquid, and it may be necessary to use a centrifugal machine. The process is continued until Nessler's reagent is no longer affected by the distillate from a portion of the liquid rendered alkaline with caustic soda. The milky colloidal solutions thus obtained can be filtered and are stable, but are coagulated by electrolytes and even by carbonic acid absorbed from the atmosphere; in this respect they differ from the class of colloidal hydroxides which are kept in solution by the presence of the nitrate or other salt. To the latter class belongs the colloidal uranium hydroxide prepared by the author, which is obtained as follows:—When a solution of uranium acetate is mixed with ether and subjected to the action of light, a violet precipitate is formed. This is washed and left to itself for a day, when the colour changes to yellow. The precipitate is then suspended in water and added to a hot dilute solution of uranium nitrate until no more dissolves. The resulting colloidal solution has an orange colour and is very stable.—W. A. C.

Uranium tetra-iodide. M. Guichard. Compt. rend., 1907, **145**, 921—922.

Uranium tetra-iodide, UI_4, is obtained by heating metallic uranium with iodine, in sealed tubes from which the air has been exhausted; the iodine is heated to 180° C., and the vapour allowed to act on the metal heated to 500° C. The iodide formed is partly melted and partly sublimed, forming molten crystalline masses, or a felted black sublimate of needles. Its m. pt. is near 500° C. and it is not very volatile between 500 and 600° C., *in vacuo*. It has the sp. gr. 5·6 at 15° C. It deflagrates in oxygen, and in dry air, when gently warmed, forming the oxide, U_3O_8. When kept at ordinary temperatures in dry air, it absorbs oxygen, and becomes covered with small black crystals of iodine. It rapidly deliquesces and decomposes in moist air, and is oxidised when heated with water, in which it is readily soluble, giving, in the cold and in the absence of oxidising agents, a green solution affording the usual reactions of uranous salts.—J. O. B.

Mercuric chloride; Detection of traces of ——. K. Kof and H. Haehn. *See* XXIII.

Synthetic camphor; U.S. Customs decision on ——. Oil, Paint, and Drug Rep., Dec. 2, 1907. [T.R.]

The United States Circuit Court has affirmed the decision of the Board of General Appraisers, declaring synthetic camphor to be entitled to entry into the United States free of duty; the customs officials classed it as "refined camphor," duty 6 cents per lb., but the importers claimed that the synthetic product was less pure than crude Formosan camphor, this latter being suitable for the manufacture of celluloid, whilst the synthetic product required a preliminary refining before it was available for the purpose.

Patents.

Borneol and isoborneol; Manufacture of ethers [esters] of ——. A. Verley, E. Urbain and A. Feige, Paris. Eng. Pat. 14,549, June 24, 1907.

Camphene or terpenes containing camphene (100 parts) is mixed with sulphuric acid containing 60—66 per cent. of H_2SO_4 (450 parts) and concentrated acetic acid (100 parts). The mixture is agitated for an hour at 20°—30° C. and is then poured into a separating apparatus. It forms two layers, the upper being bornyl acetate, and the lower sulphuric acid and unchanged acetic acid. After separation, the lower layer can be mixed with the proportion of acetic acid required for 100 parts of camphene, to make it suitable for treating more material. The amount of acid consumed is only that theoretically necessary for the formation of the borneol ester desired.—G. W. McD.

Potassium bitartrate; Process for extracting —— without the use of fuel. M. Fernandez. Fr. Pat. 379,902, July 13, 1907.

Grape-husks, argol, wine-lees, etc., are treated in the cold with dilute nitric, hydrochloric or sulphuric acid until the tartaric acid is dissolved. The filtered solution is decolorised with alumina or charcoal, and is then freed from any metals it may contain, either by treatment with sodium, potassium or ammonium sulphide, if several metals are present; by treatment with potassium ferrocyanide if only copper and iron are present; or else by treatment with potassium thiocyanate, followed by extraction with amyl alcohol or ether, if iron only is present. The purified liquid is acidified and a potassium salt is added. The precipitated potassium bitartrate is separated in a hydro-extractor, washed with water, and dried. The mother-liquor and wash-waters are used repeatedly.—A. G. L.

Silver compounds; Manufacture of soluble ——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 380,197, July 24, 1907. Under Int. Conv., Nov. 27, 1906.

Soluble silver compounds are prepared by the interaction of silver salts with thiourea, 5—10 molecular proportions of the latter being used for each atomic proportion of silver. *Example.*—143 parts of silver chloride and 380 parts of thiourea are dissolved in 1000 parts of hot water, and the solution is evaporated *in vacuo*. The crystalline residue is recrystallised from absolute alcohol. The white powder thus obtained has the composition, $AgCl,5CS(NH_2)_2$; it is soluble in water and in hot alcohol. —A. S.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Patents.

Emulsions for photographic purposes and paper, films, sheets, and plates made by means of the same. L. Lederer, Sulzbach, Germany. Eng. Pat. 26,503, Nov. 22, 1906.

See Fr. Pat. 371,358 of 1906; this J., 1907, 344.—T. F. B.

Paper for photographic purposes; Process for preparing ——. Y. Schwartz, Hanover, Germany. Eng. Pat. 993, Jan. 14, 1907.

See Fr. Pat. 373,699 of 1907; this J., 1907, 716.—T. F. B.

XXII.—EXPLOSIVES, MATCHES, &c.

Nitrocelluloses and nitroglycerin: Can mould fungi cause decomposition in —— ? B. Malenkovic. Mitt. ü. Gegenstände d. Artill. u. Geniew., 1907, 599—615.

The statement by Oscar Guttmann (Manufacture of Explosives, 1905, II., 49) that cellulose nitrates sometimes contract mould, and another by A. P. Sy (J.U.S. Artillery, Sept., Oct., 1903) to the effect that it does not seem unlikely that denitrifying bacteria might start a decomposition of cellulose nitrates, led the author to the present investigation. The following conclusions were reached after an examination not only of nitrocelluloses but of nitroglycerin. (1) Neither nitrocellulose nor nitroglycerin are in themselves liable to any direct decomposition by mould fungi. (2) Nitroglycerin is certainly, and nitrocellulose probably, toxic towards these organisms. (3) But nitrocellulose which is stored in close juxtaposition to organic matters themselves contaminated with mould fungi, becomes itself infected and shares the decomposition. Hence wet or damp nitrocellulose should never be wrapped up in paper, or other vegetable fibrous material, or in unlined wooden boxes.

Nitroglycerin ; Analysis of spent acid from the manufacture of —. H. Lemaître. Mon. Scient., 1907, 21, 809–811.

THE residue obtained on evaporation is examined for silica and the sulphates of calcium, magnesium iron, aluminium and lead. The total sulphuric acid is determined by precipitation with barium chloride, and the amount corresponding to the metallic sulphates deducted. Nitrosulphonic acid, $NO_2.SO_3H$, is determined by diluting from 2 to 20 grms. of the acid with 200 c.c. of water and titrating with $N/_2$ potassium permanganate solution. Total acidity is determined by means of a $N/1$ solution of sodium hydroxide, using phenolphthalein as indicator. The nitroglycerin in solution in the acid is estimated by agitating 100 grms. of the acid with chloroform, evaporating the latter to dryness and weighing. According to the author's figures, a fresh spent acid contained 3·32 per cent. of nitroglycerin in solution.

—G. W. McD.

Explosion which occurred during the operation of thawing gelignite in connection with the construction of the new Great Western Railway line from Clarbeston Road to Fishguard, in the county of Pembroke on the 26 Feb., 1906 ; Circumstances attending an ——. Captain M. B. Lloyd, H. M. Inspector of Explosives.

A CHARGEMAN was engaged in thawing five frozen gelignite cartridges, before use, in a warming-pan. He had emptied out the cooled water from the jacket of the warming-pan, and was replacing it by hot water from a can recently taken from the fire, when a slight hissing noise was heard and immediately afterwards the explosion occurred. The effect on the warming-pan itself was remarkable. Of the lid no traces were found except the small fragments taken out of the men's wounds ; the body of the warming pan, on the other hand, showed no signs of having had an explosion in it. The hissing was undoubtedly that produced by the active decomposition of the gelignite, which generated sufficient gas to blow off the lid of the warming-pan and carry with it the top cartridge, which had been laid across the end of the others and which might well, from its size, have been slightly jammed in the flange of the lid. On the lid reaching the ground the cartridge, already in an extremely sensitive condition, detonated violently. In discussing the probable cause of the explosion, Capt. Lloyd dismisses as wholly improbable that pouring boiling water into the outer chamber of a warming-pan should cause an explosion of well purified gelignite, or, seeing that the lid of the warming-pan was on, that a spark should have caused the initial decomposition. He arrives at the conclusion that the explosive itself was unstable, and that the hot water raised it to a sufficiently high temperature to determine its active decomposition. The purity of gelignite is determined by the Abel heat test, and no discoloration of the starch-iodide paper should be produced, at a temperature of 160° F., in less than 10 minutes, if the explosive has been well purified. Dr. Dupré's examination of a sample from the same batch of explosive showed a heat test of over half an hour, but he suspected, owing to the abnormally high heat test, that the explosive had been treated with a "masking agent," which whilst having no action in improving the stability of the explosive, effectually prevented any indication by the heat test. The substance most usually employed for this purpose is mercuric chloride. On keeping a sample of the explosive for six weeks at a constant temperature of 90° F., the heat test fell to 15 minutes. At the end of 12 weeks the heat test had fallen to 11 minutes. So small a proportion of the mercury salt as 0·00025 per cent. is sufficient to mask the heat test for a considerable time. The presence of mercury was definitely proved by the spectroscopic method. Captain Lloyd considers that the use of masking agents of this description can only have one effect, and that to conceal the instability of the explosive. The offence against the Act is one, too, which is liable to be a cause of great danger, in that with an explosive so treated, there is no means of finding out whether it is dangerously unstable or not ; or, even worse, a test may lead to the belief that dangerously unstable explosives are of good quality, and fit for prolonged storage, for a voyage through the tropics, or for somewhat drastic treatment for the purpose of thawing them. The conclusions drawn from the investigation of the accident are :—(1). That the explosive ignited spontaneously in the warming-pan. (2). That the explosion occurred outside the warming-pan but in close proximity to the lid. (3). That one at least of the cartridges was made of extremely unstable explosive. (4). That an unauthorised and illegal ingredient had been added to the explosive which had the effect of concealing its lack of stability.

—G. W. McD.

PATENTS.

Explosive ; Manufacture of an improved [safety] ——. N. Ceipek, Vienna. Eng. Pat. 7838, April 3, 1907.

AMMONIUM nitrate is intimately mixed with carbonised turmeric meal (1 to 6 per cent.), and the resulting product, after being freed from moisture, is formed into cartridges in the ordinary manner. An addition of from 6 to 10 per cent. of picric acid or trinitroluene may be made in order to increase the disruptive power of the explosive. The turmeric charcoal is prepared by finely pulverising turmeric and roasting the powder over a free fire in a slowly revolving iron drum until it has lost about 30 per cent. of its original weight.—G. W. McD.

Nitroglycerin ; Process for accelerating the separation of —— from acids. R. Haddan, London. From J. F. Lehmann, Munich. Eng. Pat. 18,597, Aug. 16, 1907.

NITROGLYCERIN is rapidly separated from the nitrating acids by passing an electric current through the mixture, the electrodes being suitably formed of platinum wire, one at the bottom of the vessel, and the other at the surface of the liquid. The small gas bubbles formed during the electrolysis are said to carry the suspended nitroglycerin to the surface. To assist the process a small percentage of water, sodium fluoride, etc., may be added to the acids.—G. W. McD.

Explosive oil, and process for the manufacture of the same. H. J. Haddan, London. From J. F. Lehmann, Munich. Eng. Pat. 21,116, Sept. 23, 1907.

GLYCEROL disulphuric acid is nitrated with nitric acid of sp. gr. 1·52, at a temperature not exceeding 30° C. The excess of acid is neutralised by the addition of lime, and the explosive oil extracted by means of ether from the filtration products. On evaporation of the ether, a yellowish-brown oil remains, solidifying at —24° C. It is soluble in hot water and the usual solvents for glycerol trinitrate, and readily gelatinises collodion cotton. It is less sensitive to shock than glycerol trinitrate.

—G. W. McD.

Explosive. G. W. Gentieu, Peoria, Ill. U.S. Pat. 871,395, Nov. 19, 1907.

A COMPRESSED granular explosive is prepared from an intimate mixture of ammonium picrate (25 parts), potassium nitrate (52), sulphur (10), charcoal (3) and hydrocellulose (10 parts).—G. W. McD.

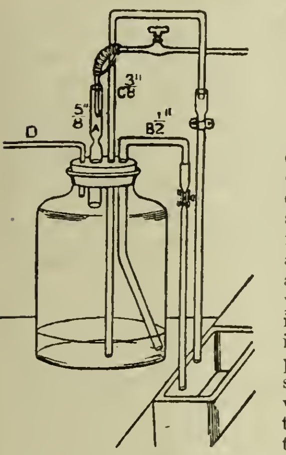
Explosives and method of making them. O. Silberrad. Fr. Pat. 380,108, Sept. 28, 1906.

SEE Eng. Pat. 18,692 of 1905 ; this J., 1907, 114.—T. F. B.

XXIII.—ANALYTICAL CHEMISTRY.

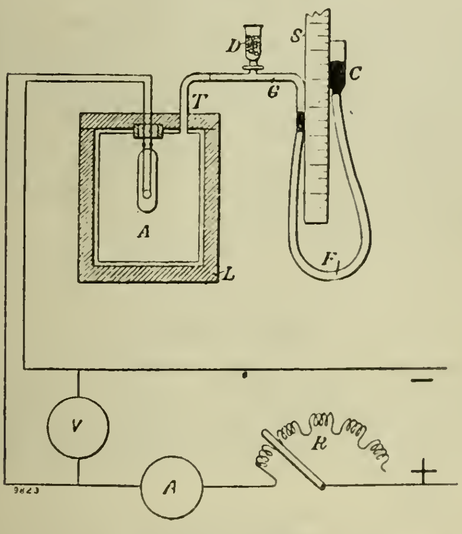
APPARATUS.

Water-jet blower of very simple construction. S. M. Revington and I. G. Rankin. Chem. News, 1907, **96**, 259—260.



A 4-litre bottle is fitted with a cork pierced as shown (see fig.). The diameter of D is ¼ inch. The tube, A, has a constriction and the water jet is so delivered that it goes diagonally across the tube on to the side of the constricted part. B is a siphon-tube the outfall from which is regulated by a clip. C is a safety tube about 30 inches high. Air passes out of D. On turning on the water and keeping the air exit closed, the pressure first starts the siphon, and then air and water escape by the safety tube. By blowing a side tube into A, and connecting A to the jet with rubber tubing, the apparatus can be used for circulating gas. The position of the jet may be adjusted by noting the height of water in the safety tube, while the same holds in the case of controlling the outfall by means of the clip.
—J. W. G.

Heat-insulating materials; Laboratory test for ——. C. R. Darling. Engineering, 1907, **84**, 790—791.



By means of the following apparatus it is stated that reliable results can be obtained with small quantities of materials under working conditions and at working temperatures. In the figure, A represents an air-tight copper cylinder, 8 ins. high and 6 ins. diameter, covered with a layer of the heat-insulating material, L, of uniform thickness. The interior of the cylinder is heated by means of a 32-candle-power incandescent electric lamp, the leads from which pass through a stuffing-gland as shown. A voltmeter, V, is placed across the lamp terminals, and an ammeter, A, and rheostat, R, are inserted in the circuit. A brass tube, T, leads from the interior of the cylinder, by way of the glass tube, G, and the flexible tubing, F, to a mercury cistern, C. As the temperature rises in A, the cistern, C, is raised so as to keep the mercury at a fixed level in G, and the difference between the initial and final level in C, measures the increase of pressure, and hence the temperature. The pressure can be adjusted when desired by means of the tap below D, the latter containing a drying agent. In making a test, the tap is opened, and the barometric pressure and the temperature of the cylinder observed, the latter by means of a thermometer placed in contact with the lid beneath the lagging. The cistern, C, is then adjusted until the mercury in G stands at the fixed level. The tap is now closed, and the current turned on—with the resistance, R, cut out—until the pressure exceeds by 2 or 3 cm. that corresponding to the required temperature. A portion of the resistance is now brought into the circuit, and the temperature allowed to fall gradually until it reaches the desired value and remains steady thereat for 10—15 minutes, when readings of the ammeter and voltmeter are taken. The heat passing through the lagging will then be in calories per second, 0·24 times, or in British thermal units per minute, 0·057 times the product of the number of volts and ampères.
—A. S.

Patent.

Electrochemical analysis, etc. U.S. Pats. 870,674 and 870,675. *See* XIA.

INORGANIC—QUALITATIVE.

Nickel; Microchemical reaction of ——. E. Pozzi-Escot. Bull. Soc. Chim. Belg., 1907, **21**, 404—405.

The crystals of nickel molybdate (this J., 1907, 1030) are easily recognisable microscopically. They form square plates, very definite, but having the angles often modified, very brilliant and highly refractive. A few drops of the solution (which must not be too strongly acid and should contain no other metal save cobalt) are concentrated on the slide, a drop of a saturated solution of ammonium molybdate is added, the slide heated to 60°—70° C., and examined. Should no crystallisation occur, a drop of water is added, and the slide heated again; on cooling, crystals are certain to be obtained if nickel is present.
—J. T. D.

Mercuric chloride; Detection of traces of ——. K. Kof and H. Haehn. Arch. Pharm., 1907, **245**, 529—533.

When moistened filter-paper is placed at a short distance above the surface of a 2 per cent. solution of mercuric chloride contained in a beaker glass, the vapours of the latter are condensed on the filter-paper, and on subsequent exposure of the latter to hydrogen sulphide, a darkening is observed which can be compared colorimetrically with darkenings produced by immersing strips of filter-paper in solutions of mercuric chloride of known strength, and then exposing to the action of hydrogen sulphide. The amount of mercuric chloride condensed on the paper can thus be estimated. In an experiment carried out at 13° C. and 763 mm. pressure, about 0·00008 grm. of mercuric chloride had been condensed in 165 hours from the solution on to a surface of 17·3 sq. cm. of paper. As the formation of the darkening had been noticed after 30 minutes' exposure, the presence of 0·000,000,011 grm. of mercuric chloride per 1 sq. cm. was thus estimated. When a sensitive plate is substituted for the filter-paper, a white image is obtained on developing; this is produced by one drop of a 0·01 per cent. solution of mercuric chloride, and thus 0·000,005 grm. of the latter can be detected after an exposure of 24 hours. The authors consider that the method may be usefully applied in the detection of traces of mercuric chloride in toxicological cases.—J. C. C.

INORGANIC—QUANTITATIVE.

Zinc; Determination of small quantities of ——. G. Bertrand and M. Javillier. Compt. rend., 1907, **145**, 924—926. (See this J., 1907, 35.)

Zinc may be quantitatively precipitated as calcium zincate in a dilution of "1 : 30,000,000," by the following method. After removing the metals precipitated by hydrogen sulphide in presence of hydrochloric acid, in the usual manner, and driving off the dissolved gas, ammonia is added until an excess of 4 or 5 per cent. of free ammonia is present in the mixture ; hydrogen peroxide is then added to ensure the precipitation of any manganese present. The precipitate is redissolved in strong hydrochloric acid. re-precipitated with ammonia and hydrogen peroxide. and the process repeated a third time. The combined ammoniacal filtrate, which will contain all the zinc, is heated to boiling, and a little milk of lime is gradually added, sufficient to liberate all the combined ammonia and to precipitate the zinc as calcium zincate. When the last trace of ammonia has been completely driven off, and the presence of free calcium oxide has been assured by the addition of a little calcium hydroxide solution. the precipitate is collected, washed with saturated calcium hydroxide solution, redissolved in pure hydrochloric acid, and evaporated on the water-bath. The mixed chlorides of zinc and calcium are redissolved in a few c.c. of 5 per cent. sodium acetate solution, and then saturated with hydrogen sulphide. After standing for 24 hours. the zinc sulphide is collected, washed with saturated hydrogen sulphide solution acidified with acetic acid, then dissolved in 5 per cent. sulphuric acid solution. This solution is evaporated to dryness, at first on the water-bath, then over a naked flame to drive off excess of acid. The anhydrous zinc sulphate thus obtained is weighed.

Nickel and cobalt, if present, will be found accompanying the zinc sulphate in the final product ; they must be removed by the usual methods.—J. O. B.

Silicon ; Determination of ——. W. R. Mott. Amer. Electrochem. Soc. Electrochem. and Met. Ind., 1907, **5**, 445.

For the determination of silicon in presence of silica, silicates, oxides, free carbon, and silicon carbide, the author recommends treatment with a solution of copper fluoride, silver fluoride or the like ; the metal of the metallic fluoride is replaced by the silicon, and is deposited, when it may be weighed or determined by any of the usual methods. The treatment with the silver fluoride solution is performed in a platinum dish. The reaction is: $Si + 4AgF = SiF_4 + 4Ag$.—A. S.

Chromium [in iron and steel] ; Two volumetric methods of determining ——. A. W. Gregory and J. McCallum. *See* X.

ORGANIC—QUALITATIVE.

Phenol ; The ferric chloride reaction of ——, and the hypochlorite reaction of aniline. F. Raschig. *See* IV.

ORGANIC—QUANTITATIVE.

Glycuronic acid ; Determination and colour reactions of ——. K. U. Lefèvre and B. Tollens. Ber., 1907, **40**, 4513—4523.

Glycuronic anhydride (glycurone) is dehydrated on boiling with hydrochloric acid, yielding furfural in the same way as the pentoses, thus: $C_6H_8O_6 = C_5H_4O_2 + CO_2 + 2H_2O$. The authors have prepared pure glycurone from euxanthic acid obtained from "purree" and found that on distillation with hydrochloric acid under the standard conditions adopted for the pentoses, the production of furfural was very much slower than in the case of the latter. Consequently, much of the furfural is converted into non-volatile products, and 3 parts of glycurone only give 1 part of furfural phloroglucide. This proportion is, however, very constant, and an accurate method for the determination of glycurone in euxanthic and urochloralic acids is available. Various samples of "purree" showed 18—19·5 per cent. of glycurone, corresponding to 43·1—46·7 per cent. of euxanthic acid. According to the above equation, the glycurone may also be estimated by absorbing and weighing the carbon dioxide evolved, the above ratio corresponding to a yield of 25 per cent. of carbon dioxide. The authors have standardised this method, boiling the substance with hydrochloric acid of sp. gr. 1·06, for 3½ hours under a reflux condenser. A slow current of pure air is aspirated through the apparatus, the carbon dioxide is washed through water, dried, and absorbed in potash-bulbs. With pure materials the results agree well with the theoretical values and with those obtained by the furfural method ; with "purree" the results are rather too high owing to the presence of other bodies which yield carbon dioxide. Since the pentoses yield no carbon dioxide on boiling with hydrochloric acid, a combination of this method with the furfural method affords a means for the simultaneous estimation of pentoses and glycurone. This double estimation, together with the cupric-reducing power of the mixture, also affords a simultaneous estimation of hexoses. "Purree" contains, on an average, 1·39 per cent. of nitrogen ; it yields, besides euxanthic acid, small quantities of hippuric acid and sometimes benzoic or *m*-toluic acid. Glycuronic acid can be made to give the same colour reaction as the pentoses with Bial's reagent for pentoses in urine (solution of orcinol and ferric chloride in strong hydrochloric acid). Xylose gives the green coloration most readily, arabinose less readily, and glycuronic acid after a still longer time. It is however a question of quantity of substance and manner of heating, and the results of the test must be interpreted with caution.—J. F. B.

Rubber and rubber analysis. G. Fendler and O. Kuhn. *See* XIIIC.

Tannin analysis : comparison of the filter method with the shake method. H. R. Procter. *See* XIV.

Chromed hide powders ; Some experiments with ——. F. P. Veitch. *See* XIV.

Nitroglycerin ; Analysis of spent acid from the manufacture of ——. H. Lemaitre. *See* XXII.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Radium ; The immediate parent of ——. O. Hahn. Ber., 1907, **40**, 4415—4420.

The author confirms the conclusion of Boltwood, that the parent of radium is an element allied to thorium. Examination of a number of thorium preparations shewed that their radium-content increased with time, and that the radium-producing substance always remained with the thorium when the latter was precipitated from solution. From observations of the rate of production of radium in thorium preparations, and of the quantity found in equilibrium in monazite sand and other minerals, the dissociation-period of radium was calculated to be between 2630 and 3250 years.—J. T. D.

New Books.

Traite Complet d'Analyse Chimique appliquee aux Essais Industriels. Par J. Post et B. Naumann, avec la collaboration de nombreux chimistes et spécialistes. Deuxième édition française entièrement refondue. Traduite d'après la troisième édition allemande et augmentée de nombreuses additions, par le Dr. L. Gautier.

Tome Premier.—Premier Fascicule. Librairie Scientifique A. Hermann, Libraire de S. M. le roi de Suède, 6, rue de la Sorbonne, 6. 1907. Price 5s. 6d.

8vo volume, containing 217 pages of subject matter, with 104 illustrations, and a table of contents. The matter is classified as follows:—I. Water and waste waters. II. Fuels. III. Pyrometry. IV. Smoke gases ; heating gas ; gas for motors ; and mine gases.

Tome Second.—Premier Fascicule. Librairie Scientifique A. Hermann, 6, rue de la Sorbonne. 1908. Price 5s. 6d.

8vo volume, containing 199 pages of subject matter, with 99 illustrations, and a table of contents. The subjects treated of in this volume are as follows:—I. Limes; mortars ; cements, and plaster. II. Pottery and earthenware. III. Glass and glazes.

Traite de Chimie Analytique Qualitative suivi de Tables systematiques pour l'Analyse Minerale. Par Louis Duparc, Professeur ord. de mineralogie et de pétrographie à l'Université de Genève, &c., et Alfred Monnier. Deuxième édition. Librairie Kündig, 11, Corraterie, Genève. Félix Alcan, 108, Bd. St.-Germain, Paris. 1908. Price 8.1 Frcs. net.

8vo volume, containing 315 pages of subject matter, and 33 pages devoted to analytical tables, etc. The matter is classified as follows:—I. Theoretical introduction to the study of analysis. II. Reagents (Wet methods). III. Reagents (Dry methods). IV. Indicators used in analysis. V. Apparatus, etc., necessary for analyses by the wet method. VI. Special apparatus. Apparatus needed for analyses by the dry method. VII. Analytical processes (wet). VIII. Analytical processes (dry). IX. Spectrum analysis. X. Reactions of the Bases. XI. Reactions of the acids. XII. Organic acids. XIII. Reactions of the rare metals (1st, 2nd, and 3rd groups). XIV. Alkaloids: (*a*) volatile alkaloids, (*b*) fixed alkaloids, (*c*) non-nitrogenous bodies which resemble alkaloids: (Digitalin; salicin; picrotoxin; cantharidin; santanin). XV. Systematic tables for mineral analysis.

The Utilisation of Wood Waste by Distillation. A General Consideration of the Industry of Wood Distilling, including a description of the apparatus used and the principles involved, also Methods of Chemical Control and Disposal of the Products. By Walter B. Harper. M.S. Publishers of the St. Louis Lumberman, St. Louis, Mo. U.S.A. Journal of Commerce Company. 1907. Vacher & Sons, Great Smith Street, Westminster, London, S.W. Price 12s. 6d.

Large 8vo volume, containing 156 pages of subject matter, and a bibliographic table. The text is illustrated with 74 engravings. The matter is subdivided as follows for due classification:—I. Historic connection. II. Principles of distillation. III. Apparatus necessary for distillation. IV. Refining methods. V. Special combinations of apparatus as used in modern plants. VI. Execution of the processes of wood distilling. VII. Refining processes. IX. General considerations for the establishment of a plant. X. Composition of wood, and products of distillation. XI. Yields, and disposal of products. XII. Chemical tests and combinations. XIII. Chemical control of plant for the distillation of wood.

Coal Tables, 1906. Messrs. Wyman & Sons, Fetter Lane, London, E.C. Price 6d.

The thirteenth annual number of this return, which is prepared in the Commercial, Labour, and Statistical Department of the Board of Trade, showing the production and consumption of coal in the principal countries of the world during each of the years from 1885 to 1906, or to the most recent years for which statistics are available. In addition to statistics of production and consumption, particulars are given of the average value per ton at the collieries, the number of persons employed in coal mining, coal imports and exports, &c. Statistics of lignite production and petroleum production in certain countries are also contained in the return.

Patent List.

Where a Complete Specification accompanies an Application, an asterisk is affixed. The dates given are (i) in the case of Applications for Patents, the dates of Application, and (ii) in the case of Complete Specifications Accepted, those of the Official Journals in which acceptances of the Complete Specifications are advertised.

Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

26,590. Bueb. Gas furnaces.* Dec. 2.

26,615. Lorey and Maiser. Filtering apparatus.* Dec. 2.

26,619. Carmichael and Morrow. Apparatus for heating, cooling, evaporating, or condensing. Dec. 2.

26,775. Riley and Kershaw. Saturators. Dec. 4.

26,821. Elmore and Elmore. *See under* X.

26,831. Cuau. Filtering apparatus. [Fr. Appl., Dec. 5, 1906.]* Dec. 4.

26,935. Venter. Concentrating lyes.* Dec. 5.

27,017. Hommel, and Metals Extraction Corporation. Apparatus for use in solution and precipitation processes. Dec. 6.

27,019. Hommel. and Metals Extraction Corporation. Apparatus for dissolving gases in liquids. Dec. 6.

27,217. Akerman. Continuous kilns. Dec. 9.

27,391. Fowler and Medley. Apparatus for subjecting gases or vapours to the action of liquids. Dec. 11.

27,463. Alexander and McClelland. Unstable chemical solutions. Dec. 12.

27,482. Venter. Concentrating lyes. [Ger. Appl., June 17, 1907.]* Dec. 12.

27,496. Kubierschky. Towers for distilling, absorbing, etc. [Ger. Appl., Dec. 12, 1906.]* Dec. 12.

27,515. Thwaites. Rotary kilns. Dec. 13.

27,645. Venter. Concentrating liquids with two or more evaporators in series. [Ger. Appl.. Sept. 20, 1907.]* Dec. 14.

Complete Specifications Accepted.

29,733 (1906). Soc. l'Air Liquide. Liquefaction of gases. Dec. 18.

4553 (1907). Neilson (Iffland). Cooling towers. Dec. 11.

4991 (1907). Mills (Sanitary Water-Still Co.). Water still. Dec. 11.

6023 (1907). Marks (A.-G. f. Kohlendestillation). Apparatus for cooling, washing, or enriching gases or liquids. Dec. 18.

11,710 (1907). Soc. l'Air Liquide. *See under* VII.

14,764 (1907). Diamanti and Beuf. Hydro-extractors. Dec. 18.

19,813 (1907). British Oxygen Co. (Ges. f. Linde's Eismaschinen). Determining and recording the composition of boiling mixtures of liquids. Dec. 18.

20,375 (1907). Sellenschmidt. Filter elements. Dec. 18.

II.—FUEL, GAS, AND LIGHT.

Applications.

26,593. Ries. Manufacture of gas.* Dec. 2.

26,644. Barker. Apparatus for making producer gas. Dec. 2.

26,830. Cummins. Artificial fuels. Dec. 4.

26,838 and 26,839. Pörscke. Manufacture of electric glow-lamp filaments from metals and oxides of high fusing-point.* Dec. 4.

26,840. Pörscke. Manufacture of glow-lamp filaments.* Dec. 4.

26,841. Pörscke. Manufacture of filaments of non-fusible metals.* Dec. 4.

26,924. Hubbard. *See under* XXIII.

27,127. Young. Incandescent gas mantles. Dec. 7.

27,367. Head. Manufacture of incandescent gas mantles. Dec. 11.

27,443. Jones. Coke ovens.* Dec. 12.

27,497. Purle. Production of metallic incandescent bodies for electric glow lamps. Dec. 13.

27,505. Ingleby, and Simon-Carvès Coke-Oven Co. Utilisation of coke oven waste products. Dec. 13.

27,567. Feld. Washing out ammonia from coal gas, etc. [Ger. Appl., May 29, 1907.]* Dec. 13.

27,568. Feld. Purifying coal gas and recovering ammonia and other products. [Ger. Appl., June 1, 1907.]* Dec. 13.

Complete Specifications Accepted.

27,641 (1906). Cox. Gas-making plants. Dec. 11.

28,181 (1906). Crossley and Rigby. Manufacture of producer gas. Dec. 18.

28,183 (1906). Ward. *See under* XXIII.

28,475 (1906). Robertson and Graham. Production of fuel and coke. Dec. 11.

28,580 (1906). Woodall and Duckham. Vertical retorts for the destructive distillation of coal. Dec. 18.

28,775 (1906). Deuts. Gasglühlicht A.-G. Producing metallic incandescence bodies for electric glow lamps. Dec. 18.

28,834 (1906). Crossley and Rigby. Producer gas generators. Dec. 18.

3243 (1907). Bruce. Air gas plant. Dec. 18.

17,973 (1907). Bloxam (Siemens und Halske A.-G.). Manufacture of electric incandescent lamp filaments. Dec. 11.

19,973 (1907). Babé and Pape. Separating sulphurous acid from combustion gases. Dec. 18.

21,078 (1907). Rider. Apparatus for manufacturing fuel gas from mineral carbonates and carbonaceous materials. Dec. 11.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM, AND MINERAL WAXES.

Applications.

26,940. Wilton and Wilton. Distillation of tar. Dec. 5.

26,915. Perelzveich and Rosenbuch. Manufacture of solidified spirit. Dec. 5.

27,335. Everett. Production of by-products from asphaltum and the like. Dec. 11.

Complete Specifications Accepted.

27,945 (1906). Cowper-Coles. Production of petroleum compounds with low flash points. Dec. 18.

2942 (1907). Craig. Manufacture of blast-furnace pitch. Dec. 11.

19,629 (1907). Stine. Treatment of wurtzilite or elaterite. Dec. 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

Applications.

26,811. Ransford (Cassella und Co.). Manufacture of trisazo dyestuffs. Dec. 4.

27,187. Johnson (Badische Anilin und Soda Fabrik). Manufacture of anthracene compounds and dyestuffs. Dec. 9.

27,392. Thompson (Siegle und Co.). *See under* XIII*A*.

27,430. Green. Production of stilbene derivatives and products therefrom. Dec. 12.

27,909. Ris and Haager. Manufacture of blue disazo colouring matters dyeing cotton and wool.* Dec. 14.

Complete Specifications Accepted.

27,213 (1906). Chem. Fabr. vorm. Weiler-ter-Meer. Manufacture of a black sulphurised dyestuff. Dec. 11.

29,765 (1906). Imray (Meister, Lucius, und Brüning). Manufacture of vat dyestuffs. Dec. 18.

4592 (1907). Johnson (Badische Anilin und Soda Fabrik). Manufacture of colouring matters containing sulphur. Dec. 11.

5122 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of halogen derivatives of indigo and their leuco-compounds. Dec. 18.

6490 (1907). Imray (Soc. Chem. Ind. in Basle). Manufacture of halogenised vat dyestuffs. Dec. 18.

9651 (1907). Ellis (Chem. Fabr. vorm. Sandoz). Manufacture of leuco derivatives from gallocyanine. Dec. 18.

7057 (1907). Lake (Chem. Fabr. Griesheim-Elektron). Manufacture of azo colouring matters. Dec. 18.

7146 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of yellow azo dyestuffs. Dec. 18.

9011 (1907). Bloxam (Act.-Ges. f. Anilinfabr.). Manufacture of sulphurised dyestuffs. Dec. 11.

10,420 (1907). Newton (Bayer und Co.). Manufacture of azo dyestuffs. Dec. 11.

13,686 (1907). Newton (Bayer und Co.). Manufacture of dyestuffs of the anthracene series and their use in dyeing and printing. Dec. 18.

15,228 (1907). Oakes. Production of a dyestuff. Dec. 18.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

Application.

27,599. Calico Printers' Assoc., and Fourneaux. Printing indigo and other vat dyes. Dec. 14.

Complete Specifications Accepted.

28,928 (1906). Liddell. Aniline and other agers and heated vessels used in printing or dyeing woven fabrics, etc. Dec. 11.

5498 (1907). Rumpf. Producing a high gloss, fast to water, soap, or acids, on cotton fabrics. Dec. 18.

13,686 (1907). Newton (Bayer und Co.). *See under* IV.

14,715 (1907). Rothwell-Jackson. Kiers for bleaching and otherwise treating piece goods in the open state. Dec. 11.

15,886 (1907). Ratignier and Pervilhac. Apparatus for finishing sized fabrics. Dec. 11.

16,520 (1907). Ebizuka. Making waterproof fabrics. Dec. 18.

VII.—ACIDS, ALKALIS, AND SALTS.

Applications.

26,949. Fraser. Fixing ozone in liquids, etc. Dec. 6.

26,981. Ramsay. Recovery of oxides of nitrogen and other readily condensable gases from air or other gases. Dec. 6.

27,334. Thwaites. Treating pyrites, pyrites cinder, etc. Dec. 11.

27,426. Thwaites. Treatment of liquor obtained from pyrites, pyrites cinder, etc. Dec. 12.

27,428. Eastick. Manufacture and use of hydrofluosilicic acid. Dec. 12.

27,506. Thwaites. Utilising liquors obtained from pyrites, pyrites cinder, etc. Dec. 13.

27,567 and 27,568. Feld. *See under* II.

Complete Specifications Accepted.

24,134 (1906). Sisson. Hydrated carbonate of magnesium. Dec. 11.

27,209 (1906). Muller and Baraduc. Production of metallic silicides. Dec. 11.

2090 (1907). Lessing. Extraction of cyanogen from gases. Dec. 18.

2144 (1907). Humfrey. Manufacture of litharge. Dec. 11.

8576 (1907). Chem. Werke F. Friedlaender Ges. Manufacture of insoluble aluminium acetate. Dec. 18.

11,710 (1907). Soc. l'Air Liquide. Purification of air and other gases. Dec. 18.

19,973 (1907). Babé and Pape. *See under* II.

20,378 (1907). Herrenschmidt. Manufacture of silicates of magnesia. Dec. 11.

20,580 (1907). Meister, Lucius, und Brüning. Manufacture of stable hydrosulphites. Dec. 11.

VIII.—GLASS, POTTERY, AND ENAMELS.

Applications.

27,449. Hidding. Earthenware which can resist variations of temperature. Dec. 12.

27,500. Hill. Converting non-absorbent, argillaceous rocks, slate rock or waste, into a soluble saturator, detergent, or scourer. Dec. 13.

Complete Specification Accepted.

29,531 (1906). Hancock. Construction of ceramic glass, porcelain, cement, and other articles. Dec. 11.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

Complete Specification Accepted.

15,765 (1907). Collos Portland Cement Co. (Colloseus). Manufacture of cement or cementitious material from slag. Dec. 18.

X.—METALLURGY.

Applications.

26,810. Ruthenburg. Concentration of ores containing wolfram.* Dec. 4.

26,821. Elmore and Elmore. Apparatus for separating subdivided matter, especially ore pulp, from a liquid. Dec. 4.

26,873. Richmond, Livingstone, and Ferguson. Crucible furnaces for melting metals. Dec. 5.

26,932. Harden, and Amalgaline, Ltd. Solder for aluminium. Dec. 5.

27,018. Hommel, and Metals Extraction Corporation. Blowing furnaces for volatile metals. Dec. 6.

27,020. Hommel, and Metals Extraction Corporation. Extraction of zinc from ores and residues. Dec. 6.

27,099. Burridge. Utilisation of small or powdered ores in the production of metals. Dec. 7.

27,142. Thwaites. Separating metallic compounds. Dec. 9.

27,172. Ingham. Manufacture of slag wool. Dec. 9.

27,282. Sinding-Larsen. Treatment of titaniferous iron ores. [Appl. in Norway, Dec. 13, 1906.]* Dec. 10.

27,489. Massenez. Manufacture of steel.* Dec. 12.

27,556. Röchling and Schoenawa Treatment of iron.* Dec. 13.

27,576. Galbraith. Furnaces for treating ores. Dec. 14.

Complete Specifications Accepted.

27,515 (1906). Thwaites. Utilising pyrites cinder and other metallic sulphides low in sulphur. Dec. 11.

27,639 (1906). Hommel. Rotary furnace for roasting ores. Dec. 11.

27,914 (1906). Lowndes (Grist). Treatment of metals such as iron or steel alloys. Dec. 18.

28,030 (1906). Reynolds. Manufacture of steel. Dec. 11.

6730 (1907). Crispo. Extraction of copper from copper residues. Dec. 11.

13,696 (1907). Küphers Metallwerke Ges. Soldering aluminium and its alloys. Dec. 18.

16,352 (1907). Juppont and Teil. Metallic alloy. Dec. 18.

16,675 (1907). Lundberg and Holmberg. Magnetic ore separator. Dec. 18.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

Applications.

26,730. Walton. Composition for electrical insulation, etc. Dec. 3.

26,829. Awalow. Electrolytic refining of copper Dec. 4.

27,385. Cowper-Coles. Apparatus for the electro-deposition of metals.* Dec. 11.

27,559 and 27,560. Murphy. *See under* XVIII*B*.

27,591. Mason. Electrodeposition of metals and alloys on aluminium and other metals. Dec. 14.

Complete Specifications Accepted.

27,740 (1906). Cowper-Coles. Electrolytic refining of copper. Dec. 11.

28,897A (1906). Cowper-Coles. Electrodeposition of iron. Dec. 18.

3724 (1907). Loring. *See under* XVIII*A*.

XII.—FATTY OILS, FATS, WAXES, AND SOAPS.

Application.

27,383. Kalle und Co. Manufacture and use of bacterial fats. [Ger. Appl., April 16, 1907.]* Dec. 11.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, &c.

(*A.*)—Pigments, Paints.

Applications.

27,381. Spicer and Bestic. Distemper. Dec. 11.

27,392. Thompson (Siegle und Co.). Manufacture of lakes of sulphuretted azo dyes. Dec. 11.

(*C.*)—India-Rubber.

Application.

26,852. Suhr. Elastic substance insoluble in water suitable for use as a rubber substitute. Dec. 4.

XIV.—TANNING, LEATHER, GLUE, SIZE, &c.

Application.

26,770. Depigny and Larmet. Apparatus for extracting tanning materials. Dec. 4.

Complete Specifications Accepted.

29,368A (1906). Roach and Roach. Composition for stuffing leather. Dec. 18.

13,475 (1907). Dunn and Dunn. Manufacture of Russia leather. Dec. 18.

15,792 (1907). Howorth (Oesterreichische Pluviusin A.-G.). Imitation chamois leather. Dec. 18.

XVI.—SUGAR, STARCH, GUM, &c.

Application.

26,751. Greenwood. Manufacture of gum tragasol. Dec. 3.

XVII.—BREWING, WINES, SPIRITS, &c.

Applications.

26,581. Pampe. Concentrating distillers' wash or slop. [Ger. Appl., Dec. 1, 1906.]* Dec. 2.

26,582. Pampe. Aseptic malt saccharifying and cooling process. [Ger. Appl., Dec. 1, 1906.]* Dec. 2.

26,600. Gates. Brewing apparatus. Dec. 2.

XVIII.—FOODS; SANITATION, WATER PURIFICATION; AND DISINFECTANTS.

(*A.*)—Foods.

Applications.

27,066. Loring. Treatment of ground products of wheat. Dec. 7.

27,549. Zimmermann. Manufacture of cattle food. Dec. 13.

27,660. Mörig. Destroying germinating power of wheat and other seeds. Dec. 14.

Complete Specification Accepted.

3724 (1907). Loring. Electrical generators for flour bleaching, etc. Dec. 18.

(*B.*)—Sanitation; Water Purification.

Applications.

27,559. Murphy. Electrode for use in purifying water and other liquids. Dec. 13.

27,560. Murphy. Apparatus for purifying water and other liquids by electricity. Dec. 13.

Complete Specifications Accepted.

25 (1907). Parsons. Sewage purification and destruction of pathogenic organisms. Dec. 11.

6562 (1907). Longwood Engineering Co., and Walsh. Machine for straining waste liquids and trade effluents. Dec. 18.

(*C.*)—Disinfectants.

Applications.

26,608. Little and Morris. Cleansing fluids for use as sheep-dips, for disinfecting, etc.* Dec. 2.

27,646. Huwart. Disinfecting by means of trioxymethylene. [Belg. Appl., Dec. 14, 1906.]* Dec. 14.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENTIAL OILS, AND EXTRACTS.

Applications.

27,113. Lewy. Manufacture of preparations of haemoglobin.* Dec. 7.

27,117. Meister, Lucius, und Brüning. Manufacture of aromatic ethanolamines. [Ger. Appl., Dec. 7, 1906.]* Dec. 7.

27,314. Lake (Lilly and Co.). Pharmaceutical compounds. Dec. 10.

27,485. Meister, Lucius, und Brüning. Manufacture of 1-phenyl-2.3-dimethyl-4-dimethylamino-5-pyrazolone. [Ger. Appl., Jan. 10, 1907.]* Dec. 12.

Complete Specification Accepted.

22,957 (1907). Raschig. Manufacture of hydrazine. Dec. 18.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Complete Specification Accepted.

13,874 (1907). Donisthorpe. Colour photography and photographic printing. Dec. 18.

XXII.—EXPLOSIVES, MATCHES, &c.

Applications.

26,791. Winchester. Explosive substance. [U.S. Appl., Dec. 4, 1906.]* Dec. 4.

26,823. South African Maganite Explosives Synd., and Bloxam. Manufacture of explosives. Dec. 4.

Complete Specification Accepted.

21,117 (1907). Haddan (Lehmann). Manufacture of explosive oils containing nitroglycerine. Dec. 18.

XXIII.—GENERAL ANALYTICAL CHEMISTRY.

Application.

26,924. Hubbard. Apparatus for automatic and continuous analysis and recording of gases. Dec. 5.

Complete Specification Accepted.

28,183 (1906). Ward. Apparatus for indicating the percentage of carbon dioxide in gases. Dec. 11.

Society of Chemical Industry.

Incorporated by Royal Charter 17*th day of June*, 1907.

In accordance with the provisions of Clause 37 of the Charter, a printed copy of draft By-laws is sent to each Member of the Society in this number of the Journal. The Council invites Members to offer observations thereon, which should reach the Secretary not later than January 15th next, in order that the final draft may be settled and submitted for consideration and adoption by the Members at a General Meeting to be held not later than March 17th, 1908, as provided by the said clause of the Charter.

By order of the Council,

Charles G. Cresswell,

Secretary.

DRAFT BY-LAWS.

Part I.—PRELIMINARY.

ort Title d mmence- ent.

(1.) These By-laws made pursuant to the Charter may be cited as "Society of Chemical Industry By laws, 1908," and shall come into operation so soon as they may be allowed by the Lords of His Majesty's Most Honourable Privy Council.

-laws ided into rts.

(2.) These By-laws are divided into parts as follows (that is to say):—

Part I.—Preliminary.
Part II.—Members.
Part III.—The Council.
Part IV.—Local Sections.
Part V.—The Journal.
Part VI.—Financial.
Part VII.—Meetings.
Part VIII.—Miscellaneous.

plicatien nterpre- on Act.

(3.) The "Interpretation Act, 1889," or any subsisting statutory modification thereof, shall apply to these By-laws.

terpre- tion.

(4.) In and for the purposes of these By-laws terms and words and expressions to which meanings are assigned by the Charter or the Act made applicable thereto have the same respective meanings, unless there be something in the subject or context repugnant to such construction.

"The Charter" means the Charter granted the 17th day of June, 1907, as amended or extended by supplemental or additional Charters granted to and accepted by the Society after the date aforesaid.

"By-laws" means any by-laws of the Society made and allowed pursuant to the Charter.

"Commencement of By-laws" means the day when the By-laws come into operation under the Charter.

"Committee" means any Committee duly appointed by the Council, and where qualified by any prefix means the Committee appointed as aforesaid for the purposes denoted or indicated by such prefix or other the meaning assigned thereto under the By-laws.

"Treasurer" means the person appointed pursuant to the By-laws as Honorary Treasurer of the Society.

"Foreign Secretary" means the person appointed pursuant to the By-laws as Honorary Foreign Secretary of the Society.

"The Secretary" means the Secretary of the Society appointed by the Council, or the person acting in that capacity by the direction of the Council pursuant to the By-laws.

"The Editor" means the Editor of the Journal appointed by the Council, or the person acting in that capacity by the direction of the Council pursuant to the By-laws.

"Sectional Officers" means the Chairman and Hon. Secretary of the several Local Sections.

"Member" means any Member of the Society.

"The Schedule" means the Schedule of Forms annexed to the By-laws.

"The Register" means the Register of the Society of 1881, continued as the Register of the Society pursuant to the By-laws.

ms.

(5.) The forms set forth in the Schedule, and such other forms as the Council may from time to time authorise, shall be used in the several cases to which they are applicable, with such amendments, alterations, or additions thereto, if any, which the Council may from time to time determine, and all notes and directions printed thereon shall be read and construed as part of such forms, and be observed accordingly, but it shall be sufficient if the forms are substantially followed, and no act or proceeding shall be invalid merely by reason of any formal defect.

Part II.—MEMBERS.

Proposal of Candidate.

(6.) Every person desirous of being admitted as a Member of the Society shall be duly proposed as a candidate for admission upon Form (A) set out in the Schedule, or such other form as the Council may from time to time prescribe. The proposal form shall be signed by two subsisting Members, to one of whom at the least the candidate shall be known personally, and every candidate shall make and subscribe the declaration therein contained—that, if elected, he agrees to be bound by the Charter and By-laws and by any Regulations made thereunder, and to further the objects of the Society.

Election of Members.

(7.) All proposal forms of Candidates, duly signed and subscribed as hereinbefore provided, received by the Secretary prior to the issue by him of notice convening an Ordinary Meeting of Council, shall be considered thereat, and the Council may in their absolute discretion, by resolution passed by a majority of those present, elect or postpone the election of any candidate as a Member of the Society, or may refuse to elect any candidate whom they consider to be not a fit or proper person to be elected as aforesaid, and upon such election may also decide whether any Member so elected shall be required to pay for the year then current the whole or any proportionate part of the annual or other subscription or other fee hereafter provided, and thereupon the Secretary shall give notice of such election and decision to the Member elected as aforesaid, and upon such notice and the payment of the said subscription or other fee, the person so elected shall, pursuant to the Charter and By-laws, become and continue to be subject to all the duties and obligations, and entitled to all the rights and privileges of a Member.

Register of Members.

(8.) The Register of the Society of 1881 shall become, and the Council shall cause the same to be continued as, the Register of the Society by the entry therein by the Secretary, or other person authorised by the Council, of the names of all persons elected Members as hereinbefore provided, together with the date of their several elections, and sufficient particulars of their several professions or occupations and addresses, and such particulars shall be amended or corrected as occasion may require, and the Council may cause to be printed, and sent without any charge therefor to each Member, a list of the names and respective addresses of all Members then appearing in the Register.

Entrance Fee.

(9.) Except as otherwise decided by the Council, every Member shall, upon notice of his election, in addition to a subscription for the current year in which he is elected, or any payment in lieu thereof, pay to the Treasurer, or other person appointed by the Council to receive Members' fees or subscriptions, an entrance fee of One Guinea, or such other amount as may for the time being be prescribed by Regulations.

Annual Subscription.

(10.) Every Member shall on the first day of January in each year pay to the Treasurer, or other person as aforesaid, the sum of One pound five shillings, or such other sum as the Council may prescribe by Regulations, and every Member shall upon his election pay the like amount as his subscription for the year current in which he is elected, or such proportionate part thereof as may be decided by the Council, but in lieu of any such payment a Member may compound for that and all future payments, as hereinafter provided.

Life Compositions.

(11.) A Member, upon his election, or any other Member whose subscription is not in arrear, may at any time compound for all annual subscriptions by payment to the Treasurer, or other person as aforesaid the sum following (that is to say):—

(*a*) A Member whose age does not exceed 30 years, the sum of £25.

(*b*) A Member whose age exceeds 30 years, the sum of £20, less such sum as is ascertained to be equal to one-fourth part of the total of the sums which have been paid by such Member as annual subscriptions after reaching the age of 30 years.

But before accepting any compounding payment the Council may require from any Member desirous of compounding such evidence of his age as they may think fit.

Subscription in Arrears.

(12.) Any Member whose annual subscription, payable on the first day of January, is unpaid on the first day of March next following, shall, while remaining subject to the duties and obligations, not be entitled to any of the rights of a Member until such subscription shall be paid, and upon the first day of May the Secretary shall give notice to all Members whose subscriptions are so in arrear, and shall furnish a list of such notices to the Council at the next ensuing Ordinary Meeting thereof, and if the Council shall then so direct, shall by further notice require such Member to pay the said arrears by a date to be fixed by them; and if any Member on the next ensuing thirty-first day of December shall continue in arrear, such Member shall cease to be a Member, and his name shall then be removed from the Register by the Secretary, but without prejudice to the right of the Council to recover any such arrears or to enforce any duty or obligation to which, as a Member, he may have become liable at the time of such removal, in any Court of competent jurisdiction, and if the Council shall so direct, the name of any Member removed as aforesaid shall be published in the Journal. Notwithstanding anything in this By-law provided, the Council in the exercise of their sole discretion may, having regard to the circumstances in which the subscription of any Member shall be in arrear as aforesaid, postpone or remit the payment thereof, and continue such Member in full enjoyment of all rights of Membership as if such subscription had not at any time been or continued in arrear.

Certain Disqualification of Members in Arrear.

(13.) A Member who has not paid before the first day of March any fee or subscription payable and due by him shall be disqualified for nomination as President, Vice-President, and Ordinary Member of Council, and to continue in any such office, and to become or remain an *ex-officio* Member of Council, and to sign the form of nomination of an ordinary Member of Council.

Resignation of Members.

(14.) Any Member may at any time determine his Membership by notice in writing to that effect, sent to the Secretary not later than the thirty-first day of December in any year, but such notice in order to operate as a determination shall be accompanied by payment of any subscription or fee which at the date of the notice shall have become payable by the Member and which remains unpaid in respect of Membership for that year.

Suspension or Determination of Membership by Council.

(15.) Any Member in respect of whom a complaint of misconduct, or disgraceful conduct, is made to the Council, which complaint, after such investigation of all the circumstances as the Council may think fit, is sufficiently established, in the opinion of the Council, may, by resolution of the Council as hereinafter provided, be suspended from rights of Membership for such period as the Council may decide, or the Council may in like manner decide that his Membership shall be determined, and thereupon such Member shall cease to be a Member, and his name shall be removed from the Register; and in the event of it being brought to the notice of the Council that any Member has been adjudged by a Court of competent jurisdiction in the country in which he is alleged to have committed an offence to be guilty of an offence which in Great Britain or Ireland would be an indictable offence punishable alone by imprisonment, then, except such offence may be regarded as a political offence, the Council may order his name to be removed from the Register, and thereupon he shall cease to be a Member. A resolution of the Council as aforesaid shall not be passed unless twelve or more Members of the Council are present at the meeting at which it is proposed and not less than two-thirds of those present vote in favour of such resolution.

Introductio of Visitors.

(16.) Every Member shall be at liberty to introduce, at any meeting of a Local Section at which the Member introducing is entitled to be present, such visitors as the rules of the Local Section may prescribe. Every such visitor shall enter his name in a book provided for that purpose, and may take part in but shall not vote at the meeting, but the Committee of the Local Section may, in consequence of any special circumstances relating to any such meeting, suspend the said liberty by notice given either in the notice convening the meeting, or at a reasonable time prior to the holding thereof.

Restriction on Use of Distinctive Title or Initials.

(17.) Any Member who shall persistently use after, or in conjunction with, his name, letters or initials which purport to indicate or convey that Membership of the Society confers upon him any degree, qualification, or authority to practise in any profession or calling, or a right to use any distinctive title, after notice from the Secretary authorised by resolution of the Council to discontinue such use, may be deemed by the Council to be guilty of misconduct, but this By-law shall not prevent any Member from *bonâ fide* subscribing or describing himself as a Member of the Society or any office bearer thereof.

Re-admissi of a former Member.

(18.) Any former Member whose Membership has ceased or been determined under any provisions of the By-laws, may apply for re-admission to Membership, and such application shall be considered and decided upon by the Council at the next ensuing Ordinary Meeting thereof in all respects as if it were a proposal for Membership of the Society, and if such application be granted, then after notice thereof by the Secretary to the applicant, and upon making such payments and complying with such conditions, if any, which the Council may decide, the applicant shall be re-admitted to Membership, and shall again become subject and entitled to all the duties, obligations, and rights of a Member. A resolution of the Council under the provisions of this By-law shall not be effective unless there shall be present not less than twelve Members of the Council, three-fourths of whom at the least shall vote in favour of such resolution, and any resolution as aforesaid, if the Council in like manner so determine, may be published in the Journal.

PART III.—THE COUNCIL.

Constitutio

(19.) The Council shall consist of:—

(*a*) Twenty-five elected Members of Council, comprising:—

- (i.) A President;
- (ii.) Twelve Vice-Presidents;
- (iii.) Twelve ordinary Members of Council;

(*b*) *Ex-officio* Members of Council, comprising:—

- (iv.) The Sectional Officers;
- (v.) The Treasurer, The Foreign Secretary, The Trustees;

all of whom shall be Members of the Society.

The elected Members of Council, except Members appointed to fill casual vacancies, shall be elected by ballot at the time, in the manner, and for the respective periods prescribed by the By-laws, and all Members of Council in office at the commencement of the By-laws shall in their several capacities continue in office as the Council, but subject to all incidences, whether as to powers, duties, retirement, re-election, nomination, election, or otherwise, as if they had been elected and were holding office pursuant to and under the several provisions of the By-laws applicable thereto.

he President.

(20.) The President shall be nominated from amongst the Members by the Council, and such Member so nominated shall be submitted by them for election at the Annual General Meeting in manner hereinafter provided. He shall retire from office at the next ensuing Annual General Meeting, and shall be eligible for re-election, but a Member who has been elected or appointed President two years or one year and a part of another year in succession, shall not be eligible for election as President before the Annual General Meeting next but one ensuing after his last retirement. A retiring President not nominated for re-election shall be nominated by the Council as one of the four Vice-Presidents to be submitted for election at the next ensuing Annual General Meeting.

ice-residents.

(21.) The Vice-Presidents shall be nominated from amongst the Members by the Council, and such Members so nominated shall be submitted by them for election at the next ensuing Annual General Meeting in manner provided by the By-laws.

Four Vice-Presidents shall retire from office at each Annual General Meeting, none of whom shall be eligible for election as a Vice-President or an ordinary Member of Council before the Annual General Meeting next ensuing after the said retirement, but a Member appointed Vice-President to fill a casual vacancy shall not, upon the expiration of the term for which he is so appointed, be ineligible as aforesaid.

All Vice-Presidents shall retire in rotation in accordance with the seniority of their respective terms of office, and if in ascertaining which four of them shall retire as aforesaid it shall appear that there is equality of term of office in the case of more than four of them of the highest degree of seniority, or in the case of two or more of them of a lower degree of seniority required to make up four retiring Vice-Presidents, the Council shall decide which of them having such respective equality of term shall retire.

A Vice-President nominated as President in accordance with the last preceding By-law shall, upon election as President, vacate the office of Vice-President, and the vacancy thereby created shall be deemed to be a casual vacancy.

rdinary embers of uncil.

(22.) Ordinary Members of Council shall be nominated from amongst the Members by the Members, and such Members so nominated shall be submitted by the Council for election at the next ensuing Annual General Meeting in manner prescribed by the By-laws.

Four ordinary Members of Council shall retire from office at each Annual General Meeting, none of whom shall be eligible for election as an ordinary Member of Council before the Annual General Meeting next ensuing after the said retirement, but an ordinary Member of Council appointed to fill a casual vacancy shall not, upon the expiration of the term of office for which he is so appointed, be ineligible as aforesaid.

All ordinary Members of Council shall retire in rotation, in accordance with the seniority of their respective terms of office, and if in ascertaining which four of them shall retire as aforesaid it shall appear that there is equality of term of office in the case of more than four of them of the highest degree of seniority, or in the case of two or more of them of a lower degree of seniority required to make up the four retiring ordinary Members of Council, the Council shall decide which of them having such respective equality of term shall retire.

An ordinary Member of Council nominated either as President or a Vice-President in accordance with the last two preceding By-laws respectively shall, upon election as President or Vice-President, as the case may be, vacate the office of ordinary Member of Council, and the vacancy thereby created shall be deemed to be a casual vacancy.

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(23.) An ordinary Member of Council shall be nominated by ten or more Members upon Form (B) in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any Member, but a Member shall not be eligible to sign more than one such nomination form, and the Member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:—

(*a*) The Member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

(*b*) The nomination is not made on the authorised printed form, or substantially not in the manner directed thereon.

(*c*) The nomination form is signed by less than ten Members not disqualified, or not ineligible to nominate as provided by the By-laws.

(*d*) The nomination form is not received before or upon the day appointed therefor.

(*e*) The Member nominated has not signed the declaration printed upon the form.

A Member whose nomination aforesaid is declared to be invalid shall receive notice thereof from the Secretary and shall not be submitted for election.

Council to notify all vacancies and nominations by them.

(24.) In every year the Council shall cause a list to be prepared setting forth the names of all Members of the Council, showing which of them are due to retire at the next ensuing Annual General Meeting, and which (if any) of them are eligible for re-election, and such list shall be approved by the Council at any meeting thereof, not less than two months prior to the Annual General Meeting aforesaid, and the Council shall at the same meeting nominate the Members to be submitted to such meeting for election as President and Vice-Presidents respectively, and shall also appoint Members as Treasurer and Foreign Secretary respectively to take places of the Treasurer and Foreign Secretary who will retire at the said General Meeting. The said list, together with the names of the Members nominated and appointed as aforesaid, shall be printed as a notice to Members, which notice shall contain a statement inviting Members to nominate the ordinary Members of Council to be elected at the said General Meeting, and appointing a day before or upon which such nominations shall be received by the Secretary according to Form (B) in the Schedule, and the said notice, as approved, shall be sent to all the Members with, or in, the next issue of the Journal.

Nomination of ordinary Members of Council.

(25.) All nomination forms of ordinary Members of Council received by the Secretary shall be considered by the Council at the meeting thereof next ensuing after the date appointed for their delivery, and the Members whose nominations are not then declared to be invalid, together with the Members nominated by the Council, as President and Vice-Presidents respectively, shall be submitted for election at the next ensuing Annual General Meeting. But if the number of Members nominated or not nominated validly shall be less than the number of vacancies, the Council shall thereupon nominate such Members as are requisite to make up the number required, and in that event, and also whenever the nominations considered and not declared to be invalid by the Council are equal to the number of vacancies, although the names of Members nominated in either case shall be submitted to the General Meeting, no ballot shall be taken thereon.

Election of Council.

(26.) The elections of all elected Members of Council, in whatever capacity, shall, except as provided by the By-laws, be by ballot taken upon the first day of each Annual General Meeting, and shall be conducted in manner and otherwise subject to such Regulations relating thereto as the Council may make, but a Member may record his votes either by delivering his ballot list personally or by post at the said General Meeting in accordance with the Regulations.

The Council in every year shall cause to be prepared, and shall send to all the Members not less than twenty-one days before the Annual General Meeting, a ballot list of the Council, showing the names of all Members thereof in their several capacities, and which of them are to retire, and setting forth separately thereon the names of Members in each class or capacity of elected Members submitted for election, and also the names of the Treasurer and Foreign Secretary appointed by the Council to succeed the retiring Treasurer and Foreign Secretary, and the names of the retiring Trustees and Auditor respectively. The ballot list shall be according to Form (C) in the Schedule, or such other form as the Council may from time to time authorise.

Meetings of Council.

(27.) One Ordinary Meeting of the Council at the least shall be held every month to transact such business relating to the affairs of the Society as may be necessary, except that if the Council so decide an Ordinary Meeting of the Council need not be held during the months of August and September, but a Special Meeting of the Council may be convened by the President at any time and shall be convened by the Secretary whenever he shall receive a notice signed by not less than seven Members of Council calling upon him to convene such meeting, and stating the matter to be considered thereat, and notice thereof shall be given to all Members of the Council as and in the manner provided by the Standing Orders of the Council, and no other business shall be considered at such Special Meeting of Council. Except where otherwise provided by the Charter, or the By-laws, any seven Members of the Council shall constitute a quorum.

Standing Orders of Council.

(28.) Subject to any of the provisions of the Charter or the By-laws, the Council may for the due and proper regulation of its own proceedings make Standing Orders, and subject to any provisions therein contained, and relating thereto, may at any time add to, alter, amend, or rescind such Standing Orders.

Appointment of Committees.

(29.) Subject to the provisions of the Charter and the By-laws, the Council may appoint Committees from amongst themselves, and may delegate any of their powers to such Committees, and in furtherance of other the objects of the Society, may also appoint Committees composed wholly of Members of the Council, or of Members of the Society, or partly of Members of the Council and partly of Members of the Society, and may fix the quorum and make rules for regulating the proceedings of any of the Committees aforesaid. The President shall be a Member of all Committees, and the Secretary, unless the Council shall otherwise decide, shall act as Secretary to each Committee appointed as aforesaid.

Resignation of Member of Council.

(30.) Any Member of the Council may resign his office by notice in writing to the Secretary of such his desire, and upon the acceptance thereof by the Council he shall cease to hold his said office, but not until then.

Vacation of office of Member of Council.

(31.) The office of any Member of the Council, whether elected or *ex-officio*, shall be deemed to be vacated for any of the following reasons:—

(*a*) If any such Member ceases to be a Member of the Society, or his Membership thereof becomes suspended for any period, or determined as provided by the By-laws.

(*b*) If any such Member becomes bankrupt, or suspends payment, or compounds with, or makes an assignment of his property for the benefit of his creditors.

(*c*) If any such Member becomes a lunatic or is declared of unsound mind.

Casual vacancies.

(32.) Any vacancy in the elected Members of Council, from whatever cause occurring, between any two Annual General Meetings, shall be filled by the Council at a Council Meeting, at which not less than twelve Members of Council are present and vote. The Member appointed to fill a casual vacancy shall retire at the time when the person in whose stead he is appointed would in due course have retired if the office held by him had not become vacant, but the Member appointed shall be eligible for re-election unless it be otherwise provided in the By-laws.

Honorary Treasurer.

(33.) The Council shall appoint a Member as Honorary Treasurer of the Society, who shall, subject to the direction and control of the Council, receive and give receipts, and account for all subscriptions, fees, and other payments payable or due to the Society, and shall cause to be made, and shall, as occasion may require, submit to the Council a statement of the income and of current payments or expenditure which are, or ought to be, made by the Council, and shall cause to be prepared, and shall prepare in sufficient time to be submitted to the Annual General Meeting, a balance sheet showing the income and expenditure, and all liabilities and assets and investments of the Society for the year ending thirty-first day of December prior to the said General Meeting, and as far as possible a general statement of the financial affairs of the Society for the year then current.

Honorary Foreign Secretary.

(34.) The Council shall appoint a Member as Honorary Foreign Secretary of the Society, who shall, subject to the direction and control of the Council, have the management of such correspondence of the Society with Departments of State or Corporate Bodies, Societies, or persons of or in foreign countries as occasion may require, and he shall report to the Council on all matters connected therewith or relating thereto.

Appointment of Treasurer and Foreign Secretary.

(35.) The Treasurer and Foreign Secretary shall be appointed annually at the meeting of the Council at which the President and Vice-Presidents are nominated, and except when appointed to fill a casual vacancy, shall remain in office from the next ensuing Annual General Meeting after their respective appointments, until the Annual General Meeting next following, and during such period shall be *ex-officio* Members of the Council. Any casual vacancy in either of the said offices shall be filled by the Council as soon as may be after the occurrence of the vacancy, but the Member appointed to fill such casual vacancy shall retire at the next ensuing Annual General Meeting after his appointment, and either of the said offices shall be deemed to be vacated for any of the reasons provided by the By-laws for the vacation of office of Member of Council.

The Secretary.

(36.) The Council shall appoint an officer who shall be "the Secretary of the Society of Chemical Industry" at such remuneration and subject to such terms as they may from time to time decide, and may in their discretion determine the appointment of any such Secretary, and appoint another Secretary.

The Editor.

(37.) The Council shall appoint an officer who shall be "the Editor of the Journal," at such remuneration as they may from time to time decide, and may in their discretion determine the appointment of any such Editor and appoint another Editor. The Editor appointed need not be a Member, but shall be responsible to the Council, and subject thereto, and to the directions of any Committees delegated by the Council to manage or conduct the preparation or publication of the Journal, shall have the conduct of the literary management and the preparation of all matter, the editing, and the printing and publication of the Journal, and the organisation, control, and direction of such literary or other staff as may be engaged on the Journal for the time being.

Council ma make Regulations

(38.) The Council may, except as otherwise provided by the Charter, make Regulations for carrying into effect the Charter and the By-laws, and for the general management of the affairs of the Society, but a regulation shall not become operative until confirmed by a resolution passed by a majority of the Members present at a General Meeting at which such regulation has been submitted for consideration, and notice of such intended submission shall be given in the notice for such General Meeting, and any regulations so confirmed may be altered, amended, or repealed after notice given as aforesaid at an ensuing General Meeting summoned for that purpose in manner provided by the By-laws.

Mode of conducting proceedings of Council.

(39.) Subject to other provisions of the By-laws relating thereto, all meetings of the Council, or of any committees appointed by them, whether as regards the time and place of meeting, notices thereof, the order, mode, or manner of conducting the business thereat, or any other matter or thing relating to such meetings, shall be respectively regulated in accordance with the Standing Orders for the time being of the Council or rules made applicable to the said committees, which Standing Orders and rules respectively the Council in their discretion from time to time are hereby empowered to make, alter, or vary.

Part IV.—LOCAL SECTIONS.

Formation of a Local Section.

(40.) A Local Section may be formed by the Council, subject to the provisions in that behalf in the Charter, whenever thirty or more Members residing in or otherwise identified in interest with a place, locality, or district, whether situate within or without Great Britain or Ireland, make application in writing to the Council, signed by such Members, to cause a Local Register to be made for that purpose, and represent to the Council that the establishment of such Local Section will further more efficiently the objects of the Society. If the Council, upon consideration of such application consider that it would be expedient to form such Local Section, they may require the signatories to form a provisional committee, and to submit draft rules under which the business of the Local Section is intended to be managed and conducted, and may provisionally approve such draft rules with any modifications thereof which to the Council may seem requisite or desirable, and upon such provisional approval, to elect a committee and officers as hereinafter provided. Upon notice to the Council that such committee and officers have been elected at a meeting of any of the signatories and any other Members numbering in the whole not less than thirty, and that the draft rules approved by the Council as aforesaid have been adopted at such meeting, the Council shall allow the adopted rules as the rules of the said Local Section, and from the date of such allowance the said Local Section shall be deemed to be constituted in accordance with the Charter and By-laws.

xisting ocal ections atified.

(41.) Every Local Section to the formation of which the Council of the Society of 1881 or the Council had consented prior to and which remains in existence at the commencement of the By-laws, shall be deemed to be duly constituted, and may so remain and be continued subject to the By-laws, and as if it had come into existence thereunder.

ules of a ocal ection.

(42.) The rules of every Local Section shall contain the following provisions :—

(i.) That the business of the Local Section shall be conducted by a Committee chosen from Members on the Register of the Local Section, consisting of a Chairman, Honorary Secretary, and ordinary Members of Committee as provided by Rules.

(ii.) That any Member of the Society, whether resident at or otherwise interested in the place or locality where the Local Section is constituted, shall upon application to the Honorary Secretary, be entitled to have his name entered upon the Register, and to become and remain a Member thereof upon payment of the annual sectional subscription if any for that and each succeeding year during which he remains a Member of the Local Section, without any entrance fee and without being elected.

For defraying the expenses of a Local Section, the Council may require that all Members thereof shall pay an annual sectional subscription not exceeding ten shillings, or the nearest monetary equivalent thereof when not payable in British coinage.

lterations f Rules.

(43.) Amendments in, alterations of, or additions to, the rules of a Local Section shall be submitted to the Council, and shall not become operative or of any effect unless and until they have been allowed by the Council, and notice of such allowance has been given by the Secretary.

Expenses f Local Section.

(44.) The expenses of a Local Section shall be defrayed out of the annual sectional subscriptions of the Members of such Section, but the Council in its discretion may defray the whole or may make a grant in aid thereof out of the General Funds of the Society, and a Local Section shall not pay, or incur, any expenses except reasonable sums for the printing, stationery, advertising, reporting, and postage required for conducting the business, and the hire of rooms for meetings thereof without the previous sanction in writing of the Council, and an account of all expenses paid or incurred by a Local Section during the year preceding the thirtieth day of June, shall on or before the fifteenth day of November in each year be sent to the Council.

ommunications to ocal ections.

(45.) The Committee of a Local Section, in furtherance of the objects of the Society, may invite or receive communications from any person, whether a Member of the Society or not, upon any subject coming within the scope of the said objects, and such communications may be made by the reading of an essay or paper, or the delivery of a lecture at a meeting of the Members of the Local Section, and every such communication shall, before or after such meeting, as the circumstances may require, be sent to the Council for their consideration, and the Council may in their discretion, subject to any condition or to any by-law or rule relating thereto, cause the same, with or without any discussion thereon, or any condensed abstract thereof, to be published in the Journal.

Sectional officers *ex-officio* Members of Council.

(46.) The Chairman and Honorary Secretary of every Local Section, duly constituted, shall become, and remain, during their respective terms of office *ex-officio* Members of the Council.

Restriction on Communications by Local Sections.

(47.) Neither the Committee of a Local Section nor any meeting thereof shall cause to be published, or authorise or countenance the publication of any notice or other communication, whether printed or otherwise, upon any matter or subject whatsoever, either in the name of the Society or in the name of the said Committee or Section, to the general public, but all such notices or communications necessary or desirable to be made, and all correspondence and communications between a Local Section and any corporate or public body or other Society, except it relate wholly to the ordinary business of such Local Section, shall be conducted through or shall be subject to the express sanction of the Council.

Cessor of a Local Section.

(48.) The Council may, at a special meeting called for that purpose, declare by resolution that a Local Section shall be suspended in operation, or shall be dissolved :—

(*a*) If it shall appear that the further continuance of the Section is not in accord with or conducive to the interests of the Society, or the furtherance of its objects.

(*b*) Whenever three-fourths of the Members of the Local Section vote in favour of a resolution, proposed at a meeting called for the express purpose, that it is desirable such Section shall be suspended or dissolved.

PART V.—THE JOURNAL.

Conduct of the Journal.

(49.) The Journal shall be under the sole conduct and management in all respects of the Council, but they may at any time, subject to any rules and regulations made by them in reference thereto, appoint from amongst the Members any Committees which seem to them desirable to assist in such conduct or management, and subject as aforesaid, shall be at liberty to delegate any of their duties or functions as regards the Journal to any such Committee. The Council may also, in addition to the Editor, appoint upon and subject to such terms, and at such reasonable remuneration as they may decide, any contributors, sub-editors, abstractors, or other person to assist in the compilation, preparation, and publication of the Journal, any of whom may or may not be Members.

Prior right of Publication.

(50.) It shall be a condition of acceptance of every communication made to any meeting of the Society, or of a Local Section, or submitted to the Council for publication in the Journal, whether made by a Member or not, that the Society shall thereby become entitled to a prior right of publication thereof, in whatever form the Council decide to make such publication in the Journal, for three months after its acceptance, and if the person by whom the communication is intended to be made is not a Member, he shall be informed of this condition by notice in writing from the Secretary, or the Honorary Secretary of the Local Section.

Publication of Journal.

(51.) The Council shall cause the Journal to be published and sent to the Members at least once in every month, upon such dates as they may think fit, and they may sell, or present gratuitously, or exchange copies, or any part thereof, to or with any State or public department, or any institution, library, society, corporate body, company, or person whatsoever.

Contents of Journ

(52.) Nothing shall be printed or published in the Journal the printing and publication whereof has not been authorised by the Council, or any Committee appointed by them, subject to the By-laws, and acting in such respect for and on behalf of the Council, but the Council or such Committee may authorise the printing and publication of any matter or thing coming within or relating to the objects of the Society, and the proceedings thereof or communications thereto, or of or to any Local Section, in such manner as they may determine, and may also accept and publish for payment any advertisements of which they may not disapprove, but all payments made therefor, or for any copies of the Journal sold as aforesaid, shall be credited to the cost of preparing, editing, printing, publishing, and distributing the Journal.

PART VI.—FINANCIAL.

ancial anagement Council.

(53.) The administration of the Funds, and of all financial matters of or relating to the Society, shall be conducted and managed by the Council, who shall act as a general Committee of Finance, but they may delegate any of their duties or functions in respect thereof to Committees composed of Members of and appointed by the Council, subject to the Standing Orders thereof, and such Committees shall act only subject to the control of the Council, and of any rules made by them in that behalf.

ual ance eet.

(54.) The Council shall receive and consider and may adopt the Annual Balance Sheet and General Financial Statement submitted by the Treasurer, and the report of the Auditors thereon, as provided by the By-laws, and shall, whether adopted or not, cause the Balance Sheet, Statement, and Report aforesaid to be printed and sent to all the Members as a notice under the By-laws, and such notice shall be sent not later than the thirtieth day of June in every year.

nancial ness at nary ing of uncil.

(55.) The Council shall, at each Ordinary Meeting thereof, receive, consider, and determine upon the reports of all committees appointed by them upon all matters whatsoever of or relating to the finances of the Society, and shall receive and consider, and may adopt the statement prepared by the Treasurer, as provided by the By-laws, and shall authorise all payments amounting to five pounds and upwards which are or ought to be made, and the cheques to be drawn therefor, and may or shall do and perform all other acts and things relating to the financial administration of the Society which by the Charter or By-laws they have authority or are required to do at such meeting.

ipts pay-

(56.) All moneys due or payable to the Society shall be paid to and received by the Treasurer, or other person in that behalf appointed by the Council, and a receipt for every such payment shall be given in the name of the Society by the said Treasurer or other person. All moneys received as aforesaid shall be paid forthwith into the account of the Society kept at such bankers as may for the time being be appointed by the Council to be the bankers of the Society, and no sum of money payable on account of the Society amounting to £5 and upwards shall be paid except by a cheque authorised to be drawn on the said account by the Council, and every such cheque shall be signed by two members of the Council and countersigned by the Secretary.

rowing ers.

(57.) Notwithstanding anything contained in the By-laws, the Council may at any time, in the exercise of their discretion, borrow money temporarily, and may pay interest thereon, and may charge the property, assets, and investments of the Society, so far as they are enabled lawfully so to do, for the repayment and payment of such borrowed money and interest respectively.

vestments.

(58.) All entrance fees and life compositions, and all donations, bequests, and endowments, unless given subject to any other condition, or otherwise provided by any Deed of Trust relating thereto, shall, and all funds of the Society not needed immediately for the ordinary purposes thereof may be invested in the names of the Trustees of the Society in any securities in which Trustees are from time to time authorised to invest by virtue of the Trustee Act, 1893, or any subsisting statutory modification thereof, with power to the Trustees, upon the authority and by the direction of the Council, from time to time to sell or vary such securities, and the Council may also from time to time place money on deposit with the bankers of the Society.

Trustees.

(59.) The Members present at the Annual General Meeting shall elect three Members, who shall not before election be Members of the Council, and such Members when elected shall become and act as Trustees of the investments and property of the Society, and all such investments and property shall be vested in and held by them for the Society as the Trustees thereof, with power to receive and acknowledge any current interest or income arising therefrom, and to pay the same to the Treasurer or other person for the time being appointed by the Council.

Each Trustee shall be proposed and seconded at the said General Meeting by two Members who are not Members of the Council, but a Member shall not propose or second more than one Trustee, and the mode of election shall be that decided upon by all the Members then present, and every Member shall be entitled to vote at the election, and the name of each Trustee duly proposed and seconded shall be voted upon separately.

A casual vacancy in the office of Trustee may be filled by those of them who are remaining appointing another Trustee, but if there be no remaining Trustee an Extraordinary General Meeting of the Society shall be convened by the Secretary without delay to elect other Trustees.

Every Trustee, whether elected or appointed, shall retire at the Annual General Meeting next ensuing after his election, but shall be eligible for re-election.

Every Trustee shall on his election or appointment become, and remain during his term of office, an *ex-officio* Member of Council.

Auditor.

(60.) The Members present at the Annual General Meeting shall, in manner provided by the By-laws for the election of a Trustee, elect as Auditor of the Society, at such remuneration as the meeting shall determine, an Accountant who shall be a member of the Institute of Chartered Accountants in England and Wales, or a firm of Accountants the partners whereof are members of the said Institute, and the person or firm so elected shall, on election, become and remain the Auditor of the Society until the next Annual General Meeting, and shall then cease to be Auditor unless re-elected at such General Meeting.

Duties of Auditor.

(61.) The Auditor shall have access at all reasonable times to all the accounts and books of account in anywise relating to the income and expenditure and otherwise the financial affairs of the Society, and shall report upon the Balance Sheet prepared by the Treasurer to be submitted to the Annual General Meeting, as provided by the By-laws, and shall certify as to the correctness or otherwise of the liabilities, assets, and investments of the Society as existing upon the thirty first day of December prior to the General Meeting at which the said Balance Sheet is to be presented, and his report and certificate as aforesaid, whatever its nature, shall be printed and sent to all the Members accompanying such Balance Sheet.

Casual appointment and removal of Auditor.

(62.) If at any time between two Annual General Meetings the office of Auditor becomes vacant, the Council may appoint an Auditor possessing the qualifications aforesaid, who shall remain in office until the next ensuing Annual General Meeting, and the Members may at any time after an Annual General Meeting, by a resolution passed by a majority of two-thirds of the votes of Members present and voting at an Extraordinary General Meeting at which not less than thirty Members are present and vote, remove any Auditor from office, and may, by a resolution passed by a majority of the votes of Members present and voting at such meeting in number not less than aforesaid, elect in manner provided by the By-laws for the election of a Trustee, and at such remuneration as the meeting may then determine, any person or firm qualified to act as aforesaid.

PART VII.—MEETINGS.

Annual General Meeting.

(63.) The Annual General Meeting for the transaction of the ordinary annual business of the Society shall be held at such place and time in every year as the Council may determine.

The ordinary annual business of the Society shall comprise :—

The Election of :—
    Members of the Council ; the Trustees ; the Auditor ;

And any other officers provided by the Charter or By-laws, to be elected at such meeting.

The reception and adoption of the Annual Report of the Council, and the Balance Sheet, Statement of Investments, and Financial Statement of the Treasurer submitted by the Council, together with the Auditor's report thereon.

And may include :—

An Address by the President.

Any communications accepted by the Council, and the discussion of the same if deemed desirable.

Conferences or discussions between the Members, or between Members and persons who are not Members, and visits to and inspection of works, manufactories, and other places of interest to the Members in furtherance of the objects of the Society.

Such other business as may be necessary and of which notice, according to the By-laws, has been duly given.

Extraordinary General Meeting. (64.) The Council may, whenever they so decide, call an Extraordinary General Meeting of the Society, and such meeting shall be called by them on receiving a requisition in writing so to do signed by not less than thirty Members, and stating the object of the proposed meeting, but business other than that for which the meeting was called shall not be discussed or transacted at an Extraordinary General Meeting.

Notices of General Meetings. (65.) Notice of the day, hour, and place of the commencement of any Annual General Meeting, shall be sent to all the Members three months at the least before such commencement. In the case of an Extraordinary General Meeting not less than fourteen days' notice thereof shall be sent either with or in the next succeeding issue of the Journal after the decision of the Council to call such meeting, or after the Council meeting next following the date upon which the requisition relating thereto was received by the Secretary. The business to be considered at any such Extraordinary General Meeting shall be set forth on the said notice.

Quorum at General Meetings. (66.) The business of an Annual General Meeting shall not commence until the Members present at the meeting number thirty or upwards.

The business for which an Extraordinary General Meeting is called shall not commence until the Members present at the meeting number thirty or upwards, and if within one hour of the time appointed for the commencement of such meeting the said number of Members are not present together, the meeting shall be thereupon and thereby dissolved.

Conduct of Business at Meetings. (67.) Subject to the provisions of the By-laws relating thereto, the order of and the manner of conducting the business, and the way in which Members may record their votes thereat, or any other matter or thing of or relating to a General Meeting of the Society not provided for in the Charter or By-laws, shall be regulated by rules made from time to time by the Council, but such rules or any addition thereto, alteration, amendment, suspension, or rescission thereof, shall, before becoming operative, be submitted to and approved at an Annual General Meeting.

Notice of Motion at Annual General Meeting to be given. (68.) A Member wishing to bring before the Annual General Meeting any motion not relating to the ordinary annual business of the Society as aforesaid, shall give notice to the Council, not less than two months before such Annual General Meeting, and no motion shall come before the meeting unless notice thereof has been so given, and on receipt of such notice of motion the Council shall give notice thereof in the next issue of the Journal.

Chairman of Meetings. (69.) At all meetings of the Society the President for the time being, and in his absence a Vice-President who has served as President, shall be Chairman, or in the absence of both, the Chairman shall be elected from among other Vice-Presidents present, or if none be present, from among the Members of Council present, or in the absence of all of them, then from among the Members present.

Minutes to be evidence. (70.) Minutes shall be made in proper books, to be provided for the purpose, of all resolutions and proceedings of meetings of the Society or the Council, and any committee appointed by either of them, or of each Local Section, and every Minute signed by the Chairman of the meeting to which it relates, or by the Chairman of a subsequent meeting, shall be sufficient evidence of the facts stated therein.

PART VIII.—MISCELLANEOUS.

Notices to Members. (71.) Any notice required by the Charter or the By-laws to be given to Members, whether relating in anywise to the affairs of the Society, or of a Local Section, may be a written or printed notice, and may be sent to Members either separately or in, or with, or if printed may be printed under the heading of "Notices," as part of the next issue of the Journal, as the Council may direct, and any notice shall be deemed to have been duly sent to a Member when such notice, or the Journal in which it is sent, or printed, and addressed to the last address of the Member appearing in the Register, has been put into the post. All notices shall be signed by the Secretary.

Provisions as to Register. (72.) The Register shall be kept by the Secretary, subject to the direction of the Council, and the last address of any Member entered therein shall for the purpose of all notices and otherwise be deemed to be the address of that Member, but a Member may at any time, by notice in writing to the Secretary, require his address last entered in the Register to be altered.

Award of a medal by Society. (73.) The practice of the Society of 1881 awarding a medal periodically to a person selected by the Council of that Society as the recipient thereof may be adopted and continued by the Council, and the Council in its discretion may for such purpose apply the funds of the Society, subject to the following conditions (that is to say) :—

(*a*) The medal shall be called "the Medal of the Society of Chemical Industry," and shall not be awarded more frequently than once in every two years.

(*b*) The recipient of the medal shall be a person who, in the opinion of the Council, has rendered conspicuous service to Applied Chemistry by research, discovery, invention, or improvements in processes, or to the Society in furtherance of its objects, and may or may not be a Member, and may be of any nationality.

(*c*) More than one medal shall not be awarded in any year.

(*d*) The presentation of the medal shall be made to the recipient either in person or proxy at the Annual General Meeting for that year in which the Council decides to award the medal, and the name of the recipient and the said service in respect of which the medal is awarded shall be notified to the Members in the notice of such General Meeting.

And the proposal to award a medal shall be considered at any meeting of the Council held after previous notice of such proposal, at which not less than twelve Members thereof are present and vote, and a resolution to so award shall not be passed unless three-fourths of the said Members vote in favour of the resolution, but if so passed at the same or another meeting, and in the same manner, the Council shall consider and decide upon the recipient, but the name of a recipient shall not be mentioned in the notice of any meeting as aforesaid.

Library. (74.) Every paper, map, plan, drawing, or model presented to the Society shall become the property of the Society, except the presentor thereof shall stipulate to the contrary at the time of presentation, and all such, together with all publications presented to or purchased by the Society, and a set of bound copies of all issues of the Journal and indices thereof published by the Society of 1881, or the Society, shall be kept upon the premises of the Society for the use of the Members in charge of a Librarian or other person appointed by the Council, and shall not be removed from such premises or kept elsewhere except upon the authority of the Council.

Pensions. (75.) The Council may, with the consent of a General Meeting, make such provision for pensioning retired officers and servants receiving remuneration in respect of their several offices and services as to the Council may seem just.

Custody of certain Books.

(76.) The Register and all Minute and Account books, or other books dealing with or recording the conduct of the business of the Society, except the business transacted by a Local Section, shall be kept upon the premises of the Society in the custody of the Secretary or other person appointed by the Council for that purpose, and shall not be removed from the said premises or kept elsewhere except by the authority of the Council.

Custody of Charter Deeds and Securities.

(77.) The Charter and all deeds, securities, and other documents of title shall be deposited for safe keeping with the bankers of the Society, who shall, whenever required, produce them for purposes of inspection and verification to the Auditor, or any two or more of the Trustees, but none of them shall be removed from the custody or possession of such bankers except upon an order in writing stating the name and address of the person to whom they may be delivered, signed by not less than two of the Trustees, and countersigned by the Secretary.

Custody and use of Common Seal.

(78.) The Common Seal of the Society shall be kept in such custody as the Council may for the time being determine, and such Seal shall not be affixed to any document or instrument except by order of the Council, and in the presence of two Members thereof, and every such document or instrument when sealed shall be signed by the two Members of the Council in whose presence the Seal was affixed, and countersigned by the Secretary.

Indemnity of Officers.

(79.) All Members of the Council, the Auditor, Secretary, Editor, and other officers shall be indemnified by the Society in respect of all losses and proper expenses incurred by them in or about the discharge of their respective duties, except such as may arise from their own respective wilful default, and none of them shall be liable for any other Member of the Council, Auditor, Secretary, Editor, or other officer, or for joining in any receipt or document, or for any act of conformity, and for any loss or expense caused to the Society except in the case of the like default.

Alteration of By-laws.

(80.) A new By-law, or the alteration, suspension, or repeal of any existing By-law, may be proposed at any time by the Council, and shall be proposed by them after receipt of a requisition so to do signed by at least fifty Members. The proposal made shall in all cases be set forth in the notice of the meeting at which it is to be considered and decided.

THE SCHEDULE mentioned in these By-laws.

FORM A.

The

SOCIETY OF CHEMICAL INDUSTRY.

Founded 1881. Incorporated by Royal Charter 1907.

Palace Chambers, 9, Bridge Street, Westminster, S.W.

We, the undersigned Members of the Society of Chemical Industry, hereby propose
(Candidate's Name in full)............................
as a fit and proper person to become a Member of the Society of Chemical Industry.

For Names *only* of Members recommending the Candidate.
....
....
....
....

And I, the said Candidate for Membership, hereby agree that, if elected, I will be bound by the Charter and By-laws and by any Regulations made thereunder and will further the objects of the Society.

(Signature of Candidate)............................
Address to which the Candidate wishes the Society's Publications to be sent, and which is to be entered in the Society's Register.
....
....
....
....
....
....
Profession or Business Occupation. .... Date ....

EXTRACT FROM BY-LAWS RELATING TO MEMBERS.
Rules 6, 9, 10, 12, and 14.

FORM B.

SOCIETY OF CHEMICAL INDUSTRY.

.....................19

We, the undersigned Members of the Society, do hereby nominate ....
of ....
in the County of ....as a candidate for election as a Member of Council of the Society.

(SIGNED)

1......................
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and I the said....................am willing to stand for election, and if elected will endeavour to attend the Council Meetings and do all in my power to promote the welfare of the Society.

SIGNATURE ....

FORM C.

SOCIETY OF CHEMICAL INDUSTRY.

BALLOT LIST.

PRESENT COUNCIL.	PROPOSED NEW MEMBERS OF COUNCIL.		
Names.	Names.	Profession or Business.	Locality.
President. 1 name.	*President.* 1 nomination.		
Vice-Presidents. 12 names.	*Vice-Presidents.* 4 nominations.		
Ordinary Members of Council. 12 names.	*Ordinary Members of Council.* Nominations by Members		

NOTICE.—The names in *italics* in the first column are those of retiring Members. The names in the second column are those of Members nominated to fill the vacancies thus created.

LIST OF COUNCIL AND OFFICERS.

President.

Eustace Carey, The Groves, Grassendale Park, near Liverpool.

Vice-Presidents.

Dr. L. Baekeland, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A.
J. Carter Bell, The Cliff, Higher Broughton, Manchester.
Dr. V. Coblentz, College of Pharmacy, 115, West 68th Street, New York City, U.S.A.
Dr. Edw. Divers, F.R.S., 3, Canning Place, Palace Gate, London, W.
David Howard, Devon House, Buckhurst Hill, Essex.
Dr. J. Lewkowitsch, 71, Priory Road, London, N.W.
Dr. E. G. Love, 80, East 55th Street, New York City, U.S.A.
N. H. Martin, Northumberland Road, Newcastle-on-Tyne.
Wm. H. Nichols, M.S., LL.D., D.Sc., 25, Broad Street, New York City, U.S.A.
Sir Wm. Ramsay, K.C.B., D.Sc., LL.D., F.R.S., 19, Chester Terrace, London, N.W.
A. Gordon Salamon, 1, Fenchurch Avenue, London, E.C.
Charles Wightman, 1, Fenchurch Avenue, London, E.C.

Ordinary Members of Council.

Dr. J. T. Dunn, 10, Dean Street, Newcastle-on-Tyne.
Oscar Guttmann, 12, Mark Lane, London, E.C.
E. Grant Hooper, 16, Royal Avenue, Sloane Square, London, S.W.
Prof. W. R. Lang, The University, Toronto, Canada.
A. R. Ling, Hazeldene, Kingston Road, New Malden.
Dr. K. E. Markel, Tower House, Bewsey, Warrington.
Sir Boverton Redwood, 4, Bishopsgate Street Within, London, E.C.
Walter F. Reid, Fieldside, Addlestone, Surrey.
Dr. F. J. Smale, c/o Wm. Davies Co., Toronto, Canada.
Thos. Tyrer, Stirling Chemical Works, Stratford, E.
Sir Thos. Wardle, Leek, Staffordshire.

Chairmen and Secretaries of Sections (Ex-officio Members of Council).

Birmingham :
Chairman .. Prof. Percy F. Frankland, F.R.S., The University, Birmingham.
Secretary .. F. R. O'Shaughnessy, Tyburn, near Birmingham.

Canadian :
Chairman .. Prof. W. H. Ellis, School of Practical Science, Toronto, Canada.
Secretary .. Alf. Burton, 44, York Street, Toronto, Canada.

Liverpool :
Chairman .. Dr. Jas. T. Conroy, Adirondack, Grassendale Park near Liverpool.
Secretary .. W. Roscoe Hardwick, 13, Batavia Buildings, Hackins Hey, Liverpool.

London :
Chairman .. R. J. Friswell, 43, Great Tower Street, London, E.C.
Secretary .. Julian L. Baker, Stainesbury Holt, Kingston Road, Staines.

Manchester :
Chairman .. Dr. G. H. Bailey, Marple Cottage, Marple, Cheshire.
Secretary .. Julius Hübner, Ash Villa, Cheadle Hulme, Cheshire.

Newcastle :
Chairman .. Prof. H. Louis, Armstrong College, Newcastle-on-Tyne.
Secretary .. Dr. F. C. Garrett, Armstrong College, Newcastle-on-Tyne.

New England :
Chairman .. Henry Howard, Dymoke Street, Brookline, Mass., U.S.A.
Secretary .. Alan A. Claflin, Box 1189, Boston, Mass., U.S.A.

New York :
Chairman .. George C. Stone, New Jersey Zinc Co., 71, Broadway, New York City, U.S.A.
Secretary .. Dr. H. Schweitzer, 128, Duane Street, New York City, U.S.A.

Nottingham :
Chairman .. J. M. C. Paton, c/o Manlove, Alliott and Co., Nottingham.
Secretary .. S. R. Trotman, City Laboratories, 1, Regent Street, Nottingham.

Scotland :
Chairman .. J. S. McArthur, 74, York Street, Glasgow.
Secretary .. Dr. C. E. Fawsitt, The University, Glasgow.

Sydney, N.S.W. :
Chairman .. Dr. R. Greig Smith, Linnæan Society's House, Elizabeth Bay, Sydney.
Secretary .. T. U. Walton, Colonial Sugar Refining Co., O'Connell Street, Sydney.

Yorkshire :
Chairman .. F. W. Branson, Wynneholme, Far Headingley, Leeds.
Secretary .. Thos. Fairley, 17, East Parade, Leeds.

Honorary Treasurer.

Samuel Hall, East London Soap Works, Bow, E.

Honorary Foreign Secretary.

Dr. Ludwig Mond, F.R.S., 20, Avenue Road, Regent's Park, London, N.W.

General Secretary.

Chas. G. Cresswell, Palace Chambers, Westminster, S.W. (Telegraphic address :—59, Palatable, London. Telephone No. 715, Victoria.)

Editor.

Watson Smith, 34, Upper Park Road, Haverstock Hill, London, N.W.

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 28, 1907 = 4422.

NOTE: "O.M." MEANS "ORIGINAL MEMBER."

A

1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.

1902. Acker, Chas. E., 105, Gluck Building, Niagara Falls, N.Y., U.S.A., Manufacturer.

1903. Ackermann, Franz W., 86, Pierrepont Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Acton, J. Rowland, Wicklewood, Maze Road, Kew, S.W., Civil Servant.

1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.

1897. Adams, Thos. H., Endon Villa, Victoria Avenue, Borrowash, near Derby, Analyst.

1905. Adams, William W., Norwood, Mass., U.S.A., Leather Works Manager.

1895. Adamson, G. P., c/o The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.

1891. Adcock, S. R., St. Helens Smelting Co., Atlas Court, St. Helens, Lancashire, Analytical Chemist.

1901. Addison, Leonard, c/o Messrs. Burt, Boulton, and Haywood, Selzaete, Belgium, Chemist.

1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.

1898. Adiassewich, Alex. V., 14, Addison Park Mansions, Kensington, W., Oil Engineer.

1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.

1883. Adriance, Dr. John S., The Union League Club, New York City, U.S.A., Analytical Chemist.

1899. Adrot, Léon, Woodside, Long Island, N.Y., U.S.A., Chemist.

1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.

1884. Akitt, Thos., Mijnbouw Maatschappij Katahoen, Lebong Soelit, Benkoelen, Sumatra, Chemist.

1883. Albright, G S., Bromesberrow Place, Ledbury, Chemical Manufacturer.

O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.

1906. Alcock, Frank H., 9, Broad Street Corner, Birmingham, Analyst.

1891. Alcock, Jno. W., Central Brewery, Mott Street, Birmingham, Maltster and Brewer.

1902. Alden, Frederick, 342, 22nd Avenue, Milwaukee, Wis., U.S.A., Chemist.

1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.

1906. Alder, H. W., 18, Holyhead Road, Coventry, Works Chemist.

1900. Aldrich, Roger C., c/o Franklin H. Kalbfleisch Co., Elizabeth, N.J., U.S.A., Mechanical Engineer.

1890. Aldrick, Edwin John, 53, Alpha Road, West Ferry Road, Millwall, E., Works Sub-Manager.

1905. Aleon, Armen P., 372/4, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Merchant.

1899. Alexander, D. Basil W., 1020, Date Street, Los Angeles, Cal., U.S.A., Chemist.

1900. Alexander, Jerome, c/o National Gum and Mica Co., 502–510, West 45th Street, New York City, U.S.A., Chemist.

1883. Alexander, W. T., Crumnock, Eccles, Manchester. Drysalter.

1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Belmont Works, Battersea, S.W., Chemist.

1891. Allan, F. H. Tielke, Portobello House, Wakefield, Analytical Chemist.

1898. Allan, John, 55, Northen Grove, West Didsbury, near Manchester, Chemist.

1902. Allbright, Wm. B., 5139, Lexington Avenue, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Kent, Analytical Chemist.

1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.

1903. Allen, Chas. A., 95, Manor Road, Darwen, Lancashire, Chemist.

1902. Allen, Chas. D., jun., 541, 6th Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.

1901. Allen, R. F., 1241, South 47th Street, Philadelphia, Pa., U.S.A., Chemist.

1889. Allen, R. L., Hillside, and (Journals) c/o Brunner, Mond & Co., Ltd., Sandbach, Cheshire, Analytical Chemist.

1904. Allen, Thos. E., c/o American Aristotype Co., Jamestown, N.Y., U.S.A., Chemist.

1900. Allen, Wilfrid T., Allington, Bexley, Kent, Director.

1893. Allerton, Rt. Hon. Lord, F.R.S. (Journals), Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Buslingthorpe, Leeds, Tanner.

O.M. Allhusen, A., Gateshead-on-Tyne, Chemical Manufacturer.

1886. Allibon, G. H., 35, Eglantine Avenue, Belfast, Ireland, Chemical Works Manager.

1887. Alliott, J. B., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.

1895. Allison, Wm. O., 100, William Street, New York, City, U.S.A., Publisher of "Oil, Paint and Drug Reporter."

1905. Allpass, Jas., c/o The Clayton Aniline Co., Ltd., Clayton, Manchester, Secretary.

1904. Alpers, Wm. C., Broadway and 31st Street, New York City, U.S.A., Manufacturing Chemist.

1889. Alpiar, Agop, Smyrna, Asia Minor, Morphia Manufacturer.

1899. Alsop, Wm. K., 137, Grove Street, Stamford, Conn., U.S.A., Chemist.

1901. Alston, Robt. A., c/o Glencairn Main Reef G. M. Co., P.O. Box 191, Germiston, Transvaal, Mining Engineer.

1904. Alton, W. Lester, 11, Briar Walk, Putney, S.W., Chemist.

1898. Ambler, Chas. Taaffe, Dharhara Station, E. I. Ry., Bengal, India, Mine Owner and Contractor.

1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.

1900. Anderson, Jas. W., The Paddock, Halling, near Rochester, Kent, Analytical Chemist.

1889. Anderson, Robt. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.

1894. Anderson, Dr W. Carrick, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist and Metallurgist.

O.M. Anderton, G. H., Howendyke, Howden, Yorks, Chemical Manufacturer.

1905. Andreae, Dr. E. P., Crestalta, Champion Hill, London, S.E., Chemist.

1889. Andrews, C. W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1904. Andrews, Geo. D., c/o J. & J. Colman, Ltd., Carrow Works, Norwich, Chemist.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).
1903. Anfilogoff, N. A., St. Vincent's, Orsett Road, Grays, and (Journals) Central Wharf, Bow, E., Chemist.
O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1892. Annandale, C. J. R., The Briary, Shotley Bridge, Co. Durham, Paper Maker.
1883. Annandale, Jas. H., Polton Paper Works, Midlothian, N.B., Paper Maker.
1887. Annison, R. H., 16, Water Lane, Tower Street, London, E.C., Master Lighterman.
1894. Ansbacher, L. A., 253, Broadway, New York City, U.S.A., Colour Manufacturer.
1903. Anspach, Dr. R., 14, Oakroyd Terrace, Manningham, Bradford, Chemist.
1902. Anthony, John, 82, Bay Street, Toronto, Canada.
1899. Appleby, C. W., Farnworth, near Widnes, Lancashire, Pith and Size Manufacturer.
1904. Appleby, Jos., Farnley, Moor Lane, Great Crosby, Liverpool, Flour Miller.
1906. Appleby, L. C. B., c/o Messrs. R. Bishop & Sons, Newark-on-Trent, Maltster.
1895. Appleby, Prof. W. R., 911, 5th Street, S.E., Minneapolis, Minn., U.S.A., Professor of Mining and Metallurgy.
1894. Appleton, H. A., 63, Rosedale Road, Forest Gate, E., Analytical Chemist.
1897. Appleton, Dr. Jno. Howard, 209, Angell Street, Providence, R.I., U.S.A., Professor of Chemistry.
1900. Appleyard, Geo. H., c/o British Oil and Cake Mills, Ltd., 151, Cleveland Street, Hull, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
1904. Appleyard, Percy, Albany, West Australia, Chemist.
1903. Arbogast, Ralph, c/o Edison Storage Battery Co., Silver Lake, N.J., U.S.A., Chemist.
1901. Archbold, Dr. Geo., c/o J. D. Conover Co., 101, Franklin Street, New York City, U.S.A., Chemist.
O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 77, Queen's Road, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., 21, Oldham Road, Miles Platting, Manchester, Manager of Chemical Works.
1901. Ardagh, Edw. G. R., School of Practical Science, Toronto, Canada, Chemist.
1900. Ardern, Edw., 4, Westbourne Road, Urmston, Manchester, Chemist.
1901. Argall, Philip, 728–732, Majestic Buildings, Denver, Colo., U.S.A., Manager (Gold Extraction Works).
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, Lodge Hotel, King's Road, Reading, Works Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Armstrong, Theodore, 115, Chestnut Street, Philadelphia, Pa., U.S.A., President, Penn. Salt Manufacturing Co.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1901. Arnold, G. Edmund, 6, Kinsgfield Terrace, Faversham, Kent, Manager (Cotton Powder Co., Ltd.).
1899. Arnott, G. W. Campbell, 114, Victoria Street, Toronto, Canada, Agricultural Chemist.
1903. Arnott, J. S., Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1901. Arundel, Arthur S. D., Penn Street Works, Hoxton, N., Paper Box Manufacturer.
1901. Asano, K., 25, Kitachonyacho, Kyobashi, Tokyo, Japan, Mining Chemist.
1906. Ash, Chas. S., 180, Townsend Street, San Francisco, Cal., U.S.A., Chemist.
1903. Ashley, Frank R., Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Chemist.
1900. Ashley, Harrison Everett, Newell, West Va., U.S.A., Metallurgical Chemist.
1900. Ashton, Jas., Rhodes Farm, Whitefield, Manchester, Chemist and Manager.
1890. Ashton-Bost, W.D. *See* Bost, W. D. Ashton.
1885. Ashwell, J. H., 117, Waterloo Crescent, The Forest, Nottingham, Bleacher and Dyer.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1903. Ashworth, Jno. B., 11, The Promenade, Egremont, Cheshire, Manager.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 62, Gilnow Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Agricultural Department, Wellington, New Zealand, Chemist.
1891. Atkins, C. E., Teigngrace, Bycullah Park, Enfield, N., Chronometer Maker.
1885. Atkinson, A. J., 44, Stuart Street, Cardiff, Analytical Chemist.
1902. Atkinson, Edwin B., Furze Glen, Lambert Road, Great Grimsby, Lecturer in Chemistry.
1905. Atkinson, James P., Dept. of Health, 55th Street and 6th Avenue, New York City, U S.A., Chemist.
1900. Atkinson, Jno. W., Betteravia, Cal., U.S.A.,Chemist.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
O.M. Attfield, Dr. J., F.R.S., Ashlands, Watford, Herts.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., jun., c/o Clark Thread Co., Newark, N.J., U.S.A., Dyeworks Manager.
1901. Auden, Dr. H. A., Westwood, Grassendale, Liverpool, Chemist.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J., U.S.A., Silk Dyer.
1887. Austen, Prof. Peter T., (Journals) 204, West 86th Street, and (communications) 89, Pine Street, New York City, U.S.A., Professor of Chemistry.
1902. Austin, J. H., Allscott, Wellington, Shropshire, Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Chemist.
1902. Avery, D., Working Men's College, Melbourne, Vic., Australia, Teacher of Chemistry.
1890. Aykroyd, H. E., Scaitcliffe, Queen's Road, Ilkley, Yorks, Dyer.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.
1903. Ayres, W. J., P.O. Box 187, Pernambuco, Brazil, Sugar Expert.

B

1904. Babb, Edward E., 41, Central Wharf, Boston, Mass., U.S.A., Food Analyst.
1895. Bacon, Nathaniel T., Peace Dale, Rhode Island, U.S.A., Chemical Engineer.
1903. Bacon, R. A., Richmond Hill, Long Island, N.Y., U.S.A., Manufacturing Chemist.
1897. Bacon, Wm., 4, New Court, Lincoln's Inn, W.C., Chemist.
1897. Badock, Stanley H., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Baekeland, Dr. Leo, Snug Rock, North Broadway, Yonkers, N.Y., U.S.A., Manufacturing Chemist.
1902. Baer, Dr. Samuel H., 212, South 7th Street, St. Louis, Mo., U.S.A., Consulting Chemist.
1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885. Bailey, Edwin M., Almond Hill, Pumpherston, Mid-Calder, N.B., Technical Chemist.
1883. Bailey, Dr. G. H., Marple Cottage, Marple, Cheshire, Chemical Lecturer.

1903. Bailey, Harold J., Maritime Coke Works, Pontypridd, S. Wales, Chemist.

1898. Bailey, Henry, 6, Elsenham Road, Wimbledon Park, S.W., Analytical Chemist.

1906. Bailey, Ralph, W., c/o Messrs. Stillwell & Gladding, 55, Fulton Street, New York City, U.S.A., Chemist.

1888. Bailey, Dr. T. Lewis, Glassford Creek, *viâ* Miriam Vale, Queensland, Australia, Chemist.

1888. Bailey, Sir W. H., Albion Works, Salford, Manchester, Chemical Engineer.

1888. Bailey, Walter P., Empresa de Gas, 13, San Roque, Seville, Spain, Chemical Engineer and Manager.

1902. Bain, Jas. Watson, School of Practical Science, Toronto, Ont., Canada, Chemist.

1890. Baird, H. Harper, 14, Cross Street, Hatton Garden, London, E.C., Laboratory Furnisher.

1902. Baird, Dr. Julian W., Massachusetts College of Pharmacy, Boston, Mass., U.S.A., Professor of Chemistry.

1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.

1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.

1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.

1903. Baker, Arthur, 96, Blackburn Road, Darwen, Lancs., Chemist.

1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.

1901. Baker, F. Guy Stirling, Marryatt's Lodge, The Forest, Snaresbrook, Essex, Student.

1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.

1905. Baker, Henry, 18, Booth Street, Manchester, Secretary.

1899. Baker, H. Fenimore, c/o Thomsen Chemical Co., Baltimore, Md., U.S.A., President.

1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.

1892. Baker, Julian L., Stainesbury Holt, Kingston Road, Staines, Brewing and Sugar Chemist.

1886. Baker, Theodore, P.O. Box 71, Wilmington, Del., U.S.A., Analytical Chemist.

1898. Baldwin, Abram T., Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Manufacturer.

1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.

1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).

1903. Ball, S. F., Hull Avenue and 209th Street, New York City, U.S.A., Analytical Chemist.

1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.

O.M. Ballard, Edw. G., 7, Godstall Chambers, Chester, Alkali Works Inspector.

1891. Ballinger, Jno., Free Library, Cardiff, Librarian.

1903. Baltzly, E. B., c/o Semet Solvay Co., Syracuse, N.Y., U.S.A., Superintendent.

O.M. Bamber, H. K., 9, Victoria Street, London, S.W., Consulting Chemist.

1894. Bamber, H. K. G., Ingress House, Greenhithe, Kent, Cement Works Chemist and Manager.

1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks., Dyer.

1905. Bampton, Geo. F., Room 24, 68, Essex Street, Boston, Mass., U.S.A., Chemist.

1[illegible]. Bancroft, John, Wilmington, Del., U.S.A., Bleacher and Dyer.

O.M. Bannister, H. C., Elmhurst, Blundellsands, near Liverpool, Chemical Works Manager.

1[illegible]. Banks, Jno. H., c/o Ricketts and Banks, 104, John Street, New York City, U.S.A., Mining Engineer.

1[illegible]. Bannan, John F., 59, Court Street, North Andover, Mass., U.S.A., Chemist (Woollen Mill).

1[illegible]. Banner, Samuel, 4, Ivanhoe Road, Liverpool, Petroleum Merchant.

O.M. Bannister, R., 59, Tregunter Road, South Kensington, S.W., Analytical Chemist.

O.M. Bannister, W., Victoria Lodge, Cork, Ireland, Manufacturing Chemist.

1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.

1906. Barbour, Robt. B., Eclipse Chemical Manufacturing Co., Chelmsford, Mass., U.S.A., Manager.

1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.

1895. Bardwell, Fred. L., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Assistant Professor of Chemistry.

1903. Baringer, Fred. J., Eagle White Lead Works, 1020, Broadway, Cincinnati, Ohio, U.S.A., Chemist.

1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.

1905. Barker, Perry, c/o U.S. Fuel Testing Plant, Boiler Division, St. Louis, Mo., U.S.A., Chemist.

1895. Barlow, Clinton W., 103–105, Greene Street, New York City, U.S.A., Merchant.

1901. Barlow, John J., 177, Manchester Road, Accrington, Calico Printer's Chemist.

1899. Barlow, Wm., 311, Market Street, Droylsden, near Manchester, Analytical Chemist.

1906. Barnes, A. G., Grassmoor Collieries, Chesterfield, Colliery Proprietor.

1891. Barnes, Edward A., Sundalen, Aasenfjorden, Norway, Technical Chemist.

1901. Barnes, Fred., 2, Fairview, Canterbury Road, Sittingbourne, Kent, Paper Mill Chemist.

1905. Barnes, F. V., 44, Lucknow Avenue, Nottingham, Gas Works Chemist.

1884. Barnes, H. J., Phœnix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.

1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.

O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.

1902. Barnett, Marcus S., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Sugar Works Chemist.

1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).

1898. Barnicott, Jas. A., Messrs. May and Baker Ltd., Garden Wharf, Church Road, Battersea, S.W., Chemical Manufacturer.

1904. Baron, Wm. Briscoe, c/o The Fuel Saving and Water Treating Co., Ltd., 2, Booth Street, Albert Square, Manchester, Chemist.

1901. Barr, Geo., c/o Trimble Dyeing and Printing Co., Philadelphia, Pa., U.S.A., Calico Printer.

O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.

1905. Barraclough, C. E., Wood View, Manningham, Bradford, Chemist.

1890. Barraclough, Wm. H., Beechwood, Mortomley, near Sheffield, Analytical Chemist.

1896. Barratt, J. Treeby, Bronheulog, Mostyn, North Wales, Chemist and Manager.

1890. Barrett, Arthur A., 5, Strada del Pozzo Leone, Messina, Sicily, Manufacturer of Essential Oils.

1890. Barrie, D. McLaurin, P.O. Box 193, Germiston, Transvaal, Analytical Chemist.

1900. Barrow, Jos., 13, The Grove, Bebington, Cheshire, Chemist.

1906. Barrs, Chas. E., 20, Carlingford Road, Hampstead, N.W., Analyst.

1905. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.

1893. Barton, G. E., c/o Whitall, Tatum, and Co., Flint Glass Works, Millville, N.J., U.S.A., Technical Chemist.

1900. Barton L. Edward, Broadway, cor. Thatcher Street, Albany, N.Y., U.S.A., Chemist.

1903. Bartripp, Geo. F., 20, Grove Road, Wanstead, Essex, Analytical Chemist.

1905. Baruch, Edgar, c/o Alta California Beet Sugar Co., Hamilton, Glenn Co., Cal., U.S.A., Chemical Engineer.

1895. Baskerville, Dr. Chas., College of the City of New York, New York, U.S.A., Professor of Chemistry.

1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.

1899. Bassett, Wm. H., 146, Litchfield Street, Torrington, Conn., U.S.A., Chemist.

1890. Bate, William, "Ladbroke," Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).

1903. Bateman, A. H. 34, Bridge Avenue, Hammersmith, W., Chemist.

1903. Bates, C. O., c/o Coe College Library, Cedar Rapids, Iowa, U.S.A., Teacher of Chemistry.

1885. Batty, R. B., Wharncliffe, Erdington, near Birmingham, Nickel Works Manager.

1903. Baty, E. J., British Insulated and Helsby Cables, Ltd., Prescot, Lancs., Chief Chemist.

1903. Bauer, Geo. W., 632, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).

1906. Bauer, H. F., 809, McAllister Avenue, Waukegan, Ill., U.S.A., Chemist.

1900. Baur, Jacob, 67, Wells Street, Chicago, Ill., U.S.A., Liquid Carbonic Acid Manufacturer.

1898. Baxter, John G., 143, Milton Road, Gravesend, Kent, Chemist.

O.M. Baxter, W. H., Nuthurst, Streatham, S.W., Brewery Director.

1899. Bayly, Francis W., Assayer.

1904. Bayly, Harold G., Usine Ste. Madeleine, San Fernando, Trinidad, Analytical Chemist.

O.M. Baynes, J., Royal Chambers, Scale Lane, Hull, County and Borough Analyst.

1897. Beadle, Alec A., Greenheys, Granville Road, High Barnet, Herts., Electro-Chemist.

1886. Beadle, Clayton, Halewood, Sidcup, Kent, Consulting Chemist.

1890. Bealey, Adam C., c/o A. C. Bealey and Sons, Radcliffe, Lancashire, Bleacher and Alkali Manufacturer.

1904. Bean, Percy, 10, Marsden Street, Manchester, Analytical Chemist.

O.M. Beanes, E., Moatlands, Paddock Wood, Kent, Manufacturing Chemist.

1905. Beasley, Jno. K., c/o Hong Kong and Shanghai Banking Corporation, Ltd., Singapore, S.S., Metallurgical Chemist.

1883. Beaven, E. S., 5, Boreham Terrace, Warminster, Wilts, Maltster.

1897. Beaver, Chas. J., Holme Lea, Ashley Road, Hale, Cheshire, Chemist.

1898. Beck, Herbert H., 105, South Queen Street, Lancaster, Pa., U.S.A., Chemist.

1905. Beckers, Dr. Wm., 128, Duane Street, New York City, U.S.A., Chemist.

O.M. Beckett, G. H., Hartford, South Beach Avenue, Ardrossan, Scotland, Analytical Chemist.

1898. Beckett, Jos. H., Duffryn House, Ebbw Vale, Mon., Analytical Chemist.

1903. Beckwith, Edw. Pierrepont, Garrison on the Hudson, N.Y., U.S.A., Chemist.

1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.

1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.

1891. Bedford, Jas. E., Messrs. Wood and Bedford, Airedale Chemical Works, Leeds, Manufacturing Chemist.

O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.

1901. Beebe, Murray C., University of Wisconsin, Madison, Wis., U.S.A., Engineer.

1901. Beevers, Clifford J., c/o Brotherton and Co., Ltd. Holmes Street, Dewsbury Road, Leeds, Analyst.

1899. Behr, Dr. Arno, 432, Arlington Court, Pasadena, Cal., U.S.A., Chemist.

1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.

O.M. Beilby, George T., 11, University Gardens, Glasgow, Chemical Engineer.

1902. Bek, Lars P., Goondi, Johnston River, North Queensland, Australia, Analytical Chemist.

1906. Belden, A. W., Fuel Testing Plant, St. Louis, Mo., U.S.A., Coke Expert.

1902. Bell, Edwin L., Grenzhausen, bei Coblentz, Germany, Manager.

1906. Bell, H. N., Tay Street, Invercargill, New Zealand, Company Manager.

1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.

1900. Bell, Hugh P., 3, Mincing Lane, London, E.C., Chemist.

O.M. Bell, J. Carter, Bank House, The Cliff, Higher Broughton, Manchester, Public Analyst.

1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.

1907. Bell, Marcus, Commonwealth of Australia Offices, 72, Victoria Street, London, S.W., until June 15th; then Explosives Dept., 423, Flinders Lane, Melbourne, Victoria, Chemist.

1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.

1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.

1902. Bement, Alburto, American Trust Building, Chicago, Ill., U.S.A., Chemical Engineer.

O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.

1897. Benfey, Dr. Hans, 295, North Road, Clayton, Manchester, Manufacturing Chemist.

1903. Benham, Keith, Deans Hill, Stafford, Analytical and Consulting Chemist.

1902. Benjamin, Albert, Springbrook Works, Middleton Road, Oldham, Bleach and Dyeworks Manager.

O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist, A.M.

1904. Benn, R. H. D., 16, Springfield Avenue, Westmount, Montreal, Canada, Analytical Chemist.

1906. Bennett, A. E. J., Bethel, Vermont, U.S.A., Leather Manufacturer.

1899. Bennett, Alex. H., c/o G. H. Ogston & Moore, Messina, Sicily, Chemist.

1901. Bennett, Arnold, c/o Montreal Steel Works, Ltd., Canal Bank, Point St. Charles, Montreal, Canada. Chemist.

1884. Bennett, Thos., Birch Vale, near Stockport, Calico Printer.

1902. Bennie, P. McN., P.O. Box 29, Niagara Falls, N.Y., U.S.A., Consulting Chemist.

1906. Benson, Richard W., Public Analysts' Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.

1905. Bentley, Prof. W. B., 42, Morris Avenue, Athens, Ohio, U.S.A., Professor of Chemistry.

1901. Bentley, Wm. H., 6, Woodbine Terrace, Irlam, near Manchester, Technical Chemist.

1890. Bentz, Ernest, 107, Shaw Lane, Dinting, near Manchester, Lecturer on Dyeing.

1905. Berge, Henry vom, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Manager.

1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.

1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.

1900. Bermingham, Jno., jun., California Powder Works, Pinole, Contra Costa Co., Cal., U.S.A., Superintendent.

1889. Bernard, Jas., jun., c/o Chas. Hadfield, Viaduct House, Dinting, near Manchester, and (Journals) Ranipet, North Arcot, Madras Presidency, India, Chemical Works Manager.

1900. Berolzheimer, D. D., 11, East 59th Street, New York City, U.S.A., Chemist.

1906. Berry, A. J., 5, University Gardens, Glasgow, Student of Chemistry.

1897. Berry, Albert E., 62, Claremont Road, Forest Gate, Essex, Works Manager.

1883. Berry, E. E., Bordighera, Italy, Technical Chemist.

1889. Berry, G. F., Atlas Chemical Works, West Ferry Road, Millwall, E., Manager.

1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.

1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.

1901. Betts, Anson G., Troy, N.Y., U.S.A., Chemist.

O.M. Bevan, E J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.

1900. Bevan, Jno. W., Risedale, St. James' Crescent, Swansea, Manager of Metallurgical Works.

O.M. Beveridge, Jas., c/o Miramichi Pulp and Paper Co., Ltd., Chatham, N.B., Canada, Pulp and Paper Manufacturer.

1900. Bevington, Col. S. B., 42, St. Thomas Street, Southwark, S.E., Leather Dresser.

1893. Bhaduri, Prof. K., Canning College, Lucknow, India, Professor of Chemistry.

1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.

1902. Biach, Dr. Ludwig K., 223, Central Avenue, Norwich, Conn., U.S.A., Chemist and Colorist.

1896. Bibby, John, c/o J. Bibby & Sons, Formby Street, Liverpool, Student.

O.M. Bickerdike, W. E., Bryer's Croft, Wilpshire, near Blackburn, Manufacturing Chemist.

1901. Bielecki, Dr. Jan, "Chemik Polski," 66, Krakowski Przediniescie, Warsaw, Poland, Chemist,

1903. Bierwirth, L. W., c/o E.I. du Pont & Co., Central National Bank Building, Wilmington, Del., U.S.A., Civil Engineer.

1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, N.B., Analytical Chemist.

1891. Biggart, Wm. L., Rossarden, Kilmalcolm, N.B., Public Analyst.

O.M. Biggs, B., 110, Cannon Street, London, E.C., Chemical Merchant.

O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.

1896. Billings, Edgar F., 178, Freeport Street, Dorchester, Mass., U.S.A., Manufacturing Chemist.

1896. Billington, Chas., jun., Heimath, Porthill, Longport, Staffordshire, Metallurgist.

1898. Binney, Harold, Washington Life Building, 141, Broadway, New York City, U.S.A., Patent Lawyer.

1902. Binning, Stevenson, 101, Shooter's Hill Road, Blackheath, S.E., Technical Chemist.

1903. Binns, John H., Thornfield, Mystic Pond, Methuen, Mass., U.S.A., Dyer and Finisher.

1896. Bird, Arthur W., c/o S. Berger & Co., Bromley-by-Bow, E., Works Engineer.

1907. Bird, Charles S., jun., East Walpole, Mass., U.S.A., Paper Maker.

1896. Bird, Jno. B., Minver House, 61, Bateman Street, Cambridge, Manure Manufacturer.

1903. Bird, Thos., 59A, Brook Street, Grosvenor Square, London, W., Surgeon.

1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.

1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts, Analytical Chemist.

1885. Birley, R. K., c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, India-rubber Manufacturer.

1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.

1884. Bishop, Fred, c/o Burmah Oil Co., Rangoon, Burmah, Technical Chemist.

1903. Bishop, Howard B., 609, Greene Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.

1905. Bixby, Willard G., 194, Hester Street, New York City, U.S.A., Blacking Manufacturer.

1904. Bjerregaard, August P., c/o Emil Calman & Co., Long Island City, N.Y., U.S.A., Varnish Chemist.

1904. Black, J. Wyclif, 20, Mardale Crescent, Edinburgh, Analytical Chemist.

1902. Black, W. Geoffrey, The Limes, New Street, Braintree, Essex, Chemist.

1894. Blackmore, H. S., 206, South Ninth Avenue, Mount Vernon, N.Y., U.S.A., Chemist (Pure Aluminium and Chemical Company).

1899. Blackwell, G. G., 44–47, The Albany, Liverpool, Mineral and Metal Merchant.

1896. Blagden, Victor, 50–51, Lime Street, London, E.C., Chemical Merchant.

1883. Blagden, W. G., The Manor House, Harting, near Petersfield, Chemical Merchant.

1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.

1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.

1902. Blakemore, Geo. H., Great Cobar Copper Mining Syndicate, Lithgow, N.S.W., Australia, Metallurgist.

1890. Blakey, A. J., Dudbridge Mills, Stroud, Gloucestershire, Dyer.

1904. Bleakley, Wm., Dean's Mill, Swinton, Lancs., Cotton Mill Manager.

1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford, Dyer and Calico Printer.

O.M. Bles, A. J. S., 32, Chorlton Street, Manchester, Chemical Merchant.

1905. Bliss, H. J. W., c/o The Thames Varnish Co., Island Wharf, Rainham, Essex, Chemist.

1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.

1891. Bloomer, Fred. J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.

1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.

1888. Bloxam, A. G., 105, Birkbeck Bank Chambers, Holborn, W.C., Chemist and Patent Agent.

1890. Bloxam, W. Popplewell, Clothworkers Research Laboratory, The University, Leeds, Research Chemist.

1903. Blumenthal, Lionel, The Lindens, Stanley Road, Broughton Park, Manchester, Chemist.

1886. Blundstone, E. R., 77, York Street, Westminster, S.W., and (Journals) Heathfield, Park Road, Hampton Hill, Middlesex, Consulting Chemist.

1906. Blyth, M. Wynter, 36, Eastcheap, London, E.C., Analytical and Consulting Chemist.

1905. Blyth, Thomas R., Uphall Chemical Works, Ilford, Essex, Analytical Chemist.

O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.

1888. Boake, Edmund J., Aberffraw, Nursery Road, Loughton, Essex, Manufacturing Chemist.

1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.

1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Instructor in Organic Chemistry.

1903. Boissevain, Chas. E. H., 92, van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.

1903. Bolam, Dr. H. W., 2, Summerfield, Leith, N.B. Lecturer on Chemistry.

1901. Bolton, E. Richards, 16, Flanchford Road, Ravenscourt Park, W., Manufacturing Chemist.

1905. Bond, John, Crowlands, Southport, Engineer.

1905. Bond, Josiah, Patagonia, Arizona, U.S.A., Mining Engineer.

1905. Bone, Dr. W. A., F.R.S., West House, Lidgett Park Road, Roundhay, Leeds, Lecturer in Chemistry and Metallurgy.

1892. Bookman, Dr. S., 9, East 62nd Street, New York City, U.S.A., Chemist.

1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.

1896. Boot, John C., Klatten, Java, Netherlands Indies, Chemist.

1904. Booth, N. Parr, Laboratory, Cadbury Bros., Ltd., Bournville, near Birmingham, Chemist.

1894. Booth, Robt., 110, Cannon Street, London, E.C., Engineer.

1891. Boothby, Chas., (Journals) 10, Church Row, Limehouse, E., and 70, Bedford Court Mansions, Bedford Square, London, W.C., Chemist.

1903. Boral, Robin, Rhodes Mount, Rhodes, near Manchester, Works Manager.

1897. Borland, C. R., P.O. Box 683, Concord, Mass., U.S.A., Smokeless Powder Manufacturer.

O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford, Kent, Manufacturer of Explosives.

1906. Bornett. S., 19, St. Dunstan's Hill, London, E.C., Technical Chemist.

1903. Boroschek, Dr. L., 24, West 82nd Street, New York City, U.S.A., Chemist.

1903. Bossi, Dr. Arnold L., Arnold Print Works, North Adams, Mass., U.S.A., Assistant Manager.

1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, N.B., Chemical Manufacturer.

O.M. Bothamley, C H., Tanglewood, Southside, Weston-super-Mare, Somerset, County Director of Technical Instruction.

1890. Bott, Dr. W. Norman, 16, St. Helen's Place, London, E.C., Consulting Chemist.

1884. Böttinger, Dr. H. T., Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, E.C., Colour Manufacturer.

O.M. Bottle, Alex., 4, Godwyne Road, Dover, Pharmaceutical Chemist.

1901. Bottomley, Dr. J. Frank., c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.

1906. Bottomley, W., c/o The United Alkali Co., Ltd., Fleetwood Salt Works, Fleetwood, Engineer.

O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1890. Boulton, James, Crayford, Mills, Stratford, E., Manufacturing Chemist.

O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.

1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, N., Manager.

1900. Bourcoud, Augustin E., Comp. General de Productos Quimicos del Aboño, Gijón, Spain, Civil Engineer.

1905. Bourne, Lyman M., 119, Montague Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Boutwell, Arthur T., c/o Smith & Dove Manufacturing Co., Andover, Mass., U.S.A., Bleacher and Dyer.

1884. Bow, R. H., 7, South Gray Street, Edinburgh, Civil Engineer.

1904. Bowden, Thos., Durn Lea, Todmorden Road, Littleborough, Lancs., Dyer and Chemist.

1905. Bowen, Henry, c/o St. Louis Chemical Co., St. Louis, Mich., U.S.A., Secretary.

1906. Bowen, Ralph A., c/o National Aniline & Chemical Co., 36, Purchase Street, Boston, Mass., U.S.A.

1885. Bowen, S. B., Brickfield Chemical Works, Llanelly, South Wales, Chemical Manufacturer.

1899. Bowen, Wm., R.R.I., Fowler (Rural Route), Fresno Co., Cal., U.S.A., Chemist.

1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.

1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.

1892. Bowes, Harry, Staveley, Broomfield Road, Heaton Moor, Stockport, Analytical Chemist.

1903. Bowey, John, jun., 567, Dufferin Avenue, London, Ont., Canada, Chemist.

1889. Bowing, Jno., 101, North Street, Wandsworth, S.W., Consulting Chemist.

1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, and (Journals) 64, Redcliffe Gardens, London, S.W., Chemical Manufacturer.

1899. Bowley, J. Plunkett, 1, Wellington Road, Battersea, and (Journals) 64, Redcliffe Gardens, London, S.W., Varnish Manufacturer.

1883. Bowman, Dr. F. H., 4, Albert Square, Manchester, Chemical Manufacturer.

1894. Bowman, Jas. H., Canada Chemical Manufacturing Co., London, Ont., Canada, Chemist.

1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.

1907. Bowman, Richard S., Sea View Terrace, Seaton Carew, Co. Durham, Chemist.

1896. Bowman, Walker, 39, Cortlandt Street, New York City, U.S.A., Chemist.

1904. Boyce, Framroze H., near Fire Brigade Station, Fort, Bombay, India, Technical Chemist.

1893. Boyce, Frank, c/o Goodall, Backhouse, and Co., White Horse Street, Leeds, Technical Chemist.

O.M. Boyd, W., P.O. Box 212, Germiston, Transvaal, Technical Chemist.

1899. Boyes, Herb. J., 7, Alameda Barao de Piracicala, Sao Paulo, Brazil, Chemist.

1905. Brabrook, G. Hale, Box 333, Taunton, Mass., U.S.A., Manufacturer.

1906. Bracegirdle, Harold W., 1 Mytton Street, Hulme, Manchester, Chemist.

1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A.. Manufacturing Chemist.

1883. Bradbury, A., Queen Buildings, 11, Dale Street, Liverpool, Chemical Broker.

1902. Bradbury, S.,Ferncliffe, Milton Grove, Glebelands Road, Ashton-on-Mersey, Chemist.

1895. Bradford, Henry, c/o A. H. Carey, Goodwood, near Chichester, Analytical Chemist.

1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.

1891. Braithwaite, Isaac, Holly Croft, Kendal, Westmoreland, Drysalter.

1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.

1904. Braman, Winfred W., Box 353, State College, Pennsylvania, U.S.A., Assistant Instructor.

1903. Brame, J. S. S., 5, Colcraine Road, Blackheath, S.E., Demonstrator in Chemistry.

O.M. Bramham, W., 86, Bow Road, London, E., and (communications) 115, Broadhurst Gardens, West Hampstead, N.W., Chemical Engineer.

O.M. Bramwell, G. H., Cowley Hill, St. Helens, Lancashire, Alkali Manufacturer.

1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Production, Aussig, Austria, Chemical Manufacturer.

1906. Brandt, H. O., 66, Sackville Street, Manchester, Merchant.

1902. Branegan, Jas. Aug., 555, North 16th Street, Philadelphia, Pa., U.S.A., Chemical Salesman.

O.M. Branson, F. W., Wynnholme, Far Headingley, Leeds, Pharmaceutical Chemist.

1903. Brassard, Fred. à, 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.

1901. Brearley, Harry, Salamander Stahlwerke, Jaegel, Riga, Russia, Analytical Chemist.

1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.

1888. Breffitt, Wm., Glasshoughton, Castleford, Yorks., Glass Manufacturer.

1905. Brettell-Vaughan, E., 15, Queen Street, London, E.C., Storage Battery Analyst.

1901. Brewer, Dr. C. E., Wake Forest, N.C., U.S.A., Professor of Chemistry.

1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.

1894. Breyer, Theodor, 842, Lunt Avenue, Rogers Park, Chicago, Ill., U.S.A., Chemist.

1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.

1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.

1894. Briggs, J. Burnett, Vauxhall Soap Works, 6, Blackstock Street, Liverpool, Soap Manufacturer.

1893. Briggs, J. F., 2, Frankfort Road, Herne Hill, S.E., Technical Chemist.

1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.

1890. Brindley, G. F., 3. Itchome, Uchisaiwai Cho, Kojimachi-Ku, Tokio, Japan, Chemical Engineer.

1905. Bristol, Dr. H. Stanley, 74, Pinckney Street, Boston, Mass., U.S.A., Chemist.

1886. Bristow, G. W., c/o Walter J. Crook, 10, Philpot Lane, London, E.C., Chemical Manager.

1887. Broadbent, H., c/o Goodall, Backhouse, and Co., Sovereign Street, Leeds, Chemist.

1896. Broadhurst, W. Homer, 290, Lafayette Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
O.M. Brock, J., Gwern-Tyno, Colwyn Bay, North Wales, Chairman of United Alkali Co., Ltd.
1905. Broemmel, G. M., 2501, California Street, San Francisco, Cal., U.S.A., Chemist.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Laboratory, Singapore, S.S., Chemist.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1895. Brookman, Fred W., 6, West Street, Rochdale, Manure Works Manager.
1906. Brooks, Cecil J., c/o The Borneo Co., Ltd., Kuching, Sarawak, Metallurgist.
1903. Brooks, H. Kibbe, Claremont, N.H., U.S.A., Chemist.
1907. Broome, James S., 18, Seedley Park Road, Pendleton, Manchester, Science Lecturer.
1901. Broome, Jos., 5, Webster Terrace, Roselle Park, N.J., U.S.A., Chemical Engineer.
O.M. Brotherton, E. A., M.P., Commercial Buildings, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., 133, Kent Street, London, Ont., Canada, Metallurgist.
1891. Brown, Cæsar R., 23, Gower Road, Forest Gate, E., Works Foreman.
O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., St. Petersburg, Russia, Analytical Chemist.
1903. Brown, Frank C., P.O. Box 211, Framingham, Mass., U.S.A., Foreman.
1904. Brown, Dr. Fred. W., 470, Lenox Avenue, New York City, U.S.A., Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1905. Brown, Harold G. S., c/o Messrs. G. H. Ogston and Moore, Strada deglo Argentieri, 19, Messina, Sicily, Analyst.
1906. Brown, Harry F., c/o E. I. du Pont Co., 716, Market Street, Wilmington, Del., U.S.A., Chemist.
1905. Brown, Hawthorne J., Oak Villa, Elton, Bury, Lancs., Paper Maker.
O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square Kensington, S.W, Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson & Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
O.M. Brown, Dr. J. Campbell, 8, Abercromby Square, Liverpool, Professor of Chemistry.
1891. Brown, J. Henry, Minas d'Aljustrel, Alemtejo, Portugal, Technical Chemist.
1901. Brown, Jos., Ashleigh House, Savile Town, Dewsbury, Manufacturing Chemist.
1905. Brown, Nicol, 4, The Grove, Highgate, N., Mining, Director.
1906. Brown, Percy S., c/o Western Electric Co., West and Bethune Streets, New York City, U.S.A., Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 2, Samuel Ogden Street, Manchester, Technical Chemist.
1889. Brown, Robt., The Firs, Hartford, Northwich, Engineer.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, 89, Board of Trade Buildings, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 213, Courtland Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C., "Strathallan," Bootle, Liverpool, Works Chemist.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
O.M. Browning, W., Broad Oak, Accrington, Calico Printer.
1901. Brownlie, David, Cordale Works, Renton, Dumbartonshire, Chemist.
1902. Brownrigg, Marcus P., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., Abbey Wood, Kent, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1890. Bruce, Jas., Craik, Saskatchewan, Canada, Distiller.
1900. Bruce, Wm. T., c/o Hugh Wallace and Co., Ltd., 5, Fenchurch Street, London, E.C., Director.
1892. Bruckmann, G. T., 192, 18th Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1905. Bruinier, A. G., 534, Canal Street, New York City, U.S.A., Agent for Kalle and Co.,
O.M. Brunner, H., Holly Mount, Tarbock Road. Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, Winnington Park, Northwich, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond and Co., Ltd., 39, Victoria Street, London, S.W., Chemical Manufacturer.
O.M. Brunner, Sir J. T., Bart., M.P., Druid's Cross, Wavertree, Liverpool, Chemical Manufacturer.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1905. Brunt, R. A., Box 71, Windsor, Ont., Canada, Sugar Chemist.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, N.B., Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1903. Bryant, V. Seymour, 80, Beeches Road, West Bromwich, Analytical Chemist.
1905. Bryce, Clarence H., c/o Benj. Moore and Co., 244, Water Street, Brooklyn, N.Y., U.S.A., Factory Superintendent.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherston Oil Works, Midcalder, N.B., Oil Works Manager.
1892. Buchanan, D. G., (Subs.) 40, St. Vincent Place, Glasgow, and (Journals) c/o Gibbs and Co., Iquique, Chili, Analyst.
1904. Buchanan, E. F., 80, Byers Avenue, Akron, Ohio, U.S.A., Chemist.
1888. Buchanan, Jas., jun., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, J. L., 3, The Wiend, Lower Bebington, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1906. Buckie, Robert H., 82, Sydenham Road, London, S.E., Works Chemist.
1897. Bucknill, Jno. A., P.O. Box 52, Government Patent Office, Pretoria, Transvaal, Comptroller General.
1900. Bull, Dr. Benjamin S., 104, Humber Road, Blackheath, S.E., Technical Chemist.
1902. Bull, Irving C., P.O. Box, 294, Middletown, N.Y., U.S.A., Chemist.
1899. Bult, Herbert J., 18, Billiter Street, London, E.C Chemist.
1907 Bult, Stanley R., 18, Billiter Street, London, E.C Chemist.
O.M. Bumby, H., Coltness Ironworks, Newmains, N.B., Ironworks Manager.

O.M. Bunker, H. E., 19, Napier Street, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., c/o Peruvian Corporation, Ltd., Lima, Peru, Analyst.
1894. Bunting, W. Lightfoot, Forest Bank, Crawshawbooth, near Manchester, Calico Printer.
1905. Bunzl, Hugo, 175, High Street, Chorlton-on-Medlock, Manchester, Chemist.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1886. Burdekin, G., jun., 10, Clifton Terrace. St. Helens, Lancashire, Chemical Works Manager.
1896. Burford, Samuel F., Beechworth, Stoneygate Road, Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 1, Birch Avenue, Talbot Road, Old Trafford, Manchester, Technical Chemist.
1901. Burgess, Prof. C. F., University of Wisconsin, Madison, Wis., U.S.A., Electro-chemical Engineer.
1889. Burgess, Geo., Hale Road, Ditton, Widnes, Chemist.
1889. Burgess, Wm. T., 20, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1899. Burkhardt, Dr. G. A., c/o Bohrgesellschaft Erkelenz. Erkelenz, Rheinland, Germany, Chemist.
1897. Burland, Lt.-Col. Jeffrey H., 824, Sherbrooke Street, Montreal, Canada, Paper and Card Manufacturer.
1900. Burleigh, Wm. F., c/o Murphy Varnish Co., Newark, N.J., U.S.A., Technical Chemist.
1897. Burls, Frank B., 4, Dyer's Hall Road, Leytonstone, Essex, Chemist.
1898. Burls, Herbert T., (Journals) c/o Royal Societies Club, St. James Street, S.W., and (communications) Foulis Terrace, Onslow Gardens, S.W., Mechanical Engineer.
1901. Burnand, Sydney, Manbré Saccharine Co., Ltd, Hammersmith, W., Manager.
O.M. Burnard, R., Plymouth Chemical Works, Plymouth, Chemical Manufacturer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks., Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, Architect.
1907. Burnham, Frank E., c/o Avery Chemical Co., 7, Sears Street, Boston, Mass., U.S.A., Chemist.
1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burnside, Chas. F., California Powder Works, Santa Cruz, Cal., U.S.A., Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.
O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1906. Burrough, Ernest J., Cale Street Distillery, Chelsea, S.W., Rectifier.
1892. Burrough, Horace, jun., 509, West Lombard Street, Baltimore, Md., U.S.A., Technical Chemist.
1888. Burrows, Edw., Home Villa, Low Fell, Gateshead-on-Tyne, Alkali Works Manager
1907. Burt, Dr. Milo C., c/o Taylor, Burt & Co., Holyoke, Mass., U.S.A.
1905. Burtenshaw, Wm. H., P.O. Box 814, Detroit, Mich., U.S.A., Secretary, Michigan Carbon Works.
1901. Burton, Alf., 44, York Street, Toronto, Canada, Dyer and Finisher.
1905. Burton, Jas. K., 336, Drexel Building. Philadelphia, Pa., U.S.A., Consulting Chemist.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1904. Burton, T. R., c/o Scott, Greenwood and Son, 19, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1897. Burwell, A. W., Kyle Street, Lakewood, *via* Cleveland, Ohio, U.S.A., Consulting Chemist.
1885. Bury, J. H., Church Chemical Works, near Accrington, Chemical Manufacturer.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1903. Butler, Fredk., Ash Tree Lane, Hough Green, near Widnes, Manager (Ditton Copper Works).
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, T. H., c/o Frau Wenzel, Forstweg 14, Jena, Germany, Chemical Student.
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
1903. Buttenshaw, E. L., Thurleigh. Priory Road, Sale, Cheshire, Analytical Chemist.
O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 28–31, Bishopsgate Street Within, London, E.C., and (Journals) Roselawn, Berkeley, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
1902. Butterworth, F. J., P.O. Box 54, Newark, N.J., U.S.A., Chemist.
1892. Buttfield, Horace V., 13, Wellington Road, Bush Hill Park, Enfield, N., Chemical Demonstrator.
O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado, 8, Bilbao, Spain, Technical Chemist.
1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1899. Byrnes, Dr. Eugene A., 918, F. Street, N.W., Washington, D.C., U.S.A., Patent Lawyer.
1893. Byrom, T. H., Laboratory, Wigan Coal and Iron Co., Wigan, Analytical Chemist.
1887. Bythway, M., 44, Lloyd Street, Albert Square, Manchester, Drysalter.

C

1884. Cabot, Godfrey L., 82, Water Street, Boston, Mass., U.S.A., Chemist.
1906. Caddick, Arthur, 9, Albert Crescent. Lincoln, Works Chemist.
1889. Cadett, Jas., Ashtead, Surrey, Chemical Engineer.
1902. Cady, Wm. H., 127, Power Street, Providence, R.I., U.S.A., Colour Chemist.
1905. Cain, Dr. J. C., 28, Pembury Road, Lower Clapton, N.E., Colour Chemist.
1891. Caines, G. S. A., 7, Rochester Terrace, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1891. Caldecott, W. Arthur, Box 1167, Johannesburg, Transvaal, South Africa, Metallurgist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., Ormidale, Little Moor Hill, Smethwick, Chemical Manufacturer.
1888. Caldwell, Wm., Murray Street, Paisley, N.B., Drysalter.
1891. Calkin, Wm. S., Spring Forge, Pa., U.S.A., Paper Pulp Works Chemist.
1902. Calm, Chas. E., 190, Michigan Street, Chicago, Ill., U.S.A., Manufacturing Chemist.
1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1901. Calvert, Jos. E., 293, Butler Street, Etna, Allegheny Co., Pa., U.S.A., Analytical Chemist.
1895. Cambier, Jacob, 910, Spruce Street, Pueblo, Colo., U.S.A., Chemist.
1894. Cameron, Alex., Whitcher Place, Rochester Road, Camden Road, N.W., Chemical Engineer.
1891. Cameron, Jas., 70, Old Chester Road, Woodhey, Rock Ferry, Cheshire, Chemist.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.

O.M. Cammack, J., 67, King Edward Road, Denton's Green, St. Helens, Lancashire, Technical Chemist.

1886. Campbell, Andrew, c/o Burmah Oil Co., Ltd., Dunneedaw, Rangoon, Burmah, Analytical Chemist.

O.M. Campbell, Archibald, Berry Lodge, Rugeley, Staffordshire, Technical Chemist.

1902. Campbell, Ashley, Colonial Sugar Refining Co., Ltd., Yarraville Refinery, Melbourne, Vic., Australia, Analytical Chemist.

1906. Campbell, Geo. H., 15, Spadina Road, Toronto, Canada, Manufacturing Chemist.

1899. Campbell, Jas. Eunyce, 22, Cambridge Street, Worcester, Mass., U.S.A., Chemical Engineer.

1904. Campbell, J. H., 41, Summit Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.

1904. Campion, A., Laboratory, 144 Wellington Street, Glasgow, Chemist and Metallurgist.

1897. Canfield, F. D., jun., c/o Cuban Sugar Refining Co., Cardenas, Cuba, Sugar Refiner.

1893. Cannon, J. C., Staverton House, Shoreham, Sussex, Analyst

O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.

1891. Canziani, Enrico, 3, Palace Green, Kensington, W., Civil Engineer.

1891. Carden, Albert J., Dunster House, 12, Mark Lane, E.C., Distiller.

1904. Carel, Prof. Hubert C., Laboratory, University of Minnesota, Minneapolis, Minn., U.S.A., Chemist, (State Board of Health).

1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.

O.M. Carey, Eustace, The United Alkali Co., Ltd., 30, James Street, Liverpool; and (Journals) The Groves, Grassendale Park, near Liverpool, Chemical Manufacturer.

1906. Carey, William G., Moulton Settlement, Leysian Mission, City Road, London., E.C., Chemist.

1904. Cargill, J. T., c/o Finlay, Fleming and Co., Rangoon, Burmah, East India Merchant.

O.M. Carlile, T., St. Bryde's, Dunblane, N.B., Chemical Manufacturer.

1895. Carlsson, Hugo, Fagersta, Sweden, Analytical Chemist.

1893. Carmichael, Dr. H., 176, Federal Street, Boston, Mass., U.S.A., Analytical Chemist.

1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.

1884. Carmody, Prof. Patrick, Government Laboratory, Port of Spain, Trinidad, Analytical Chemist.

1903. Carneiro da Cunha, J. M., Comp. Agricola and Mercantil, Rua do Apollo, 28, Pernambuco, Brazil, Manager.

1897. Carnell, Wm. C., c/o Tacony Chemical Works, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.

O.M. Caro, Dr. H., C. 8 N. 9, Mannheim, Baden, Germany, Technical Chemist.

1906, Caro, Dr. Nikodem, Meineckestrasse 20, Berlin, Germany, Analytical Chemist.

1893. Carpenter, C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.

1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.

1900. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.

1903. Carpenter, H. C. Harold, 11, Oak Road, Withington, Manchester, Chemist and Metallurgist.

1906. Carpenter, P. H., Cawnpore Sugar Works, Cawnpore, India, Analyst.

O.M. Carpenter, R. Forbes, Prestwich, Greencroft Gardens, West Hampstead, N.W., Chief Inspector under the Alkali, &c., Works Acts.

1904. Carr, Francis H., Kelvin, Church Avenue, Sidcup, and (Journals), Burroughs, Wellcome and Co., Ltd., Dartford, Kent, Manufacturing Chemist.

1904. Carroll, Jno. L., 23, Division Place, Newark, N.J., U.S.A., Secretary (American Oil and Supply Co.).

1885. Carruthers, J. G., Burnbrae House, Milngavie, N.B., Dyeworks Manager.

1901. Carson, Geo. C., Hotel Broadway, Denver, Colo., U.S.A., Mining Engineer.

1906. Cart, John Trevor, c/o Messrs. C. A. Parsons and Co., Heaton Works, Newcastle-on-Tyne, Chemist.

O.M. Carteighe, M., 180, New Bond Street, London, W., Pharmaceutical Chemist.

1904. Carter, A., Cuba Street, Petone, Wellington, New Zealand, Works Manager.

1905. Carter, Robert A., c/o Roessler and Hasslacher Chemical Co., Box 68, South Amboy, N.J., U.S.A., Chemist.

1895. Carter, Stewart F., Glenlyon Dyeworks, Saylesville, R.I., U.S.A., Superintending Chemist.

1903. Carter, Thomas, 322, Scarr Hill, Bradford, Yorks, Works Chemist.

1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.

1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.

1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.

1906. Casaburi, Dr. V., c/o Ford Morocco Co., Wilmington, Del., U.S.A., Leather Chemist.

1903. Caspari, Dr. W. A., 28, Coleshill Road, Teddington, Chemist and Physicist.

1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).

1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.

O.M. Cawley, G., 25, Victoria Street, Westminster, S.W., Chemical Engineer.

O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.

1897. Cawley, Thos. A., British Gelatin Works, New Bedford Road, Luton, Gelatin Manufacturer.

1900. Cayvan, Llewellyn L., 927, West Monroe Street, Chicago, Ill., U.S.A., Chemist.

1902. Cerasoli, Alburto, c/o Dr. L. Mond, 18, Avenue Rd., Regent's Park, N.W., Engineer.

1906. Chadsey, S. B., c/o International Harvester Co., Hamilton, Ontario, Canada, Chemist.

1891. Chadwick, Walter M., 24, West 3rd Street, Bayonne, N.J., U.S.A., Chemical Works Manager.

1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.

1901. Chamberlain, G. E., 103, South Kensington Avenue, La Grange, Ill., U.S.A., Chemist.

1902. Champion, Edmund C., 510, South Washington Avenue, Iola, Kansas, U.S.A., Chemist.

O.M. Chance, A. M., Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.

O.M. Chandler, Dr. C. F., Columbia University, West 116th Street, New York City, U.S.A., Professor of Chemistry.

1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory, Wakefield, Yorks., Analytical Chemist.

1906. Chaplin, Wm. H., 13, Penywern Road, Earl's Court, London, S.W., Wine Merchant.

1890. Chapman, Alf. C., 8, Duke Street, Aldgate, E.C., Analytical Chemist.

1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., Analytical Chemist.

1905. Chapman, D. L., 10, Parsonage Road, Withington, Manchester, Demonstrator in Chemistry.

1906. Chapman, E. A., 2, Kensington Park, Stapleton Road, Bristol, Works Chemist.

1903. Chapman, Geo. W., Swift Fertilizer Works, 913, Prudential Building, Atlanta, Ga., U.S.A., Superintendent.

O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.

1894. Charlier, A. C. J., 6, Talbot Road, South Tottenham, N., Consulting Chemist.

1902. Charlton, Thos., 252, Irvington Place, Denver, Colo., U.S.A., Manufacturing Chemist.

1900. Chase, March F., c/o Mineral Point Zinc Co., Depue, Ill., U.S.A., Chemist.

1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.

1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.

1905. Cheesman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.

1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.

1905. Cheke, Thos. W., 105, London Road, Sawbridgeworth, Analytical Chemist.

1894. Cheney, J. P., c/o Cheney Bros., South Manchester, Conn., U.S.A., Silk Manufacturer's Chemist.

1885. Cheyne, A. M., c/o Messrs. Burgoyne, 16, Coleman Street, London, E.C., Analytical Chemist.

1905. Chick, Oliver, 52, High Street, Hornsey, N., Analytical Chemist.

1902. Chilwell, John, Post Office, Auckland, New Zealand, Analyst.

1906. Chittenden, George, The Francis Frost Co., Ltd., Toronto, Canada, Chemist.

1893. Cholerton, A. F., 40½, Belgrave Gate, Leicester, Manufacturing Chemist.

1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale, Lancs., Analytical Chemist.

O.M. Christie, J., Levenfield, Alexandria, N.B., Dyer and Printer.

1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.

1906. Christie, Dr. W. A. K., Technical Chemist.

1898. Christison, Geo., Cremona, Cambridge Drive, Glasgow, Engineer.

O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.

1904. Chubb, H. M., Wharfedale Villas, Tadcaster, Yorks., Brewery Chemist.

O.M. Church, Professor A. H., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.

1890. Church, Elihu D., jun., 63, Wall Street, New York City, U.S.A., Soda Manufacturer.

1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.

1896. Claflin, Alan A., (Communications) Box 1189, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.

1900. Clamer, Guilliam H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.

1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.

1901. Clapham, Henry E., Laurel Bank, Wilsden, near Bradford, Yorks., Technical Chemist.

1905. Clapp, Geo. A., 503, Walnut Street, Newtonville, Mass., U.S.A., Chemist.

1891. Clapp, Ralph R., c/o Standard Ammonia Co., Ltd., Iceland Wharf, Old Ford, E., Ammonia Works Manager.

1889. Clapperton, J., jun., Analytical Chemist.

1903. Clare, Henry, Hepscott, Morpeth, Northumberland, Schoolmaster.

1905. Clark, Alfred N., Box 168, Wallaceburg, Ont., Canada, Technical Chemist and Engineer.

1906. Clark, Allan J., c/o Homestake Mining Co., Lead, S. Dakota, U.S.A., Metallurgist.

1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.

1896. Clark, Donald, Bairnsdale, Victoria, Australia, Director of School of Mines.

1904. Clark, Ernest, Royal Technical Institute, Salford, Assistant Lecturer in Chemistry.

1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.

1904. Clark, Dr. Homer, c/o The Vacuum Varnish and Chemical Co., 6, Seaview Avenue, East Norwalk, Conn., U.S.A., Chemical Manufacturer.

O.M. Clark, Dr. J., 138, Bath Street, Glasgow, Analytical Chemist.

1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.

1906. Clark, M. H., c/o Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1902. Clark, Robt. M., Rockbank, Partickhill, Glasgow, Chemist.

1906. Clark, T. W. Firth, Laboratory, Johnson Street, Mile End, London, E., Analyst.

1906. Clark, Wm. B., 42, Robertson Street, Greenock, Chemist.

1907. Clark, Wm. H., 152, Newport Road, Middlesbrough, Analytical Chemist.

1903. Clark, Dr. W. Inglis, 104, South Canongate, Edinburgh, Manufacturing Chemist.

1902. Clark, Wm. Linus, Champion Coated Paper Co., Hamilton, Ohio, U.S.A., Chemist.

1904. Clarke, A. R., 613–617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.

1891. Clarke, Goddard, M.P., South Lodge, Champion Hill, S.E.; and (Journals) 60—64, Artillery Lane, London, E., Drysalter.

1903. Clarke, Robt. W., (Journals) c/o Clinical Research Association, Ltd., 1, Southwark Street, London, S.E., (subs.) 3, Aberdeen Villas, Chase Road, Southgate, N., Analyst.

1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.

O.M. Claudet, A. C., 6, Coleman Street, E.C.; and (Journals) 9, Daleham Gardens, Hampstead, N.W., Metallurgist.

1889. Claus, Wm. H., c/o Claus and Ree, Clayton, Manchester, Manufacturing Chemist.

O.M. Clayton, E. G., Chemical Laboratory, 23, Holborn Viaduct, London, E.C., Consulting Chemist.

1895. Clayton, Dr. G. C., Etonfield, Wavertree, Liverpool.

1891. Clayton, J. W., c/o Clayton and Jowett, Ltd., Concert Street, Liverpool, Essence Distiller.

1894. Clayton, Robt. H., Woodleigh, Blackfield Lane, Kersal, Manchester, Chemist.

1905. Clayton, W. E., Royal Victoria Yard, Deptford, S.E., Superintendent.

1907. Clement, Leonard, 13, Champion Park, Denmark Hill, London, S.E., Chemist.

1893. Clemes, J. H., The Bracken, Newquay, Cornwall.

1886. Cleminshaw, E., Alkali Works, Oldbury, near Birmingham, Technical Chemist.

1883. Clemons, G. H., Cudbear Street, Hunslet Road, Leeds, Dyeware Manufacturer.

1884. Clerk, Dugald, 18, Southampton Buildings, Chancery Lane, W.C., Engineer.

1899. Cleveland, D. B., 1403, First National Bank Building, Cincinnati, Ohio, U.S.A., Chemist.

1905. Clexton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein & Co.).

1906. Clifford, Jos., Ivy House, Prestbury, near Macclesfield, Chemist.

1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.

O.M. Cloud, T. C., 4, Lloyd's Avenue, Fenchurch Street, London, E.C., Metallurgist.

O.M. Clowes, Dr. F., 40, Craven Street, Charing Cross, W.C.; and the Grange, College Road, Dulwich, S.E., Chief Chemist (L.C.C.).

1891. Clutton, J. H., Elliott's Metal Co., Ltd., Burry Port, R.S.O., Carmarthenshire, Assayer.

1900. Clymer, Wm. R., c/o National Carbon Co., Cleveland, Ohio, U.S.A., Chemist.

1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.

1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.

1893. Cobb, Jno. W., Farnley Ironworks, near Leeds, Technical Assistant to Managing Director.

1904. Coblentz, Lambert, 1708, Sutter Street, San Francisco, Cal., U.S.A., Chemist.

1894. Coblentz, Dr. Virgil, College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Chemistry.

1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.

1898. Cochrane, A. Lynde, 9, Charles Street, Boston, Mass., U.S.A., Clerk (Cochrane Chemical Co.).

1901. Cockburn, John A., Ardeer, Stevenston, Ayrshire, Analytical Chemist.

1902. Cocking, Allan T., Carhampton House, Four Oaks, Sutton Coldfield, Ammunition Manufacturer.

1905. Coes, Chas. S., 119, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.

1906. Coffman, Herbert, 314, East Seneca Street, Ithaca, N.Y., U.S.A., Cement Works Chemist.

1903. Cofman-Nicoresti, J., 24, St. Gabriel's Road, Cricklewood, N.W., Chemist.

1903. Coggeshall, Dr. G. W., Chestnut Street, Dedham, Mass., U.S.A., Chemical Manufacturer.

1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.

1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.

O.M. Cohen, Dr. J., 13, Cardigan Road, Leeds, Analytical Chemist.

1897. Cohn, Alfred J., 122, East 74th Street, New York City, U.S.A., Chemist.

1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.

1904. Cohoe, Prof. W. P., 110, Park Road, Toronto, Canada, Professor of Chemistry.

1903. Colbert, W., British S.A. Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.

1891. Colby, Albert L., 217, West 110th Street, New York City, U.S.A., Metallurgical Engineer.

1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.

O.M. Colby, W. H., Carreg-wen, Aberystwith, Wales.

1893. Coleman, W. H., 78, Egerton Road, Withington, Manchester, Tar Works Chemist.

O.M. Collens, E., Vinegar Works, Stourport, Worcestershire, Manager.

1905. Collett, John H., Hillfield, Gloucester, Chemical Manufacturer.

1887. Collett, J. M., Hillfield, Gloucester, Chemical Manufacturer.

1901. Colley, Bernard T., c/o Velardena M. and S. Co., Velardena, Darango, Mexico, Assayer.

1903. Collier, Pierre, Companhia Industrial Pernambucana, Pernambuco, Brazil, Civil Engineer.

1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, N.B., Textile Chemist.

1898. Collingridge, Frank, 73, Fountain Road, Edgbaston, Birmingham, Chemist.

1883. Collins, J. H., Crinnis, Par Station, Cornwall, Technical Chemist.

1899. Collins, S. Hoare, Armstrong College, Newcastle-on-Tyne, Agricultural Chemist.

1888. Collins, W. Hepworth, c/o Edw. Wihl & Co., 17, Nicholas Street, Manchester, Analytical Chemist.

1899. Collis, Walter T., 89, Greenfield Road, Harborne, Birmingham, Chemist.

1891. Colman, Dr. H. G., Elmside, Worcester Park, Surrey, Analytical Chemist.

1892. Colquhoun, Lewis, c/o South African Explosives Co., Modderfontein, Transvaal, Analytical Chemist.

1894. Colquhoun, W., Plas Penyddol, Bersham, near Wrexham, North Wales, Engineer.

1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.

1906. Comber, A. W., Suramangalam, Salem District, South India, Manager (Magnesite Works).

1900. Comey, Arthur M., 12, Pearl Street, Boston, Mass., U.S.A., Technical Chemist.

1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.

1899. Conant, Francis M., Megansett, Mass., U.S.A., Chemical Engineer.

1906. Condit, Louis C., Chemical Laboratory, B. and O. R. R., Mount Clare, Baltimore, Md., U.S.A., Chemist.

1901. Connah, Jas., 12, Kiddepore Gardens, Hampstead, N.W., Government Analyst.

1905. Conner, Arthur B., 1070, Fort St. West, Detroit, Mich., U.S.A., Chemist.

1883. Connor, C. C., 4, Queen's Elms, Belfast, Ireland, Chemist.

1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.

1906. Conrau, Oliver, Sugar Estate "La Grange," St. Croix, Danish West Indies, Administrator.

1889. Conroy, Dr. Jas. T., Adirondack, Grassendale Park, Liverpool, Chemist.

1887. Constable, W. H., (Journals) Australian Alum Works, Runcorn; and (communications) Riversdale, Dee Banks, Chester, Analytical Chemist.

1902. Converse, W. A., Rooms 226—224, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.

O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.

1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.

1888. Cook, Jno. J., Atlas Foundry, St. Helens, Lancashire, Ironfounder.

1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.

1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.

1891. Cooke, Arthur W., c/o Brotherton and Co., Ltd., Holmes Street, Dewsbury Road, Leeds, Analytical Chemist.

1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.

1901. Cooper, T. S., 36, Demesne Road, Alexandra Park, Manchester, Calico Printing Chemist.

1891. Cooper, Walter J., The Elms, Lower Penarth, South Wales, Cement Works Manager.

1906. Cooper, William, Public Analyst's Laboratory, 67, Surrey Street, Sheffield, Analytical Chemist.

1897. Cooper, Wm. R., 113, Tulse Hill, S.W., Electrical Engineer.

1890. Corcoran, Bryan, 31, Mark Lane, London, E.C., Chemical Engineer.

1887. Cordner-James, J. H., Finsbury House, Blomfield Street, London, E.C., Mining Engineer.

1905. Cormack, Wm., c/o G. Nelson, Dale and Co., Ltd., Emscote Mills, Warwick, Chemist.

1899. Cornelison, Dr. Robt. W., Bloomfield, N.J., U.S.A., Consulting Chemist.

1906. Cornwell, R. de Vere, Salisbury, Rhodesia, Chemist.

1903. Corrêa de Brito, Dr. L., Rua do Commercio, 6, Recife, Pernambuco, Brazil, Civil Engineer.

1889. Corrie, David, c/o Nobel's Explosives Co., Ltd., Polmont Station, N.B., Technical Chemist.

1903. Cortright, R. M., 20, South Centre Street, Bethlehem, Pa., U.S.A., Assistant Chemist.

1894. Coste, J. H., 40, Craven Street, W.C., and (Journals) 54, Alconbury Road, Upper Clapton, N.E., Analytical Chemist.

1891. Cotton, W. F., Hollywood Roebuck, Co. Dublin, Gas Works Manager.

1905. Cotton, Wm. H., 16, Hauptstrasse, Höchst a/Main, Germany, Chemist.

1906. Coupe, Miles, 46, Millarbarn Lane, Waterfoot, near Manchester, Chemist.

1898. Coupe-Annable, H. W., c/o Tungsten and Rare Metals Co., Queen's Road, Battersea, S.W., Chemist.

1894. Court, Heywood, 67, Surrey Street, Sheffield, Analytical Chemist.

1898. Courtney, Samuel, 37, The Mount, Belfast, Ireland, Manager.

1894. Cousins, W. J., 17, Temple Chambers, Temple Avenue, E.C., Consulting Chemist and Director.

1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.

1903. Cowan, Wallace, 6, Salisbury Road, Edinburgh, Analytical Chemist.

1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.

1897. Cowburn, Arthur W., 29, Princess Street, Manchester, Chemical Merchant and Analytical Chemist.

1904. Cowee, Harvey D., 161, River Street, Troy, N.Y., U.S.A., Chemist.

1905. Cowles, Horace W., jun., Box 225, Hinsdale, Du Page Co., Ill., U.S.A., Assistant Chemist.

1891. Cownley, A. J., 225, Barry Road, Dulwich, S.E., Analytical Chemist.

1891. Cowper-Coles, Sherard Osborn, Grosvenor Mansions, Victoria Street, Westminster, S.W., Metallurgical Engineer.

1905. Cox, Harold N., 398, McDonough Street, Brooklyn, N.Y., U.S.A., Chemist.

1902. Coyle, Benj. C., City Laboratory, 17, Castle Street, Dublin, Analytical Chemist.

1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.

1895. Craig, Thos. J., Cathkin View, Clincarthill, Rutherglen, N.B., Chemist.

1904. Cramer, A., jun., 882, East 29th Street, Paterson, N.J., U.S.A., Chemist.

1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.

1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.

1898. Cranfield, Wm., 11, Avondale Place, Halifax, Yorks., Teacher of Chemistry.

1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.

1902. Craven, Alfd. B., 91, Fielding Terrace, Armley, Leeds, Analytical Chemist.

1889. Craven, Chas. E., Oak Villa, Bramley, near Leeds, Dyer.

1899. Craven, Jas, c/o Columbia Creosoting Co., Shirley, Ind., U.S.A., Chemist.

1906. Craven, J. A., 119, Town Street, Armley, Leeds, Chemist.

1891. Craven, Jno., jun., c/o Dominion Tar and Chemical Co., Ltd., Sydney, C.B., Canada, Chemist.

1906. Craven, John I., P. O. Box 3568, Boston, Mass., U.S.A., Chemist and Salesman.

1885. Craw, John, 15, Cadogan Street, Glasgow, Drysalter.

O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.

1890. Crawshaw, E., 25, Tollington Park, London, N., Dye Merchant.

1900. Crayen, Dr. Gustav, 354, West 23rd Street, New York City, U.S.A.

1905. Crean, Jno. F., 25, Abercromby Square, Liverpool, Oil Refiner.

O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and 9, Bridge Street, Westminster, S.W., Chemist.

1901. Cribb, Cecil, 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.

1905. Crighton, W. H., 138, Evering Road, Stoke Newington, N., Chemist.

1890. Criper, Wm. R., c/o Messrs. D. Weldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.

1902. Croasdale, Dr. Stuart, 1574, York Street, Denver, Colo., U.S.A., Mining Engineer and Metallurgist.

1889. Cronquist, Prof. A. Werner, Storksund, Stockholm, Sweden, Inspector General of Explosives.

1901. Cronquist, G. W., Hyllinge, Grufva, Sweden, Fire Brick Works Manager.

O.M. Crookes, Sir Wm., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.

1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.

O.M. Crosfield, A. L., 46, Bidston Road, Oxton, Birkenhead, (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.

1896. Crosfield, Capt. G. R., Volunteer Quarters, Sankey Street, Warrington, Soap Manufacturer.

1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.

1894. Crossley, Prof. Arthur W., Pharmaceutical Society, 17, Bloomsbury Square, London, W.C., Professor of Chemistry.

1904. Crossley, T. Linsey, c/o Nashua River Paper Co., East Pepperell, Mass., U.S.A., Analytical Chemist.

1892. Crossman, Tom, Albion Brewery, Coldhurst Street, Oldham, Brewing Chemist.

1894. Crow, Henry W., 94, Romford Road, Stratford, E., Tar Distiller.

1884. Crow, Dr. J. K., 2, Ulundi Road, Blackheath, S.E., Technical Chemist.

1902. Crowell, Henry H., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Dyer.

1893. Crowther, Edw., Woodland Dyeworks, Headingley, Leeds, Dyer.

1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.

1899. Crowther, J., Tenuta Etrusca Miniere, Campiglia Marittima, Toscana, Italy, Metallurgist.

1906. Crowther, R. E., c/o Mark Fletcher and Sons, Ltd., Moss Lane, Whitefield, Manchester, Chemist.

1884. Crowther, Walter M., Chemical Works, Gomersal, near Leeds, Manufacturing Chemist.

1884. Crumbie, W. D., 146, Washington Street, East Orange, N.J., U.S.A., Analytical Chemist.

1906. Cruser, Dr. Fred. Van D., c/o Union Metallic Cartridge Co., Bridgeport, Conn., U.S.A., Chemical Engineer.

1902. Crush, E. H., 3, Westcombe Park Road, Blackheath, S.E., Technical Chemist.

1892. Cullen, Wm. Dynamite Factory, Modderfontein, Transvaal, Chemist.

1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.

1897. Culmann, Dr. Julius, c/o G. Siegle und Co., 79, Duane Street, New York City, U.S.A., Chemist and Colourist.

1905. Culver, Ralph F., 16, Quincy Street, North Adams, Mass., U.S.A., Chemist.

1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.

1905. Cuming, R. Burns, Currie Street, Adelaide, South Australia, Manufacturing Chemist.

1897. Cunliffe, Albert J., Claytonfield, Clayton-le-Woods, Chorley, Lancashire, Calico Printer.

1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.

1906. Cunnington, Alfred V., c/o Brunner, Mond and Co., Ltd., Northwich, Cheshire, Chemical Works Manager.

O.M. Curphey, W. S., 7, Derby Crescent, Kelvinside, Glasgow, Alkali Works Inspector.

1902. Currier, Edw. Eug., 74, Fremont Avenue, Everett, Mass., U.S.A., Chemist.

1898. Curtis, Marvin, 103, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.

1903. Cushing, Robt. P., c/o Kistler, Lesh & Co., Lock Haven, Pa., U.S.A., Chemist.

1902. Cutbush, Chas. G., 149, Westcombe Hill, Blackheath, S.E., Electrical Engineer.

1899. Cutler, Fred. F., 183, Essex Street, Boston, Mass., U.S.A., Publisher.

1904. Cutts, Henry E., 55, Fulton Street, New York City, U.S.A., Technical Chemist.

D

O.M. Dacie, J. C., Soap Works, Putney, S.W., Soap Manufacturer.

1906. Dains, F. B., Washburn College, Topeka, Kas., U.S.A., Professor of Chemistry.

1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.

1905. Dalal, Vasanji Premji, Nepean Sea Road, Malabar Hill, Bombay, Lecturer on Chemistry.

1904. Dale, G., Waverley Terrace, Hood Lane, Warrington, Technical Chemist.

1907. Dalley, Henry, 9, East 69th Street, New York City, U.S.A., President.

1905 Dampney, Gerald F., Hunter's Hill, Sydney, N.S.W., Australia, Paint Manufacturer.

1884. Daniell, Louis C., (Journals) Royal Standard Brewery, Tamworth, New South Wales; and (subs.) c/o W. T. Allen and Co., 132, Queen Victoria Street, London, E.C., Brewer.

1904. Danker, Dan. J., 247, Atlantic Avenue, Boston, Mass., U.S.A., Dyestuff and Chemical Manufacturer.

1905. Danker, Fred E., 73, Sawyer Avenue, Dorchester, Mass., U.S.A., Salesman (Oakes Manufacturing Co.).

1903. Dannenbaum, Dr. H., National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.

1902. Danziger, Jos. L., 259, West 112th Street, New York City, U.S.A., Analytical Chemist.

1885. Darby, Jno. H., Brymbo Hall, near Wrexham, Ironmaster.

1894. Darling, G. A., P.O. Box 3720, Johannesburg, Transvaal, S.A., Metallurgical Chemist.

O.M. Darling, W. H., 26, Dover Street, Manchester, Analytical Chemist.

1887. Davenport, Dr. B. F., 161, Tremont Street, Boston, Mass., U.S.A., Consulting Chemist.

1900. Davidson, Alex., jun., 8, Traquair Park, Corstorphine, Midlothian, N.B., Analytical Chemist.

1899. Davidson, Charles, 328, Golfhill Drive, Dennistoun, Glasgow, Analytical Chemist.

1905. Davidson, Frank A., 182, Mount Vernon Street, West Roxbury, Mass., U.S.A., Pharm. Chemist.

1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.

1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.

1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.

O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.

1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.

1905. Davidson, Thos. A., c/o Naylor Bros., Varnish Works, Southall, Middlesex, Chemist.

1905. Davidson, Dr. Wm. B., City Gas Works, Saltley, Birmingham, Chemist.

1889. Davies, G. W., 8, Spring Hill, Stockport, Chemical Lecturer.

1906. Davies, Harry R., 58, Hamilton Street, Readville, Mass., U.S.A., Chemist.

1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.

1907. Davies, James, 16, Suffolk Street, Rotherhithe, London, S.E., Scientific Apparatus Maker.

1896. Davies, Llewellyn J., 103, Bute Road, Cardiff, Analytical and Consulting Chemist.

1886. Davies, M. Lloyd, North American Chemical Co., Bay City, Mich., U.S.A., Alkali Works Manager.

1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., Cocoa Works, York, Research Chemist.

1903. Davies, Thomas, 56, Wellesley Street, Toronto, Ont., Canada, Manufacturer.

1900. Davis, Arthur C., 2, Downing Grove, Cambridge, Cement Maker.

O.M. Davis, A. R., Fern Bank, Hawarden, Flintshire, Analytical Chemist.

1901. Davis, Bernard F., c/o Borneo Co., Bidi, Sarawak, Metallurgical Engineer.

1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.

1902. Davis, Emerson, 30, Watson Street, Detroit, Mich., U.S.A., Chemist.

1893. Davis, Fred., 51, Imperial Buildings, Ludgate Circus, London, E.C., Consulting Chemist.

O.M. Davis, George E., 265, Strand, London, W.C., Chemical Engineer.

O.M. Davis, H. W., Government Laboratory, Clement's Inn Passage, Strand, W.C., Analytical Chemist.

1[illegible]. Davis, V. P., c/o American Sheet and Tin Plate Co., Vandergrift, Pa., U.S.A., Chemist.

1897. Davis, Wm. A., [illegible], Quenington Mansions, Rostrevor Road, Fulham, S.W., Chemist.

1905. Davison, Alex. Young, 219, Pleasant Street, Winthrop, Mass., U.S.A., Dyestuff and Chemical Merchant.

1900. Daw, Fred W., Alexander Place, Ebbw Vale, Mon., Metallurgical Chemist.

1903. Dawes, Arthur W., 3, Madison Place, Albany, N.Y., U.S.A., Chemist.

O.M. Dawson, C. A., 40, Russell Road, Sefton Park, Liverpool, Technical Chemist.

1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals) 187, Eglinton Road, Woolwich, S.E., Technical Chemist.

1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.

O.M. Deacon, H. Wade, 8, Ullet Road, Liverpool; and (Journals) c/o F. W. Wright, 22, Peel House Lane, Widnes, Alkali Manufacturer.

O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.

1903. Dean, Harry, 23, Spinkfield Road, Birkby, Huddersfield, Chemist.

1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.

1899. Deane, Leopold M., 5, Whitehall Road, Rugby, Explosives Chemist.

1905. Dearman, E., c/o The Lavers Manufacturing Co., Ltd., Woolwich, N.S.W., Australia, Tar Distiller.

1892. Deaville, B., Beech Avenue, Nottingham, Manufacturing Chemist.

1903. De Blois, W. H., c/o General Chemical Co., Hudson Heights, N.J., U.S.A., Chemist.

1899. De Castro, J. Paul, Laboratory, Effingham House, Arundel Street, Strand, W.C., Consulting Chemist and Assayer.

1902. De Cew, J. A., 14, Sun Life Building, Montreal, Canada, Chemist.

1893. De Clerck, Maurice, Heule-lez-Courtrai, Belgium.

1884. Deering, W. H., Chemical Department, Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1900. Deerr, Noel, Blairmont, Berbice, British Guiana, Analytical Chemist.

1902. Deghuée, Dr. Jos. A., 247, Harrison Street, Brooklyn, N.Y., U.S.A., Chemist.

1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.

1893. Delahaye, Philibert, 105, Rue St. Lazare, Paris (IX.), Gas Engineer.

1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.

1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.

1904. Dempwolf, Chas., jun., 713, South George Street, York, Pa., U.S.A., Chemical Manufacturer.

1899. Denham, Wm. S., 2, Kelvinside Terrace North, Glasgow, Chemist.

1891. Denison, Joseph R., Lingholme, Heaton, Bradford, Yorks., Analytical Chemist.

1898. Dent, Dr. Frankland, Government Analyst's Laboratory, Singapore, S.S., Consulting Chemist.

1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.

1901. Devas, Dr. Ernest W., Fairview, Hale Grove, Edgware, N.W., Technical Chemist.

1906. Deverell, Louis C., c/o Straits Trading Co., Ltd., Singapore, S.S., Chief Chemist.

1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.

O.M. Dewar, Sir J., F.R.S., Royal Institution, Albemarle Street, W. (Journals); and 1, Scroope Terrace, Cambridge, Professor of Chemistry and Physics.

1889. Dewey, Fred. P., Lanier Heights, Washington, D.C., U.S.A., Metallurgist.

1904. Dewhirst, J. A., Borough Laboratory, Halifax, Yorks., Analyst.

1891. De Wilde, Prof. P., 1, Quai du Léman, Geneva, Switzerland, Professor of Chemistry.

1903. Diamond, Wm., c/o Simon-Carves, Ltd., Barrow Collieries, near Barnsley, Yorks., Works Manager.

O.M. Dibdin, W. J., Edinburgh Mansions, Howick Place, S.W.; and (Journals) Purley Bury, Purley Downs Road, Sanderstead, Surrey, Analytical Chemist.

1897. Dick, Jno., c/o Jno. Dick, Ltd., 77, York Street, Toronto, Ont., Canada, Manufacturer.
1902. Dick, Jno., Wharf Road, Cubitt Town, London, E., Manager and Chemist.
1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Street, Glasgow, Analytical Chemist.
1896. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, E.C., Secretary.
1904. Dickenson-Gair, C. J., 55, Lyham Road, Brixton, S.W., Analytical Chemist.
1902. Dickerman, Prof. Judson C., University of Wisconsin, Madison, Wis., U.S.A., Professor of Chemistry.
1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.
O.M. Dickinson, A. J., 57, Lewisham High Road, New Cross, S.E., Tar Distiller.
1905. Dickinson, Cyril, Abbotsford, Hollycroft Avenue, Hampstead, N.W., Analytical Chemist.
1898. Dickson, Samuel, 2, Broadway, Westminster, S.W., Analytical Chemist.
1899. Dieckmann, Dr. Otto, 1182, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.
1901. Diehl, Oscar C., c/o Saginaw Salt Co., St. Charles, Mich., U.S.A., Chemist.
1894. Diestel, Wm., 128, Duane Street, New York City, U.S.A., Dyestuff Importer.
1906. Dillon, Fred N., 16, Prospect Street, Fitchburg, Mass., U.S.A., Engineer.
1898. Dillon, Wm., Highfield, Wetherby, Yorks, Oil, Colour, and Varnish Manufacturer.
O.M. Divers, Dr. E., F.R.S., 3, Canning Place, Palace Gate, Kensington, W., Professor of Chemistry.
1903. Divine, Robt. E., c/o W. E. Garrigues, Foot of Leib Street, Detroit, Mich., U.S.A., Chemist.
1899. Dixon, Fred W., 557, West 144th Street, New York City, U.S.A., Dyer.
1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.
1884. Dixon, Wm., 102, Spring Street, Bury, Lancashire, Science Master.
1902. Dixon, Wm. A., 97, Pitt Street, Sydney, N.S.W., Australia, Public Analyst and Assayer.
1892. Dobb, Thos., c/o J. T. Dobb & Son, West Bar, Sheffield, Pharmaceutical Chemist.
O.M. Dobbie, Dr. J. J., F.R.S., Royal Scottish Museum, Chambers Street, Edinburgh, Director.
1901. Dobbie, Jas., Laurel Bank, Broomfield Road, Ayr, N.B., Tanner.
O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.
1906. Dobson, Samuel, 22, Dangan Road, Cambridge Park, Wanstead, N.E., Paint Works Manager.
1890. Dodd, A. J., Heathfield House, Belvedere, Kent, Works Manager.
1889. Dodd, W. Ralph, Trederwen, Village Road, Enfield, Middlesex, Chemical Works Manager.
1906. Dodds, Thos., c/o Reckitt & Sons, Ltd., and (Journals) 3, Morrill Street, Holderness Road, Hull, Works Manager and Chemist.
1900. Dodge, Dr. Francis D., 291, Henry Street, Brooklyn, N.Y., U.S.A., Chemist.
1907. Dodge, Frank E., 6951, Hegeman Street, Tacony, Pa., U.S.A., Chemist.
1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.
1897. Doerflinger, Wm. F., c/o Acker Process Co., Niagara Falls, N.Y., U.S.A., Research Chemist.
1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.
1905. Dolan, H., Dunesk, Grappenhall Road, Stockton Heath, Warrington, Chemist.
1903. Dole, Richard B., c/o U.S. Geological Survey, Washington, D.C., U.S.A., Chemist.
1897. Dolge, Carl B., Westport, Conn., U.S.A., Manufacturer of Instruments and Antiseptics.
1903. Donald, Dr. Jas. T., 112, St. Francois Xavier Street, Montreal, Canada, Consulting Chemist.
1906. Donald, Richard A., 80, King Street East, Toronto, Canada, Wood Distiller.
O.M. Donald, W., Saltcoats, N.B., Analytical Chemist.
1900. Donald, Wm., Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.
1902. Donaldson, Thos., c/o South African Explosives Co., Ltd., Modderfontein, Transvaal, Chemist.
1905. Donnan, Prof. F. G., Physico-Chemical Laboratory, The University, Liverpool, Professor of Physical Chemistry
1886. Doolittle, Orrin S., c/o Semet Solvay Co., 100, William Street, New York City, U.S.A., Chemist.
1905. Doolittle, Roscoe E., 17, South 13th Street, Newark, N.J., U.S.A., Chemist.
1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.
1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.
O.M. Dott, D. B., Ravenslea, Musselburgh, N.B., Analytical Chemist.
1906. Doty, Henry D., c/o Manhattan Rubber Manufacturing Co., Passaic, N.J., U.S.A., Chemist.
1897. Douglas, Geo., Heather Bank, Bingley, Yorks., Dyer.
1894. Douglas, Loudon M., 3, Lauder Road, Edinburgh, Chemical Manufacturer.
1884. Douglas, William, Diamond Plantation, Demerara, British Guiana, Chemical Engineer.
1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.
1900. Dow, Dr. Allan W., 73, Upper Mountain Avenue, Montclair, N.J., U.S.A., Chemist.
1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.
1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.
1885. Dowson, J. Emerson, 39, Victoria Street, Westminster, S.W., Civil Engineer.
1901. Doxrûd, Christian, Christiania, Norway, Professor of Chemical Technology.
1902. Drake, Bryant S., Barksdale, Wis., U.S.A., Chemist.
1885. Drake, Chas. A., Three Mills Distillery, Bromley-by-Bow, E., Brewer.
1886. Dreaper, W. P., 41, Quilter Road, Felixstowe, Suffolk, Technical Chemist.
O.M. Drew, D., Lower House Print Works, near Burnley, Calico Printer.
1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
O.M. Dreyfus, Dr. C., Clayton Aniline Co., Ltd., Clayton, Manchester, Dye Manufacturer.
1905. Dreyfus, Dr. Isaac, c/o Schoellkopf & Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chief Chemist.
1904. Dreyfus, Dr. L. A., c/o The Muralo Co., New Brighton, N.Y., U.S.A., Chemist.
1893. Dreyfus, S., 1, Sunnyside Terrace, North Road, Clayton, Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 162, East 95th Street, New York City, U.S.A., Chemist.
1899. Drobegg, G., 81, Maiden Lane, New York City, U.S.A., Superintending Chemist.
1889. Drummond, Hon. Sir George, K.C.M.G., Montreal, Canada.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1904. Dubois, Dr. Norman A., 22, Hawthorne Avenue, Yonkers, N.Y., U.S.A., Instructor in Chemistry.
1903. Dubuque, Edwin D., 310, Realty Building, Elmira, N.Y., U.S.A., Chemist.
1899. Ducas, B. P., 151, Front Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1907. Ducca, Dr. Wilhelm, 315, Avenue C., Bayonne, N.J., U.S.A., Chemist.
1905. Duché, E., 6, Eastcheap, London, E.C., Merchant.
1897. Duckham, Alex., Phœnix Wharf, West Ferry Road, Millwall, E., Works Chemist.
1905. Duckworth, Harry S., Dover, N.H., U.S.A., Printworks Chemist.
1890. Dudley, Dr. C. B., 1219, 12th Avenue, Altoona, Pa., U.S.A., Analytical Chemist.
1887. Dudley, Prof. W. L., Vanderbilt University, Nashville, Tenn., U.S.A., Professor of Chemistry.

1906. Duerr, E. Oliver, Alan Drive, Hale, Cheshire, Fruit Preserver.
1899. Duff, Wm. S., Sebert Villa, Bushwood, Leytonstone, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Las Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1901. Dufty, Lawrence, 8, Clarke Street, Sheffield, Analytical Chemist.
1905. Duggan, Edw. J., The Charles E. Sholes Co., 164, Front Street, New York City, U.S.A., Vice-President.
O.M. Duggan, T. R., 60, Foyle Road, Blackheath, S.E., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd., (Journals) Elberfeld, Germany; (subscriptions) 19, St. Dunstan's Hill, E.C., Chemist.
1905. Dukes, Bernhard, 1, Great James Street, Bedford Row, London, W.C., Patent Agent.
1888. Dukes, T. William, Box 10, Vryheid, South Africa, Merchant.
1906. Duncalfe, Roger, Forge Mills, Bestwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., 1, Trafalgar Road, Higher Bentcliffe, Pendleton, Manchester, Analytical Chemist.
1904. Duncan, R. A., P.O. Box, 509, Honolulu, Hawaii, Chemist.
1904. Duncan, Wm. Wheeler, 406, Massachusetts Avenue, Boston, Mass., U.S.A., Chemist.
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.
1898. Dunham, Edw. K., 338, East 26th Street, New York City, U.S.A., Professor of Bacteriology and Hygiene.
1905. Dunlop, Harry, Cragdarroch, Cove, Dumbartonshire, Chemist.
1892. Dunn, Fred., 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
O.M. Dupré, Dr. A., F.R.S., Edinburgh Mansions, Howick Place, S.W., Consulting Chemist.
1905. Durand, Halsey, Dept. of Health, 55th Street and 6th Avenue, New York City, U.S.A., Chemist.
1897. Durant, H. T., P. O. Box 603, Buluwayo, Matabeleland, South Africa, Metallurgist.
1905. Durfee, Winthrop C., 190, High Street, Boston, Mass., U.S A., Manufacturing Chemist.
1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Assistant Professor of Chemistry.
1907. Durrans, Thos. H., 1, Cornwall Terrace, Regent's Park London, N.W., Chemist.
[illegible] Duryea, Chester B., c/o Edwardsburg Starch Co., Cardinal, Ont., Canada, Starch Manufacturer.
1906. Dushman, Saul, School of Practical Science, Toronto, Canada, Electrochemist.
1891. Dvorkovitz, Dr. P., 45, St. Mary Axe, London, E.C., Technical Chemist.
1903. Dyck, George E., c/o Virginia Carolina Chemical Co., Station C., Memphis, Tenn., U.S.A., Analytical Chemist.
O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
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E

1905. Eager, Chas. E., 124, High Street, Boston, Mass., U.S.A., Merchant.
1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.
1899. Earnshaw, Edward H., c/o The Union Gas and Electric Co., 4th and Plum Streets, Cincinnati, Ohio, U.S.A., Chemist.
O.M. Earp, W. R., c/o Rowland A. Earp, Buckfastleigh, Devon, Chemical Manufacturer.
1902. Easterbrooks, Frank D., Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.
1884. Eastick, C. E., 7, King Edward Street, Whitechapel, E., Sugar Works Manager.
O.M. Eastick, J. J., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Petroleum Works Manager.
1905. Easton, Herbert Fyfe, Herodsfoot, St. Keyne, R.S.O., Cornwall, Manager of Explosives Factory.
1891. Eastwick, Jos. H., 2216, North 51st Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Eastwood, Edw., 7, Bolton Road, Port Sunlight, Birkenhead, Soapmaker.
1902. Eastwood, Robert F., 90, Peel House Lane, Widnes, Chemist.
1906. Eaton, B. J., Institute of Medical Research, Kuala Lumpur, Selangor, Fed. Malay States, Government Chemist.
1903. Eaton, Edward N., 1628–315, Dearborn Street, Chicago, Ill., U.S.A., Chemist.
1902. Eckel, Edwin Clarence, U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
1892. Eddy, Harrison P., Sewage Purification Works, Worcester, Mass., U.S.A., Superintendent.
1901. Eddy, W. Clifton, corner of Glover and Penn Streets, Woodbury, N.J., U.S.A., Superintendent.
1894. Ede, Henry E., 10, Violet Bank, Nether Edge, Sheffield, Chemist.
1885. Edge, Anthony, 79, Milton Street, Readville, Mass., U.S.A., Chemist.
1900. Edgerley, Daniel W., Chilton Paint Co., 120, High Street, Boston, Mass., U.S.A., Chemist.
1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.
1902. Edwards, H. Seaton, 19, Park Road, Port Sunlight, Cheshire, Analyst.
1903. Edwards, R. S., Columbia Hotel, Portland, Maine, U.S.A., Chemist.
1906. Egleson, J. E., Capelton, Quebec, Canada, Chemist.
1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.
1896. Ehrhardt, Ernest F., Badische Anilin und Soda Fabrik, Ludwigshafen a/Rhein, Germany, Research Chemist.
1895. Ekenberg, Dr. M., 72, Victoria Street, Westminster, S.W., Technical Chemist.
1885. Elborough, T., 59, Mark Lane, London, E.C., Manure Manufacturer.
1901. Elkan, Leo A., 594, Dearborn Avenue, Chicago, Ill., U.S.A., Tanner.
1901. Elkins, Arthur W., 520, Park Avenue, East Orange, N.J., U.S.A., Civil Engineer.
1884. Elliott, Dr. A. H., Consolidated Gas Co., 4, Irving Place, New York City, U.S.A., Chemist.
1906. Elliott, Edward, c/o Reckitt and Sons, Ltd., Bourke Street, Redfern, Sydney, N.S.W., Chemical Engineer.
1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.
1896. Elliott, Dr. J. F., c/o Grimwade and Co., 6, Trinity Square, E.C.; and (Journals), O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.
1904. Elliott, Philip, c/o Lanosoap, Ltd., Marion Street Works, Bradford, Yorks, Works Chemist.
1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.
1906. Ellis, Arthur E., 7, West 129th Street, New York City, U.S.A., Chemist.
1905. Ellis, Carleton, 168, South Broadway, White Plains, N.Y., U.S.A., Chemical Engineer.
1885. Ellis, C. J., Almorah Villa, Milngavie, near Glasgow, Technical Chemist.
1893. Ellis, E. Victor, 7, Hillside Crescent, Edinburgh, Analytical Chemist.

1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.

O.M. Ellis, H., 120, Regent Road, Leicester, Chemical Merchant.

1907. Ellis, Theodore H., 641, Calvert Building, Baltimore, Md., U.S.A., Oil Refiner.

1891. Ellis, Prof. W. Hodgson, School of Practical Science, Toronto, Ont., Canada, Professor of Applied Chemistry.

1891. Ellison, Henry, Northfield, Cleckheaton, Yorks., Manufacturing Chemist.

O.M. Elmore, A. S., 4, Broad Street Place, London, E.C., Electro-Metallurgist.

1907. Elsden. A. Vincent, 77, Coleraine Road, Blackheath, S.E., Analytical Chemist.

1904. Elson, J. Hugh, Monroe Drug Co., Unionville, Mo., U.S.A., General Manager.

1901. Emerson, Dr. W. H., Georgia School of Technology, Atlanta, Ga., U.S.A., Professor of Chemistry.

1902. Emery, Arthur L., c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A., Chemical Engineer.

1905. Emery, Delevan, Bradford, Pa., U.S.A., Oil Refiner.

1899. Emery, E. G., Pinole, Contra Costa Co., Cal., U.S.A., Technical Chemist and Engineer.

1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.

1907. Emrich, Horace H., Perth Amboy Plant, Am. S. and R. Co., Mauser, N.J., U.S.A., Mining Engineer.

O.M. Endemann, Dr. H., 23, William Street, New York City, U.S.A., Analytical Chemist.

1897. Enequist, Erik W., 1651, New York Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1894. Enequist. John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.

1904. Englehard, Charles, 41, Cortlandt Street. New York City, U.S.A., Platinum Importer.

1895. English, Frank H., 47, Shelley Avenue, East Ham, E., Analytical Chemist.

1899. Enright, Bernard, c/o St. Louis Portland Cement Co., St. Louis, Mo., U.S.A., Chemist.

1906. Ephraim, Dr. Julius, Kőniggraetzerstrasse 69, Berlin, S.W., 11, Germany, Chemist and Patent Agent.

1904. Erdmann, Prof. Dr. H., Bismarck Strasse 12 II., Charlottenburg, Berlin, Professor of Inorganic Chemistry.

1907. Erdoes, Julius, 242, East 122nd Street, New York City, U.S.A., Chemical Engineer.

1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.

1904. Ermen, Walter F. A., 10, Marsden Street, Manchester, Analytical Chemist.

1905. Ernst, C. A., Lansdowne, Pa., U.S.A., Chemist.

1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.

1897. Escher, Paul, c/o Smith, Emery and Co., 1068, Broadway, Oakland, Cal., U.S.A., Chemist.

1884. Esilman, A., 25, Roe Lane, Southport, Lancashire, Analytical Chemist.

O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.

1905. Etheridge, Arthur T., 22, Ardoch Crescent, Stevenston, Ayrshire, N.B., Chemist.

1903. Euler, C. G., 18-20, Platt Street, New York City, U.S.A., Agent for Essential Oils.

1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.

1898. Evans, Ernest D., The Western Tanning Co., Bedminster, Bristol, Tanner.

1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.

1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.

1905. Evans, Jacob V. R., Ridgway, Pa., U.S.A., Chemist.

1904. Evans, James Rittenhouse, 19, High Street, Pottstown, Pa., U.S.A., Chemist.

1883. Evans, Sir John, K.C.B., F.R.S., Britwell, Berkhamstead. Herts, Paper Maker.

1905. Evans, John, 67, Surrey Street. Sheffield. Analytical Chemist.

1889. Evans, R. E., 3, Glencoe, Stratford-on-Avon, Brewing Chemist.

1896. Evans, Dr. Thos., University of Cincinnati, Ohio, U.S.A., Instructor in Technical Chemistry.

1903. Evans, Wm. J., 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.

1904. Everitt, Walter, 83, The Grove, Ealing, W., Analyst.

O.M. Evershed, F., c/o Clarke, Nickolls and Coombs, Hackney Wick, N.E., Chemist.

1903. Evershed, John, Union Oil Mills, Copenhagen Place, Limehouse, E., Chemist.

1907. Eves, Archie P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.

1894. Ewan, Dr. Thos., 57, Montgomerie Street, Kirklee, Glasgow, Chemist (Aluminium Co.).

1904. Ewing, Dr. A. Ramsay, 1, Alton Gardens, Hillhead, Glasgow, Technical Chemist.

1892. Exley, Arthur, Braemore, Vesper Road, Kirkstall, Leeds, Tanner.

1905. Eynon, Lewis, 57, Darenth Road, Stamford Hill, N., Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Deutsche Gold und Silber Scheide-Anstalt, Frankfort a/M., Germany, Chemist and Director.

O.M. Fahlberg, Dr. C., Nassau a/Lahn, Germany, Manufacturing Chemist.

1902. Fahrig, Dr. Ernst., 3642, Old York Road, Philadelphia, Pa., U.S.A., Consulting Chemical Engineer.

1902. Faill, Jas., 51, Partickhill Road, Glasgow, Technical Chemist.

1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.

1905. Fairchild, Jno. G., 150, Rodney Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Fairhall, E. J., c/o A. Boake, Roberts & Co., Ltd., 4, Rue Lamartine, Lille (Nord), France, Chemist.

O.M. Fairley, T., 17, East Parade, and (Communications) 8, Newton Grove, Leeds, Analytical Chemist.

O.M. Fairlie, H. C., Camelon Chemical Works, Falkirk, N.B., Chemical Manufacturer.

1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, N.B., Manufacturing Chemist.

1894. Fairweather, Wallace, 62, St. Vincent Street, Glasgow, Patent Agent.

1902. Fairweather, Wallace C., 65-66, Chancery Lane, W.C., Engineer.

1898. Falding, F. J., 55, Broadway, New York City, U.S.A., Chemical Engineer.

1891. Fallon, J. H. M., Boulhaf-le-Dyr, Ligne de Tebessa, Algeria, Fertiliser Expert.

1897. Farmer, John E., Beddington Farm, near Croydon, Assistant Manager (Sewage Works).

O.M. Farrant, N., c/o J. Nicholson and Sons, Chemical Works, Hunslet, Leeds, Chemist.

1897. Farrell, Frank J., 44, Prince of Wales Mansions, Battersea Park, S.W., Analytical Chemist.

O.M. Farries, T., 12, Coleman Street, London, E.C., Manufacturing Chemist.

O.M. Farrington, T., 5, Summerhill Terrace, Cork, Ireland, Chemical Engineer.

1902. Fasnacht, E. A., The Hollies, Clayton Bridge, Manchester, Technical Chemist

O.M. Faulkner, F., The Laboratory, 65, Bath Row, Birmingham, Consulting Brewer's Chemist

1891. Fawcett, Jas. H., c/o Bank of Australasia, 4, Threadneedle Street, London, E.C., Metallurgist.

1884. Fawsitt, C. A., Atlas Chemical Works, East Nelson Street, Glasgow, Chemical Manufacturer.

1903. Fawsitt, Dr. Chas. E., 9, Foremount Terrace, Glasgow, Assistant in Chemistry.

1906. Feeley, Edward J., 88, Broad Street, Boston, Mass., U.S.A., Aniline Colour Dealer.

1903. Feilmann, Dr. M. E., 92, Victoria Street, Westminster, S.W., Chemist.

1892. Feld, Walther, Hauptstrasse 14, Zehlendorf-Warmseebahn, Germany, Chemical Works Director.

1905. Felton, Herbert L., 524, East Second Street, South Boston, Mass., U.S.A., Distiller.

1899. Ferguson, Geo., Gleniffer Soap Works, Paisley, N.B., Soap Manufacturer.

1900. Ferguson, Geo. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Professor of Analytical Chemistry.

1896. Ferguson, J. Hart, Loch Katrine Distillery, Camlachie, Glasgow, Distillery Manager.

O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.

1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.

1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.

1905. Fernberger, Harry M., Dollar Bay, Houghton Co., Mich., U.S.A., Chemist.

1906. Fernyhough, F., The Abbey Cottage, Leek, Staffordshire, Printworks Manager.

1905. Fiebiger, Peter, 530, Canal Street, New York City, U.S.A., Colour Chemist.

1893. Fiebing, John H., 644, 28th Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.

1905. Field, Charles, III., 57, Waban Hill Road, Chestnut Hill, Mass., U.S.A., Research Chemist.

1885. Field, E. W., Cloud House, Sandiacre, near Nottingham, Brewer.

1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.

1891. Field, Wm. Eddington, 65, Sutherland Road, Armadale, Melbourne, Victoria, Chemist.

1884. Filcock, P., Sunny Bank, Prestbury Road, Macclesfield, Analytical Chemist.

1900. Fillis, Frank, Brookland, London Road, Neath, South Wales, Cement Works Manager.

1907. Finch, Archibald M., Vitriol and Chemical Works, Cwmbran, R.S.O., Monmouthshire, Chemical Manufacturer.

1904. Finch, Martin L., Vitriol and Chemical Works, Cattedown, Plymouth, Chairman of Directors.

1905. Findlay, Dr. Alex., The University, Birmingham, Lecturer on Physical Chemistry.

1899. Finzland, Jno. J., Sandon, B.C., Canada.

1899. Finley, Norval H., 7229, Hermitage Street, Belmar Station, Pittsburg, Pa., U.S.A., Chemist.

1904. Finn, Cornelius P., Pontefract Road, Castleford, Yorks, Technical Chemist.

1903. Fischer, Dr. Carl, 213–215, Water Street, New York City, U.S.A., Chemist.

1903. Fish, Chas. C. R., 10, Park Square, Boston, Mass., U.S.A., Chemist.

1905. Fish, Chas. H., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Textile Manufacturer.

1900. Fisher, Henry, 57, East 83rd Street, New York City, U.S.A., Teacher of Chemistry.

O.M. Fisher, W. W., 5, St. Margaret's Road, Oxford, Chemical Lecturer.

1906. Fiske, Aug. H., 141, Milk Street, Boston, Mass., U.S.A., Chemist.

1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.

1904. Fitch, A. J., 19, Grange Road, Canonbury, N., Brewer's Chemist.

O.M. Fitzbrown, G., Ditton Copper Works, Widnes, Metallurgist.

1897. Fitzgerald, Francis A. J., Fitzgerald and Bennie Laboratories, P.O. Box 29, Niagara Falls, N.Y., U.S.A., Chemical Engineer.

1902. FitzGibbon, Thos., 115, Harbord Street, Fulham, S.W., Analytical Chemist.

1900. Fitz-Randolph, R. B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.

1906. Flammer, E., c/o Kraemer and Flammer, Heilbronn a/N., Germany, Manufacturing Chemist.

1901. Flavelle, Jos. W., Toronto Technical School, College Street, Toronto, Canada, Chemist.

1892. Fleming, J. Arnold, Britannia Pottery, 136, Glebe Street, Glasgow, Potter.

1903. Fleming, Jno. A., 1757, Willard Street, N.W., Washington, D.C., U.S.A., Engineer.

O.M. Fletcher, A. E., Coombe Lea, Dorking, Surrey, Ex-Chief Inspector Alkali, &c., Works.

1893. Fletcher, E. Morley, 3, Woodhouse Cliff, Leeds, Alkali Works Inspector.

O.M. Fletcher, F. W., c/o Fletcher, Fletcher & Co., Ltd., Holloway, N., Manufacturing Chemist.

1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.

1904. Fletcher, Wm. E., Box 83, Tamaqua, Pa., U.S.A., Chemist.

1899. Focht, Louis, 105, E. Hanover Street, Trenton, N.J. U.S.A., Civil Engineer.

1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.

1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.

1900. Fogetti, Lucien, 4070, Lake Avenue, Chicago, Ill., U.S.A., Chemist.

1895. Fogg, Chas. A., Graythorne, Albert Road, Bolton-le-Moors, Lecturer on Chemistry.

1901. Folsom, Herbert A., 112, Water Street, Boston, Mass., U.S.A., Textile Chemist.

1900. Forbes, Eli, Clinton, Mass., U.S.A., Chemist.

1895. Forbes, Paul R., 15, William Street, New York City, U.S.A., Chemist and Assayer.

1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.

1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.

1905. Foregger, Dr. R. von, c/o Roessler & Hasslacher Chemical Co., 100, William Street; and (Journals) P.O. Box 1999, New York City, U.S.A., Chemist.

1899. Forel, Geo., 18, Rue Hohenlohe, Strasburg, Alsace, Germany, Chemist.

1885. Formoy, J. Arthur, Chestham, Grange Road, Sutton, Surrey, Oil Expert.

1904. Forrest, Chas. N., New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemist.

1898. Forrest, J. Kerr, Hawsleigh, Balaclava Road, St. Kilda East, Victoria, Australia, Manufacturing Chemist.

1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.

1905. Forrester, H. A., Usina de Gas, Retiro, Buenos Ayres, S. America, Chemical Works Manager.

1902. Forstall, Alf. E., 58, William Street, New York City, U.S.A., Consulting Gas Engineer.

1901. Forster, Miss E. L. B., King's College, Strand, London, W.C., Analyst.

1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, Burton-on-Trent, Chemist.

1899. Forster, Dr. M. O., F.R.S., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.

1884. Forster, Ralph C., c/o Messrs. Bessler, Waechter, and Co., 18 and 19, Fenchurch Street, London, E.C., Chemical Merchant.

1884. Forth, Henry, Meadowcroft, Marple, Cheshire, Drysalter.

1907. Forward, Charles C., Iroquois, Ontario, Canada, Chemist.

O.M. Foster, R. Le Neve, Bollindene, Wilmslow, Cheshire, Manufacturing Chemist.

1906. Foster, Robt. K., 120, Victoria Parade, Collingwood, Melbourne, Victoria, Pharmaceutical Chemist.

1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.

1903. Fotheringham, John, North Brazilian Sugar Factories, Ltd., Tiuma, Pernambuco, Brazil, Chemist.

1906. Foucar, J. Louis, 20, St. John's Park, Blackheath, S.E., Chemist.

1904. Foust, Thomas B., c/o Bon Air C. & I. Co., Allen's Creek, Tenn., U.S.A., Chemist.

1891. Fowler, Dr. Gilbert J., Broad Oak, Urmston, near Manchester, Consulting Chemist (Manchester Corporation Rivers Committee).
1898. Fowler, Theo. V., P.O. Box 168, Buffalo, N.Y., U.S.A., Chemical Works Manager.
1896. Fox, A. Stanley, Rosehurst, Athelstan Road, Faversham, Kent., Chemist (Cotton Powder Co., Ltd.).
1898. Fox, Jno., 42, Highfield Road, Rock Ferry, Cheshire, Analyst.
O.M. Fox, T., jun., c/o Fox, Bros. and Co., Ltd., Wellington, Somerset, Wool Manufacturer.
1905. France, Edward W., Philadelphia Textile School, Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.
1901. France, G. Herbert, Woodroyd Dyeworks, Low Moor, Bradford, Yorks., Dyer.
1899. Franchot, Stanislaus P., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., Chemist.
1885. Francis, Edwd., Park Ravine, Nottingham, Chemical Lecturer.
O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., Glucose Works Manager.
O.M. Francis, G. B., 38, Southwark Street, London, S.E., Wholesale Druggist.
O.M. Francis, W. H., Cleveland, Thornton Road, Clapham Park, S.W., Wholesale Druggist.
1903. Francksen, Dr. Aug., 4803, Garden Street, Bridesburg, Philadelphia, Pa., U.S.A., Chemist.
1906. Frank, Prof. Dr. A., Berlinerstrasse 26, Charlottenburg, Germany, Chemist.
1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.
1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, India-rubber Manufacturer.
1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.
1904. Frankl, A., Clotilde Chemical Works, Nagy Bocskó, Hungary, Chief Manager.
O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbro', Analytical Chemist.
O.M. Frankland, Prof. P. F., F.R.S., The University, Birmingham, Professor of Chemistry.
1906. Fraps, Geo. S., Texas A. & M. College, College Station, Texas, U.S.A., Professor of Chemistry.
1904. Frasch, George B., Chemist.
1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.
1900. Frasch, Herman, 82, Beaver Street, New York City, U.S.A., Oil Refiner.
1904. Fraser, Jas. D., 8, Percy Street, Ibrox, Glasgow, Chemist.
1891. Fraser, L. McG., 98, Commercial Road East, London, E., Chemical Engineer.
1902. Fraser, R. A., 519, Produce Exchange, Manchester, Fellmonger.
1886. Fraser, W. J., 121, Adelaide Road, London, N.W., Mechanical Engineer.
1907. Fraser, Wm. M., c/o The Texas Co., Port Arthur, Texas, U.S.A., Chemist.
1902. Frederick, Geo. E., jun., P.O. Box 762, New York City, U.S.A., Chemical Merchant.
1885. Freear, H. M., Hardwick Road, Woburn Sands, Beds., Analytical Chemist.
1899. French, Alf., St. Bartholomew's Hospital, Rochester, Kent, Dispenser.
1900. French, Thos., 1, Kelvinside Terrace West, Glasgow, Chemist.
1903. Frerichs, Dr. F. W., Herf and Frerichs Chemical Co.; and (Journals), 3828, Westminster Place, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1903. Frew, John, Dunrod Cottage, Hamilton, N.B.
1907. Freytag, Henry, c/o Otto Isler and Co., Manchester, Chemical Merchant.
1906. Friend, G. Clausen, c/o The D. B. Martin Co., 2504, North 34th Street, Philadelphia, Pa., U.S.A., Chemist.
1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.
1902. Fries, Jno. W., Winston, Salem, N.C., U.S.A., Cotton Manufacturer.
O.M. Friswell, R. J., 43–45, Gt. Tower Street, London, E.C., Consulting Chemist.
1898. Frith, J. Mason, Linden Lodge, Runcorn, Cheshire, Lime Burner.
1899. Fritzsche, Karl, c/o Schimmel and Co., Miltitz, near Leipsig, Germany, Manufacturer of Essential Oils.
1906. Frohner, Edward, jun., c/o Standard Table Oil Cloth Co., Youngstown, Ohio, U.S.A., Manager.
1890. Frost, Dr. Howard V., 3958, Drexel Boulevard, Chicago, Ill., U.S.A., Professor of Chemistry.
1884. Frost, Joe, Storths Mill, Moldgreen, Huddersfield, Manufacturing Chemist.
O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.
1904. Fryer, Percival J., 27, Minster Road, West Hampstead, N.W., Analyst.
1906. Fuchs, Herman C., 83, Marlborough Road, Brooklyn, N.Y., U.S.A., Dry Colour Chemist.
1903. Fudge, T., 604, Avenue E., Bayonne, N.J., U.S.A., Chemist.
1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.
1895. Fuerst, W. F., 2, Stone Street, New York City, U.S.A., Chemical Merchant.
1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.
1902. Fuller, Henry C., c/o E. E. Brown, 6, State Street, Worcester, Mass., U.S.A., Analytical Chemist.
1899. Fuller, Robt. F., Neston Park, Corsham, Wilts., Rubber Manufacturer.
1899. Fuller, W. M., c/o Morris and Griffin, Maindee, Newport, Mon., Chemical Manufacturer.
O.M. Fuller, Wm., 8, Orchard Road, Blackheath, S.E., Chemist.
1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.
1896. Fulton-Smith, I., 20, Bold Street, Warrington, Brewer.
1906. Furlong, John R., 182, Commercial Road, London, E., Research Chemist.
1906. Futers, Stephen H., Glenraven House, Heol-y-Fai, Maesteg, Glamorgan, Analyst.
1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

1898. Gabain, Chas. E., Messrs. Gabain Frères, Havre, France, Manufacturer of Edible Fats.
O.M. Gabbett, E. R., 64, Vanbrugh Road, Blackheath, S.E.; (Journals) Prince Regent's Wharf, Silvertown, E., Chemical Engineer.
1904. Gadd, Henry Wippell, 100, Fore Street, Exeter, Analytical Chemist.
1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1890. Gajjar, T. K., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.
1884. Gall, Henry, 4, Rue Albert Joly, Versailles, France, Technical Chemist.
1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.
1897. Galletly, J. C., 101, Armadale Street, Dennistoun, Glasgow, Assistant to Professor of Metallurgy.
1905. Gallinagh, James P., Electricity Works, Limerick, Ireland, Borough Electrical Engineer.
1901. Gallivan, Frank B., 48, Wallingford Road, Boston, Mass., U.S.A., Chemist.
1903. Gallum, Albert F., Milwaukee, Wis., U.S.A., Tanner.
1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.
1901. Galpin, Harry T., 55, West 57th Street, New York City, U.S.A., Chemist.
1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.

1887. Gamble, Jas. N., The Laboratory, Procter and Gamble Co., Ivorydale, Ohio, U.S.A., Soap Manufacturer and Oil Refiner.

O.M. Gamble, Sir Josias, Bart., Haresfinch, St. Helens, Lancs., Chemical Manufacturer.

1894. Gane, Eustace H., 95, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.

1888. Gans, Adolf, Farbenfabrik von L. Cassella & Co., Frankfort a/Main, Germany, Dye Works Manager.

1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus and Gansser, Garessio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.

1896. Gardair, Aimé, 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.

1893. Gardiner, H. J., 90, Cannon Street, London, E.C., Chemical Manufacturer.

1905. Gardner, Franc E., 633, North Western Avenue, Chicago, Ill., U.S.A., President, Gardner-Barada Chemical Co.

1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemistry and Dyeing Department.

1897. Garfield, Jos., Thackley, Bradford, Yorks., Civil Engineer.

1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.

1905. Garle, John L., Sanctuary House, Tothill Street, Westminster, Consulting Chemist.

1904. Garnar, G. Lestor, Monticello, Sullivan Co., N.Y., U.S.A., Superintendent of Leather Works.

1904. Garnaus, John C., P.O. Box 326, New York City, U.S.A., Dyestuff Merchant.

1890. Garrett, Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.

1900. Garrigues, W. E., Foot of Lieb Street, Detroit, Mich., U.S.A., Chemical Engineer.

1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.

1899. Garroway, Wm., 694, Duke Street, Glasgow, Chemical Manufacturer.

1898. Garry, H. Stanley, 66, Mapperley Road, Nottingham, Manure Works Manager.

O.M. Garton, R., Messrs. Hill, Garton, & Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.

1886. Gascoyne, Dr. W. J., 2741, North Charles Street, Baltimore, Md., U.S.A., Analytical Chemist.

O.M. Gaskell, Holbrook, Woolton Wood, Woolton, near Liverpool, Alkali Manufacturer.

O.M. Gaskell, Holbrook, jun., Erindale, Frodsham, Cheshire, Engineer.

1902. Gaskell, Holbrook III., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.

1897. Gaster, Leon, 32, Victoria Street, Westminster, S.W., Electrical Engineer.

1895. Gate, Tom Erskine, (Journals) The Santubong Cutch and Tanning Extract Co., Ltd., Santubong, Sarawak, Borneo, and (subscriptions) Calder House, Dewsbury, Yorks., Manufacturing Chemist.

O.M. Gatheral, Geo., 174, Soho Hill, Handsworth, Birmingham.

1906. Gaunt, Percy, Norman Road, Rusholme, Manchester, Chemist.

1903. Gaylord, Wallace K., Throop Polytechnic Institute, Pasadena, Cal., U.S.A., Professor of Chemistry.

1904. Gazdar, J. J., 5, Wroxham Mansions, Canfield Gardens, South Hampstead, N.W., Barrister-at-Law.

1905. Geisenheimer, Albert, P.O. Box 994, New York City, U.S.A., Dyestuff Merchant.

1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison St., New York City, U.S.A., Consulting Chemist.

1901. Gemmell, G. H., 4, Lindsay Place, George IV. Bridge, Edinburgh, Analytical Chemist.

1901. Gent, Percy W., 789, Highland Avenue, Forest Hill, Newark, N.J., U.S.A., Chemist.

1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.

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1905. George, J. K., 60, Wall Street, New York City, U.S.A., Manufacturer.

1902. George, Wm. K., c/o Standard Silver Co., Ltd., 35, Hayter Street, Toronto, Ont., Canada, Manufacturer.

1903. Georgii, Max, 606, F. Street, N.W., Washington, D.C., U.S.A., Patent Attorney.

1904. Gerard, Thos. A., 122, Foxhill Road, Nottingham, Soap Manufacturer.

1906. Gerkensmeyer, Henry H., 109, South Eastern Avenue, Joliet, Ill., U.S.A., Chemist.

O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.

1905. Geussler, Dr. Otto, c/o Farbenfabr. vorm. F. Bayer, Elberfeld, Germany, Chemist.

1903. Ghose, Anukul, 42, Shambazar Street, Calcutta, India, Analyst.

1891. Gibb, Thos., Wilford, Dornoch Terrace, Brisbane, Queensland, Metallurgist.

1903. Gibbings, Wm., 11, Howard Drive, Grassendale, Liverpool, Works Manager.

O.M. Gibbins, H. B., 177, Redland Road, Bristol

1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.

1904. Gibbs, A. E., Wyandotte, Mich., U.S.A., Manufacturing Chemist.

1883. Gibbs, D. Ceil, Soap Manufacturer.

O.M. Gibbs, Wm. P., Fabriken, Hjerpen, Jemtland, Sweden, Analytical Chemist.

1893. Gibbs, W. T., Buckingham, Prov. Quebec, Canada, Manufacturing Chemist.

O.M. Gibson, Dr. J., 20, George Square, Edinburgh, Chemical Lecturer.

O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, *via* Chester, Brick and Tile Manufacturer.

1905. Gibson, John, Victorian Portland Cement Works, Burnley Street North, Richmond, Vic., Australia, Manager.

1906. Gibson, Robt. R., Boise, Idaho, U.S.A., Chemist.

1905. Gibson, Wm. F., Burham Cement Works, near Aylesford, Kent, Works Chemist.

1904. Giese, Otto E., 4, Cedar Street, Manhattan, New York City, U.S.A., Importer.

1899. Gifford, Wm. E., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.

1892. Gilbard, T. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.

1905. Gilbertson, Isaac H., 5, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.

1903. Gilby, Joseph W., c/o Brotherton and Co., Ltd., Haigh Park Chemical Works, Stourton, Leeds, Works Chemist.

O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Chequer Lawn, St. Albans, Herts.

1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.

1900. Gildersleeve, W. H., Middlesboro', Ky., U.S.A., Chemist.

O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.

1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass, U.S.A., Assoc. Professor of Technical Analysis.

1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.

1903. Gillean, R. Hampson, c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.

1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.

1903. Gillett, Wm. Lowry, Hotel San Remo, Central Park West and 75th Street, New York City, U.S.A., Chemical Engineer.

1906. Gillies, Donald B., Tonopah, Nevada, U.S.A., Mining Engineer.

1905. Gilliland, Elijah P., 79, Highland Avenue, Salem, Mass., U.S.A., Foreman Tanner.

1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1892. Gilmour, J. D., 190, Butterfiggins Road, Glasgow, Chemist.

1891. Gimingham, Edw. A., 28, Stamford Hill Mansions, Stamford Hill, N., Electrician.

1904. Ginsburg, Louis, 438, Main Street, New Britain, Conn., U.S.A., Match Manufacturer.

1886. Girdwood, Dr. G. P., 111, University Street, Montreal, Canada, Professor of Chemistry.

1906. Girtin, Thomas, H. L. Raphael's Refinery, Thomas Street, Burdett Road, London, E., Bullion Refiner.

1903. Gladding, Thos. S., 55, Fulton Street, New York City, U.S.A., Analytical Chemist.

1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.

1906. Glasel, Dr. Chas. J., Tanner.

1889. Glaser, Chas., 22, South Gay Street, Baltimore, Md., U.S.A., Consulting Chemist.

1906. Glass, A. Melville, 37, Chancery Lane, London, W.C., Patent Agent.

1907. Gleason, Fred. J., Walpole, Mass., U.S.A., Superintendent (Mass. Chemical Co.).

1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.

1894. Glen, Chas., Glengowan Printworks, Caldercruix, N.B., Calico Printer.

1890. Glen, J., jun., Glengowan Printworks, Caldercruix, N.B., Calico Printer.

1900. Glendenning, Arthur, 31, Bright Street, Middlesbrough, Analytical Chemist.

1884. Glendinning, H., Winnington Park, Northwich, Cheshire, Technical Chemist.

1904. Glendinning, T. A., Wellpark Brewery, Glasgow, Brewery Chemist.

1895. Glenn, Wm., Baltimore Chrome Works, 1348, Block Street, Baltimore, Md., U.S.A., Chrome Manufacturer.

1888. Gloag, Robt. F., Grove Hill, Middlesbrough, Secretary

O.M. Glover, G. T., 24, Craven Hill Gardens, Lancaster Gate, W., Chemical Works Manager.

1896. Glover, H., East Falls, Schuylkill, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.

1905. Glover, Nathan H., 355, River Street, Mattapan, Boston, Mass., U.S.A., Gum Manufacturer.

O.M. Glover, William, 25, North View, Heaton, Newcastle-on-Tyne, Technical Chemist.

1903. Goetschius, Howard B., Little Ferry, N.J., U.S.A., Chemist.

1896. Goetz, Isidore, 5, Brondesbury Park, London, N.W., Mine Manager.

1905. Gokhale, Dr. K. N., The Indian Pharmacy, Girgaum, Bombay, India, Manager.

1898. Golding, Jno., Ashby Road, Kegworth, Derby, Agricultural Chemist.

1906. Goldschmidt, Dr. Karl, Chemical Works, Essen-Ruhr, Germany, Manufacturing Chemist.

O.M. Goldschmidt, Dr. S. A., 43–51, Sedgwick Street, Brooklyn, N.Y., U.S.A., Chemical Manufacturer.

1897. Goldschmiedt, Dr. Guido, Laboratory, II Salmgasse 1, Prag, Austria, Professor in Imperial German University.

1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).

1899. Goldsmith, Dr. Jno. N., British Xylonite Co., Ltd., Manningtree, Essex, Chemist.

1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.

1900. Goodchild, Wm. H., (Journals) Porcura, Boicza, Vei Deva, Hungary, and (subscriptions) Elmwood Lodge, Long Lane, Finchley, N., Chemist.

1898. Goode, J Archibald, 16, Crampton Street, London, S.E., Analytical Chemist.

1906. Goodhue, Leonard H., c/o Boston Rubber Shoe Co., Melrose, Mass., U.S.A., Chemist.

1904. Gooding, E. Claude, Willow House, Washford, Somerset, Chemical Student.

1898. Goodrich, Chas. G., Akron, Ohio, U.S.A., Rubber Manufacturer.

1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.

1894. Goodwin, Dr. W. L., The School of Mining, Kingston, Canada, Professor of Chemistry.

O.M. Goppelsroeder, Dr. F., Leimenstrasse, 55, Basel, Switzerland, Professor of Chemistry.

1898. Gordon, Colin, Storers' Wharf, Wharf Road, Poplar, E., Chemical Engineer.

1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.

1883. Gore, Dr. G., F.R.S., 20, Easy Row, Birmingham, Metallurgist.

1906. Gorrie, David, c/o D. Gorrie & Sons, South Methven Street, Perth, N.B., Engineer.

1905. Gorsline, Wm. H., Rochester Sewer Pipe Co., Rochester, N.Y., U.S.A., Secretary and Manager.

1891. Gorvin, Jno. C., English Crown Spelter Co., Ltd., Swansea, Works Manager.

O.M. Gossage, F. H., Camp Hill, Woolton, Liverpool, Alkali Manufacturer.

1897. Gossage, W. Winwood, Widnes, Lancashire, Soap Manufacturer.

1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.

1890. Goulding, Sir Wm. J., Bart., North Wall, Dublin, Manure Manufacturer.

1903. Govers, F. X., 250, Main Street, Owego, Tioga Co., N.Y., U.S.A., Manager and Chemist.

O.M. Gowland, Prof. W., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).

1886. Goyder, G. A., 12, Pirie Street, Adelaide, South Australia, Chemist.

1890. Grabfield, Dr. J. P., c/o Morris and Co., 35th Street and 11th Avenue, New York City, U.S.A., Chemist.

1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.

1883. Graesser, R., Cefn, near Ruabon, North Wales, Manufacturing Chemist.

O.M. Graham, Prof. C., The Reculvers, Hastings, Consulting Chemist.

O.M. Graham, C. C., Oriel House, Scarborough, Yorks., Technical Chemist.

1883. Grandage, H., City Chambers, 2, Darley Street, Bradford, Dyer.

1897. Granger, Dr. J. Darnell, 25, All Saints Street, Nottingham, Analytical Chemist.

1900. Granja, Rafael, Ceres Chemical Co., Kingston, N.Y., U.S.A., Chemist.

1905. Grant, Alexander, 13, Kilgraston Road, Edinburgh, Baker.

1903. Grant, Henry C., c/o Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.

1896. Graves, Geo. H., c/o General Chemical Co., Bridgeport, Conn., U.S.A., Manufacturing Chemist.

1896. Graves, Walter G., 364, Harkness Avenue, Cleveland, Ohio, U.S.A., Chemist.

1895. Gray, Elisha B., c/o United Oil and Refining Co., Beaumont, Texas, U.S.A., Oil Inspector and Chemist.

1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.

1904. Gray, Jas., Heymann's Laboratory, P.O. Box 3427, Johannesburg, Transvaal, Chemist.

1901. Gray, J. Campbell, Glengoyt, Strines, near Stockport, Printworks Chemist.

1886. Gray, Jno., 13, Queen's Road, Rock Ferry, near Birkenhead, Oil Works Chemist.

1902. Gray, John, Port Credit, Ont., Canada, Starch Manufacturer.

1903. Gray, Jno. Lathrop, c/o Tide Water Oil Co., East 22nd Street, Bayonne, N.J., U.S.A., Assistant Superintendent (Paraffin Works).

1896. Gray, Dr. Thos., The Technical College, Glasgow, Professor of Technical Chemistry.

1905. Gray, W. B., Messrs. Lever Bros., Balmain, Sydney, N.S.W., Australia, Analytical Chemist.

1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.

1901. Greaves, Albert E., c/o P. Spence and Sons, Ltd., Goole Alum Works, Goole, Yorks., Works Chemist.

1891. Greaves, I. A. R., Morton, Gainsborough, Brewer

1894. Greaves, Wm., Powell-Duffryn Co., Ltd., Bye Product Works, Bargoed, near Cardiff, South Wales, Chemical Engineer and Chemist.

1894. Greeff, R. W., 20, Eastcheap, London, E.C., Chemical Agent.

1890. Green, Alfred H., Oaklands, Lowton, Newton-le-Willows, Lancs., Manufacturing Chemist.

O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and Clothworkers' Department, The University, Leeds, Professor of Dyeing.

1907. Green, Clarence, c/o Nicholson and Co., Beaumont Works, St. Albans, Herts, Chemist.

1906. Green, Ernest, 113, Hulton Street, Moss Side, Manchester, Science Teacher.

1903. Green, G. F. Dudbridge, Lea Conservancy Board, Hackney Wick, N.E., Manufacturing Chemist.

O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.

1896. Green, Jno. Wilberforce, 108, Kenilworth Avenue, Wimbledon Park, S.W., Technical Chemist.

O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.

O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.

1906. Greene, George M., 99, Mercer Street, Jersey City, N.J., U.S.A., Chemist.

1884. Greenhalgh, Jas. Herbert, Whitebirk, Green Mount, Bury, Lancs., Assistant Manager of Printworks.

O.M. Greenway, T. J., Chillagoe, North Queensland, Australia, Metallurgist.

1902. Greenwood, Conrad Varley, Horsfield, Colne, Lancs., Cotton Mill Manager.

O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Lancashire, Technical Chemist.

1897. Gref, Anthony, 128, Duane Street, New York City, U.S.A., Patent Lawyer.

1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.

1905. Greiner, F. M., Ensley, Alabama, U.S.A., Steel Melter.

O.M. Greville, H. L., 39, Croft Road, Bromley, Kent, Consulting Chemist.

1906. Grice, Walter T., 9, Dalhousie Square, Calcutta, India, Chemist.

1900. Griffin, Dr. Jno. J., Catholic University of America, Washington, D.C., U.S.A., Professor of Chemistry.

1890. Griffin, Jno. R., Kemble Street, Kingsway, W.C., Chemical Apparatus Maker.

1886. Griffin, Martin L., Mechanicville, Saratoga Co., N.Y., U.S.A., Consulting Chemist.

1902. Griffiths, Manfred E., Temple Road, Stowmarket, Suffolk, Explosives Chemist.

1894. Griffiths, Thos., The Cedars, Clapham Common, S.W., Manufacturing Chemist.

1902. Grimwade, Wilfrid R., 335—343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.

O.M. Grimwood, R., 60, Woodland Rise, Muswell Hill Road, N., Analytical Chemist.

1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.

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1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.

1906. Groenewoude, Sidney H., 36, Grosvenor Road, Highbury, N., Analytical Chemist.

1897. Gronemeyer, Herman H., 315, Amesbury Avenue, Cleveland, Ohio, U.S.A., Chemical Superintendent.

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O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).

1903. Grundy, F. Barnes, Victoria Mills, Bredbury, near Stockport, Technical Chemist.

1899. Gudemann, Dr. Edw., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.

1906. Guess, Geo. A., c/o Cananea Consolidated Copper Co., Cananea, Sonora, Mexico, Chemist.

1898. Guess, Harry A., c/o Federal Lead Co., Flat River, Mo., U.S.A., Chemist.

1899. Guest, Edw. Graham, 5, Church Hill, Edinburgh, Cereals Chemist.

1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.

1906. Gulline, Percy, Merrimack Manufacturing Co., Lowell, Mass., U.S.A., Printworks Superintendent.

1905. Gummere, W., 125, East Hanover Street, Trenton, N.J., U.S.A., Chemist.

1904. Gundlach, Walter, 153, East 79th Street, New York City, U.S.A., Superintendent of Colour Works.

1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.

1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lancs., Paper Mill Chemist.

1900. Günther, Chas. E., Liebig's Extract of Meat Co., Ltd., 4, Lloyd's Avenue, London, E.C., Merchant.

1902. Günther, Wm. J. W., c/o Colonial Sugar Refining Co., Ltd., 1, O'Connell Street, Sydney, N.S.W., Australia, Inspector.

1894. Gurney, J. Clare, Fundicion de Plomo de D. Miguel Zapata, Portman, Prov. de Murcia, Spain, Analytical Chemist.

1899. Gutcher, Wm., Singapore Oil Mills, Singapore, S.S., Superintendent Engineer.

1903. Guthrie, Alan, South End, Northallerton, Yorks, and (Journals) c/o Cooper, Allen and Co., Cawnpore, India, Leather Chemist.

1903. Guthrie, Alex., Inglewood, Eaton Road, Coventry, Manager.

1901. Guthrie, John M., 199, Ferry Road, Leith, N.B., Analytical Chemist.

1903. Guttmann, Dr. Leo F., College of the City of New York, New York City, U.S.A., Research Chemist.

1892. Guttmann, Oscar, 12, Mark Lane, London, E.C., Consulting Chemical Engineer, M.Inst.C.E.

1904. Gyr, Dr. K. H., Zug, Switzerland, Analytical Chemist.

H

1902. Haas, Herbert, Union Ironworks, San Francisco, Cal., U.S.A., and (Journals) c/o Compania Metallurgica de Torreon, Torreon, Coahuila, Mexico, Metallurgical Engineer.

O.M. Habirshaw, W. M., 341, Madison Avenue, New York City, U.S.A., Chemical Engineer.

1904. Hacking, D. H., Henfield House, Clayton-le-Moors, near Accrington, Lancs., Soap Manufacturer.

1883. Hacking, W. H., The Grange, Clayton-le-Moors, near Accrington.

1900. Haddock, Arthur G., 60, Highbury, Newcastle-on-Tyne, Technical Chemist.

1907. Haddock, Franklin, 27, Marion Street, West Lynn, Mass., U.S.A., Leather Manufacturer.

1898. Haddow, Geo., Parkview, Redding, Polmont Station, N.B., Chemist.

1887. Hadfield, R.A., Hecla Works, Sheffield; 28, Hertford Street, Mayfair, London, W., and (Journals) Parkhead House, Sheffield, Steel Founder.

1884. Hadkinson, F., Pamphila Oil and Soap Works, Mitylene, Mediterranean, Oil Refiner and Soap Manufacturer.

O.M. Hadkinson, R., Smyrna, Asia Minor, Oil Refiner.

1904. Hadley, Geo., 58, Halesowen Street, Blackheath, Staffs., Spelter Works Manager.

1906. Haefele, J. E., 44, Randolph Avenue, East Rutherford, N.J., U.S.A., Chemist.

1902. Haff, Max M., Laboratory, 188, Metcalfe Street, Ottawa, Canada, Chemist.

1906. Hagen, Dr. Carl, 47, Victoria Street, London, S.W., Representative of Du Pont Powder Co.

1887. Haig, Robert, Dollarfield, Dollar, N.B., Chemical Engineer.

1904. Haigh, B. Wilson, 4, York Street, Barnsley, Yorks., Chemical Engineer.
1896. Haigh, De Laguel, 33, Norwood Avenue, Summit, N.J., U.S.A., Chemist.
1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.
1905. Haines, Harold W., 153, West 121st Street, New York City, U.S.A., Chemist.
1889. Haines, Reuben, Haines Street, near Chew Street, Germantown, Philadelphia, Pa., U.S.A., Analytical Chemist.
O.M. Hake, C. N., 423, Flinders Lane, Melbourne, Victoria, Australia, Inspector of Explosives.
1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1888. Hale, Edw. P., Endmoor, near Kendal, Analytical Chemist.
1903. Hale, Dr. Frank E., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.
1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.
1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1886. Hall, Archibald D., 7, Fenchurch Avenue, London, E.C., Analytical Chemist.
1898. Hall, Clarence A., 51, Allen Lane, Mount Airy, Philadelphia, Pa., U.S.A., Chemist.
O.M. Hall, Edgar, Silver Spur, Stanthorpe, Queensland, Australia, Technical Chemist.
1902. Hall, Henry, c/o Booth and Co., Irk Vale Works, Middleton, Lancashire, Dyer and Finisher.
1893. Hall, Jas. W., Bombay, Baroda and Central India Railway, Sabarmata, near Ahmedabad, India, Linseed Oil Mills Manager.
1885. Hall, Jno. A., Victoria Chemical Works, Victoria, British Columbia, Analytical Chemist.
1900. Hall, Jos. J., 810, Sixth Avenue East, Cedar Rapids, Iowa, U.S.A., Chemist.
O.M. Hall, S., East London Soap Works, Bow, London, E., Soap Manufacturer.
1896. Hall, S. Godfrey, East London Soap Works, Bow, E.; (Journals) 19, Aberdeen Park, Highbury, N., Soap Maker.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Scale Lane, Hull, Analytical Chemist.
1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.
1900. Hallock, Dr. Albert P., 440, First Avenue, New York City, U.S.A., Chemist.
1892. Hamaguchi, K., Hiro Mura, Arito Gori, Wakayama Ken., Japan, Soy Manufacturer.
1904. Hamblet, Abel Martin, c/o Oxford Paper Co., Rumford Falls, Maine, U.S.A., Chemist.
1897. Hambly, Fred. J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, c/o Pittsburg Reduction Co., East St. Louis, Ill., U.S.A., Electro-Chemist.
1904. Hamilton, E. H., c/o Arizona Smelting Co., Humbolt, Arizona, U.S.A., General Superintendent.
1885. Hamilton, Oswald, Lancaster Cottage, Old Stratford, near Stony Stratford, Chemical Engineer.
1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, N.B., Works Manager.
1898. Hammersley, W. Stanley, 15, Rue des Carriers, Soignies, Belgium, Tanner.
O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1902. Hampson, B. A., Hampson's Collieries, Waschbank, Natal, S. Africa, Assayer.
1900. Hampton, F. T., Hill City, Tenn., U.S.A., Civil Engineer.
1906. Hancock, H. Irving, Blue Point, N.Y., U.S.A., Chemist.
1905. Hancock, Thos. J., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
1889. Handy, Jas. O.. 325, Water Street, Pittsburg, Pa., U.S.A., Chemist.
1888. Hanks, Abbot A., 2563, Washington Street, San Francisco, Cal., U.S.A., Assayer.
1901. Hanna, Charles E., P.O. Box 2303, Montreal, Canada, Secretary.
1899. Hanna, Dillinger C., 4262, Parkside Avenue, Philadelphia, Pa., U.S.A., Chemist and Superintendent.
1905. Hanna, W. W., 109, North Water Street, Philadelphia, Pa., U.S.A., Aniline Colour Manufacturer.
1905. Hanson, H. Norman, Field Head, Brighouse, Yorks., Research Assistant.
1905. Harcourt, Prof. R., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James, M.B., Cordobanes 16, Mexico City, Mexico, Chemist and Pathologist.
1901. Hardcastle, G. Fred., 17, Chaucer Street, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, 2, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
1905. Hardy, Chas. H., c/o Reckitt & Sons, Ltd., Hull, Chemist.
1902. Hardy, G. D., 11, Montague Place, Toronto, Ont., Canada, Metallurgist.
1906. Hargreaves, Frank, c/o The Electrolytic Alkali Co., Ltd., Middlewich, Cheshire, Chemist.
1896. Hargreaves, Jas., May Villa, Peel House Lane, Widnes, Lancashire, Chemical Engineer.
O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, 35, Boulevarde, Petersham, Sydney, N.S.W., Australia, Chemist.
O.M. Harland, R. H., Plough Court, 37, Lombard Street, London, E.C., Consulting Chemist.
1904. Harley, B., 12, Russell Street, Falkirk, N.B., Analytical Chemist.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2208, San Antonio Street, Austin, Texas, U.S.A., Professor of Chemistry.
1904. Harrington, Dr. B. J., University Library, McGill University, Montreal, Canada, Director.
1903. Harrington, E. M., 109, Broad Street, Woodbury, N.J., U.S.A., Explosives Manufacturer.
1905. Harrington, John H., 139, High Street, Perth Ambog, N.J., U.S.A., Chemist.
O.M. Harrington, W. B., Leeview, Montenotte, Cork, Ireland, Chemical Manufacturer.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
O.M. Harris, David, F.R.S.E., Lyncombe Rise, Prior Park Road, Bath, Chemical Manufacturer.
1897. Harris, Fred. W., Corporation Chemical Department, 26, John Street, Glasgow, Public Analyst.
1906. Harris, Jonathan, W., 259, South Clinton Street, Chicago, Ill., U.S.A., Chemist.
1900. Harris, L. A., Wyoming, Wood Vale, Lordship Lane, London, S.E., Chemist.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun., 31, William Street, Toronto, Canada, Metallurgist.
O.M. Harrison, A., Thames Sugar Refinery, Silvertown, London, E., Sugar Works Chemist.
1905. Harrison, E. F., Langholm, Purley Oaks Road, South Croydon, Analytical Chemist.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Chemist.

1904. Harrison, H. E., 1688, Buckingham Place, Chicago, Ill., U.S.A., Chemist.

1892. Harrison, Prof. John B., C.M.G., 45, Westbourne Park Road, Bayswater, W., Government Analyst.

1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.

1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.

O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.

1905. Hart, George Adam, Sewage Engineers' Office, Municipal Buildings, Leeds, Civil Engineer.

1890. Hart, H. W., 5, Cambridge Road, Ansdell, Lytham, Lancashire, Analytical Chemist.

1897. Hart, Wm. Beamont, Manchester Laboratory, 8, Exchange Street, Manchester, Consulting Chemist.

1883. Hartley, Joseph, 102, Kirkmanshulme Lane, Longsight, Manchester, Technical Chemist.

1889. Hartley, R. Kent, Springwood House, Middleton Junction, near Manchester, Chemical Works Manager.

O.M. Hartley, Prof. W. N., D.Sc., F.R.S., Royal College of Science, Dublin, Professor of Chemistry.

1897. Hartmann, Ernest E., c/o United Club, No. 4, Yokohama, Japan, Chemist.

1892. Hartridge, Jas. Hills, Holmwood, Hendon, N., Manufacturing Chemist.

1905. Hartshorne, Wm. D., 40, Pleasant Street; and (Journals) Arlington Mills, Methuen, Mass., U.S.A., Agent.

1905. Hartwell, F. O., c/o Holyoke Card and Paper Co., Springfield, Mass., U.S.A., Purchasing Agent.

1901. Hartwell, S. Warren, 215, North 2nd Street, Easton, Pa., U.S.A., Chemist.

1901. Hartzell, Harry S., 126, North 4th Street, Allentown, Pa., U.S.A., Chemist.

1899. Harvey, Chas., 17, Alloa Road, Goodmayes, Ilford, Essex, Manufacturing Chemist.

1892. Harvey, E. Feild, Omrac, St. John's, Newfoundland, Chemist.

1885. Harvey, Ernest W., Stoneleigh, Grove Road, Clapham Park, S.W., A.R.S.M., Engineer.

1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.

1899. Harvey, Thos. F., 84, Henry Road, West Bridgford, Nottingham, Analyst (Drug Co.).

1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.

1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.

1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colourist.

1900. Haslwanter, Chas., 86, Pilling Street, Brooklyn, N.Y., U.S.A., Analytical Chemist.

1897. Hasslacher, Jacob, P.O. Box 1999, New York, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hasting, J. J., c/o Louis Leavitt, North 11th Street and Driggs Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.

1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubs, W., Starch Works Manager.

1906. Hattrick, J. M., 7, Bridge Street, Sydney, N.S.W., Australia, Agronom.

1900. Havens, Dr. F. S., 1434 Pine Street, Philadelphia, Pa., U.S.A., Silk Conditioner.

1906. Havercroft, Arthur E., 3, Carlton Terrace, Hornsea, Yorks, Chemist.

1899. Hawdon, H. S., Cleadon, near Sunderland, Manager.

1895. Hawker, E. W., Adelaide Club, Adelaide, South Australia, Metallurgist.

1902. Hawkins, Clement C., c/o The Chatfield Manufacturing Co., Carthage, Ohio, U.S.A., Chemist.

1897. Hawkins, Ernest M., Lime Tree Farm House, Stone Street, Petham, Canterbury, Chemist.

O.M. Hawkins, H., White's Farm, Grittenham, Chippenham, Wilts, Explosive Works Manager.

1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.

1893. Hawkins, J. Dawson, c/o Colo. Phila. Reduction Co., Colorado City, Colo., U.S.A., Smelting Works Manager.

1905. Hawley, Fred G., Box 10, La Cananea, Sonora, Mexico, Assayer and Chemist.

1887. Hawliczek, Josef, 77A, Lord Street, Liverpool, Consulting Chemical Expert.

1899. Haworth, Dr. Edw., Sunnyside, Norman Road, Runcorn, Cheshire, Chemist.

1903. Haworth, Herbert, Crown Works, Appley Bridge, near Wigan, Director (Grove Chemical Co.).

1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.

1895. Hay, Alex. B., Kelvindock Chemical Works, Maryhill, Glasgow, Manufacturing Chemist.

1898. Haycraft, Jos. H., St. Peter's, Adelaide, South Australia, Metallurgical Chemist.

1904. Hayman, Jack V. J., Semper Aurea, Burwell, Cambridge, Chemist.

1894. Haynes, David O., 90, William Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."

1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Chemist.

1906. Hayworth, W. P., 119, Clapton Common, London, N.E., Chemist.

1902. Hazard, Dr. Elmer C., Shrewsbury, N.J., U.S.A., Chemist.

1905. Hazard, Fred. R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).

1903. Hazen, Chas. R., 106, Belmont Place, Westmount, Quebec, Canada, Chemist.

1894. Heal, Carlton, Duston, near Northampton, Chemist.

1903. Heald, Henry I., Hove House, Adwick Road, Mexborough, near Rotherham, Yorks, Manager of Earthenware Factory.

1890. Heape, Chas., 19, George Street, Manchester, Calico Printer.

O.M. Heath, R. C., Myton Grange, near Warwick, Chemical Manufacturer.

1905. Heathcote, Henry L., Warwick Avenue, Earlsdon, Coventry, Research Chemist.

1904. Heaton, Noel, 20, Baker Road, Harlesden, N.W., Colour Manufacturer.

1895. Hebden, Jno. C., P.O. Box 824, Providence, R.I., U.S.A., Works Manager and Chemist.

1905. Heberlein, Dr. Edw., c/o H. T. Enthoven & Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.

1889. Hecht, Jos. L., Bettendorf Metal Wheel Co., Davenport, Iowa, U.S.A., Analytical Chemist.

1895. Hecker, Paul, 102, Fenchurch Street, London, E.C., Chemical Merchant.

1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.

1889. Heckmann, C., 9, Görlitzerufer, Berlin, S.O., Germany, Chemical Apparatus Maker.

1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.

1895. Hedley, Geo. H., Hedge Mill, Loudwater, Bucks., Chemical Manufacturer.

1902. Heebner, Prof. Chas. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Pharmaceutical Chemistry.

1903. Hegeman, John W., 102, Barbey Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Hehner, Charles, c/o H. and A. Saunders, Eclipse Building, King Street, Toronto, Canada, Assistant Manager.

O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.

1902. Heike, Rudolph E., American Sugar Refining Co., P.O. Box L., Jersey City, N.J., U.S.A., Chemist.

1905. Heilborn, Jacob, 503, Washington Street, Brookline, Mass., U.S.A., Traveller.

1898. Heileman, W. H., 2530, Regent Street, Berkeley, Cal., U.S.A., Expert Field Assistant.

1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.

1885. Hellon, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.

O.M. Helm, H. J., 27, Hammelton Road, Bromley, Kent, Government Analyst.
1903. Helps, D. H., c/o Reading Gas Co., King's Road, Works, Reading, Engineer and Manager.
1898. Hemingway, Frank C. R., 133, Front Street, New York City, U.S.A.
1883. Hemingway, H., 9, Albemarle Mansions, Hampstead, N.W., Chemical Manufacturer.
1884. Hempleman, F. S., 39, Brunswick Terrace, Hove, Sussex, Manure Manufacturer.
1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.
1883. Henderson, Prof. G. G., The Technical College, George Street, Glasgow, Professor of Chemistry.
1902. Henderson, Prof. Jas. A. Russell, Chihli Provincial College, Paotingfu, North China, Professor of Chemistry and Physics.
1900. Henderson, J. Brownlie, Government Analyst's Office, Brisbane, Queensland, Government Analyst.
1902. Henderson, J. C. A., 120, Bishopsgate Street Within, London, E.C.
1894. Henderson, Jos., Thornaby Ironworks, Thornaby-on-Tees, Metallurgical Chemist.
1894. Henderson, Norman M., Broxburn Lodge, Broxburn, N.B., Oil Works Manager.
1906. Henderson, Thos., 14, Dey Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.
1893. Hendrick, Jas., Marischal College, Aberdeen, Lecturer on Agricultural Chemistry.
1906. Henius, Dr. Max, 327, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.
1904. Henley, F. R., 9, Beaufort Gardens, London, S.W., Brewer's Chemist.
1889. Hennin, Alphonse, Portoferraio, Elba, Italy, Metallurgical Chemist.
1905. Henning, Albert, 92, Harrow Road, Leytonstone, N.E., Chemical Manufacturer.
1906. Henning, C. I. B., P.O. Box 42, Santa Cruz, Cal., U.S.A., Chemist.
1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.
1894. Hepburn, J. G., Priory Works, Dartford, Kent, Leather Manufacturer.
1906. Herig, Harry W., 35, Rose Avenue, Jersey City, N.J., U.S.A., Chemist.
1891. Heriot, T. H. P., 37, Church Crescent, Muswell Hill, N., Analytical Chemist.
O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.
O.M. Heron, John, 110, Fenchurch Street, London, E.C., Brewing Chemist.
1903. Herreshoff, J. B. F., 40, West 69th Street, New York City, U.S.A., Chemical Engineer.
1899. Herrick, Rufus F., 16, Herrick Street, Winchester, Mass., U.S.A., Chemist.
1887. Herriot, Wm. Scott, Ravenswood, Partickhill, Glasgow, Mechanical Engineer.
O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.
1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Assistant Professor of Metallurgy.
O.M. Herschel, Prof. A. S., F.R.S., Observatory House, Slough, Bucks., Hon. Professor of Experimental Physics.
1898. Hersey, Milton L., P.O. Box 554, Montreal, Canada, Consulting Chemist.
1901. Hershey, Aldus N., c/o Sharpe and Dohme, Baltimore, Md., U.S.A., Chemist.
1903. Herstein, Dr. Bernard, 9A, Trask Avenue, Bayonne, N.J., U.S.A., Technical Chemist.
1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.
1906. Herz, Dr. Albert, Rosemount, Hipperholm, Halifax, Yorks, Chemist.
1898. Heslop, Oliver, Fernsholme, Prescot Road, St. Helens, Lancs., Analytical Chemist.
1885. Hess, Dr. Adolph, Kirkstall Road, Leeds, Chemical Manufacturer.
1904. Hess, H. W., c/o Libbey Glass Co., Toledo, Ohio, U.S.A., Chemist.
1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1904. Heurich, Christian, 1307, New Hampshire Avenue, N.W., Washington, D.C., U.S.A., Brewer.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, and (Journals) Spring Vale, near Gurnard, Isle of Wight, Engineer.
O.M. Hewitt, Dr. D. B., Oakleigh, Northwich, Cheshire, Alkali Manufacturer.
1903. Hewitt, H. R., 329, Bradford Road, Manchester, Chemical Works Manager.
1896. Hewitt, Dr. J. Theo., 7, The Avenue, Surbiton, Lecturer.
1890. Hewlett, John C., 40-42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1905. Heymann, Dr. Fritz, (Journals) temporary, 53, Dorotheenstr., Berlin, N.W.; and 7, Elsworthy Terrace, Hampstead, N.W., Analytical Chemist.
1906. Heys, Charles H., 124, Yonge Street, Toronto, Canada, Consulting Chemist.
1884. Heys, W. E., Llanberis, Bushey Hall Road, Watford, Consulting Engineer.
1883. Heywood, J. H., 231, Drake Street, Rochdale, Technical Chemist.
1897. Hibbard, Paul L., 2657, North 42nd Court, Chicago, Ill., U.S.A., Starch Chemist.
1906. Hibbert, John C., 6, Victoria Road, West Bridgford, Nottingham, Chemist.
1901. Hiby, Dr. Walter, 4, Southampton Row, London, W.C., Chemical Engineer.
1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.
1906. Hickman, T. Moore, Holmdale, Penn Road, Wolverhampton, Analyst.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
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1886. Higgins, C. L., 79, Bedford Street South, Liverpool, Manufacturing Chemist.
1905. Higgins, Eric, 5, Oak Terrace, Beech Street, Liverpool, E., Chemist.
1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.
1901. Highley, Arnold, 26, Parkfield Avenue, Bradford Moor, Bradford, Chemist.
1904. Hildebrand, Charles C., Costello, Pa., U.S.A., Chemist.
1903. Hill, Chas. Alex., 64, Park Street, Southwark, S.E., Chemist.
1897. Hill, George, Barton-on-Humber, Chemical Works Manager.
1897. Hill, Dr. Herbert M., University of Buffalo, N.Y., U.S.A., Professor of Chemistry and Toxicology.
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1892. Hill, Sydney, Eastholme, Prince's Avenue, and (Journals) c/o Blundell, Spence & Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, James Street Leather Works, York, Tanner.
1902. Hill, Wm. G. H., jun., American Rubber Co., Cambridgeport, Mass., U.S.A., Chemist.
1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.
O.M. Hills, C. H., Anglesea Copper Works, Low Walker, Newcastle-on-Tyne, Copper Smelter.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.

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1893. Hilton, Edgar G., 17, Howard Drive, Grassendale, Liverpool, Varnish and Paint Manufacturer.

1899. Hinchley, J. W., 15, Fawcett Street, London, S.W., Chemical Engineer.

1906. Hinckley, Everett H., Saylesville, R.I., U.S.A., Foreman.

1904. Hinckley, J. F., c/o Jones Bros., Pearl and Water Streets, Brooklyn, N.Y., U.S.A., Chemical Engineer.

1905. Hind, H. Lloyd, 55, Stanton Road, Burton-on-Trent, Analytical Chemist.

O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dyeworks Manager.

1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.

1891. Hinman, Bertram C., 48, Sydenham Hill, Sydenham, S.E., Metallurgical Chemist.

1892. Hinshelwood, Thos., Glasgow Oil and Paint Works, Glenpark Street, Glasgow, Oil Refiner.

1905. Hiorns, A. H., Caerleon, Chester Road, Erdington, near Birmingham, Science Teacher.

1900. Hirsh, Jos. E., 1245, 85th Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Hirshfield, E., c/o United Chemical Co., 52, Broadway, New York City, U.S.A., Chemist.

1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks., Works Chemist.

1886. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, N.B., Gas Engineer and Manager.

1900. Hobbs, Alex. F., c/o The United States Finishing Co., Box A, North Station, Providence, R.I., U.S.A., Printworks Superintendent.

1900. Hobbs, Dr. Perry L., Western Reserve Medical College, Cleveland, Ohio, U.S.A., Professor of Chemistry.

1906. Hobsbaum, Isaac B., 79, Claremont Road, Forest Gate, E., Analytical Chemist.

1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.

1904. Hochstetter, Henry, Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Chemist.

1894. Hodge, Andrew, Dalmonach Works, Bonhill, Dumbartonshire, Printworks Chemist.

1890. Hodges, Harry B., Long Island Railroad Co., Long Island City, N.Y., U.S.A., Chemical Engineer.

O.M. Hodgkinson, Dr. W. R., 18, Glenluce Road, Blackheath, S.E., Professor of Chemistry.

O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.

1897. Hodgson, Matthew, Ardmore, Wicklow, Ireland, Technical Chemist.

1905. Hodgson, T. R., 23, Aberdeen Road, Highbury, N.

1890. Hodgson, Wm., 66, Deansgate, Manchester, Oil and Colour Broker.

1903. Hoffmann, W. F., 23, Division Place, Newark, N.J., U.S.A., Chemical Merchant.

1906. Hogarth, Julius W., 37, Annandale Street, Sydney, N.S.W., Australia, Demonstrator of Chemistry.

1886. Hogben, W., 9, Duddingston Crescent, Portobello, Edinburgh, Chemist.

O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.

1905. Holcroft, Harold, Parkdale, Wolverhampton, Ironfounder.

1902. Holde, Dr. D., Königl. Materialprüfungsamt, Grosser Lichterfelde, W., Germany, Principal.

1899. Holden, Archie Neill, c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Chemist.

1903. Holden, G. E., 23, Durnford Street, Middleton, near Manchester, Works Chemist.

1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.

1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Colliery Lane, Clayton, Manchester, Manufacturing Chemist.

1902. Holdsworth, Ernest T., 10, Merton Road, Bradford, Dyer.

1904. Holgate, Arthur, c/o Wm. Holgate and Sons, Ltd., Earl Street, Liverpool, Corn Miller.

1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.

1884. Holgate, Thos., 5, Victoria Street, Westminster, S.W., Gas Engineer.

O.M. Holland, Philip, 22, Taviton Street, Gordon Square, London, W.C., Analytical Chemist.

1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.

1901. Hollick, Herbert, c/o General Chemical Co., Camden, N.J., U.S.A., Works Manager.

1902. Holliday, Lionel B., Lunnclough Hall, Huddersfield, Chemical Manufacturer.

1896. Hollings, J. Spencer, Vrondeg, near Wrexham, North Wales, Works Manager.

1903. Hollinshead, Peter, 19, The Hollow Way, Runcorn, Cheshire, Chemist.

1900. Hollinshead, Dr. W. H., Vanderbilt University, Nashville, Tenn., U.S.A., Teacher of Chemistry.

1904. Holloway, E. G., c/o Jas. S. Kirk and Co., Chicago, Ill., U.S.A., Chemist.

1890. Holloway, G. T., 57-58, Chancery Lane, London, W.C., Analytical and Consulting Chemist.

1900. Hollway, Jno., 6, Highbury Grange, London, N., and (Journals) c/o Wm. Galbraith, 97, William Street, Sheffield, Mine Owner.

1883. Holmes, Ellwood, Wyncote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.

O.M. Holmes, F. G., Northcroft, Tewitwell Road, Harrogate, Yorks., Technical Chemist.

1907. Holmes, Wm. E., Trent Bridge Leather Works, and (Journals) 31, George Road, West Bridgford, Nottingham, Chemist.

1900. Holthouse, Harold B., 12, Melton Grove, West Bridgford, Notts., Chemist.

1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.

1892. Holton, E. C., 601, Canal Road, S.W., Cleveland, Ohio, U.S.A., Chemist.

1893. Holzapfel, Max, Milburn House, Newcastle-on-Tyne, Manufacturer.

1893. Homfray, D., The Ings, Misterton, near Gainsborough, Analytical Chemist.

1905. Hook, Arthur Henry, Box 25, Greenwood, B.C., Canada, Chemist.

1904. Hooker, A. H., c/o Heath and Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Manufacturing Chemist.

O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, S.W., Chemist.

1889. Hooper, Ernest F., Wear Fuel Works, Hendon Dock, Sunderland, Technical Chemist.

1888. Hope, Jas., Dean House, Lenzie, N.B., Nickel Works Manager.

1904. Hopewell, Fredk., 86, Youville Square, Montreal, Canada, Manager.

1892. Hopkins, Erastus, Lake Helen, Fla., U.S.A., Consulting Chemist.

1894. Hopkins, Herbert W., (Journals) c/o Waihi G. M. Co., Waihi, Paeroa, N.Z.; and 13, Harrington Gardens, South Kensington, S.W., Metallurgist.

1905. Hoppenstedt, A. W., 138, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemist.

1898. Hopwood, Wm. H., Levenbank Cottage, Jamestown, Dumbartonshire, Printworks Chemist.

1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.

1904. Hornsey, J. W., 216, Prospect Street, Cranford, N.J., U.S.A., Chemical Engineer.

1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.

1902. Horsfall, L. H., c/o Binny and Co., Madras, India, Chemist.

1901. Horton, Edw., jun., 10, Smith Street, Chelsea, S.W., Student.

1906. Hoseason, Jas. H., Sun Buildings, Bridge Street, Manchester, Chemical Manufacturer.

1902. Hosford, Roger F., 125, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., Room 54, 81, South Clark Street, Chicago, Ill., U.S.A., Chemist.
1905. Hough, Warwick M., 902, Rialto Building, St. Louis, Mo., U.S.A., Attorney-at-Law.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 26, Princess Street, Manchester, Drysalter.
O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard F., Quantocks, Montalt Road, Woodford Green, Essex, Chemist.
O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, City Mills, Stratford, E., Chemical Manufacturer.
1903. Howard, Fred. A., 254, Montello Street, Brockton, Mass., U.S.A., Chemist.
1898. Howard, Henry, Dymoke Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1904. Howard, T., c/o Williams Bros. and Co., Hounslow, Chemist.
O.M. Howard, W. D., City Mills, Stratford, London, E., Chemical Manufacturer.
1906. Howe, Chester A., 124, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1905. Howe, Roland E., 196, Commonwealth Avenue, Concord Junction, Mass., U.S.A., Explosives Chemist.
1904. Howell, Walter L., Appraiser's Office, Custom House, New Orleans, La., U.S.A., Chemist.
1906. Howland, George W., 293, Dufferin Street, Toronto, Canada, Manager.
1899. Howles, Fred., c/o McDougall Bros., Millwall Docks, London, E., Chemist.
1889. Howorth, F. Wise, 46, Lincoln's Inn Fields, W.C., Technical Chemist and Chartered Patent Agent.
1906. Hoyler, Fritz, 49, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Ash Villa, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1898. Hudson, Albert W., Rigby Mining and Reduction Co., Mayer, Ariz., U.S.A., Metallurgist.
1902. Hudson, C. Edward, c/o E. G. Jepson and Co., Albion Walk Chambers, Leeds, Drysalter.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.
O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1898. Hughes, Raymond M., Oxford, Butler Co., Ohio, U.S.A., Professor of Chemistry and Physics.
1900. Hulley, Geo. D., c/o J. Eavenson and Sons, Delaware Avenue and Penn Street, Camden, N.J., U.S.A., Soapworks Chemist.
1906. Hulme, Robert B., c/o Kentucky Refining Co., Louisville, Ky., U.S.A., Chief Chemist.
1905. Hulton, H. F. E., 11, Colinette Road, Putney, S.W., Chemist.
1905. Humel, Edward J., 7912, Grace Avenue, S.W., Cleveland, Ohio, Chemist.
1893. Humfrey, Chas., Hilderstone, Hartford, Cheshire, Alkali Works Manager.
1901. Humphrey, H. C., c/o Corn Products Refining Co., Room 1509, 26, Broadway, New York City, U.S.A., Chemist.
1903. Humphrey, John, 72, Great Russell Street, London, W.C., Editor ("Pharmaceutical Journal").
1902. Humphrey, Rich. L., U.S. Geological Survey, Exposition Grounds, St. Louis, Mo., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 31, Nassau Street, New York City, U.S.A., Engineer.
O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts, Gas Engineer.
1895. Hunicke, Dr. H. Aug., 3532, Victor Street, St. Louis, Mo., U.S.A., Prof. of Applied Chemistry.
1900. Hunt, Arthur V., 284, New Chester Road, Port Sunlight, Cheshire, Analytical Chemist.
O.M. Hunt, Bertram, 121, West George Street, Glasgow, Technical Chemist.
O.M. Hunt, Chas., 15, Victoria Street, Westminster, London, S.W., Gas Engineer.
1883. Hunt, J. S., Appleton, Widnes.
1903. Hunt, P. C. Holmes, Metropolitan Gas Co., Flinders Street, Melbourne, Vic., Australia, Gas Engineer.
O.M. Hunt, W., Hampton House, Wood Green, Wednesbury, Staffordshire, Chemical Manufacturer.
1903. Hunter, H. B., Dennery Factory, St. Lucia, West Indies, Sugar Works Manager.
1902. Hunter, Hy. Blount, Hunter Chemical Co., Norfolk, Va., U.S.A., Industrial Chemist.
1893. Hunter, Prof. Matthew, Cowside, Settle, Yorks, Professor of Chemistry.
O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.
1902. Huntly, Geo. N., 96, Gower Street, London, W.C., Analytical and Consulting Chemist.
1904. Huntzinger, Alfred, Route de Condette, Pont de Briques, Pas de Calais, France, Chemist and Colourist.
1903. Hurlburt, Allen S., c/o General Chemical Co., Hudson River Works, Hudson Heights, N.J., U.S.A., Chemist.
1904. Hurren, F. H., 31, Melville Road, and (Journals) c/o The Rover Co., Ltd., Coventry, Analytical Chemist.
1894. Hurry, E. H., Goodwyns, Haslemere, Surrey, and (Journals) The Red House, Broadstairs, Mechanical Engineer.
O.M. Huskisson, P. L., 77, Swinton Street, London, W.C., Chemical Manufacturer.
O.M. Huson, C. W., 18, Batavia Buildings, Hackins Hey, Liverpool, Analytical Chemist.
1894. Hutcheson, Jno. F., 22, St. Enoch Square, Glasgow, Chemical Manufacturer.
1906. Hutchings, W. Maynard, Easedale, Elmfield Road, Gosforth, Newcastle-on-Tyne, Metallurgist.
O.M. Hutchinson, C. C., 3, Harcourt Buildings, Temple, E.C., Barrister-at-Law and Chemical Engineer.
1900. Hutchinson, E. George, Gas Works, Stockport, Gas Engineer.
O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.
1901. Hutton, Dr. Robt. S., The University, Manchester, Lecturer on Electro-Chemistry.
1906. Hutton, James S., 61, Plymouth Road, Malden, Mass., U.S.A., Chemist.
O.M. Huxley, Jas. H., c/o Vickers, Son and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.
1906. Huyett, Miles C., 1203, Traders Bank Building, Toronto, Canada, Mechanical Engineer.
1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.
1902. Hyde, Austin T., P.O. Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1897. Hyde, B. T. Babbitt, 80, West Street, New York City, U.S.A., Soap Manufacturer.
1899. Hyde, Fred, S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.
1899. Hyde, Wm. Grantley, 26, Winsham Grove, Clapham Common, S.W., Assayer.
1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.
1896. Hyndman, H. H., Francis, 27, Pembroke Square, Kensington, W., Consulting Chemist.

I

1898. Ibbotson, E. C. Gysinge, Sweden, Metallurgist.

1900. Ichioka, Tajiro, 19, Maruyama Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).

1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.

1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.

1902. Ihart, John P., 373, West 35th Street, New York City, U.S.A., Technical Chemist.

1900. Imrie, John, 415, Shields Road, Glasgow, Analytical Chemist.

1906. Ingalls, Robert C., 53, Commercial Street, West Lynn, Mass., U.S.A., Sales Manager.

1900. Ingalls, Walter R., (Communications) 505, Pearl Street, New York City; and (Journals) Bement Avenue, West New Brighton, Staten I., N.Y., U.S.A., Mining Engineer and Metallurgist.

1889. Ingle, Dr. Harry, Creskeld, Balwearie Road, Kirkcaldy, Fifeshire, Organic Chemist.

1891. Ingle, Herbert, Dept. of Agriculture, Government Buildings, Pretoria, Transvaal, Chemist.

1906. Inglis, Dr. Jno. K. H., University College, Reading, Berks, Lecturer.

1884. Inglis, R. A., Culrain, Bothwell, N.B., Analytical Chemist.

1906. Innes, Dr. W. Ross, 6, Griffiths Road, Wimbledon, S.W., Chemist.

1904. Irlam, H. A., Clevedon, Hightown Road, Luton, Beds., Manager and Chemist.

1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.

1906. Irwin, John T., Cledford, Middlewich, Cheshire, Manufacturing Chemist.

O.M. Irwin, W., Inglehurst, Stand, near Manchester, Analytical Chemist.

1893. Isaac, J. F. V., Research Chemist.

1896. Isaacs, Louis A., 110, Greencroft Gardens, West Hampstead, N.W., (Journals) c/o Yeatman and Co., Ltd., Denmark Street, E., Manufacturer.

1901. Isakovics, Alois von, Synfleur Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.

1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.

J

1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.

1898. Jackson, Alf. George, 65, Ann Street, Brisbane, Queensland, Electro-Chemical Engineer.

1906. Jackson, Arthur A., 672, East 43rd Street, Chicago, Ill., U.S.A., Chemist.

1901. Jackson, Daniel D., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn N.Y., U.S.A., Chemist.

1903. Jackson, Dr. D. H., 73, Parliament Hill, Hampstead, N.W., Chemist.

O.M. Jackson, Edward, Ravens Clift, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.

1904. Jackson, Ernest W., 11, Queen's Terrace, Middlesbro', Analytical Chemist.

1891. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.

1883. Jackson, Frederick, 14, Cross Street, Manchester. Laboratory Furnisher.

1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.

1901. Jackson, Percy G., Chemical Laboratory, Locomotive Dept., Midland Railway, Derby, Chemist.

O.M. Jackson, R. V., c/o Scotch and Irish Oxygen Co., Polmadie, Glasgow, Technical Chemist.

1890. Jackson, Saml., c/o H. S. Duncan, Roundhay, Harrington's Road, Chetput, Madras, India, Analytical Chemist.

1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church, near Accrington, Director (Tar Distillery).

1898. Jackson, Thos., Clayton Chemical Works, Clayton, Manchester, Chemical Manufacturer.

1900. Jackson, Victor G., 21, Frankfort Road, Herne Hill, S.E., Chemist.

1901. Jackson, W. B., Glengowan Printworks, Caldercruix, N.B., Chemist.

1903. Jackson, Wm. D. N., 291, Station Road, Wallsend-on-Tyne, Analytical Chemist.

1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).

1893. Jackson, Rt. Hon. W. L., F.R.S. *See* Allerton, Rt. Hon. Lord.

1899. Jackson, W. Morton, c/o Manchester Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.

O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.

1901. Jacobs, Charles B., 52, Beaver Street, New York City, U.S.A., Chemist.

1901. Jacobsen, Rudolph C., 154, Lake Street, Chicago, Ill., U.S.A., Editor of "Hide and Leather."

1900. Jacoby, Areli H., c/o American Dyewood Co., 156, William Street, New York City, U.S.A., Chemist.

1897. Jacqué, Maurice, "La Cantabrica," Galdacano, cerca Bilbao, Spain, Chemical Engineer.

1901. Jadhava, Khasberao B., Nausori, Bombay, India, Collector and District Magistrate.

1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.

1886. Jago, Wm., 5, Fig Tree Court, Temple, London, E.C., Barrister-at-Law.

1889. James, Alf., 2, Broad Street Place, London, E.C., Mining Engineer.

1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.

1885. James, Dr. J. Wm., Aylmer House, Weston-super-Mare; and (Journals) 29, Redcliff Street, Bristol, Chemical Lecturer.

1893. James, Lawrence S., 32, Hawley Street, Boston, Mass., U.S.A., Gas Inspector.

1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.

1902. Jameson, Lewis, 83, Queen Victoria Street, London, E.C., Consulting Chemist.

1903. Janes, Frank W., Wolseley Street, Surrey Hills, Victoria, Australia, Assayer.

1890. Jantzen, Paul, 133, Fenchurch Street, London, E.C., Chemical Merchant.

O.M. Japp, Dr. F. R., F.R.S., The University, Aberdeen, Professor of Chemistry.

1906. Jardine, Samuel, c/o Dallyn, Jardine and Co., 23, Scott Street, Toronto, Canada, Chemical Merchant.

1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.

O.M. Jarmay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.

1900. Jarvie, Jas., Monkland House, Kirkintilloch, N.B., Chemist.

O.M. Jayne, Dr. H. W., 931, North Broad Street, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

O.M. Jekyll, J., Castle Moat House, Lincoln, Chemical Manufacturer.

1892. Jenkin, W. A., 5, Bella Vista, Minas de Rio Tinto, Provincia de Huelva, Spain, Metallurgical Chemist.

1905. Jenkins, Chas. D., 8, Grove Street, Winchester, Mass., U.S.A., Chemist.

1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.

1894. Jenks, Robt. L., Central Excise Laboratory, Kasauli, Punjab, India, Chemist.

1905. Jennison, Jas., 103, Lynwood Avenue, Darwen, Lancashire, Chemist.

1904. Jepson, John Elliott, The Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.

1899. Jerdan, Dr. David S., c/o J. and G. Cox, Ltd., Gorgie Mills, Edinburgh, Chemist (Gelatni Works).

1899. Jessop, Louis V., Holmlea, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jessup, Alfred E., Tientsin, North China, Assayer.
1904. Jewell, Wm. M., Cable Building, Chicago, Ill., U.S.A., Chemist and Engineer.
1904. Jewson, F. T., Thornly Park Terrace, Paisley, N.B., Chemist.
1896. Job, Robt., 109, Windsor Street, Reading, Pa., U.S.A., Analytical Chemist.
1906. John, David, Haileybury, Ontario, Canada, Chemist.
1886. Johnson, A. E., Claremont, Lyndhurst Road, Wolverhampton, Analytical Chemist.
1904. Johnson, Cedric, Field House, Winnington, Northwich, Chemical Engineer.
1906. Johnson, Chas. C., Vandreuil Station, Quebec, Canada, Chemical Engineer.
1905. Johnson, Chas. F., Avery Chemical Co., Littleton, Mass., U.S.A., Superintendent.
1902. Johnson, Chas. M., 701, Orchard Street, Avalon, Allegheny Co., Pa., U.S.A., Chemist.
1891. Johnson, Edmond E., The Gales, Roding Lane, Woodford Bridge, Essex, Chemical Engineer.
1900. Johnson, Edw., c/o Herdeiros Bowman, Ltd., Caixa 57, Pernambuco, Brazil, Sugar Works Manager.
1902. Johnson, Emil F., 96–98, Maiden Lane, New York City, U.S.A., Consulting Chemist.
1900. Johnson, F. Carter, National Acid Co., 714, Union Street, New Orleans, La., U.S.A., Chemical Engineer.
1904. Johnson, F. M. G. (Journals), 286, Peel Street, Montreal, Canada; and (communications) University College, London, W.C., Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1906. Johnson, Dr. Harold, 5 and 6, Fowkes' Buildings, Great Tower Street, London, E.C., Chemist.
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
1903. Johnson, Horace, Waialua, Oahu, Hawaii, Chemist.
O.M. Johnson, J. E., 40, Idmiston Road, Stratford, E., Manufacturing Chemist.
1895. Johnson, Jesse F., Vaudreuil Station, P.Q., Canada, Chemical Engineer.
1884. Johnson, J. Grove, 23, Cross Street, Finsbury, E.C., Assayer.
1900. Johnson, John, c/o John Johnson and Co., Franklin Square, New York City, and (Journals) 1335, 53rd Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1900. Johnson, Jno. W. H., York House, Thornhill, Dewsbury, and (Journals) West Riding Rivers Board, Wakefield, Yorks., Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
O.M. Johnson, S. H., Warren Hill House, Loughton, Essex, Chemical Engineer.
1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
O.M. Johnson, T. A., Field House, Winnington Park, Northwich, Cheshire.
1903. Johnson, Thos., Caixa 94, Pernambuco, Brazil, Manager.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1889. Johnston, Thos., Nobel's Explosives Co., Ltd., 195, West George Street, Glasgow, Manager.
1904. Johnston, Thos. J., 4, Garrioch Drive, Kelvinside North, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Princess Bay, Staten Island, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W. E.
O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
O.M. Johnstone, Jas., Shawfield Works, Rutherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, National Distilleries Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
O.M. Johnstone, W. G., 14, South Clerk Street, Edinburgh, Chemist.
1905. Jolliffe, Frank, 60, Sandrock Road, St. John's, S.E., Chemist.
1902. Jollyman, Walter H., P.O. Box 3782, Johannesburg, Transvaal, Analyst.
1903. Jones, Alfred O., c/o Carr and Co., Caldewgate, Carlisle, Works Chemist.
1904. Jones, Arthur B., c/o General Chemical Co., Station F, Box 12; and (Journals) 452, Russell Avenue, Cleveland, Ohio, U.S.A., Superintendent.
1897. Jones, Chas. H., c/o Capillitas Copper Co., Muschaca, near Andalgala, Prov. Catamarca, Argentina, Technical Chemist.
1902. Jones, David R., Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 18, Warren Road, Chingford, Essex, Explosives Works Manager and Chemist.
1896. Jones, G. Cecil, Stour Villa, Mistley, Essex, Brewer's Chemist.
1904. Jones, G. Poole, c/o Sinnamahoning Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemical Engineer.
1903. Jones, G. Robert, Gas Works, Caixa 147, Pernambuco, Brazil, Gas Engineer.
1905. Jones, Harold, Morro Velho, Villa Nova de Lima, Minas Geraes, Brazil, Analyst and Assayer.
O.M. Jones, H. Chapman, Royal College of Science, South Kensington, S.W., Senior Demonstrator in Chemistry.
1898. Jones, Henry, Broughton Bridge Mills, Salford, Dyer and Finisher.
1893. Jones, Herbert. *See* Sefton-Jones, H.
1901. Jones, Herbert J., c/o The Scottish Acid and Alkali Co., Ltd., Kilwinning, N.B., Chemist.
1905. Jones, J. E. Stacey, Masonic Buildings, Coventry, Consulting Chemist and Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1899. Jones, Llewellyn J. W., Tacoma Smelting Co., Tacoma, Washington, U.S.A., Metallurgist.
1898. Jones, Martin L., c/o Ooregum G. M. Co., Oorgaum, Mysore State, India, Metallurgical Chemist.
1894. Jones, M. W., Greystonedale, Kensington Hill, Bristol, Manager (Oil and Colour Works).
1887. Jones, T. Tolley, Australian Explosives and Chemical Co., Ltd., 138, Queen Street, Melbourne, Victoria, Australia, Explosives Manufacturer.
O.M. Jones, Walter Norris, Lancashire Metal Works, Widnes, Technical Chemist.
1903. Jones, Wm. App, c/o Boston Artificial Leather Co., Metropolitan Building, New York City, U.S.A., Chemist.
1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
1905 Jones, W. H. Matthews, City Surveyor's Offices, The Town Hall, Chester, Deputy Surveyor.
1899. Joplin, Geo. C., 12, Harrington Street, Sydney, N.S.W., Australia, Analyst.
1904. Jordan, Stanley, 100, William Street, New York City, U.S.A., Importer of Chemicals.
1897. Jorissen, Dr. Wm. P., Koninklijk Inst. v. d. Marine, Willemsoord, Holland, Editor.
1905. Joseph, A. F., Royal College, Columbo, Ceylon, Lecturer on Chemistry.
1900. Josephson, Edgar, 131, Amity Street, Brooklyn, N.Y., U.S.A.
1906. Joshua, Dr. Walter P., 45, Belsize Avenue, Hampstead, N.W., Chemist.

1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Jouët, Dr. C. H., Roselle, Union Co., N.J., U.S.A., Technical Chemist.
1889. Journand, Louis, Epaillage Chimique, Pont Evêque, près Vienne (Isère), France, Technical Chemist.
1904. Jowett, Dr. H. A. D., Phoenix Mills, Dartford, Kent, Chemist.
1903. Joyce, Clarence M., c/o Arlington Co., Arlington, N.J., U.S.A., Chemist.
1887. Jürgensen, Dr. Rolof, Karlsgasse 5, Prag-Zizkov, Austria, Chemist.
1900. Just, Jno. A., 915, West Genesee Street, and P.O. Drawer 40, Syracuse, N.Y., U.S.A., Chemist.
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1896. Kalbfleisch, Franklin H., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Chemical Manufacturer.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1907. Karp, Samuel E., 305, Franklin Avenue, Scranton, Pa., U.S.A., Chemist.
1905. Katzenbach, Welling S., 164, Front Street, New York City, U.S.A., Chemist.
1901. Kauder, Dr. E., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth, Amboy, N.J., U.S.A., Chemist.
1904. Kawai, I., Camphor Monopoly Bureau, Kumoidori, Kobé, Japan, Chemist.
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
O.M. Kay, Wm., E., Marple Lodge, Marple, Cheshire, Printworks Chemist.
1905. Kaye, Frederick, Hampden House, Phœnix Street, London, N.W., Research Chemist.
1904. Kaye, Thos., Westerfield, Perth, Scotland, Analytical Chemist.
1905. Kayser, Edwin Cuno, c/o Messrs. J. Crosfield & Sons, Ltd., Warrington, Chemist.
1884. Keane, Dr. Chas., A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
O.M. Kearns, H. W., Baxenden House, near Accrington, Dyer.
1897. Kearns, Jno. S., Baxenden House, near Accrington, Chemist and Dyer.
1894. Kebler, Lyman F., Department of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chief of Drug Laboratory.
[illegible]. Keily, C. L., c/o Ilford, Ltd., Ilford, Essex, Chemist
[illegible]. Keiser, Prof. E. H., Washington University, St. Louis, Mo., U.S.A., Professor of Chemistry.
1905. Keith, Simeon C., jun., 20, Highland Avenue, Somerville, Mass., U.S.A., Chemist and Bacteriologist.
[illegible] Kell, Henry C., c/o Martineau's Brewers' Sugar Co., King Edward Street, London E., Sugar Chemist.
[illegible] Keller, Dr. Edward, P.O. Box 724, Baltimore, Md., U.S.A., Chemist and Metallurgist.
1906. Keller, Robt. J., c/o Geigy Aniline & Extract Co., 89, Barclay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1889. Kempson, John F., Pye Bridge Chemical Works, near Alfreton, Derbyshire, Chemical Manufacturer.
1901. Kennedy, Alex., Kenmill House, Bothwell, N.B., Rosin Distiller.
1903. Kennedy, Hugh Watson, 626, South 19th Street, Philadelphia, Pa., U.S.A., Chemist.
1901. Kenrick, Dr. Frank B., 73, Baldwin Street, Toronto, Canada, Lecturer on Chemistry.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1906. Kepner, S. H., 149, 12th Street, Long Island City, N.Y., U.S.A., Superintendent.
1900. Keppelmann, Alf. J., P.O. Box 1382, Philadelphia, Pa., U.S.A., Chemical Merchant.
1888. Ker, Alan D., 14, Wilton Mansions, Glasgow, Chemical Manufacturer.
1899. Kern, Walter P., 343, Lafayette Avenue; and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., 525, Jefferson Avenue, Niagara Falls, N.Y., U.S.A., Ceramic Engineer (Carborundum Co.).
1894. Kerr, Jas., Surgeons Hall, Edinburgh, Lecturer on Chemistry.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., c/o General Chemical Co., 608, Philadelphia Bourse, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1902. Kessler, Henry W., 317, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1903. Kessler, R., jun., The Nordmont Chemical Co., Nordmont, Pa., U.S.A., Chemical Manager.
1893. Kestner, Paul, 7, Rue de Toul, Lille, France, Chemist.
1898. Keswick, Wm., M.P., 3, Lombard Street, London, E.C., Merchant.
1900. Kewley, Jas., Arbory Road, Castletown, Isle of Man, and (Journals) Balek Pappan, Dutch Borneo, Technical Chemist.
1890. Keys, W. H., Lyndon House, West Bromwich, Oil and Chemical Manufacturer.
1892. Kibble, W. Oakes, Charlotte, N.C., U.S.A., Chemical Engineer.
1896. Kier, Thos., Thornliebank, Glasgow, Chemist.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.,
1901. Kilmer, Fred. B., New Brunswick, N.J., U.S.A., Chemical Manufacturer.
1905. Kimball, Herbert S., 101, Tremont Street, Boston, Mass., U.S.A., Mill Engineer.
O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1905. King, Capt. Alex E., R.A., Egyptian Army Citadel, Cairo, Egypt, Inspector of Explosives.
O.M. King, A. J., M.P., (Journals) Ingersley Vale, and (communications) Rock Bank, Bollington, near Macclesfield, Bleacher and Finisher.
1884. King, Col. C. M., Campsie Alum Works, Lennoxtown, N.B., Alum Manufacturer.
1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.
O.M. King, J. Falconer, 20, Chambers Street, Edinburgh, Consulting Chemist.
1887. King, Col. Robt., 115, Wellington Street, Glasgow, Chemical Manufacturer.
1907. King, Robt. J., c/o Merrimac Chemical Co., North Woburn, Mass., U.S.A., Chemist.
1895. King, Sidney J., 1, Russell Villas, Pope's Grove, Strawberry Hill, Middlesex, Colour and Dyestuff Traveller.
O.M. King, Walter R., 16, Mincing Lane, London, E.C., and (Journals) Holford Lodge, Trinity Avenue, Southend-on-Sea, Chemical Manufacturer.

1905. King, Warren, C., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Salesman.

1903. King, William, c/o Natal Estates, Ltd., South Coast Junction, Natal, S. Africa, Analytical Chemist.

1899. King, Wm. R., 17, Fernwood Road, Summit, N.J., U.S.A., Mechanical Engineer.

1896. Kingdon, Holman, 25, Grappenhall Road, Stockton Heath, Warrington, Technical Chemist.

1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.

O.M. Kingzett, C. T., 1, Hornton Street, Kensington, W., and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Technical Chemist.

1906. Kinnersley, H. W., c/o Blyth and Platt, Solar Works, Watford, Herts, Chemist and Manufacturer.

1892. Kinnicutt, Professor L. P., 77, Elm Street, Worcester, Mass., U.S.A., Professor of Chemistry (Worcester Polytechnic Institute).

1897. Kipping, Dr. F. Stanley, F.R.S., University College, Nottingham, Prof. of Chemistry.

1906. Kirby, Oswald F., Leeds Institute, Leeds, Lecturer on Chemistry.

1898. Kirkland, Archd., 78, High Street, Irvine, N.B., Baker.

1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.

1897. Kirkland, Robt., 25, Collier Road, Cambridge, Chemist.

1905. Kirkman, A. S., 52, Bridge Street, Brooklyn, N.Y., U.S.A., Soap Manufacturer.

1900. Kirkpatrick, Prof. Stafford F., School of Mining, Kingston, Ont., Canada, Professor of Metallurgy.

1887. Kitamura, Y., Kaigun Kosho, Yokosuka, Japan, Agricultural Chemist.

1902. Kitchen, Wm. J., Port Melbourne North, Vic. Australia, Soap and Candle Manufacturer.

1891. Kitson, Rt. Hon. Sir James, Bart., M.P., Gledhow Hall; and (Journals) Monkbridge Iron and Steel Co., Ltd., Leeds, Iron and Steel Manufacturer.

1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.

1900. Kittredge, H. G., 217, North Ludlow Street, Dayton, Ohio, U.S.A., Chemist.

1900. Kleber, Dr. Clemens, Union Avenue, Clifton, N.J., U.S.A., Director (Fritzche Bros.' Laboratory).

1888. Kleemann, Dr. S., Farben Fabrik, Forchheim, Bavaria, Analytical Chemist.

1903. Kline, Clarence M., 429, Arch Street, Philadelphia, Pa., U.S.A., Wholesale Druggist.

1889. Klipstein, A., 122, Pearl Street, New York City, U.S.A., Chemical Manufacturer.

1902. Klipstein, Ernest C., 116, Prospect Street, East Orange, N.J., U.S.A., Chemical Manufacturer.

1907. Klotz, John R. McPherson, 26, State Street, Newark, N.J., U.S.A., Industrial Chemist.

1891. Knaggs, Alfred B., Bradley Lane, Huddersfield, Technical Chemist in Dyeworks.

1905. Knapp, Sewell A., 1243, Myrtle Street, Oakland, Cal., U.S.A., Mine Manager.

1906. Knapp, Walter R., c/o Semet Solvay Co., Ensley, Ala., U.S.A., Chemist.

1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.

1904. Kniffen, Frederick, c/o International Smokeless Powder Co., Parlin, N.J., U.S.A., Chemist.

1887. Knight, A. H., 2, Gerald Road, Oxton, Cheshire, Assayer.

1903. Knight, Harley F., 64, Amhurst Park, Stamford Hill, N., Analyst.

1884. Knight, Henry, Stanley House, 73, Anfield Road, Liverpool, Colour and Varnish Manufacturer.

O.M. Knight, J. Baillie, Royal Primrose Soapworks, Silvertown, London, E., Soap Manufacturer.

1887. Knights, J. West, Public Laboratory, Tenison Road, Cambridge, Analytical Chemist.

1885. Knipler, F., c/o R. Harper and Co., Port Melbourne, Victoria, Australia, Starch Manufacturer.

1883. Knowles, Joshua, Stormer Hill, Tottington, near Bury, Calico Printer.

1904. Knowles, W. R., The Hollies, Wood Green, Wednesbury, Chemical Works Manager.

1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and c/o Parbury, Henty and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.

1902. Knudsen, Hans, 68, Victoria Street, London, S.W., Inventor.

1906. Knudsen, Kristian Hv., 226, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1905. Koch, Geo. W., Lock Box 12, Woodhaven, Long Is., N.Y., U.S.A., Chemist.

1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa. U.S.A., Chemist.

1903. Koch, Walter E., 527, Guaranty Trust Building, El Paso, Texas, U.S.A., Metallurgical and Mining Engineer.

1904. Koebig, Dr. J., 127, West First Street, Los Angeles, Cal., U.S.A., Chemical Engineer.

1901. Koehler, Dr. H., c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Manager.

1904. Koerner, H. Theo., Beyerstrasse 28, Chemnitz, Germany, Student of Chemistry.

1884. Kohn, Dr. Charles A. *See* Keane, Dr. Chas. A.

1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.

1904. Korte, Dr. R. F., Schwarzenstein, Altena i/Westfalen, Germany, Chemist.

1902. Kottmann, Dr. Gustav, Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

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1906. Krais, Dr. Paul, 60, Nauclerstrasse, Tuebingen, Germany, Chemist.

1894. Krause, Dr. Albert H., 32, Wellington Avenue, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).

O.M. Krause, Prof. Dr. G., Cöthon (Anhalt), Germany, Chemist.

O.M. Krause, O. H., c/o American Sugar Refining Co., Jersey City, N.J., U.S.A., Chemical Engineer.

1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.

1900. Kremers, Dr. Edw., Madison, Wis., U.S.A., Professor (University of Wisconsin).

1906. Kremers, William, Holland, Mich., U.S.A., Sugar Mill Superintendent.

1904. Kübler, Alfred, 69, Barclay Street, New York City, U.S.A., Vice-President, Geigy Aniline and Extract Co.

O.M. Kühl, W. H., 73, Jägerstrasse, Berlin, Germany, Bookseller.

1900. Kunheim, Dr. Erich, 32, Dorotheenstrasse, Berlin, N.W., Germany, Chemist.

1904. Kunz, Dr. George F., c/o Tiffany and Co., 37th Street and 5th Avenue, New York City, U.S.A., Gem Expert.

1905. Kurt, Franklin T., 458, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.

1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.

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1906. Lacell, Harold G., Marlowe, Hendon Lane, Finchley, N., Chemist.

1890. Lacey, E. C., 10, Clarence Road, Croydon, Manufacturing Chemist.

1903. Lachman, Dr. Arthur, Petaluma, Cal., U.S.A., Chemical Engineer.

O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.

O.M. Lake, G. jun., Lee Mount, Glossop, Derbyshire, Analytical Chemist.

1907. Lake, Henry B., Laboratory, Canadian Pacific Railway Co., Winnipeg, Canada, Chemical Engineer.

1900. Lamar, Wm. R., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Chemist.

1898. Lamb, Morris Chas., 151, Westcombe Hill, Blackheath, S.E., Chemist.

1900. Lambert, Walter S., Vardre Road, Clydach, R.S.O., Glamorgan, Analyst.

1907. Lancaster, Harry M., School of Practical Science, Toronto, Canada, Chemist.

1895. Lancaster, Jno. C., 260, Alfreton Road, Nottingham, Engineering Works Manager.

1904. Lancey, Darragh de, c/o Waterbury Buckle Co., Waterbury, Conn., U.S.A., Secretary.

1895. Landin, John, 40, Drottninggatan, Stockholm, Sweden, Public Analyst.

1904. Lane, C. Cyril P., c/o The Avon India-Rubber Co., Melksham, Wilts., Chemist.

1906. Lane, Fred H., 418, Sackett Street, Brooklyn, N.Y., U.S.A., Chemist.

1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.

1890. Lang, Jas. G., P.O. Box 475, Victoria, B.C., Canada, Analytical Chemist.

1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

O.M. Langdon, Dr. M. J., Room 511, 621, Broadway, New York City, U.S.A., Analytical Chemist.

1890. Lange, Dr. Martin, Malapani, bei Oppele a/Schl, Germany, Analytical Chemist.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.

1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.

1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto Canada, Chemist.

1898. Langstaff, Wm., Grasselli, N.J., U.S.A., Chemist.

1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks., Chemist and Manager.

1905. La Pierre, Elie H., 588, Huron Avenue, Cambridge, Mass., U.S.A., Pharmacist.

1906. Larsen, Axel, 76, York Street, Westminster, S.W., Mining Engineer.

1903. Larter, Alfred T., Coolavin, St. Stephen's Road, Hounslow, Chemist.

1907. Lasché, Prof. Alfred, The Lasché Institute, 2809, Vine Street, Milwaukee, Wis., U.S.A., Chemist and Bacteriologist.

1904. Lasher, F. G., The Lake Pigment Co., Dunellen, N.J., U.S.A., Chemist.

1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.

1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.

1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Chemist.

1904. Laury, N. Arthur, c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.

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1904. Law, Herbert, 72, Belvedere Road, Liscard, Cheshire, Analytical Chemist.

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[illegible] Lawrence, V. O., 801, Drexel Building, Philadelphia, Pa., U.S.A., Chemical Works Manager.

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[illegible] Lawson, Wm., c/o Great Western Sugar Co., Sterling, Colo., U.S.A., Chemist.

[illegible] Lawson-Johnston, G., (Journals) 29, Portman Square, W., and c/o Bovril, Ltd., 152, Old Street, London, E.C., Vice-Chairman.

1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.

1893. Lawton, Thos., Calthorpe House, Aldridge Road, Perry Bar, Birmingham, Chemical Works Manager.

1905. Laycock, Thos. P., Fletton Spring, Peterborough, Managing Director, Platico Mantle Co.

1890. Laycock, Dr. W. F., 46, Boar Lane, Leeds, Analytical Chemist.

1902. Lazell, Ellis Warren, 42, North 16th Street, Philadelphia, Pa., U.S.A., Chemist.

1898. Lean, Geo., 15, Park Terrace, Glasgow, Chemist.

1897. Leathart, Thos. H., c/o Locke, Blackett and Co., Ltd., Lead Works, Newcastle-on-Tyne, Lead Manufacturer.

O.M. Leather, Dr. J. Walter, Agricultural Research Institute, Pusa, Bengal, India, Government Chemist.

1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.

1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).

1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.

1896. Lederle, Dr. E. J., 518, Fifth Avenue, New York City, U.S.A., Chief Chemist.

1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.

1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.

1903. Ledoux, Aug. D., 68, Beaver Street, New York City, U.S.A., Importer of Pyrites.

1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.

1901. Lee, FitzHugh, c/o Grasselli Chemical Co., Cleveland, Ohio, U.S.A., Superintendent.

1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.

1905. Lee, John C., Mountford Street, Brookline, Mass., U.S.A, Assistant Engineer (American Telegraph and Telephone Co.).

1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.

1885. Lee, S. Wright, 6–10, Whitechapel, Liverpool, Wholesale Druggist.

1906. Lee, William, 43, Daisy Bank, Heaton Park, Manchester, Works Chemist.

1886. Leeds, F. H., 26, East Bank, Stamford Hill, N., Analytical Chemist.

1903. Leerburger, Henry, 54, Beekman Street, New York City, U.S.A., Essential Oil Merchant.

1903. Leese, Jos., jun., 3, Ash Grove, Victoria Park, Manchester, Analytical and Technical Chemist.

1901. Lefebvre, Georges, Compagnie du Phospho-Guano, 27 Rue La Rochefoucauld, Paris, Director.

1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.

1907. Lehmann, Dr. Adolf, Bangalore, India, Agricultural Chemist.

1901. Leibfried, Jno. E., Bethlehem, Pa., U.S.A., Analytical Chemist.

1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.

1906. Leigh, Edw. Collier, Caixa 147, Pernambuco, Brazil, Gas Works Manager.

1902. Leighton, A. E., Cordite Factory, Aruvankad, Nilgiris, India; and Journals (until May 31st only) to Whitcott, Edgware, Middlesex, Analytical Chemist.

1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.

1904. Le Maistre, Fred J., Eastern Laboratory, Chester, Pa., U.S.A., Research Chemist.

1898. Leman, Wm. T., c/o The Texas Co., Port Arthur, Tex., U.S.A., Oilworks Manager.

1901. Lengfeld, Dr. Felix, 1804, Fillmore Street, San Francisco, Cal., U.S.A., Manufacturing Chemist.

1883. Lennard, F., c/o Forbes, Abbott & Lennard, Ltd., Chemical Works, Shoreham, Sussex, Chemical Manufacturer.

1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.

1903. Lepsius, Prof. Dr. B., Griesheim a/M., Germany, Director (Chem. Fabr. Griesheim-Elektron).

1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIIIᵉ.), France.

1904. Lesley, R. W., Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1907. Leslie, Fred A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Assistant Chemist.

1894. Leslie, Hugh M., Marikuppam, Mysore State, South India, Chemical Engineer.

1904. Lessing, Dr. Rudolf, 3, Moriston Place, Clydach, R.S.O., Glam., Chemist.

1900. Lessner, Chas. B., Carrill, Spain, Metallurgical Chemist.

1892. Lester, J. H., Royal Exchange, Manchester, Analytical Chemist.

1904. Le Sueur, E. A., 50, MacLaren Street, Ottawa, Ont., Canada, Electrical and Chemical Engineer.

1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.

1898. Leuthardt-Thornton, Peter, 14, Steele's Road, Hampstead, N.W., Chemical Manufacturer.

891. Lever, Wm. H., M.P., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.

901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.

1903. Levi, Dr. Louis E., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Chemist.

1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.

1901. Levinstein, Dr. Herbert, 21, Minshull Street, Manchester, Chemist.

O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.

1903. Levy, Arthur G., 45, Clifton Hill, Abbey Road, London, N.W., Chemist.

1901. Levy-Mond, Dr. Albert, Brimsdown Works, Ponders End, Middlesex, Chemical Engineer.

1905. Lévy, René J., c/o Soc. l'Air Liquide, 43, Rue St. Lazare, Paris, Chemist and Technical Manager.

1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.

1898. Lewin, H. James, Royal Victoria Yard, Deptford, S.E., Analytical Chemist.

1889. Lewis, A. E., 20, Seymour Street, Broadgreen, near Liverpool, Analytical Chemist.

1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.

1904. Lewis, Edw. W., c/o J. G. Ingram and Son, London India Rubber Works, Hackney Wick, N.E., Chemist.

1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.

1905. Lewis, F. W., Aetna Powder Co., 1718, Tribune Building, Chicago, Ill., U.S.A., Secretary.

1900. Lewis, John, 35, Mundania Road, Honor Oak, S.E., Cashier (Paint Works).

1900. Lewis, S. Judd, 122, Newington Causeway, London, S.E., Analytical Chemist.

1889. Lewkowitsch, Dr. Julius, 71, Priory Road, West Hampstead, N.W., Consulting Chemist.

1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.

O.M. Lichtenstein, Theodore, Chemical Works, Silvertown, E., Manufacturing Chemist.

1904. Lichtenthaeler, Robt. A., 303, South Main Street, Winston-Salem, N.C., U.S.A., Chemist.

1892. Liddle, G. A., Eyreton Terrace, Crosby, Isle of Man, Chemist, Dyewood Extract Works.

1885. Liddle, W. T., 14, Willows Avenue, Ansdell, Lytham, Chemist and Manager.

1904. Lieber, Hugo, 1, Platt Street, New York City, U.S.A., Chemist.

O.M. Liebmann, Dr. A., 16, Darby Avenue, West Didsbury, Manchester, Analytical Chemist.

1899. Liedbeck, P. F. Alarik, 43, Strandwagen, Stockholm, Sweden, Chemical Engineer.

O.M. Lightfoot, T. E., 88, Arden Terrace, Accrington, Calico Printer's Chemist.

1905. Liley, Thos. A., 37, Aston Road, Bramley, Leeds, Chemist.

1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.

1885. Lilly, Oliver M., The Croft, Spondon, Derby, Colour Manufacturer.

1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.).

1906. Linder, S. E., Leodholt, The Drive, Buckhurst Hill, Essex, Analytical Chemist.

1903. Lindmueller, C., c/o United Zinc and Chem. Co., Argentine, Kansas, U.S.A., Chemist.

1897. Lindsay, Robt., Cyanide Works, Ferreira Deep G. M. Co., P.O. Box 1056, Johannesburg, Transvaal, Chemist.

1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, E.C.; and (Journals) Hazeldene, Kingston Road, New Malden, Consulting Chemist.

1901. Lippincott, Warren B., c/o United Zinc and Chemical Co., Argentine, Kansas, U.S.A., Chemist.

1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.

1896. Lishman, Geo. P., Bunker Hill, Fence Houses, Co. Durham, Colliery Chemist.

1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.

1901. Little, C. A., Elyria, Ohio, U.S.A., Analytical Chemist.

1889. Little, Wm. G., Blendon Grove, Bexley, Kent, Chemical Manufacturer.

O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.

1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.

1886. Liversedge, A. J., c/o Fullerton, Hodgart & Barclay, Ltd., Vulcan Works, Paisley, N.B., Mechanical Engineer.

1906. Liversedge, S. G., City Laboratory, Castle Street, Dublin, Ireland, Analytical Chemist.

1904. Liverseege, J. F., Council House, Birmingham, Public Analyst.

O.M. Liversidge, Prof. A., F.R.S., The University, Sydney, N.S.W., Professor of Chemistry.

1907. Liversidge, Bernard, Rossholme, Clifton Lane, Rotherham, Yorks, Analytical Chemist.

1883. Livingston, W. J., London County Council, Spring Gardens, London, S.W., Analytical Chemist.

1903. Llewellyn, Ivor P., Goole Alum Works, Goole, Chemist.

1899. Lloyd, Charles, (subscriptions) c/o Lake View Consols, Ltd., Salisbury House, London, E.C.; and (Journals) c/o Manager, Lake View Consols, Ltd., Boulder, West Australia, Secretary.

1900. Lloyd, Fred. J., Muscovy House, Trinity Square, London, E.C., Analyst.

1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.

1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks, Lecturer in Chemistry.

1900. Lloyd, Thos. H., c/o Quibell Bros., Newark, Analyst.

1901. Lober, Jno. B., Vulcanite Portland Cement Co., 1230, Land Title Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.

1888. Lodge, Edw., 25, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.

1900. Loeb, Dr. Morris, 273, Madison Avenue, New York City, U.S.A., Professor of Chemistry.

1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.

1905. Lomax, Abraham, 179, Lord Street, Farnworth, R.S.O., Potter's Chemist.

1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.

1898. Longstaff, Jas. P., Chemical Department, The University, Edinburgh, Assistant.

1904. Loomis, Dr. H., 58, West 40th Street, New York City, U.S.A.
1902. Loomis, Henry M., P.O. Box 185, Harrisburg, Pa., U.S.A., Chemist.
1890. Lord, F. J., 4, Winmarleigh Street, Warrington, Analytical Chemist.
1896. Lord, Jno. Lloyd, 23, Park View, Elton, Bury, Lancs., Chemist and Manager.
1897. Lord, N. W., 338, West 8th Avenue, Columbus, Ohio, U.S.A., Professor of Metallurgy.
O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.
1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.
1905. Loring, Lindley, 55, Kilby Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).
O.M. Lorrain, J. G., Norfolk House, Norfolk Street, Strand, London, W.C., Chartered Patent Agent.
1904. Lossen, Dr. Clemens F., Strada Lipscani 10, Bukarest, Roumania, Chemist.
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O.M. Louis, D. A., 77, Shirland Gardens, London, W., Metallurgist and Mining Engineer.
1894. Louis, Prof. Henry, Armstrong College, Newcastle-on-Tyne, Professor of Mining.
O.M. Love, Dr. E. G., 80, East 55th Street, New York City, U.S.A., Analytical Chemist.
1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Broxburn Oil Co., Ltd.).
1895. Lovejoy, Frank W., Kodak Park, Rochester, N.Y., U.S.A., Chemical Engineer.
1904. Loveland, Jas. W., 8, Kenwood Street, West Somerville, Mass., U.S.A., Superintendent of Soap Works.
O.M. Lovibond, J. W., Lake House, Salisbury, Tintometer Manufacturer.
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1897. Low, Albert H., P.O. Drawer 1537, Denver, Colo., U.S.A., Metallurgical Chemist.
1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
1905. Lowe, Houston, The Lowe Bros. Co., Dayton, Ohio, U.S.A., Paint and Varnish Maker.
[illegible] Lowe, James, City Chambers, 45, John Street, Glasgow, Gas Engineer.
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O.M. Lowe, W. F., 9, Hough Green, Chester, Analytical Chemist.
1904. Lowenstein, Arthur, c/o Nelson, Morris and Co., U.S. Yards, Chicago, Ill., U.S.A., Chemist.
1885. Lowes, Dr. J. G. F., Snitterfield House, Stratford-on-Avon, Paper Maker.
[illegible] Lowson, Wm., The University, Leeds, Chemical Lecturer.
1895. Lucas, A., Survey Department, Giza, Egypt, Analyst.
1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
O.M. Lucas, R., [illegible] 11, Wiesbaden, Germany, Technical Chemist.
O.M. Luck, A. Courtenay, Naval Arsenal, Zarate, Argentina, Explosives Chemist.
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1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, N.B., Technical Chemist.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Lundholm, Carl O., Nobel's Explosives Co., Ltd., Ardeer Factory, Stevenston, Ayrshire, Manager.
1898. Lundteigen, Andreas, Union City, Mich., U.S.A., Chemist.
O.M. Lunge, Prof. Dr. G., [illegible] 56, Zurich, V., Switzerland, Professor of Chemistry.
1894. Lungwitz, Theo., c/o Chas. Pfizer and Co., 81, Maiden Lane, New York City, U.S.A., Chemist.
1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.
1890. Luthy Edmund O., 2419, Ohio Avenue, Cincinnati, Ohio, U.S.A., Distiller.
1884. Lüthy, Otto, Maywood, N.J., U.S.A., Analytical Chemist.
1895. Luxmoore, Dr. Chas. M., University College, Reading, Lecturer on Chemistry.
1899. Luxton, Thos., 28, Albany Street, Hull, Teacher of Chemistry.
1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds., Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds., Straw Dyer.
1884. Lyle, James, Ardesco, Plaistow Wharf, Victoria Docks, E., Sugar Refiner.
1885. Lyle, Jno., 21, Mincing Lane, London, E.C., Sugar Refiner.
1902. Lyle, Robert F., Berry Yards Sugar Refinery, Greenock, N.B., Analytical Chemist.
1896. Lymn, Arthur H., 71, College Road, Bromley, Kent, Chemical Works Manager.
1906. Lynch, W. D., 10, Pinckney Street, Boston, Mass., U.S.A., Analytical Chemist.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
1902. Lyon, Edwd. H., 520, West 27th Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks., Tar Distiller.
1906. Lyons, Robert H., Emporium, Pa., U.S.A., Chemist.
O.M. Lytle, A. M, North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.

M

1898. Maass, Frank, P.O. Box 1507, Paterson, N.J., U.S.A., Silk Dyer.
1904. Mabee, Fred. Carleton, Sumner Hall, Cambridge, Mass, U.S.A., Assistant in Chemistry.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1891. Macadam, Herbert E., Milton House, Selsdon Road, Wanstead, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1891. Macallan, J., 3, Rutland Terrace, Clontarf, Dublin, Analytical Chemist.
1894. McAlley, Robt., Bankside, Falkirk, N.B., Paint Works Manager.
1892. Macara, Thos., jun., 30, Oakfield Road, Stroud Green, N., Chemist.
1889. McArthur, Jno., 196, Trinity Road, Wandsworth Common, S.W., Chemist.
1887. McArthur, J. B., Price's Patent Candle Co., Limited, Bromborough Pool, near Birkenhead, Chemist.
O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.
1901. MacArthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., 7, Temple, Dale Street, Liverpool, Drysalter and Dyewood Extractor.
1905. McCallum, A. L., Queen Building, Halifax, N.S., Canada, Analytical and Consulting Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
O.M. McCallum, J. M., Southdene, Paisley, N.B., Soap Manufacturer.
1903. McCandless, Jno. M., State Laboratory, Atlanta, Ga., U.S.A., Analytical Chemist.
1894. McCann, Owen, c/o J. Gilton and Co., Oriel Street, Vauxhall Road, Liverpool, Printing Ink Manufacturer.

1905. McCaw, Major W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.

1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.

1903. McCourt, Cyril D., 7, Malwood Road, Balham Hill, S.W., Research Chemist (Morgan Crucible Co.).

O.M. McCowan, W., Essex Wharf, Narrow Street, Limehouse, E.

1897. McCrae, Dr. John, jun., P.O. Box 434, Pretoria, Transvaal, and (Journals) 7, Kirklee Gardens, Kelvinside, Glasgow, Chemist, Dept. of Agriculture.

1898. McCreath, Wm. D., c/o Quantock Vale Cider Works, North Petherton, Bridgewater, Cider Manufacturer.

1884. McCulloch, J., 13, Clarence Drive, Hyndland Road, Glasgow, Chemical Works Manager.

1900. McCulloch, John, Glencoe, Lostock Gralam, Cheshire, Chemical Engineer.

1903. McCully, R. E. J., Crown and Quarry Works, Frindsbury, Rochester, Kent, Analytical Chemist.

O.M. McDaniel, J. J., Woodlands, Bandon, Ireland, Distiller.

O.M. Macdonald, A., 72, Great Clyde Street, Glasgow.

1907. McDonald, Geo. G., 66, Madison Avenue, Toronto, Canada, Student.

1897. MacDonald, G. W., Beechfield, The Park, Birkenhead, Explosives Chemist.

O.M. Macdonald, J. W., Cleveland, The Glebe, Blackheath, S.E., Analytical Chemist.

1902. Macdonald, Peter, jun., c/o Mazapil Copper Co., Ltd., Concepcion del Oro (Apartado No. 5), Saltillo, Zacatecas, Mexico, Analytical Chemist.

1899. MacDonald, S. Fremont, c/o Ashtabula Hide and Leather Co., Ashtabula, Ohio, U.S.A., Tanner.

O.M. McDonald, T. McG., Walilabo Estate, St. Vincent, West Indies, and (Journals) 27, Prince of Wales Mansions, Battersea, S.W., Sugar Chemist.

1906. Macdougald, Geo. D., City Laboratory, 13, Shore Terrace, Dundee, Analyst.

1895. McDougall, Isaac, jun., 68, Port Street, Manchester, Student.

1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.

1906. McDowall, Wm., c/o Inglis, Lomax and Co., Antofagasta; Chile, South America, Analytical Chemist.

1906. McDowell, Alex. H., c/o General Chemical Co., Bayonne, N.J., U.S.A., Chemist.

1905. McDowell, Stewart H., 1239, South 47th Street, Philadelphia, Pa., U.S.A., Colour Maker.

1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."

1891. McEwen, Atholl F., 40, Handen Road, Lee, S.E., Analytical Chemist and Assayer.

1901. McEwen, Duncan C., 175, St. Vincent Street, Glasgow, Metallurgical Chemist.

1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.

O.M. Macfarlane, R. F., Tharsis Copper Works, East Moors, Cardiff, Works Manager.

1884. Macfarlane, Thos., 317, Queen Street, Ottawa, Canada, Analyst to Dominion of Canada.

1901. McFarlane, Walter, Sunnyside, Mansewood, Pollockshaws, Glasgow, Printworks Manager.

1890. McFarlane, W. W., 522, West 9th Street, Chester, Pa., U.S.A., Dyeworks Manager.

1893. McGhie, T. Burns, c/o Quirk, Barton and Co., Normandy Wharf, Rotherhithe, S.E., Analytical Chemist and Assayer.

1904. McGill, A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.

1891. McGill, Dr. J. T., Vanderbilt University, Nashville, Tenn., U.S.A., Adjunct Professor of Chemistry.

1899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co., Pipe House Wharf, Swansea, Analytical Chemist.

1887. McGlashan, John, Cawnpore Sugar Works, Cawnpore, India, Technical Chemist.

1902. McGovney, Chas. S., Engineering Experiment Station, Urbana, Ill., U.S.A., Chemist.

1884. McGowan, John, Ash House, Talke, near Stoke-upon-Trent, Colliery Manager.

1906. McGregor, Russell, 20, Havelock Square, Sheffield, Analytical Chemist.

1905. McGrigor, G. D., Perranuthnoe, Marazion, Cornwall, Mine Owner.

1896. McIlhiney, Dr. Parker C., 145, East 23rd Street, New York City, U.S.A., Chemist.

1894. McIlwaine, Alf. W., Stoneferry, Hull, Oil Manufacturer.

O.M. MacIndoe, G. D., Ness Street, Invercargill, New Zealand, Public Analyst and Consulting Chemist.

1903. Macintire, Benj. Gould, P.O. Box 365, Rumford Falls, Maine, U.S.A., Chemist.

1904. Macintosh, J. C., Bruce Mines, Ont., Canada, Chemist.

1888. MacKean, Wm., 208, Bedford Hill, Balham, S.W., Technical Chemist.

O.M. McKechnie, D., Heath House, Runcorn, Copper Extractor.

O.M. McKechnie, D. M., Metal Works, Widnes, Lancashire, Copper Extractor.

1904. McKechnie, R. D., Productos Quimicos de Huelva, Sociedad Anonyma, Huelva, Spain, Chemist.

1887. McKellar, W. G., c/o United Alkali Co., Ltd., Eglinton Works, Irvine, N.B., Technical Chemist.

1906. Mackendrick, W. P., c/o Anglo-American Oil Co., Ltd., 13, St. Ann Street, Manchester.

1904. McKenna, A. G., 506, Hawkins Avenue, Braddock, Pa., U.S.A., Metallurgical Chemist.

1895. McKenna, Dr. Chas. F., 221, Pearl Street, New York City, U.S.A., Chemist.

1899. McKenzie, Alex. H., 17, North Street, North Adams, Mass.,U.S.A., Colour Mixer.

1893. McKerrow, C. A., Thornbank, Knutsford Road, Alderley Edge, Cheshire, Consulting Chemist.

1905. McKerrow, W. J., c/o J. C. and J. Field, Ltd., Lambeth, S.E., Analytical Chemist.

1893. McKesson, John, 91, Fulton Street, New York City, U.S.A., Manufacturing Chemist.

1891. Mackey, W. McD., Victoria Chambers, Leeds, Analytical Chemist.

1900. McKillop, George F., Broxburn Oil Works, Broxburn, N.B., Works Chemist.

1890. McKillop, Jno., 93, Brook Green, London, W., Metallurgist.

1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y., U.S.A., Colour Maker.

1898. McLaurin, Robt., 414, Sauchiehall Street, Glasgow, Chemist.

1888. MacLean, Alex. S., 31, Bank Street, Greenock, N.B., Soap Refiner.

1905. McLellan, Basil G., c/o Rowutree & Co., Ltd., The Cocoa Works, York, Analytical Chemist.

1892. McLeod, Jas., Westhill, Cardross Road, Dumbarton, N.B., Analytical Chemist and Gas Examiner.

1903. MacMahon, F. W., 31, Marler Road, Forest Hill, S.E., Chemist (Oxychlorides, Ltd.).

1896. McMaster, Daniel, c/o Oxford Paper Co., Rumford Falls, Maine, Paper Mill Manager.

1894. Macmillan, Arch., Seaforth House, Blackhall, Midlothian.

1907. McMillen, Russell H., Research Department, Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., U.S.A., Chemist.

1903. McMullan, Charles, 4, William Street Chambers, Belfast, Ireland, Chemist.

1904. McMullen, Alan, 108, James Street, Dublin, Ireland, Brewer.

1889. McMurtrie, J. M., 320, Maxwell Road, Pollokshields, Glasgow, Brass Founder.

1900. McMurtrie, Dr. Wm. T., 480, Park Avenue, New York City, U.S.A., Chemist.

1895. McMurtry, G. C., Wallaroo Smelting Works, Wallaroo, South Australia; and (Subscriptions) c/o C. H. Izod, 84, Queen Victoria Street, London, E.C., Manager.

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1892. McVie, Jas. P., Ravenscraig, Canning Street, Hebburn-on-Tyne, Analytical Chemist.
1894. McVitie, Robt., Biscuit Works, Willesden, N.W., Biscuit Manufacturer.
1901. Maertens, Emile, P.O. Box 1002, Providence, R.I., U.S.A., Engineer.
1895. Magnus, Isidor, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture, Richmond, Va., U.S.A., Chemist.
1906. Maguire, Peter, Hamer House, Rochdale, Lancashire, Chemist and Colourist.
1885. Mahon, R. W., N. Y. Central and Hudson River Railroad, West Albany, N.Y., U.S.A., Chemist.
1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
1904. Mair, William, 7, Comiston Road, Edinburgh, Chemist.
1905. Major, Ernest, Eagle Paint Works, Snail's Bay, Balmain, Sydney, N.S.W., Australia, Paint Works Manager.
O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks., Tar Distiller and Chemical Manufacturer.
1886. Mallinckrodt, Edw., Mallinckrodt Chemical Works, St. Louis, Mo., U.S.A., Manufacturing Chemist.
1897. Mallory, J. Halsey, Drawer 69, Columbia, S.C., U.S.A., Assistant Chemist (The American Cotton Oil Co.).
1896. Mann, E. A., Government Laboratory, Perth, Western Australia, Government Analyst.
1893. Mann, Harold H., Indian Tea Association, Royal Exchange Buildings, Calcutta, India, Research Chemist.
1899. Mann, Jas. S., 97, Greengate Street, Plaistow, Essex, Analyst.
1891. Mann, John C., 9, Lambert Street, Hull, Chemist.
1903. Mannhardt, Hans, c/o Heath & Milligan Manufacturing Co., 170, Randolph Street, Chicago, Ill., U.S.A., Chemical Engineer.
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1904. Marckworth, O. S., Ohio Testing Laboratory, 25 and 26, Board of Trade, Columbus, Ohio, U.S.A., Analytical Chemist.
1903. Murdock, Jno. R., Westminster, Md., U.S.A., Chemical Engineer.
1904. Maréchal, H., Eugene Maréchal et fils, Vénissier (Rhone), France, Oilcloth Manufacturer.
1883. Markel, Dr. K., Tower House, Bewsey, Warrington, Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Yorks., Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather Manufacturer.
1902. Marriott, F. Grant, 14, Selby Street, Toronto, Canada, Chemical Student.
1904. Marris, H. C., The Russian Steam Oil Mills Co., 32, Kourlandski Street, St. Petersburg, Russia, Analytical Chemist.
1904. Marschall, Adolf J., Madison, Wis., U.S.A., Chemist.
1901. Marsden, Dr. Fred., c/o Messrs. H. Ashwell & Co., New Basford, Nottingham, Chemist.
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1905. Marsh, John, Massarah Cement Works, near Helwan, Egypt, Cement Works Chemist.
O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood, Lancashire, Chemist.
[illegible] Marsh, W., Union Alkali Co., Soho Works, Ancoats, Manchester, Chemical Manufacturer.
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1891. Marshall, Dr. Hugh, 12, Lonsdale Terrace, Edinburgh, Professor of Chemistry.
1901. Marshall, Jos. W., 143, De la Pole Avenue, Hull, Science Lecturer.
1896. Marshall, Percy S., Union Laboratory, Half Moon Street, Huddersfield, Assistant Chemist.
1883. Marshall, Wm., Carisbrook, Queen's Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., Barkley, Teddington, Middlesex, Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston, Mass, U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.
1895. Martin, Chas., H., 40, Bolton Road, Pendleton, Salford, Oil and Soap Works Manager.
O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1899. Martin, Wm. E., c/o Kynoch Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
O.M. Martin, W. H., 183B, King's Road, Chelsea, London, S.W., Analytical Chemist.
1887. Martineau, Sydney, Northwood, Rydal Road, Streatham, S.W., Sugar Chemist.
1894. Martyn, T. Graham, 11, Stratton Terrace, Truro, Cornwall, Metallurgist.
1905. Marx, Dr. Emil, Fährstrasse 102, Wilhelmsburg, Hamburg, Germany, Research Chemist.
1902. Marx, Joseph S., California Powder Works, Pinole, Cal., U.S.A., Chemist.
1905. Marx, Dr. Max, 81, Shanley Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1904. Mason, Dr. Edward D., 22, George Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.
1906. Mason, Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
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1906. Mason, M. Edgar, 510, Talbot Avenue, Boston, Mass., U.S.A., Chemist.
1892. Mason, Thos., Beech Avenue, Nottingham, Manufacturing Chemist.
1906. Massa, Corradino, Castelguelfo Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1904. Masson, Victor E., Pleasant Valley Wine Co., Rheims, Steuben Co., N.Y., U.S.A., Chemist.
1902. Masujima, Prof. Bunjiro, 23, Midoricho Itchome, Honjoku, Tokyo, Japan, Prof. of Applied Chemistry.
1903. Masure, Gaston, 7, Rue de Constantine, Rouen, France, Chemist.
1902. Masury, Fred L. M., Lock Box 144, Sharon, Pa., U.S.A., Explosives Manufacturer.
O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1904. Mather, J. Cecil, 15, The Holloway, Runcorn, Cheshire, Works Chemist.
1900. Mather, Wm., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1907. Matheson, A. Greville E., c/o South Staffordshire Mond Gas Co., Tipton, South Staffordshire, Engineer.
1890. Matheson, W. J., c/o Cassella Colour Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Shanklin, Lucion Road, Upper Tooting, S.W., Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Crucible Steel Co. of America, Syracuse, N.Y., U.S.A., Chemist.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Matos, Louis J., 105, North 19th Street, East Orange, N.J., U.S.A., Chemist.
1896. Matsui, G., c/o Japan Sugar Refinery Co., Onagigawa, Tokio, Japan, Chemical Engineer.
O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.

1899. Matthews, Dr. J. Merritt, 320, South Broad Street, Philadelphia, Pa., U.S.A., Professor of Chemistry and Dyeing (Philadelphia Textile School).
1889. Mawdsley, W. H., c/o Gold Mining Co., Ltd., Mount Morgan, Queensland, Chemist.
1906. Mawson, Fred. E., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, and (communications) English Street, Carlisle, Cumberland, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., Piedmont, Mineral Co., West Va., U.S.A., Chemist.
1897. May, George H., c/o Fabrikoid Co., Newburgh, N.Y., U.S.A., Assistant Chemist.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1896. Mayfield, A. S., Thirlmere, Newland, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., High Street, Freemantle, Western Australia, Manufacturing Chemist.
1900. Maywald, F. J., 1028, 72nd Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1902. Meade, Richd. K., Nazareth, Pa., U.S.A., Chemist.
1904. Meads, Charles J., Bel Air, Dartmouth, Inland Revenue Officer.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatsheaf Works, Alexandrina, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, Basle Chemical Works, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Chemist.
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1901. Meldrum, Dr. And. N., 16, Mooroaks Road, Sheffield, Lecturer on Chemistry.
O.M. Mellon, W. W., 9, Glenart Avenue, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
O.M. Mellor, S., Magnesium Metal Co., Patricroft, Manchester, Metal Refiner.
1884. Melville, D., 2, Melville Avenue, Delray, Detroit, Mich., U.S.A., Chemical Works Manager.
1893. Mensching, Dr. C., Anilinfabrik., Greppen bei Bitterfeld, Germany, Chemist.
1905. Menzies, David, 11, Camphill Avenue, Langside, Glasgow, Analyst.
O.M. Menzies, R. C., Inveresk Mills, Musselburgh, N.B., Paper Maker.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1886. Mercer, J. B., 4, Tabley Road, Knutsford, Cheshire.
1890. Merck, E., Darmstadt, Germany, Manufacturing Chemist.
1905. Merck, George, Merck and Co., University Place, New York City, U.S.A., Manufacturing Chemist.
1887. Merrell, Geo., Lock Box 786, Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.
1903. Merrill, Herbert C., c/o Eimer & Amend, 205, Third Avenue, New York City, U.S.A., Chemical Engineer.
1906. Merrils, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
1905. Merrin, A. C., 44, Bishopsgate Street Without, London, E.C., Assistant Editor and Analyst.
1902. Merritt, Wm. G., 643, Second Avenue, Detroit, Mich., U.S.A., Chemical Engineer (Berry Bros. Varnish Manufacturers).
1904. Merry, Jno. B., 12, Mayfield Road, Handsworth, Birmingham, Metullurgical Chemist.
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1903. Mersereau, Gail, 181, Pearl Street, New York City, U.S.A., Chemist.
1905. Merz, Eugene, P.O. Box 216, Newark, N.J., U.S.A., General Superintendent, Heller and Merz Co.
1905. Merzbacher, Aaron, Laboratory, Reading Iron Co., Reading, Pa., U.S.A., Chemist.
1897. Meslans, Prof. M., 59 Quai de la Baronnie, Ablon (Seine et Oise), France, Professor of Chemistry.
O.M. Messel, Dr. R., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield, Altham, near Accrington, Tar Distiller.
1905. Methley, Bernard, 21, Clifton Mount, Rotherham, Yorks., Engineering Chemist.
1898. Metz, Herman A., P.O. Box 78, New York City, U.S.A., Chemical Merchant.
1905. Metzis, Josef, Anglicia Petroleum Co., Drohobycz., Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Product Co., Louisville, Ky., U.S.A., Chemist.
1904. Meyenberg, Dr. Alex., 9, Nelson Street, Plymouth Grove, Manchester, Works Manager.
1907. Meyer, Dr. Erwin, The Hartford Rubber Works Co., Hartford, Conn., U.S.A.
1898. Meyer, Dr. Franz, 52, Broadway, New York City, U.S.A., Metallurgical and Chemical Engineer.
1902. Meyer, Dr. Fredk. L., 2028, Park Avenue, Philadelphia, Pa., U.S.A., Chemist.
1900. Meyer, Karl, Sortedams Dossering 95A, Copenhagen, O., Denmark, Technical Chemist.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
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1906. Mihalovitch, Sydney F., 514, East Pearl Street, Cincinnati, Ohio, U.S.A., Chemist.
1896. Miles, G. Wellington, 29, Central Street, Boston, Mass., U.S.A., Analytical Chemist
1889. Milestone, W. C., 7, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1899. Millar, Jas. H., P.O. Box 120, Durban, Natal, Manufacturing and Analytical Chemist.
1897. Millard, Edgar J., 40–42, Charlotte Street, London, E.C., Chemist and Manager.
1903. Millen, J. Dunlop, Mount Bischoff Mine, Waratah, Tasmania, Assistant General Manager.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
1904. Miller, Chas. E., 58, Chardon Street, Boston, Mass., U.S.A., Manufacturing Chemist.
O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1899. Miller, Geo., Clydesdale, Groes Road, Cressington, Liverpool, Technical Chemist.
1900 Miller, Hampton K., Lake City, Flo., U.S.A., Chemist (Florida A. and M. College).
1893. Miller, Dr. Harry E., 1015, Chestnut Street, Oakland, Cal., U.S.A., Chemist.
1902. Miller, H. Harold, 303, Front Street East, Toronto, Canada, Chemist.
1883. Miller, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1904. Miller, Jas., Pharmacist.
1894. Miller, Dr. John A., 40–45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1894. Miller, J. Carlile, 188, St. Vincent Street, Glasgow, Manufacturing Chemist.
1888. Miller, J. Hopkins, 5, Catherine Street, Parliamentary Road, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1899. Miller, P. Schuyler, 3500, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1901. Miller, Stuart B., c/o Eastern Dynamite Co., Lewisburg, Ala., U.S.A., Chemical Engineer.

1904. Miller, William Exley, c/o The Arizona Copper Co., Ltd., 29, St. Andrew Square, Edinburgh, Secretary.
1901. Miller, W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
1904. Millroy, Alfred T., 53, Guilford Street, London, W.C., Laboratory Furnisher.
O.M. Mills, Prof. E. J., F.R.S., 64, Twyford Avenue, West Acton, W., Emeritus, Professor of Technical Chemistry and Consulting Chemist.
1904. Mills, Dr. J. E., University of North Carolina, Chapel Hill, N.C., U.S.A., Associate Professor of Chemistry.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1906. Mills, Wm. Hobson, Northern Polytechnic Institute, Holloway, London, N., Lecturer in Chemistry.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., 4, Fenchurch Avenue, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, Arlesey, near Hitchin, Herts., Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., c/o Joseph Smithson, Ltd., India Buildings, Halifax, Yorks., Chemist.
1901. Milroy, Andrew, Glenbarry, Giffnock, Glasgow, Manager.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1889. Miniati, T. K., Penketh, near Warrington, Chemist.
1904. Minor, John C., jun., Saratoga Springs, N.Y., U.S.A., Manufacturer.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1901. Mitchell, Frank H., c/o Dill and Collins, Richmond and Tioga Streets, Philadelphia, Pa., U.S.A., Tutor in Chemistry.
1898. Mitchell, G. D. H., c/o S. S. White Dental Manufacturing Co., Prince's Bay, Staten Island, N.Y., U.S.A., Chemist.
1883. Mitchell, J. W., Plantation House, Clough Fold, near Manchester, Waste Bleacher.
1906. Mitchell, Oswald H., c/o Basil Turner, Woolwich, Sydney, N.S.W., Australia, Assayer.
1904. Mitsugi, R., Weimarerstrasse 9, II., Charlottenburg, Germany, Chemist.
O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.
1902. Möckel, Heinrich A., Paper Mill, Altdamm, near Stettin, Germany, Chemist and Engineer.
1905. Modi, Dr. E. M., Opposite Grant Road Station, Sleater Road, Bombay, India, Manufacturing and Analytical Chemist.
1906. Moe, Eldor H., 24, South First West Street, Salt Lake City, Utah, U.S.A., Chemist.
1903. Möhlau, Prof. Dr. Rd., Semperstrasse 4, Dresden, A., Germany, Professor of Colour Chemistry.
O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1904. Mole, Herbert B., The Croft, Shepton Mallet, Somerset, Brewer.
1902. Molesworth, F. H., Jersey Road, Antarmon, N.S.W., Australia, Analytical Chemist.
1[illegible]. Moller, Emil A., 44, Sherman Avenue, Tompkinsville, N.Y., U.S.A., Manager (Sanitas Co.).
1903. Mo[illegible], Richard, South Manchester, Conn., U.S.A., Chemical Engineer.
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1905. Monell, Ambrose, 43, Exchange Place, New York City, U.S.A., President (International Nickel Co.).
1906. Monier-Williams, G. W., The Lammas, Esher, Surrey.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, N.B., Analytical Chemist.
1901. Moody, Chas. J., Lake View Consols Mine, Boulder, West Australia, Analyst and Assayer.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich, S.E., Lecturer on Chemistry.
1898. Moody, Dr. Herbert R., College of the City of New York, New York City, U.S.A., Science Instructor.
1884. Mook, Chas., 2, Kapellenstrasse, Eisenach, Germany, Alkali Works Director.
1903. Mooney, F. M., 118, Pembroke Road, Dublin, Chemical Manure Manufacturer.
1903. Mooney, Geo. A., 310, St. Paul Street, Montreal, Canada. Chemical Merchant.
1902. Mooney, Luke, 36, West 52nd Street, Bayonne, N.J., U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.
1901. Moore, Chas. W., 38, Demesne Road, Whalley Range, Manchester, Chemist.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
1906. Moore, F. H., 39, Lime Street, London, E.C., Analytical Chemist.
1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1905. Moore, Leslie R., 173, Oakleigh Road, Newton, Mass., U.S.A., Chemist.
1899. Moore, Quintin, jun., c/o Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow, Works Manager.
1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.
1899. Moore, Dr. Russell W., 47, Linden Place, Orange, N.J., U.S.A., Chemist (U.S. Appraiser's Office).
1890. Moore, Thos., Laboratoire du Service Local, Noumea, New Caledonia, Analytical Chemist.
1905. Moorwood, F. Colin, c/o Flockton, Tompkin and Co., Ltd., Newhall Steelworks, Sheffield, Steel Manufacturer.
1903. Moran, Geo. A., 333, Haverhill Street, Lawrence, Mass., U.S.A., Chemist.
1890. Mordle, F. Dare, Guilderoy, Matlock Bath, Derbyshire, Starch Manufacturer.
1902. More, Andrew, 61, Quarrendon Street, Fulham, S.W., Government Analyst.
1906. Morewood, C. Darcy, Frodingham Ironstone Mines, Scunthorpe, near Doncaster, Analytical Chemist.
1901. Morgan, Dr. Gilbert T., Royal College of Science, South Kensington, S.W., Demonstrator of Chemistry.
1905. Morgan, Jerome J., College Park, Md., U.S.A., Teacher.
1890. Morgan, J. Jas., Laboratory, Cammell, Laird and Co., Workington, Cumberland, Assayer.
1907. Morgan, Leonard G., United States Mint, Philadelphia, Pa., U.S.A., Electro-Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Wavertree, Liverpool, Manufacturing Chemist.
1885. Morgans, Thos., 60, Queen Square, Bristol, Civil Engineer.
1907. Morhous, Oakley A., 1839, 82nd Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Morison, Jas., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1897. Morison, Samuel L., c/o John Brett, 8, Lendal, York, Water Engineer.
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1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.
1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.
1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.
1906. Morris, A. H., 27, Hartington Road, Bolton, Lancs., Brewer.

1898. Morris, Edgar F., c/o Cornbrook Chemical Co., Ltd., Colour Works, Stockport, Research Chemist.

1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.

1890. Morris, Herbert N., 13, Birch Grove, Rusholme, Manchester, Technical Chemist.

O.M. Morris, J. Haydn, 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.

1902. Morrison, Jos., Wellfield, Farnworth, Widnes, Manager.

1906. Morrow, Jas. M., 7, Rosebery Terrace, Kirkcaldy, N.B., Analytical Chemist.

1901. Morse, Willard S., Seaford, Del., U.S.A., Assistant Manager.

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1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.

1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.

1889. Morton, Jas., Dalquhurn Works, Renton, N.B., Dyeworks Manager.

1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.

1902. Mosbaugh, F. R., c/o Heald Extract Co., Lynchburg, Va., U.S.A., Chemist.

1905. Moseley, F. A. D. H., Box 1657, Johannesburg, Transvaal, Analytical Chemist.

1888. Mosenthal, Henry de, 220, Winchester House, Old Broad Street, E.C., Explosives Company Manager.

1903. Mosher, Walter R., 1274, West Avenue, Buffalo, N.Y., U.S.A., Chemist.

1906. Moss, Wm, Moss Chemical Manufacturing Co., Foot of Carlaw Avenue, Toronto, Canada, Chemical Manufacturer.

1894. Moszczenski, J. von, Tartar Chemical Co., Ninth Street and Gowanus Canal, Brooklyn, N.Y., U.S.A., Consulting Chemist.

1897. Motion, Jno., c/o Valvoline Oil Co., Edgewater, N.J., U.S.A., Oil Refinery Chemist.

1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.

1901. Moule, Jno. W., c/o The Chillagoe Co., Ltd., Chillagoe, Queensland, Metallurgist.

1884. Moult, J., Underhill, Low Fell, Gateshead-on-Tyne, Secretary.

1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.

1905. Moulton, Rt. Hon. Sir J. Fletcher, F.R.S., 57, Onslow Square, London, S.W., Lord Justice of Appeal.

1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).

1905. Mrazsek, F. M., 29, Mincing Lane, London, E.C., Consulting Chemist.

1904. Muckenfuss, A. M., c/o University of Mississippi, University, Miss., U.S.A., State Chemist.

1907. Mueller, Dr. Carl, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Muir, Jas. Stanley, 8, Westminster Gardens, Glasgow, W., Chemist.

1906. Muir, Wm., Regent Factory, Linlithgow, Scotland, Analytical Chemist.

1894. Muir-Smith, W., c/o A. B. Fleming and Co., Ltd., Caroline Park, Edinburgh, Oil Works Manager.

O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.

1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.

1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C.; U.S.A., Professor of Chemistry and Dean.

1900. Munsell, Dr. Chas. E., c/o Devor and Raynolds Co., 110, Horatio Street, New York City, U.S.A., Colour Chemist.

1900. Munton, Fred T., The Oak House, Winsford, Cheshire, A.R.S.M., Analytical Chemist.

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1904. Murdoch, Alexander, 557, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

1886. Murdoch, R. H. M., Shore Road, Stevenston, Ayrshire, Explosives Chemist.

1899. Murphy, Albert J., The Laboratory, 11, Lyddon Terrace, Leeds, Brewer's Chemist.

1906. Murphy, Frederic W., Standard Sugar Refinery, Granite Street, South Boston, Mass., U.S.A., Chemist.

1901. Murray, Benjamin L., c/o Merck and Co., University Place, New York City, U.S.A., Chemist.

1903. Murray, Chas. B., 611, Bailey Farrell Building, Pittsburg, Pa., U.S.A., Chemist.

1899. Murray, Jas. J., Iron King Mine, Blanchard, Arizona, U.S.A., Mining Engineer.

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1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.

1896. Murray, Dr. Thos. S., 1, Nelson Street, Dundee, Professor of Chemistry.

1905. Murray, Wm. Wallace, c/o Union Abattoir Co., Baltimore, Md., U.S.A., Chemist.

1905. Murrill, Dr. Paul I., P.O. Box 986, Wilmington, Del., U.S.A., Representative, E.I. du Pont Co.

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1907. Musso, Louis A., Department of Agriculture, 140, George Street, North Sydney, N.S.W., Australia, Assistant Viticulturist.

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1895. Muurling, I. J. R., P.O. Box 1935, New York City, U.S.A., Dyestuff Importer.

1891. Myers, Wm. S., Nitrate of Soda Propaganda, 12, John Street, New York City, U.S.A., Director.

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N

1902. Naef, Dr. Ernest E., Clydach, Swansea, South Wales. Chemist.

1903. Nagel, Dr. Oscar, c/o De la Vergne Machine Co., Foot of East 138th Street, New York City, U.S.A., Chemist.

1903. Nagel, Oskar H. L., c/o Larned and Baker Co., Syracuse, N.Y., U.S.A., Superintendent (Chemical Works).

1897. Nairn, Michael, Ben Dhu, Kirkcaldy, N.B., Linoleum Manufacturer.

1901. Nakagawa, Sosuke, c/o Tokyo Ryusan Kwaisha, Kameido Oshimacho, near Tokyo, Japan, Chief Engineer.

1903. Nakayama, Takakichi, c/o Fuji Paper Co., Sanjikkenbori, Tokyo, Japan, Chemist.

1901. Nanabhai, Krishnalal, 8-10, Nepean Sea Road, Malabar Hill, Bombay, India, Technological Chemist.

1893. Napier, Jno. W., Gas Works, Alloa, N.B., Manager and Chemist.

1904. Napper, Sidney S., c/o S. Courtauld & Co., Ltd., Foleshill Road, Coventry, Chemist.

1903. Nash, A. Douglas, 280, State Street, Flushing, N.Y., U.S.A., Glass Manufacturer.

1897. Nash, Leonard M., Westlands, Princess Road, Finsbury Park, N., Works Chemist.

1905. Nash, W. A., Corn Exchange Bank, New York City, U.S.A., President, Corn Exchange Bank.

1906. Nathan, Albert, 60, Wall Street, New York City, U.S.A., Patent Lawyer.

1900. Nathan, Lt.-Col. Sir Frederic L., R.A., Royal Gunpowder Factory, Waltham Abbey, Essex, Superintendent.
1892. Naylor, Wm., 3, Garstang Road, Fulwood, Preston, Lancs., Chemist.
O.M. Naylor, W. A. H., 38, Southwark Street, London, S.E., Manufacturing Chemist.
1899. Neate, Percy J., "Belsize," Watts Avenue, Rochester, Kent, Director of Cement Co.
1902. Neave, Geo. B., Technical College, Montrose Street, Glasgow, Assistant to Professor of Chemistry.
1905. Neech, Herbert R., St. Catherine's, Lincoln, Chemical Engineer.
1905. Needham, Edward R, 48, Paton Street, Glasgow, Manufacturing Chemist.
1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Neil, Dr. Archibald A., 82, Eccles Old Road, Manchester, Chemical Engineer.
1898. Neil, Jas. Millar, 12 Woodland Avenue, Toronto, Canada, Technical Chemist.
1890. Neill, Geo. D., Drumslea, Greenock, N.B., Sugar Refiner.
1898. Neilson, Alex. McG., P.O. Box 615, Durban, Natal, Analytical Chemist.
1889. Neilson, Thos., Highland Boy Smelter, Murray, Utah, U.S.A., Metallurgical Chemist.
1903. Neiman, Howard S., 122, Hudson Street, New York City, U.S.A., Manufacturing Chemist.
1902. Neish, Arthur C., Columbia University, New York City, U.S.A., Chemist.
1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
1906. Nestell, Raymond J., 115, West 68th Street, New York City, U.S.A., Chemical Instructor.
1901. Neufville, Dr. Rudolf de, c/o Metallurgische Gesellschaft, Frankfort a/M., Germany.
1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.
1903. Neumann, Dr. Max, Capellenstrasse 51, Wiesbaden, Germany.
O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.
1905. Newall, Joseph, 28, Greenway Road, Runcorn, Cheshire, Chemist.
1889. Newberry, Spencer B., Sandusky Portland Cement Co., Sandusky, Ohio, U.S.A., Manager.
1900. Newkirk, Chas. C., c/o The M. Werk Co., 411, Poplar Street, Cincinati, Ohio, U.S.A., Chemist.
O.M. Newlands, B. E. R., 2, St. Dunstan's Hill, London, E.C., Analytical and Consulting Chemist.
O.M. Newlands, W. P. R., 10, Cricklade Avenue, Streatham Hill, S.W., Sugar Chemist.
O.M. Newton, Jno., Manor Works, Rotherhithe New Road, London, S.E., Manure Manufacturer.
1900. Newton, Dr. Wm., Ashcombe, London Road, Dorking, Chemist.
1901. Nibelius, Axel W. T., American Forcite Powder Manufacturing Co., Landing, N.J., U.S.A., Chemist.
1904. Nichols, C. W., 406, Clinton Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).
1904. Nichols, J. A., Stanley Mount, New Mills, near Stockport, Teacher of Science.
1888. Nichols, Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., President, San Carlos Copper Co.
1897. Nicholson, Harry, St. David's Mines, Ltd., Bontddu, Dolgelly, North Wales, Assayer.
1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.
1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, N.B., Chemist.
1897. Nickel, Herman, c/o The N. K. Fairbank Co., 3rd and Convent Streets, St. Louis, Mo., U.S.A., Chemist.
O.M. Nicol, Dr. W. W. J., 15, Blacket Place, Edinburgh, Chemical Lecturer.
1903. Nicoll, Frank, Jesmond House, Hartman Street, Accrington, Chemist.
1905. Nieghorn, Albert, c/o Canada Chemical Manufacturing Co., Toronto, Canada, Agent.
1900. Nield, J. H., c/o General Chemical Co., P.O. Box 8, Hudson Heights, N.J., U.S.A., Superintendent.
1906. Nielsen, Dr. Carl, c/o General Electric Co., Laboratory, Schenectady, N.Y., U.S.A., Chemist.
1898. Nightscales, Geo., 2, St. James' Parade, Hull, Oil Merchant.
1899. Nihoul, Dr. Edw., Waremme, Belgium, Director of the Liège Tannery School.
O.M. Nimmo, Jas., Penshurst, 8, Lawrence Road, South Norwood, S.E., Analytical Chemist.
1885. Nishigawa, T., 12, Yamamato Dori, Nichome, Kobe, Japan, Director of Sulphuric Acid and Soda Works.
1898. Nishikawa, T., c/o Nippon Seimikaisha, Onoda, Nagato, Japan, Chemist.
1904. Noake, Frank, 20, Craddock Street, Wolverhampton, Gas Engineer.
O.M. Nolting, Dr. E., Ecole de Chimie, Mulhouse, Alsace, Germany, Professor of Chemistry.
1905. Norden, Julius, United Chemical Works, 94, Leadenhall Street, London, E.C., Chemical Manufacturer.
O.M. Norman, F. J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
1900. Norman, Geo. M., Woodbury, N.J., U.S.A., Chemist.
1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
1898. Norris, Albert P., 760, Massachusetts Avenue, Cambridgeport, Mass., U.S.A., Assistant Chemist.
1904. Norris, Cassius W., 612, Commerce Street, Milwaukee, Wis., U.S.A., Tannery Chemist.
1899. Norris, Geo. L., Standard Steel Works, Burnham, Mifflin Co., Pa., U.S.A., Chemist.
1902. North, Barker, Glenholme, Glenholme Road, Manningham, Bradford, Lecturer in Chemistry.
1890. North, E. Gordon N., Technical Chemist.
O.M. Northing, J., The Murrough, Wicklow, Ireland, Technical Chemist.
1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1905. Norton, F. A., National Canners' Laboratory, Aspinwall, Pa., U.S.A., Chemist.
O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
1887. Norton, Dr. T. H., U.S. Consulate, Smyrna, Turkey-in-Asia, Ph.D., Sc.D., U.S. Consul.
1901. Novarine, John L., 289, Myrtle Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1899. Noyes, Henry, c/o J. C. Lanyon and Sons, Coronation House, Lloyd's Avenue, London, E.C., Engineer.
1901. Noyes, Prof. Wm. A., Melrose Street, Chevy Chase, Md., U.S.A., Editor (J. Amer. Chem. Society).

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1905. Oakes, Francis J., 2, West 72nd Street, New York City, U.S.A., Dye and Chemical Manufacturer.
1905. Oakes, F. J., jun., 147, Milk Street, Boston, Mass. U.S.A., Secretary, Oakes Manufacturing Co.
1904. Oberländer, Dr. Otto, Laboratory, Chamber of Commerce Buildings, Oxford Court, Cannon Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Bureau of Central Sugar Mills, Brisbane, Queensland, Supervising Chemist.
1900. O'Brien, Frederick, 87, Dongola Road, Horfield, Bristol, Analytical Chemist.
1906. O'Brien, John W., c/o Grasselli Chemical Co., Grasselli, Ind., U.S.A., Acid Manufacturer.

1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).

1900. O'Byrne, Leo C., 996, Washington Boulevard, Chicago, Ill., U.S.A., Chemist.

1902. Ockel, Reinhold, 9, Walton New Road, Warrington, Technical Chemist.

1901. O'Connor. Chas. P., 55, Church Street, Montclair, N.J., U.S.A., Analytical Chemist.

1887. Oddie, Jas., School of Mines, Ballarat, Australia, Chemical Lecturer.

1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.

1888. Ogata, Saburo, Zohei Shikyoku, Okurasho, Tokyo, Japan, Assayer.

1905. Ogden, Alfred W., Room 1007, 641, Washington Street, New York City. U.S.A., Chemist.

1901. Ogden, Richard L., 314 North Main Street, Bethlehem, Pa., U.S.A., Chemist (U.S. Navy).

1906. Ogilvie, Alex. M., 9, Belmont Drive, Giffnock, Renfrewshire.

1896. Ogilvy, D. J., Gest Street and C. H. and D. R. R., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.

1901. Ogston, Alex. G., Heath Park, near Aberdeen, N.B., Soap Manufacturer.

1903. Ohlenschlager, J. G., jun., 20, St. Dunstan's Hill, London, E.C., Chemical Merchant.

1905. Ohliger, Willard, c/o F. Stearns & Co., Detroit, Mich., U.S.A., Chemist.

1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.

1888. Oliver, Wm. Letts, 101, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.

1901. Olivier, Dr. Louis, 22, Rue du Général-Foy, Paris, 8^e, Directeur (Revue Générale des Sciences).

1905. Ollenbach, D. S., Cordite Factory, Aruvankad, Nilgiris, India, Assistant Government Surgeon.

O.M. Ollerenshaw, S., 96, Davyhulme Lane, Urmston, Manchester, Technical Chemist.

1906. Olmsted, Fred A., 93, Broad Street, Boston, Mass., U.S.A., Chemical Engineer.

1904. Olney, L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.

1903. O'Loughlin, C. C., c/o Pittsburg Reduction Co., Niagara Falls, N.Y., U.S.A., Analyst.

1904. Olshausen, B. A., 1505, St. Andrew's Place, Los Angeles, Cal., U.S.A., Student.

1899. Olsson, Gustav, c/o Hecla Compressed Gas Co., West 3rd Street, Chelsea, Mass., U.S.A., Manufacturing Chemist.

1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.

O.M. O'Neill, E. H., 6, Elder Avenue, Crouch End, N., Managing Director.

1905. Ormandy, Dr. W. R., Bewsey Cottage, Warrington, Chemist.

1898. Ormerod, Dr. Ernest, Research Chemist.

1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.

O.M. Orr, A., 35A, Bligh Street, Sydney, New South Wales, Analytical Chemist.

O.M. Orr, J. B., Crossacres, Woolton, Liverpool, Chemical Manufacturer.

1884. Orr, Robert, c/o Jas. Miller, Son and Co., 79, West Nile Street, Glasgow; and (Journals), Kinnaird, Larbert, N.B., Manufacturing Chemist.

1899. Orr, Thos. W., Esperanza Nitrate Co., Taltal, Chile, Chemist.

1905. Osborne, Frank W., Oxford Club, Lynn, Mass., U.S.A., Chemist.

1897. Osborne, Thos. B., Box 164, New Haven, Conn., U.S.A., Chemist.

1900. Osbourne, Jno. P., 572, Alexandra Parade, Dennistoun, Glasgow, Analytical Chemist.

1900. O'Shaughnessy, Francis R., Home Farm, Tyburn, Birmingham, Chemist.

1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Science (University of Sheffield).

1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.

1905. Otsuki, Prof. Chiri, 16, Shinsuwachō. Koishikawaku, Tokyo, Japan. Professor of Applied Chemistry.

1898. Oushkoff, John P., c/o P. K. Oushkoff and Co., Moscow, Russia, Chemical Manufacturer.

1903. Outwater, Raymond, 1312, B. Street S.W., Washington, D.C., U.S.A., Chemist.

1887. Overtoun, Lord, 7, West George Street, Glasgow, Chemical Manufacturer.

1904. Owen, Halsall, Newholme, Latchford, Warrington, Engineer.

1906. Oxley, Horace F., c/o British Algin Co., and (Journals), Bryn Derwen, Holywell, North Wales, Chemist.

1903. Ozias, Ramon E., 732, Clinton Avenue, Newark, N.J., U.S.A., Assayer.

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1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.

O.M. Packard, E., Jun., Bramford, near Ipswich, Manure Manufacturer.

1899. Paessler, Dr. Joh., Vorstand der Deutschen Versuchsanstalt für Lederindustrie, Freiberg in Sachsen, Germany, Chemist.

1904. Page, Edwin P., 31, Market Street, Stourbridge, Worcestershire, Chemist.

O.M. Page, F. J. M., 54, Sutherland Street, Pimlico, S.W., Chemical Lecturer.

1907. Page, Leslie, c/o Swift and Co., Soap Works, 37, Medford Street, Somerville, Mass., U.S.A., Chemist.

1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.

1892. Paine, Augustus G., 41, Park Row, New York City, U.S.A.; and (Journals) c/o Richard Stutz, Johnsonburg, Pa., U.S.A., President of Paper Making Co.

O.M. Paine, S., Devisdale, Bowdon, Cheshire, Pharmaceutical Chemist.

1902. Pakes, Dr. Walter C. C., Box 4581, Johannesburg, Transvaal, S. Africa, Analyst and Bacteriologist.

1905. Palethorpe, Percy R., The Tobacco Warehousing and Trading Co., 11th and Magnolia Avenue, Louisville, Ky., U.S.A., Chemist and Manager.

1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President of Dye and Chemical Co.

1903. Palmenburg, O. W., 80, St. Nicholas Avenue, New York City, U.S.A., Chemist.

1905. Palmer, Dr. Chas. S., 637, Valley Road, Upper Montclair, N.J., U.S.A., Associate Editor.

1902. Palmer, Fred. G., Athelstan Road, Faversham, Kent, Analyst.

1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.

1887. Palmer, Thos. C., 98, Commercial Road East, London, E.; and (Journals) Beechwood, Moss Lane, Pinner, Engineer.

1906. Papazzoni, Chas. F., c/o Keystone Powder Manufacturing Co., Emporium, Pa., U.S.A., Chemist.

1902. Paquin, Felix, Memphis, Tenn., U.S.A., Chemist.

O.M. Park, J., Hillside House, 12, Millburn Street, Glasgow, Chemical Manager.

1906. Parke, Jas., School of Practical Science, Toronto, Canada, Chemist.

1888. Parker, Chas. E., Penketh, Warrington, Tanner.

1894. Parker, Chas. E., U.S. Dept. of Agriculture, Bureau of Chemistry, Washington, D.C., U.S.A., Chemist.

1898. Parker, Charles H., Merrills House, March End, Wednesfield, Staffs., Chemist.

1891. Parker, Edw., Thorncliffe, Denton, Manchester, Analytical Chemist.

1906. Parker, Elias G., 238, Grafton Avenue, Newark, N.J., U.S.A., Chemist.

1904. Parker, G. H., c/o Messrs. Haddock, Parker and Co., 14, Chapel Street, Liverpool, Chemical Broker.

1894. Parker, Dr. J. Gordon, Herold's Institute, Drummond Road, Bermondsey, S.E., Head of Tanning School.
1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., N.Y. Testing Laboratory, Long Island City, N.Y., U.S.A., Analytical Chemist.
O.M. Parker, Thos., Electrical Engineer.
1894. Parker, Thos. J., 25, Broad St., New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
1903. Parker, Wm. B., Belgrava, Clifton Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).
1901. Parker, Dr. Wm. Huntington, 177, State Street, Boston, Mass., U.S.A., Chemist (U.S. Appraiser).
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
1905. Parr, Prof. S. W., University of Illinois, Urbana, Ill., U.S.A., Professor of Applied Chemistry.
1904. Parrett, Ben. C., c/o Struthers Furnace Co., Struthers, Ohio, U.S.A., Analyst.
1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
1901. Pass, James, Onondaga Pottery Co., Syracuse, N.Y., U.S.A., Pottery Manufacturer.
1902. Patch, Prof. Jas. A., Syrian Protestant College, Beirût, Syria, Professor of Chemistry.
1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1901. Paterson, David, Leabank, Rosslyn, Midlothian, Colour Chemist.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alliott and Co., Ltd., Nottingham, Mechanical Engineer.
1886. Paton, W. Grant, Airlie, Huyton, near Liverpool, Alkali Works Manager.
1901. Patterson, Chas. A., Washburn, Wis., U.S.A., Analytical Chemist.
O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.
1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.
O.M. Patterson, T. L., Maybank, Finnart Street, Greenock, N.B., Sugar Works Manager.
1882. Patterson, Wm. Hamilton, The Sycamores, Ballasalla, Isle of Man, Technical Chemist.
O.M. Pattinson, J., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
O.M. Pattison, Jas., Drimnamona, Kilmalcolm, N.B., Chemical Merchant.
1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.
1905. Patton, Dr. Walter D., United States Glue Co., Milwaukee, Wis., U.S.A., Chemist.
1904. Patz, E. O., 215, Water Street, New York City, U.S.A., Manager, Berlin Aniline Works.
1891. Paul, Jas., H., 19, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
1902. Pay, Walter Herbert, Government Laboratory, Durban, Natal, S. Africa, Chemist and Assayer.
1904. Payne, A. G. C., 63, Plassey Street, Penarth, near Cardiff, Chemist.
O.M. Payne, J. B., 15, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.
1898. Payne, J. H., c/o Eastman Kodak Co., Kodak Park Works, Rochester, N.Y., U.S.A., Chemical Engineer.
1898. Pearce, Edw. D., Messrs. T. P. Shepard and Co., P.O. Box 1336, Providence, R.I., U.S.A., Manufacturing Chemist.
1884. Pearce, Jas. Stanley, Clements, Snaresbrook, Essex, Chemical Manufacturer.
1897. Pearce, Richard, c/o G. B. Pearce, The Beeches, Hayle, Cornwall, Smelting Works Manager.
1902. Pearce, Sidney H., P.O. Box 149, Johannesburg, Transvaal, South Africa, Metallurgist.
1883. Pearce, W., M.P., Chemical Works, Bow Common, London, E., Chemical Manufacturer.
1903. Pearcy, A. C., 27, St. Kilda's Road, Stoke Newington, N., Director, Explosives Co.
1903. Pears, Thos., The Laboratory, Soap Works, Isleworth, Soap Manufacturer.
1893. Pearson, Frank P., 8, Richmond Street, Haverhill, Mass., U.S.A., Chemist.
1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.
O.M. Pechiney, A. R., Les Rochers, Hyères (Var), France, Chemical Engineer.
1898. Peck, Dr. Ernest L., Claremont, Merrilocks Road, Blundellsands, near Liverpool, Chemist.
1898. Peckham, Stephen F., Room 104, 280, Broadway, New York City, U.S.A., Chemist.
1894. Peden, Jno., 30, Ardgowan Street West, Greenock, N.B., Analytical Chemist.
O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).
1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1905. Peet, Wm. J., Stockyards Station, Kansas City, Kas., U.S.A., Superintendent.
1903. Peffer, Harry C., c/o Aluminium Co. of America, East St. Louis, Ill., U.S.A., Manufacturing Chemist.
1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, Colliery Owner.
1906. Peirce, Edwin H., c/o American Telephone and Telegraph Co., 125, Milk Street, Boston, Mass., U.S.A., Chemist.
1899. Pell, A., 7, Elphinstone Circle, Bombay, India, Chemist.
1897. Pellew, Chas. E., Columbia University, New York City, U.S.A., Adjunct Professor of Chemistry.
1904. Pelly, Russell George, 63, Rowan Road, Brook Green, Hammersmith, W., Analytical Chemist.
1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.
1904. Pennington, Thos. J., c/o Mogul Mining Co., Pluma, South Dakota, U.S.A., Chemist.
1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.
1906. Pennymore, Percy G., Eskbank Iron and Steel Works, Lithgow, N.S.W., Australia, Chemist and Blast Furnace Manager.
1885. Pentecost, S. J., Alexandra Mount, Mapperley Hill, and (Journals), Sherwood Hill Works, Sherwood Rise, Nottingham, Lace Dresser.
1887. Pentermann, H. T., 37, Clifton Crescent, Peckham, S.E., Brewing Chemist.
1892. Peploe, D. H. T., Underriver House, Sevenoaks, Kent.
1899. Peppel, S. Vernon, 1538, North High Street, Columbus, Ohio, U.S.A., Chemist.
1885. Perkin, A. G., F.R.S., 8, Montpelier Terrace, Hyde Park, Leeds, Technical Chemist.
1898. Perkin, Dr. F. Mollwo, Borough Polytechnic Institute, Borough Road, S.E., Head of Chemical Department.
O.M. Perkin, Sir William H., F.R.S., The Chestnuts, Sudbury, Harrow, Research Chemist.
1887. Perkin, Dr. W. H., jun., F.R.S., Fairview, Wilbraham Road, Fallowfield, Manchester, Professor of Chemistry.
1903. Perkins, Frank G., 136, Newton Street, Waltham, Mass., U.S.A., Starch Manufacturer.
1893. Perkins, T. S., 39, Garden Place, Brooklyn, N.Y., U.S.A., Chemist.
1899. Perks, Walter G., (Journals) Glanafon, and (communications) c/o National Explosives Co., Ltd., Hayle, Cornwall, Manufacturer.
1904. Perrott, Bert, County School, Neath, Glamorgan, Demonstrator in Chemistry.
1906. Perrow, Mosby G., Lynchburg, Va., U.S.A.
1901. Perry, Chas. M., 4, Catalpa Road, Providence, R.I., U.S.A., Bleach and Dyeworks Chemist.
1887. Perry, D., Norwood, Lenzie, N.B., Manufacturing Chemist.

1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.

1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.

1903. Perry, Robt. Swain, c/o Harrison Bros. and Co., Inc., 35th Street and Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President.

1901. Persons, Ashton C., 74, Oak Street, Willimantic, Conn., U.S.A., Chemist.

1897. Peter, Dr. A. H., c/o Zinsser and Co., Hastings-on-Hudson, N.Y., U.S.A., Chemist.

1906. Peterson, Charles A., 104, Front Street East, Toronto, Canada, Chemist.

1893. Pethybridge, Walter, 3, Rhodesia Road, Clapham Rise, S.W., Chemist and Assayer.

1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.

1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.

1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.

1883. Pettigrew, J., 6, St. Helen's Place, Bishopsgate, London, E.C., Technical Chemist.

1892. Pettigrew, Robt., c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.

1902. Pettitt, Alf., 375, State Street, Brooklyn, N.Y., U.S.A., Chemist.

1906. Peucheu, Arthur G., Standard Chemical Co., Ltd., 509, Manning Chambers, Toronto, Canada, Chemical Manufacturer.

1905. Peuchot, A., 129, Crosby Street, New York City, U.S.A., Chemical Manufacturer.

1906. Peverley, Frank, 21, Gladstone Street, Skipton, Yorks, Dyer.

1904. Peyser, Horace F., 68, West 47th Street, New York City, U.S.A., Chemist.

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1900. Peyton, Wm. C., c/o Peyton Chemical Co., Room 328, Montgomery Block, San Francisco, Cal., U.S.A., Chemist.

1904. Pfahler, H. W., 907, Delaware Avenue, South Bethlehem, Pa., U.S.A., Chemist.

1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.

1903. Philipp, Herbert, 84, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.

1886. Phillips, A. G., 11, Essex Villas, Phillimore Gardens, Kensington, W., Barrister-at-Law.

1904. Phillips, Edw. W., c/o Fairmont Coal Co., and (Journals) 800, Gaston Avenue, Fairmont, W. Va., U.S.A., Chemist.

1891. Phillips, G. Brinton, (Journals) 622, Race Street; and (communications) 2007, De Lancey Place, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

O.M. Phillips, Harcourt, Lynwood, Turton, Lancs., Analytical Chemist.

1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.

1904. Phillips, V. C., Haselmere, Morris Avenue, Manor Park, E., Chemist.

1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.

1906. Phipps, Chas. B., Mount Prospect Laboratory, Flatbush Avenue and Eastern Parkway, Brooklyn, N.Y., U.S.A., Chemist.

1883. Phipson, Dr. T. L., Casa Mia, Putney, S.W., Analytical and Consulting Chemist.

1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.

O.M. Pick, Dr. S., Direction der Soda Fabrik, Szczakowa, Galizien, Austria, Chemical Engineer and Manager.

1904. Pickard, Glenn H., c/o The Spencer-Killogg Co., Buffalo, N.Y., U.S.A., Chemist.

1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.

1902. Pickard, R. H., Isca, Merlin Road, Blackburn, Teacher and Analyst.

1904. Pickett, Chas. E., 26, East 33rd Street, Bayonne, N.J., U.S.A., Superintendent, Borax Refinery.

1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.

1888. Pilkington, G., 263, Walmersley Road, Bury, Lancashire, Analytical Chemist.

1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.

1894. Pilling, John E., Agnew Villas, 78, Whitegate Drive, Blackpool, Chemist.

1906. Pincott, Emile S., 222, St. James Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).

1905. Pinnock, H. T., Beacon House, Dudley Port, Tipton, Chemist.

1883. Pipe, Jas., Messrs. Wm. Henderson & Co., Irvine, N.B., Chemical Manufacturer.

1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.

1905. Pirie, Frank D., Stoneywood Works, Bucksburn, Aberdeenshire, Paper Manufacturer.

1900. Pitman, Jno. R., c/o Laflin and Rand Powder Co., Haskell, N.J., U.S.A., Chemist.

1907. Pitman, Brig.-Gen. John, c/o J. R. Pitman, Haskell, N.J., U.S.A., U.S. Army (retired).

O.M. Pitt, T., 16, Coleman Street, London, E.C., Manufacturing Chemist.

1902. Pittard, Jno., 30, Mansfield Road, Ilford, Essex, Chemical Manufacturer.

1905. Pittock, C. K., Baithney Estate, Saklaspur, Hassan, India, Coffee Grower and Chemist.

1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.

1899. Pizey, Jas. H., Bella Vista, 19, Minas de Rio Tinto Prov. de Huelva, Spain, Chemist.

1905. Plath, Dr. F., Deutsche Ton- und Steinzeugwerke, A.-G., Berlinerstrasse 22 B., Charlottenburg, Germany, Managing Director.

1894. Platten, Frank, 12, Montague Road, Edgbaston, Birmingham, Metallurgical Chemist.

1890. Platts, Jno. C., 12, Alton Terrace, Fairfield, Manchester, Metallurgical Chemist.

1896. Plaut, Albert, 120—128, William Street, New York City, U.S.A., Wholesale Druggist.

1888. Playfair, David J., 7, Victoria Crescent, Dowanhill, Glasgow, Manufacturing Chemist.

1907. Playter, Geo. H., 6, Beacon Street, Boston, Mass., U.S.A., Mining Engineer.

1891. Pocklington, Hy., 41, Virginia Road, Leeds, Assurance Co.'s Local Manager.

1901. Pollard, Wm., Museum, Jermyn Street, London, S.W., Chemist (H.M. Geological Survey).

1904. Pollitt, Dr. Geo. P., Winnington, Northwich, Cheshire, Chemist.

1902. Pollitt, Jas. C. T., Church Hill, Solihull, Warwickshire, Managing Chemist.

1893. Pollitt, R. B., Civil Engineer.

1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.

1890. Pomeroy, Dr. Chas. T., 55, Broad Street, Newark, N.J., U.S.A., Ink Manufacturer.

1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.

O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.

1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.

1895. Pont, Pierre S. du, Wilmington, Del., U.S.A., Explosives Manufacturer.

1892. Pope, Frank, c/o The Dunwoody Bros. Soap Co., Denver, Colo., U.S.A., Chemist.

O.M. Pope, S., 35, Victoria Road, Runcorn, Chemical Works Manager.

1899. Pope, Thos. H., The University, Birmingham, Chemist.

1900. Pope, Prof. W. J., F.R.S., Municipal School of Technology, Manchester; and (Journals), Corchester, Bramhall, Cheshire. Professor of Chemistry.

1900. Popplewell, Jos. M., Provan Chemical Works, Provanmill, Glasgow, Chemist.

1899. Porter, A. Felix, 1613, Rodney Street, Wilmington, Del., U.S.A., Chemist.

1896. Porter, Herbert, 80, Lancaster Avenue, Fennel Street, Manchester, Alkali Inspector.

1902. Porter, J. Edw., P.O. Box 785, and 205, W. Genesee Street, Syracuse, N.Y., U.S.A., Chemist.

1906. Porter, John J., Box 551, Staunton, Va., U.S.A., Chemist and Metallurgist.

1901. Porter, Jno. L., New Orleans Sewerage Board, 602, Carondelet Street, New Orleans, La., U.S.A., Chemist.

1904. Portner, Edward G., Robert Portner Brewing Co., Alexandria, Va., U.S.A., Chemist.

1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.

1905. Potter, Chas. Ed., c/o City Dairy Co., Ltd., Spadina Crescent, Toronto, Canada, General Manager.

1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.

O.M. Potter, E. P., Salwick Hall, near Preston, Alkali Manufacturer.

1906. Potter, Dr. H. Noel, 510, West 23rd Street, New York City, U.S.A., Electrical Engineer.

1905. Potter, N. S., jun., c/o Western States Portland Cement Co., Independence, Kas., U.S.A., Chemist.

1890. Potter, Rowland S., Eastbury, Upland Park Avenue, Loughton, Essex, Chemist.

1900. Potts, Geo. E., 18, Tremont Street, Pottsville, Pa., U.S.A., Explosives Manufacturer.

1900. Pough, Frank H., c/o T. and S. C. White Co., 28, Burling Slip, New York City, U.S.A., Manager.

1889. Powell, A., Ernest, 46, Monton Street, Moss Side, Manchester, Oil Merchant.

1900. Powell, Harry J., 506, Lordship Lane, London, S.E., Glass Manufacturer.

1884. Powell, L. S., The Old Manor House, Ashley, Stockbridge, Hants, Electrician.

1897. Power, Dr. Fred. B., Wellcome Research Laboratories, 6, King Street, Snow Hill, London, E.C., Director.

1902. Powney, Wm. E. F., Department of Mines, Edfu, Upper Egypt., Analytical Chemist.

1900. Pratt, N. P., Laboratory, Atlanta, Ga., U.S.A., Manufacturing Chemist.

1889. Pratt, Walter E., Patchetts, Caton, near Lancaster, Analytical Chemist.

1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.

1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.

1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.

1905. Prentice, G. L., c/o Parson Manufacturing Co., 299, Broadway, New York City, U.S.A., Treasurer.

1900. Prescott, Saml. C., 739, Boylston Street, Boston, Mass., U.S.A., Instructor in Bacteriology.

1905. Preston, Jas. F., Lowell, Mass., U.S.A., Manufacturing Chemist.

1896. Preston-Jackson, J. W. A., Castleford, Yorkshire, Consulting and Analytical Chemist and Druggist.

O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.

1895. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.

1904. Prichard, Norman B., Tweed, Ontario, Canada, Superintendent.

1904. Prideaux, E. B. R., 62, Queen Street; and (Journals), Heriot Watt College, Edinburgh, Research Chemist.

1905. Priest, Geo. Wesley, Mansfield, Mass., U.S.A., Manufacturer.

1886. Priestman, A., 17, Falkner Square, Liverpool, Drysalter.

1904. Pring, J. N., Linden Bank, Sandbach, Cheshire, Student.

1899. Prinsen-Geerligs, H. C., Pekalongan, Java, Netherlands Indies, Director of Sugar Cane Experimental Station.

1893. Pritchard, Edgar J., 5, Cumberland Gate, Kew, Surrey, Works Manager.

1903. Pritchard, Philip M., Chief Engineer's Office, United Alkali Co., Ltd., Widnes, Engineer.

1896. Prochazka, Dr. Geo. A., 138, West 13th Street, New York City, U.S.A., Colour Manufacturer.

O.M. Procter, Prof. H. R., The University, Leeds; and (Journals) Rowangarth, Ben Rhydding, near Leeds, Yorks., Lecturer on Tanning.

1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.

1890. Proctor, Miss Anne J., Free Library, Widnes, Librarian.

O.M. Proctor, C., 43a, London Road, Forest Hill, S.E., Analytical Chemist.

1901. Propach, C., 224, Randolph Street, Chicago, Ill., U.S.A., Colour Merchant.

1894. Proude, Jas., 30, Cromwell Terrace, Halifax, Yorks., Soap Works Chemist and Manager.

1907. Puckhaber, Geo. C., 165, Rodney Street, Brooklyn, N.Y., U.S.A., Glue Maker.

1906. Pudney, Sydney H., 156, Bellwood Avenue, Toronto, Canada, Foreman.

1905. Pugh, John V., Ginting House, Allesley, near Coventry, Works Director (Rudge Whitworth, Ltd.).

1899. Pullar, Edmund, Keirfield, Bridge of Allan, N.B., Manufacturer.

1894. Pullar, Herbert S., Pullar's Dyeworks, Perth, N.B., Dyer.

O.M. Pullar, Sir Robert, M.P.; Journals to Jas. Craigie, Sandeman Public Library, Perth, N.B., Dyer.

O.M. Pullar, R. D., Pullar's Dyeworks, Perth, N.B., Dyer.

1903. Pullin, Sydney R., Attasi Mines, Princisu, Dunkwa Station, Sekondi, Gold Coast Colony, Chemist.

1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.

1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, N.B., Professor of Chemistry.

1906. Purves, Geo., The Refinery, Canal Bank, St. Ambriose Street, St. Henri de Montreal, Canada, Chemist and Works Manager.

1905. Pyman, Dr. Frank Lee, The Oaks, Hitchin, Herts., Chemist.

Q

1903. Queeny, Jno. F., (Journals) Monsanto Chemical Works, and (communications) 1810, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.

1905. Queiroz, Dr. Luiz M. Pinto de, Caixa 255, Sao Paulo, Brazil, Manufacturing Chemist.

1903. Queneau, Augustin L., c/o New Jersey Zinc Co., South Bethlehem, Pa., U.S.A., Mining Engineer.

1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.

1902. Quinan, Kenneth B., c/o De Beers Explosives Works, Somerset West, C.C., South Africa, Chemist.

1897. Quinan, Wm. R., (Journals) General Manager, De Beers Explosives Works, Dynamite Factory, Cape Colony, South Africa; and (subscriptions) c/o De Beers Consolidated Mines, 15, St. Swithin's Lane, E.C., Superintendent (Powder Works).

1897. Quirk, Jno. S., Lead Smelting Works, St. Helens, Lancs., Manager.

R

1898. Radcliffe, Lionel G., 431, Stretford Road, Manchester, Chemist.

1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.

1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.

1895. Raegener, Louis C., 141, Broadway, New York City, U.S.A., Patent Lawyer.

1906. Rafft., Dr. Albert K., Moosic, Pa., U.S.A., Chemist.

1901. Ralston, Wm., 3, Windsor Terrace, Linthouse, Glasgow, Government Chemist.

1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.

O.M. Ramsay, Sir William, K.C.B., F.R.S., University College, London, W.C.; Journals to 19, Chester Terrace, N.W., Professor of Chemistry.

1885. Ramsay, W., c/o Cammell, Laird and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.

1898. Ramsden, Andrew, York Villa, Walmersley Road, Bury, Lancs., Sugar Works Manager.

1906. Ranck, Samuel H., Ryeison Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.

1901. Ransom, Francis, The Chilterns, Hitchin, Herts., Manufacturing Pharmaceutical Chemist.

1905. Ransom, H. B., 78, St. George's Square, London, S.W., Engineer.

1904. Rapelje, Walter S., 957, Liberty Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).

1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.

1893. Ratcliff, Frank D., The Cottage, Green Hill, Bromsgrove, Worcestershire, Vinegar Brewer.

1904. Ratcliffe, C. F., c/o Brotherton and Co., Ltd., Provan Chemical Works, Millerston, Glasgow, Tar Distiller.

1904. Ratcliffe, Mrs. F. A., The Orchard, Dulwich Common, West Dulwich, S.E.

1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.

1895. Rau, Dr. H. M., 130–132, Pearl Street, New York City, U.S.A., Chemist.

1901. Rauter, Dr. G., Cauerstrasse, 2, Charlottenburg, 1, bei Berlin, Germany, Engineering Chemist.

1901. Rawlins, Herbert J. L., The Cottage, Rainhill, Lancashire, Managing Director.

1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.

O.M. Rawson, Chris., 2, Melbourne Place, Bradford, Consulting Chemist.

1906. Raymond, R. S., Marshall's Co-operative Breweries Co., Ltd., Paddington, Sydney, N.S.W., Australia, Brewer.

1895. Read, E. J., St. Ives, The Avenue, Gravesend, Kent, Analyst.

1890. Reade, Thos., Sebright House, Tettenhall Wood, Wolverhampton, Manufacturing Chemist.

O.M. Readman, Dr. J. B., Mynde Park, Hereford, Analytical and Consulting Chemist.

1907. Rebhun, Frank E., c/o Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A.

1902. Redfern, C. G., 4, South Street, Finsbury, London, E.C., Patent Agent.

1890. Redgate, J. G., Traffic Street, Nottingham, Aërated Water Manufacturer.

O.M. Redwood, Sir Boverton, 4, Bishopsgate Street Within, London, E.C., Petroleum Expert.

1884. Redwood, Iltyd J., The Chestnuts, Erith Road, Bexley Heath, Kent, Technical Chemist.

1887. Redwood, Robt., 4, Bishopsgate Street Within, London, E.C., Secretary.

1891. Redwood, T. Horne, Olveston, Sedlescombe Road, St. Leonard's-on-Sea, Analytical Chemist.

1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.

1884. Reed, Albert E., The Grange, Leigham Court Road, Streatham, S.W., Paper Works Chemist.

1902. Reed, Herbert C., c/o Stamford Manufacturing Co., Stamford, Conn., U.S.A., Chemist.

1905. Reed, Herbert W., 153, Milk Street, Boston, Mass., U.S.A., Dye Salesman.

1895. Reed, Dr. J. Hastings, Hambledon Mill, *via* Cairns, North Queensland, Sugar Manufacturer.

1906. Reed, William, Bridge House, Bridge Road, Millwall, E., Foreman (Desilverising Works).

1893. Reekie, J. A., Woodhouse, Hayfield, Derbyshire, Calico Printer's Colour Mixer.

1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.

1897. Rees, W. H., c/o Alameda Sugar Co., Alvarado, Cal., U.S.A., Chemist.

1906. Rees, Walter J., c/o Chann, Bros. and Co., Ltd., Smethwick, near Birmingham, Glass Works Chemist.

1900. Reese, Dr. Chas. L., c/o Repauno Chemical Co., Chester, Pa., U.S.A., Chemist.

1897. Reid, Andrew, 37, Mount Stuart Street, Shawlands, Glasgow, Chemist.

1906. Reid, James, Moffat Mills, Airdrie, N.B., Chemist.

1905. Reid, Dr. John H., 11, Glover Street, Birkenhead, Chemist.

1907. Reid, Robert, Ageneia de Tharsis, Huelva, Spain, Analytical Chemist.

1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemical Student.

1895. Reid, T. Anderson, c/o Johnsen, Jörgensen, and Wettre, 38, Victoria Buildings, Manchester, Works Manager.

O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.

1893. Reid, Wm., Jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.

1904. Reinherz, Otto, 9, Heaton Grove, Bradford, Yorks., Chemist.

1906. Reinhold, Gustave, 11, Hervey Road, Blackheath, S.E., Works Manager.

1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.

1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopoeia.

1900. Remington, J. Stewart, Aynsome, Grange-over-Sands, R.S.O., Lancs., Consulting Chemist.

1903. Remsen, President Ira, Johns Hopkins University, Baltimore, Md., U.S.A., President.

1884. Renaut, F. W., 17, Emanuel Avenue, Friar's Park, Acton, W., Secretary.

1905. Render, Fredk., Underley House, Whitefield, Manchester, Explosives Manufacturer.

O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.

1901. Renwick, Frank F., Cromer Villa, Warley Road, Brentwood, Essex, Chemist (Photographic Works).

1907. Reoch, Robert A. S., Cocheco Manufacturing Co., Dover, N.H., U.S.A., Printworks Superintendent.

1894. Rettie, Theodore, 16, Great King Street, Edinburgh, Metallurgical Chemist.

1895. Reubens, Chas. M., 143, West 111th Street, New York City, U.S.A., Chemist.

1905. Revis, Cecil, 77, King Street West, Hammersmith, W., Analyst.

O.M. Reynolds, Dr. J. Emerson, F.R.S., 29, Campden Hill Court, Kensington, W., Professor of Chemistry.

1904. Rhett, Edmund, American Ether Co., Richmond, Va., U.S.A., Superintendent.

O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.

1892. Rhodes, P. J., Church Bridge House, Accrington, Dye and Print Works Manager.

1902. Rhodin, B. E. F., Sault Ste. Marie, Ont., Canada, Chemical Engineer.

1905. Richard, Francis C., Range Quarters, Mount Morgan, Queensland, Assayer (Mt. Morgan G.M. Co.).

1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.

1888. Richardson, Clifford, New York Testing Laboratory, Long Island City, N.Y., U.S.A., Chemical Engineer.

1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., City Analyst's Office, Bradford; and (Journals) Oak Lea, Menston-in-Wharfedale, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., c/o H. D. Pochin and Co., Ltd., Salford, Manchester, Manager.
1905. Richardson, L. G., Russell Buildings, 10, Leeds Street, Bradford, Yorks., Chemist.
1889. Richardson, S. M., 415, Main Street, Bonhill, N.B., Analytical Chemist.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., 2, Thornfield Road, West Park, Headingley, Leeds, Drysalter.
1900. Richardson, Wm. Derrick, 4306, Forestville Avenue, Chicago, Ill., U.S.A., Chemist (Swift and Co.).
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja Bolotnaja, St. Petersburg, Russia, Textile Chemist.
1904. Richardson, Wm. S., 201, High Street, Lincoln, Chemical Manure Manufacturer.
1886. Richmond, H. D., 8, Woodfield Road, Ealing, W., Chief Chemist (Aylesbury Dairy Co.).
1898. Richmond, Jno. R., 14, North Road, West Kirby, Cheshire, Alkali Works Manager.
1901. Richmond, Sylvester O., 12, Amblecote Road, Grove Park, Lee, S.E., Analytical Chemist.
1907. Ricketts, Guy D., 25, Huskisson Street, Liverpool, Lecturer on Metallurgy (Liverpool University).
1886. Riddell, R., 87, Horninglow Street, Burton-on-Trent, Brewer.
1894. Ridding, Howard C., School of Mines, Clinton Road, Redruth, Cornwall, Principal.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905 Ridge, H. M., Owton Manor, Seaton Carew, Co. Durham, Mining Engineer.
O.M. Ridsdale, C. H., Ravenscroft, Roman Road, Linthorpe, Middlesbrough, Analytical Chemist.
1899. Riederer, Emil J., c/o Eastern Dynamite Co., Forcite Works, Landing, N.J., U.S.A., Works Chemist.
1902. Riederer, Dr. Herman S., 251, West 95th Street, New York City, U.S.A., Chemist.
1907 Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1892. Riker, Jno. J., 46, Cedar Street, New York City, U.S.A., Merchant.
O.M. Riley, E., 2, City Road, Finsbury Square, London, E.C., Metallurgical Chemist.
O.M. Riley, J. E., c/o John Riley & Sons, Hapton, near Accrington, Chemical Manufacturer.
1884. Riley, Jno., Mayfield, Thornliebank, near Glasgow, Print Works Manager.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1904. Riley, W. A., Hazeldene, College Road, Norwich, Brewer.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., 4, Sewardstone Road, Waltham Abbey, Essex, Explosives Chemist.
1901. Ripley, Philip F., 48, Central Street, Andover, Mass., U.S.A., Chemist.
1885. Ritson, T. N., 1, West Cliff Villas, West Cliff Road, Ramsgate, Gas Engineer.
1906. Rivière, Harry V., 232, Lafayette Street, Salem, Mass., U.S.A., Chemist and Leather Superintendent.
O.M. Rix, W. P., Frocester House, Kinglake Road, Egremont, Cheshire, Potter.
1890. Roberts, C. F., Linfitts, Delph, *via* Oldham, Chemical Merchant.
O.M. Roberts, F. G. Adair, Oak Hill Lodge, Frognal, N.W., Chemical Manufacturer.
1901. Roberts, H. E. C., 14, Newton Road, Faversham, Kent, Chemist (Cotton Powder Co., Ltd.).
1885. Roberts, R. Wightwick, 22, Calle Arturo Prat, Valparaiso, Chili, Analytical and Consulting Chemist.
1900. Roberts, Wm. Brittain, Wilderspool House, Warrington, Brewer and Analyst.
1902. Roberts, Wm. H., Lynwood, Wellington Field, Wavertree, Liverpool, Analytical Chemist.
1902. Robertshaw, Chas. D., c/o Chas. Price and Co., Oilworks, Belvedere, Kent, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1897. Robertson, Andrew, J., 2, North Ninth Street, Richmond, Va., U.S.A., Analytical Chemist.
1903. Robertson, Fred., 128, Wellington Street, Glasgow, Analytical Chemist.
1900. Robertson, Jas., 6, Windsor Terrace, Lefroy Street, Coatbridge, N.B., Analytical Chemist.
1891. Robertson, Dr. Robt., 9, Sewardstone Road; (Journals) Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1905. Robertson, Robt., 135, Pearl Street, Boston, Mass., U.S.A., Dyestuff Salesman.
1897. Robinson, Clarence J., Westerleigh, West New Brighton, N.Y., U.S.A., Chemist.
1900. Robinson, Edw. B., 2, Westcott Street, Hull, Oil Distiller.
1904. Robinson, Prof. Franklin C., Bowdoin College, Brunswick, Maine, U.S.A., Professor of Chemistry.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
O.M. Robinson, H. H., 75, Finborough Road, West Brompton, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
O.M. Robinson, Jno., 8, Albert Road, Widnes, Chemical Engineer.
O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nitshill, N.B., Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., Suffolk House, Cannon Street, London, E.C., Manager (Pena Copper Mines).
1904. Roeber, Dr. E. F., 114, Liberty Street, New York City, U.S.A., Editor, "Electrochemical Industry."
1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks., Works Manager.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1900. Rogers, Geo. J., Wallaroo Smelting Works, South Australia, Chemist.
1890. Rogers, Harry, 5, Stoke Newington Common, London, N.
1899. Rogers, John, Ardeer Factory, Stevenston, Ayrshire, N.B., Chemist.
1907. Roller, Frank R., 525, 31st Street, Oakland, Cal., U.S.A., Powder Works Superintendent.
1898. Roller, H. C., Verona, and Riversdale Avenues, Newark, N.J., U.S.A., Superintendent.
1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
O.M. Rollin, J. C., 1, St. Nicholas Buildings, Newcastle-on-Tyne, Chemical Manufacturer.
1905. Romanes, J. W., Minas de Rio Tinto, Huelva, Spain, Chemical Engineer.
1898. Roode, Rudolf de, International Paper Co., Glens Falls, N.Y., U.S.A., Chemist and Superintendent.
O.M. Roscoe, Sir Henry, F.R.S., 10, Bramham Gardens, South Kensington, S.W., Consulting Chemist.
1901. Roscow, Jas., 471, Park Avenue, Paterson, N.J., U.S.A., Colourist and Chemist.
1893. Roscow, Jno. F., P.O. Box 417, Boonton, N.J., U.S.A., Print Works Chemist.
1899. Roscow, Wm., 24, Prince Street, Pawtucket, R.I., U.S.A., Analytical Chemist.

1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.

1901. Rose, Jno. Leonard, Gorton Brook Chemical Works, Manchester, S.E., Chemist.

1902. Rosebrugh, Prof. T. K., 666, Spadina Avenue, Toronto, Canada, and (Journals) 203, Kirk Avenue, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.

1904. Rosenblatt, A. H., Chemist.

1897. Rosengarten, Dr. Geo. D., 1700, Fitzwater Street, Station D, Philadelphia, Pa., U.S.A., Manufacturing Chemist.

1905. Rosenhain, Walter, Park View, Park Road, Teddington, Chemist and Metallurgist.

1896. Rosenheim, Dr. Otto, 68, Belsize Park Gardens, Hampstead, N.W., Research Chemist.

1887. Ross, Alex. J. J., Tayavalla, Falkirk, N.B., Chemical Manufacturer.

1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.

1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.

1906. Rossi, Auguste J., c/o Roessler Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossi, Louis M., c/o Perth Amboy Chemical Works, Perth Amboy, N.J., U.S.A., Mining Engineer.

1906. Rossiter, E. C., 4, Park Road, West Smethwick, Birmingham, Chemical Engineer.

1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.

1905. Rothwell, Robert R., 88, George Street, Moss Side, Manchester, Chemistry and Physics Teacher.

O.M. Rottenburg, Paul, Castle Chambers, 55, West Regent Street, Glasgow, Chemical Merchant.

1899. Rouse, H. W., 62, Russell Road, Custom House, E., Foreman (Sulphuric Acid Works).

1903. Rouse, Wm., 25, Albert Street, Alexandria, Dumbartonshire, Chemist.

1906. Rowell, Herbert W., c/o Locke, Lancaster and Co., Ltd., Bridge Road, Limehouse, E., Analytical Chemist.

O.M. Rowland, W. L., 4800, Chester Avenue, Philadelphia, Pa., U.S.A., Chemist.

1904. Rowley, Ernest W., Chemical Laboratory, Locomotive Department, North Eastern Railway, Gateshead-on-Tyne, Analytical Chemist.

1901. Rowley, Walter Eugene, c/o Schoellkopf, Hartford and Hanna Co., 100, William Street, New York City, U.S.A.

1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.

1896. Royal-Dawson, H., c/o Messrs. Peyton & Son, Chemical Works, Lister Street, Birmingham, Chemist.

1898. Royle, Chas. L., c/o Parry and Co., Samalkot, Godaveri District, Madras, India, Sugar Chemist.

1898. Royle, Thos. H., (Journals) 12, Barfield Villas, George Lane, Woodford, Essex, and (communications) Bareilly, United Provinces, India, Chemist.

O.M. Royse, S. W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.

1902. Rücker, Dr. Hermann von, 675, Potomac Avenue, Buffalo, N.Y., U.S.A., Chemist.

1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.

1895. Rudge, Alfred, Sutton Alkali Works, St. Helens, Lancs., Analytical Chemist.

1904. Ruef, Harry H., c/o The Warner Chemical Co., Carteret, N.J., U.S.A., Chemist.

1884. Ruffle, Jno., Musley, Ware, Herts., Consulting Chemist and Electrician.

1905. Rüger, Richard, 8, Alroy Road, Anfield, Liverpool, Chemist.

1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., P.O. Box 1999, 100, William Street, New York City, U.S.A., Chemical Merchant.

O.M. Rumble, C., Belmont Works, Battersea, London, S.W., Candle Works Chemist.

1899. Rumbold, Wm. R., 47, Watling Street, London, E.C., Electro-Metallurgist.

1895. Rump, Ernst, The Leeds Phosphate Works, Hunslet, Leeds, Manager.

1903. Runting, D. A., Moreland Grove, Coburg, Melbourne, Vic., Australia, Assayer.

1903. Runyan, Elmer G., Hutchins Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.

1899. Rushby, Wm., Broomfield House, Batley, Yorks., Analyst.

1906. Russell, David, Cadham, Markinch, Fife, Scotland, Paper Maker.

1884. Russell, Jno., Anchor Brewery, Britten Street, Chelsea, London, S.W., Brewer.

O.M. Russell, Dr. W. J., F.R.S., 34, Upper Hamilton Terrace, London, N.W., Professor of Chemistry.

1901. Rust, Robt. R., 1315, Fourth Street, Peru, Ill., U.S.A., Chemist.

1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.

1905. Ryan, Prof. F. G.; (Journals) c/o Parke, Davis and Co., Detroit, Mich., U.S.A., and (subscriptions) c/o Parke, Davis and Co., 111, Queen Victoria Street, London, E.C., Manufacturing Chemist.

1906. Ryan, Irenæus F., 452, Fairmount Avenue, Jersey City, N.J., U.S.A., Chemist.

1905. Ryland, Chawner, 53, Park Road, Aston, Birmingham, Brewer and Chemist.

S

1895. Saalfeld, Adolphe, 2, South King Street, Manchester, Chemical Merchant.

1895. Saarbach, Dr. L., 114, Pearl Street, New York City, U.S.A., Consulting Chemist.

1905. Sabin, Alvah H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.

1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.

O.M. Sadler, Sir Samuel A., Middlesbrough-on-Tees, Colour Manufacturer.

1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.

1896. Sadtler, Dr. S. S., 29, South 10th Street, Philadelphia, Pa., U.S.A., Chemist (U.S. Customs).

1905. Safford, E. Brigham, Albuquerque, New Mexico, U.S.A., Chemist.

1897. Sage, C. Edward, 160—162, Kennington Park Road, London, S.E., Consulting Chemist.

1907. Saiki, Kenkichi, 38, West 68th Street, New York City, U.S.A., Chemist.

1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.

1885. Salamon, Jno., Rainham, S.O., Essex, Manufacturing Chemist.

1884. Salis-Mayenfeld, Dr. E. von, 9, Macpherson Terrace, Albany, N.Y., U.S.A., Technical Chemist.

1902. Salm, Louis N., 22, Cliff Street, New York City, U.S.A. Chemist.

1902. Salter, M. J., Greyrick House, Mickleton, Campden, Gloucestershire, Analytical Chemist.

1905. Sammet, Dr. G. Victor, 68, Northampton Street, Boston, Mass, U.S.A., Chemist.

O.M. Samuel, W. Cobden, 66, Croxted Road, West Dulwich, S.E., Analytical Chemist.

1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.

1904. Sand, Dr. Henry J. S., University College, Nottingham, Lecturer and Demonstrator.

1906. Sanders, J. McConnell, c/o Direccion General de Aduanas, Palacio Nacional, Mexico, D. F., Analytical Chemist.

1902. Sanders, Warren W., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Chemist.

1895. Sanderson, John, c/o B. S. Cohen, Ltd., 15, Clerkenwell Close, London, E.C., Chemist.

1898. Sanderson, T. C., Duboise Avenue, West New Brighton, N.Y., U.S.A., Chemical Engineer.

O.M. Sanford, P. Gerald, 20, Cullum Street, London, E.C., Public Analyst and Consulting Chemist.
1904. Sanger, Prof. Charles Robt., Harvard College, Cambridge, Mass., U.S.A., Professor of Chemistry.
1890. Saniter, E. H., Strafford Villa, Moorgate, Rotherham, Analytical Chemist.
1901. Sargent, Dr. Geo. W., Carpenter Steel Co., Reading, Pa., U.S.A., Chemist and Metallurgist.
1903. Saunders, Lewis E., c/o Norton Emery Wheel Co., Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
1895. Savage, Arthur E., Charles Street, Elsternwick, Victoria, Australia, Metallurgist.
1895. Sawers, Wm. D., 1, Athole Gardens Place, Glasgow, Chemist.
1903. Sawin, Luther R., Mt. Kisco Laboratory, Mount Kisco, N.Y., U.S.A., Bacteriologist.
1901. Sawyer, Dr. Harris E., c/o Felton and Son, 524, East Second Street, South Boston, Mass., U.S.A., Chemist.
1898. Saxe, Sigmond, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1895. Sayer, Harry, 5, Orchard Road, High Barnet, Herts., Metallurgical Chemist.
1890. Sayers, Jos. J., Nobel Villa, Stevenston, Ayrshire, Explosives Chemist.
1895. Scales, F. Shillington, "Jersey," St. Barnabas Road, Cambridge.
1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
O.M. Schack-Sommer, Dr. G., 48, Marlborough Mansions, Victoria Street, London, S.W., Sugar Refiner.
1899. Schaefer, Dr. L., Maywood, N.J., U.S.A., Manufacturing Chemist.
1903. Schanche, Herman G., 3401, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1906. Scheffer, Heinrich, 7, Conyngham Road, Rusholme, Manchester, Chemical Apparatus Manufacturer.
1903. Scheidel, Dr. Aug., Union Club, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beach Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, 15, University Place, New York City, U.S.A.
1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1895. Schieffelin, Dr. W. Jay, 841, Southern Boulevard, New York City, U.S.A., Manufacturing Chemist.
1901. Schieren, G. Arthur, Dixie Tannery, Bristol, Tenn., U.S.A., Mechanical Engineer and Tanner.
1905. Schill, Dr. Emil, c/o G. Siegle Co., 79, Duane Street, New York City, U.S.A., Chemist.
1902. Schlegel, Jno. Wm., cor. Main and Toledo Avenues, Elmhurst, Long Island, N.Y., U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1902. Schlesinger, Basil E., 92, Mount Vernon Street, Boston, Mass., U.S.A., Chemist.
1901. Schlichting, Emil, 1716, Chestnut Street, Philadelphia, Pa., U.S.A., Chemist.
1905. Schmidt, Herman B., 2523, Essex Place, W.W.H., Cincinnati, Ohio, U.S.A., Manufacturing Chemist.
1906. Schmidt, J., Cross Street, Burton-on-Trent, Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., 172, Columbus Avenue, Boston, Mass., U.S.A., Chemist.
1906. Schmoelle, Joseph, 14th Floor, Rector Building, Chicago, Ill., U.S.A., Chemical Engineer.
1901. Schneider, Edw. J., c/o Union Carbide Co., Niagara Falls, N.Y., U.S.A., Chemist.
1[illegible]. Schneider, Dr. F. G., Continental Color and Chemical Co., 32, India Street, Boston, Mass., U.S.A., Technical Chemist.
1[illegible]. Schniewind, Dr. F., c/o United Coke and Gas Co., 17, Battery Place, New York City, U.S.A., Chemist.
1904. Schniewind, Heinrich, Jun., Susquehanna Silk Mills, 62, Greene Street, New York City, U.S.A., Vice-President and Treasurer.
1897. Schoder, Dr. Robt., 6, Brandreth Road, Balham, S.W., Chemist.
1904. Schoeller, Dr. Walter R., c/o D. C. Griffith & Co., Victoria Avenue, Bishopsgate Without, London, E.C., Analytical Chemist.
1902. Schofield, Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1898. Scholes, Geo. R., Dépôt Général de la Liebig's Extract of Meat Co., Ltd., Antwerp, Belgium, Analytical Chemist.
1906. Schramm, Quirin, Otto-Hilgenstock Coke Oven Co., Ltd., Tingley, near Wakefield, Chief Chemist.
1906. Schroeder, C. M. E., 221, Pearl Street, New York City, U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Co., 36, Ash Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Schulten, Dr. C., 11, Clive Row, Calcutta, India, Analytical Chemist.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.
1893. Schüpphaus, Dr. R. C., 175, Pearl Street, New York City, U.S.A., Consulting Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1902. Schwarz, Gustav A., Grasselli Chemical Co., 60, Wall Street, New York City, U.S.A., Manager.
1889. Schweich, Emile. *See* Mond, Emile S.
1903. Schweickert, Karl, 45, Hazelwood Avenue, Rahway, N.J., U.S.A., Chemist.
1894. Schweitzer, Dr. H., 128, Duane Street, New York City, U.S.A., Analytical Chemist.
1905. Schweizer, Alfred, 14, Rue de Calais, Paris, France.
1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President, Casein Co.
1906. Scott, Alex. C., Davington House, Faversham, Kent, Assistant Manager (Cotton Powder Co.).
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1906. Scott, A. Putnam, Dominion Iron & Steel Co., Sydney, C.B., Canada, Chemist.
1889. Scott, Ernest G., 2, Talbot Court, Gracechurch Street, London, E.C.; and (Journals) 67, Lord Street, Liverpool, Soap Works Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, 33, Sciennes Road, Edinburgh, Analytical Chemist.
1902. Scott, Walter, c/o The Powell Duffryn Steam Coal Co., Ltd., Aberaman, near Aberdare, Chemist.
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical Chemist.
1889. Scovell, M. A., Lexington, Kentucky, U.S.A., Agricultural Chemist.
1904. Scoville, Wilbur L., 50, Washington Street, Boston, Mass., U.S.A., Analytical Chemist.
O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
1895. Seabrooke, H. Cecil, Black Ash, Grays, Essex, Research Chemist.
1906. Seabury, Richard W., c/o Loando Hard Rubber Co., Boonton, N.J., U.S.A., Factory Superintendent.
1900. Searby, Fred. M., West Berkeley, Cal., U.S.A., Oilworks Superintendent.
1889. Searl, Albert, Montreux, Victoria Road, Sidcup, Kent, Technical Chemist.
1898. Searle, Alfred B., 29, Ashfield Terrace West, Newcastle-on-Tyne; and (Journals) Cliftonville, Claremont, Sheffield, Analytical Chemist.
1905. Seaver, Joshua, 212, Milk Street, Boston, Mass., U.S.A., Dealer in Dyestuffs and Chemicals.
1907. Sebold, George, 354, Elizabeth Avenue, Elizabeth, N.J., U.S.A.

1901. Sederholm, Erik, K. Flottans Varf, Stockholm, Sweden, Chemist (Royal Navy Board).

1905. Seebohm, H. C. A., 128, Duane Street, New York City, U.S.A., Importer of Dyestuffs and Chemicals.

1905. Seeker, A. F., 528, Eighth Street, Brooklyn, N.Y., U.S.A., Food Analyst.

1901. Seeler, Dr. F., c/o Merck and Co., Rahway, N.J., U.S.A., Manufacturing Chemist.

1893. Sefton-Jones, Herbert, c/o W. P. Thompson and Co., 322, High Holborn, London, W.C., Chemist.

1902. Segaert, Edw., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1899. Seher, A., c/o Maas and Waldstein Co., Riverside Avenue, Newark, N.J., U.S.A., Chemist.

1906. Seiter, Francis J., 3401, Charlton Street, Chicago, Ill., U.S.A., Chemist.

1896. Seldner, Rudolph L., 1395, Dean Street, Brooklyn, N.Y., U.S.A., Instructor in Chemistry.

1904. Seligman, Dr. Richard, Messrs. J. and W. Seligman, Mills Buildings, New York City, U.S.A.; and (Journals) 33A, High Street, Kensington, W., Chemist.

1905. Sellers, Geo. E., Rock View, Milnsbridge, near Huddersfield, Aniline Colour Maker.

1884. Semet, Louis, 217, Chaussée de Vleurgat, Brussels, Alkali Manufacturer.

1898. Sen (Gupta), Nagendra Nath, 19, Lower Chitpur Road, Calcutta, India, Physician and Chemist.

1899. Senior, Francis L., Lock 28, Sanford, Maine, U.S.A., Mill Chemist.

1906. Setz, C. F., Herculaneum, Mo., U.S.A., Chemist and Metallurgist.

1904. Setzler, Dr. Horace B., c/o Lake Carriers Oil Co., Coraopolis, Pa., U.S.A., Superintendent.

1900. Seward, Geo. O., Holcomb Rock, Va., U.S.A., Chemist.

1905. Sewell, B. F. Brooke, Ferry Lane, Annapolis, Md., U.S.A., Chemical Engineer.

1896. Seyler, Clarence A., Technical Institute, Nelson Terrace, Swansea, Chemist and Assayer.

1903. Shacklady, T. G., Addiscombe Villas, Cliffe-at-Hoo, Rochester, Technical Chemist.

1906. Shadbolt, Fred, c/o South Metropolitan Gas Co., Chemical Works, East Greenwich, S.E., Chemical Engineer and Manager.

1906. Shah, S. J., Chaklasi, *via* Nadiad, India, Manager of Condensed Milk Co.

1905. Shainwald, R. L., jun., Bound Brook, N.J., U.S.A., Chemical Student.

1906. Shankland, George A., Millthorpe, Watson Avenue, Mansfield, Notts, Manager.

1892. Shanks, Arch., Bridgend Mills, Dalry, Ayrshire, N.B., Chemist.

1883. Sharp, James, Shirley Manor, Wyke, near Bradford, Yorks., Dyer.

1891. Sharpe, Granville H., 11 and 12, Great Tower Street, London, E.C., Analytical Chemist.

1904. Sharples, G. H., Holly Villas, Sutton Lane, Middlewich, Cheshire, Works Chemist.

1905. Sharples, Philip P., 22, Concord Avenue, Cambridge, Mass., U.S.A., President (Natl. Coal Tar Co.).

1884. Sharples, Stephen P., 26, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.

1896. Sharpley, Wm. P., P.O. Box 102, Germiston, Transvaal, S. Africa, Analytical Chemist.

1900. Sharwood, Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.

1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.

1906. Shaw, H. G., Box 373, Barberton, Ohio, U.S.A., Chemist.

1905. Shaw, John, 40, India Wharf, Boston, Mass., U.S.A., Manufacturing Chemist.

O.M. Shearer, A., 5, Derby Road, Burton-on-Trent, Technical Chemist.

1904. Shedden, Frank, 25, Hareholme Lane, Clough Fold, Manchester, Science Master.

1905. Sheldon, John C., 40, Arthur Road, Erdington, near Birmingham, Chemist.

1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.

O.M. Shenston, W. A., F.R.S., 46, College Road, Clifton, Bristol, Chemical Lecturer.

1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.

1902. Shepard, Chas. H., Laboratory, Union Iron Works, San Francisco, Cal., U.S.A., Chemist.

1889. Shepard, Dr. Chas. U., (communications) P.O. Box 42, Summerville, S.C.: and (Journals) P.O. Box 284, Charleston, S.C., U.S.A.

1906. Shepard, Jas. H., Experimental Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.

1907. Shepheard, Fred G., 9, Leinster Road, Rathmines, Co. Dublin, Ireland, Chemist.

1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E.

1900. Shepherd, E. Sanger, 12, Heath Hurst Road, Hampstead, N.W., Scientific Instrument Maker.

1893. Shepherd, H. H. B., Northcote, Mount Pleasant Lane, Upper Clapton, N.E., Chemist.

1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.

1907. Shepperson, Wm., 21, The Pryors, Hampstead Heath, N.W.

1895. Sherman, G. W., 264, Spicer Street, Akron, Ohio, U.S.A., General Manager.

1899. Shero, John E., c/o Pittsburg Reduction Co., Niagara Falls, N.Y., U.S.A., Chemist.

1906. Sherwin, R. S., c/o Pittsburgh Reduction Co., East St. Louis, Ill., U.S.A., Chemist.

1893. Shields, Dr. John, Minas de Rio Tinto, Prov, de Huelva, Spain, Chemist.

1896. Shimomura, K., c/o Osaka Seimi Works Co., Kawagishicho, Nishiku, Osaka, Japan, Chemist.

1886. Shimosé, Masachika, 110, Hakusan-Gotenmachi, Koishikawa, Tokyo, Japan, Chemical Engineer.

1902. Shimotome, H., see Soma, Professor H.

1888. Shishkoff, Sergius A., Perm, Russia, Glass Manufacturer.

1905. Shoffstall, Arthur S., 307, Morris Street, Woodbury, N.J., U.S.A., Chemist.

1899. Sholes, Chas. E., 164, Front Street, New York City, U.S.A., Chemical Agent.

1900. Shonk, Albert, Alma, Merivale Road, Harrow, Analytical Chemist.

1899. Shores, Dr. Jeff. H., Beaconsfield Road, Widnes, Chemist.

1897. Shorey, Dr. Edmund C., P.O Box 360, Honolulu, H.I., Chemist.

1904. Short, Andrew, Choppington, Morpeth, Works Chemist.

1903. Shorter, A. E., 64, Garden Reach, Calcutta, India, Soap and Candle Manufacturer.

1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.

1901. Shukoff, Dr. Alexis A., Borowaja No. 86, St. Petersburg, Russia, Technical Chemist.

1899. Shuler, Darius P., R. F. D. No. 7, Box 146, Los Angeles, Cal., U.S.A., Chemist.

1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.

1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.

1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.

1902. Sibley, Samuel E., Tottenham, Warren Road, Marrickville, Sydney, N.S.W., Australia, Technical Chemist.

1902. Siebold, Alfred, c/o British Dyewood and Chemical Co., Lacovia P.O., Jamaica, Technical Chemist.

1907. Siegel, Dr. Nathan, 305, East 33rd Street, New York City, U.S.A., Chemist.

1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.

1906. Silverman, Max, Park Hotel, Williamsport, Pa., U.S.A., Chemist.

1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.

1901. Sim, Wilfrid A., c/o Wm. Sim and Son, 40, Jane Street, Leith, N.B., Colour Manufacturer.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 55–56, Bishopsgate Street, London, E.C., Chemical Engineer.
1890. Simonds, Dr. F. M., 159, Front Street, New York City, U.S.A., Mining Engineer and Assayer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, via Singapore, S.S., Engineer.
1906. Simons, F. D., Continental Mexican Rubber Co., Apartado 176, Torreon, Mexico, Chemist.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Edward H., 52, Park Street, Jersey City, N.J., U.S.A., Chemist.
1905. Simpson, Henry, 120, Denman Street, Radford, Nottingham, Works Chemical Assistant.
O.M. Simpson, W. S., 17, Lakeside Road, Palmer's Green, N., Analytical Chemist.
1900. Sims, W. Edgar, Hillcroft, Frodsham, viâ Warrington, Technical Chemist.
1906. Sinclair, Edmund E., 3, Marion Street, New York City, U.S.A., Printing Ink Manufacturer.
1894. Sinclair, Dr. W., 60, Stirling Road, Trinity, Edinburgh, Chemist.
1890. Sindall, R. W., 201, Wellmeadow Road, Catford, S.E., and (Journals) Oxford Court, Cannon Street, E.C., Paper Chemist.
1889. Singer, Ignatius, 3, Parkfield Road, Manningham, Bradford, Manufacturing Chemist.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., Glenside, Church Lane, Moston, Manchester, Demonstrator of Chemistry.
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1905. Sjoström, Waldemar L., 37, Farnham Street, Lawrence, Mass., U.S.A., Dyeworks Superintendent.
1885. Skaife, Wilfred T., 70 Sherbrooke Street West, Montreal, Canada, Sugar Chemist.
1894. Skelton, John R., c/o Norwich Crape Co., Ltd., St. Augustine's, Norwich, Technical Chemist.
1897. Skertchley, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1904. Skerten, Wm. B., 25, Broad Street, New York City, U.S.A., Chemical Accountant.
1891. Skilton, C. F. E., Brewery House, Staines, Brewer.
1901. Skinner, Hervey J., c/o A. D. Little, 93, Broad Street, Boston, Mass., U.S.A., Chemist.
1904. Skirrow, Dr. F. W., 17, Curzon Avenue, Victoria Park, Manchester, Research Chemist.
1904. Skowronski, S., c/o Amer. Smelting & Refining Co., Maurer, N.J., U.S.A., Chemist.
1901. Skarratt, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1906. Slack, Edwin B., 39, Huron Street, Toronto, Canada, Chemist.
1904. Slater, Dr. Arthur, The Priory, Burton-on-Trent, Lecturer and Demonstrator.
1897. Slatter, Geo. W., 241, Carlton Terrace, Nab Wood, Shipley, Yorkshire, Analytical Chemist.
1900. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1905. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
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1901. Smale, Dr. F. J., c/o Wm. Davies Co., Toronto, Canada, Chemist.
1906. Small, Frank Bergmann, Foyle Villa, Merton Road, Bootle, Liverpool, Works Chemist.
1906. Small, Fritz H., c/o Graton and Knight Manufacturing Co., Worcester, Mass., U.S.A., Chemist.
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1904. Smith, Albert E., c/o Mount Hope Finishing Co., North Dighton, Mass., U.S.A., Superintendent.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Prof. of Chemistry.
1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyer's Manager.
1897. Smith, Allan, c/o Kellner-Partington Paper Pulp Co., Hallein, bei Salzburg, Austria, Chemist.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 43, Castle Street, Liverpool, General Manager.
1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1906. Smith, Arthur D., 91, Avenue C., Bayonne, N.J., U.S.A., Chemist.
1906. Smith, Arthur G., Washington Portland Cement Co., Baker, Wash., U.S.A., Chief Chemist.
1906. Smith, Charles, Knowsley Road, Smithills, Bolton, Lancashire, Science Master.
1893. Smith, Edgar B., Box 599, Sydney, Cape Breton, Canada, Chemist.
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1892. Smith, Ernest A., The Assay Office, Leopold Street Sheffield, Assayer.
1903. Smith, Ewing, c/o Borneo Co., Ltd., Kutching, Sarawak, Borneo, Analytical Chemist.
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1891. Smith, Francis P., c/o Union Oil Co. of California, 10—12, Old Slip, New York City, U.S.A., Chemist.
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1897. Smith, Sir Geo. J., c/o Bickford, Smith, and Co., Ltd., Tuckingmill, Cornwall, Fuse Manufacturer.
1906. Smith, Dr. G. McPhail, Chemical Laboratory, University of Illinois, Urbana, Ill., U.S.A., Instructor in Chemistry.
1906. Smith, Geo. Thos., 94, Leadenhall Street, London, E.C., Chemical and Colour Merchant.
1890. Smith, Harry, 93, Holly Avenue, Newcastle-on-Tyne, Colour Works Manager.
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1903. Smith, James, South Bank, Frodsham, Cheshire, Metallurgist.
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1888. Snape, Dr. H. Lloyd, Balholm, Lathom Road, Southport, Director of Education for Lancashire.
1896. Snowdon, J., jun., Messrs. Snowdon, Sons and Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., 19, East Parade, Newcastle-on-Tyne, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors' Nobelkrut).
1894. Sohn, Chas. E., 2, Harpur Street, Bedford Row, London, W.C., and (Journals) 126, Hewitt Road, Harringay, N., Analyst.
1906. Solomon, M., 45, Newhall Street, Birmingham, Manager (Carbon Works).
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.
1884. Solvay, Ernest, 43, Rue des Champs Elysées, Brussels, Alkali Manufacturer.
1902. Soma, Prof. H., Higher Technical School, Asakusa, Tokyo, Japan, Professor of Chemistry.
1897. Somerset, H. St. John, jun., Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Assayer.
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1903. Sommermeier, Edw. E., 1590, Neil Avenue, Columbus, Ohio, U.S.A., Chemist.
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1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
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1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1904. Sparke, Archibald, Public Library and Art Gallery, Bury, Lancs., Chief Librarian, &c.
1904. Sparre, Fin, 1810, Washington Street, Wilmington, Del., U.S.A., Chemist.
1901. Sparrow, J. Marcellus, c/o Imperial Varnish and Colour Co., Ltd., 6-22, Morse Street, Toronto, Canada, Varnish and Colour Manufacturer.
1904. Spayd, Chas. Hay, Fernwood P.O., East Lansdowne, Delaware Co., Pa., U.S.A., Analytical Chemist.
1904. Speiden, C. C., 181, Front Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Sewage Works, Deighton, Huddersfield, Chemist.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, Truro, N.S., Canada, Chemist.
1906. Spencer, Fred. W., c/o Standard Ammonia Co., Ltd., Glebe Point, Sydney, N.S.W., Australia, Works Manager.
1884. Spencer, Jno., Globe Tube Works, Wednesbury, Tube Manufacturer
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1901. Spencer, Robt., jun., 3, Woodville Terrace, Bradford.
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1897. Sperry, Erwin S., P.O. Box 656, Bridgeport, Conn., U.S.A., Metallurgist.
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1884. Spiegel, Dr. Adolf, Messel, bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, P. E., 21, Cadogan Gardens, London, S.W., and (Journals) Freudenbergstr. 30, Zurich, Switzerland, Chemical Student.
1906. Spiera, V. G., Middlepark, Kamptee, Central Provinces, India, Chemist.
1889. Spies, Adolph, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1889. Spies, Hermann, 102, Fenchurch Street, London, E.C., Chemical Merchant.
1885. Spiller, A., Edison-Swan Electric Co., South Benwell Works, Newcastle-on-Tyne, Electrician.
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1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
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1900. Spurge, Edw. C., 619, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Chemist.
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1896. Stafford, Chas. H., c/o The Birkacre Printing Co., Chorley, Lancs., Colourist.
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1905. Stahl, Dr. Paul G., 13, Square de Jussieu, Lille (Nord), France, Chemical Manufacturer.

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1904. Standfast, Jno. T., c/o Messrs. Burt, Boulton, and Haywood, Ltd., Selzaete, Belgium, Chemist.
1905. Stanley, Harry, 3, St. Michael's Park, Bristol, Lecturer on Applied Physics and Engineering.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.
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1896. Statham, Noel, c/o The West Virginia Paper and Pulp Co., Piedmont, West Va., U.S.A., Engineer.
1904. Stauffacher, W., 64, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.
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1896. Steel, Fred. W., c/o Cuming, Smith and Co., Yarraville, Melbourne, Vic., Australia, Chemist.
1900. Steel, Jno. S., Achernat, Blackburn, Melbourne, Vic., Australia, Chemist.
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1906. Steers, Thornton, 224, Grand Avenue, Brooklyn, N.Y., U.S.A., Chemist.
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1903. Stell, S. F., 25, Henry Street, Keighley, Yorks., Teacher of Chemistry.
1887. Stenhouse, T., Townhead, Rochdale, Analytical Chemist.
1903. Stephan, Geo. B., c/o Larkin Soap Co., Buffalo, N.Y., U.S.A., Perfumer.
1904. Stephen, A. E., Lachlan Gold Fields, Ltd., Forbes, N.S.W., Australia, Analytical Chemist.
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1889. Stern, Arthur L., Southbank, Stapenhill Road, Burton-on-Trent, Brewing Chemist.
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1903. Steven, A. B., The University, Leeds, Lecturer on Dyeing.
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1888. Stevens, Arthur F., 96, Newgate Street, London, E.C., Paper Examiner.
1904. Stevens, Edgar B., 688, Seventh Street, Buffalo, N.Y., U.S.A., Chemist (Wood Products Co.).
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1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.
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1884. Stevens, Wm., The Native Guano Co., Ltd., 29, New Bridge Street, London, E.C., Secretary.
1907. Stevenson, Chas. E., 80, Polwarth Terrace, Edinburgh, Dyer.
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1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.
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1890. Stewart, Robt., 43, Leagrave Road, Luton, Chemical Works Manager.
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1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.
1904. Stieglitz, Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.
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1893. Stock, F. W. Keating, County Analyst's Office, Darlington, Analytical and Consulting Chemist.
1900. Stockdale, Edgar, c/o E. Dewhurst and Co., Ltd., Printworks, Batley, Yorks., Colour Mixer.
1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.
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1903. Stormer, Edward J., c/o Case Threshing Machine Co., Racine, Wis., U.S.A., Analytical Chemist.
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1906. Straus, Louis, 18, West 83rd Street, New York City, U.S.A., Merchant.

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1890. Studer, Simon J., Helvetia, Stockton Heath, near Warrington, Technical Chemist.
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1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
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1894. Sutherland, Geo., Croft Cottage, Bonhill, N.B., Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, The British Aluminium Co., Ltd., Baker Street, Greenock, N.B., Manager of Carbon Factory.
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1900. Sutton, W. Lincolne, Hillcroft, Eaton, Norwich, Public Analyst.
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1904. Swindells, Seth, 181, Orford Lane, Warrington, Chemist.
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1903. Sykes, Walter F., 85, Water Street, New York City, U.S.A., Chemical Merchant.
1902. Sylow, Paul L. P. G., Korsör, Alexandra Street, Drummoyne, Sydney, N.S.W., Australia, Analytical Chemist.
O.M. Syme, W. B., Elm Cottage, Addiewell, West Calder, N.B., Oil Works Chemist.
1906. Symes, Langford P., Parcora Freezing Works, Timaru, New Zealand, Chemist.
1903. Symmes, Whitman, 2231, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemical Engineer.
1906. Symonds, Abram E., Wick Lane Colour Works, Old Ford Road, Bow., E., Colour Manufacturer.
1905. Szegö, A. S., 60, Bewsey Street, Warrington, Chemist.

T

1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1896. Takagi, T., Kyoikuhin, Seizo Kaisha, Asakusa, Shickihen Cho, Tokyo, Japan, Chemical Engineer
O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.
O.M. Takamine, Dr. Jokichi, 521, West 179th Street, New York City, U.S.A., Engineer.
1890. Takayama, Jintaro, Nando Machi 26, Ushigome, Tokyo, Japan, Director (Imperial Industrial Experiment Station).
1905. Talbot, Prof. Henry P., Mass. Institute of Technology, Boston, Mass., U.S.A., Professor of Inorganic Chemistry.
1903. Talbott, Dr. B. E., Chaneyville, Md., U.S.A., Manufacturing Chemist.
1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan, Chemist.
1906. Tanaka, S., 4, Uratakashimacho Nichome, Yokohama, Japan, Chief Chemical Engineer (Electric Wire Works).
1900. Tankard, Arnold R., 82, Llanthewy Road, Newport, Mon., Analytical Chemist.
O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
O.M. Tatlock, J., 45, Renfrew Street, Glasgow, Laboratory Furnisher.
O.M. Tatlock, R. R., 11, Bellshaugh Road, Kelvinside West, Glasgow, Consulting Chemist.
1902. Tatters, Hugh Lee, 10, Birchfield Road, Widnes, Analytical Chemist.
1906. Tattersfield, Frederick, The Hollins, Dewsbury, Yorks, Analyst.
1905. Taussig, Dr. Hugo, 237, East 72nd Street, New York City, U.S.A., Chemist.
1905. Taveau, René de Mortemer, 1218, Mount Royal Avenue, Baltimore, Md., U.S.A., Research Assistant, Johns Hopkins University.
1898. Taverner, W., Ashland, Oregon, U.S.A., Analytical Chemist.
1901. Tayler, Jno. Bernard, Anglo-Chinese College, Tientsin, North China, Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Station F., Box 12, Cleveland, Ohio, U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1902. Taylor, Edward R., Penn Yan, N.Y., U.S A., Manufacturing Chemist.
1902. Taylor, Francis O., c/o Parke, Davis and Co., Detroit, Mich., U.S.A., Analytical Chemist.
1886. Taylor, G. Crosland, Ravenscar, Helsby, near Warrington, Electrical Engineer.
1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.
1893. Taylor, G. W., Dinting Vale Printworks, Dinting, near Manchester, Printworks Chemist.
O.M. Taylor, H. E., 702, Alexandra Parade, Dennistoun, Glasgow, Lead Works Manager.
1883. Taylor, Jas., Nymagee, N.S.W., Australia, Government Metallurgist.

1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.
1901. Taylor, Jno., c/o Brotherton and Co., Ltd., Tar Works, Litherland, Liverpool, Chemist.
1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.
1896. Taylor, Martin, "The Clough," Buckhurst Hill, Essex, Chemical Works Manager.
1901. Taylor, M. J., 77, Front Street East, Toronto, Canada, Soap Manufacturer.
1901. Taylor, Sidney H., 65, Newbridge Road, Weston, Bath, Works Chemist.
1902. Taylor, Tom, jun., Journals to Kent House, Sale, Cheshire; communications to Cornbrook Chemical Co., Ltd., Stockport, Colour Manufacturer.
1898. Taylor, Walter, 20, Canning Street, Bury, Lancs., Technical Chemist.
1905. Taylor, Wm. H., 20, Balcaskie Road, Eltham Park, Kent, Chemist.
1903. Tazaki, T. M., 15, Kamiyoshicho, Asakusaku, Tokyo, Japan, Technical Chemist.
1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.
1899. Teas, Wm. Holmes, Ridgeway, Pa., U.S.A., Chemist.
O.M. Teed, Dr. F. L., Chem. Laby., 9, Mincing Lane, London, E.C., Analytical Chemist.
1905. Teeple, Dr. J. E., Industrial Laboratories, 164, Front Street, New York City, U.S.A., Director.
1904. Teller, George L., The Columbus Laboratories, 103, State Street, Chicago, Ill., U.S.A., Chemist.
1906. Tempany, Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.
1905. Temperley, Joseph, 22, Down Street, Piccadilly, London, W.; and (Journals) 72, Bishopsgate Street Within, E.C., Shipowner.
1884. Tennant, Jas., Alex. Fergusson and Co., Ltd., 38, McAlpine Street, Glasgow, Lead and Colour Manufacturer.
1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., Savannah, Ga., U.S.A., Chemist.
1888. Terry, Albert, Verulam, Mount Albert Road, Balwyn, near Melbourne, Victoria, Brewer.
1884. Terry, Hubert L., (Journals) 3, Herbert Street, Moss Side, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.
O.M. Tervet, R., 54, Penshurst Road, South Hackney, E., Oil Works Manager.
1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.
1897. Tetlow, Dr. Wm. E., Ash Cottage, Ashfield, Dunblane, N.B., Chemist.
1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.
1907. Thomas, Alphonse H., 122, Front Street, New York City, U.S.A., Chemist.
O.M. Thomas, Chas., J.P., D.L., Pitch and Pay, Stoke Bishop, near Bristol, Soap Manufacturer.
1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.
1902. Thomas, Jas. E., Box 53, Krugersdorp, Transvaal, South Africa, Cyanide Manager.
O.M. Thomas, J. W., Overdale, Shortlands, Kent, Analytical Chemist.
1902. Thomas, Nehemiah M., Roseville Avenue, Pymble, N.S.W., Australia, Inspector
1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.
1888. Thomas, S. Percy, 2, Landrock Road, Hornsey, N., Technical Chemist.
[illegible] Thomas, Wm. Harrison, jun., R.F.D. No. 37, South Norwalk, Conn., U.S.A., Printworks Chemist.
1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.
[illegible] Thompson, A. J., Bernina, Friern Lane, Whetstone, N.; and (Journals) 42, Snow Hill, London, E.C., Buyer (Burroughs, Wellcome & Co.).
[illegible] Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.
1898. Thompson, Edw. C., 32, Ulundi Road, Westcombe Park, S.E., Manufacturing Chemist.
1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.
1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Thompson, Dr. J. Fairfield, c/o Orford Copper Co., New Brighton, N.Y., U.S.A., Chemist.
1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.
1885. Thompson, W., Sankey Hill, Earlestown, Lancashire, Sugar Refiner.
O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.
1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.
1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.
1891. Thomson, Jas. M., Royal Gunpowder Factory, Waltham Abbey, Essex, Manager (Cordite Branch).
1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.
O.M. Thomson, W., Royal Institution Laboratory, Manchester, Analytical and Consulting Chemist.
1890. Thomson, Wm. Thos., Royal Gunpowder Factory, Waltham Abbey, Essex, Explosives Chemist.
1902. Thorburn, Jas., c/o The British Explosives Synd., Pitsea, Essex, Manager.
O.M. Thorne, Dr. L. T., 2, Denbigh Gardens, Richmond-on-Thames; and (Journals) Southampton Wharf, Battersea, S.W., Technical Chemist.
O.M. Thorneycroft, Wallace, Plean House, Plean, Stirling, Technical Chemist.
1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.
1907. Thornton, A. D., 13, Tupper Street, Montreal, Canada, Rubber Manufacturer.
1891. Thornton, Chris., 26, Larch Street, Providence, R.I., U.S.A., Printworks Manager.
1891. Thornton, David H., Brookfoot Dyeworks, Brighouse, Yorks., Dyer.
1887. Thornton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.
1899. Thornton, Wm., (Journals) c/o Isaac Brandon and Bros., Panama, Central America; and (subsn.) c/o Thos. Thornton, Hermand, West Calder, N.B., Chemist.
1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.
1907. Thorp, Thos., Moss Bank, Whitefield, near Manchester, Engineer.
1906. Thorp, Walter, Limerick, Ireland, Analytical Chemist.
1905. Thorpe, Dr. J. F., Yannaford, Heaton Mersey, Lancs., Lecturer, Manchester University.
O.M. Thorpe, Dr. T. E., C.B., F.R.S., Government Laboratory, Clement's Inn Passage, Strand, W.C.; and (Journals) 61, Ladbroke Grove, Notting Hill, W., Chief Chemist (Customs and Inland Revenue).
1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.
1902. Thurlow, Nathaniel, 78, Warburton Avenue, Yonkers, N.Y., U.S.A., Chemist.
1898. Thurnauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.
1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.
1905. Tichenor, Henry D., 18, Exchange Place, New York City, U.S.A., Custom House Broker.
1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.
1903. Tighe, Arthur, Springfield, Darlinghurst Road, Sydney, N.S.W., Australia, Chemical Student.

1901. Tilden, Philip S., c/o Franklin H. Kalbfleisch Co., Metropolis Building, Broadway and 16th Street, New York City, U.S.A., Manufacturing Chemist.

O.M. Tilden, Prof. W. A., F.R.S., The Oaks, Murray Road, Northwood, Middlesex, Professor of Chemistry.

1900. Tilley, Jas. W., 95A, Southwark Street, London, S.E., Research Chemist.

1906. Tillson, Henry E., 75, Abbott Street, Laurence, Mass., U.S.A., Dyer.

1901. Timmans, W. G., c/o Basford Chemical Co., Basford, Nottingham, Chemical Works Manager.

O.M. Timmis, T. Sutton, Widnes, Chemical Manufacturer.

1905. Tindall, W. B., 39, St. Mary Street, Toronto, Canada, Secretary and Treasurer.

1894. Tipler, Fred. C., 48, Brooklyn Street, Crewe, Analytical Chemist.

1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.

1890. Tobey, C. H., Burks Falls, Ontario, Canada, Tannery Chemist.

1894. Toch, Maximilian, 52, 9th Street, Long Island City, N.Y.; and (Journals) 320, Fifth Avenue, New York City, U.S.A., Chemist.

1886. Todd, A. M., 204, North Rose Street, Kalamazoo, Mich., U.S.A., Manufacturing Chemist.

1905. Todhunter, B. E., West Hydraulic Engineering Co., 23, College Hill, London, E.C.

1906. Tolman, Frank S., 451, State Street, Flushing, N.Y., U.S.A., Superintendent, Oakes Manufacturing Co.

1905. Tolson, Stanley, c/o The Elastes Co., Ltd., North Kent Works, Erith, Chemist and Factory Manager.

O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.

1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.

1899. Tone, Jay E., 1427, Woodland Avenue, Des Moines, Iowa, U.S.A.

1896. Tonkin, John, 2603, East Broad Street, Richmond, Va., U.S.A., Manufacturing Chemist.

1902. Torrey, Charles A., jun., Security Life Deposit Vaults, Boston, Mass., U.S.A., Chemist.

1905. Torrey, Prof. H. A., Harvard Chemical Laboratory, Cambridge, Mass., U.S.A., Assistant Professor of Chemistry, Harvard University.

O.M. Towers, J. W., Widnes, Lancashire, Analytical Chemist.

1892. Townsend, Chas. W., 19, Crawford Street, Port Dundas, Glasgow, Chemical Manufacturer.

1892. Townsend, Oliver C., 22, Heston Crescent, Rugby, Chemical Manufacturer.

1897. Towse, Walter, 31, Malvern Street, Newcastle-on-Tyne, Technical Chemist.

1904. Toyne, Francis D., 270, Spotland Bridge, Rochdale, Chemist.

1905. Trainer, David, 43, Exchange Place, New York City, U.S.A., Agent (Orford Copper Co.).

1899. Trantom, Dr. Wm., Hawthorne Lodge, Latchford, near Warrington, Chemist.

1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.

1900. Traquair, Jno., Glenfield Starch Works, Paisley, N.B., Analytical Chemist.

1904. Trautwein, Alfred P., Carbondale, Pa., U.S.A., President (Carbondale Chemical Co.).

1906. Travell, Norman E., 26, Forest Road, Nottingham, Lace Dresser.

1905. Travelli, Chas. I., United Printing Machinery Co., 246, Summer Street, Boston, Mass., U.S.A., Mechanical Engineer.

1893. Travers, Prof. Morris W., F.R.S., Indian Institute of Science, Bangalore, India; and (communications) c/o J. Lyon and Co., 4, Lombard Court, London, E.C., Professor of Chemistry.

1889. Trechmann, A. O., Halling Lime and Cement Works, near Rochester, Kent, Cement Manufacturer.

1885. Trechmann, Dr. C. O., Warren Cement Works, Hartlepool, Cement Manufacturer.

1895. Treharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.

1885. Trewby, Herbert, 62, St. John Street, London, E.C., Analytical Chemist.

1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.

1898. Tripp, Dr. E. Howard, The Modern School, Bedford, Science Master.

O.M. Trobridge, A., c/o Trobridge & Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.

1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.

1906. Trotz. Johan O. E., 311, Main Street, Worcester, Mass., U.S.A., Consulting Engineer.

1904. Trubek, M., Wood Ridge, Bergen County, N.J., U.S.A., Manufacturing Chemist.

1900. True, Percival E., 279, Douglas Avenue, Elgin, Ill., U.S.A., Chemical Engineer.

1887. Tsukiyama, S., 2nd of No. 2116, Fukiaicho, Kobe, Japan, Paper Mills Chemist.

1894. Tucker, Alex. E., Norwich Union Chambers, Congreve Street, Birmingham, Metallurgist and Chemist.

1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.

1886. Tuer, Arthur H., Thornhill, near Wigan, Analytical Chemist.

1903. Tufts, C. G., c/o Semet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.

1907. Tufts, John L., 15, Park Avenue, Winchester, Mass., U.S.A., Chemical Engineer.

1901. Tulloch, Wm. F., 7, West George Street, Glasgow, Merchant.

1904. Tunnell, Raymond W., 425, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.

1899. Turnbull, Dr. Andrew, Manchester and Liverpool District Tanners' Federation, 3, Lord Street, Liverpool, Consulting Chemist.

1888. Turnbull, G. W., 2, Haws Hill, Carnforth, Lancashire, Metallurgical Chemist.

1905. Turnbull, John, 66, Jarvis Street, Toronto, Canada, Manufacturer of Food Products.

1904. Turnbull, R. H., c/o MacAndrew and Forbes Co., Camden, N.J., U.S.A., Analytical Chemist.

1884. Turnbull, W. S., 37, West George Street, Glasgow, Chemical Manufacturer.

1902. Turner, Basil, 5, Moore Street, Sydney, N.S.W., Australia, Metallurgist.

1902. Turner, Jos., c/o Read Holliday, and Sons, Ltd., Huddersfield, Chemist.

1905. Turner, Prof. Thomas, Springfields, Upton Road, Selly Park, Birmingham, Professor of Metallurgy.

1897. Turney, Fred. N., Saventham, near Brussels, Belgium, Leather Dresser.

1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.

1906. Tuttle, Dr. Franklin E., 125, East Maxwell Street, Lexington, Ky., U.S.A., Prof. of Chemistry.

1903. Tutton, Henry Ralph, 19, St. James' Parade, Bath; and (Journals) 12, Ivy Street, Penarth, S. Wales, Chemist.

1905. Tutwiler, Carrington C., 1706, North Broad Street, Philadelphia, Pa., U.S.A., Chemist.

1890. Tweedy, Jas., 306A, Burdett Road, Limehouse, E., Metallurgical Chemist.

1905. Twigg, Geo. F., 29, Fairfax Road, Derby, Gas Works Chemist.

1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.

1897. Twynam, H., c/o Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, Mining Engineer.

O.M. Twynam, T., Wyngard House, Coatham Road, Redcar, Yorks., Metallurgist.

1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.

O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.

1893. Tyrer, Chas. T. Stirling Chemical Works, Stratford, E., Manufacturing Chemist.

O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.

1899. Tysoe, Jos., South Metropolitan Gas Co., East Greenwich, S.E., M.Inst.C.E., Gas Engineer.

U

1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.

1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.

1900. Ulmer, Geo. F., c/o Arbuckle Bros., Sugar Refinery, Foot of Pearl Street, Brooklyn, N.Y., U.S.A., Chemist.

O.M. Umney, C., (Journals) Fernbrake, Branksome Wood Road, Bournemouth; and (communications) 50, Southwark Street, London, S.E., Manufacturing Chemist.

1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.

1889. Underhill, Thos. J., "Stanley," Quernmore Road, Bromley, Kent, Inspector of Stores.

1885. Underwood, G. R., 4, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.

1883. Usmar, J. H., 22, Billiter Street, London, E.C., Chemical Merchant.

1904. Uyeda, Toyokitsu, Takasago, Harima, Japan, Chemist.

V

1905. Van Arsdale, G. D., c/o Copper Queen Consolidated Mining Co., 99, John Street, New York City, U.S.A., Chemist.

1896. Van der Linde, Harold, 47, Yonge Street; and (Journals) 101, Tyndall Avenue, Toronto, Canada, Chief Chemist (Gutta-Percha and Rubber Manufacturing Co.).

1895. Vanderpoel, Dr. Frank, 153, Center Street, Orange, N.J., U.S.A., Chemist.

1904. Van Duzen, Dr. Harlan P., 232, Gt. Portland Street, London, W., Doctor of Medicine.

1903. Van Dyck, Edwin M., c/o Ault & Wiborg Co., 534, Pearl Street, New York City, U.S.A., Chemist and Ink Maker.

1897. Van Gelder, Arthur P., c/o Eastern Dynamite Co., Landing, N.J., U.S.A., Superintendent.

1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R., Baltimore, Md., U.S.A., Metallurgical Chemist.

1896. Van Ingen, Dudley A., Palmerton, Pa., U.S.A., Chemist.

1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.

1905. Van Lange, Dr. A. R., Maarssen, Holland, Manufacturing Chemist.

1897. Van Marken, J. C., Repelen, near Moers, Germany, Chemical Engineer.

1902. Vanwinckel, W. H., c/o Lyman Bros. and Co., Ltd., 71, Front Street East, Toronto, Canada, Chemist.

1885. Vargas-Vergara, J. M., Apartado No. 237, Bogota, Colombia, S. America, Metallurgical Chemist.

1905. Varshnei, Ishwar Das, Sikandra Rau, Dist. Aligarh, U.P., India, Chemical Engineer.

1898. Verity, Ben, Magog, Prov. Quebec, Canada, Print Works Chemist.

1897. Verity, Victor, 1150, Bennington Street, East Boston, Mass., U.S.A., Chemical Works Foreman.

1904. Vernon, R. H., c/o Westrumite Co. of America, 1117, Monadnock Building, Chicago, Ill., U.S.A., Student.

O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.

1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.

1906. Viett, Ad. Otto, Saccharin-fabrik A.-G. vorm. Fahlberg List and Co., Salbke-Westerhüsen a/E., Germany.

1895. Vigelius, Carl, 175, Pearl Street, New York City, U.S.A., Shellac Bleacher.

1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.

O.M. Voelcker, E. W., 22, Tudor Street, London, E.C., Analytical and Consulting Chemist.

1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.

1901. Vogel, G. C., c/o Pfister and Vogel Leather Co., Milwaukee, Wis., U.S.A., Tanner.

1897. Vogel, Julius L. F., Messrs. Steinhart, Vogel & Cloud, Highfield Works, Feltham, Middlesex.

1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.

1897. Voorhees, Louis A., Box 55, New Brunswick, N.J., U.S.A., Agricultural Chemist.

1899. Voorhees, Samuel S., c/o Supt. Architect, 18, Treasury Dept., Washington, D.C., U.S.A., Chemist.

1902. Vorisek, Dr. Anton, College of Pharmacy, 115–119, West 68th Street, New York City, U.S.A., Instructor.

1888. Vörster, Fritz, Cöln-Marienburg, Germany, Manufacturing Chemist.

1885. Voss, Hermann, 19, Beckenham Road, Beckenham, Kent, Manure Works Manager.

1899. Voss, Walter A., Eastwood Road, Rayleigh, Essex, Manufacturing Chemist.

W

1896. Wachtel, Gregory, Furstadtskaia 9, St. Petersburg, Russia, Chemical Engineer.

1904. Wackenreuter, A. G., 134–136, Kinzie Street, Chicago, Ill., U.S.A., Colour Manufacturer.

1905. Waddell, Montgomery, 1, West 101st Street, New York City; and (Journals) Genasco Silk Works, Lansdowne, Pa., U.S.A., Consulting Engineer.

1895. Waddington, Thos. W., 74, Blackburn Road, Padiham, Lancashire, River Inspector.

1902. Wade, Frank, 76, Beach Farm Road, Southsea, Analytical Chemist.

1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.

1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.

1897. Wagner, Dr. Theodore B., 1444, Wilson Avenue, Chicago, Ill., U.S.A., Chemist.

1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.

1906. Wagstaffe, E. A., 35, Faulkner Street, Manchester, Analytical Chemist.

1906. Wahl, Dr. Robert, 327, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewer's School.

1903. Wainwright, J., 15, Bolton Road, Port Sunlight, near Birkenhead, Soap Works Manager.

1884. Wainwright, Dr. J. H., 60, Wall Street, New York City, U.S.A., Analytical Chemist.

1906. Wainwright, R. E., Woodside Dyeworks, Horsforth, near Leeds, Dyer.

1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.

1904. Wait, Walter S., 30, Kilby Street, Boston, Mass., U.S.A., Chemist.

1901. Waite, C. Nelson, c/o The Jessup & Moore Paper Co., Delaware Mills, Wilmington, Del., U.S.A., Chemist.

1899. Wakefield, Wm. C., c/o Savile Town Chemical Co., Ltd., Mill Street East, Dewsbury, Chemist.

1905. Waldenberger, Chas. A., c/o Independent Baking Powder Co., 322-328, Warren Street, Jersey City, N.J., U.S.A., Chemist.

1894. Waldman, Louis J., P.O. Box 162, Albany, N.Y., U.S.A., Aniline Dye Manufacturer.

1895. Waldstein, Dr. Martin E., 100, William Street, New York City, U.S.A., Manufacturing Chemist.

1887. Walker, Archibald, 8, Crown Terrace, Glasgow, Distiller.

1897. Walker, H. V., 586, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist.

1894. Walker, Dr. Jas., University College, Dundee, Professor of Chemistry.

1902. Walker, Jas., Knowle House, Mirfield, Yorks., Woollen Manufacturer.

1897. Walker, Jas. W., Castle Park, Irvine, N.B., Chemical Manufacturer.

1906. Walker, Jas. W., Stonydale, Oakamoor, Stoke-on-Trent, Assayer.

1902. Walker, Jno. H., Gourepore Works, Naihati, E.B.S.R., Bengal, India, Chemist.

1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.

1900. Walker, Dr. Wm. H., Mass. Institute of Technology, Boston, Mass., U.S.A., Chemical Expert.

1906. Walker, Wm. J., 10, Victoria Terrace, Penketh, near Warrington, Analytical Chemist.

1895. Walker, W. Sloane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.

1897. Wallace, Edwin C., P.O. Box 241, East Auburn, Cal., U.S.A., Chemist.

1897. Wallace, Robt. A., 12, Avonmore Mansions, West Kensington, W., Chemical Manufacturer.

1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.

O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.

1906. Wallerstein, Leo., 105, East 91st Street, New York City, U.S.A., Chemist.

1899. Wallerstein, Dr. Max, 105, East 91st Street, New York City, U.S.A., Chemist.

1886. Walsh, F. T., 195, Nesmith Street, Lowell, Mass., U.S.A., Colour Printer.

1901. Walsh, Lionel O. P., c/o Burt, Boulton and Haywood, Ltd., Prince Regent's Wharf, Silvertown, E., Chemist.

1903. Walsh, Peter H., P.O. Box 469, Magog, Quebec, Canada, Analytical Chemist.

1904. Walther, Wm., Holzapfel's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.

1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.

1905. Wangemann-Bock, H. P., (subscriptions) 13, Featherstone Buildings, High Holborn, London, W.C.; and (Journals) Friedrichstrasse 185, Berlin, W.. 8, Germany, Engineer and Patent Agent.

1895. Want, W. Philip, 44, Bishopsgate Street Without, London, E.C., Pharmacist and Editor.

1901. Warburton, Frank, 50, Rosebery Road, Muswell Hill, N., Manager.

1904. Warburton, George H., 33, Kilburn Priory, West Hampstead, N.W., Analytical Chemist.

1896. Warburton, Thos., 92, Stanley Grove, Longsight, Manchester, Chemist.

1903. Ward, Dudley R., Myson Gold Mine, Marikuppam, Mysore State, South India, Analytical Chemist.

O.M. Ward, Geo., Messrs. Hirst, Brooke, and Hirst, Ltd., Millgarth Mills, Leeds, Chemical Manufacturer.

1891. Ward, G. J., The Cottage, Hallam Fields, Ilkeston, Notts., Civil Engineer.

1884. Ward, Howard Chas., Yeatton, Hordle, Lymington, Hants, Deputy Chairman of Gas Co.

1898. Ward, John, Barnstone Blue Lias Lime Co., Ltd., Barnstone, Notts., Manager.

1899. Ward, Wm. J., Bryn Merllyn, Bagillt, North Wales, Chemist.

1906. Wardlaw, Thos. D., c/o The Geigy Aniline and Extract Co., 60, Front Street West, Toronto, Canada, Manager.

1897. Wardle, Sir Thos., 54, St. Edward Street, Leek, Staffordshire, Silk Dyer.

1902. Waring, W. Geo., Webb City, Mo., U.S.A., Metallurgical Chemist.

1899. Warnes, Arthur R., 40, Margaret Street, Beverley Road, Hull, Chemist.

1890. Warren, Fiske, c/o S. D. Warren and Co., Cumberland Mills, Maine, U.S.A., Paper Manufacturer.

1902. Warren, H. D., Laboratory, Gutta Percha and Rubber Manufacturing Co., Ltd., 47, Yonge Street, Toronto, Canada, President.

1890. Warren, Jno. Davis, 7, Essex Road, Acton, W., Manufacturing Chemist.

1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.

1907. Warren, W. H., 27, Musgrave Crescent, Walham Green, S.W.

1885. Waterfall, W. B., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.

1890. Waterhouse, Major-General Jas., Hurst Mead, High Street, Eltham, Kent, Assistant Surveyor-General of India (retired).

1891. Waterhouse, Robt., 8, Severn Road, Sheffield, Analytical and Agricultural Chemist.

1902. Watkins, E. J., (communications) 10, Montpelier Road; (Journals) c/o Mellin's Food, Ltd., Stafford Street, Peckham, S.E., Works Chemist.

1900. Watkins, Norman, (communications) Box 767, and (Journals) 1701, Makiki Street, Honolulu, Hawaiian Islands, Chemist.

1898. Watkins, Willard H., c/o Schoellkopf, Hartford and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.

1894. Watmough, Benj., 1, Ryeburn, Stanley Road; and (Journals) c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.

1894. Watson, Alex. Forbes, St. James's Gate Brewery, Laboratory, Watling Street, Dublin, Chemist.

1884. Watson, Chas., c/o Josiah Hardman, Ltd., Aston Church Road, Birmingham, Manufacturing Chemist.

1894. Watson, Chas. Ernest, 28, Highfield Road, Stretford, Manchester, Chemical Assistant.

1890. Watson, Eric E., (Journals) The Queensland Smelting Co., Aldershot, Maryborough, Queensland, Australia; (subs.) c/o S. Watson, Queen Insurance Buildings, Dale Street, Liverpool, Chemist.

1895. Watson, H. Ard, c/o Tunstall and Co., Ltd., Leeds Bridge, Leeds, Tar Distiller.

1901. Watson, Herbert J., 35, Park Road, Widnes, Chemist.

1903. Watson, H. W., c/o H. Hogarth, Denton Avenue, Gledhow, Leeds, Analytical Chemist.

1903. Watson, Hugh M., 22, Coleraine Road, Blackheath, S.E., Paint Manufacturer.

1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.

1905. Watson, James, 41, Sherburn Street, Holderness Road, Hull, Works Chemist.

O.M. Watson, Jno., c/o City and Suburban G.M. Co., Box 1026, Johannesburg, Transvaal, Technical Chemist.

1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.

O.M. Watson, Jno. C., The Bleachery, Saylesville, R.I., U.S.A., Manager of Printworks.

1904. Watson, Percy, 554, Somerset Avenue, Taunton, Mass., U.S.A., Chemist and Dyer.

O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.

1901. Watt, Francis L., 10, Northcote Chambers, Reihy Lane, Circular Quay, Sydney, N.S.W., Australia, Student.

1906. Watt, H. E., 35, Clarence Road, Sidcup, Kent, Chemist.

1904. Watt, John, 17, Maple Avenue, Toronto, Ont., Canada, Glass Manufacturer.

1900. Watts, Chas. J., 40, City Road, London, E.C., Manufacturer.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1906. Webb, E. A., 51, Pearson Avenue, Toronto, Canada, Manufacturing Chemist.
1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.
1900. Webb, Jno. F., 20, Louvaine Road, St. John's Hill, Battersea, S.W., Mining and Electrical Engineer.
1901. Webb, Wm. J., 26, Livingston Avenue, Yonkers, N.Y., U.S.A., Superintendent of Printing Department.
1905. Webber, W. J., 55, Kilby Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1905. Weber, Nicholas M., 737, Western Avenue, West Lynn, Mass., U.S.A., Leather Manufacturer.
1884. Webster, C. S. Stanford, Malvern House, Redland, Bristol, Consulting and Analytical Chemist.
1901. Webster, Geo. J., Standard Chemical Co., Ltd., Gooderham Building, Toronto, Canada, Secretary.
1902. Webster, Jno., Chemical Laboratory, Guy's Hospital, London, S.E., Analyst.
1906. Weddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.
1904. Wedekind, Rud., Uerdingen am Rhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Utley, Pennsylvania Salt Manufacturing Co., Philadelphia, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 408, Third Street, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1895. Weems, Dr. J. B., Aspen Hall, Crewe, Va., U.S.A., Agricultural Chemist.
1898. Weeple, Lawrence, Pinchin's Wharf, Stratford, E., Colour Works Chemist.
1904 Weil, Jacob A., c/o The Power Gas Corporation, Ltd., 39, Victoria Street, Westminster, S.W., Chemist.
1906. Weir, James, Imperial Varnish and Colour Co., 6—24, Morse Street, Toronto, Canada, Chemist.
1902. Weiskopf, Erich, Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.
1902. Weiss, Georg H., Chemische Fabrik, Hudemühlen, Hanover, Germany, Chemical Manufacturer.
[illegible]. Weiss, Philip, jun., c/o Vulcanite Portland Cement Co., Phillipsburg, N.J., U.S.A., Chemist.
[illegible] Wer[illegible]müller, Ernest C., Hill Crest, The Heath, Runcorn, Cheshire, Research Chemist.
1893 Welch, J. Cuthbert, Alaska Copper Co., Coppermount, Alaska, U.S.A., General Superintendent.
[illegible] Weldon, Leonard E., 154, Egypt Road, New Basford, Nottingham, Dyer.
1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
[illegible] Wells, Jas. Gray, Carlton Lawn, Chester Road, Stretford, Manchester, Brewing Chemist.
[illegible]. Wells, Pierson L., 86, Joralemon Street, Brooklyn, N.Y., U.S.A., Patent Lawyer and Engineer.
[illegible]. Welsh, Jas., Horrocks Lane Dyeworks, Red Bank, Manchester, Printworks Manager.
[illegible]. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
O.M. Welsh, W., Holt Town, Manchester.
1905. Welt, Dr. Ida, 18, West 83rd Street, New York City, U.S.A., Chemist.
[illegible] Wenger, Francis E., Helvetia, Newcastle, Staffordshire, Ceramic Colour Manufacturer.
[illegible] Wen[illegible], Dr. W., c/o Herrn H. Schultz, Graalstrasse, L[illegible]burg, Germany, Manager.
[illegible] Wertheimer, M. A., Kaukauna, Wis., U.S.A., Paper Manufacturer
[illegible]. We[illegible]r, Dr. John A., 103, State Street, Chicago, Ill., U.S.A., Consulting Chemist.
[illegible]. We[illegible], Carl, (communications) Geheimer Commerzienrath C. We[illegible]l, Bernburg; and (Journals), [illegible] Solvay-Werke Act.-Ges., Bernburg, Anhalt, Germany, Alkali Manufacturer.
1889. Wesson, D., c/o Southern Cotton Oil Co., 24, Broad Street, New York City, U.S.A., Technical Chemist and Cotton-Oil Expert.
1903. West, Leonard, Merrywood, Belton Road, Derby, Manufacturing Chemist.
1900. Westenfelder, B. D., 924, Clinton Street, Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1904. Weston, Thos. W., c/o Jos. Watson and Sons, Whitehall Soap Works, Leeds, Mechanical Engineer.
1885. Weston, Wm., 17, St. David's Road, Southsea, Analytical Chemist.
1902. Wethered, Wm. P., Redcourt, Carnatic Road, Mossley Hill, Liverpool, Manager.
1890. Wetter, Jasper, 37–39, Essex Street, Strand, London, W.C., Patent Agent.
O.M. Whalley, L. J. de, 148, Jerningham Road, New Cross, S.E., Sugar Chemist.
1904. Whatmough, Dr. Wm. H., Woodleigh, Cheadle, Cheshire, Chemist.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., Trenton, Mich., U.S.A., Chemist.
1907. Wheeler, R. Vernon, c/o Messrs. Monks, Hall and Co., Warrington, Chemist.
1895. Wheelwright, Dr. E. W., 24, Stanmore Road, Edgbaston, Birmingham.
1905. Whetton, John, 23, Church Street, Toronto, Canada, Manager of Canadian Branch of Read Holliday & Sons, Ltd.
O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1902. Whipple, G. C., St. Paul Building, 220, Broadway, New York City, U.S.A., Chemist.
1893. Whitaker, Alf., Newlaithes Grange, Horsforth, Leeds, Dyer.
1899. Whitaker, Milton C., 825, Monmouth Street, Gloucester City, N.J., U.S.A., Chemist.
1895. Whitaker, Thos., Newlay Hall, near Leeds, Dyer.
O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
1898. White, Alf. H., 1017, Hill Street, Ann Arbor, Mich., U.S.A., Instructor in Chemical Technology.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks, Manufacturing Druggist.
1905. White, Clarence B., c/o Herringbone Metal Lath Co., 156, Fifth Avenue, New York City, U.S.A., Chemist.
1901. White, H. Graham, 24, Bidston Road, Oxton, Birkenhead, Works Chemist.
1889. White, Henry, 245, Western Road, Crookes, Sheffield, Manufacturing Chemist.
1887. White, J. Campbell. *See* Overtoun, Lord.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
O.M. White, Paul T., Horton Field House, West Drayton, Chemical Manufacturer.
1905. White, William, Beloeil Station, Province Quebec, Canada, Chemist.
1894 White, W. Gilchrist, 133, Tottington Road, Bury, Lancs., Calico Printer's Chemist.
1906. White, Wm. T., c/o American Hide and Leather Co., Lowell, Mass., U.S.A., Leather Manufacturer.
1905. Whitehead, Walter, 82, Ship Avenue, Medford, Mass., U.S.A., Manufacturer of Textile Chemicals.
1903. Whitehouse, P. L., c/o W. H. Keys, Hall End Works, West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, 5, Bagnall Street, West Bromwich, Staffordshire, Chemical Lecturer.

1905. Whiteside, Harold, c/o W. H. Holmes & Sons, Portland Road, Newcastle-on-Tyne, Colour Maker.
1892. Whiteside, Jno. L., 376, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1885. Whittaker, C. J., Winthrop, Ansdell Road, Lytham, Lancashire, Chemical Engineer.
1904. Whittier, Charles T., 322, Warren Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., c/o Nobel's Explosives Co., Ltd., Ardeer, Stevenston, N.B., Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lancs., Bleacher.
1899. Wiarda, Jno. C., 259–273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1897. Wiborg, F. B., The Ault and Wiborg Co., Cincinnati, Ohio, U.S.A., Manufacturer.
1890. Wickens, B. Foster, 31, Bermondsey Wall, London, S.E., Managing Director (Wickens, Pease and Co., Ltd.).
1906. Wickett, Dr. S. Morley, c/o Wickett and Craig, Ltd., Don Esplanade, Toronto, Canada, Leather Manufacturer.
1905. Widmann, Eugene A., 595, Eighth Avenue, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1904. Wieler, Eric E., 4, Palatine Road, Withington, Manchester, Chemical Merchant.
1904. Wiener, William, 62½, Nelson Place, Newark, N.J., U.S.A., Analytical and Consulting Chemist.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggin, W. W., 55, George Street, Birmingham, Nickel Refiner.
1904. Wigglesworth, Edwin, c/o Pulaski Mining Co., Pulaski, Va., U.S.A., Manufacturing Chemist.
1897. Wigglesworth, Henry, 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
O.M. Wightman, C., 1, Fenchurch Avenue, London, E.C., Chemical Merchant.
1906. Wikner, Sigurd A., Hull Road, Hedon, near Hull, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent., Analytical Chemist.
1893. Wilder, F. L., Morro Velho, Villa Nova de Lima, Estado de Minas Geraes, Brazil, Assayer.
1902. Wilder, Salmon W., jun., North Woburn, Mass., U.S.A., Treasurer.
1899. Wildman, Arthur J., 133, Central Park Road, East Ham, E., Chemist.
1902. Wiley, Dr. Harvey W., Bureau of Chemistry, Department of Agriculture, Washington, D.C., U.S.A., Chief.
1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1895. Wilkins, Charles, 40, Church Lane, Hornsey, N., Manufacturing Perfumer.
1899. Wilkins, H. A. J., c/o New Jersey Zinc Co., 71, Broadway, New York City, U.S.A., Mining Engineer.
1904. Wilkinson, Prof. J. A., Transvaal Technical Institute, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks., Chemical Manufacturer.
1906. Wilkinson, John E., 71, Lombard Street, Toronto, Canada, Gold and Silver Refiner.
1903. Willard, C. T., 29, Chestnut Street, Newark, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C. (Journals), 34, Hamilton Terrace, St. John's Wood, N.W., Patent Agent.
1900. Willenz, Dr. Michel, Rue Haringrode 4, Antwerp, Belgium, Leather Trades Chemist.
1906. Williams, A. Ll. Griflith, Uzina Cansançao de Sinimbu, S. Miguel dos Campos, Maceio, Brazil, Sugar Planter.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 9, Calvert Terrace, Swansea, Chemist.
1905. Williams, Gerard W., South Rose Deep, Ltd., Box 21, Germiston, Transvaal, Metallurgical Chemist.
1891. Williams, Henry J., 161, Tremont Street, Boston, Mass., U.S.A., Chemical Engineer.
1904. Williams, Jno. T., Lord's Court Building, 27, William Street, New York City, U.S.A.,
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, (subscriptions) 75, Fairfax Road, London, N.W., and (Journals) c/o A. J. Simons, Pontianak, Dutch West Borneo, *vià* Singapore, Chemist.
1885. Williams, Rowland, Hale Cote, Albert Park, Lancaster, Analytical Chemist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A.. Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, Arnold Printworks, North Adams, Mass., U.S.A., Chemical Engineer.
1887. Williams, W. Collingwood, 68, Grove Street, Liverpool, Analytical Chemist.
O.M. Williams, W. J., 5004, Franklin Street, Frankford, Philadelphia, Pa.. U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., 66, Onslow Gardens, Muswell Hill, N., Analytical Chemist.
O.M. Williamson, Robt., Low Walker, Newcastle-on-Tyne, Technical Chemist.
1903. Wills, J. L., 133, Midwood Street, Brooklyn, N.Y., U.S.A., Technical Chemist.
1905. Wills, Wm. R., 162, Main Street, Waltham, Mass., U.S.A., Dyer.
1895. Willson, Thos. L., St. Catherine's, Ont., Canada, Electrical Engineer.
1890. Wilson, Alf., c/o Messrs. J. and E. Sturge, 18, Wheeley's Lane, Birmingham, Chemist.
1884. Wilson, Anthony W., 20, Westcott Street, Hull, Colour Works Manager.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
O.M. Wilson, C. J., 14, Old Queen Street, Westminster, S.W.
1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
1903. Wilson, Geo. C., Mysore Gold Mines, Kolar Gold Field, Mysore State, India. Chemist.
O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1902. Wilson, Geo. W., 84, Glossop Road, Gamesley, Dinting, near Manchester, Works Chemist.
1899. Wilson, Gordon, Benallan, Kirkintilloch, N.B.; and (Journals) Promontorio, Estacion Chinacates, Durango, Mexico, Chemist and Assayer.
1886. Wilson Jno., Tyneside, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., The Vines, Oxford Road, Runcorn, Chemical Engineer.
1902. Wilson, Jno. B., Mount Morgan G. M. Co., Mount Morgan, Queensland, Australia, Mining Engineer.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
O.M. Wilson, J. H., 8, Friar's Stile Road, Richmond, S.W., Chemical Manufacturer.
1906. Wilson, J. Murray, c/o Hamilton Powder Co., Belveil Factory, near Montreal, Canada, Technical Chemist.
1902. Wilson, Leonard P., Boston House, Stoney Stanton Road, Coventry, Technical Chemist.
O.M. Wilson, R. H., Eaglescliffe, R.S.O., Co. Durham, Chemical Manufacturer.
1900. Wilson, Walter A., Ardeer, Stevenston, Ayrshire.
1885. Wilson, Dr. W. H., Presidency College, Madras, India, Lecturer on Physics.

1890. Wilson, W. W., The Grange, Carbrook, near Stalybridge, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1901. Wing, Herbert H., Monticello, N.Y., U.S.A., Chemical Engineer.
1892. Wing, J. D., 22, William Street, New York City, U.S.A., Merchant.
1893. Wingate, Hamilton M., Technical Chemist and Metallurgist.
1892 Wingfield, T. R., 5, Bromwich Street, Bolton, Brewer.
O.M. Wingham, A., Livermead House, Torquay, Metallurgical Chemist.
1906. Winkler, S. M., 38 and 40, Main Street, Cincinnati, Ohio, U.S.A., Chemical Merchant.
O.M. Winser, P. J., Moor House, Biddulph Moor, Congleton, Cheshire, Consulting Chemist.
O.M. Winsloe, H., c/o Tennants and Co., Clayton, Manchester, Manufacturing Chemist.
1892. Winstanley, Hy., Bridge House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, Dr. A., Chemische-Fabrik-Griesheim-Elektron, Werk Oehler, Offenbach a/Main, Germany, Chemist.
1892. Wirtz, Dr. Quirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1900. Wishart, Harlan L., Washburn, Wis., U.S.A., Chemist.
1889. Wishart, Jno., 39, St. Vincent Place, Glasgow, General Manager (Oakbank Oil Co., Ltd.).
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
1906. Withey, Wm. S., c/o Brustad Mines, Ltd., Eidsvold, Norway, Assayer and Chemist.
O.M. Witt, Dr. Otto N., Ebereschenallee 10, Westend bei Berlin, Professor of Chemistry.
1892. Witthaus, Dr. R. A., Cornell Medical College, First Avenue and 28th Street, New York City, U.S.A., Professor of Chemistry.
1905. Wittmack, Chas. A., 606, West 113th Street, New York City, U.S.A., Chemist.
1907. Wolcott, Townsend, 39, Whitehall Street, New York City, U.S.A.
1904. Wolf, August S., Laboratory, E. L. A. S., 120, Broadway, New York City, U.S.A., Chemist.
1903 Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1894. Wolterek, Dr. H. C., 3, Edinburgh Mansions, Howick Place, London, S.W., Consulting Chemist.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1890. Wood, Ebenezer, Stephenson Street, Canning Town, E., Manufacturing Chemist.
1906. Wood, E. Elliott, Hurricane House, Brymbo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Hazelhurst, Doncaster Road, Barnsley, Yorks., Assistant Manager (Glass Works).
1901 Wood, Frank S., Chin Chu, Heathcote Street, Newland, Hull, Cement Works Chemist.
1887 Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1888 Wood, Wm., 20, Rue Général van Merlen, Antwerp, Belgium, Bleacher and Dyer.
1906 Woodall, Corbet, Palace Chambers, Westminster, S.W., Civil Engineer.
O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Technical Chemist.
1902 Woodhead, Chas. E., 458, Edge Lane, Droylsden, Manchester, Chemist.
1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1890. Woodman, Dr. Durand, 80, Beaver Street, New York City, U.S.A., Analytical Chemist.
1900. Woodrow, John, 12, Park Road, Hull, Chemist.
1902. Wood[illegible]le, T. Frank, c/o Warner Chemical Co., 141, Broadway, New York City, U.S.A., Secretary.
1906. Woodward, Horace A., 1268, Amsterdam Avenue, New York City, U.S.A., Chemist.
1896. Woodward, Jas., 31, Coventry Road, Ilford, Essex, Government Analyst.
1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.
1904. Woolcott, Herbert, 44, Zinzan Street, Reading, Brewer's Chemist.
1896. Woolf, Julian, 51, Buckland Crescent, South Hampstead, N.W., Manufacturer.
1889. Woolf, Mortimer, Yeatman and Co., Denmark Street, E., and (Journals) Mayfield, Mortimer Road, St. John's Wood, N.W., Vinegar Brewer.
1906. Woollatt, Dr. George H., Municipal Technical School, Portadown, Ireland, Principal.
O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.
1905. Woore, N. L., P.O. Mount Morgan, Queensland, Australia, Assayer.
1901. Worden, Edw. C., c/o Clark Thread Co., Newark, N.J., U.S.A., Analytical Chemist.
O.M. Worrall, H., Crimsworth, Whalley Range, Manchester, Dyer.
1903. Worstall, Robt. A., 726, Clinton Place, Evanston, Ill., U.S.A., Chemist.
1900. Worthington, Arthur, Lynwood, Green Lane, Bolton, Chemist and Sub-Manager.
1896. Wrampelmeier, T. J., 2253, Piedmont Avenue, Berkeley, Cal., U.S.A., Chemist.
O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1901. Wren, E. Cecil, Glencoe, Eaglescliffe, R.S.O., Co. Durham, Vinegar Brewer.
1904. Wright, Allister M., 62, Harman Street, Addington, Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1895. Wright, Arthur C., c/o Turner, Morrison and Co., 6, Lyons Range, Calcutta, India, Chemist.
1904. Wright, Chas. L., Fuel Testing Plant, U.S. Geological Survey, St. Louis, Mo., U.S.A., Chemical Engineer.
1905. Wright, Daniel, 287, Maverick Street, East Boston, Mass., U.S.A., Manufacturer of Dyestuffs and Chemicals.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.
O.M. Wright, L. T., 1020, Fourteenth Street, Oakland, Cal., U.S.A., Chemical Engineer.
1900. Wright, Walter J., 70, Newton Road, Faversham, Kent, Chemist (Cotton Powder Co.).
1890. Wülfing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1904. Wünsche, Fritz, Reichenbachstrasse 25p., Dresden-Altst, Germany, Chemist.
1906. Wuth, Dr. Berthold, Oaklands, Bramhall, Cheshire, Chemist.
1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.
1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 106, Witham Road, Sheffield, Professor of Chemistry.
1905. Wyrall, Cyril de, Ridgefield Park, N.J., U.S.A., Chemist.

Y

1900. Yamaoka, S., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chief Engineer.
1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1899. Yates, Arthur, Lebong Donok, Benkoelen, Sumatra, Netherlands Indies, Metallurgist.
O.M. Yates, F., 64, Park Street, Southwark, London, S.E., Chemical Manufacturer.

1897. Yates, Wm. H., 11, Lansdowne Road, Southport, Lancashire, Technical Chemist.
1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1906. Yockey, Harry, c/o National Lead Co., 7th and Freeman Streets, Cincinnati, Ohio, U.S.A., Chemist.
1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., 18, Tatsuokacho, Hongo, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1901. Young, Dr. A. H. Innes, 54, Merton Road, Bootle, Student.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o Continental Color & Chemical Co., 32, India Street, Boston, Mass., U.S.A., Colourist.
1890. Young, Dr. Geo., 83, Harvard Court Mansions, Honeybourne Road, West Hampstead, N.W., Chemist.
1904. Young, James, 2A, Dartmouth Road, Brondesbury, N.W., Chemist.
O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.
1886. Young, Jno., Claremont House, Beverley Road, Hull, Gas Engineer.
1904. Young, Jno. H., c/o The Cassel Cyanide Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 4, Portland Terrace, Newcastle-on-Tyne, Inspector under Alkali Acts.
1883. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
O.M. Young, W. C., Laboratory, 19–20, Aldgate, London, E.C., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks., Chief Chemist.

Z

1899. Zabriskie, C. B., 100, William Street, New York City, U.S.A., Manager (Pacific Coast Borax Co.).
1897. Zacharias, Dr. P. D., Philhellinon Street 22, Athens, Greece, Industrial Chemist.
1897. Zahorski, Dr. Boleslas, Maywood, N.J., U.S.A., Technical Chemist.
1906. Zaremba, Edw., 944, Monadnock Building, Chicago, Ill., U.S.A., Manager (American Foundry Co.).
1906. Zdanowicz, Joseph, 12, Trebovir Road, South Kensington, S.W., Chemical Engineer (Artificial Silk).
1898. Zehetmayr, Ferd. F., 85, Gracechurch Street, London, E.C., Merchant.
1904. Zieme, Carl H., c/o New Castle Stamping Co., New Castle, Pa., U.S.A., Chemist.
1899. Zilz, Henry, 22, Bush Lane, London, E.C., Agent (Badische Anilin und Soda Fabrik).
O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 & 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1904. Zimmermann, H. D., c/o American Ether Co., Richmond, Va., U.S.A., Chemist.
1905. Zinkeisen, Oscar T., 135, William Street, New York City, U.S.A., Importer of Chemicals.
1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1907. Zlinkoff, Henry, 230, West 82nd Street, New York City, U.S.A., Student of Chemistry.
1895. Zoeller, E. V., Tarboro,' N.C., U.S.A., Cottonseed Oil Refiner and Pharmacist.
1899. Zumbeck, Aug., 66, Mark Lane, London, E.C., Chemical Merchant.

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